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Resilience at OECD: Current State and Future Directions

Draft paper

This draft paper, undertaken by staff at the US Army Corps of Engineers and the OECD NAEC Unit, outlines how OECD Directorates are working to build safeguards, buffers and resilience to physical, economic, social and environmental shocks.

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Resilience at OECD: Current State and Future Directions

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Abstract

Introduction

Resilience is a topic of increasing interest on an international scale. As both a governing philosophy and a tool for system and organization assessment, resilience generates the capacity to understand system's ability to recover and adapt following both predictable and unknown future disruptions. Such an approach can assist many countries to better strategize against a variety of uncertain and complex threats ranging from climate change, to infrastructural degradation and failure, to economic and financial challenges by emphasizing the capacity of these systems to efficiently recover from disruption and adapt to better meet future potential disruptions. However, resilience lacks a universally accepted definition and practice that bridges multiple disciplines and application areas. As such, international governance and norms-building have an opportunity to more clearly scope the theory and practice of resilience within the global economy.

The Organisation for Economic Co-operation and Development (OECD) is one of the preeminent international governance authorities with a clear mission to stimulate economic development and world trade. A recent interest by OECD includes the role of resilience to improve the national and international response to various budding and ongoing crises, including economic and financial disruption, threats to societal cohesion and harmony, and general catalysts for crises that may escalate into violent conflict. As a major norms-building organization that seeks to align member state and observing state governing practices via shared principles and goals, OECD's discourse on resilience plays a role towards the broader adoption of resilience philosophies into the governing practices of various countries.

A core question for OECD centers upon identifying which veins of resilience's scientific practice to build from. Many in academia have reflected upon the interdisciplinary, multi-temporal, and multi-stakeholder nature of resilience, yet few have explored how the governing philosophies and policy documents pertaining to resilience in various industrial, economic, and social sectors are discussed and implemented in high-level policy arenas. One prominent example includes the National Academy of Sciences, which defined disaster resilience as the ability to plan and prepare for, withstand and absorb,

recover from, and adapt to adverse events (Larkin et al 2015[1]). Similarly, Alberts & Hayes (2003)[2] emphasize the need to consider resilience across a broad spectrum of categories, including physical and information systems infrastructure as well as cognitive and social systems and frameworks. These represent a small number of the growing body of resilience literature, and represent opportunities for norms-building bodies like OECD to utilize in their own application of resilience for international governance.

Given the growing body of academic literature which academically frames resilience, a better understanding of OECD's formulation of resilience is required to determine (a) how OECD understands and implements resilience in various sectors, and (b) which opportunities may exist for extensions of resilience discussion given growing opinion in scientific literature. To address both of these considerations and, this paper comparatively reviews how public policy documents published within various OECD directorates frame resilience as a governing philosophy and policy objective. Using such analysis, it is possible to better understand how OECD's discussion of resilience might shape governing practices of the global economy, as well as to identify future opportunities for discourse and exploration not currently covered by many OECD directorates.

Methods

This paper employed the use of the resilience matrix framework to compare temporal and spatial scales of resilience across OECD directorates. A number of OECD directorates (N = 12) were included in the study based on the following criteria: one or more published materials produced by the directorate contained the use of the word 'resilience' (see SI text, *Summary of policy communities and select publications*). Publications (n = 27) for each of the twelve OECD directorates were included in the study from the past decade based on the following criteria: publicly available and contained the use of the word 'resilience'.

The published materials were scored for direct and indirect inclusion of temporal and spatial stages of resilience (see SI text for definitions, Table 1). Publications were first scored based on direct use of each of the four temporal stages of resilience, if direct use of the words "plan," "absorb," "recover," and "adapt" or synonym phrases were used to describe each of the terms within the publication (large square, Table 1). The criteria for each of the resilience stages were defined in the following ways: (1) plan/prepare included the steps taken by organizations to prepare critical functions and features of their operation for a universe of potential threats, (2) absorb comprised the capability of a system/organization to absorb the consequences of a shock without breaking and maintaining a certain degree of function, (3) recover included the time and resources needed for the system to recover its functionality post-shock and (4) adapt included the capacity of an organization or system to 'learn' and improve its capacity to absorb and recover from shocks based upon past experience. The publications were also scored for "indirect" reference to each of the four temporal stages of resilience, where metrics and other indicators were used to signify reference and inclusion of the four stages of

[1] Larkin, S., Fox-Lent, C., Eisenberg, D. A., Trump, B. D., Wallace, S., Chadderton, C., & Linkov, I. (2015). Benchmarking agency and organizational practices in resilience decision making. *Environment Systems and Decisions*, *35*(2), 185-195.

[2] Alberts, D. S., & Hayes, R. E. (2003). Power to the edge: Command... control... in the information age. OFFICE OF THE ASSISTANT SECRETARY OF DEFENSE WASHINGTON DC COMMAND AND CONTROL RESEARCH PROGRAM (CCRP).

temporality (medium square, Table 1). The last category denoted a lack of either direct or indirect reference to each of the four NAS resilience stages (small square, Table 1).

Each publication was also scored based on the three primary spatial domains of resilience, including the physical, informational, and social assets of resilience. The criteria for each of the spatial resilience domains were defined in the following ways: (1) physical showed that resilience was assessed within the context of physical infrastructure, (2) information revealed that resilience was discussed with regard to information flows and data moving up the system, and (3) social showed that resilience was applied within the context of societal action and making society nimble in the face of shock.

Direct inclusion of each of the temporal stages and resilience domains were mapped for each OECD directorate and affiliate agency in a resilience matrix (Figure 1). The direct scoring for the temporal and spatial stages of resilience for the OECD directorates were compared to the temporal and spatial stages employed among various US federal agencies (Figure 1). Two separate coders coded each of the publications for content analysis based on the temporal and spatial stages of resilience. The coders analyzed content for resilience definitions, examples of indicators/metrics of resilience, and quantitative and/or qualitative approaches from each publication by which to measure resilience (see SI text for content, Table 2). This information was used to assess metrics and scales of analysis employed for each publication. A survey of OECD Directorates was conducted after scoring of the publications to assess the need for a normalized definition of resilience.

Results

OECD's resilience matrix shows that while all facets of resilience are considered across the collection of all directorates and affiliates, most focus is placed upon the 'plan' and 'absorb' temporal stages, as well as the 'social' domain (Figure 1). Alternatively, the resilience matrix shows that the content of publications produced by the OECD directorates on an organizational level does not consistently address the latter temporal stages of resilience, including the recovery and adaptation temporal stages post-disruption. The resilience matrix also shows that the OECD directorates place lesser emphasis on the physical and information domains of resilience for any given system-of-interest, relative to similar analysis conducted by US agencies (Figure 1).

Some directorates, such as the Trade and Agriculture Directorate (TAD), excel at addressing resilience across the temporal stages and spatial domains of resilience. One publication produced by the TAD, for example, discusses resilience across all three domains of resilience (social, physical, and infrastructure), and addresses resilience temporally in terms of preparation, absorption, and recovery. The second publication authored by the TAD discusses resilience in terms of information and social domains of resilience, and discusses the importance of addressing resilience across all four temporal stages (plan and prepare for, absorb, recover from, and adapt). Other directorates and affiliate agencies, such as the International Energy Agency (IEA), do not directly address resilience across any temporal stage and is precluded from the resilience matrix. Still, other directorates, such as the Environmental Directorate (ED), occupy the resilience matrix within one temporal stage (preparation and social domain (physical) only.

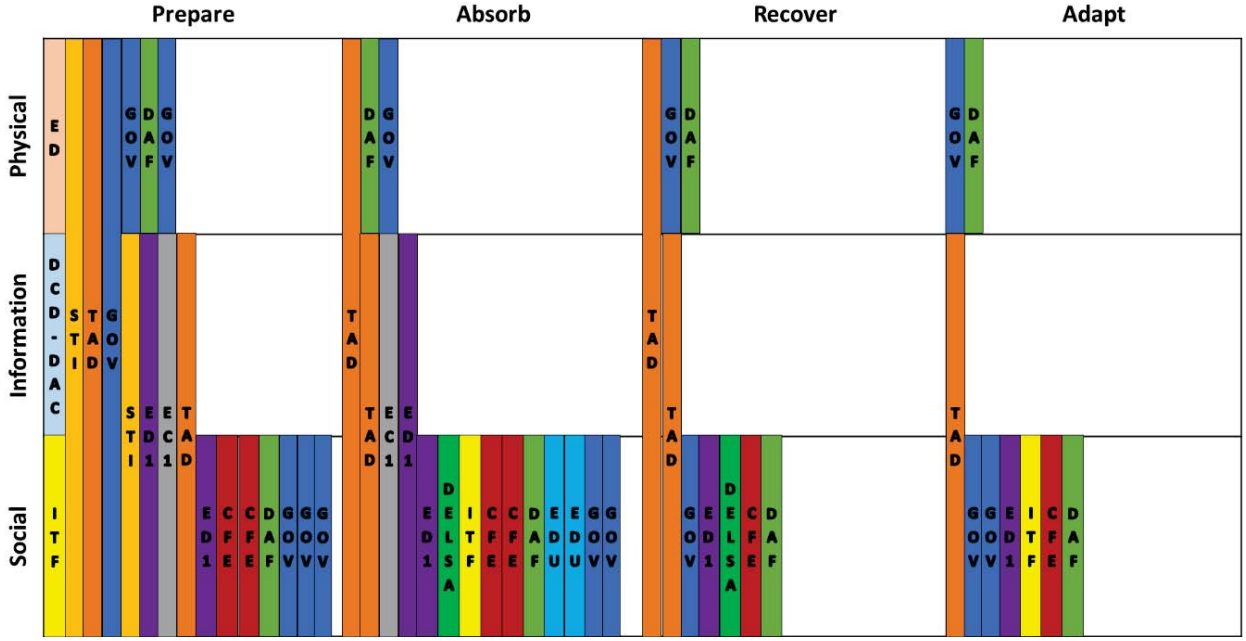
The resilience matrix produced by Larkin et al. 2015, which was constructed to assess the temporal stages and spatial domains of resilience in publications produced by various US federal agencies,

comparatively shows that on the organizational level in the United States resilience is discussed largely in terms of physical domains of resilience. The resilience matrix also shows that, within the physical domain of resilience, that resilience is addressed across the early stages of resilience pre-impact and the recovery stage of resilience immediately post-impact. Lesser emphasis is placed on the social and information domains of resilience, and temporally on resilience in terms of adaptation.

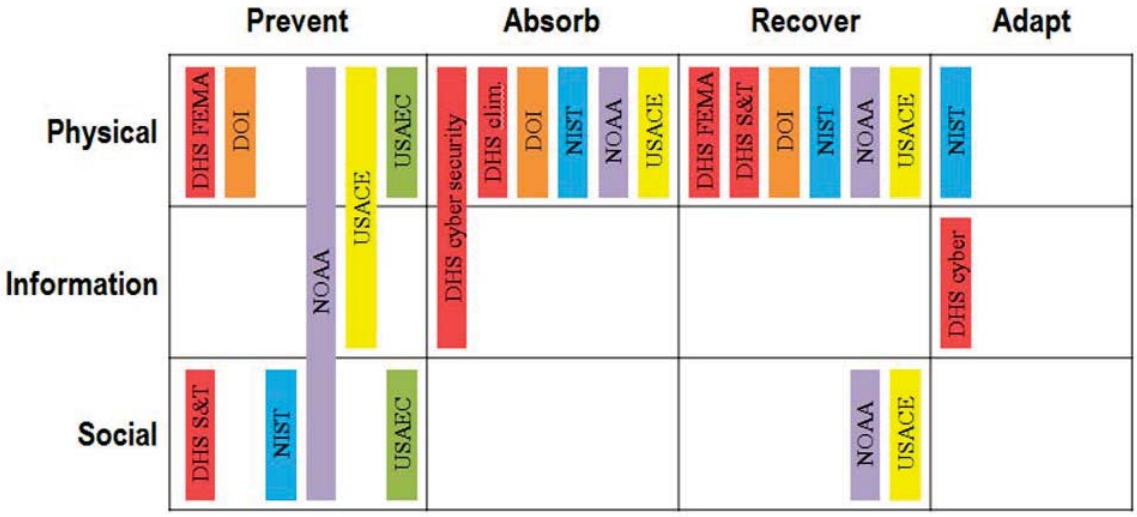
As a broad overview of the resilience content of the OECD publications produced by various OECD directorates and affiliate organizations, 13 of the 27 publications did not provide resilience definitions. Of the 14 resilience definitions provided within the publications, 2 of the publications referred to the need for systems to prepare for future shocks, 13 of the publications referred to the need for systems to absorb, or withstand shocks, 10 of the definitions referred to the need for systems to recover following an adverse attack, and 7 of the definitions referred to the need for systems to adapt, or learn and transform their structures in preparation for future events. The resilience metrics varied drastically depending on the system and domain being discussed, and provided insight into the type of shocks that were anticipated to targeted systems, along with the measures used to define and monitor resilience. Two of the publications included metrics related to the information domain with the majority of metrics used to assess resilience within the social domains of resilience. Various qualitative and quantitative assessments were discussed and ranged from multi-stakeholder engagement and case studies for the preparation of systems against shocks to quantitative assessments such as resilience systems analysis, safety analysis, risk/hazard assessments, vulnerability and needs assessments, economic/cost benefit analysis, risk auditing/screening tools, climate forecasts and early warning monitoring, foresight analysis, and global value chain modelling for the monitoring and reduction of vulnerabilities amongst various systems.

Figure 1. Resilience matrix showing the direct temporal (plan and prepare for, absorb, recover from, and adapt) and spatial (social, information, physical) domains of resilience for (a) each of the twelve OECD agencies and affiliate directorates and (b) each of the seven US federal agencies and departments discussed within Larkin et al. 2015.

(a) OECD Directorates



(b) US Agencies (Larkin et al., 2015)



Discussion

As this paper highlights, various OECD directorates and affiliate organizations advocate for the use of resilience to combat systemic threats to various interconnected and complex systems, such as those related to energy, climate, education, and finance. This paper shows that the resilience matrix can

normatively be used by various international and domestic agencies including US federal agencies and the OECD to coordinate the inclusion of resilience across all relevant temporal stages and spatial domains. While the focus of physical domains of resilience naturally arise from US federal agencies out of a need to address infrastructure needs related to natural disasters, such as Hurricane Katrina in 2005, and social domains of resilience arise naturally with regard to OECD member states from a socio-ecological perspective, every interconnected system requires physical, information, and social infrastructure. The resilience matrix ensures that bodies dedicated to the enhancement of resilience among integrated systems address resilience across all applicable social, physical, and information domains. Similarly, the resilience matrix ensures that bodies dedicated to the enhancement of resilience address all temporal stages of resilience pre- and post- disaster impact.

While the publications produced by various OECD agencies and affiliate organizations are found to largely highlight the importance and need for resilience to combat social challenges, they generally do not directly address resilience as it relates to system functionality within the physical and information domains. The spatial fragmentation of resilience across the physical, information, and social domains leaves national structures vulnerable in managing "all hazards" of interconnected systems. The resilience matrix shows that OECD agencies and affiliate organizations advocate for strong use of social networks and capital to enhance the use of personnel and institutions in expectation of event response, while foregoing equally critical emphasis on equipment, network structure and data preparation, analysis, and storage for the recovery of system functionality in the course of adverse events (Linkov et al. 2013).

The resilience matrix also shows that OECD directorates emphasize risk-based approaches such as the capacity of a system to prepare for and withstand threats, yet generally do not place as much emphasis upon resilience-based approaches system recovery and adaptation post-impact in a cross-directorate view. This temporal exclusion foregoes much of the benefits of resilience analysis compared to the employment of traditional risk assessments in that emphasis on system recovery and adaptation is largely ignored. Across the OECD directorates, this translates into a call for greater use of data tracking to anticipate recovery scenarios, teamwork and knowledge sharing to enhance system recovery, physical system changes to recover functionality, and changes to improve system resilience in anticipation of similar impacts occurring to systems-of-interest over time (Linkov et al. 2013).

An important consideration for any resilience work among OECD directorates within the social domain and across all temporal stages of the resilience matrix includes the interplay between promoting system resilience while foregoing potential status quo benefits such as economic opportunity. Economic policies, for instance, can present tradeoffs between growth and resilience. The Economics Department (ED1) refers to this as the growth-fragility nexus (OECD, 2016k). In this way, a policy, or a bundle of policies, can either be growth-enhancing or growth-limiting as well as either resilience-building or resilience-diminishing. Labor market flexibility can be increased (resilience-building) through reforms to employment protection legislation to have positive long-term effects (OECD, 2016j). However, when demand conditions are weak there can be significant negative impacts on private-sector employment (growth-limiting) within two-to-three years following such a reform. Tax policies designed to encourage investment and homeownership (growth-enhancing) can also be resilience-diminishing as firms and households assume excessive debt which can lead to financial risks and recessions in the face of an inadequate financial regulatory framework (OECD, 2016j).

The inclusion of a broad overview of resilience (see SI text, Table 2) shows that the inclusion of resilience definitions, examples of resilience metrics/indicators, and qualitative and quantitative analyses to measure resilience are useful for an overall impression of resilience content among OECD directorate and affiliate organization publications. However, the lack of a framework to assess resilience leaves directorates without an avenue to harmonize and coordinate their understanding and application of risk-based and resilience-based approaches.

Alternatively, the resilience matrix addresses the need for directorates to include a normative definition of resilience, both temporally and spatially. The resilience matrix specifically addresses the need to assess resilience across all resilience metrics and scales of analysis. Further, the use of resilience matrices enable OECD directorates to employ a normative definition of resilience within their risk governance frameworks moving forward. Despite differences in environmental, social, and economic challenges being addressed across OECD directorates, the use of a normalized definition of resilience and resilience matrix recognizes the interconnectivity of systems across social, information, and physical domains and the emphasis and need for OECD directorates to bolster system recovery and adaptation in the face of adverse events. The normalization and operationalization of resilience across OECD directorates might also ensure that resilience metrics and indicators, such as those emphasized in the Economics Directorate (ED1) and Centre for Entrepreneurship, SMEs, Local Development and Tourism (CFE), relate to all aspect of systems resilience, including metrics and indicators pertaining to the temporal stages and social domains of resilience. Normalization of resilience standards is particularly salient given the increasing system complexity and cascading effects of shocks to the global network of interconnected systems as globalization continues (Shea, 2016).

The survey of Directorates on resilience indicated a mixed response to the idea of a normalized definition. For instance, whilst the NAS definition focusing on “planning”, “absorbing”, “recovering” and “adapting” as the key elements of resilience is useful for understanding the concept in many systems, potential shocks - and the routes of exposure to such shocks - can vary across different systems. In that light, many Directorates felt there was a danger that some of the precision necessary for resilience in a specific system may be lost when attempting to move to an overly generic approach. However, it was acknowledged that a “normalized definition of resilience” would incorporate the intrinsic multi-dimensionality of resilience. Indeed, most OECD work has so far focused on piece-meal dimensions (e.g. economic resilience, environmental resilience, etc.), thus a broader definition could help connecting the different strands. Were a common definition of resilience agreed across the OECD, developing comparable methodologies or indicators would be difficult as these would, necessarily, be specific to the subject and to the type of risk.[3]

[3] *How’s Life? 2017,* presented a dashboard and country profiles, as well as (where possible) whether the level of each indicator has improved or worsened since 2005. These indicators may be used as an indication of the resilience or sustainability of countries’ well-being. This built on *How’s Life? 2015* which introduced a new set of indicators to illustrate some of the resources that are important for sustaining well-being in the future. These included measures encompassing stocks of capital (natural, human, economic and social) as well as a range of relevant flows (e.g. investments, depletions, emissions) and risk factors that may affect the future evolution of stocks over time.

Conclusion: towards a new approach to resilience at the OECD

The need to take a more systems-based approach to resilience is now recognized by the OECD. Through the NAEC Initiative, the OECD is working with the US Army Corps of Engineers (USACE) to implement the approach to resilience set out in Pillar I of the US National Security Strategy, where resilience is defined as "the ability to withstand and recover rapidly from deliberate attacks, accidents, natural disasters, as well as unconventional stresses, shocks, and threats to our economy and democratic system." This is a joint program with the Institute for Applied Systems Analysis (IIASA), the National Institute of Standards and Technology (NIST) and the Joint Research Centre of the European Commission. The different partners share a joint understanding around the four key points that are central to the US strategy:

Infrastructure Resilience: Find cost-efficient solutions for dealing with the inevitable natural disasters and adversarial acts. The current strategy of buying down risk is not working, and a resilience-based approach offers solutions that are more sustainable, including financially.

Supply Chain Resilience: Supply chains are interconnected and vulnerable to systemic failures. Ways to assess and manage international supply chains efficiently are needed.

Resilience and Security: Asymmetric threats are a feature of modern-day adversarial activities. Hardening components of the system is the traditional course of action, but low barriers to entry (for cyber-attacks for example) makes this approach of limited use. Resilience should be the goal.

Information domains: Societal resilience to fake news and disinformation should be improved.

Traditionally, the OECD tended to use resilience to mean the capacity to resist downturns. There is an awareness that the systemic threats modern societies face are increasingly difficult to model, and are often too complex to be solved using traditional approaches of risk assessment that focus primarily upon system hardness and ability to absorb threats before breaking. The new approach to resilience will focus on the ability of a system to anticipate, absorb, recover from, and adapt to a wide array of systemic threats.

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