Prediction and causal loop modelling to identify limits of systems thinking methods and define complex systems

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Prediction is the core of ALL systems thinking

ALL systems thinking comprise three elements:

- Method providing **prediction** support for decision-making
- Method for gathering the data for **prediction**
- Method for developing and communicating **predictions**

Prediction is the essential core of all systems thinking

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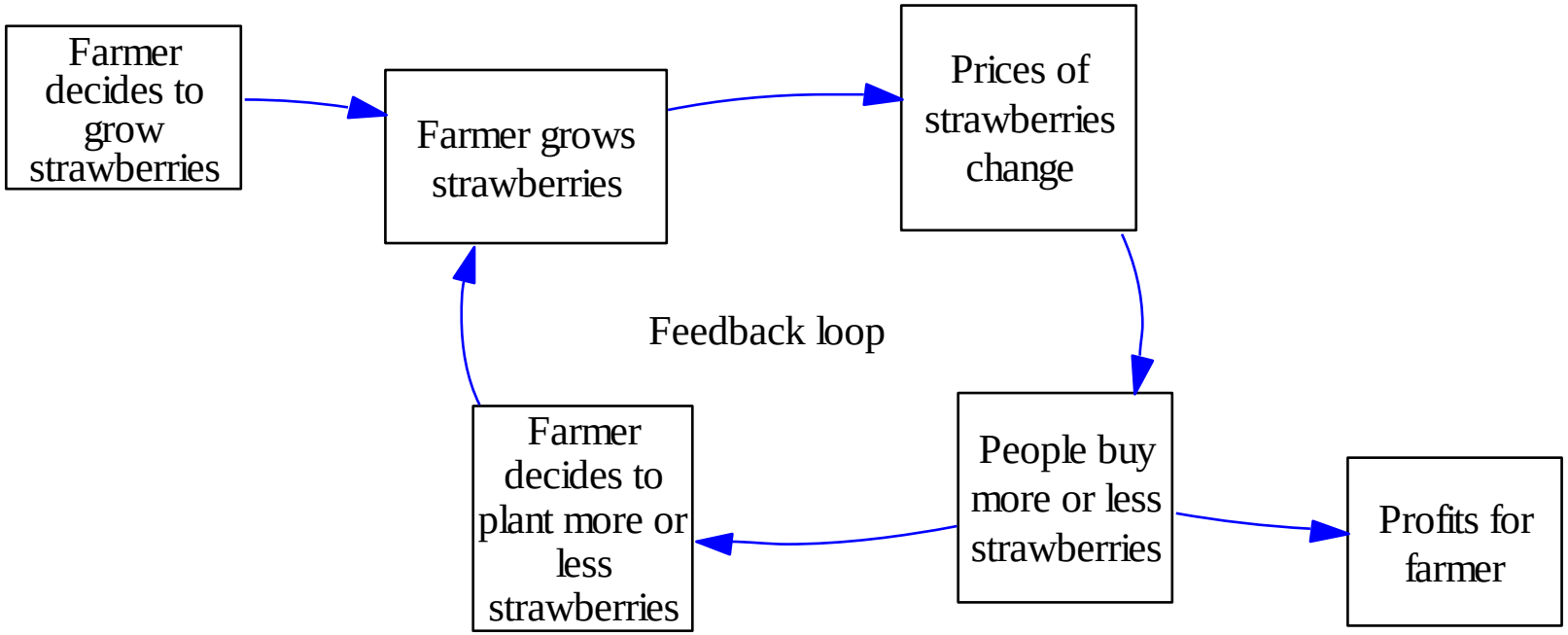
Feedback loops



Single feedback loop

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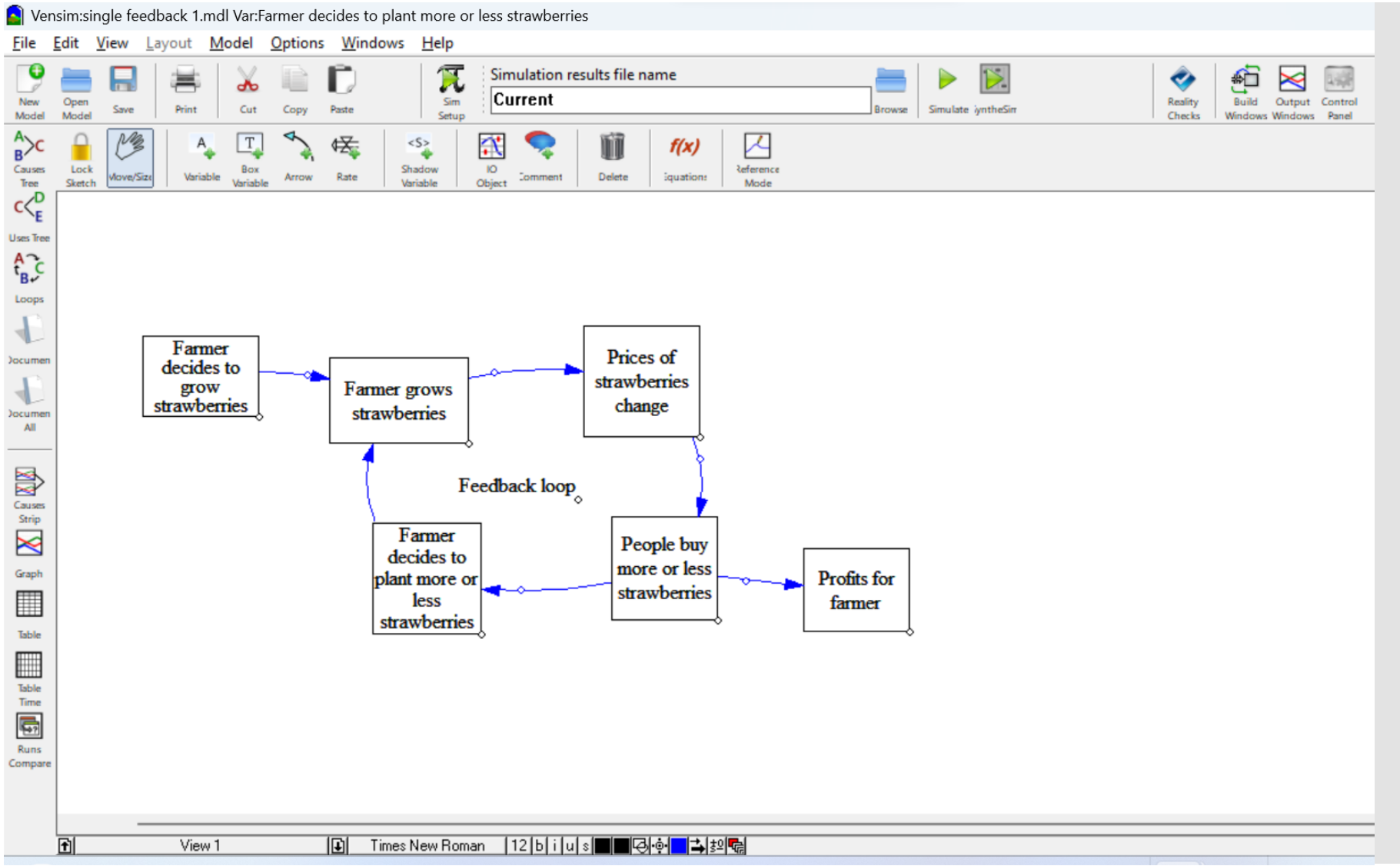
Vensim



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COVID in Western Australia

- Western Australia population ~ 3million mostly living in Perth
- COVID state of emergency declared in WA in 1 March 2020after 1st death.
- Movement tightly controlled for 3 weeks including indoor venues closed. Food takeaway service only. Movement in state restricted and state boundaries closed except for essential workers
- Community transmission totally controlled by April 20
- 8 May 2020 down to ~ zero cases and zero deaths and life as normal
- Economy boomed at around 5%/year
- Border reopened 3 March 2022 and state of emergency annulled Sept 2022

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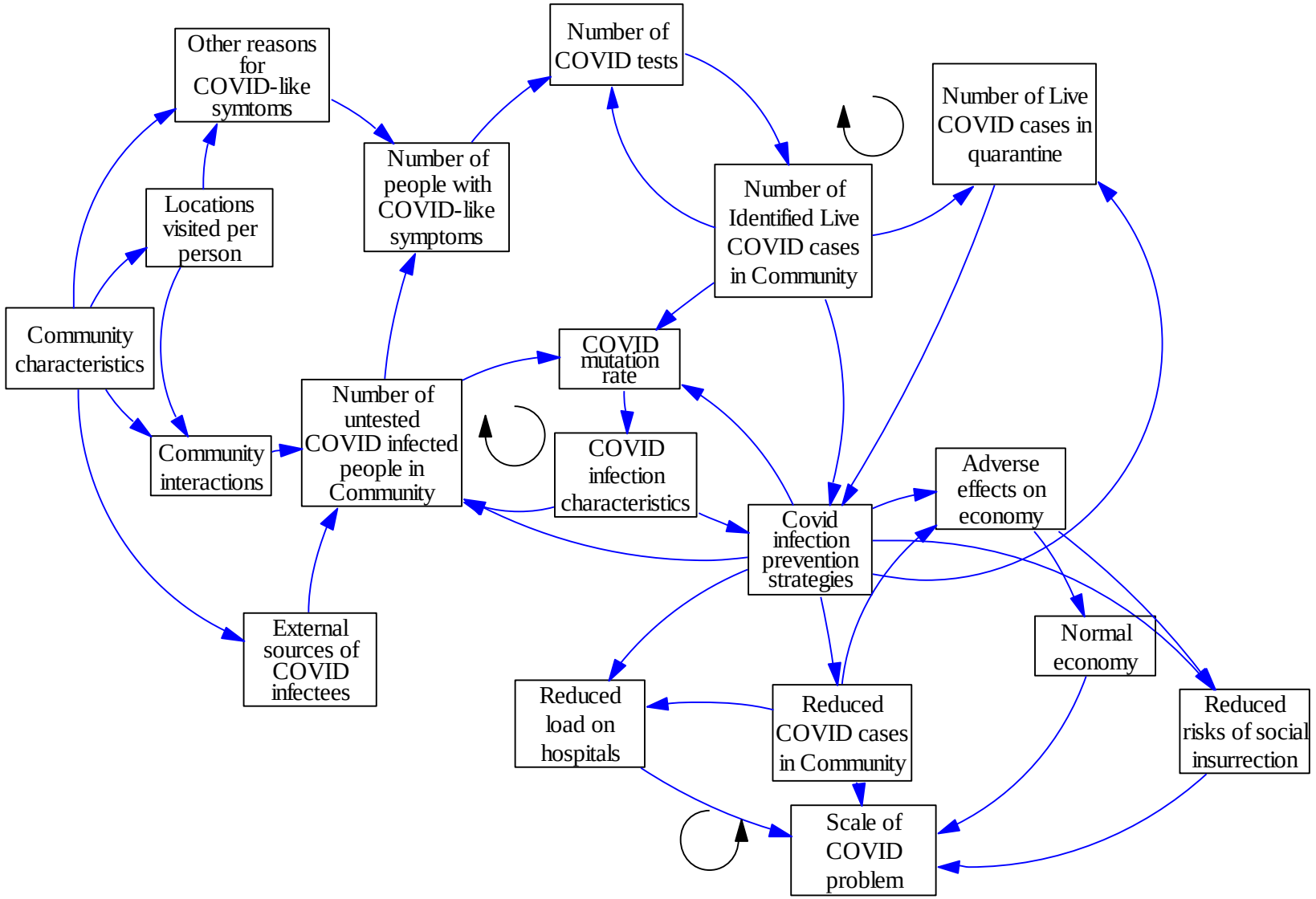
Causal Loop Model for COVID



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Two Feedback Loop Limitation Axiom

Two Feedback Loop Limitation Axiom

- Individuals cannot mentally predict the outcomes of situations whose behaviour is driven by two or more feedback loops
- There is a widely held delusion that individuals can predict behaviours and outcomes of situations with behaviours shaped by two or more feedback loops

The Two Feedback Loop Limitation Axiom was identified by Dr Terence Love in 1994.

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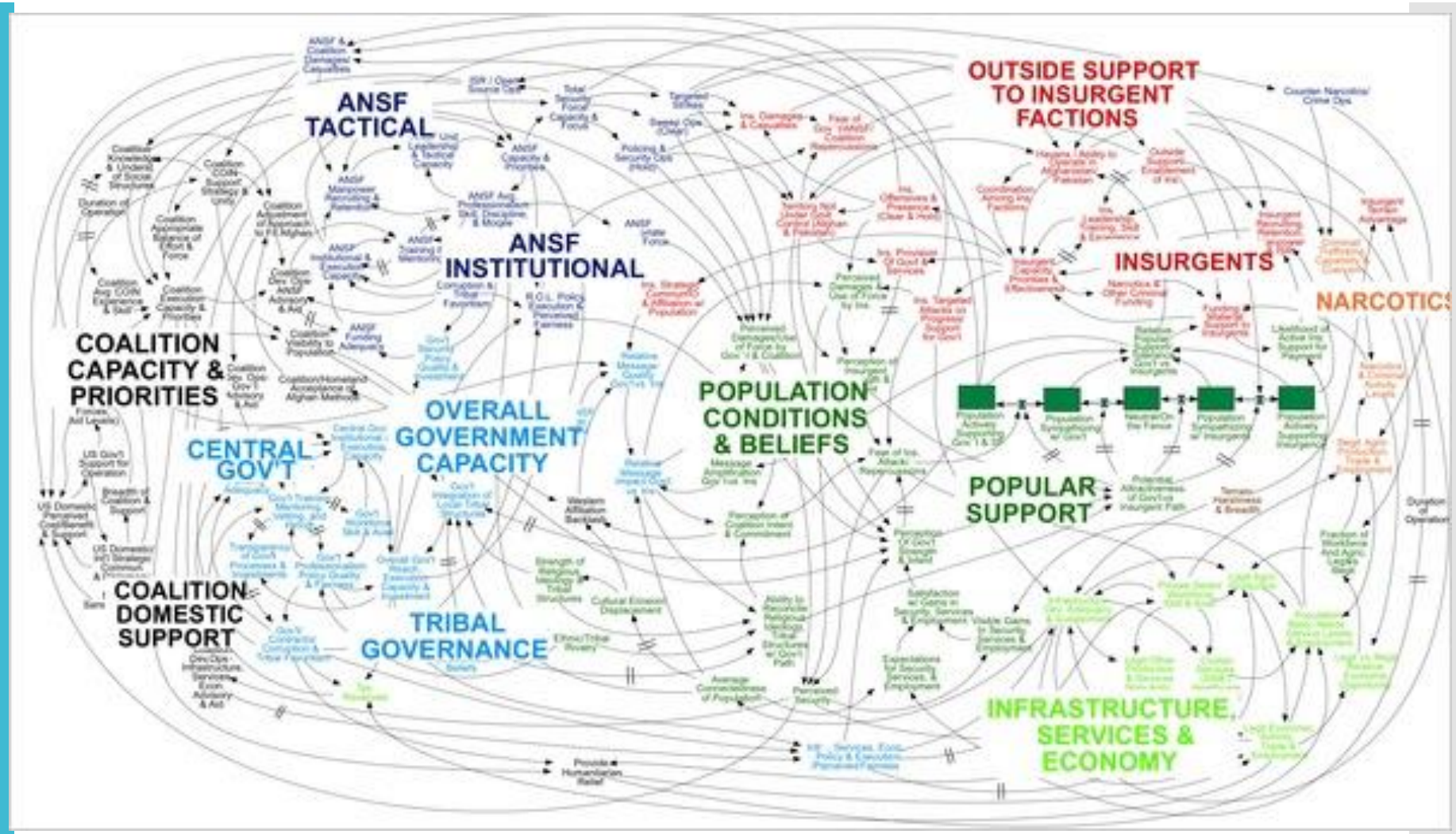
Typical real world power and control context



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Implications of Two Feedback Loop Limitation Axiom

Main implications of Two Feedback Loop Limitation Axiom are:

- It is invalid to ask individuals to mentally make decisions and strategies for situations with two or more feedback loops they will produce wrong answers (yet believe they are correct)
- Participative and collaborative methods for research, decision-making and design are not valid for situations with **more than two feedback loops**
- Reconceiving situations as having less than two feedback loops (e.g. converting them to linear systems) results in faulty predictions of outcomes
- Two feedback loops provides a better definition of 'complex'

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Robust definitions of complexity

- **Simple system:** Small number of elements and relationships with **maximum of one feedback loop** and fulfils system structure assumptions
- **Complicated system:** Any number of elements and relationships with **maximum of one feedback loop** and fulfils system structure assumptions
- **Complex system:** Any number of elements and relationships with **two or more feedback loops** and fulfils system structure assumptions
- **Hyper-complex system:** Any number of elements and relationships **with two or more feedback loops and does not fulfil conventional system structure assumptions**

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Characteristics of hyper-complex systems

- System behaviours, purpose, ownerships, subsystems, subsystem relationships and control mechanisms vary continuously.
- System boundary(ies) do not separate system elements of interest from each other and from environment
- System boundary(ies) not static and not necessarily always owned and controlled by system owner
- Sub-systems are not static in ownership, purpose, roles or relationships
- Control is dynamic and exerted through a variety of changing subsystems and factors; some outside the system
- Multiple feedback loops exist with changing structure, dynamics, purposes, causal relations, existence and ownership
- Coercive situations involving multiple asymmetric power relations unaligned to subsystems
- Control and system behaviours operate outside of the variables being addressed
- Parts of system and environment are chaotic
- Most of the situation and its causal relations are unknown

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Examples of hyper-complex systems

- US –Afghanistan and similar wars
- Epidemics with associated disasters and social breakdowns
- Middle East (Saudi, Iran, Israel, Lebanon, Palestine, US, Russia)
- Climate change control and politics
- Local government
- Health systems in impoverished countries with low levels of governance or conflicted governance
- Managing malnutrition
- Sectarianism in India
- Large-scale international business competition
- Improving the government of countries captured by criminal cartels or industry lobbies
- Any system with large number of feedback loops in which the systems structure and ownerships of system elements changes
- International political tension between elites (wars by any means)
- National systems subject to hidden control via psyops or similar

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Contact details

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