

Sustainable Manufacturing: Is It Resilient?

NIST Advanced Manufacturing Technology
Partnership for Research and Innovation in
Sustainable Manufacturing (PRISM)



Joseph Fiksel, Executive Director
Sustainable and Resilient Economy
The Ohio State University



**THE OHIO STATE
UNIVERSITY**

Discovery Themes

THIS IS NOT BUSINESS AS USUAL.

End Global Poverty



END POVERTY IN ALL ITS FORMS EVERYWHERE

Food Security



END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE

Health & Well-Being



ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL AT ALL AGES

Universal Education



ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL

Gender Equality



ACHIEVE GENDER EQUALITY AND EMPOWER ALL WOMEN AND GIRLS

Clean & Safe Water



ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL

Provide Energy



ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL

Provide Jobs



PROMOTE SUSTAINED, INCLUSIVE AND SUSTAINABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL

Innovate for Resilience



BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION

Fight Climate Change



TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS*

Protect Oceans



CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT

Protect Ecosystems



PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS

Peace & Justice



PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT, PROVIDE ACCESS TO JUSTICE FOR ALL AND BUILD EFFECTIVE, ACCOUNTABLE AND INCLUSIVE INSTITUTIONS AT ALL LEVELS

Global Partnership



STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT



Reduce Inequality



REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES

Resilient Cities



MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE

Sustainable Economy



ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS



Sustainability is the capacity for:

- Ensuring economic prosperity
- Protecting ecological resources
- Enhancing societal well being



continuity

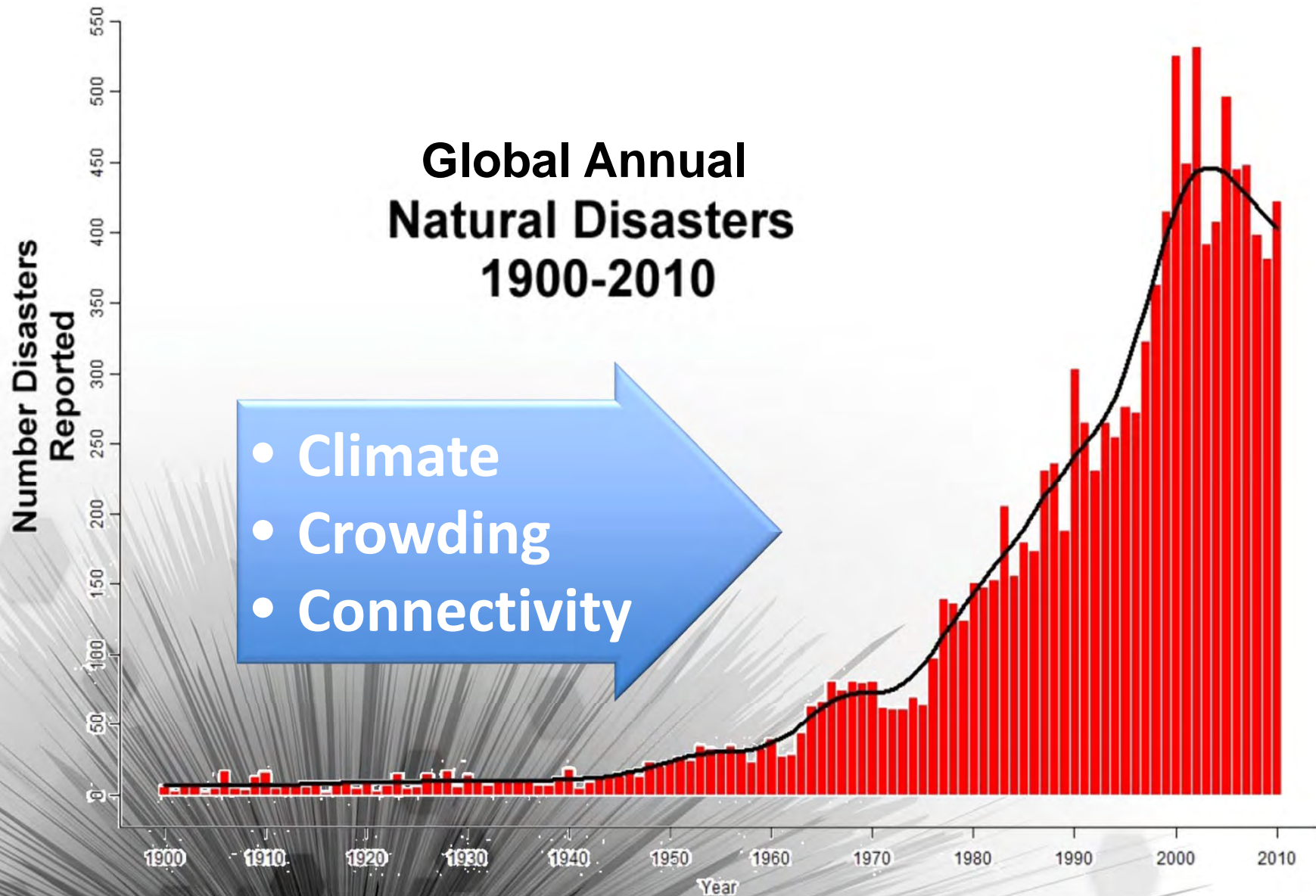


fitness

Resilience is the capacity for:

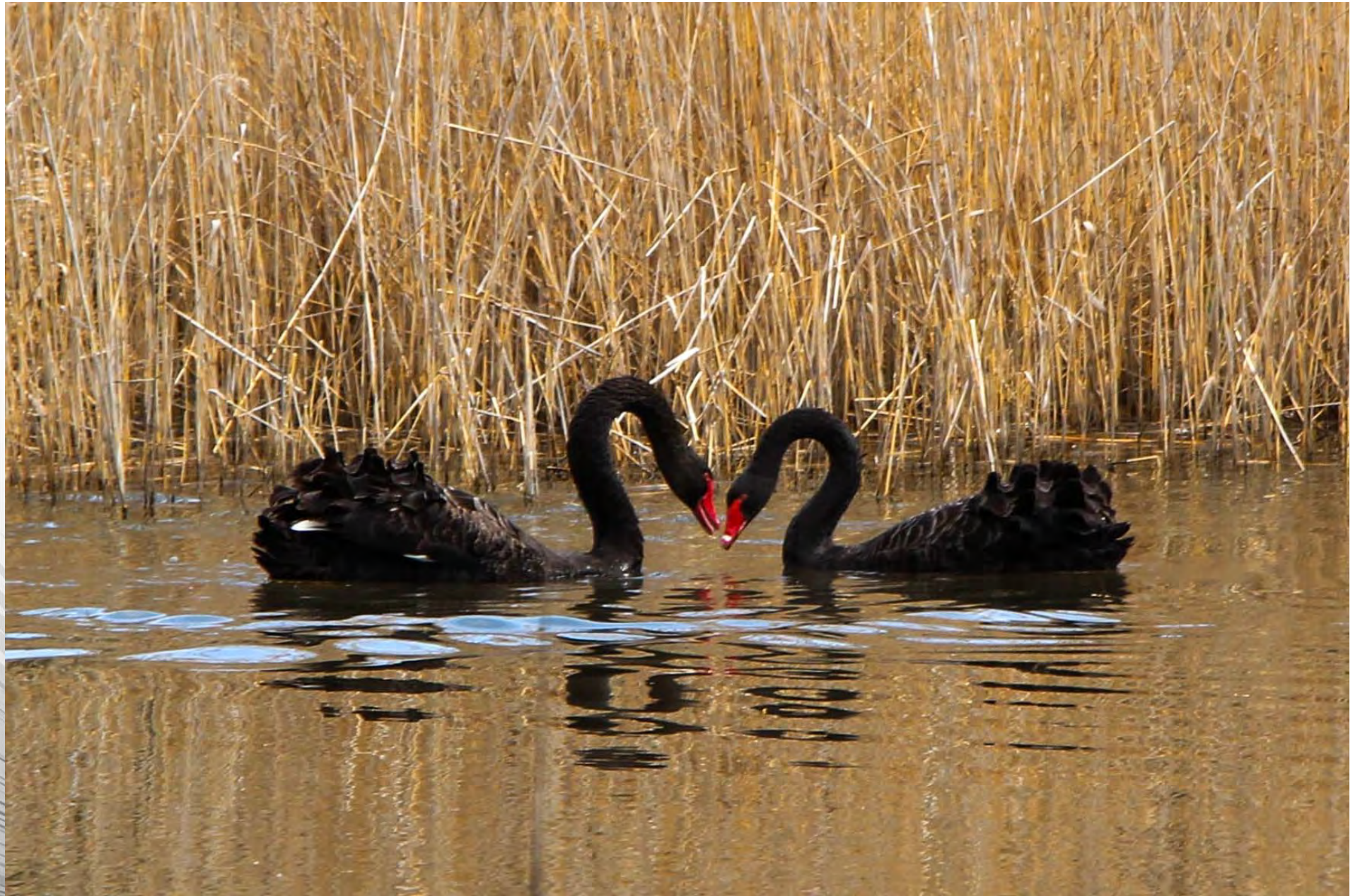
- Overcoming unexpected crises
- Adapting to turbulent change
- Flourishing in a chaotic world





- Climate
- Crowding
- Connectivity

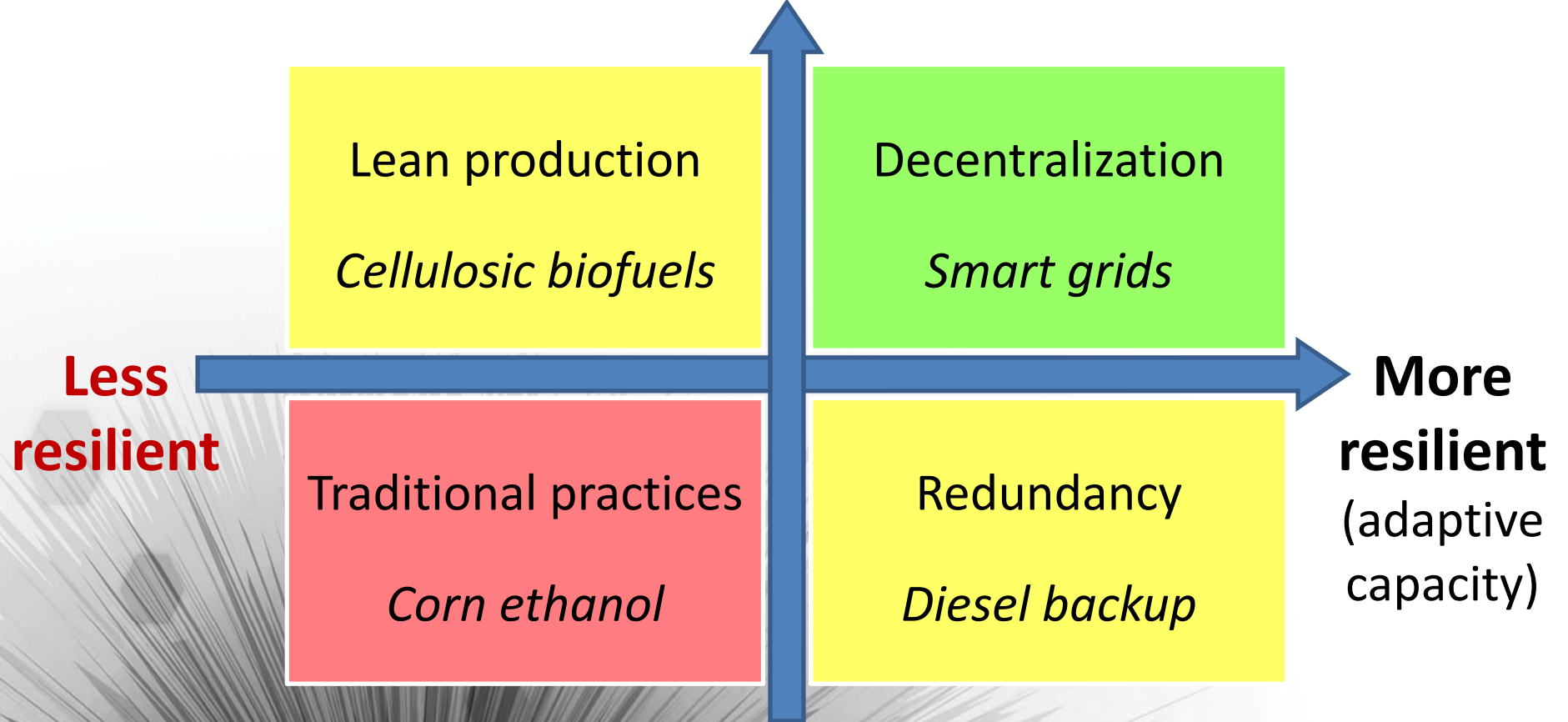
EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.be - Université Catholique de Louvain, Brussels - Belgium



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Black Swans are Multiplying

More sustainable
(ecological footprint)

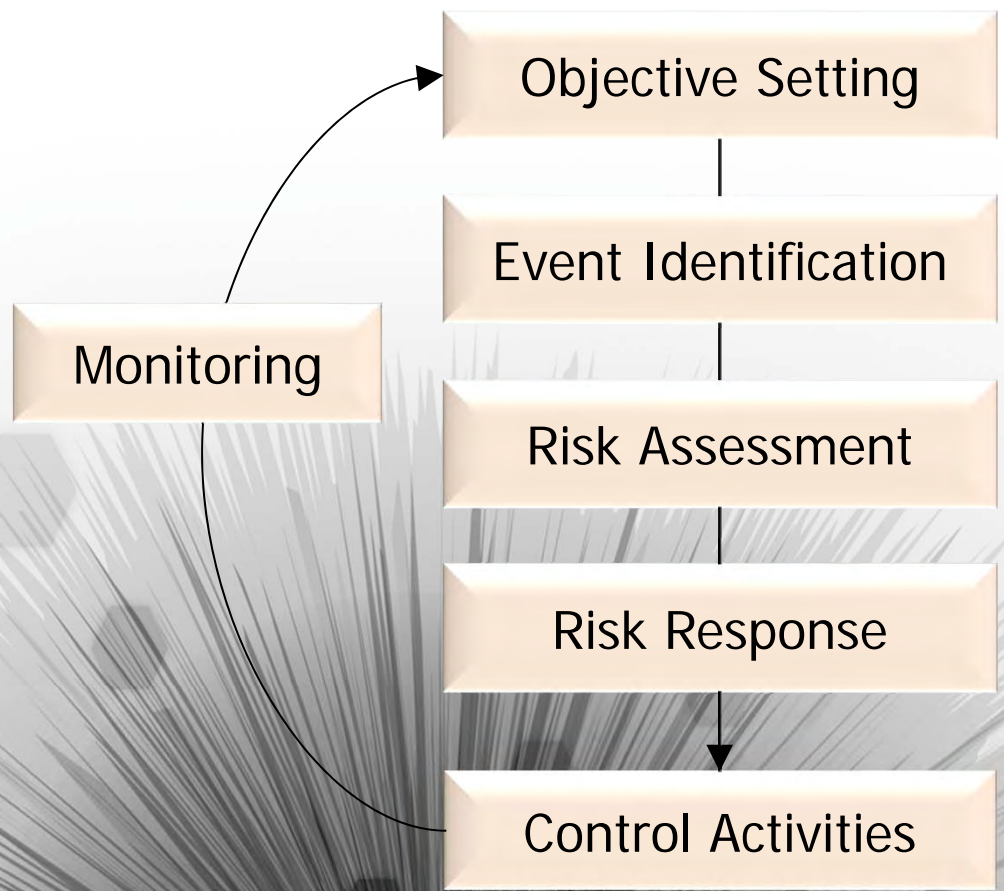


Less sustainable

Adapted from: J. Fiksel, J. Goodman, A. Hecht, "Navigating Toward a Sustainable Future," *Solutions*, Oct. 2014



COSO Framework for Enterprise Risk Management

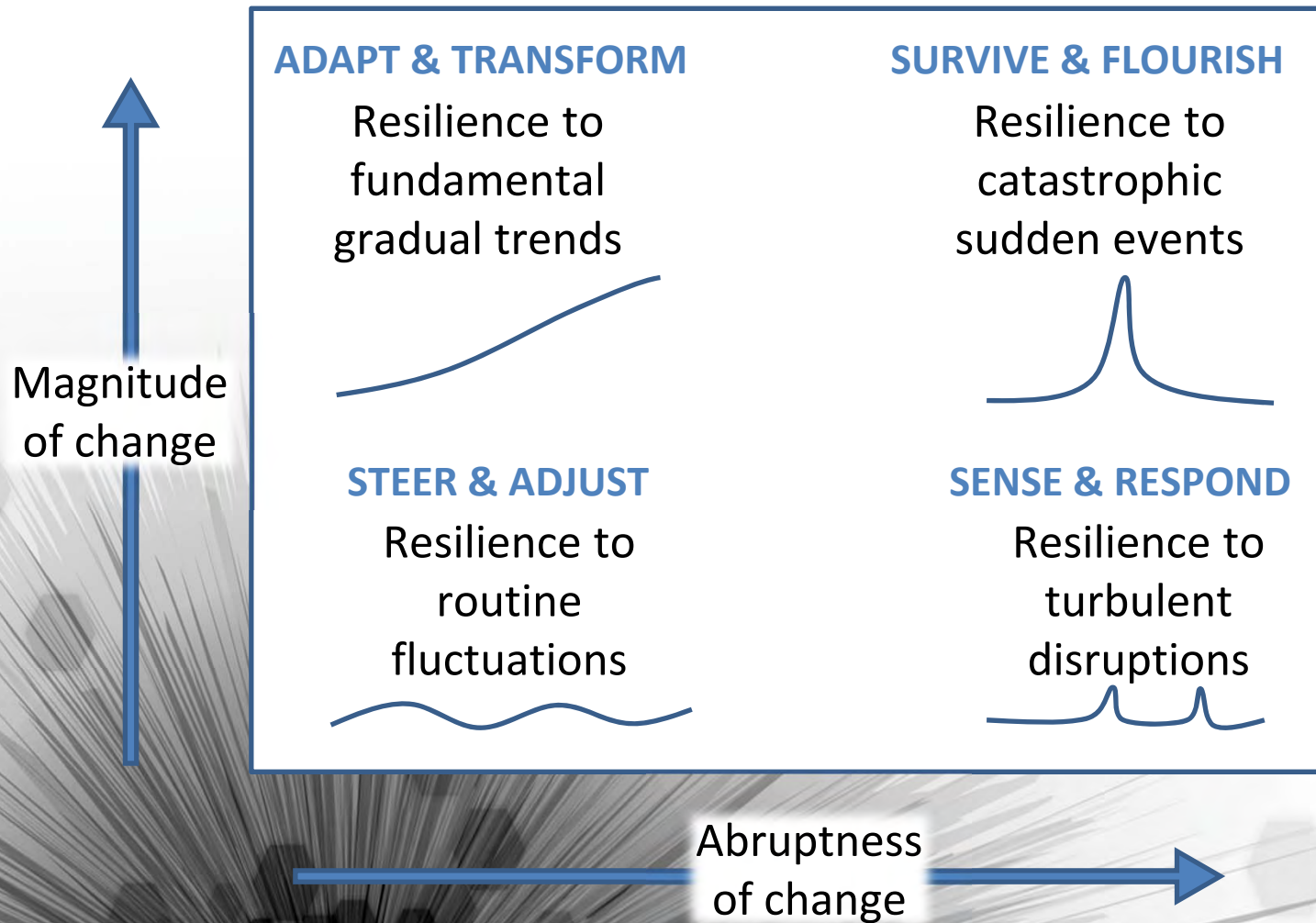


Risks cannot always be anticipated

Risks may be hard to quantify

Adaptation may be needed to remain competitive

Managing in Turbulent Times



- Security
- Flexibility
- Capacity
- Efficiency
- Visibility
- Adaptability
- Anticipation
- Recovery
- Dispersion
- Collaboration
- Organization
- Market position
- Financial strength



Increasing Capabilities



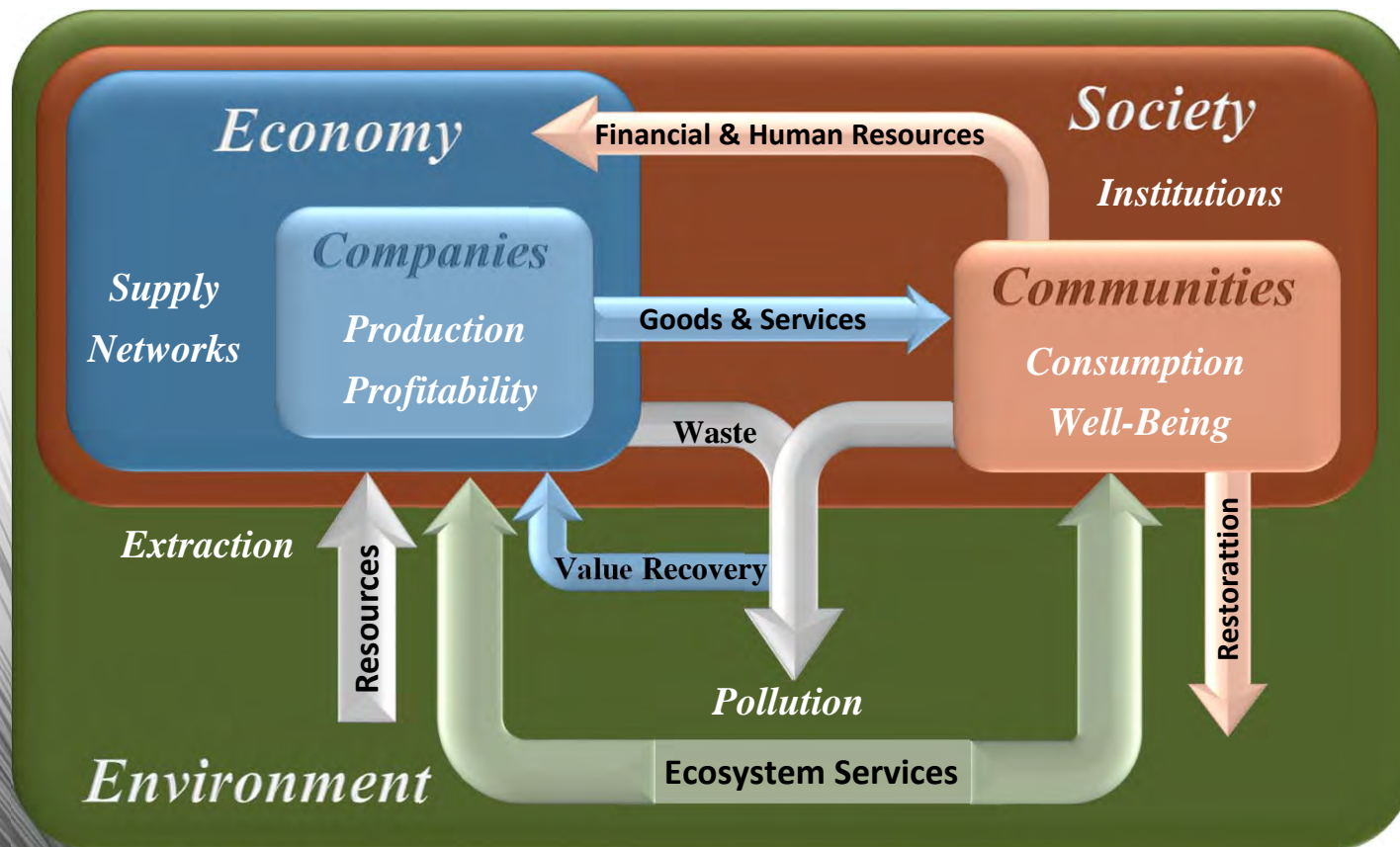
Increasing Vulnerabilities

- | | |
|--------------------|--------------------|
| Turbulence | Deliberate threats |
| External pressures | Resource limits |
| Connectivity | Sensitivity |

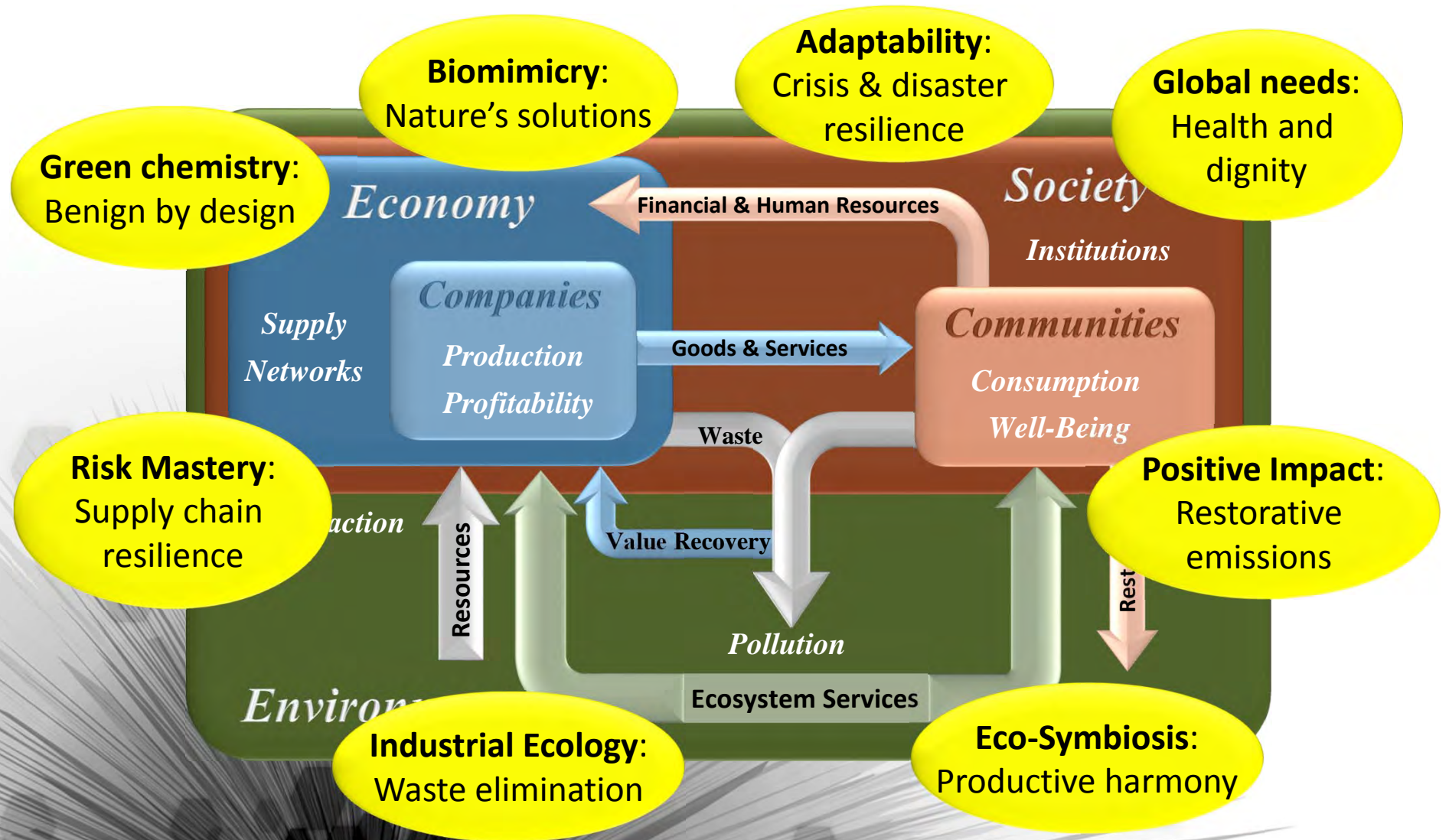
Source: Fiksel, Polyviou, Croxton, Pettit, *From Risk to Resilience: Learning to Deal with Disruption*, MIT Sloan Management Review, Winter 2015, pp. 79-86.



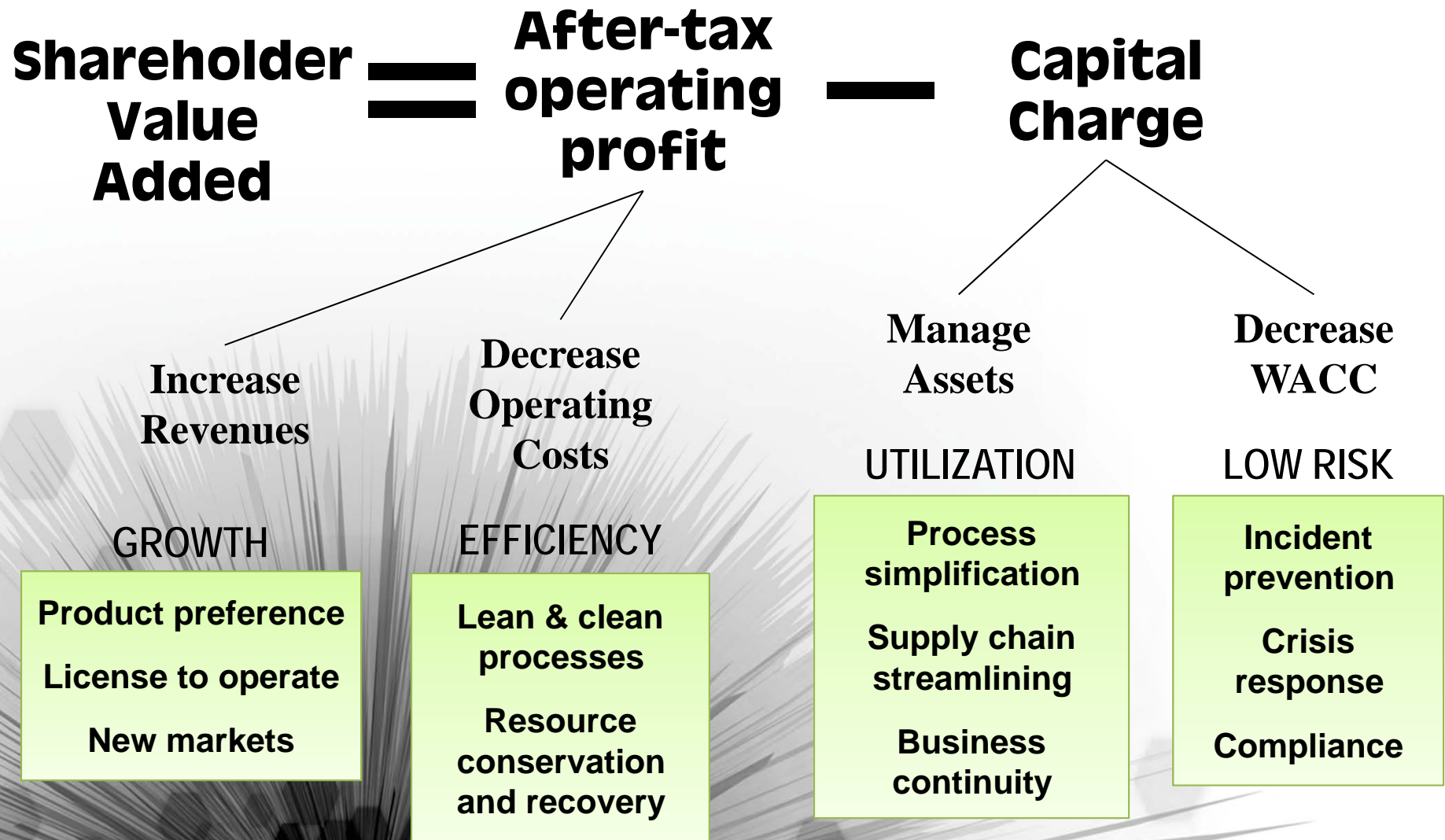
Triple Value Framework



Innovation Opportunities



Economic Value Creation



	Top-line growth	Operating profit	Asset utilization	Risk reduction	Intangible value
Dow Chemical	Expand into new markets	Avoid excessive costs	Right-size fixed assets	Business continuity	Customer loyalty
L Brands		Anticipate shipment delays		Business continuity	
AEP		Maintain electrical service			Community quality of life
Cisco	Resilient product design			Supply chain visibility	
Veolia		Assess true cost of water	Optimize infrastructure	Avoid water shortages	Reputation and brand



Aerospace Industry: Opportunities for Value Creation

	Sustainability	Resilience
Product design	<ul style="list-style-type: none">• Reduce energy demands• Avoid toxic constituents	<ul style="list-style-type: none">• Enhance security• Ensure durability
Supply chain processes	<ul style="list-style-type: none">• Minimize assembly cost• Facilitate disassembly	<ul style="list-style-type: none">• Minimize disruptions• Ensure availability
Community well-being	<ul style="list-style-type: none">• Enhance natural and social capital	<ul style="list-style-type: none">• Enable adaptability in times of crisis



“Crisis”

危 机

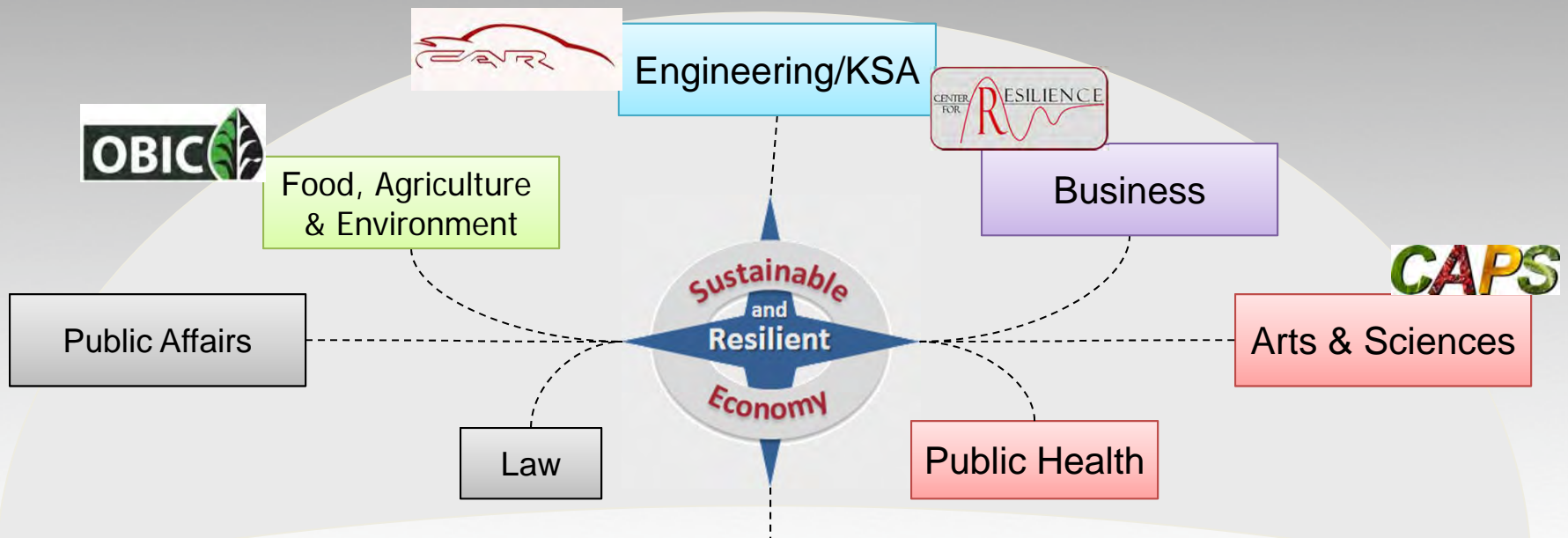
Danger

Opportunity



Sustainable and Resilient Economy

Mission: Accelerate the development of sustainable and resilient **production and consumption** systems that enhance the value and reduce the adverse impacts of global material and energy flows.



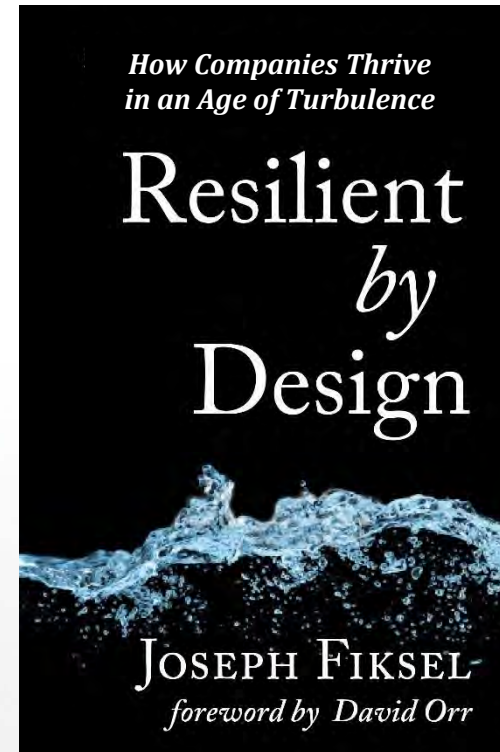
External Collaborators & Sponsors:

Universities, Research Institutes, Corporations, Agencies





Joseph Fiksel
Design for Environment
Second Edition
A Guide to Sustainable
Product Development
(McGraw-Hill 2009, 2011)



Joseph Fiksel
Resilient by Design
How Companies Thrive
in an Age of Turbulence
(Island Press, 2015)

