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Keynote Speech

Navigating Healthcare Delivery as a System of Systems: A Governing Proposition

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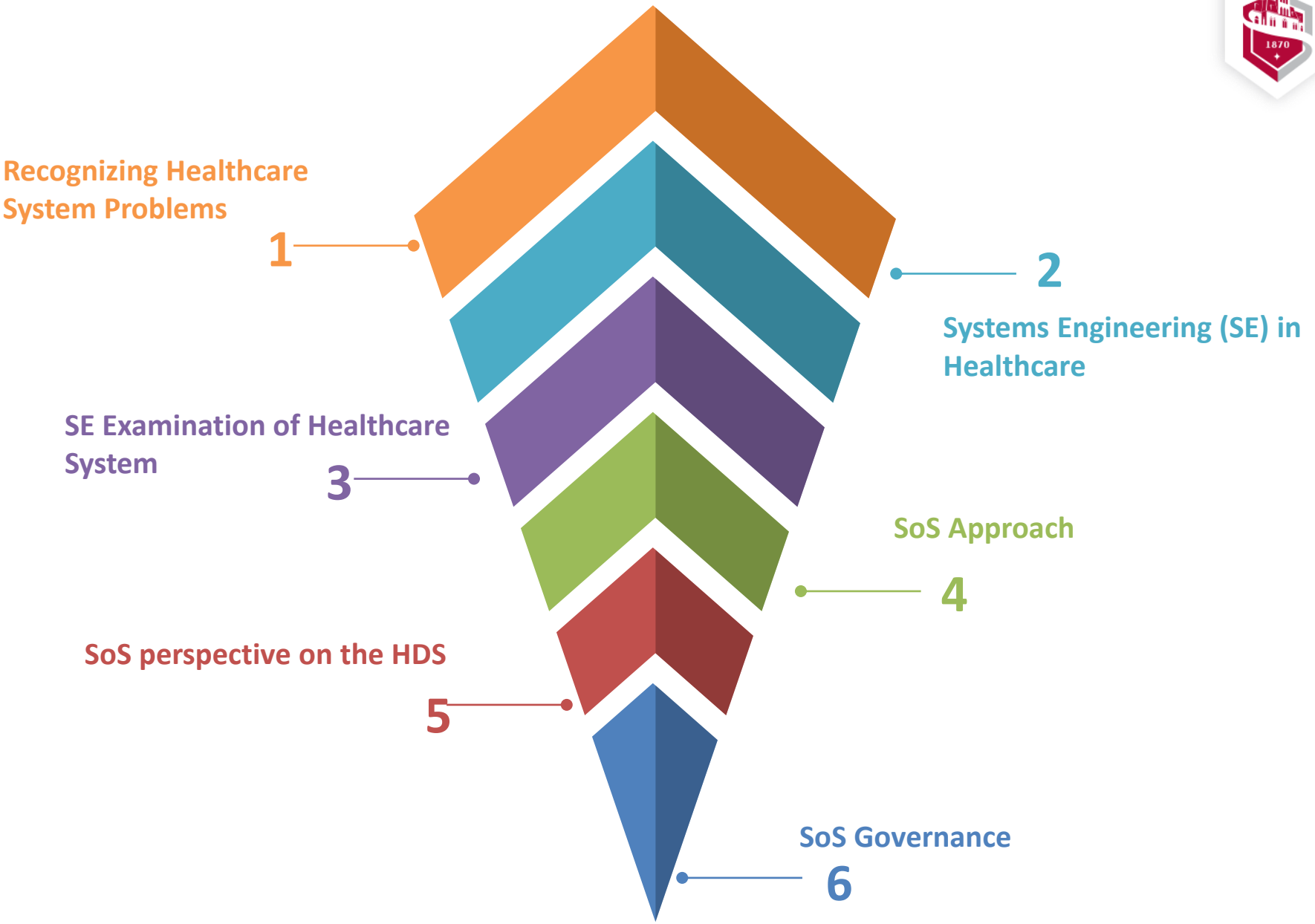
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Agenda

1. Problem Statement for Healthcare Delivery System (HDS)
2. Applications of Systems Approaches to HDS
3. Healthcare Delivery Sub-systems
4. A System of Systems (SoS) Approach
5. A SoS Perspective on HDS
6. A SoS Governance Proposition

Healthcare Delivery System and Its Challenges

Health System is a sum of organizations, institutions, and resources focused on health, and may be thought of as a network of diverse entities and cutting across multiple sectors.

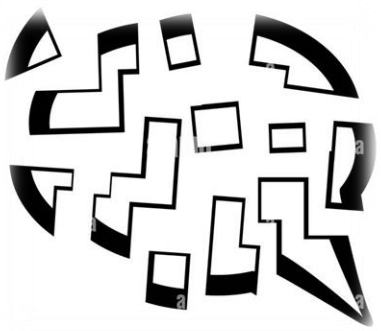
A diverse range of healthcare providers, such as clinicians, hospitals, and other healthcare facilities, as well as insurance plans and purchasers of healthcare services are parts of this network.

These entities operate in different arrangements, including groups, networks, and independent practices, and can be found in both public and private sectors, including for-profit and not-for-profit entities, with involvement from voluntary and governmental regulators.

IOM (2002)

The HDS' Structure

Traditional health care in the United States as resembling a cottage industry, marked by fragmentation at various levels of government wherein fragmentation occurs at the federal, state, and local levels.



The public health system has a nature of patchwork, where each state or territory determines its own public health department, relying on collaboration and information sharing with hospitals, physicians, emergency workers, and other relevant entities.

Gursky's analysis takes a very high-level thinking perspective, highlighting the systemic issue of fragmentation within the national healthcare landscape.

HDS' Cost

The United States has one of the highest costs of healthcare in the world.

In 2021, U.S. healthcare spending reached $4.3 trillion, which averages to about $12,900 per person. (*CMS, National Health Expenditure Data, December 2022*).

Fragmentation was associated with $4,542 higher healthcare spending (*Frandsen et al 2015*).

Fragmented care led to a 25% increase in medical costs and 16% more visits to the emergency room (*Healthcare Finance*).

In 2020 alone, the AHA estimated that hospital financial losses were at least $323.1 billion (*AHA 2020*).

Hospitals and health systems face an additional $53 billion to $122 billion in losses in 2021 (*AHA 2021*).

In his book "The Fragmentation of U.S. Healthcare; causes and solutions," Einer Elhauge (2010) defines fragmentation as the presence of multiple decision makers responsible for healthcare decisions that could be better handled through unified decision making. This leads to a lack of understanding of the complete picture, limited power to take necessary actions, or even incentives to shift costs onto others.

Elhauge also discusses the various dimensions of fragmentation, ranging from treating specific illnesses to fragmented treatments for individual patients, patients over time, patient groups, and the question of expanding the appropriate group to include others on a broader scale.

To address the pressing issue of fragmentation in healthcare, urgent attention and comprehensive solutions are needed to foster a more integrated and cohesive healthcare system.

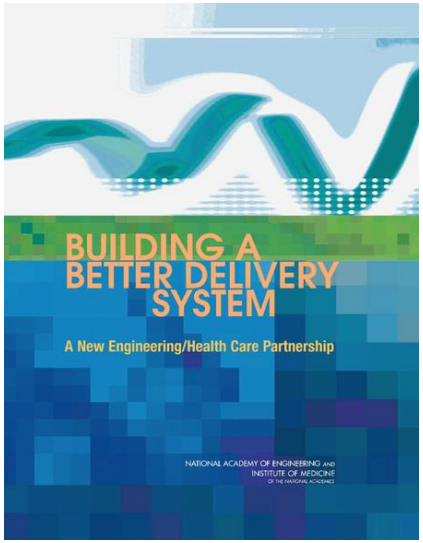
The last thing healthcare needs is another stand-alone innovation that perpetuates the silos that exist in the field today, instead it needs system reform and redesign to be able to fulfil the expected capabilities and meet the market demand, as well as addressing the interrelated quality and productivity crises facing the healthcare system as a whole. **(SEBoK, P 720)**

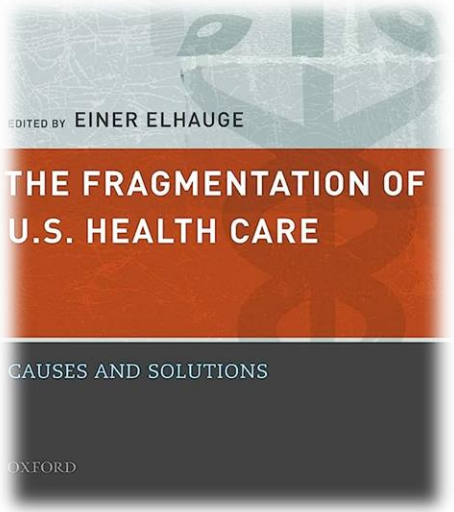
The transformation process, as highlighted by Salinsky and Gursky (2006), should involve targeted resource allocation, regional planning, technical upgrades, personnel reorganization, incorporation of private-sector assets, and performance monitoring.

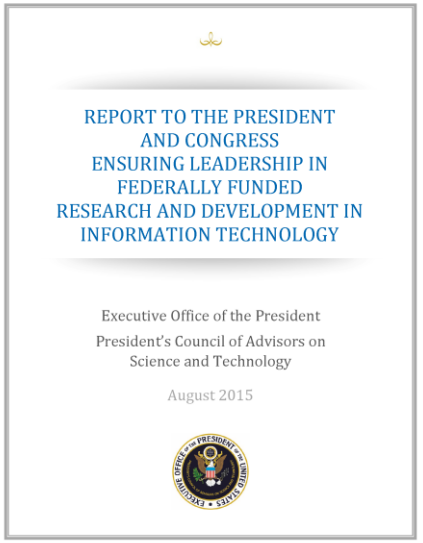
Outlined goals and objectives

The plan outlined in the Building a Better Delivery System report aims to transform the U.S. healthcare sector into a high-performance 'system' by fostering interdependence among its constituent entities and promoting awareness of the implications and consequences of their actions on the system as a whole.

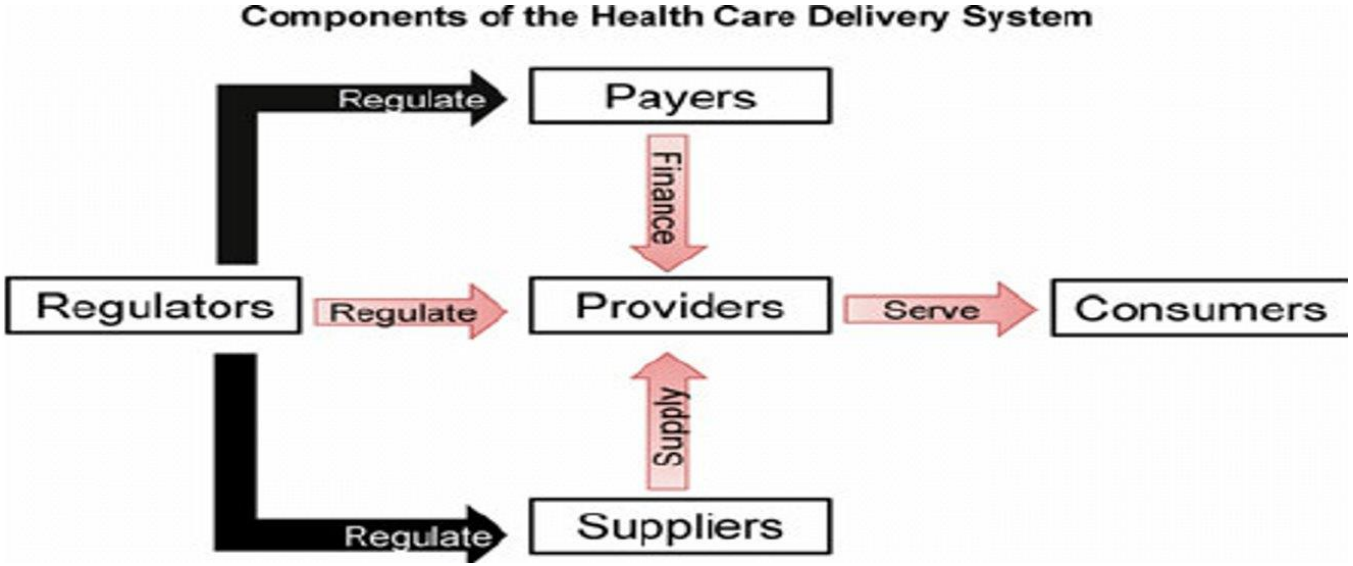
Systems engineering has the potential to accelerate healthcare improvement by addressing misaligned incentives (fee for service vs. fee for outcomes) and the absence of key enablers such as access to valuable data and expertise in systems techniques and engineering (PCAST 2014).







HDS through the Lens of Systems Engineering



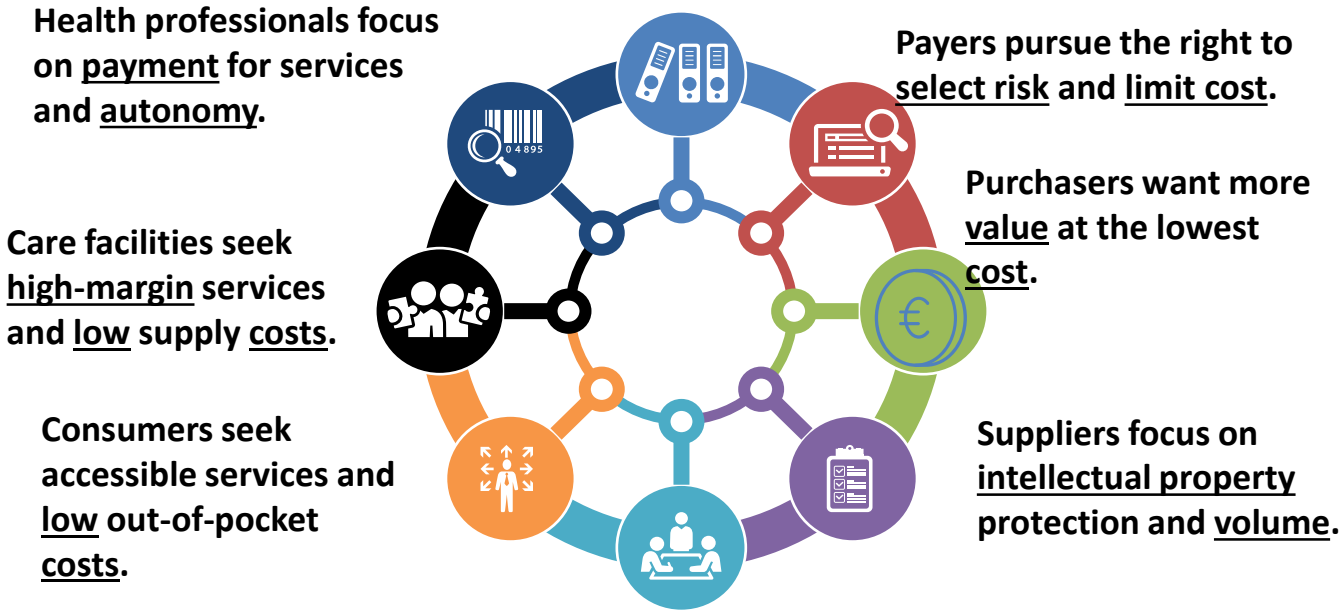
Providers: organizations, services, and professionals involved in delivering healthcare to patients.

Payers: both public and private organizations responsible for financing healthcare services.

Suppliers: entities that provide resources and materials to support healthcare delivery.

Regulators: overseeing and influencing the actions of providers, payers, and suppliers.

The healthcare system is a clash among competing forces of stakeholders (communities of interest) who have different performance measures and sub-groups of stakeholders.

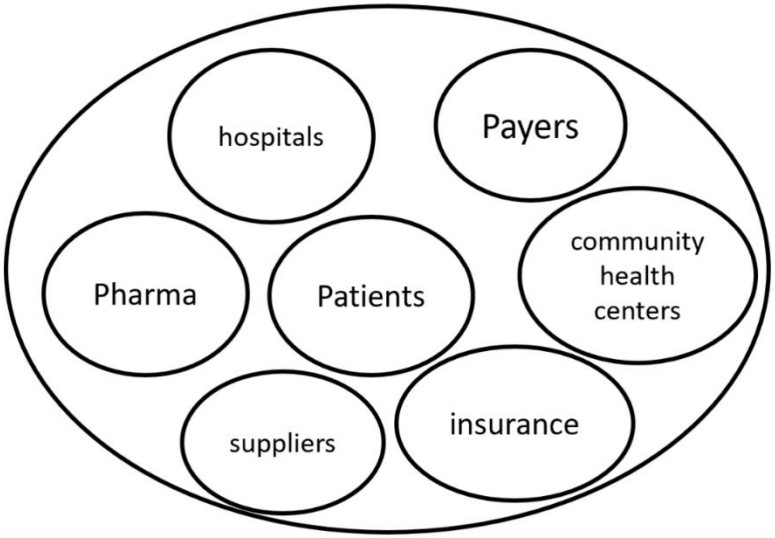


Engineering a Learning Healthcare System: A Look at the Future William W. Stead

As Porter and Teisberg (2006) said that the different stakeholders compete in a zero-sum game.

HDS is NOT a single system with a purpose: it's a complex set of independent systems that have their own objectives, way of operation, and capabilities.

Yet, they collaborate to attain bigger objectives, way of operation, and capabilities that none of them could do alone.



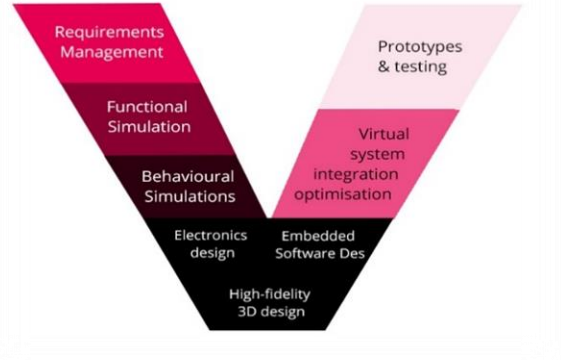
The entire SoS collaborate to provide comprehensive and coordinated care to the patient.

The question now is how best to proceed with SE? What Strategic Approach Should be Adopted to Advance?

Traditional Systems Engineering (T-SE)

The Systems Engineering's life cycle models are good as they are to initiate or reform a single system and suitable for monolithic systems; however, they are not atypical for contemporary organizations to treat the engineering of SOS.

Sage and Cuppan (2001)



So, the complex and interconnected nature of HDS requires a specialized discipline that goes beyond T-SE, providing a comprehensive approach to effectively design, implement, and maintain these intricate systems for optimal performance.

The System of Systems (SoS) Approach

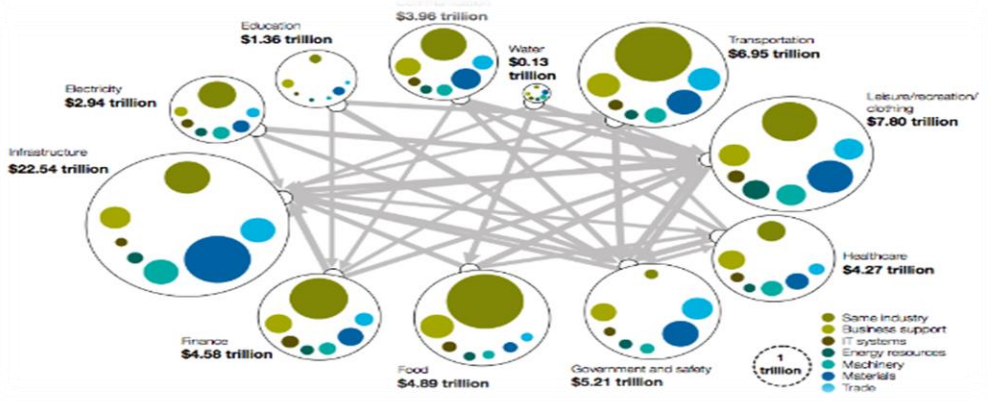
Many (SoS) exist, often without their SoS nature recognized, causing them to evolve without leveraging (SE) advantages.

(Dahmann, 2014)

We postulate that the (HDS) also fits into this category of systems.

So, what exactly is SoS?

(System of Systems)



SoS is a system-of-interest whose system elements are themselves systems; typically, these entail large scale inter-disciplinary problems with multiple, heterogeneous, distributed systems".

(INCOSE, 2007)

When SoS are acknowledged and treated as such, they can be classified into distinct SoS types, offering a valuable framework for comprehending the nature of SoS Dahmann (2014).

SoS types and characteristics

Numerous studies have extensively examined the various types and characteristics:

01 Maier (1998)

1. Operational Independence of the Individual Systems.
2. Managerial Independence of the Systems.
3. Geographical Dispersion.
4. Emergent Behavior.
5. Evolutionary Development.

02 Keating et al. (2003)

Metasystem consisting of multiple, autonomous, and interconnected subsystems. These subsystems are diverse in technology, context, operation, and geographical distribution

03 Cropley (2004)

Focused on information exchange between the components. He proposed a knowledge management approach to change management for SoS that emphasized **five** key components: who, what, when, where, and how?

04 Boardman & Sauser (2006)

1. Autonomy.
2. Belonging.
3. Connectivity.
4. Diversity.
5. Emergence.

05 Adams et al. (2014)

Proposed a systems theory construct that consists of a set of axioms. The construct includes **seven** axioms: centrality, contextual, goal, operational, viability, design, and information.

Accordingly, based on the characteristics of the current HDS, as well as the definitions and characteristics of SoS, the current HDS is a SoS.

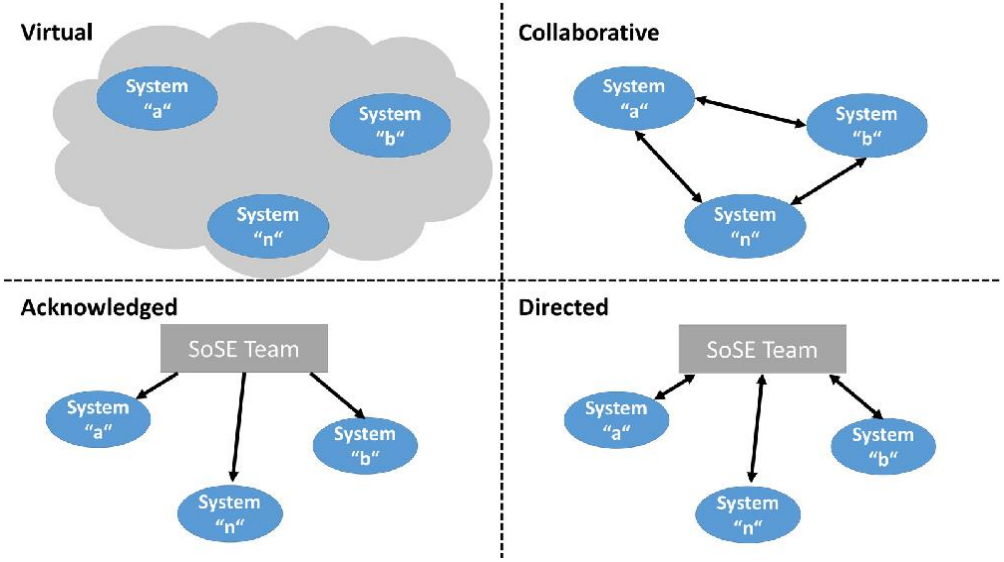
In other words, the HDS exhibits all the key characteristics of SoS and should be analyzed as such.

For a more efficient and effective healthcare delivery system, it should be approached as an SoS rather than a mere collection of independent systems.

In doing so, the first step is identifying the specific type of the current HDS.

Types of Systems

A closer investigation of the types by Maier (1998)



Categories of Systems of Systems (adapted from Lane, 2013)

The (HDS) falls under the category of a Collaborative (SoS), wherein multiple independent systems come together voluntarily to deliver comprehensive services, operating without a central authority or standardized communication mechanism.

Unraveling the Link Between HDS Type and Fragmentation

Contrary to its common reference as a healthcare system, it was neither intentionally designed as a system nor has it functioned as one.

We posit that the Collaborative (SoS) nature of the current healthcare system is the central driver of its fragmentation.

There are various reasons for the fragmentation within this type of SoS, which include but are not limited to:

1- Diverse communities of interest with conflicting values and beliefs lead to self-interest-driven behavior.

Decision-making influenced by authority and coercion allows constituent systems to prioritize their interests over the SoS goals.

(Jackson, 2003)

2- Systems rarely see the full range of possibilities and do not know what other systems are planning to do.

In SoS, when individual constituent systems are developed in isolation, they disrupt the delicate balance of synergies, hinder the realization of a unified business vision, and impede the achievement of long-term goals.

The Synergism Principle, (Azani, 2009)

3- In an ideal situation, the constituent systems being cognizant of one another's plans; however, fragmentation may endure.

Constituent systems are striving to fulfill their individual local requirements to the utmost, a pursuit that may engender conflicts with the overarching capabilities of the SoS.

Although the SoS capability needs should be met by the constituent systems as they meet their own local requirements, in many cases the SoS needs may not be consistent with the requirements for the constituent systems.

INCOSE's 7 Pain Points, Capabilities and Requirements

The sum of the parts is neither equal, nor greater than the whole SoS.

4- Being unrecognized Collaborative (SoS) can result in unacknowledged risk on the SoS level.

The high levels of connectivity and interactions among separately owned and operated constituent systems can give rise to emergent behaviors and unintended consequences.

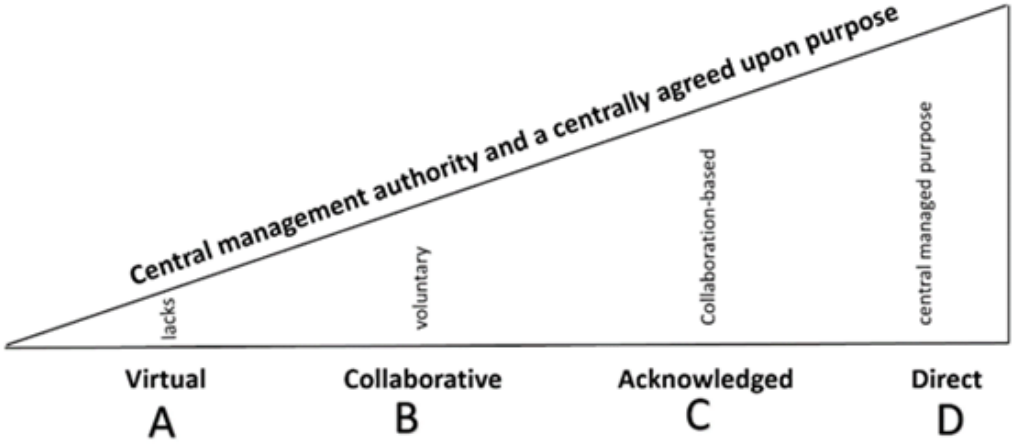
(SEBoK 713)

Unfortunately, that may lead to significant risks going unnoticed or underestimated, rendering their mitigation plans inadequate.

The illustration reveals that, despite being commonly referred to as a healthcare system, it was not deliberately conceived or structured as a system and has never functioned as one. They are only related units which use each other because they need each other.

An in-depth examination of Maier's (1998) four types uncovers a notable association between two key variables, independence and centrality.

that guides the transformation of the HDS Collaborative SoS to better fit healthcare while addressing fra



Exploring Alternatives and Recognizing Limitations

Transformation Potential	Mechanism	Benefits	Drawbacks
Collaborative to Virtual SoS	- Reduce centralized control and commercial agreements, and any contractual constraints. - Encourage self-organization.	- Greater autonomy for constituent systems. - Flexibility and independence.	- Lack of coordination and alignment. - Risk of conflicts and self-Interests. - Tragedy of the Commons.
Collaborative to Direct SoS	- Maximize centralized control and authority. - Establish a clear hierarchy where all constituent systems are subordinated to the central management.	- Maximized Centralization. - Strong interdependence and coordination.	- Reduced system autonomy. - Complex alliance management. - Rule-Beating.
Collaborative to Acknowledged SoS	- Establish central authority. - Standardize communication and coordination	- Enhanced collaboration between the SoS and its constituent systems. - Conflict Resolution. - Improved Information Sharing.	- Risk of Bureaucracy. - Loss of Autonomy.

By imposing strict control, the potential for innovation is hindered, while a complete absence of control leads to disjointed clusters that are challenging to integrate.

To successfully deliver a (SoS), it is crucial to maintain effective control due to the distributed nature of teams, parallel design streams, and the presence of multiple hierarchical levels.

(Henshaw et al., 2013)

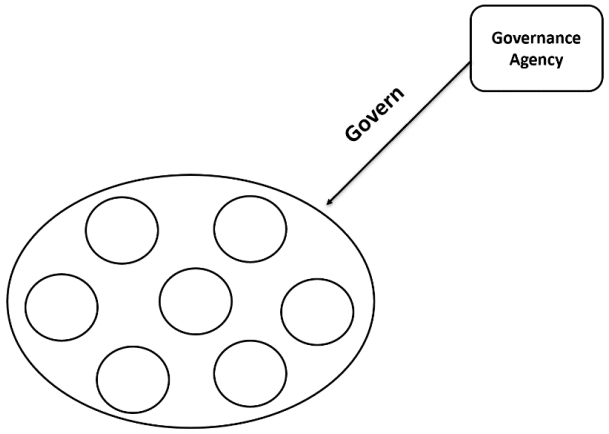
An engineered (SoS) can incorporate various control mechanisms, including conformer, regulator, as well as negative and positive feedback mechanisms.

Azani (2009)

Sauser et al. (2009), control paradox within (SoS):

- 'management' transformation into 'governance.'
- 'control' in SoS is contingent upon rules, time, and bandwidth, while 'command' hinges upon trust, influence, fidelity, and agility.

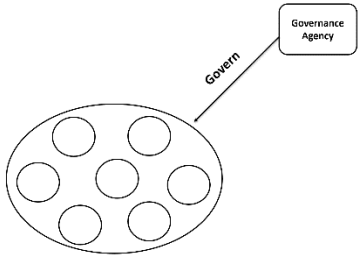
Conceptualizing the Proposal



Our proposition is combining features of both centrality and independence by introducing an ***external governing entity*** to govern the interconnections among the systems.

Strong governing agency, at the national level, is essential to address systemic issues, provide necessary coordination and guidance, allocate resources, establish policies, foster sustainable change, and ensure the healthcare system is well-organized.

Metaphoric Illustrations



- In the context of a soccer game
- International Classification of Disease (ICD)

Such a system would respect the autonomous and dynamic nature of the constituent systems, while also ensuring that all constituent systems comply with the SoS's values, mission, and information exchange.

HDS governance

"Health system governance refers to the rules and norms that shape roles and responsibilities, incentives and interactions in the health sector."

(WHO)

Governance refers to the institutions and processes used to provide accountability, transparency, responsiveness, rule of law, stability, equity and inclusivity, empowerment, and widespread participation.

Urban Policy Initiative

Typically, this is what the HDS requires.

In essence, the focal questions are what is and how we implement such a governance approach, and what is the source of the power that determines the HDS' objectives and drivers.

This is our ongoing research!