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Managing Healthcare Data Assets as a Complex Adaptive System

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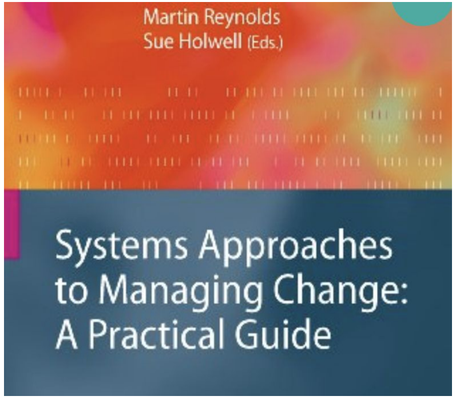
Managing healthcare data assets as a complex adaptive system

Katie Clift | March 8, 2019

Prelude



- System Dynamics (J. Forrester)
- **Viable Systems Model** (S. Beer)
- Strategic Options Development & Analysis
- **Soft Systems Methodology** (P. Checkland)
- **Critical System Heuristics** (W. Ulrich)

Fall 2016
Holistic Strategies

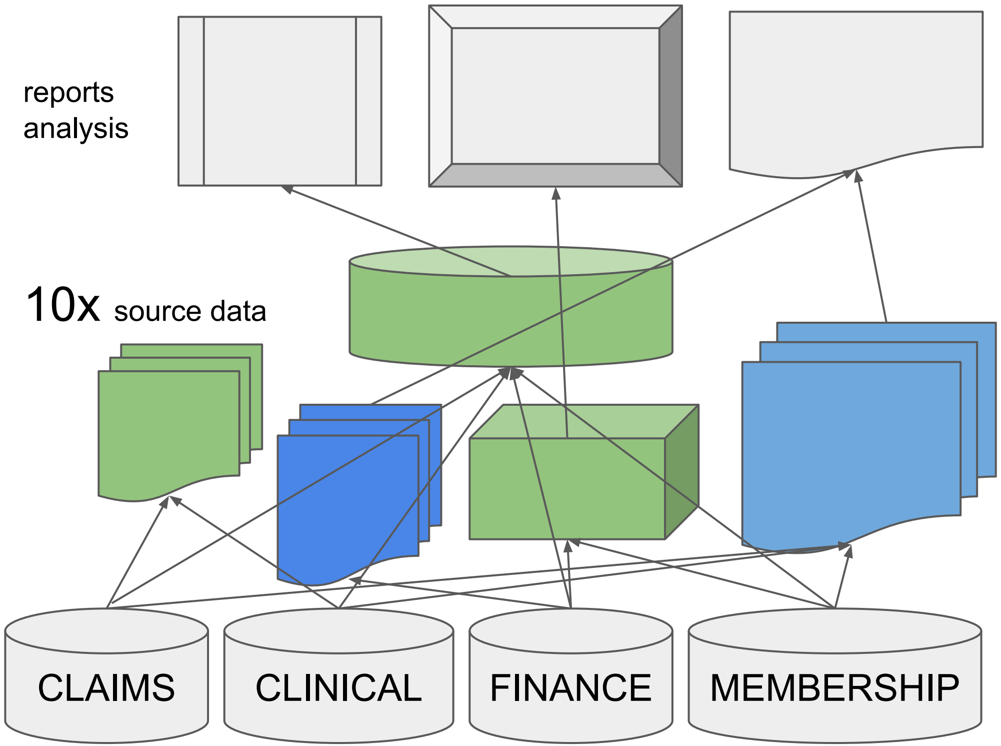
Spring 2018
Reading & Conf

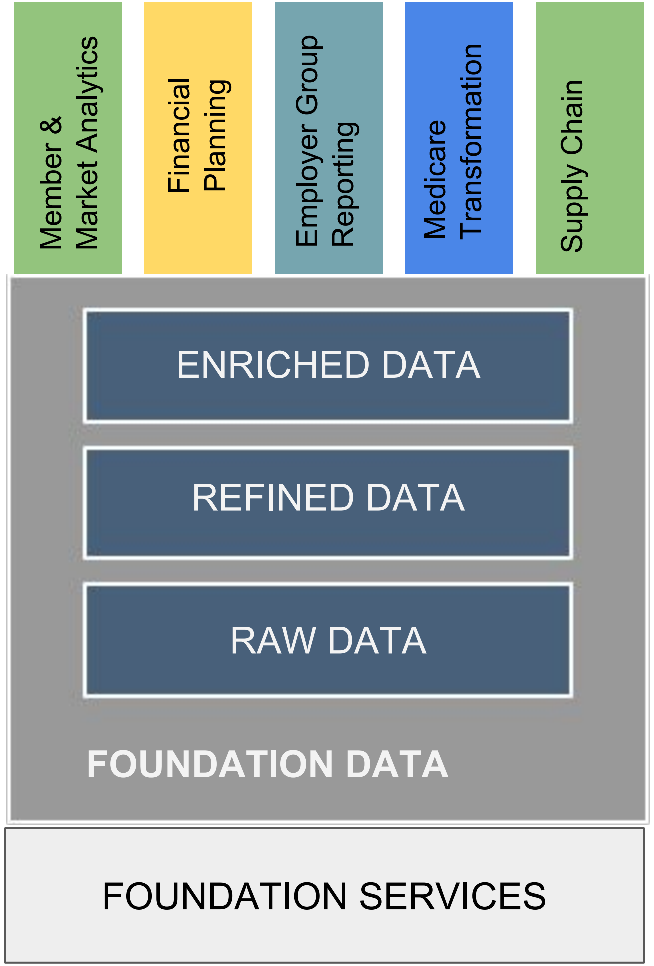
Fall 2018
Artificial Life

Winter 2019
Systems Philosophy

Project to develop a **shared platform for data and analytics** in a highly federated healthcare delivery organization

Project Background |
Status Quo & Vision





Objective & Research Questions

Standards and practices are a critical aspect of the approach to develop a common platform for data and analytics. The stated objective of this work is **to identify, prioritize and establish or adopt, standards and practices** to guide IT and analytic teams as they develop and operationalize solutions on the common data platform.

Q1: *In what ways do concepts from **cybernetics and complex adaptive systems** inform a sustainable approach to **design and implement standards and practices** that guide analytics and IT teams in developing **shared infrastructure and data**?*

Q2: *What **complexity-related risks** might arise as this project matures?*

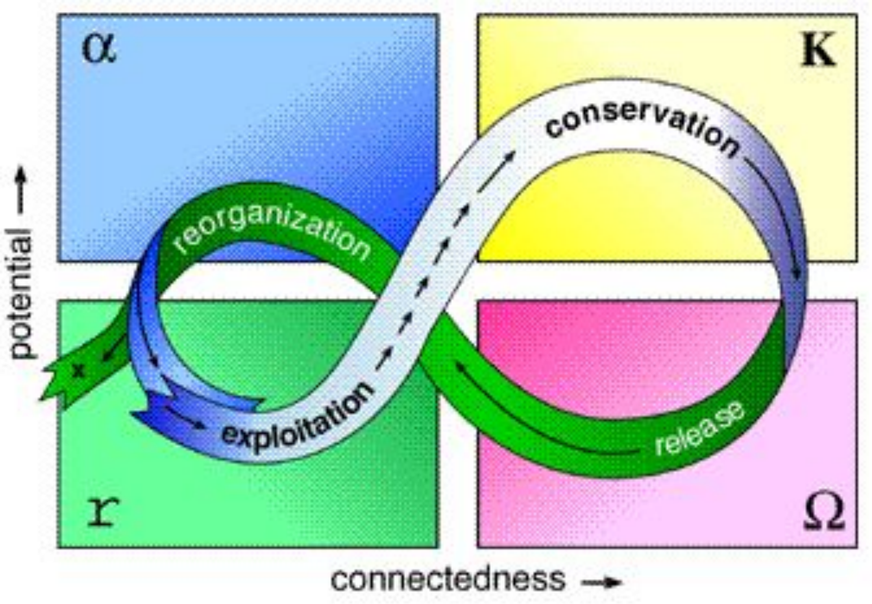
Complex Adaptive Systems per Holland

‘[T]hese systems **change and reorganize their component parts to adapt themselves to the problems posed by their surroundings**. This is the main reason the systems are difficult to understand and control - they constitute a **"moving target."** We are learning, however, that the **mechanisms that mediate these systems are much more alike than surface observations would suggest**. These mechanisms and the deeper similarities are important enough that the systems are now grouped under a common name, ***complex adaptive systems***.’

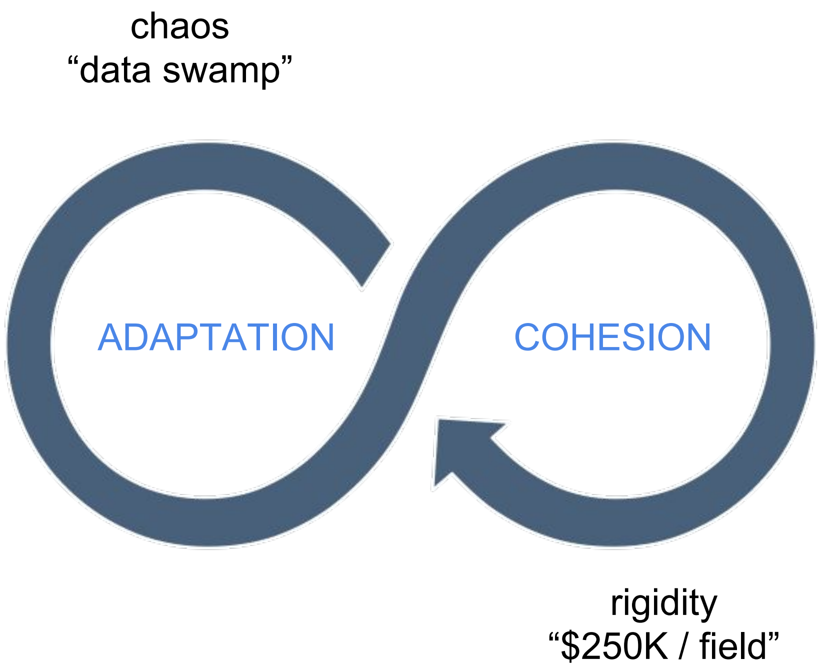
Complex Adaptive Systems
Author(s): John H. Holland
Source: *Daedalus*, Vol. 121, No. 1, A New Era in Computation (Winter, 1992), pp. 17-30
Published by: The MIT Press on behalf of American Academy of Arts & Sciences
Stable URL: https://www.jstor.org/stable/20025416
Accessed: 12-11-2018 06:14 UTC

Panarchy and Self-Organized Criticality | Purpose

Q1: *In what ways do concepts from* ***cybernetics and CAS theory*** *inform a sustainable approach to* ***design and implement standards and practices*** *that guide analytics and IT teams in developing* ***shared infrastructure and data****?*

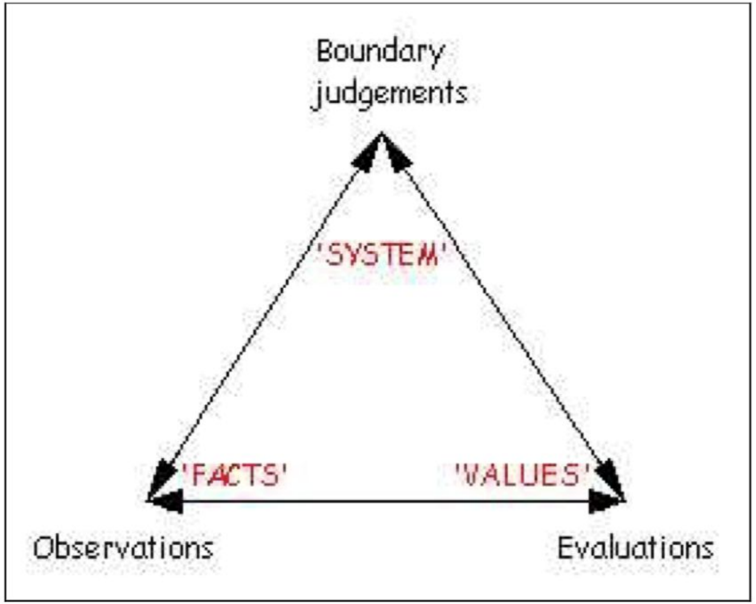


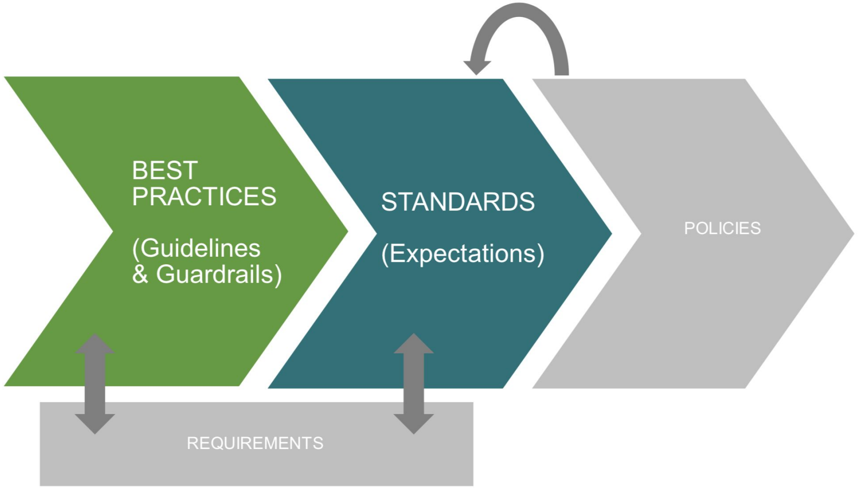
SOURCE: Adaptive cycle (Gunderson 2002)



Critical Systems Heuristics | Degrees of Freedom

Q1: *In what ways do concepts from* ***cybernetics and CAS theory*** *inform a sustainable approach to* ***design and implement standards and practices*** *that guide analytics and IT teams in developing* ***shared infrastructure and data****?*

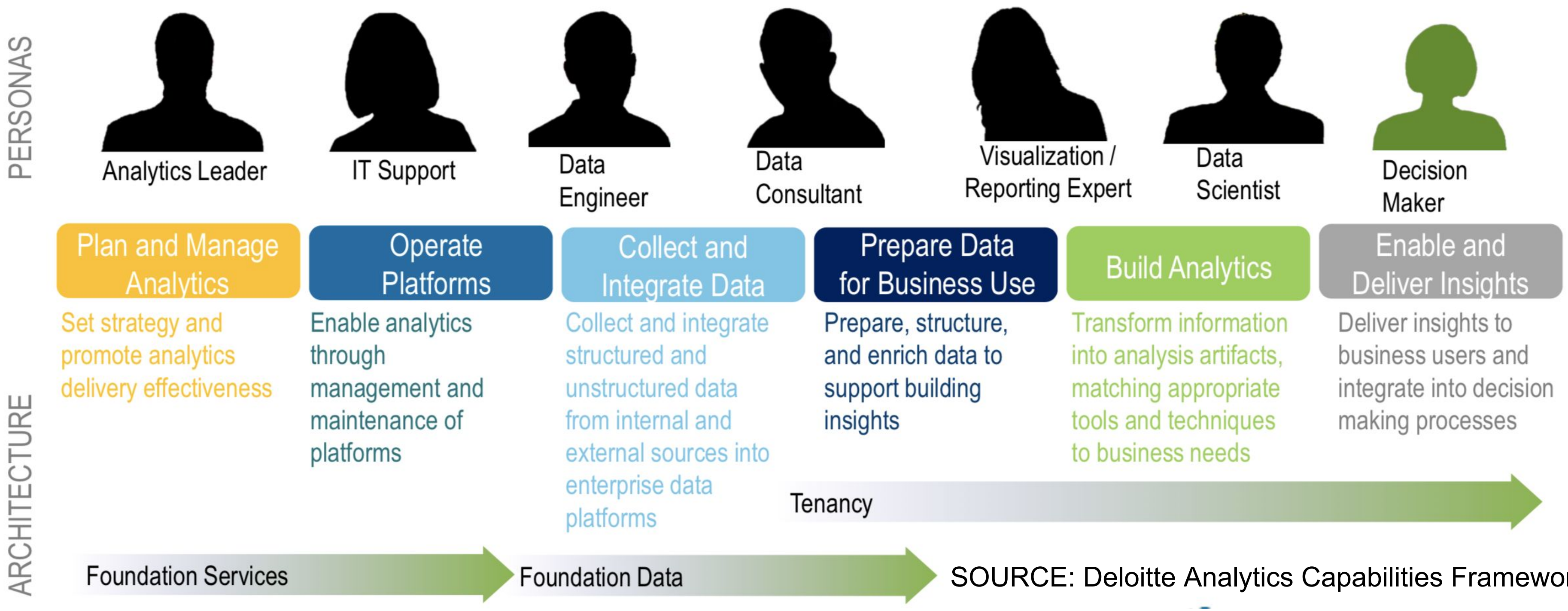




SOURCE: Systemic triangulation (Ulrich, 2005)

Critical Systems Heuristics | Stakeholders

***Q1:** In what ways do concepts from **cybernetics and CAS theory** inform a sustainable approach to **design and implement standards and practices** that guide analytics and IT teams in developing **shared infrastructure and data**?*

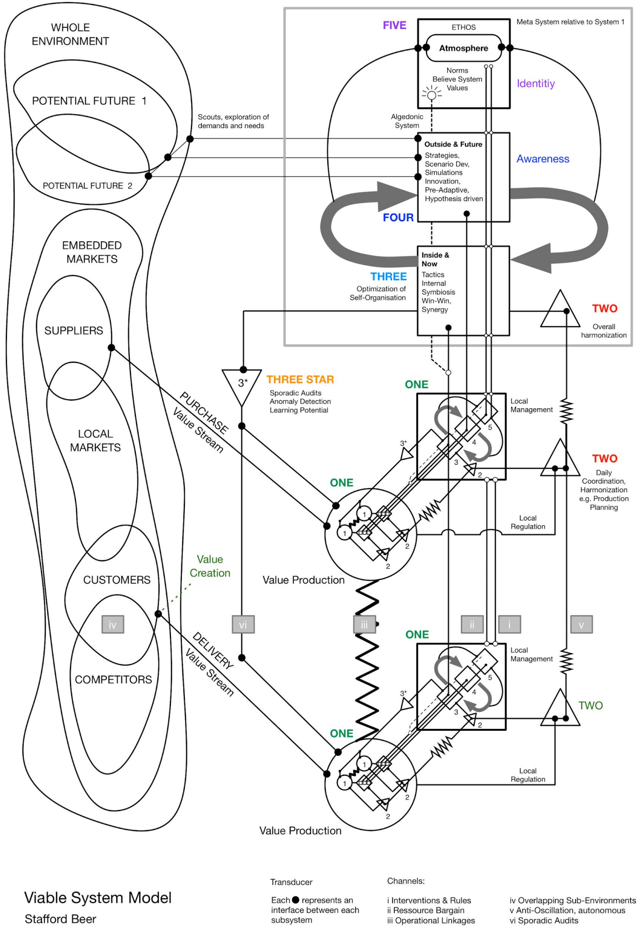


SOURCE: Deloitte Analytics Capabilities Framework

Critical Systems Heuristics | Boundary Critique

***Q1:** In what ways do concepts from **cybernetics and CAS theory** inform a sustainable approach to **design and implement standards and practices** that guide analytics and IT teams in developing **shared infrastructure and data**?*

Function	Category	Category Description
Plan & Manage Analytics	Infrastructure	Reusable infrastructure services are discoverable & understood.
	Platform	Reusable platform services are discoverable & understood.
	Foundational Data Management	Reusable data assets are discoverable, understood and governed transparently.
	Governance	Oversight to data domains, business rules, enrichments, tools and services on the Analytics Digital Foundation (ADF) helps ensure they are complete, non-duplicative, communicated and evolved.
	Analytics Services	Flexible services support innovation and speed to insight.
Operate Platforms	Security Framework	Access to platforms and infrastructure is limited to authorized users, processes, and devices, and is managed consistent with the assessed risk of unauthorized access to authorized activities and transactions. (NIST)
	Data Security	Information and records (data) are managed consistent with KP's risk strategy to protect the confidentiality, integrity, and availability of information. (NIST)
	Production	Procedures are maintained and used to manage information systems and assets.
Collect & Integrate Data	Data Ingest (Raw Data)	Raw data is stored in its native or near-native format, typically sourced from a System of Record (SoR). Though not intended to meet the needs of wider audiences who require curated data, it may address the needs of a limited data science audience.
	Data Refinement (Refined Data)	Refined data is prepared for analyst use by removing inconsistencies and errors, improving quality and semantic consistency, and simplifying access. The goal is to provide good-quality, trusted data in a way that is understood and accessible.
	Shared Enrichments	Enriched data is created to support decision making. This often involves manipulating and blending diverse data, applying experience and knowledge, and transforming the data into an asset used to gain analytical insight.
Prepare Data for Business Use	Dimensional Models	Data preparation including stored or on-demand transformations may be necessary to make data more efficient for reporting.
	Tenant Improvements	Tenants are logically distinct analytics systems that share data models, enrichments, analytic models, reports and visualizations to meet a defined business need.
	Extracts	Data extracts aggregate and de-identify the data as much as possible in order to minimize risk and cost related to data transmission.
	Analytic Data Layer	Data preparation including extraction, integration/blending, and transformation may be necessary for analysis and reporting. This stage assumes a familiarity with the input data, along with an awareness of the potential biases.
Build Analytics	Question/problem definition	Analysis question, benefits, stakeholders and data inputs are identified. Prior analysis results and production reports are searchable to prevent duplication of effort.
	Business Intelligence / Reports	Descriptive reports are accessible on-demand, discoverable, and documented to facilitate re-use and adoption.
	Model Development	Methods, workflows, data sources, and tools are established and evaluated based on the ability to address identified questions.
	Results Communication	Results are communicated as broadly as appropriate after considering sensitivities related to information sharing.
Enable & Deliver Insights	Decision Making	Decisions can be made with increased confidence that the data and analysis addresses the business question with an appropriate amount of certainty and/or caution.
	Management & Operations Reporting	...
	Embedded Insights	...
	External Customer Delivery	...



SOURCE: By Mark Lambertz - Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=59912637

Viable System Model | Advisory Groups

***Q1:** In what ways do concepts from c**ybernetics and CAS theory** inform a sustainable approach to **design and implement standards and practices** that guide analytics and IT teams in developing **shared infrastructure and data**?*

4 Capabilities & Tools

3 Data Access & Use

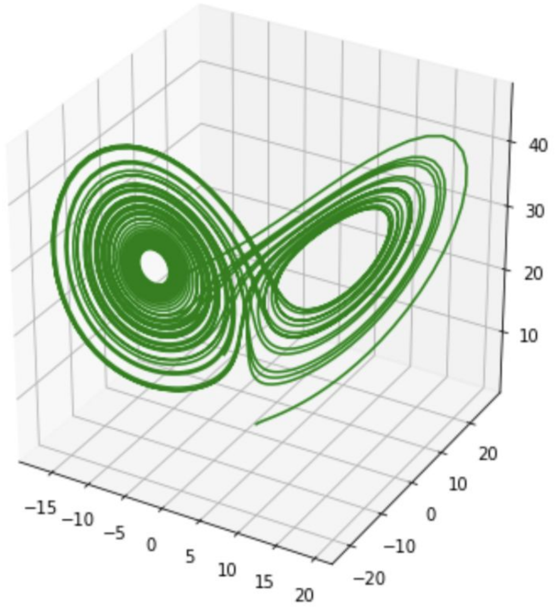
2 Data Modeling & Patterns

1 Metrics Delivery

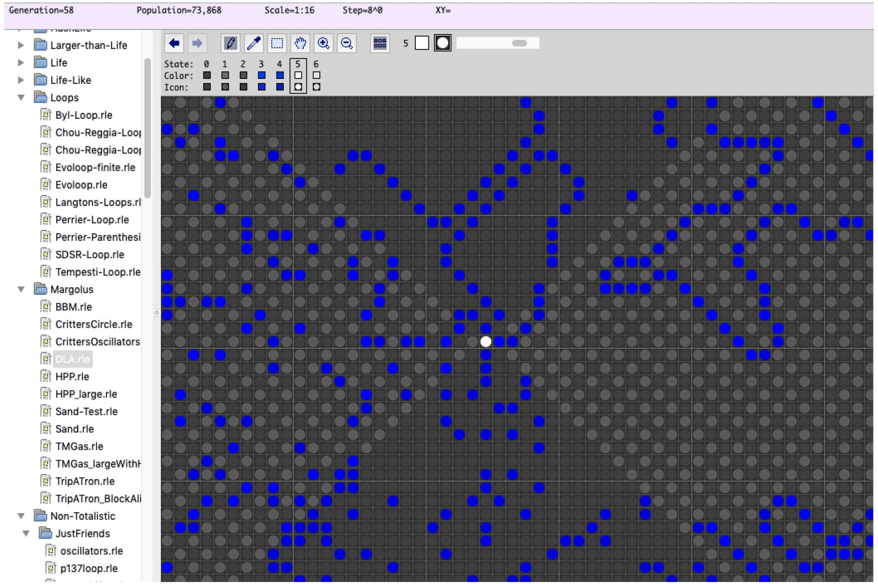
Complexity-related risks

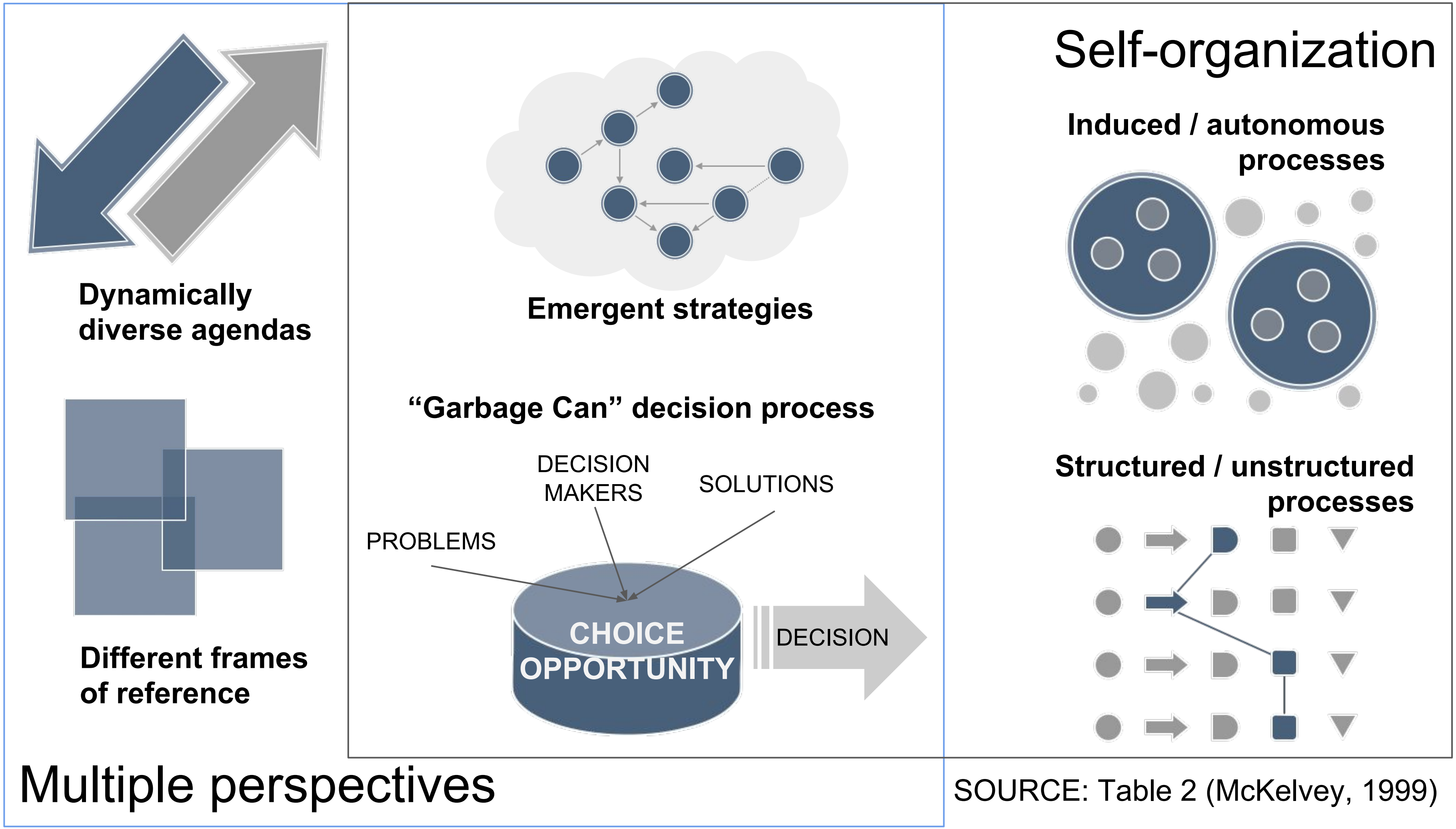
***Q2:** What **complexity-related risks** might arise as this project matures?*

Dynamic attractors & Path dependence



Complexity catastrophe (McKelvey, 1999)




Self-organization
Induced / autonomous processes
Structured / unstructured processes
Dynamically diverse agendas
Emergent strategies
"Garbage Can" decision process
DECISION MAKERS
SOLUTIONS
PROBLEMS
CHOICE OPPORTUNITY
DECISION
Different frames of reference
Multiple perspectives
SOURCE: Table 2 (McKelvey, 1999)

Risk mitigation (1 of 2)

About the agents

- Maintain some **heterogeneity** among agents.
- Maintain agent **capability** (e.g., adaptation, innovation, communication, openness)
- Maintain **“weak-tie” connections**.
- Periodically refresh “weak-tie” connections to **disrupt path dependence** (canalized networks) and create an environment where self-organization is again possible.
- Maintain agent connections to **contextual drivers**.
- Steer agents towards industry-**relevant adaptive directions**.
- Coach agents to **lower threshold gates** for environmental signals, increase connectivity to other agents, and focus adaptive tension drivers to minimize threshold fatigue.

About the policies

- Watch for **order creation that inhibits** innovation opportunities (senescence).
- Address **habitual bureaucratic responses** in a visible way to minimize complexity catastrophe.
- Open organizational boundaries to **facilitate the flow of new ideas** from the competitive environment.

SOURCE: Managing Coevolutionary Dynamics (McKelvey, 2002)

Risk mitigation (2 of 2)

Potential response	Underlying risk	Strategies to address
“Not invented here”	Standards are ignored or rejected by agents	Transparency Broad participation
“Perfect as enemy of the good”	Advisory groups dissolve	Approval mechanism

Dialogue (Q&A, Comments)