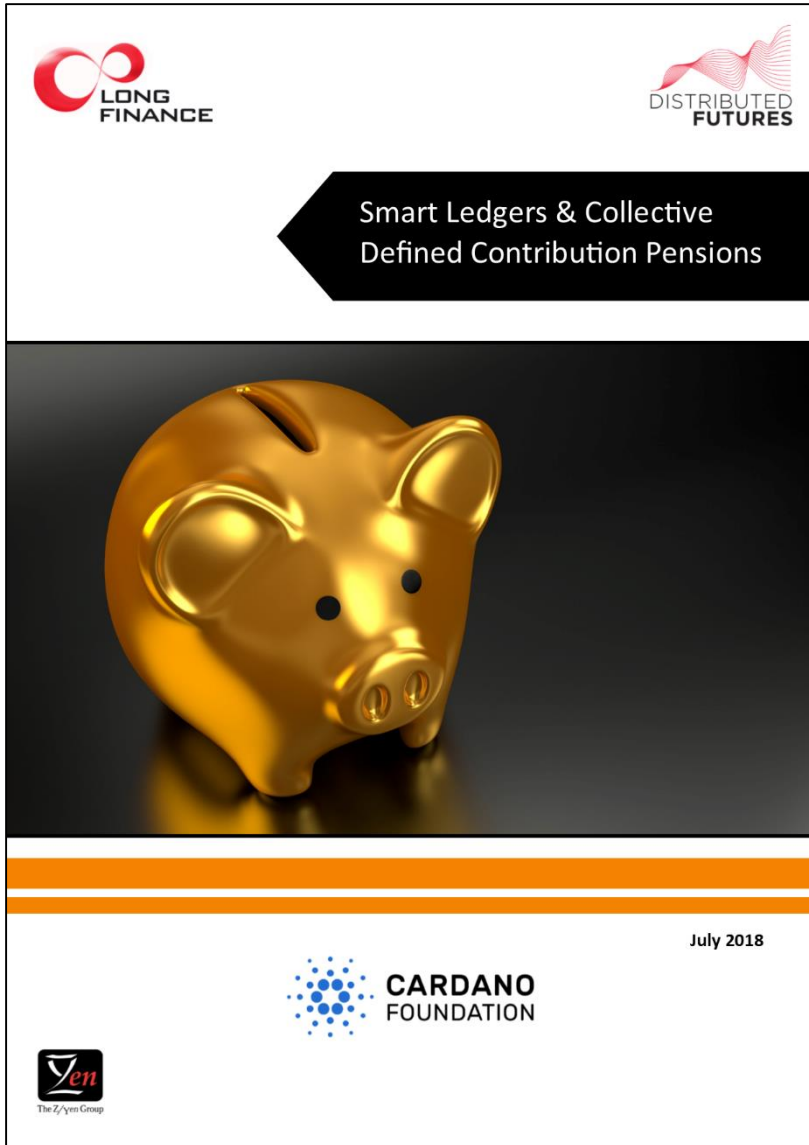# Introduction

James Pitcher
Programme Director
Z/Yen Group

james_pitcher@zyen.com

Agenda

15:00 – 15:05   Welcome & Introduction
15:05 – 15:20   Presentation
15:20 – 15:25   Questions
15:25 – 15:30   Concluding Remarks

Report

Read the report at:

https://bit.ly/2KE5POT

Z/Yen Group

- ◆ **Special** – City of London's leading commercial think-tank
- ◆ **Services** – projects, strategy, expertise on demand, coaching, research, analytics, modern systems
- ◆ **Sectors** – technology, finance, voluntary, professional services, outsourcing

➢ Independent Publisher Book Awards Finance, Investment & Economics Gold Prize 2012 for *The Price of Fish*

➢ British Computer Society **IT Director of the Year** 2004 for PropheZy and VizZy

➢ DTI **Smart Award** 2003 for PropheZy

➢ *Sunday Times* Book of the Week*, Clean Business Cuisine*

➢ £1.9M **Foresight Challenge Award** for Financial £aboratory visualising financial risk 1997
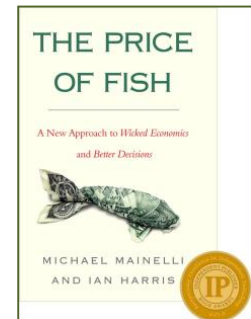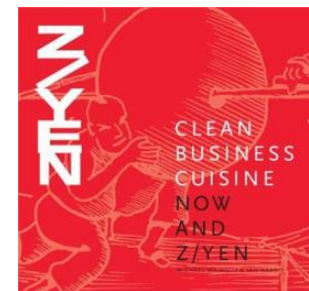
Distributed Futures Programme

We work in partnership with many stakeholders to learn together and build the vital infrastructure needed to make Smart Ledgers a success.

Our research is structured around four themes:

♦ Societal
♦ Technological
♦ Economic
♦ Political

Directed at four outcomes:

♦ Expanding frontiers
♦ Changing systems
♦ Delivering services
♦ Building communities

Sponsored By

Distributed Futures Research

The Missing Links In The Chains?
Mutual Distributed Ledger (aka Blockchain) Standards
November 2016

Responsibility Without Power?
The Governance Of Mutual Distributed Ledgers (aka Blockchains)
July 2016
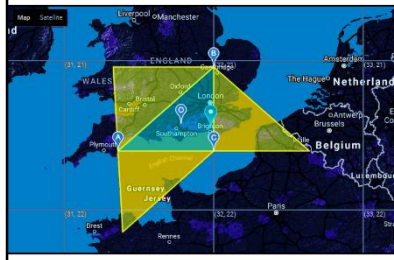
Smart Ledger Geostamping
Steps Towards Interoperability & Standards
December 2017

The Quantum Countdown
Quantum Computing And The Future Of Smart Ledger Encryption
February 2018

Get Smart About Scandals
Past Lessons For Future Finance
March 2018

Liquidity Or Leakage
Plumbing Problems With Cryptocurrencies
March 2018

The Economic Impact Of Smart Ledgers On World Trade
April 2018
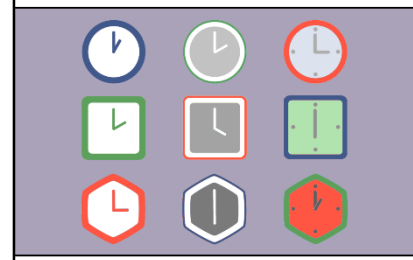
Timestamping Smart Ledgers
Comparable, Universal, Traceable, Immune
May 2018

Timeline

2017 | **2018** | **2018** | **2019**

EXPANDING FRONTIERS

Human Adjudication In Smart Ledgers	Artificial Intelligence – The Risks
Pensions & Distributed Ledgers ❹	
Smart Ledger Geostamping ❻	Fractal Characteristics & Measures
Cryptocurrency Liquidity ❷	Money Supply Rules, Algorithms & Liquidity
Economic Impact Of Smart Ledgers On World Trade ❼	Industry Pilot – Shipping
General Data Protection Regulation & Governance	Green Ledgers & Sustainability Certificates – Forestry & Fish

CHANGING SYSTEMS

Get Smart About Scandals ❸	Provability In 'Smarts'
The Quantum Countdown ❶	Inter-Exchange Operability On A Smart Commodities Ledger
Timestamping – Accuracy & Comparability ❺	Taxonomies & Classifications Of Smart Ledgers
	Prior Smarts – The Origins Of Smart Ledger Technology
IP Rights On Smart Ledgers – Music	Voting Structures On Smart Ledgers – Equities
	Cryptocurrency Energy Consumption
	WIR Revisited
Smart Ledger Surveillance Techniques	Cyber-Catastrophe Insurance Linked Security Pilot
Taxation & Smart Ledgers	

DELIVERING SYSTEMS

Directory Services	Smart Data Structures & InterPlanetary C#ASMs
Architectures For Tokenless Ledgers	Visualising Smart Ledgers
Audit & Accounting For Smart Ledgers	Online Simulation For Tokens & Cryptocurrencies
Economics Of Competing Currencies	Certificate Authenticity & Management
	Protection & Indemnity Mutuals
Survey Of The Regulatory Landscape For Smart Ledgers	

BUILDING COMMUNITIES

Games & Fun	Online Micro Courses
Standards & Interoperability	Technical Fora
Ledger Learnings & Simulations	Performance Benchmarking
RegTech	Regulatory Consultations

Terminology Evolving

- **ledger** – a record of transactions

- **distributed** – divided among several or many, in multiple locations

- **mutual** – shared in common, or owned by a community

- **mutual distributed ledger (MDL)** - a record of transactions shared in common and stored in multiple locations

- **mutual distributed ledger technology** – a technology that provides an immutable record of transactions shared in common and stored in multiple locations

- **blockchain** - "a transaction database shared by all nodes participating in a system based on the Bitcoin protocol"

- **smart ledger** – MDL with embedded, executable code

Smart Ledgers Hold Immense Promise

Area	Possible Applications
Financial instruments, records, models	Currency, private and public equities, certificates of deposit, bonds, derivatives, insurance policies, voting rights associated with financial instruments, commodities, derivatives, trading records, credit data, collateral management, client monies segregation, mortgage or loan records, crowd-funding, P2P lending, microfinance, (micro)charity donations, account portability, airmiles & corporate tokens, etc.
Public records	Land and property titles, vehicle registries, shipping registries, satellite registries, business license, business ownership/incorporation/dissolution records, regulatory records, criminal records, passport, birth/death certificates, voting ID, health and safety inspections, tax returns, building and other types of permits, court records, government/listed companies/civil society, accounts and annual reports, etc.
Private records	Contracts, ID, signature, will, trust, escrow, any other type of classifiable personal data (e.g. physical details, date of birth, taste) etc.
Semi-private/semi-public records	High school/university degrees and professional qualifications, grades, certifications, human resources records, medical records, accounting records, business transaction records, locational data, delivery records, genome and DNA, arbitration, genealogy trees, clinical trials, etc.
Physical keys	Key to home, hotel, office, car, locker, deposit box, mail box, Internet of Things, etc.
Intellectual property	Copyrights, licenses, patents, digital rights management of music, rights management of intellectual property such as patents or trademarks, proof of authenticity or authorship, etc.
Other records	Cultural, historical events, documentary (e.g. video, photos, audio), (big) data (weather, temperatures, traffic), SIM cards, archives, geostamping, etc.

Smart Ledgers & Collective Defined Contribution Pensions

Con Keating
Author

Collective Defined Contribution Pensions

- These are collective schemes which offer, but do not guarantee, targeted pensions
- Targeted pensions may be cut
- DC "pensions" are simply savings schemes, with an income conversion issue at retirement
- CDC schemes resolve this problem by indicating the retirement income equivalence of the capital sum accrued – they complete the DC offering
- Pensions are long term in nature
- And ultimately depend upon their history
- The outcome is catenated on the prior history
- Long term projections morph into realised actuality as time progresses
- The scheme is DC – there is no recourse to any sponsor. The fund is all there is.
- An immutable record of history in critical

Pension Awards

- The terms on which pensions are awarded are set annually by trustees

- For each award there is an implicit investment return on the contribution made. (Contractual Accrual Rate - CAR).

- The contribution and the scheme CAR determine a member's equitable interest in the scheme, and most importantly the scheme's fund

- Equitable interest is a pseudo-liability. This is a division of the fund agreed among members

- Members may transfer at any time at the NAV of their equitable interest

- Liability valuation is conducted continuously using this time consistent rate

- Not market-derived rates or the expected return on assets

- The rate is updated as actual events displace the assumptions of the original pension projections

Sustainability and Management

♦ To be sustainable over time, a scheme must be and operate equitably among all members

♦ This eliminates the possibility of intergenerational inequity

♦ Scheme rules can ensure this – they can be encoded as smart contracts

♦ In essence, smart ledgers reduce these key issues to matters of administration, rather than trustee discretions

♦ The rules encompass both risk-pooling and risk-sharing

♦ These rules admit longer investment horizons – no member is faced by the at retirement de-risking of DC – and higher total returns

♦ The member has the option to transfer out, and to manage their pension pot in drawdown

♦ Many other countries have forms of pension where benefits may be cut – all have significant design flaws

Risk -Sharing

DISTRIBUTED FUTURES

- Risk-sharing among members substitutes for the buffers and capital adequacy requirements of other financial institutions

- The decision criterion is the solvency ratio – assets relative to total equitable interests

- If the scheme finds itself in deficit, then a support mechanism is applied.

- This is a self equilibrating system

- If deficits arise because the trustees were over-optimistic in their awards, the rules system will cut these back to that which has been achieved

- If pensions in excess of those justified by the level of funding are paid, and a rule determines the extent and duration to which those excess payments are permitted, then the equitable interests of all non-pensioner members are increased to maintain equitable balance

- With these rules automated, member confidence and trust in CDC pensions should follow

- Members may see in near real time both the net asset value and the pension income equivalent of their equitable interest

Data Requirements

♦ Usual static data requirements for members – age, pensionable salary, marital status…

♦ Assumptions used by trustees in setting contributions. Longevity, Indexation…

♦ Contribution and CAR awards histories. A form of individual "pot" – a member's equitable interest - though part of a collective enterprise

♦ Pension fund, with a scheme specific mandate – a target return on average – where the average is determined by the extent of risk-sharing utilisation

♦ Operations of the risk-sharing rules over time

♦ Administration requirement – for the receipt of contributions, payment of pensions and operations of the risk-sharing rules
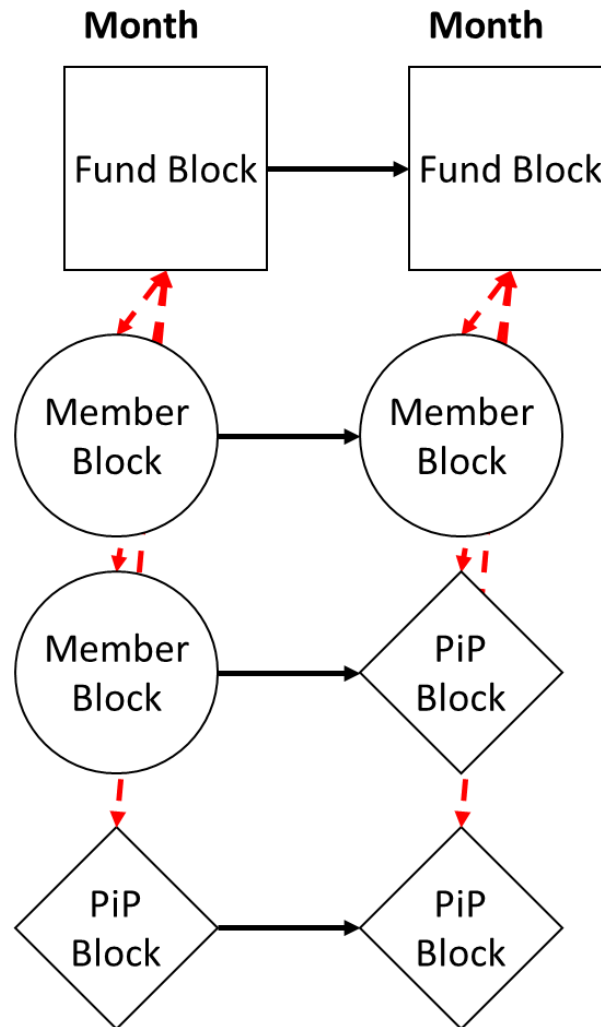
Smart Ledgers for CDC

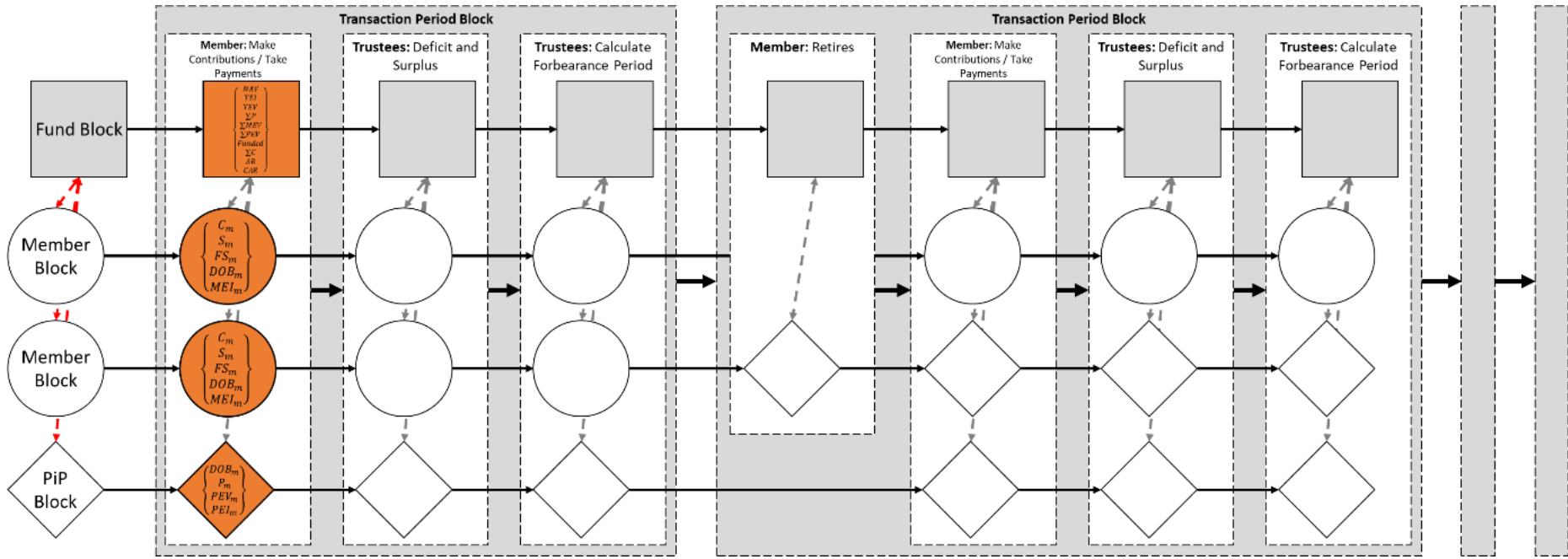Assuming the existence a Smart Ledger platform

Key considerations:

♦ Multi-chain structure
♦ Strongly permissioned system
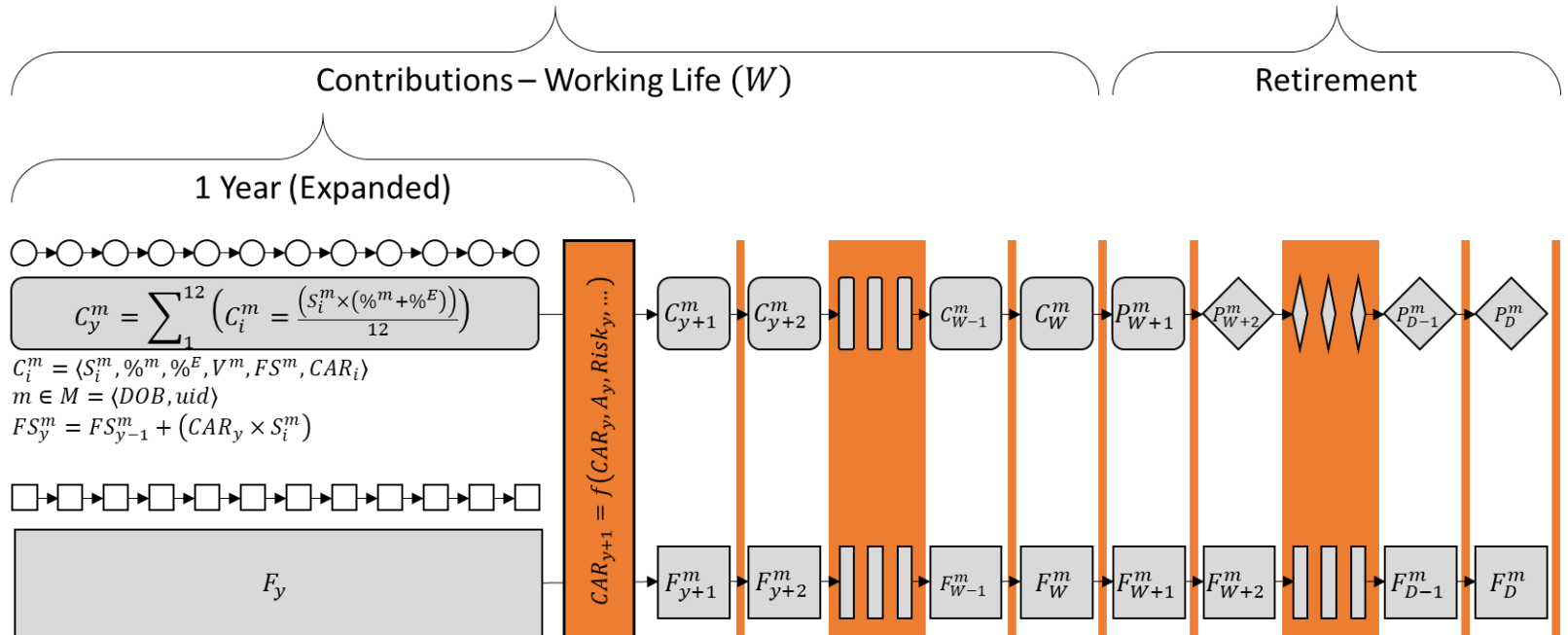♦ Managed through Smart Contracts

Multi-Chain Structure - Overview

- ◆ Chain types
- ◆ Fund
- ◆ Members
  - ▫ Active
  - ▫ Deferred
  - ▫ In-payment
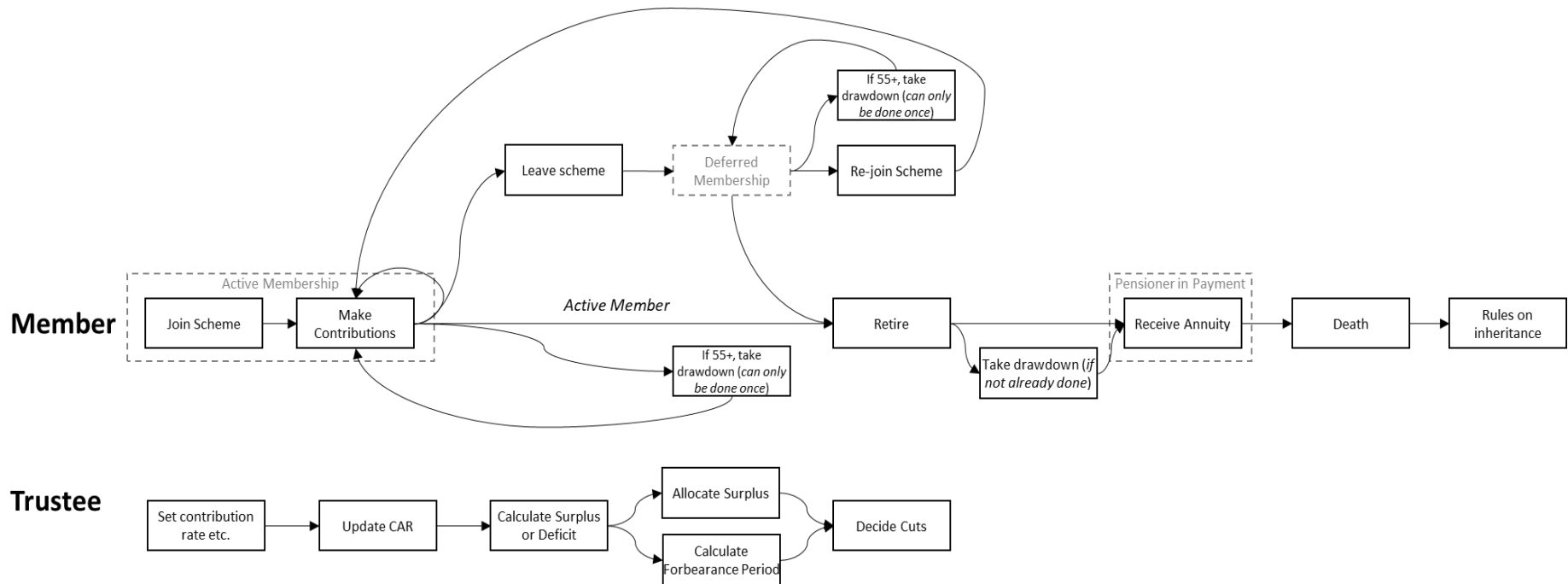
Multi-Chain Structure - Detail
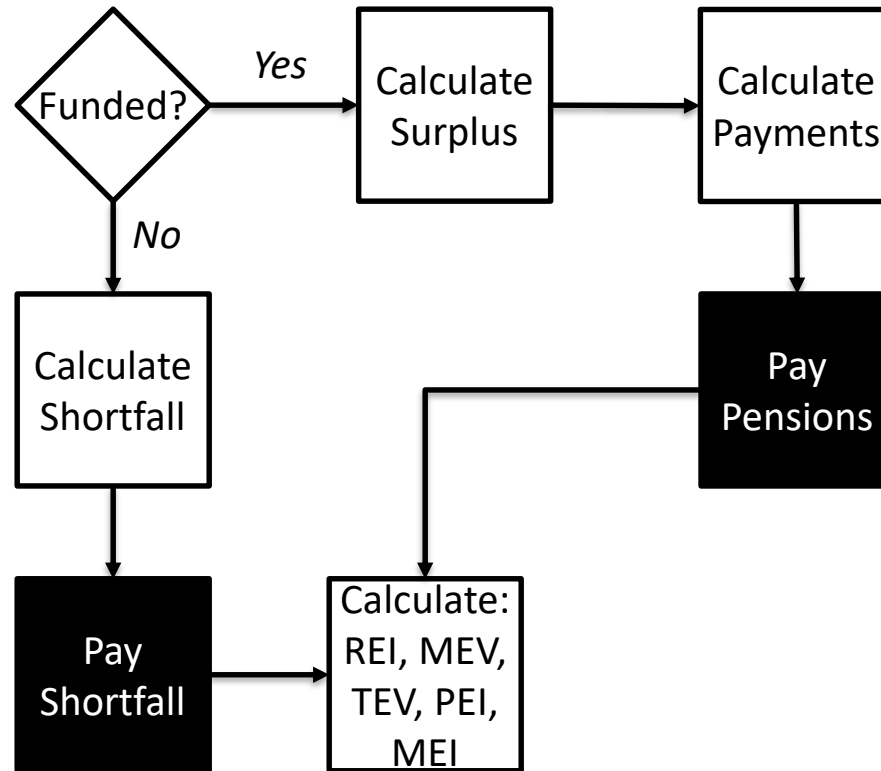
Single Member Chain

Automated Process Flow

Steps can then be automated using Smart Contracts

Example Smart Contract

Deficit & Surplus Calculation

Conclusions - CDC

♦ Member mutual collective

♦ Embed the contractual accrual rate

♦ Target retirement outcome

♦ Scheme members have an equitable interest in the scheme

♦ Members are accountable to each other and pensions are 'best efforts' endeavours

Conclusions - Smart Ledgers

- ◆ Administration over the very long-term
- ◆ Governance and transparency
- ◆ Adjustment rules
- ◆ Embed risk pooling and risk sharing
- ◆ 'Dashboards'

Smart Ledgers & Collective Defined Contribution Pensions

Questions

Concluding Remarks

James Pitcher
Programme Director
Z/Yen Group

james_pitcher@zyen.com

Thank you!

"Get a big picture grip on the details."
Chao Kli Ning

THE PRICE OF FISH

A New Approach to *Wicked Economics* and *Better Decisions*

MICHAEL MAINELLI AND IAN HARRIS