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Economic Resilience in National Space Economies

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REDEFINING LIMITS

ABSTRACT

Concerns around changing geopolitical climate, national and international space law regimes, technological advancement, and public/private investment and consumer demands necessitate precautionary measures or actions from spacefaring nations that will allow for long-term success in a dynamic industry.

Although the space industry is known for tremendous growth, throughout the ongoing COVID-19 pandemic, negative changes in private investment, demand, supply, and public policy have revealed that the satellite manufacturing, earth observation services, navigation services, and space exploration segments of the space sector have low to medium economic resilience [1]. Low economic resilience prompts poor crisis recovery which leads to productivity and revenue losses. Currently, the space economy is quantitatively measured through the use of indicators that describe its size and extent of growth. International comparability is difficult to maintain given the range of industrial classification systems that exist and variations in the timeliness of data.

Despite the dynamism of the sector, there is an absence of economic resilience measurements.

This proposal offers a framework that describes (1) how the concept of economic resilience fits into the wider context of the space sector and (2) how the economic resilience of a space sector can be measured through the use of indicators. In addition, this framework will be supplemented with a compartmentalization scheme that puts nations into categories to help distinguish the types of economic resilience indicators required for each group of nations.

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 - a. Concept
 - b. Indicators
 - c. Compartmentalization scheme



RESEARCH OBJECTIVES AND SCOPE

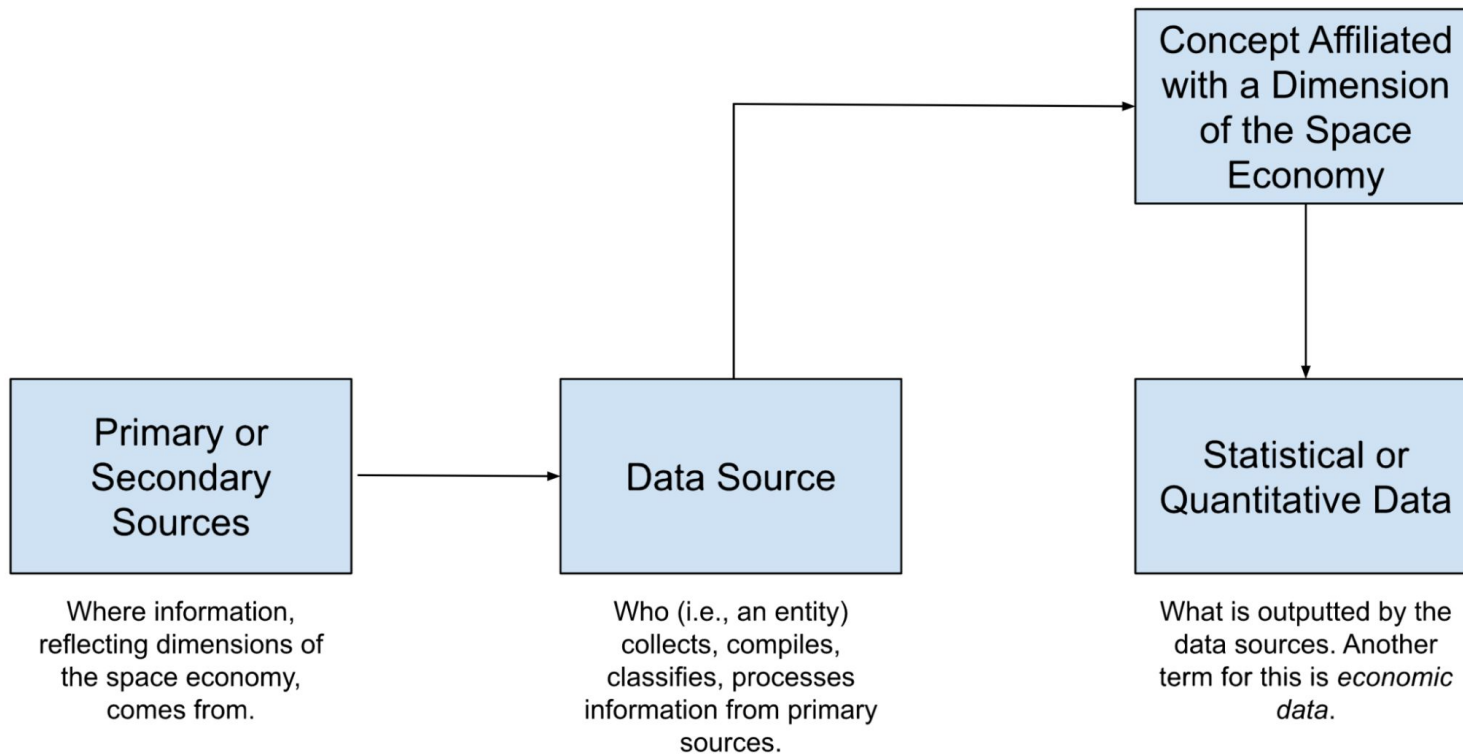
Objectives

1. Identify the wider context within which economic resilience can be applied in the space sector.
2. Develop indicators to provide quantitative measures of a national space sector's economic resilience.
3. Describe and mitigate challenges associated with international comparability to ensure that clear comparisons can be made between the economic resilience measures of different nations.

Scope: Public and Private Sectors; Upstream and Downstream Sectors.



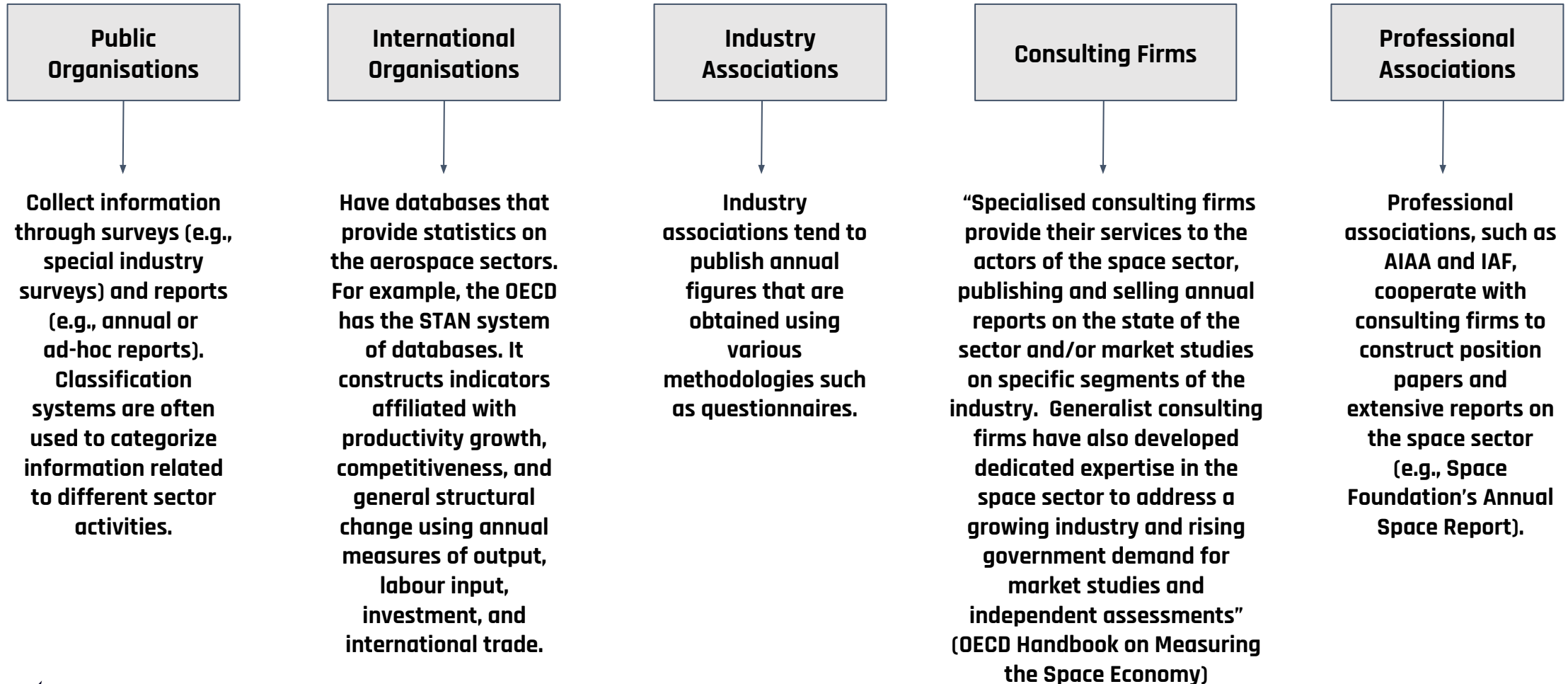
BACKGROUND: CURRENT METHODS FOR MEASURING SPACE ECONOMY



Economic data on the space economy in its original form is not quantitative. Special care must be taken to ensure that selected primary/ secondary sources reflect sought-after information on the space economy.

Data sources responsible for outputting statistical data that appropriately describe the socio-economic impacts of the space economy include public organisations, international organisations, industry associations, consulting firms and professional associations.

BACKGROUND: CURRENT METHODS FOR MEASURING SPACE ECONOMY

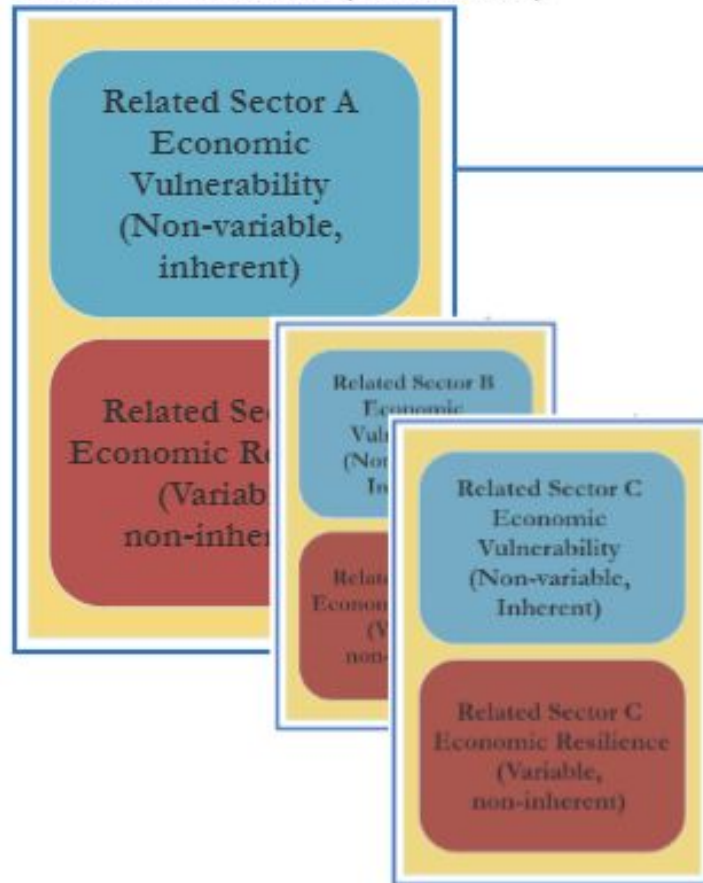


LITERATURE GAPS

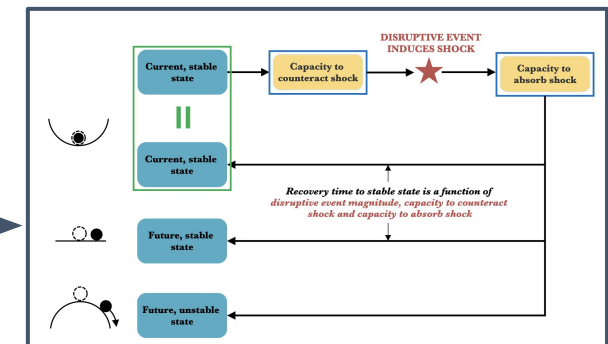
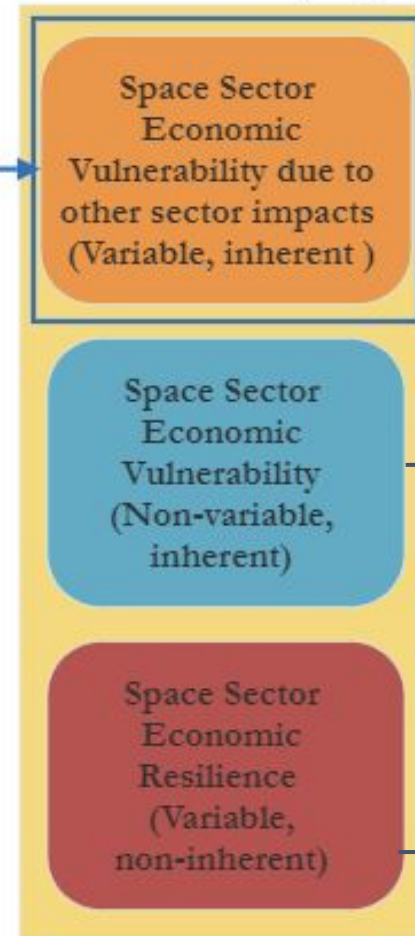
- From a general standpoint, the field of economic resiliency is “young, with few resources, conceptual frameworks, or case studies” (The World Bank on Resilient Industries). This especially is the case for the space sector.
- Lack of economic resilience measurements and standardisation means that it is hard to quantify the reactions of national space sectors to sector-wide disruption events such as COVID-19
- Precisely measuring economic resilience and identifying key areas of weakness allows space actors to:
 - Minimise losses and disruption
 - Continue and quickly resume operations after disruption events
 - Sustain and increase competitiveness

APPLYING COMPOSITE ECONOMIC RESILIENCE TO SPACE SECTOR

Relevant Sectorial Composite Economic Resilience Measures (Established)



Space Sector Composite Economic Resilience Measure (Proposed)



COMPOSITE ECONOMIC RESILIENCE

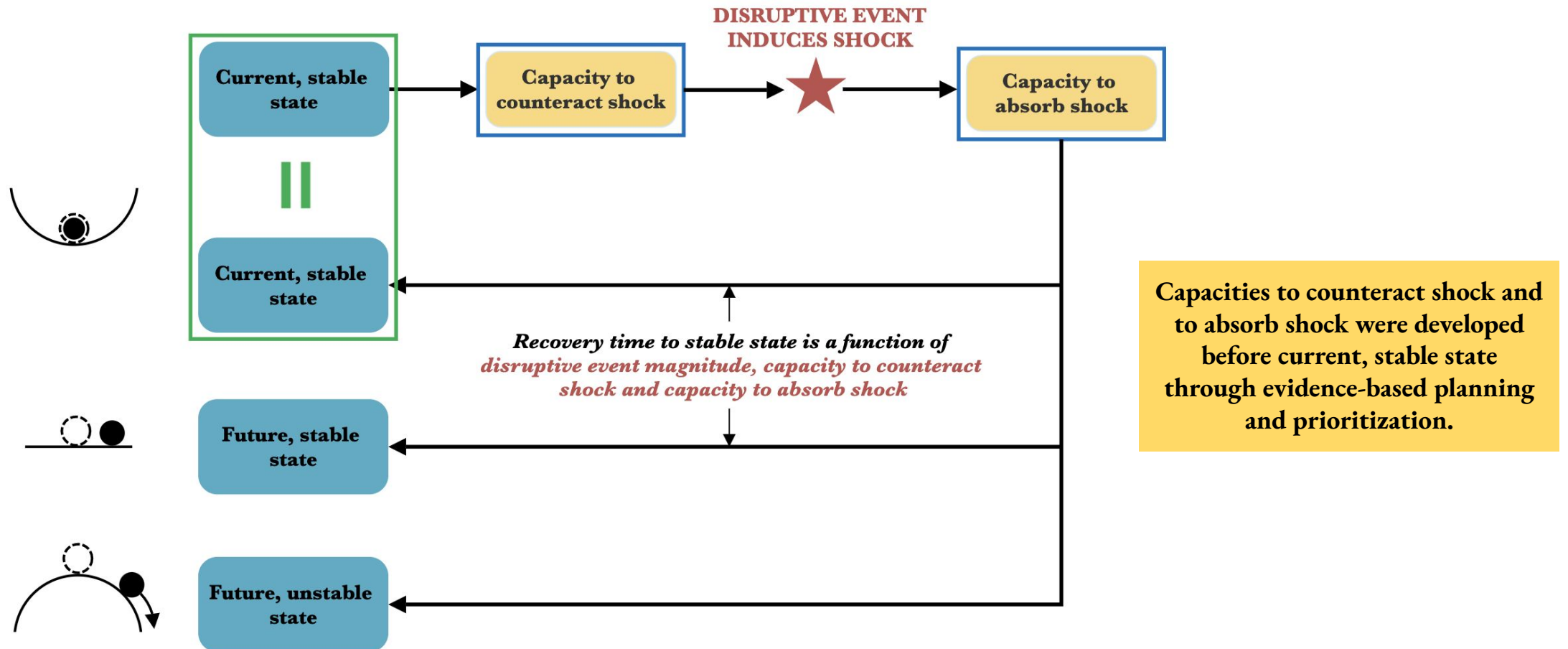
1. Composite economic resilience is defined as the ability to avoid, withstand, and recover from severe economic fluctuations at the sectoral level.
2. Composite economic resilience of a sector is composed of inherent and non-inherent components. The inherent component is termed economic vulnerability, which is defined as a collection of inherent disadvantages that the specific sector leaders cannot eliminate, mitigate, or adapt to, to a large degree. The non-inherent component is termed economic resilience, which is defined as the ability of sector leaders to eliminate, mitigate, or adapt to disruptive events (Briguglio, Lino et al.).
3. The variable and inherent economic vulnerability of the space sector is determined by both the economic vulnerability and economic resilience of other related sectors that impact the space sector. In this way, both non-variable inherent and variable non-inherent aspects of other sectors are packaged together into conditions that can change for the space sector (variable), but cannot be easily mitigated by space sector leaders (inherent).
4. Composite economic resilience is measured as a sum total of the indicators affiliated with economic vulnerability and economic resilience. Each indicator will be assigned a weighting.

DISRUPTIVE EVENTS

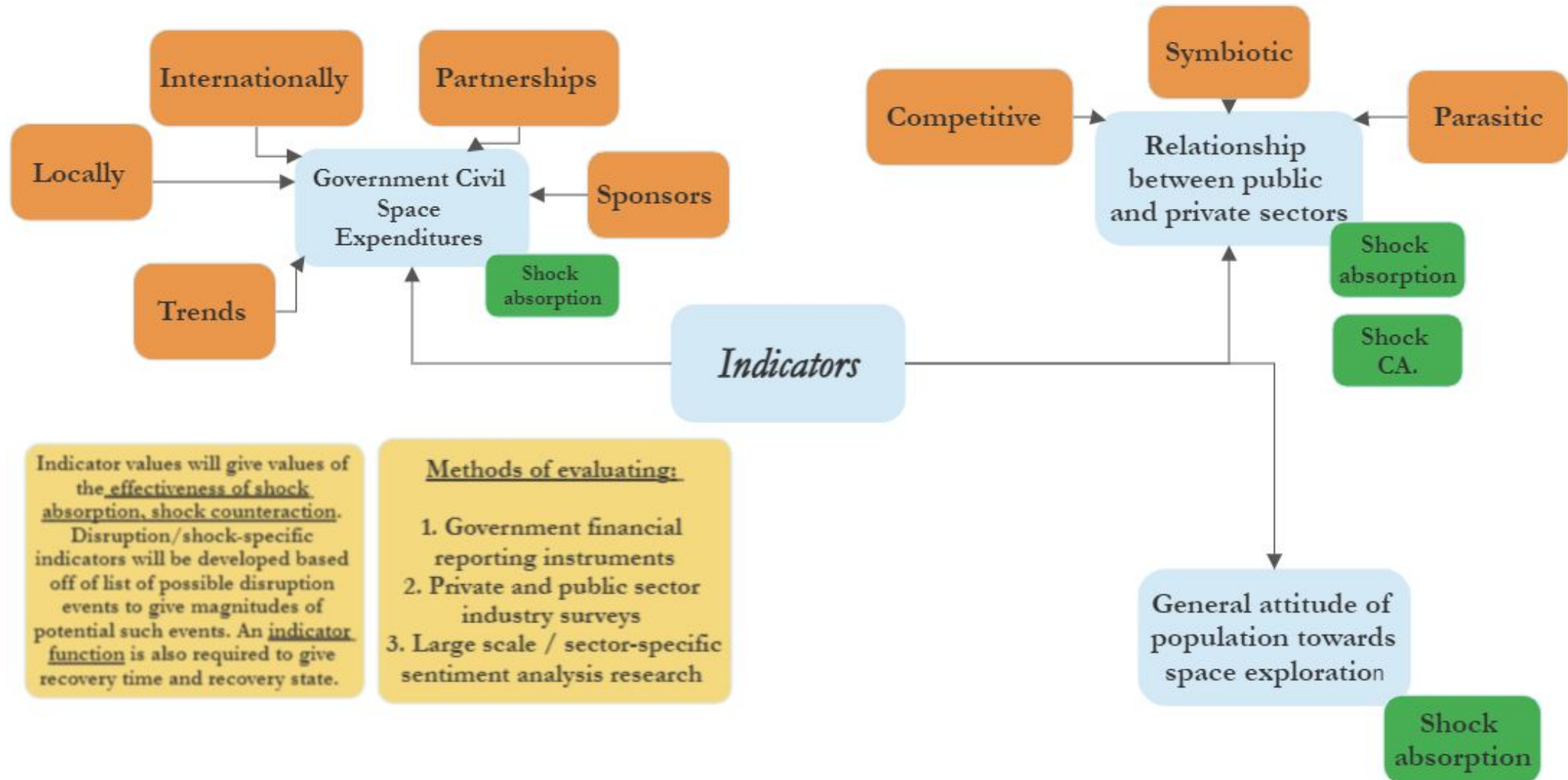
Categorization Framework of Disruptions by Sanchis and Poler:

- Business interruption;
- Damage to reputation/brand;
- Delays to and failed due dates;
- Failure to attract or retain top talent;
- Failure to meet customer needs;
- High inventories;
- Impossibility to pay personnel, suppliers, taxes;
- Increase in final product prices;
- Increased production costs;
- Injury to end customers;
- Injury to workers;
- Loss of intellectual property/data;
- Loss of networked communication;
- Physical damage;
- Reduced sales;
- Understaffing;
- Unfulfilled orders.

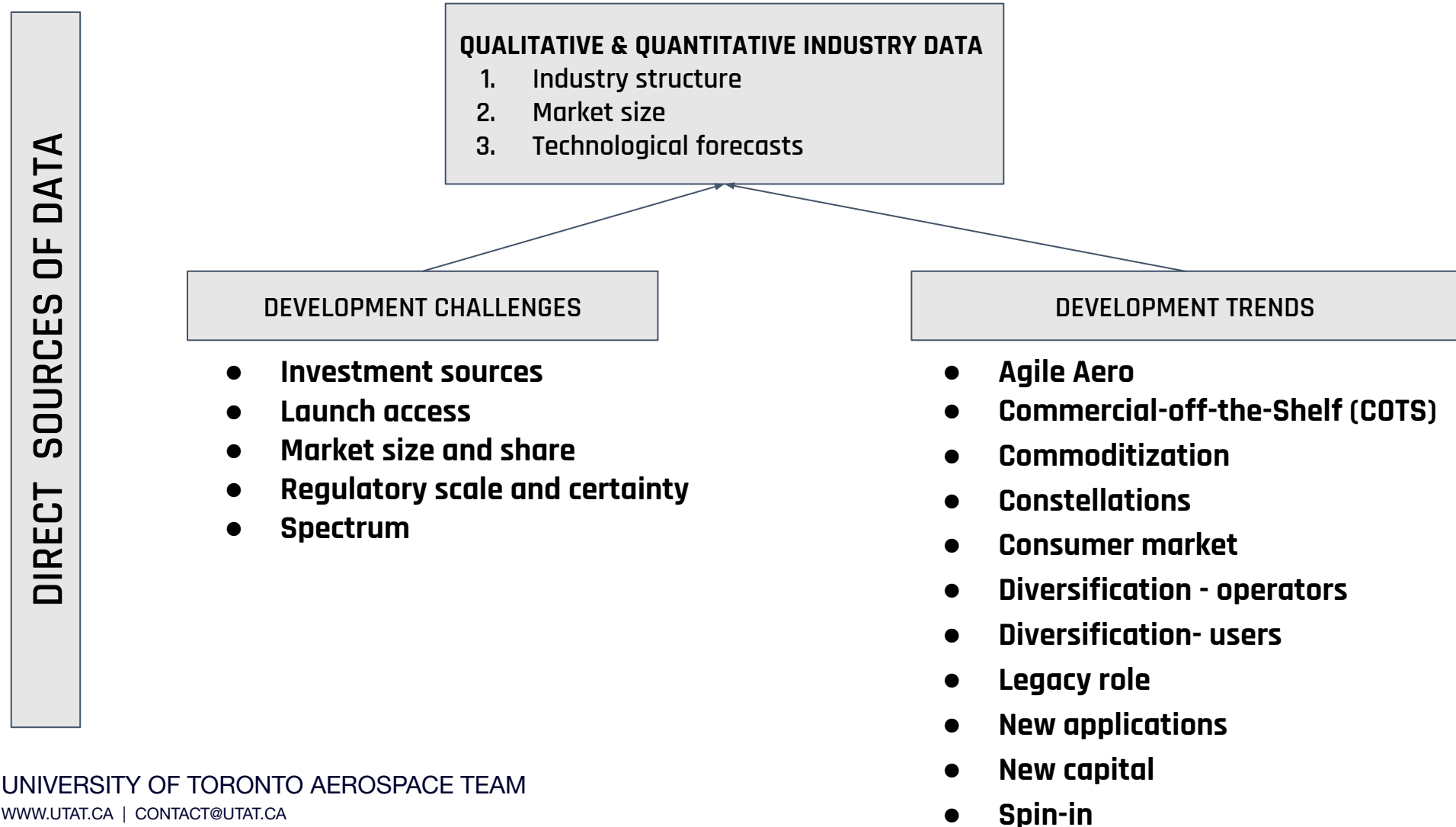
ECONOMIC RESILIENCE FRAMEWORK FOR SPACE SECTOR



SPACE-SECTOR-SPECIFIC INDICATORS TO MEASURE ECONOMIC RESILIENCE



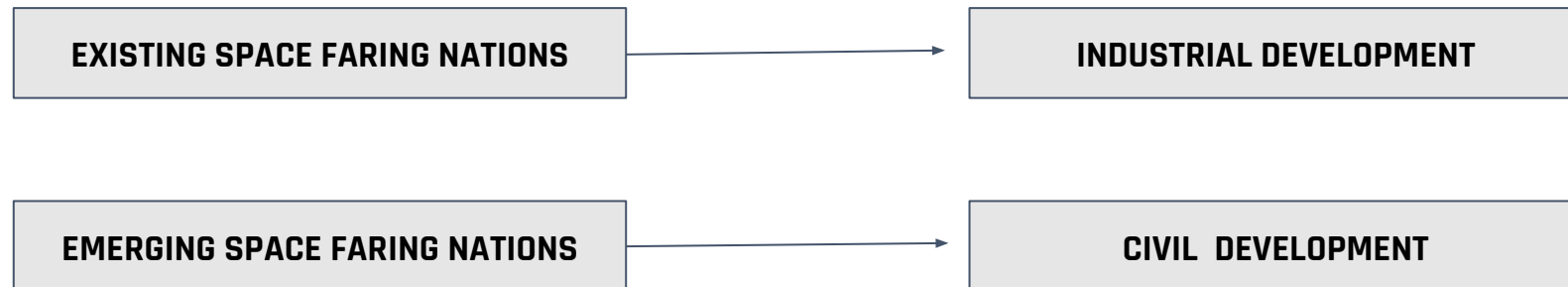
INTERNATIONAL COMPARABILITY



INTERNATIONAL COMPARABILITY

INDIRECT SOURCES OF DATA

- Industry/agency budget and its distribution towards civil, defense and scientific activities
- Overseeing structures of stakeholders
- Internal organizational structure
- Types of programs
- Partnerships and knowledge transfers amongst agencies/industries
- Sources of funding outside of the GDP
- Engagement in activities allows for technology transfer



INTERNATIONAL COMPARABILITY

PURPOSE OF RESILIENCE INDICATORS IN DATA

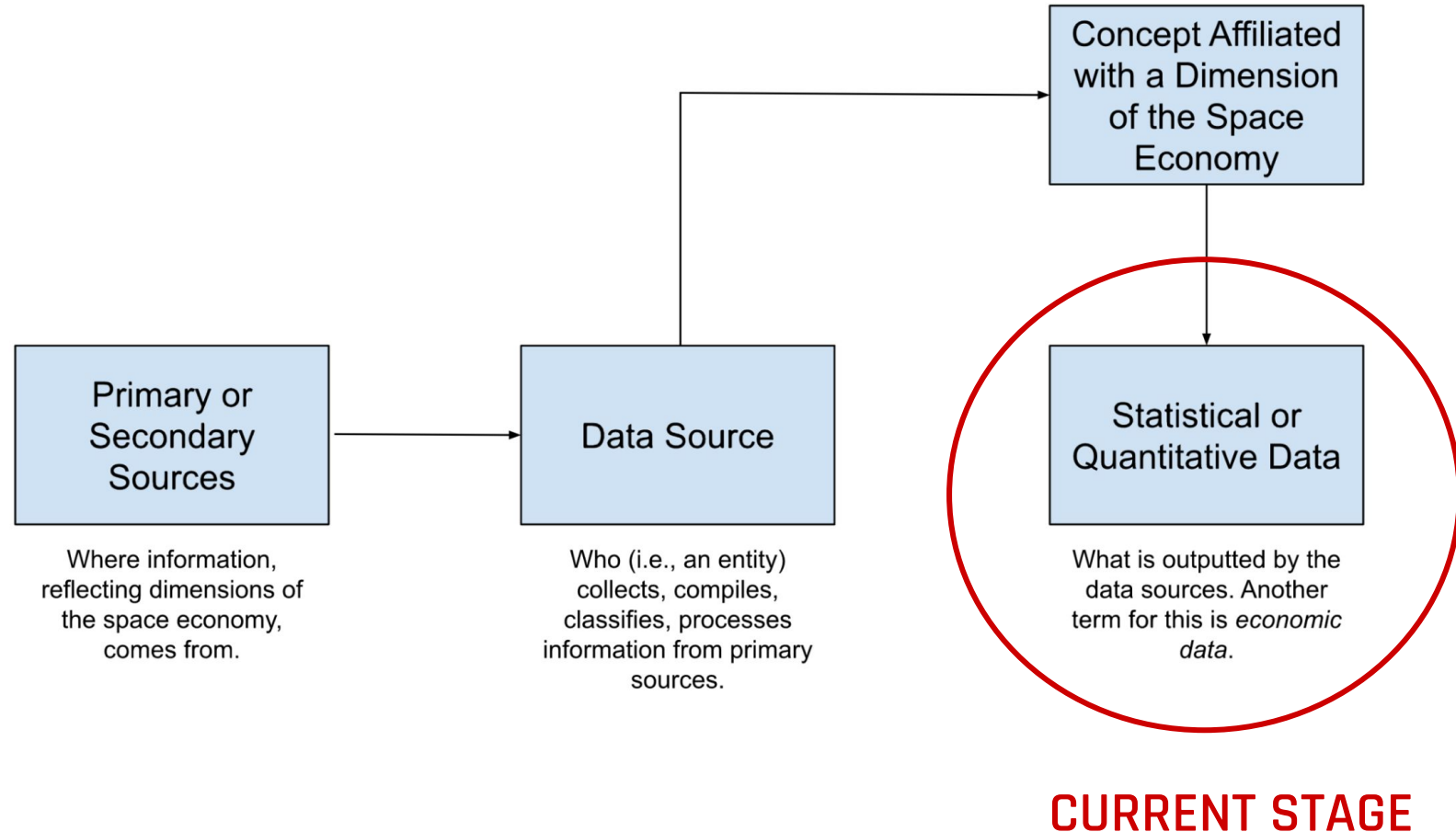
- **Gain insights for decision making, target-setting and establishing regulations**
- **Monitor and evaluate developments**
- **Derive quantitative estimates**
- **Increase awareness amongst firms and nations through the**
- **sharing of information**
- **Focusing scholarly discussion; and**
- **Promoting cooperative action and collaboration**

NOTABLE EXAMPLES

- A. **Novel partnerships, like that between SpaceX and NASA compared to traditional contractors like Boeing and Lockheed Martin**
- B. **UNOOSA April 2022 Outcome Report: resiliency during the COVID-19 pandemic, Earth applications of space technologies, and climate action— industry and nation resilience vulnerability and an increasingly prevalent source of shock**

NEXT STEPS

- Fully develop the quantitative methods needed for evaluating indicators listed for economic resilience measurements.
- Combining developed indicators to measure composite economic resilience.
- Compile a list of national space economies by composite resilience rankings, and identify critical areas of weakness for potential mitigation measures.



Thank you for your time!
Q&A now in session.

