GOVERNMENT, FOR YOUR SMART LEDGERS OF LAST RESORT

Professor Michael Mainelli
Executive Chairman of Z/Yen Group and Principal Advisor to Long Finance (United Kingdom)

Z/Yen has been building mutual distributed ledgers (aka blockchains) since 1995 and has a Smart Ledger architecture community, ChainZy. Michael's latest book, ***The Price of Fish: A New Approach to Wicked Economics and Better Decisions****, written with Ian Harris, won the 2012 Independent Publisher Book Awards Finance, Investment & Economics Gold Prize.*

REGULATE THIS

Regulation around the world inflates in every sector – healthcare, food, logistics, or finance – and on just about any measure, paperwork, bureaucracy, manpower, and cost. At least two forces are increasing the scale of regulation, those being motivation and opportunity. Society seems increasingly ***motivated*** to control risk as opposed to taking risk (e.g. patient or consumer protection), and regulation is one approach to doing so. Furthermore, new technology provides more ***opportunities*** to regulate by offering tools for recording, analysing, and enforcing regulation. Combined with the complications of globalisation, we have a twisted tangle of regulatory wires.

Economies can only handle so much regulation, leading to movements encouraging regulation cuts, isolation from supra-national regulation, or disregard for regulation in certain forms of trade. Nor is direct regulation the only approach to control risk. Market-based standards, seals, audits, and kitemarks[1] provide long-standing third ways between completely free markets and completely regulated markets (i.e. voluntary standard markets where there is competition for certification underneath an accreditation structure). But that's for another day.

Whether it is a government or a voluntary standards market or an exchange guaranteeing quality, society's traditional response to controlling risk involves putting a third party at the centre of transactions. A good example is a government providing a national property register. Such a register is crucial to everyone knowing who owns what. It functions as a national ledger of initial property ownership and all the purchase and sale ledger entries thereafter. A central bank keeps the national, or supra-national, ledger for the currency.

THE CENTRAL THIRD PARTY PROBLEM

Central or 'trusted' third parties are the traditional custodians of central ledgers. Sometimes they are not so much 'trusted' as imposed (i.e. you will use the government's land registry). Central third parties perform three roles, to:

- ***validate*** – confirming the existence of something to be

1 Kitemark is a UK product and service quality certification mark that is owned and operated by The British Standards Institution (BSI Group).

traded and membership of the trading community;

- ***safeguard*** – preventing duplicate transactions (i.e. someone selling the same thing twice or 'double-spending'); and
- ***preserve*** – holding the history of transactions to help analysis and oversight, and in the event of disputes.

The central third party approach, while scarcely bettered over millennia of civilisation (think back to at least the Sumerians and cuneiform temple records), has its problems, with the two biggest being corruption and monopoly. Corruption is an ever-present danger. Any central registry becomes a target for cheating and the controllers of the ledger are an obvious weakness. The officials, public or private, are susceptible to bribery or other inducements to collude with cheaters. This is often seen as a third-world problem, but the global-traded markets have seen corruption in LIBOR[2] and foreign exchange markets 'fixing' certain important pricing benchmarks through central functions.

Any successful registry or exchange is also susceptible to becoming a natural monopoly. Some natural monopolies are enforced, often for good reason (e.g. there is only one land registry in our country to reduce disputes from competing ledgers). Some natural monopolies evolve from success, a particular financial exchange, a source for swapping data, or a broking house. Natural monopolies can easily lead to a propensity to be indolent or overcharge, or both.

SMART LEDGERS

Mutual distributed ledgers (MDLs, aka blockchains) and smart contracts are the 'next big thing' in technology. MDLs are multi-organisational databases with a super audit trail. MDLs have been used for years but gained fame, or notoriety, as they began to be used since 2009 in cryptocurrencies such as Bitcoin, as the 'Bitcoin

2 LIBOR rates, which stand for London Interbank Offered Rate, are benchmark interest rates for many adjustable rate mortgages, business loans, and financial instruments traded on global financial markets.

blockchain'. A 'smart contract' or 'sprite' is "the implementation of contract terms as executable computer code". Smart contracts can be embedded in MDLs to record what has been agreed to happen when certain events occur. A simple example of a smart contract is one that pays $50,000 on every day in July when the temperature recorded by a given field on the Met Office website is above 33 °C.

A smart contract can be anything that has a time, a test, and a trigger (e.g. a premium uplift), a notification of change of circumstances, or a claim.

While bankers have been atwitter with the challenges cryptocurrencies pose to payment systems, other sectors have already quietly implemented them, such as healthcare organisations using Smart Ledgers to chronicle clinical trials, or insurers using them to log swaps of data. Smart Ledgers are particularly suited to identity, document, and agreement exchange (IDAX). IDAX may be their 'killer app'.

Smart Ledgers are a technology for fair play in a globalised world. Three characteristics enhance fairness. First, most Smart Ledgers have no centre. This means fair play for everyone regardless of their location. Second, a permanent record protects transactions. The records are distributed and immutable. A benefit of decentralisation is strong cybersecurity and physical robustness. The process, which lets many computers all over the world process transactions together, also means that if a machine is compromised, it does not affect the rest of the computers holding the Smart Ledger. Third, 'mutual' means held in common or owned by no one. Nobody has to be in charge of a Smart Ledger; they operate by consensus. A sovereign entity or a company can run Local Smart Ledgers, and they can choose who could participate, similar to an existing corporate network but more secure.

Smart Ledgers challenge central third party monopolies. At the very least, safeguarding and preservation of the ledger move into the technology. Validation choices range from keeping a central third party but removing their ownership of the data, to algorithmic consensus, to existence verification, to unanimous consensus, and more.

REGULATORY SIMILARITY

There are numerous regulators working directly for governments, or as independent quangos alongside government. The variety almost defies description or distillation, but six elements seem part of the regulatory process[3]:

- ***identify*** – use top-down analysis to identify risks;
- ***assess*** – research and investigate issues;
- ***monitor*** – set limits for control based on tolerances;
- ***control*** – apply regulatory tools;
- ***evaluate*** – monitor outcomes;
- ***learn and adapt*** – adjust risk assessments, issues, tolerances, tools, and outcomes based on inputs (resources), outputs (consumer protection and political satisfaction), and feed-forward (market development, e.g. levels of competition).

Shared information is an integral part of all six elements. Regulators have an obligation to use information wisely. In many countries, various 'open data' initiatives are freeing data to the public. This can be data freed from, or data freed to, regulators. A good example of data freed has been Land Registry data in the United Kingdom (UK). As part of a commitment to economic growth and data transparency, the Land Registry releases price paid data, transaction data, and price index data. In turn, this open data has sparked much analysis and innovation from property valuation and maintenance to anti-money laundering and anti-tax-avoidance initiatives. Another example has been public transportation operational data around the world, leading to extremely useful consumer information mobile phone apps that provide up-to-the-minute transportation advice.

3 Adapted from the Solicitors Regulation Authority - http://www.sra.org.uk/risk/risk-framework.page - but could have been adapted from numerous others, e.g. financial, utilities, food and drugs, etc.

SMART LEDGERS – THE REGULATORS' BEST FRIEND?

Smart Ledgers can facilitate the open data trend. Current open data approaches are largely either periodic data deposits in the public realm or access to a central operational database. With Smart Ledgers, the data contributor can apply the smart contract approach of "time, test, trigger". This permits the data contributor to donate data, confident that certain rules will be followed. These rules can be as simple as release after 90 days; to release partially after 7 days to certain people if certain conditions are met; to release after 10 days some indexed data constructed from data released daily but without revealing the underlying data, although it has been immutably recorded in case of dispute.

Already, clinicians are recording various assessments and trial data to Smart Ledgers. In one case, tens of thousands of assessments around the world are recorded daily using one of Z/Yen's Smart Ledgers. In a few years the assessments will feature in applications to regulators in the UK and in the United States (US), such as the Food & Drug Administration. In another case, the States of Alderney already provide a free timestamping and recording service using a Smart Ledger. Alderney hopes to attract Smart Ledger communities that want to be regulated. How far might Smart Ledgers assist government and regulators? Under the six process elements, some current discussions include:

Identify – The IDAX approach is being used by the government of Estonia for its national identity card, *ID-kaart*, along with government documentation stored on a MDL. This approach is being promoted around the world and several governments are examining similar systems. Numerous private sector organisations are promoting Smart Ledgers for their own identity systems to help financial services firms reduce onerous anti-money-laundering and know-your-customer processes, as well as prepare for forthcoming General Data Protection Regulation requirements for consumers' 'right to be forgotten'. The fundamental insight is that in a Smart Ledger, the consumer controls their data at all times. More widely, initiatives such as the EU Services Passport aim to unite documentation on organisational entities or assets such as land, ships, aircraft, or automobiles. Ideal for Smart Ledgers. Finally, datalogging to Smart Ledgers of all types of activity can form the basis for identifying risks in the widest regulatory sense from air travel to electricity, health care, waste, or water. A product containing a hazardous chemical can be tracked from mining to manufacture to muck, i.e. disposal.

Assess – The explosion of data sources and data logging requires a structured way of creating rule-based access to historic data. In turn, statistical analysis, artificial intelligence and big data techniques can give regulators unprecedented insight into regulated activities. In the financial markets these approaches could start with enforced trade reporting to a Smart Ledger. Current trade reporting tends to be to a private-sector information services firm tempted to use its sole source of information for high charges. In future, a mutual Smart Ledger could suffice, giving the regulator deep access to all activity, while giving paying users a privileged view, with free release to the general public after a certain period.

Monitor – Smart Ledgers can embed the logic of regulation and oversight, thus enforcing notification. Direct limits can be set such that automatic notification of customer cash movements over a certain amount, or electricity outages over a certain length of time must be investigated. Approaches such as Dynamic Anomaly & Pattern Response, permit the automatic identification of unusual conditions that are statistically unusual but may be within set limits. Sophisticated monitoring will raise significant issues of privacy as people increasingly understand that by gaining better control of source data, governments can perform analysis that could verge on 'creepy'. A combination of information might send a mobile phone user the question, "why are you sitting at home alone with no electricity?" This might be useful

in care for the elderly, but certainly unnerving. Such creepy moments are already possible, but they may become more evident. And that's before we discuss releasing even more data.

Control – Regulators like to set rules, but detailed rules can be hard to enforce. In financial services in the early 2000's, regulators abandoned trade-by-trade enforcement of 'best execution' for the customer in favour of some bland legal assurances that firms would do their best to provide customers with a good deal. Smart Ledgers could enforce such rules more easily. The National Physical Laboratory is examining using its microsecond quantum clock timing along with a Smart Ledger logging service for just such applications. Similar controls could apply to 'best prices' in other regulated markets, or ensuring that a 'patient visit every X hour' rule is enforced.

Evaluate – Outcomes could become very public. The combination of an authoritative registry with enormous computing power to analyse, assess, and monitor, will release precise information about regulatory success or failure at the level of individual outcomes. A continuing series of UK consumer financial scandals, from endowment mortgages to pensions mis-selling to split-cap trusts to precipice bonds to payment protection insurance, might come to a swerving halt. In financial services, so-called robo-advisors are gaining popularity. MDLs will record permanently the data provided to the robo-advisor, the advice given at the time, and the results. This will allow people to pore over outcomes over long periods of time. Given the shaky foundations of much financial advice, this may drive some firms to take less responsibility more responsibly.

Learn & Adapt - The ability to exercise fine and immediate control may well be the biggest challenge Smart Ledgers pose governments, regulators, and society. A challenging example may come if and when governments move one of the most 'core' ledgers of all, the monetary system, into Smart Ledgers such as digital fiat currency. The use of digital fiat currency is being very actively discussed in the UK and elsewhere. A digital fiat currency raises the spectre of enormous struggles over control. Stakeholders might suggest boycotting an errant company based on media reports. Jurisdictions can go wild about taxation. It's a short move from hotel taxes to foreigner surcharges on all transactions. Income redistribution might be pushed as the reason for value added tax (VAT) rates that rise much higher the closer you get to a wealthy centre, such as Trafalgar Square.

Smart Ledgers are here, and show every sign of increasing deployment due to their amelioration of the central third party problem, their technological flexibility, and their power. The power for such precise control comes with great danger and great responsibility. The dangers range from privacy to authoritarianism to trampling over property rights. Yet, Smart Ledgers may provide one of the best tools for reshaping a more open, trusting society. Our responsibility is to get learning and thinking now about how best to use Smart Ledgers for mutual good and common wealth.

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