A COMPREHENSIVE TYPOLOGY OF COMPLEX SC RISK NETWORKS USING A DATA DRIVEN APPROACH

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- Assess risk (and resilience) in Industry 4.0 setting

- Describe an exploratory research project

- Develop an Enterprise Risk Management typology

Overarching Objective

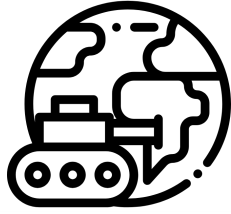Develop an empirical research agenda related to Enterprise Risk Management

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cyber

physical

cyber
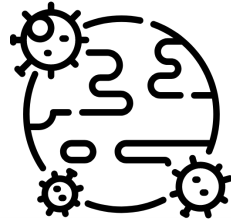
physical

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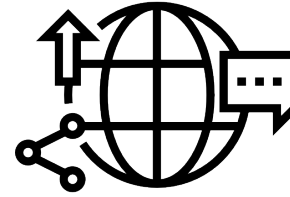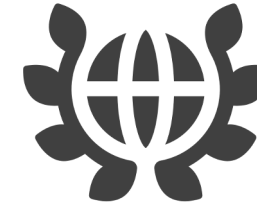
Why Complex Adaptive System Network?

Trade agreements

War

Pandemic
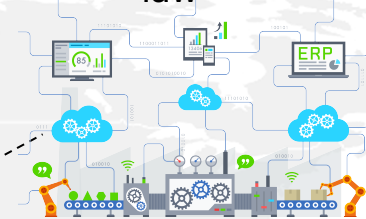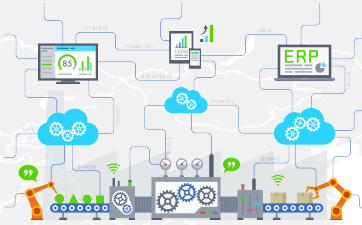
Social trends

International law

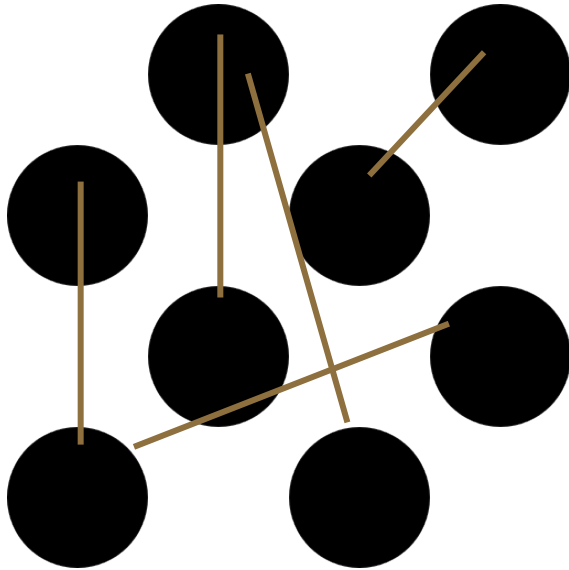Cyber threats

COMPLEX ADAPTIVE SYSTEMS

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Source: Sheth A, Sinfield JV. 2021 (in-review). "A simple framework to organize enterprise risks", Journal of Risk Research
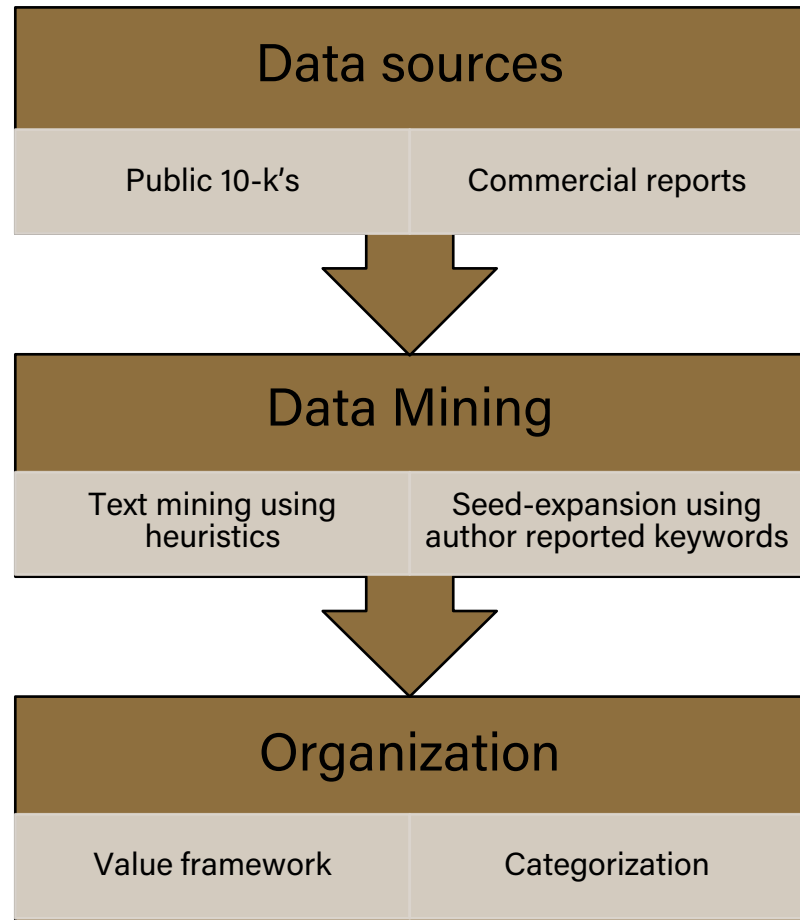

A broader view of potential risks and interconnections is foundational to understand the adaptive dynamics
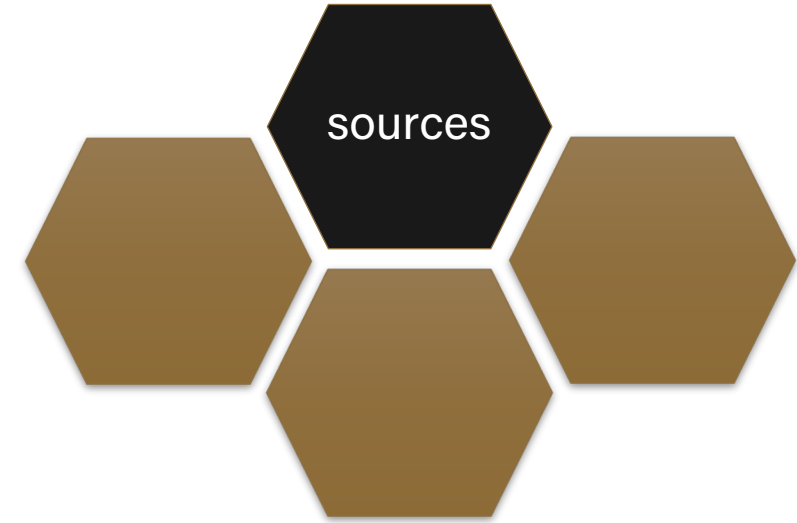
sources

A comprehensive risk typology will ground risk profile-performance relationships better towards empirical advancement
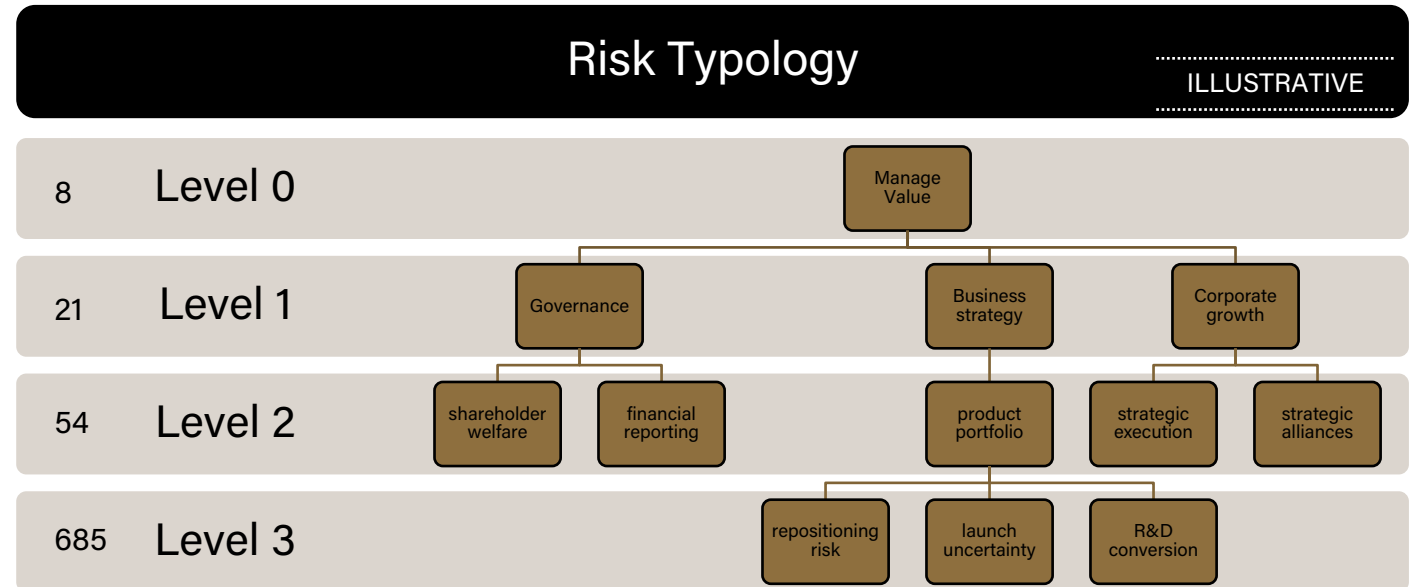
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A Comprehensive Enterprise Risk Typology

Data sources

| Public 10-k's | Commercial reports |

Data Mining

| Text mining using heuristics | Seed-expansion using author reported keywords |

Organization

| Value framework | Categorization |

Risk Typology ILLUSTRATIVE

8	Level 0
21	Level 1
54	Level 2
685	Level 3

Manage Value

Governance · Business strategy · Corporate growth

shareholder welfare · financial reporting · product portfolio · strategic execution · strategic alliances

repositioning risk · launch uncertainty · R&D conversion

Protect Value
Deliver Value
Capture Value
Manage Value
Risk
Create Value
Convey Value
Identify Value
Sustain Value

~700 non-unique risk factors
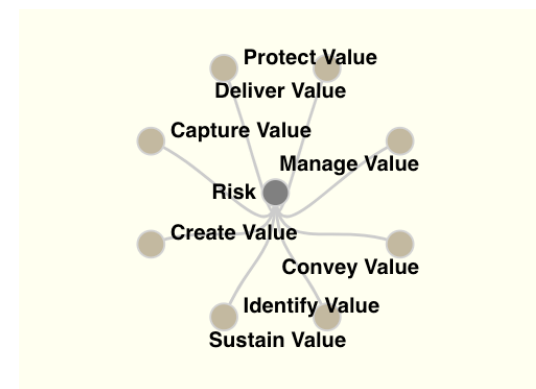
Risk Factors   **Value Framework**   **Risk Typology**

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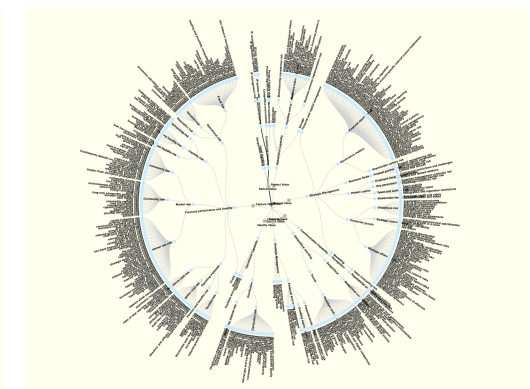
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As a next step:

Seeking expert opinion on classifying ~130 operations risk factors in order to convert the typology tree structure into a lattice network structure.

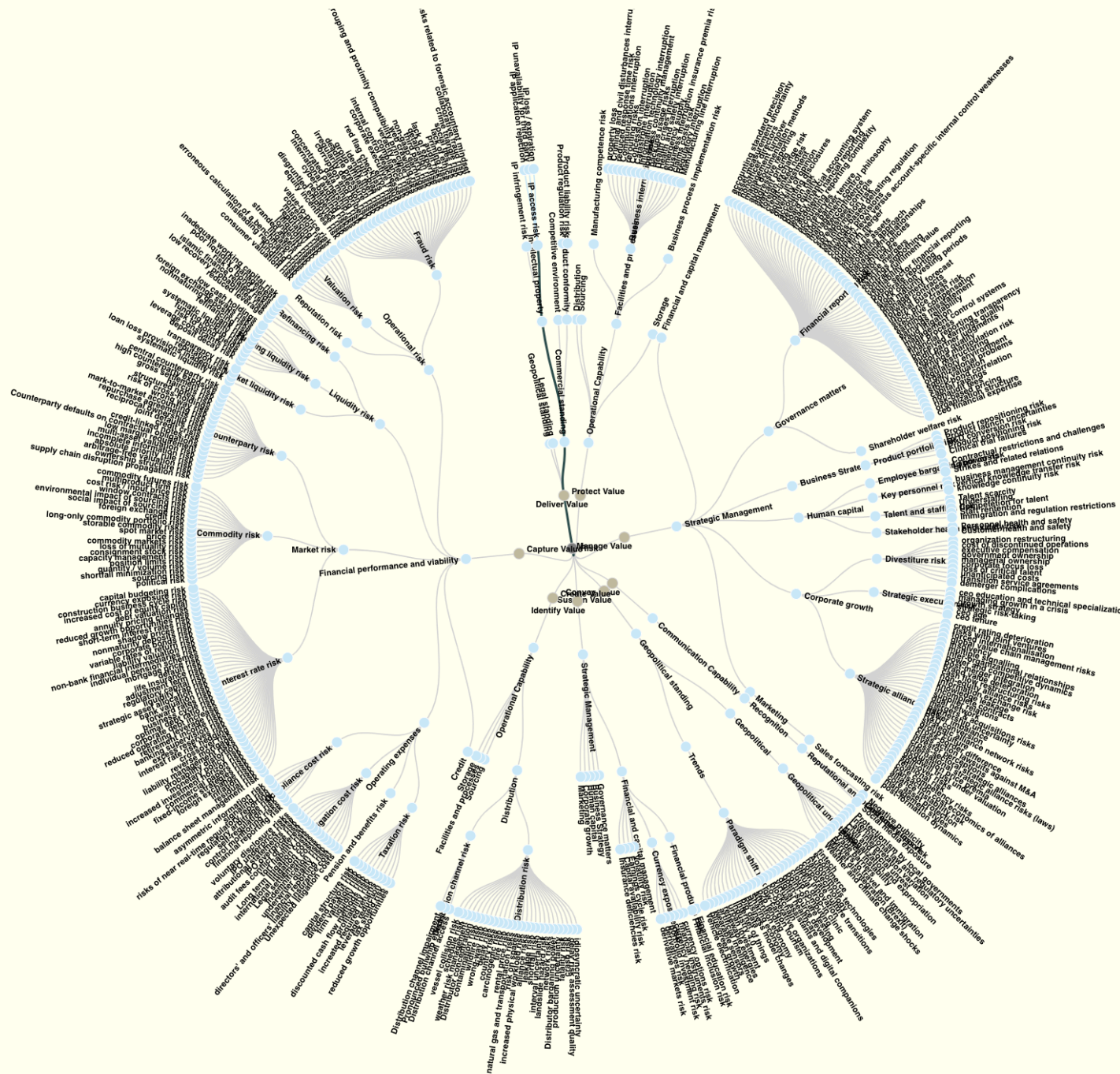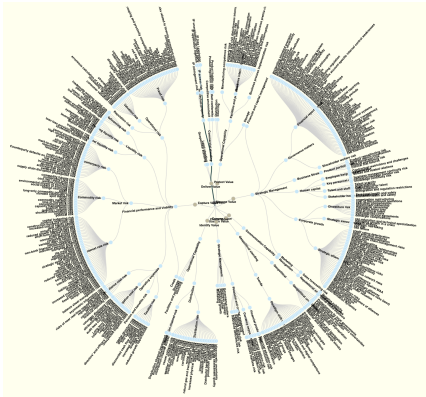| Level 1*	Level 2	Level 3	Level 4	Level 5
Risk Typology	**Risk Typology**	**Risk Typology**	**Risk Typology**	**Risk Typology**
Capture Value	Capture Value	Capture Value	Capture Value	Capture Value
Convey Value	Convey Value	Convey Value	Convey Value	Convey Value
Create Value	Create Value	Create Value	Create Value	Create Value
Deliver Value	Operational Capability	Operational Capability	Operational Capability	Operational Capability
Identify Value	Deliver Value	Facilities and processes	Facilities and processes	Facilities and processes
Manage Value	Identify Value	Sourcing	Business interruption risk	Business interruption risk
Protect Value	Manage Value	Storage	Business process implementation risk	Catastrphe interruption
Sustain Value	Protect Value	Deliver Value	Manufacturing competence risk	Regulatory interruption
	Sustain Value	Identify Value	Sourcing	Health crises interruption
		Manage Value	Storage	Criminal and civil disturbances interruption
		Protect Value	Deliver Value	Concession interruption
		Sustain Value	Identify Value	Health and safety interruption
			Manage Value	Manufacturing line interruption
			Protect Value	Information technology interruption
			Sustain Value	Communications interruption
				Rerouting risks
				Property loss
				Emergency supply
				Backup usage risks
				Business continuity management
				Business interruption insurance premia risk
				Reduced response time risk
				Claims costs risk

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*Converting Risk Typology Into Complex Risk Networks ***

Data mining and
text analysis
(AI tools)

Survey and
Semi-structured
interviews

Fuzzy Cognitive
Mapping

Comprehensive typology

Conceptual relationships

Complex network analyses

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1 – Professor, Civil Engineering, Purdue University
2 – Doctoral Candidate, Civil Engineering, Purdue University

Source: Sheth A, Sinfield JV. 2021 (in-review). "A simple framework to organize enterprise risks", Journal of Risk Research
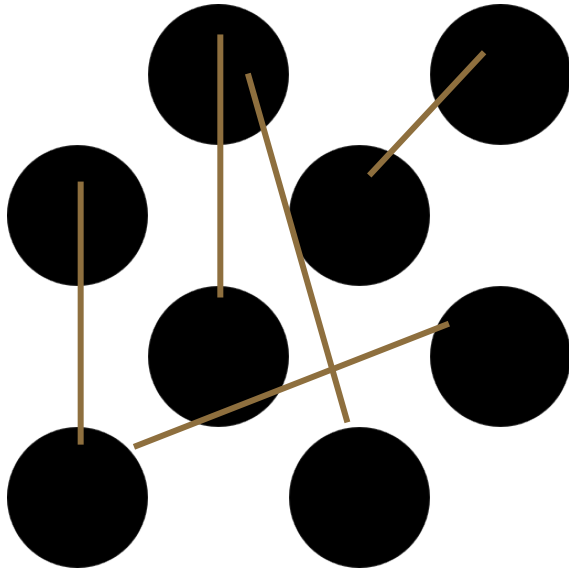
A broader view of potential risks can help develop a better understanding of interconnections
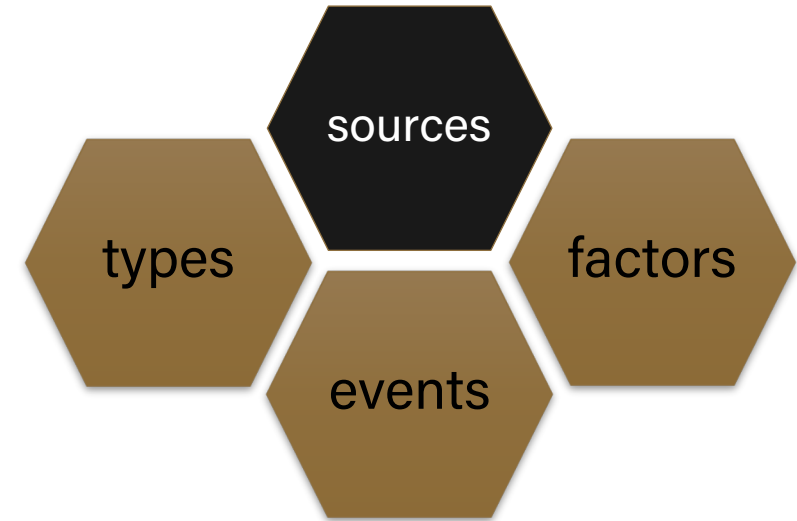
A comprehensive risk typology can help ground risk profile-performance relationships better

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An Organizing Schema For Empirical Research

Permanence of the induced change
How permanent is the change it causes?

- Permanent
- Reversible
- Temporary
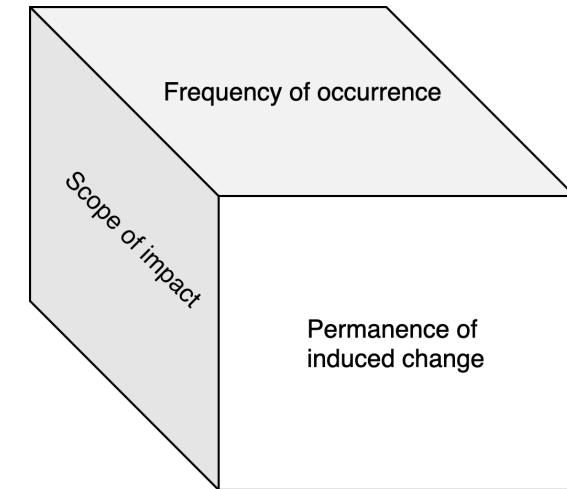
Frequency of its occurrence
How frequent and therefore, uncertain / predictable is it?

- Regular / predictable
- Irregular / estimable
- Unexampled / imaginable

Scope of the impact
How far reaching is its impact? Which stakeholders are affected?

- Intra-firm
- Inter-firm
- Intra-industry

Frequency of occurrence

Scope of impact

Permanence of induced change

DEPENDENT VARIABLE

Measure	Unit of analysis
Operational performance	Firm
Financial performance	Firm, Industry
Growth & Innovation	Firm, Industry

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RESEARCH

Overarching / Contingency View

- Empirically examine firm risk and growth (innovation, BM choices)
- Empirically examine risk and industry operational characteristics

Configurational / Holistic View

- Model to identify highly centralized and distributed risks
- Examine performance impact of cascading effect of specific events

TEACHING

Overarching / Contingency View

- Strategy and organizational design choices
- Actionable risk management via the contingency view

Configurational / Holistic View

- Machine Learning applications in business management
- Power and limitations of automated systems

THANK YOU

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