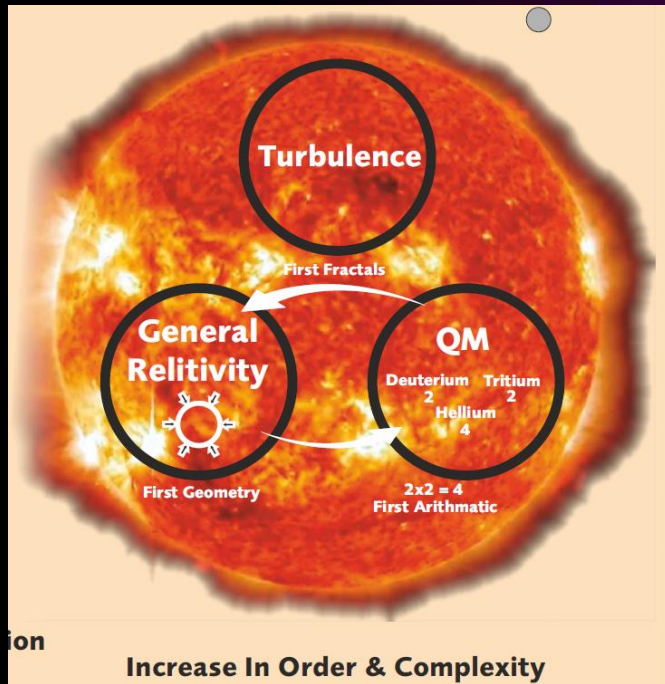Institute
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E PERITIA RATIO

IFoA GIRO Conference 2024
18–20 November, ICC, Birmingham

A New Actuarial Approach to Complex Problems

Chris Smerald + Ian Thomas
Sensing and Responding to Chaos and Nonsense Working Party

IFoA GIRO Conference 2024

~~Better~~ Sensing and Responding to ~~Change~~ Chaos and Nonsense ~~(BSRCH)~~ (SRCHN)

A Long Journey

Emerge aqua

Information and It's Conservation

Listening

Statistical Process Control
New Diagnostics

Systems Thinking
Nonsense Detection

Better Define Actuarial Science
Futurism

Model Philosophy

Chaos Self-Organising Leadership

Information surprise links everything

# If You Followed the Working Party Since Inception, You Would Understand:

1. How to listen effectively.

2. How to identify non-random variation in your data using Control Charts.

3. How to better calculate standard deviation.

4. How to adopt a futurist mindset to make forecasts instead of mere predictions.

5. What the actuarial value proposition is and how to leverage it across broader fields.

6. How to challenge and explain expert judgements more fully.

7. Why non-linear feedback cannot be overlooked in actuarial work.

8. How models, company interactions, and leadership are intricately and fractally interconnected.

9. The overall strategy for sensing and responding to chaos and nonsense.

10. Why the Actuarial Control Cycle needs updating.

11. How to be an Analytic Leader

Working Party members

- Chris Smerald, Chair -Emerald Lake Consulting, OAC/Broadstone

- Ian Thomas – Aurora-Insurance

- Yaakov Moser –Menora Mivtachim

- Moshe Steinberg – Aon

- Many Previous Contributors

- Join Us and become a systems scientist!

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Use the Right Tools for the Right Job at the Right Time in the Right Way

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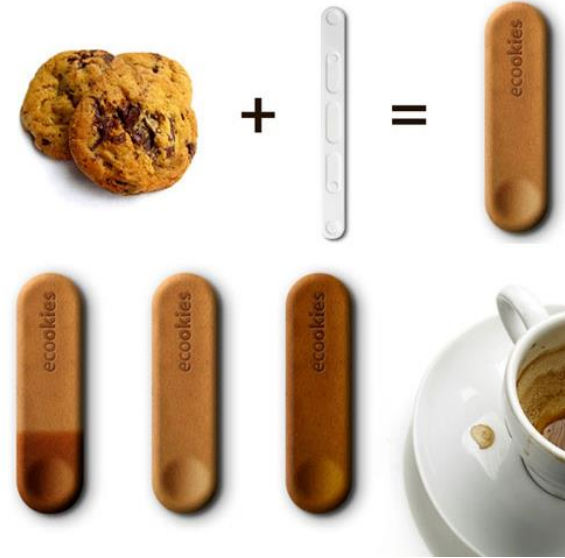
Relationships, Information Exchange and Surprise

Scientist Peter A Cook says that relationships only occur because of exchanges of Information.

Think about this. How could a relationship exist without this?

Claude Shannon[1] further links the exchange of information to surprise

At Bell Labs was interested in the capacity of electronic communication. What was the limit of information that could be transmitted over a noisy wire?

"The significant aspect is that the actual message is one selected from a set of possible messages. It is the probability of a message that matters in electronic communication."

So what matters in communication theory is how surprised the user would be by the message.

He might define the surprise in a message as **Log$_2$ (1/probability of the message**).

And the total amount of surprise in a set of messages (or data), its "Entropy" H as:

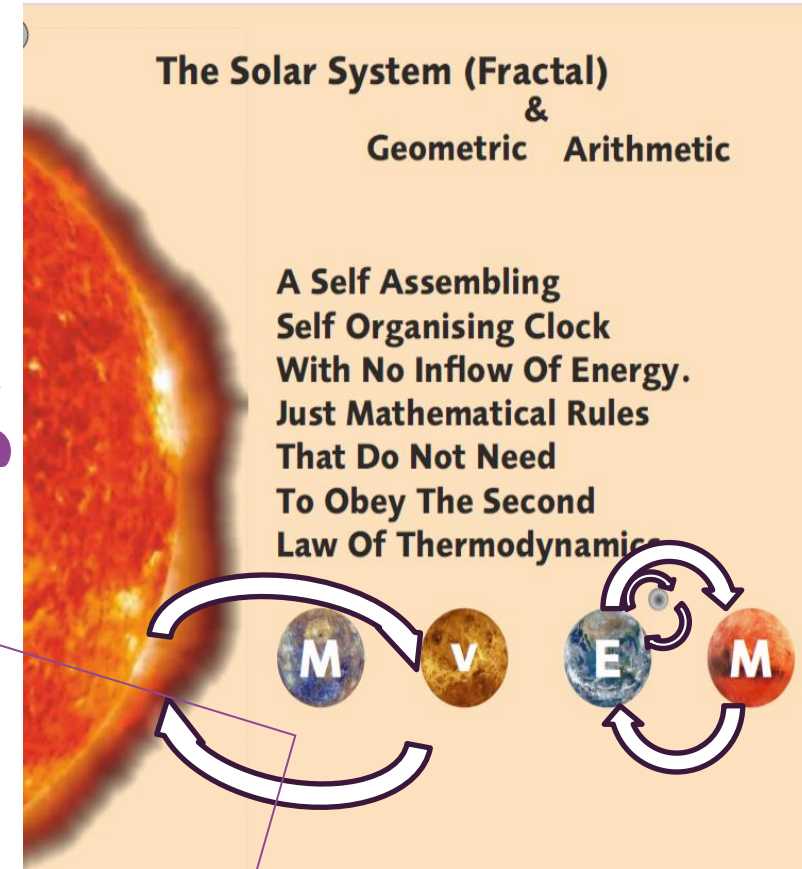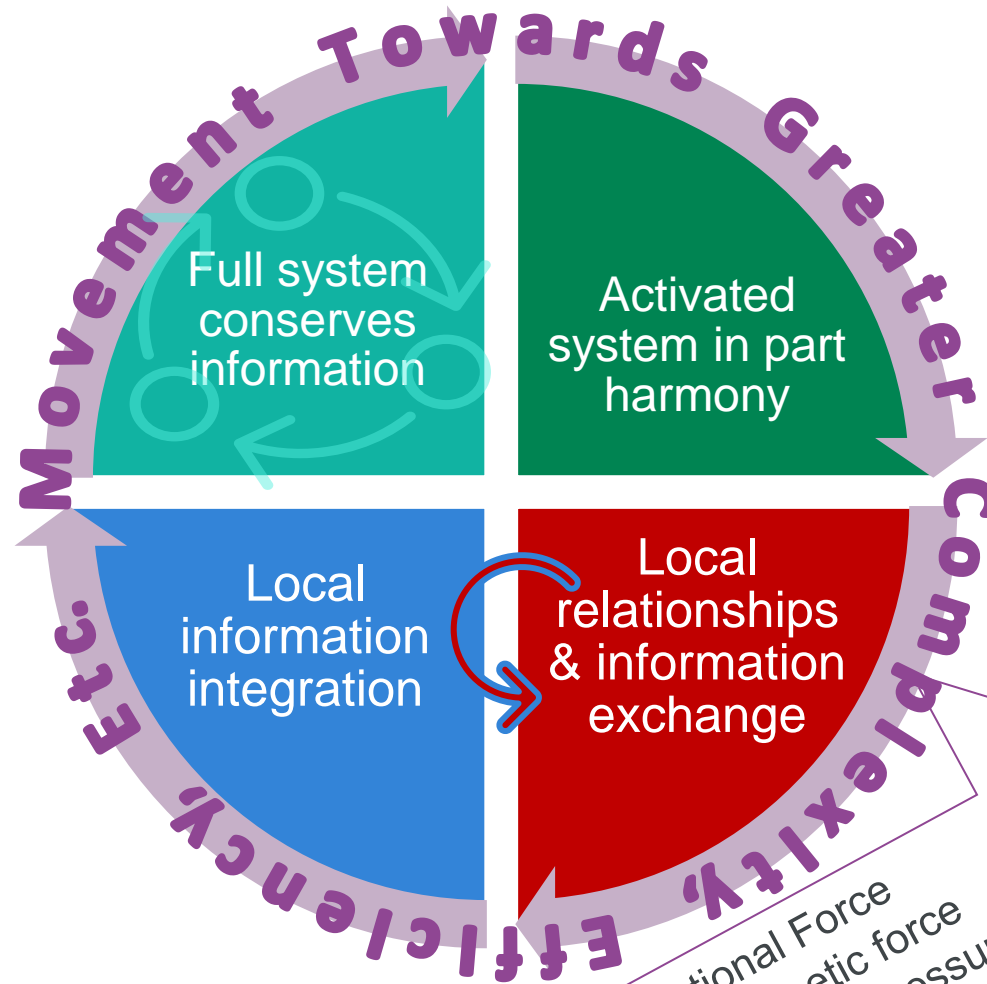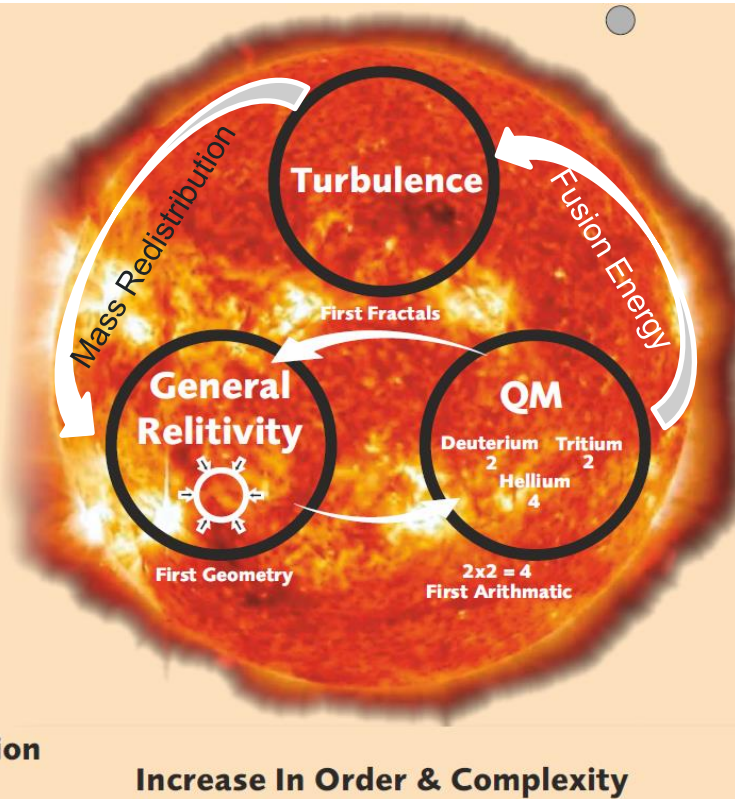"We shall call H = $\sum p_i \log 1/p_i$ the entropy of the set of probabilities $p_1,,,p_n$

If x is a chance variable pulled from $p_1,,,p_n$ we will write H(x) for its entropy"

H is a measure of "bits" of information needed to communicate an average message and is a massively important mathematical finding.
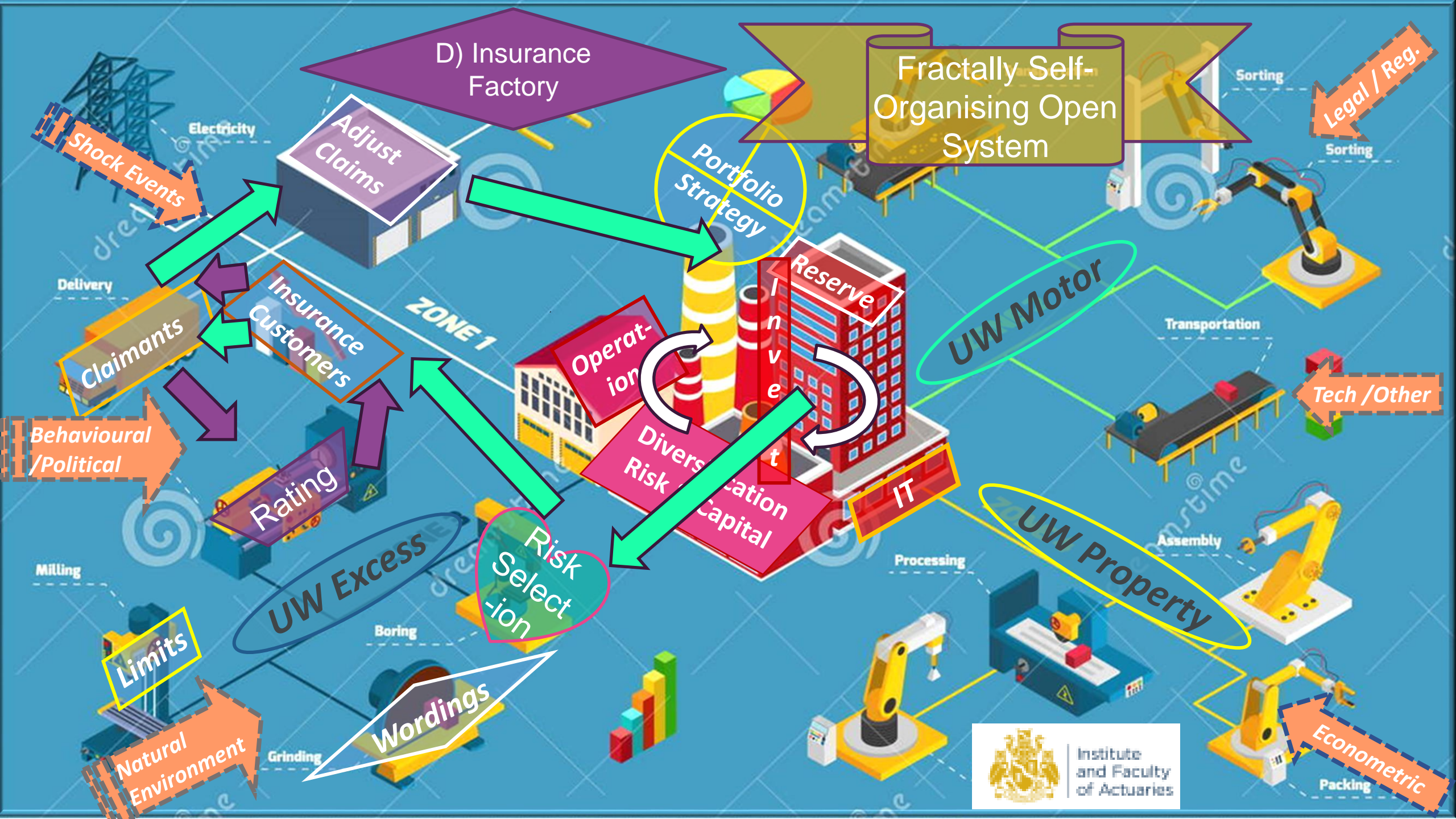
[1] A Mathematical Theory of Communication, C. E. SHANNON, The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948

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Natural Systems Self-Organisation Examples (P A Cook)

Increase In Order & Complexity

Turbulence

Mass Redistribution

Fusion Energy

First Fractals

General Relitivity

QM

Deuterium 2   Tritium 2

Helium 4

First Geometry

2x2 = 4
First Arithmatic

Forces are not just weak and strong, they are fast and slow

Movement Towards Greater Complexity. Efficiency Etc

Full system conserves information

Activated system in part harmony

Local information integration

Local relationships & information exchange

Gravitational Force
Electromagnetic force
Solar radiation pressure
Planetary bulge (oblateness)
Thermal effects

The Solar System (Fractal) & Geometric Arithmetic

A Self Assembling
Self Organising Clock
With No Inflow Of Energy.
Just Mathematical Rules
That Do Not Need
To Obey The Second
Law Of Thermodynamics

M V   E M

D) Insurance Factory

Fractally Self-Organising Open System
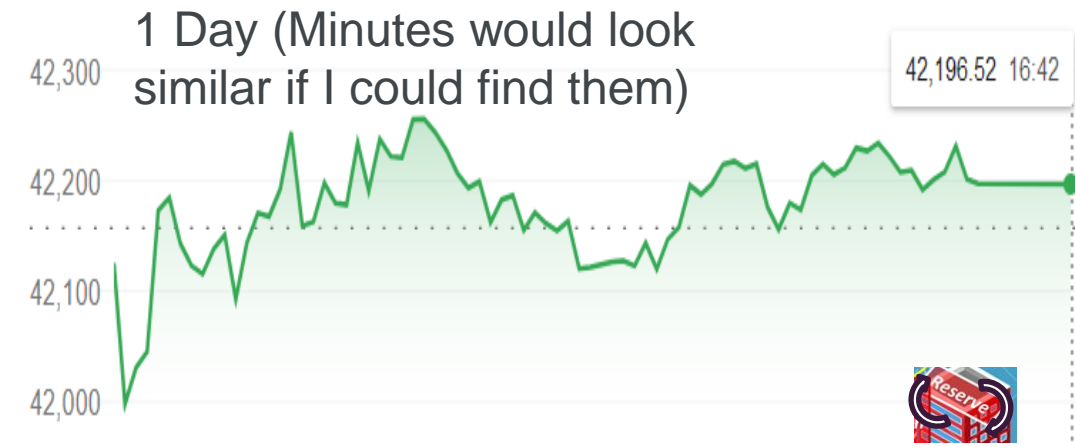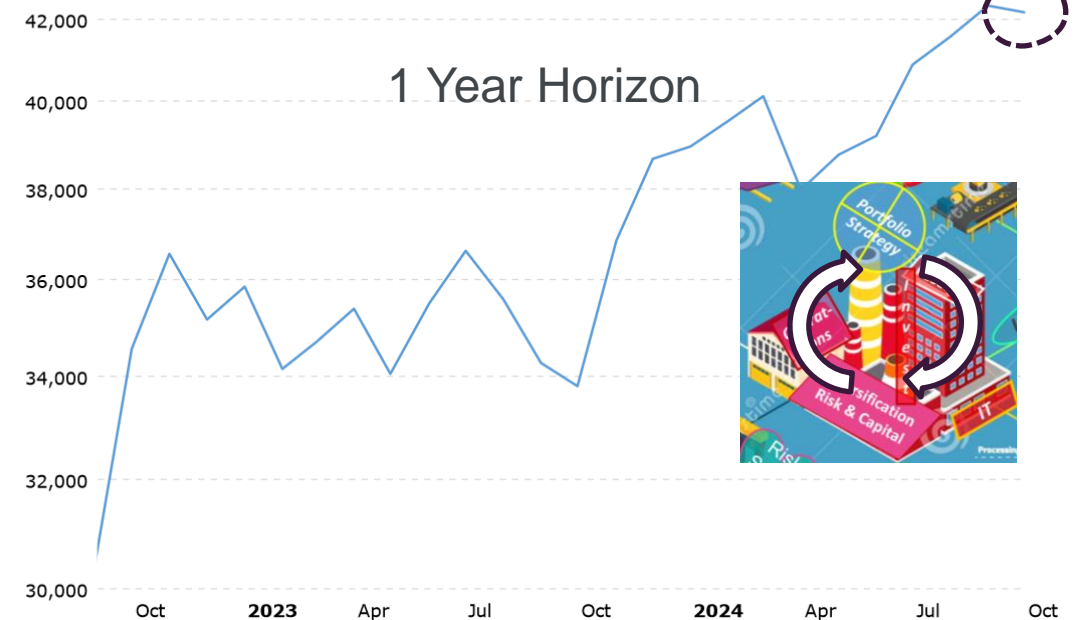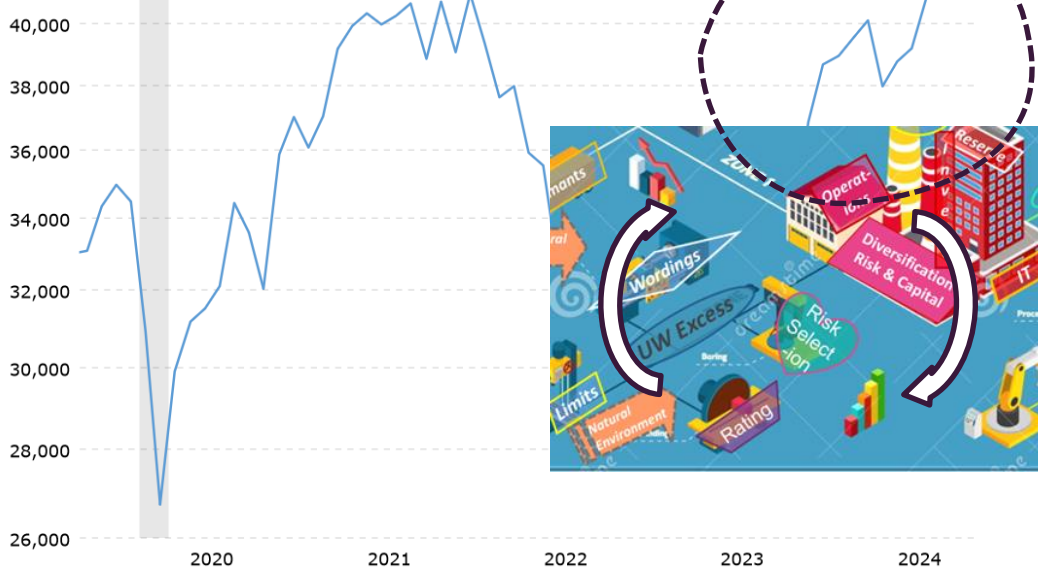
Fractal Market Hypothesis: DJIA
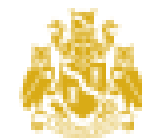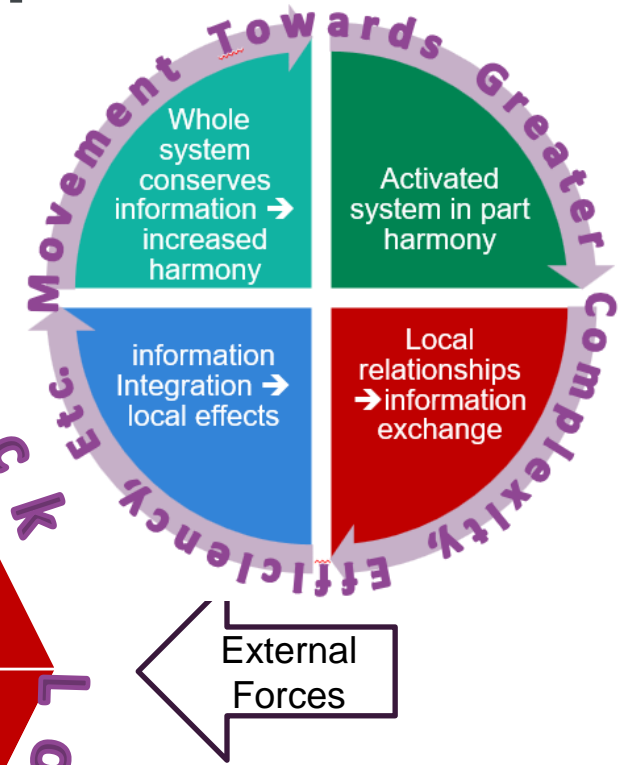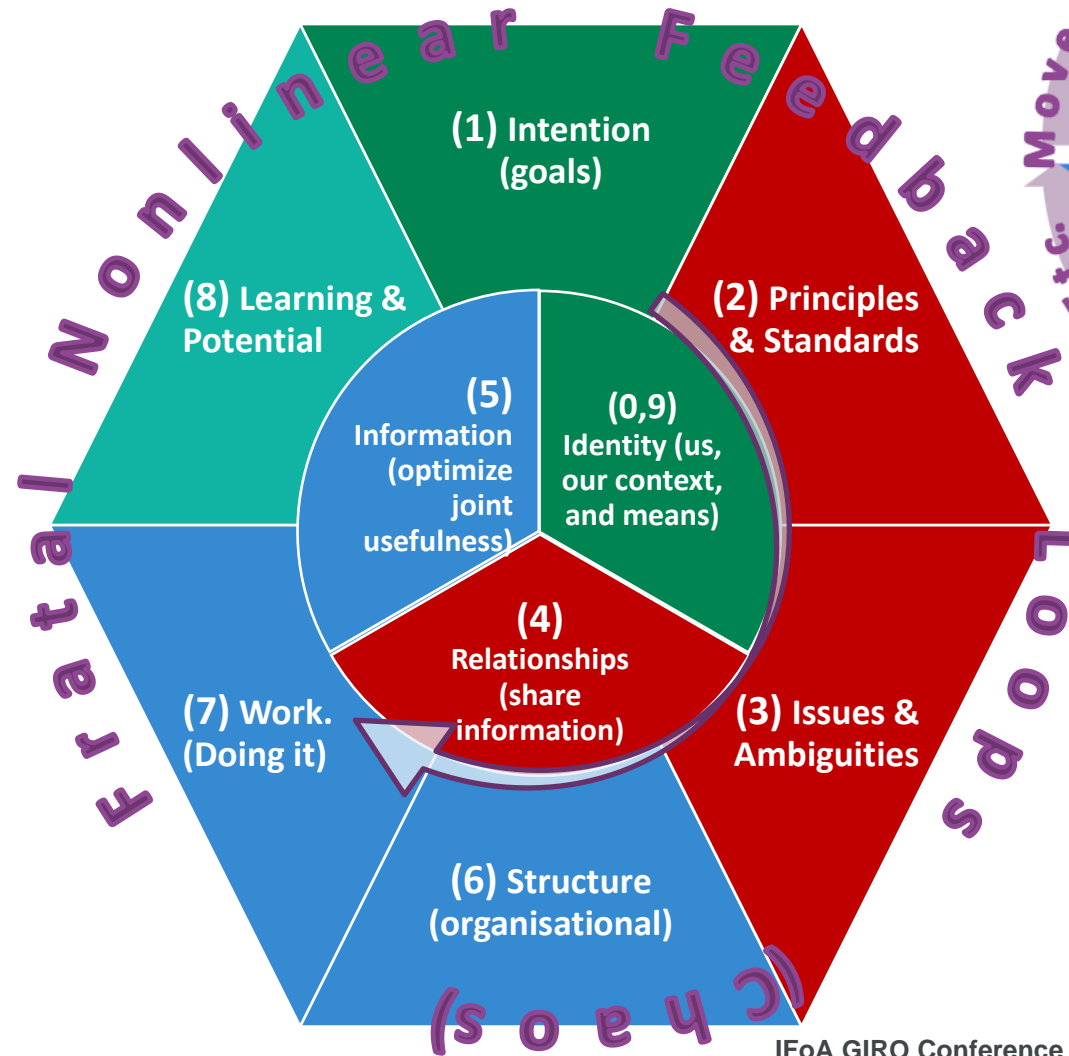

100 Years (logarithm, inflation adjusted)
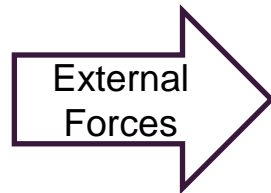
5 Years (logarithm, inflation adjusted)

1 Year Horizon

1 Day (Minutes would look similar if I could find them)

42,196.52 16:42

https://www.macrotrends.net/1319/dow-jones-100-year-historical-chart

Richard Knowles: Self-Organising Leadership

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Belle WV: A Great Place for a Chemical Plant?

- Shut Down Threat
- Bullying
- Dreadful Safety
- High Costs
- Poor Quality
- Bad Customer Service
- Silo Culture

Stagnant Air

Town

1 Mile Long, 1/3 Mile Wide

River

Explosion

40M Pounds Ammonia
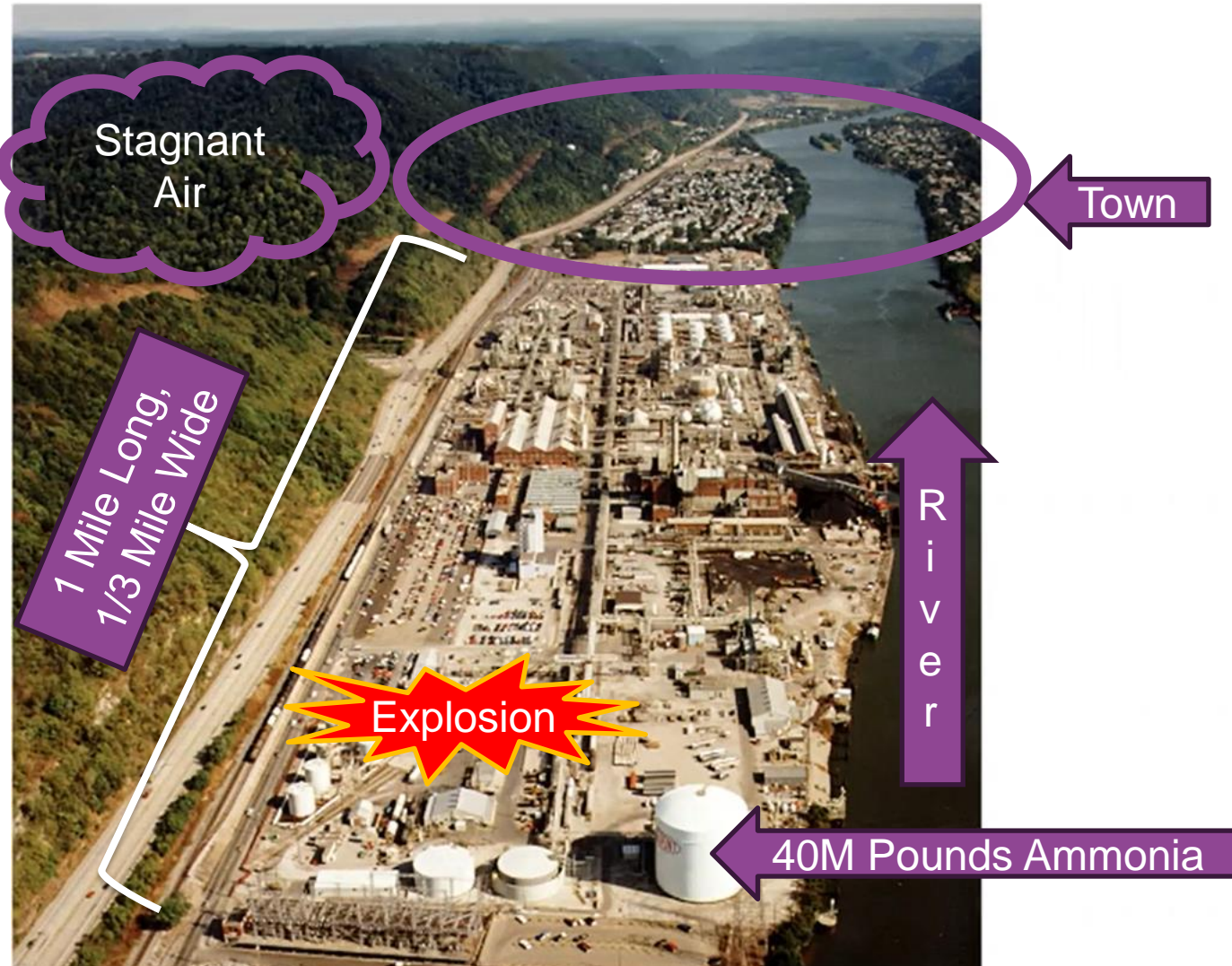
Richard Knowles

Dr Richard Knowles
Safety Engineer + Cyberneticist

Richard Knowles: Self-Organising Leadership
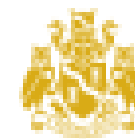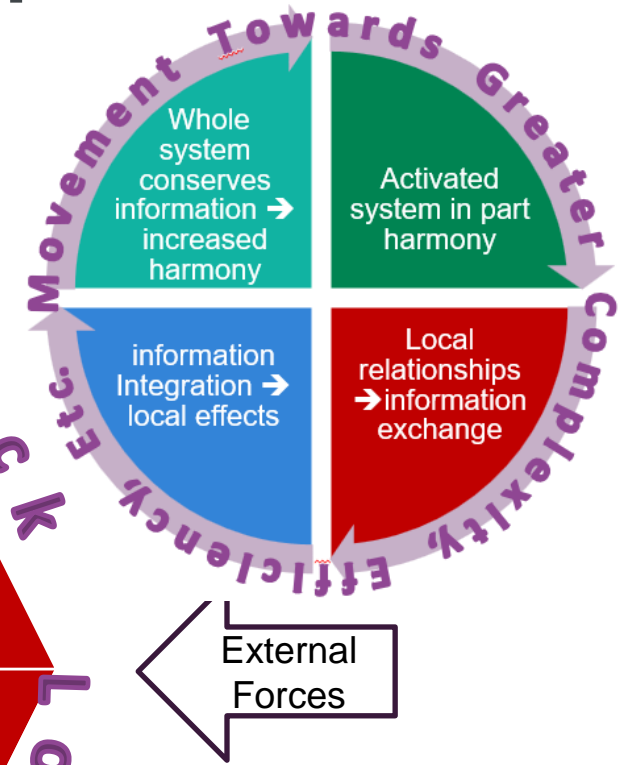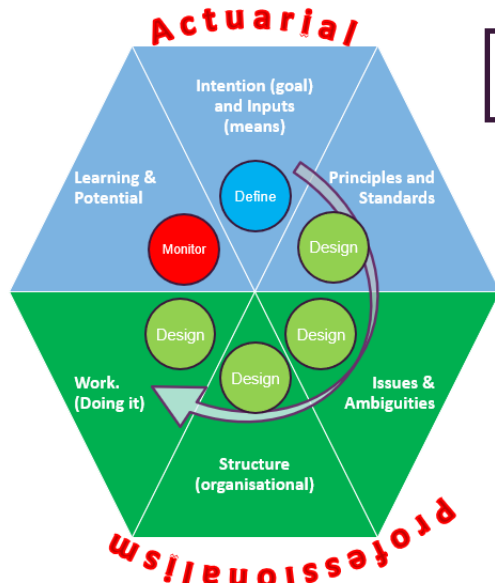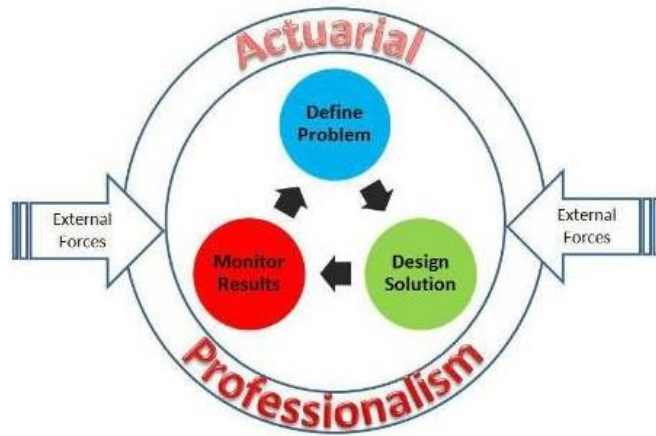
What if a Supreme Court ruling shifted the balance in favour of the seriously injured and encouraged improved safety?

The UK legal system heavily relies on Judicial College Guidelines for non-economic injury awards, but these "focus primarily on physical injuries, with less guidance for quantifying damages for psychiatric injuries or distress"[1]

Additional factors, such as contributory negligence, can further limit awards.

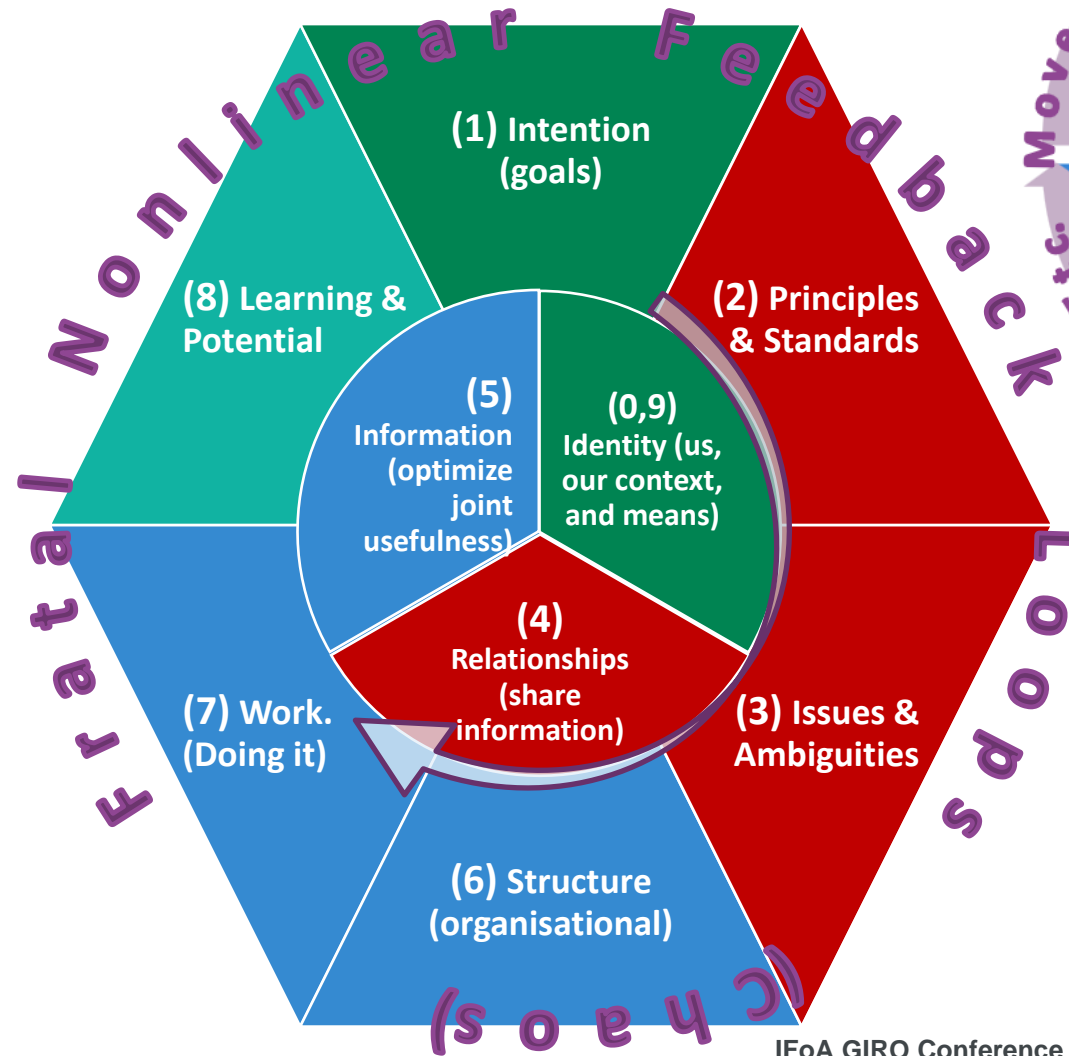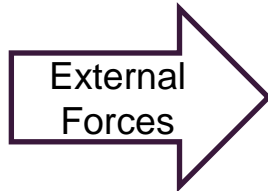The "loser pays" rule for attorneys' fees tends to favour well-resourced parties.

This can lead to under-compensation and may reduce safety incentives for potentially liable defendants.

[1]https://ropewalk.co.uk/blog/quantifying-damages-for-psychiatric-injury-and-distress-caused-by-data-breaches/

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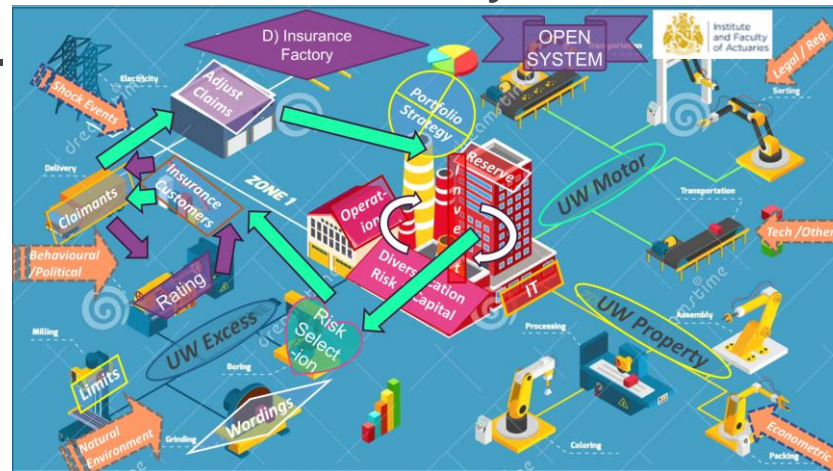
Systems to Navigate:

- Your Context in Relation to the Shock

- The System of Interest

- Management History

- Key Stakeholders

- Engagement Model

- Story of Change

- Data Acquisition and Exploration

- Integration / Modelling

- Conservation of Information (Sharing)

Consider your **CORE CONTEXT:**

1) Step 1 – Setting your identity

   a) What skills and experience do you have for dealing with this sort of event

   b) What role you want to have with this shock event?

      i. I want to do better in my role.

      ii. I want my colleagues around me to do better, because that will help me too.

      iii. I want to explore having a more strategic role in this event.

   c) What pressures or constraints do you have

Grounding

2) STEP 2 - QUICK RUN THROUGH **SYSTEM OF INTEREST**

   a) STEP 1A - REVIEW OF YOUR SYSTEM (FACTORY)

      i) Connected Systems: Identify the parts of the environment and factory impacted the most/ first - think timeline. Think about different goals that may have changed.

      ii) Connected Challenges: identify which areas have issues whose solution is related to yours, related goals.

      iii) Start thinking about information that could be shared.

   b) STEP 1B – **MANAGEMENT HISTORY**: Query resources and people with histories of previous events

      i) Contact with those knowledge people could be particularly helpful at many levels.

      ii) What has happened before that would help us understand now: how the response was organised, what was the rough and the smooth?

      iii) What is similar or different vs. the relevant past events

D) Insurance Factory

OPEN SYSTEM

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Shock Events

Legal / Reg.

Electricity

Adjust Claims

Portfolio Strategy

Transportation

Sorting

Delivery

Reserve

UW Motor

Claimants

Insurance Customers

ZONE 1

Operat-ion

Invest

Behavioural /Political

Tech /Other

Transportation

Rating

Divers...cation Risk...Capital

IT

UW Excess

Risk Select-ion

UW Property

Milling

Processing

Assembly

Limits

Boring

Natural Environment

Grinding

Wordings

Coloring

Packing

Econometric

Influencing and Being Influenced

3) STEP 3 – **KEY STAKEHOLDERS**: Engage With Key Contacts and Prioritised Others (previous step helps)

   a) Follow the leads identified in step 1. If possible, take with you the reasons why you have identified those people - share why you think they can help you (this can provoke great knowledge sharing)

   b) Share some of the company response speculation

   c) Listen well to their views and suggestions

   d) This act will build relationships, leading to sharing of information. Which leads to stronger relationships, which builds better information (it is a loop).

   e) (Information is shared, Information is Conserved)

More Conversations will happen with and without you.

Optimal Direction Self Organises

4) STEP 4 – ENGAGEMENT MODEL Emerges of how entity should (start) to deal with this event

   a) Steps 1-2 give an improved chance of having the role you want

5) STEP 5 - YOU NOW HAVE SOMETHING TO DO

   a) Could be part of an event team, or it could be just your role and what you should do now that you know extra stuff about the event. But you are better prepared, better included.

   b) Your actions will likely:

      i) Involve key relationships with: Claims, UW, Legal, ERM

      ii) Data and Analytics

      iii) Using relationships and knowledge built

Identifying feedback loops in the emerging system

6) Step 6 - Story of Change in the system. You want to build on your previous feedback and map out in more detail

   a) How the system may evolve

      i. Think about timelines of the primary accident

      ii. Then of some of the affected stakeholders. What is their timeline?

      iii. Think about how the same timelines might be different 1 year on

      iv. Think about how the year 2 result might compare to a similar system like the us tort system

   b) Consider the Data

      i. Accessible ideal: immediately available, frequently updated, low cost

      ii. How long before an effect should be visible

      iii. Who else would use it

      iv. Who might you tap

# Surprise Detection Diagnostics

7) Step 7 Find Surprise

   a) Traditional actuarial diagnostics, but make them incremental too

   b) Incremental AvE / Control charts (Shannon Entropy can help you choose better expectations)

   c) Listen for others' surprise then look for supporting data

8) Step 8 Integrate the Surprise into your work

   a) Start linking it to your systems feedback model

   b) Look for connections and adjust your expectations

   c) Consider nonlinearities in the links you find

   d) Prioritise what's still needed new and as support

   e) Compare notes and share as you go

   f) Start adapting your models

9) Step 9 Ensure your Information is conserved the organisation
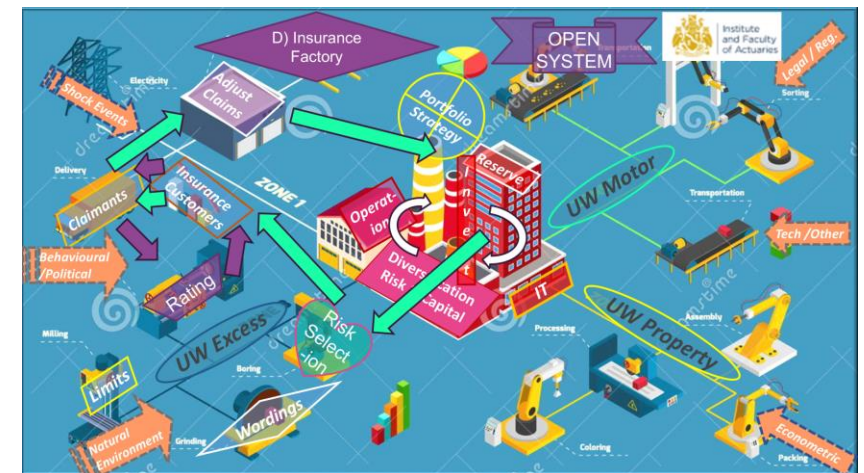
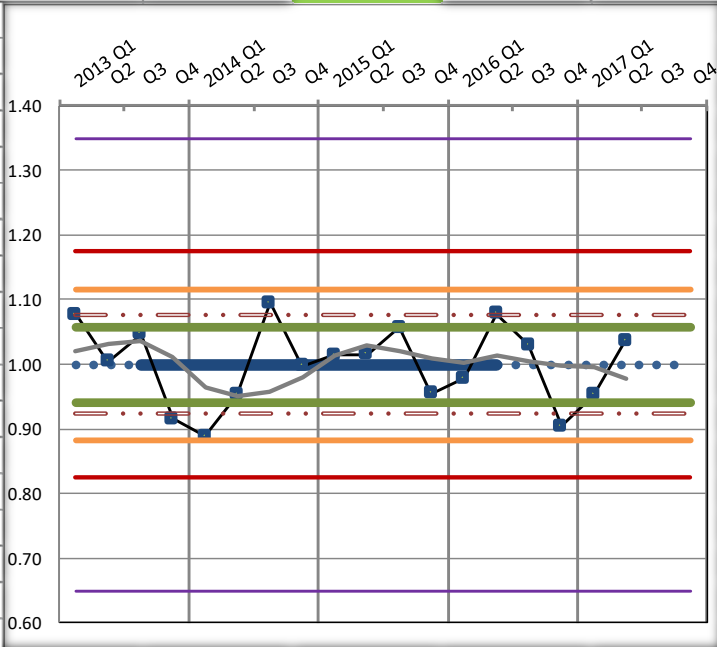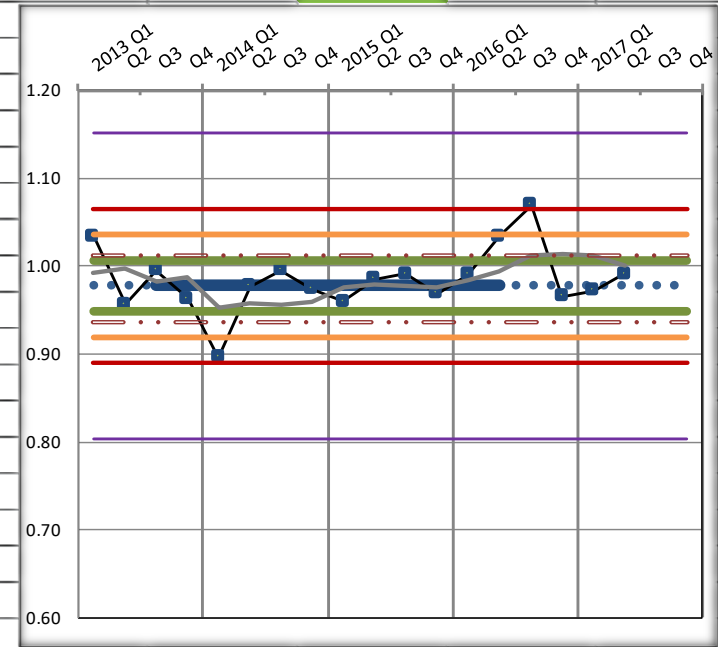# Case Distribution: Settled as % Avail to Settle

November 15, 2024

23
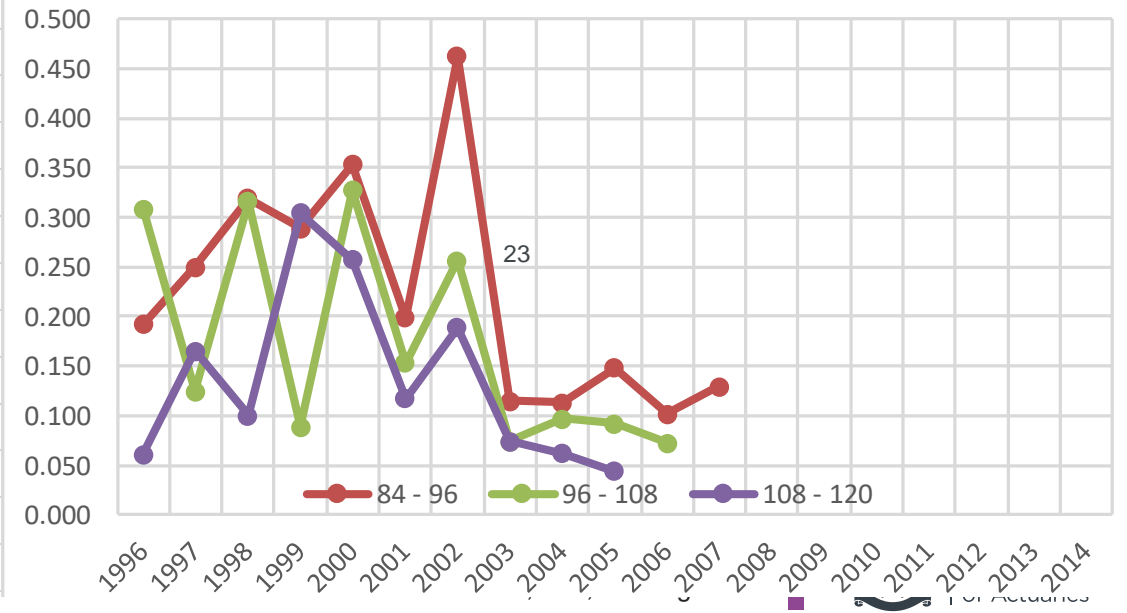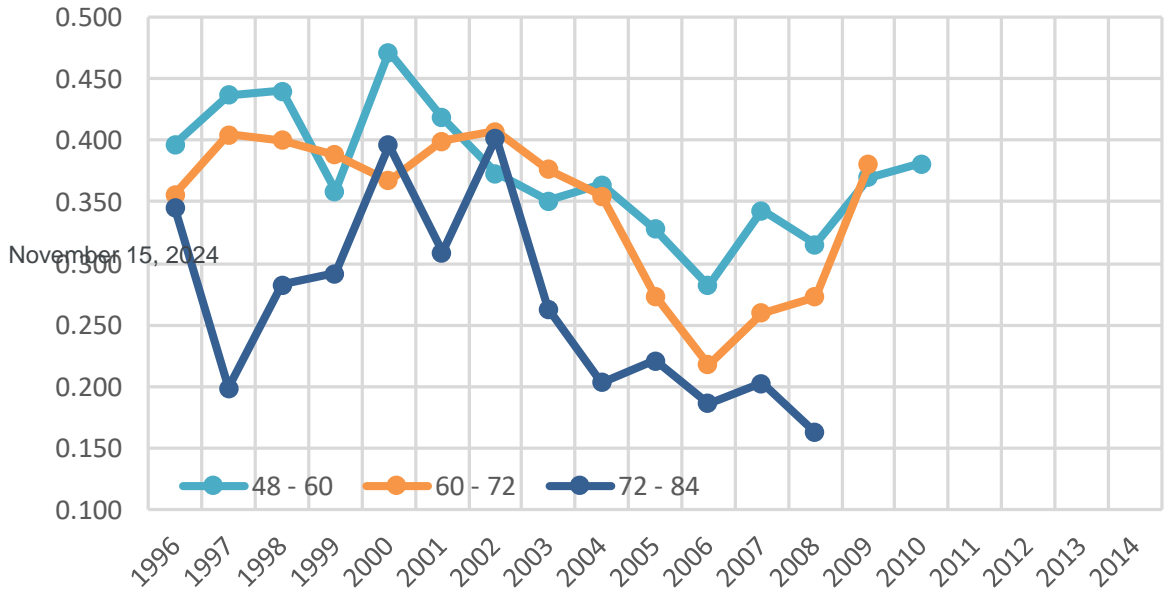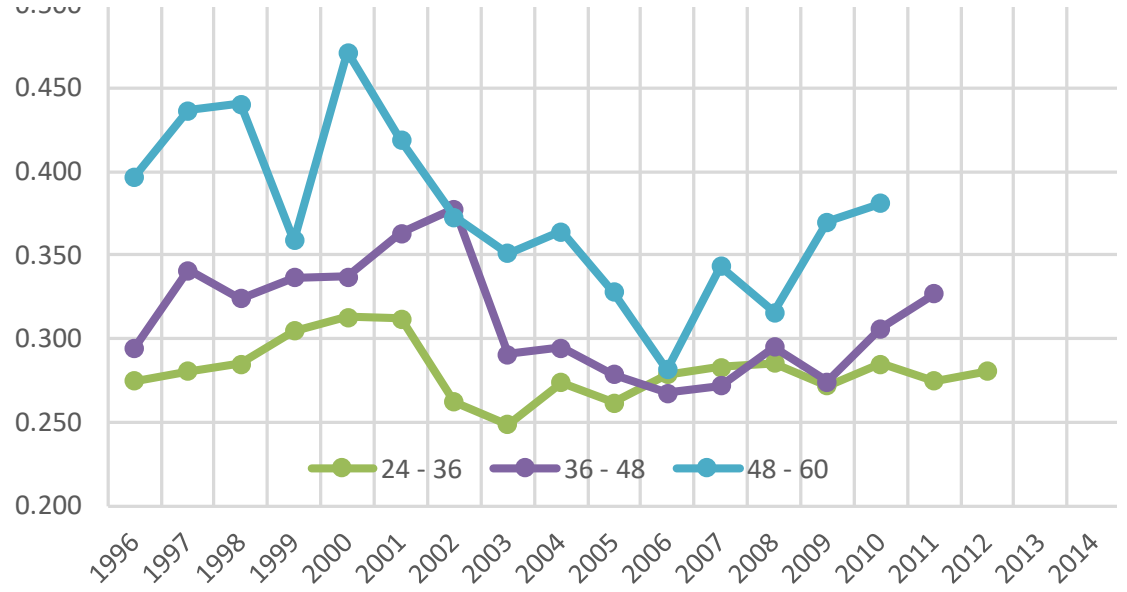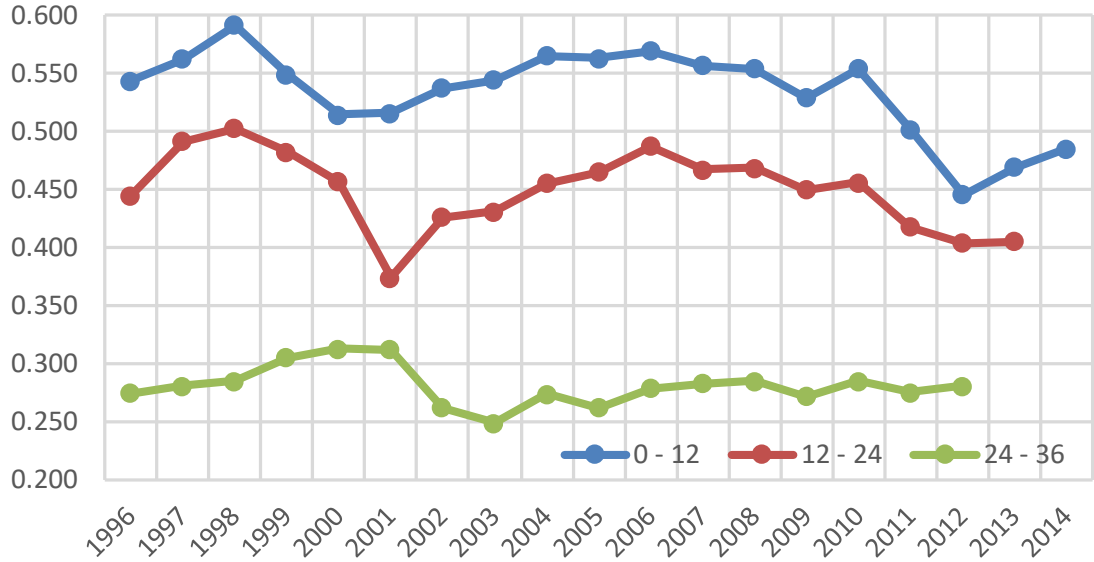
Storyboard View

November 15, 202_
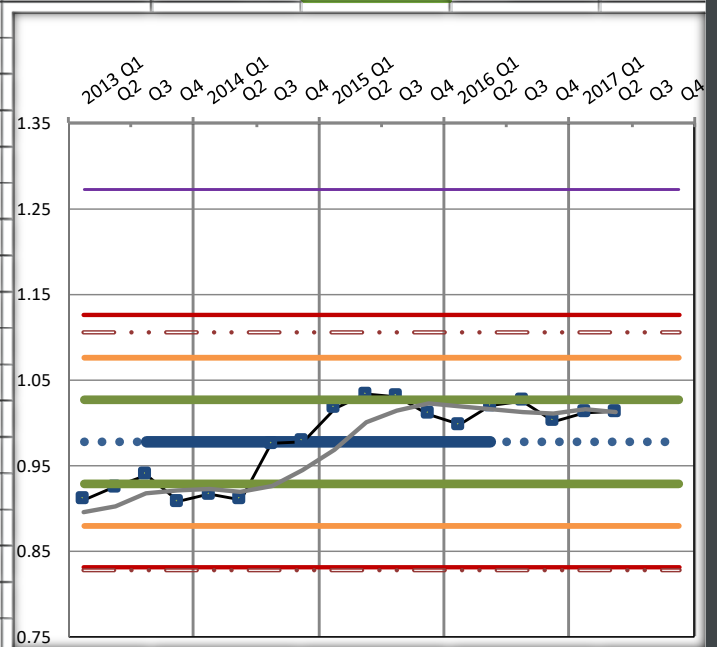
Reported Claims Qtrly A/E — OK

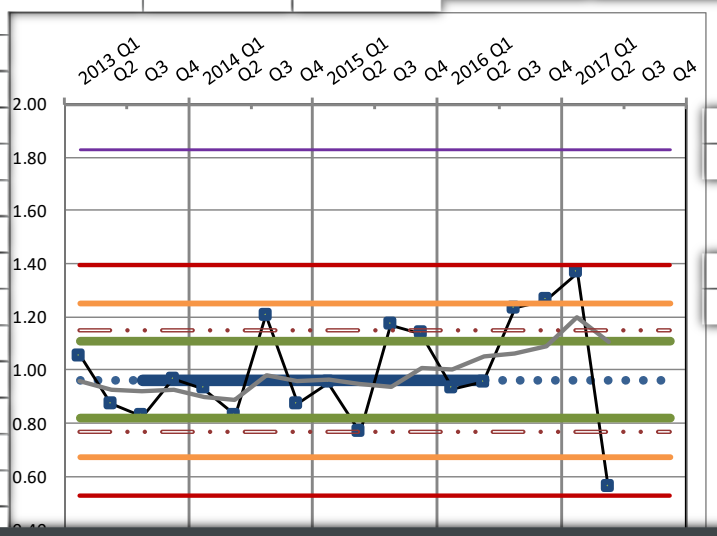# Closed With Payment — OK
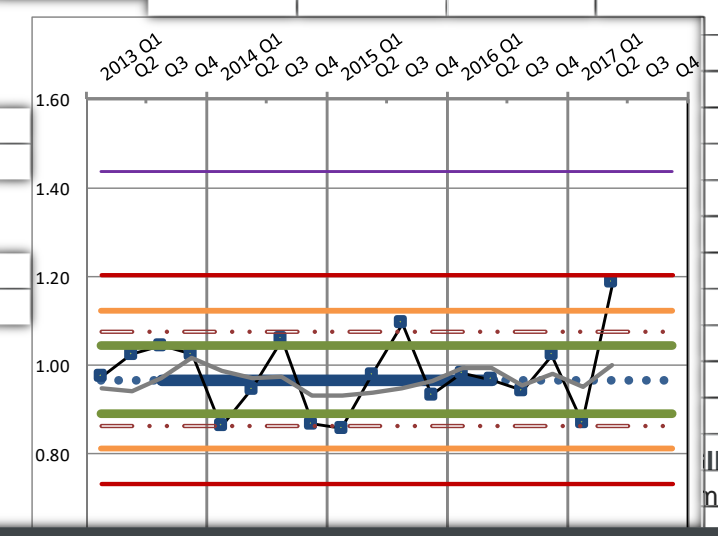
Open — OK, but 2015 Assignable Cause
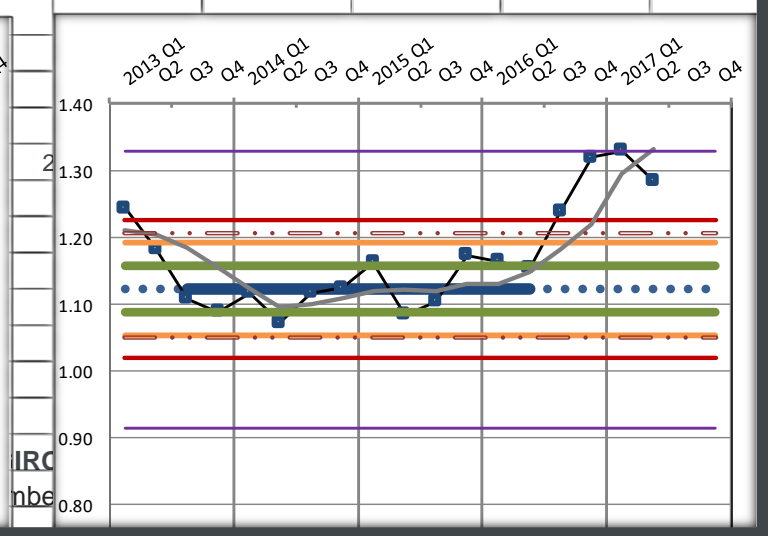
Incurred & Legal A/E — Extreme Event
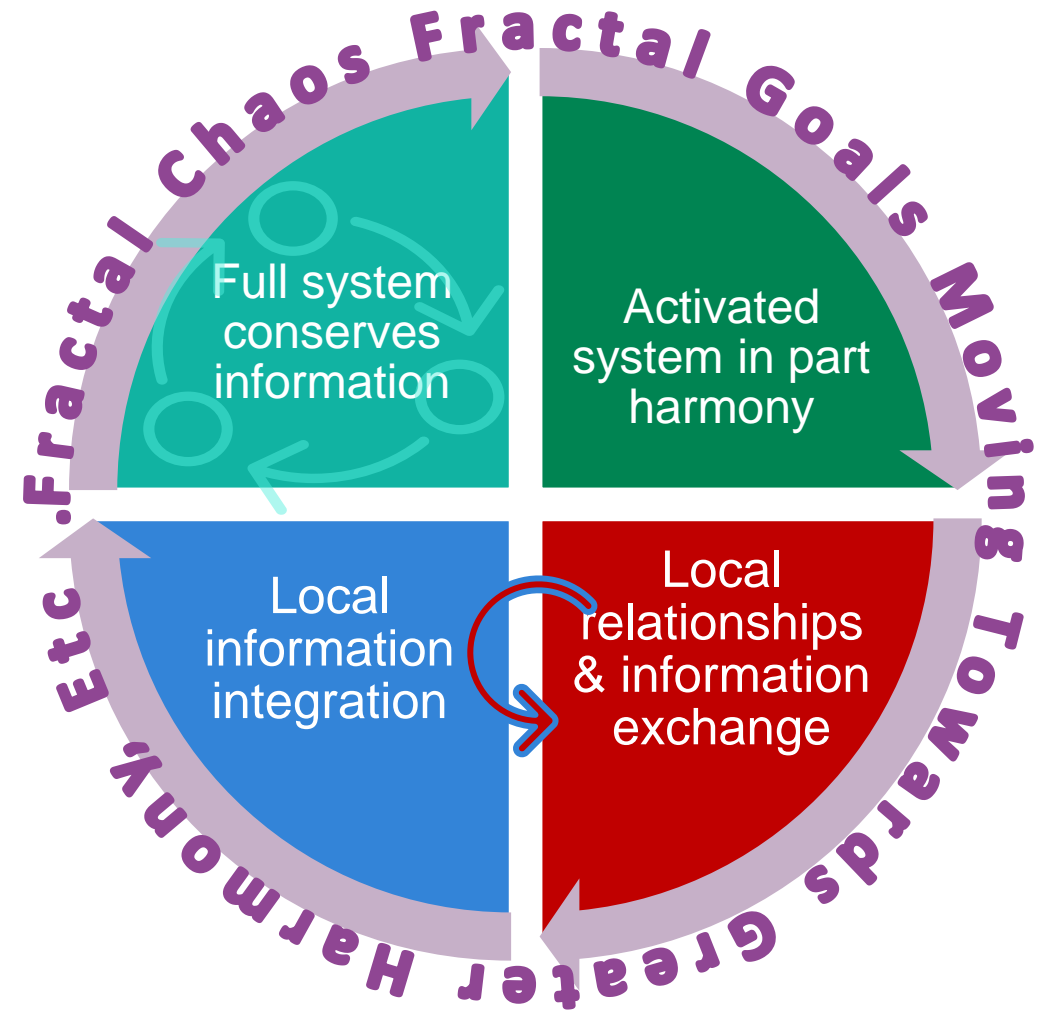
Paid Loss + Legal — OK

Case OS — Extreme Event

The Actuary as a Chaotician

- Understanding how systems and systems self-regulation work

- Acting at different fractal levels

- Forming relationships to better detect and exchange surprising information

- Integrating surprise effectively

- Taking advantage of non-linear feedback loops to helping structure the surprise into the consciousness of the firm

- Improved understanding of fractal levels

- Better: Detection, Integration, Influence, Understanding, Relationships, …

Self-Organisation is Everywhere

1. The Natural World
2. At Home
3. The Insurance Environment
4. Office Politics
5. Collaboration
6. Mapping a System
7. Data Investigations
8. Modelling
9. Good Actuarial Reports

Full system conserves information

Activated system in part harmony

Local information integration

Local relationships & information exchange

Fractal Chaos Fractal Goals Moving Towards Greater Harmony Etc.

Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.