

залученням конкретних інструментів у вигляді показників сталого розвитку. Таким чином, тут пропагуються макроекономічні елементи, які завдяки своєму складу інтегрують найбільше число елементів сталого розвитку в модель бухгалтерського обліку і є найбільш підходящими для задоволення вимог розвитку.

Ключові слова: сталий розвиток, модель обліку, інтеграція.

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В КАКОЇ СТЕПЕНІ ТРЕБОВАНИЯ УСТОЙЧИВОГО РАЗВИТИЯ ИНТЕГРИРОВАНЫ В РУМЫНСКУЮ МОДЕЛЬ БУХГАЛТЕРСКОГО УЧЕТА?

Цель данной статьи состоит в обосновании элементов устойчивого развития в бухгалтерском учете хозяйствующих субъектов. Особое внимание уделяется принципам устойчивого развития как в национальном контексте, так и в европейском пространстве. Подход субъектов экономической деятельности к интеграции требований устойчивого роста в модель бухгалтерского учета давно обсуждается, поскольку потребленные природные ресурсы не могут быть четко отражены в бухгалтерской отчетности организаций. Обсуждение этой темы ведется с привлечением конкретных инструментов в виде показателей устойчивого развития. Таким образом, здесь пропагандируются макроэкономические элементы, которые благодаря своему составу интегрируют наибольшее число элементов устойчивого развития в модель бухгалтерского учета и являются наиболее подходящими для удовлетворения требований развития.

Ключевые слова: устойчивое развитие, модель учета, интеграция.

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DECENTRALISED CENTRAL MANAGEMENT: NEW PERSPECTIVES ON THE SOCIALIST PLANNING DEBATE

The importance of the centralisation/decentralisation debate has been highlighted during the Covid-19 pandemic. This controversy is not new. The paper examines the two possibilities. – planning from the centre or, from the periphery and finally proposes a third way which combines the best of both. The debate is approached from various angles – a cybernetic perspective, socio-political perspective and an economic perspective. The core result is the creation of Decentralised Central Control (DCC) which allows optimal control at nodes/regions and data transmission and decision implementation is optimised. The DCC is predicated on the assumption that technology advance can create a system of central planning which is essentially decentralised and is not inhibited by the fatal flaws of traditional Central Planning such as leads and lags in decision making and information exchange on the back of a static and unchanging technology. The fractal system envisaged in this paper is almost a clone of the rational expectations configuration of the perfect market where there is instantaneous market clearing and near-perfect foresight for all agents on the basis of common knowledge. In this paper, we have demonstrated the notion of the problem of externalities and the divergence between private and social cost in common scarce resources and the solution offered by Eleanor Ostrom which is in fact a qualitative version of the Folk Theorem of Game Theory where perfect solutions arise once all parties realise a commonality purpose given a low discount rate and trigger price strategies.

Key words: Central Planning, Decentralisation, Fractal, Complex Adaptive System.

1. Introduction

In an episode of the US political thriller "House of Cards", Frank, the political fixer, forces one of the senators under his control, Peter Russo, to cease supporting a shipyard in his constituency. Russo follows orders and becomes very unpopular with his constituents as the shipyard closes resulting in the loss of 12000 jobs. Later, for political reasons of his own, Frank decides to make Russo the governor of the state. To overcome Russo's unpopularity, Frank organises a new development in the constituency which will bring in more than 12000 jobs and has a better future than the shipyards which would be always under threat of closure. Ignoring the ethical and moral issues, let us analyse this situation cybernetically. Frank can be regarded as a Central Planner. In Frank's mind there is a macromodel of the situation which is entirely focused on Frank's political agenda and is divorced from the micromodel in Russo's

brain (which is for him to be appreciated by his voters). What is beneficial for Frank (the nation) is not beneficial for Russo (the region). It is an example of Central Planning being non-aligned with local planning. How can these different mental models/plans be aligned? The purpose of this paper is to investigate such cases which are part of the continuous centralisation-decentralisation debate.

The debate is not new. The paper examines the two issues. – planning from the centre or from the periphery and proposes a third way which combines the best of both. The debate can be approached from a cybernetic perspective, socio-political perspective and an economic perspective. Each is discussed in turn.

2. The Cybernetic Perspective

Cybernetics is the study of organisations, their purposes, structures and ethics. It is a methodology that takes a dispassionate stance and can be applied to every type of

organisation from the very small, (say a family), to a club, (say a village gardening society), to a company (say Toyota,) and to a nation. This perspective does not dictate a structure but analyses the appropriate structure for a particular context (environment). Nevertheless, one can observe general principles that are core to any cybernetic approach. These are that:

1. The organisation is viewed as a System;
2. Organisations are teleological i.e. have a specified purpose;
3. Organisations operate with a set of Ethics;
4. Organisations have a recursive structure;
5. The problem is one of optimal control.

Let us consider these in turn.

- A system can be defined as a collection of inter-dependent parts where the relationship between the parts is more influential than the parts themselves. This thinking is called "Systems Thinking" and forms a new paradigm called "the Systems Paradigm". A difference between this paradigm and the earlier "Scientific Paradigm" of Newton, Descartes and Galileo is that in the latter paradigm, there exists the concept of harmony and equilibrium. The universe is compared to a perfect watch where the watchmaker was God. Systems Thinking is a completely different way of looking at the world. It views life as a never-ending PROCESS, a commitment to the future even one might say a fulfilment of a dream. Think of Bill Gates aspiration to put a computer on everyone's desk and Steve Jobs inspiration to create tools that would help people realize their dreams and benefit the world, System Thinking incorporates change as a way of life. It regards change as inevitable and an opportunity rather than a threat. It concentrates on connections, interconnections dependencies, possibilities valuing cooperation and aspiration rather than competition and short-term gains.

- Every organisation has a purpose which is its reason for existence. Although mission and vision statements abound, most of them are bland statements and finding the true purpose of an organisation is often a very difficult task. Unfortunately, there is often a discrepancy between the intended and declared purpose and the actual purpose. This leads to cognitive dissonance [6].

- Every organisation exists in a particular environment and develops a suitable structure to survive. The process dynamics are governed by a set of beliefs or mechanisms which can also be called Ethics. Ethics set out conditions under which the organisation operates. Two such ethical principles, that are relevant to our debate, are competition and cooperation. These are often seen as different ends of a spectrum, but we argue that this is not necessarily so. The concept of competition was given prominence by Darwin in his Theory of Evolution [5]. The basic evolutionary idea is that during reproduction, mutations can occur in the genetic makeup of a species. This mutation could be helpful for survival or not. Those with the more helpful mutation will survive and the others will fall away. So, the better adapted, "the fittest", survive i.e. the survival of the fittest. An example is that of moths in the Manchester region of England in the 19th Century. Because of the industrial revolution, the atmosphere became murky and some moths evolved a darker colouring. This meant that they were less likely to be spotted by a predator and gave them a competitive advantage over the lighter hued varieties. In this sense, the better suited to the environment, "the fitter moths" survived. But there was no direct competition between the darker and the lighter

coloured moths. The darker ones did not introduce "getting darker" into their agenda. In terms of human behaviour, it is recognised that a competitive nature is built into the human psyche, but this is often more internalised than externalised. The dominant urge is to become better, "to become fitter" with a consequence that this will be of long-term benefit. But the method of competition is not prescribed. Lynn Margolis spent decades working on Eukaryotic cells before the scientific world recognised her underlying thesis – that there was another evolutionary mechanism which was cooperation [28]. Since then many cases have been discovered where species have survived because they were in a symbiotic relationship with one or more other species. This work on cooperation was continued by a Nobel prize winner, Lin Ostrom with her work on shared resources. She found that sharing a common resource was a better strategy than "winner takes all" [30]. A good example of cooperation is Open ware software introduced by Linux twenty years ago [25].

- Recursive structures are observed in many organisations. By this is meant that there are levels of organisation which although they have different operators doing different operations, there exists a common organisational blueprint for the process. An example is the hierarchical organisational structure in a university. Universities have Rectors, Deputy Rectors, vice deputies, at the top stratum This is repeated at the next level (Faculty) with Deans, vice deans etc and then at the departmental level with departmental heads, vice heads etc. Each level has different operating conditions, but the organisational structure is the same. Recursion was heavily used in the Viable System methodology introduced by Stafford Beer in the 1970's. Here the "blueprint was five systemic roles which were repeated at various levels [3]. In the 1970's, recursive structures in mathematics were investigated by the Belgian mathematician Benoit Mandelbrot which he developed into a new branch of mathematics called "Fractals" A fractal is a set which has self-similarity i.e. every part of the set has a similar structure [26]. This concept will be used later in the paper.

- In many man-made organisations there is the element of control, but this is not true of the most successful organisation that we know – Nature. In Nature there is no single entity that could be said to be "in control". Nature is a self-adaptive system where every part is interdependent on another. There is competition and cooperation. The system exists in homeostasis i.e. dynamic equilibrium. As an example, the study of ant behaviour suggests that there is no overall controlling mechanism Every ant is born the same but can assume many roles and even switch roles in times of danger.

Many philosophers have speculated that control is an illusion. One cannot control.

The best laid schemes o' mice an' men gang aft a-gley' [4].

The road to hell is paved with good intentions (proverb)

The fact that humankind has thought that it can control Nature instead of recognising that it is itself part of nature has contributed to the current problems of climate change and environmental degradation.

Another alternative to control is that life is a game

All the worlds a stage and all the players actors (As You like It Shakespeare)

This is not just fanciful speculation as a very flourishing and commonly used decision-making

methodology is Game Theory developed by Von Neuman after the second great war [38].

2. The Socio-political Perspective

Most organisations involve, in some way other, the presence of a "society". The meaning of the word "society" is ambiguous. In this regard, Margaret Thatcher famously contended that, "There is no such thing" as society. However, what is frequently ignored is the full context of the speech which continued: "There are individual men and woman and there are families. But does anything connect these individual men and woman with those families." She left unanswered "what this connection was".

The Athenians of 5th and 4th century claimed with pride that they were an autochthonous nation that had never changed its place of habitation. According to Thucydides, Attica, where Athens is located, over its history had known very few migrations. The Athenians even personified their autochthony by wearing cicada-shaped ornaments in their hair as a token representing their belief that, like cicadas, Athenians were born from the soil and thus had always lived in Attica. This concept of Athenian autochthony has been linked to the rise of Athenian democracy. and was as an argument for its democracy and egalitarianism [32]. All Athenians were earth-brothers and thus deserved to have equal access to political power. In the authors view, this defined the Attic nation, but did it define the Athenian society. We would argue that it didn't as the purpose of the Academy (founded by Plato) was to teach good citizenship which presupposes that the concept of Athenian society was not as clearly defined as the Athenian nation [2]. The two notions of Nation and Society need further deconstruction.

Human beings are social animals and thus society must have originated before a nation. A nation is a political entity which is associated with a territory and with written codified laws. Society has rituals which are similar to laws but unwritten and vague. The influential Economist, Von Hayek had the opinion that no philosopher had agreed as to what society actually means [10]. Patterns emerge in the behaviour of populations that might lead to a form of large-scale self-organisation. Von Hayek was passionately against State control. His idea was to comprehend a communication infrastructure for millions of people to share information in real time. (He identified this as the price system of a free market.)

Underlying this problem of society and possible control mechanisms is the concept of rationality. Since the Enlightenment, humankind has believed that rational, logical thought bestows the power to control-life, nature and society. This is a remit of every government and management board. Well-thought out policies should produce the desired effects. It was thought that this belief, aligned with the desire to control, would banish uncertainty. Von Hayek claimed that this is not possible and is an example of "human hubris". There cannot be a single right way to live or organise society and even if there was, we can never know enough or be wise enough to bring it into existence.

The discussion can be further illustrated by the great debates in the early 20th century between the two French sociologists Emile Durkheim and Gabriel Tarde.

Gabriel Tarde conceived sociology as based on small psychological interactions among individuals (much as if it were chemistry), the fundamental forces being imitation and innovation. Among the concepts that Tarde initiated was the idea of "group-mind" (taken up and developed by Gustave Le Bon), This was an attempt to explain so-called herd behaviour (or crowd psychology), and economic psychology, where he anticipated a number of modern developments. Tarde can thus be regarded as a forerunner of "Behavioural Economics". He stressed the role of

imitation in decision making and pioneered the idea of "herding" [14]. This was developed later by Richard Thaler and is now termed "Nudge theory" which recognises the disproportionate potential of small and marginal changes [37].

Emile Durkheim believed very strongly in using statistics to identify the invisible norms binding us all together. In his view, Society was a network – a complex system through which trends, behaviours and information travels. He argued that sociology should be conceptualized on a level of its own, one that avoids reduction to individual-level psychology. Durkheim focused on the norms that constrain behaviour, as if these were imposed from somewhere "outside," while Tarde saw these norms as the products of interaction. The origins of centralisation and decentralisation can be seen emerging from these differences. Durkheim's sociology overshadowed Tarde's insights, and it took fifty years until U.S. scholars, such as the Chicago school of sociology, espoused his theories [11].

Devolution could be seen as a intermediate way between centralisation and decentralisation. An example is the UK which devolved powers (such as education, health and policing) for Scotland while keeping central control through taxation. In the authors opinion, this merely exacerbated the movement for Scottish independence. The key issue here was not nationhood but power. Scotland has always had a firm sense of nation (through culture, dress, music) which has never been in doubt and fully recognised not only by the UK but the world in general. In our view, devolution is just a slippery slope from full central control to eventual independence and is therefore not considered further in this debate.

3. The Economic perspective

Looking at the five general principle enumerated in the Cybernetic section:

- Over the last twenty years, Economics has lost its way [31, 35]. We have published several papers suggesting a new way forward by using Systems Thinking and Cybernetics [18, 19, 20, 21].

- The purpose of an Economic system is often confused with money [40]. A better purpose would be eudaemonia which is a Greek word commonly translated as "happiness" or "welfare"; although "human flourishing or prosperity" and "well-being" have been suggested as more accurate translations [33]. In classical economic theory, the agent is regarded as an independent entity who maximises personal welfare. This promotes an ethic of competition (the selfish case).

- There is little recursion in modern economic theory. Mandelbot noticed that time series data is a fractal which he developed as a Fractal Theory of Economics. However, this notion has not yet been developed or accepted [27].

- The centralisation issue is best exemplified by the Socialist Planning Debate which was an academic discourse on the issue as to how a socialist economy (central planning) would run an economy given the absence of private markets, money supply, real and nominal prices for capital goods and the private ownership of production facilities. [17, 23]. The debate focused on the application of central planning for the allocation of resources which might act as a substitute for capital markets and as to whether such arrangements could be better than a free market capitalist system in terms of economic efficiency and factor productivity. (decentralisation) [24].

A key feature of the debate, concerned the theory of price or, value in a socialised economy which is the binding force holding the economy together. (Adam Smith's invisible hand) This debate emerged in the 1920s in the context of

the Austrian school, represented by Von Mises and Friedrich Hayek, who argued consistently against the rationality of socialism and between the neo-classical school as represented by Oscar R. Lange and Abba P. Lerner [22, 16]. So the debate was perceived as an argument between the exponents of the capitalist principles and the proponents of socialism (centralisation v decentralisation).

Abstracting from the dramatis personae, the core issue was the extent to which market forces of supply and demand (which control value) would exist under socialist planning and what other devices (or shadow prices) could exist which could replicate the marginal opportunity cost of a capitalist system. Von Mises believed that private ownership of capitalist production facilities was essential for the rational functioning of the economy. So any movement away from the anonymity of market forces would lead away from efficient organisational economic systems [39]. His argument against socialism was a direct attack on the work of Otto Neurath [13] who argued for the feasibility of central planning. Von Mises argued that in a centralised money market, anonymous, market price-determined systems were essential for rational calculation regarding their allocation and use.

Laing rebutted Von Mises attacks on socialism [15]. He argued that although calculations of individual marginal costs and prices could not be done in price terms, they could in real or engineering terms. Laing contended that such shadow prices or values could be obtained without the existence of capital and money markets by applying principles such as those in the Walrasian General Equilibrium model. In Laing's models, a Central Planning would be responsible for setting marginal cost prices through a trial and error method to establish equilibria, effectively using a notional Walrasian auction. Top and senior management of state-owned enterprises would be directed to set market prices equal to marginal costs so that macroeconomic equilibrium and the Pareto efficiency would be achieved. Laing's model was further refined by Abba Lerner and eventually becoming known as the Laing-Lerner Theorem [25]. The model argues that if all production is performed by a public body such as the state, there would be an implicit functioning price mechanism, which is Pareto efficient. Similar to perfect competition in a market economy. Hence this model is based on the principle of the state direction of enterprise managers to set prices equal to marginal opportunity cost. In private businesses, managers are directed to maximise profit which amounts to the same thing. The Laing-Lerner model is a form of planned economy where the central planning bureau allocates capital whilst the markets allocate labour, consumer and tradable goods. The planning bureau assimilates a market in capital goods by an auction process.

This encapsulated portrayal of the debate in the 1920s has focused on economists who were central to the controversy in microeconomic theory. Others featured in the literature were leading Marxian theorists such as Morris Dobb who tended to focus on egalitarian issues relating to income distribution [7]. Moreover, the massive contributions by Joseph Schumpeter in the controversy have not been highlighted because Schumpeter was not directly involved in the rational economic pricing debates, but more on the mainsprings of capitalist economic growth and the likely failures of a socialist planning system due to lack of entrepreneurship, profit and innovation [34].

Dynamic change in modern technology with regards to the digitalisation of business practices, high-speed super computers and advanced computer science relating to neural networks may be applied to this debate whence interesting insights are found. Von Hayek (ibid) argued that the market system economised on knowledge and was

therefore the most efficient way of allocating scarce resources which had alternative uses. He argued that the anonymity of market price discovery/diffusions/dispersion and the speed with which transactions could take place in capital and financial markets, could never be replicated by a central planning socialised system. [12] Rapid modern technological change in Neural networks, information transmission, the superfast transmission of ideas, means that Hayek's problem of a "single mind" can now be portrayed as fractalized nodes which can mimic the operation of the entire system because they effectively embody the total system in miniature form and are hence are holograms of the market system; so that each node now becomes a micro node of a global total system which is endemic to the whole.

One reason why central planning often does not work is because for a single entity to capture the full picture is not rational even with many embedded planning agents. This, however, is true for all economic systems since aggregate transactions involve many data elements and intricacies. Economies, when viewed on the scale of a nation state, are highly complex. Therefore, to rely on a single entity to manage the macroeconomics of an entire country and do it efficiently is unrealistic. Hayek believed that the government should act less like an economy controller and planner and more like a regulator. The governments have revealed repeatedly how frequent mistakes are made and that the state only cares about what works most of the time. Therefore, giving more control to smaller local governments for specific areas is much more realistic, if not perfect [36].

Hayek's price theory provides a useful starting point for discussing the benefits of bottom-up, decentralized modes of human ordering that represent polycentrism. This theory holds that economic knowledge is widely dispersed throughout society and incapable of being comprehensively understood by any one person or group of people; therefore, centralized economic planning inevitably fails because it cannot accurately assess or calculate the needs and coordinated desires/activities of dispersed agents in disparate communities. Thus it is only in a market economy, where consumers freely trade according to their unique preferences, would rational pricing gradually be revealed.

Hayek's theory of knowledge is predicated on the fallibility and limitations of human intelligence [12]. This is due to the complexity of human behaviour and interaction exceeds the capacity of one mind or group of minds fully to comprehend it, human coordination requires deference to emergent or spontaneous orders, rooted in custom, that adapt to the dynamic, evolving preferences of regular consumers. Hayek's enunciation of price theory propounds collective wisdom – or implanted knowledge – and cautions against grand designs based on the proficiency of a select class of people.

Michael Polanyi, another polymath and an ardent anti-Marxist, advocated related theories about polycentricity, spontaneous order, central planning, and knowledge, but he focused less on economic theory and more on scientific discovery, independent inquiry, and the free, systematic exchange of ideas [1]. Scientific advancement, in his view, did not proceed as the construction of a house proceeds, namely according to a fixed plan or design, but rather by a process analogous to, in his words, "the ordered arrangement of living cells which constitute a polyclonal organism." Three aspects of this core process are:

1. Throughout the process of embryonic development, each cell pursues its own life, and yet each so adjusts its growth to that of its neighbours that a harmonious structure of the aggregate emerges. This is exactly how scientists co-

operate: by continually adjusting their line of research to the results achieved up to date by their fellow scientists.

2. Polanyi laboured to show that "the central planning of production" was "strictly impossible" and that "the operations of a system of spontaneous order in society, such as the competitive order of a market, cannot be replaced by the establishment of a deliberate ordering agency." He described the inefficiencies of purely hierarchical organizational structures within which information rises upward from the base, mediated successively by subsequent, higher tiers of authority, arriving ultimately at the top of a pyramid, at some supreme authority, which then centrally directs the entire system, commanding orders down to the base. This convoluted process, besides being inefficient, is susceptible to disinformation and misinformation, and to a lack of reliable, on-the-ground knowledge of relevant circumstances. While Polanyi points to mundane instances of spontaneous ordering, such as passengers at train stations, without central direction, standing on platforms and filling seats on the trains,

3. He also examined more complex forms of behavioural adaptation to interpersonal interactions that, over time and through repetition, emerge as tacitly understood habits and rules that gain acceptance by the larger corporate body [1].

Centralization concentrates power in elites in lesser spaces, whereas decentralization divides and spreads power among vast networks of agents across wider spaces. Under centralized government, altruistic elites who enjoy power may, in theory, quickly accomplish good, but malevolent agents who enjoy power may quickly accomplish evil. Given the inherent, apocryphal dangers of the latter possibility, centralized authoritarian governments are not preferred. There is, moreover, on a considerable range of issues, disagreement about what constitutes the bad, the good, the evil and the virtuous. If questions about badness or goodness, evil and virtuousness are simply or hastily resolved in favour of the central power, then resistant communities—threatened, marginalized, silenced, and coerced—may eventually exercise their political agency, mobilizing into insurrectionary alliances to undermine the central power. Centralized power therefore increases the probability of large-scale violence whereas decentralized government reduces conflicts to local levels which tend to be minor and offsetting.

Polycentric orders produce communities that regulate themselves through the mediating institutions they have voluntarily erected to align with inherent values, traditions, and priorities. A man alone in the wilderness is vulnerable to threats. When he enters society, however, he combines with others who, with common interests, serve and protect each other from outside threats. If society grows large, materializing as vast states or governments, the people therein lose their sense of common purpose, their desire to unify for mutual benefit and protection. Factions and classes arise, each contending for power. The people in whom the sovereignty of the central power supposedly resides may become disempowered and marginalized as the network of bureaucratic functionaries proliferates. The people are displaced by the monopoly of a force of the central power. Although progress cannot be achieved without constructive competition among and between rival groups, societies cannot flourish when their inhabitants do not share a fundamental sense of common purpose and identity.

Centralized power may at first blush seem to be more efficient because its decision-making process is not complex, consisting as it does of top-down commands to subordinates. Theoretically, and only theoretically, ultimate efficiency could be achieved if all power were possessed by

one person. However, in reality no one person could protect his or her power from external threats or internal insubordination. In fact, the concentration of power in one person invites dissent and insurrection. It is easier, after all, to overthrow one person than to overthrow many. Therefore, in practice, centralized power requires the supreme authority to build bureaucracies of agents and functionaries which dutifully institute top-down directives.

But how does the central power generate a sense of loyalty and duty among and between these subordinates? Through patronage and political favours, pensions, rent seeking, influence peddling, immunities, cronyism, graft—in short, by strengthening the human urge for self-aggrandizement, elevating select people and groups to privileged positions at extraordinary expense to ordinary people or consumers. Accordingly, centralization as a form of human organization incentivizes corruption, malfeasance, and dishonesty while building convoluted networks of costly officials through whom information is mediated and distorted. The result is widespread corruption, misunderstanding, and inefficiency.

5. Synthesis

The discussion has thus far considered centralisation and decentralisation from various perspectives and found respective inherent weaknesses. Are there any alternative frameworks which optimise the strengths of both?

To reiterate, centralization refers to the processes in which activities involving planning within an *organisation* are concentrated to a specific *leader* or, location. In a centralized organization, the decision-making powers are retained in the Centre, and all other nodes receive commands from this centralised unit. An effective centralized system offers the following strengths:

- A clear chain of direction
- Focused vision
- Reduced organisational costs
- Increased decision-making efficiency

However, weaknesses exist in the delay lags between decision making and implementation, the existence of false data being transmitted and the possibility of demotivated workers. This is due to a feeling of alienation resulting from a sense of subjection. An optimum control system would be one that preserved the advantages and eliminated the shortcomings innate to a centralised system. Such an idealised alternative structure is shown in figure 1 which is dubbed a Decentralised Central Control System (DCCS). Here, there is a central Hub which contains a master plan or a strategy. This is transmitted to centres such as 1, 2, 3 and 4. Each of these centres transmits to more centres (shown for centre 4). This is repeated and at a certain stage there is communication with the economic environment.

Thus far, this is the same as a standard centralised system with all the innate hindrances. However, the core difference is that we now configure the DCCS a fractal and the whole central plan embedded in each nodal point. Moreover, given current technological advances in communications and the enhanced velocity of data transmission, information updating if not instantaneous, is extremely rapid. Thus, there now exists a means for eliminating the delay lags. The functionary, at say station 4e1, could be allocated the autonomy to make decisions thus negating the motivational disadvantages. Nevertheless, the decision is also a centralised one as the station 4e1 now possesses the whole of the master strategy. Information from ALL nodes is now continuously transmitted which feeds back into the plan. Hence, the strategy is continuously updating by responding to changing environments. The prerequisite of a centralised Hub now ebbs, since it is only necessary for the seeding of

strategy. This solution embraces the best of both cases and may be termed – a decentralized central control model and is shown in figure 1 below.

This solution encompasses the best of both – a decentralized central control model. A model developed on these principles would be a complex adaptive system which takes account of non-linearity's in terms of production, income-distribution and growth. The notion of a fractal incorporates the idea of recursion; hence each representative node/agent is identical to the whole. So, the impact of regional deviations from the central signal could be rapidly identifiable at region and state level. Issues

relating to corruption could be minimized by developing a macro model for each region which was identical to the aggregate system. This would ensure that the impact of regional divergences from the central signal commands could be easily identified at both region and state level. Such a macroeconomic model would set planning targets for activities which would benefit the totality of the system and would be perfectly transparent in regions. Conflicts would naturally arise, but these could be solved by the rule that gave the federal authority precedent over regional governorates.

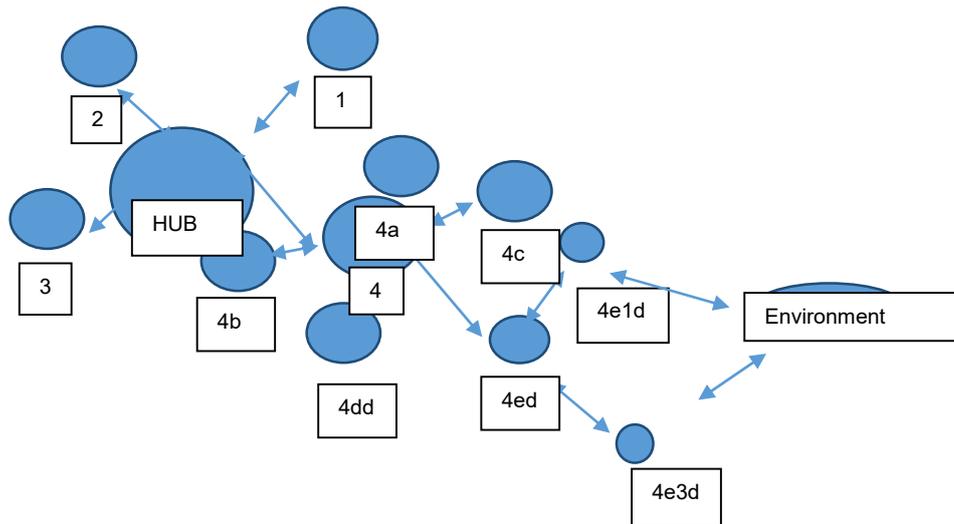


Fig. 1. A schematic of a DCCS

Consequences of a DCCS are:

- There is no chain of command as command is embedded into every node which creates a clear, focussed, implementable vision.
- Costs are reduced and efficiency increased.
- The problem of the node operator feeding back bogus information is eliminated as every node has access to every environment
- The problem created by node agents delivering false data is removed as each atomised node has access to universal information. This is tantamount to perfect knowledge for all scenarios
- If truthful information is transmitted at high velocity, all of the shortcomings of centralisation evaporate.
- Decision making will be centralised although is a decentralised configuration.

This constitutes a fractal system as the whole consists of parts and where every part mirrors the whole. Each part is an analogue of the whole, it is atomized, competitive, flexible and capable of adapting to new technologies. The inputs and outputs in two regions, say 1 and 2, are affected by the same macro fundamentals but the impact of asymmetric macroeconomic impact on one region rather than another could be compensated for by the central authority making compensation payments or side payments.

In such a system, regions 1 and 2 would, over time, experience similar levels of economic activity, economic growth, wage rates, interest rates, employment and success. Setbacks, crises and other external shocks could be compensated by the centralized authority e. g. the monetary transmission mechanism could reasonably stabilise levels of economic activity and welfare in either region 1 or 2.

The strengths of this system are that it considers the totality of the system rather than the individual parts and the central control authority could make better decisions on regional matters given an enhanced information flow. The totality of the system and its survivorship is better served when a central (federal) authority makes global macro decisions for both regions rather than individual action.

Clearly the design of such a system would require that time lags be minimized between central signals being issued and action being undertaken in the regions. However, in this model, the "central signals" are in fact at the node so there would be no time lag in the receipt of the signal (as there was in the Soviet Union where messages would take days to travel say from Moscow to Siberia) Once a signal is received, it does not mean that the action is immediately taken – so this is another type of time-lag However, if these time lags were significant it would affect the micromodel (situated at the node) which would affect the local outcomes. If the effect of such a time lag was negative, then it would be in the local operator to diminish them. If the effect was positive, a local operator may decide to slow down the action. However, this would be immediately flagged up on the micromodel which is available to all hubs and peer-to-peer pressure would operate to deter from such behaviour. Incidentally, if the system also operated using a cryptocurrency then more time lags will be eliminated

Another drawback would be the potential for corruption at the central control authority where decisions may be taken to maximize self-interest rather than for the region's economic performance.

Two types of corruption are theoretically possible. One is that the local operator tries to manipulate decisions to favour self-interest. Because of the highly integrated nature and interconnectedness of the system, it would be

very difficult to estimate which action would be in self-interest. The system is a non-linear one which means, amongst other things, that there is no simple cause and effect mechanism. Therefore, taking a decision which seems would benefit the local region at the expense of others would be highly dangerous and the resulting behaviour of the system would not be predictable.

The second form of corruption would to change data to suit your perceived selfish purpose. If this were possible, the previous argument would apply but this can be made impossible i.e. the data can be made unhackable. This is done by using the "blockchain" system. Here, the data is stored in the form of an interlinking chain and no bit of data can be changed without changing all the links before and after. It is proven that a blockchain that is properly formed cannot be altered. Once more, modern communication advances can help solve previously very difficult problems.

5.1. Two practical Examples

5.1.1. Water Distribution

In 1990; the Mid-Durham regional water supply was modelled by the researchers. This area consisted of five reservoirs plus a very large lake called Kielder. These reservoirs had to supply five different regions with varying amounts of water yet also keep the rivers at a certain level. The inflow was primary rainfall which was unpredictable but could be estimated. All reservoirs had a critical level which it would be dangerous to go below resulting in draw-down charts for outflows. The model worked by looking at the two largest reservoirs and using rules to divert water to the others and thus to the supply. These rules were prioritised and worked from historical practice. The model also took into account data that was fed in from the other reservoirs. If the reservoirs could not satisfy demand, then water was used from Kielder which could be considered an inexhaustible but costly resource. I quote from the Kielder Agreement document "Because the details of the Kielder Operating Agreement we so complex it was extremely difficult to determine the outcome that would be reached on the application of the rules at different times of year with varying rainfall patterns and changing seasonal demand. It was therefore decided that the rules would be encapsulated within a model that would simulate the behaviour of the system under changing operational conditions with three water companies competing for resources whilst being governed by regulations contained within the Kielder operating agreement".

This model has all the features of a centralized model. The system functioned in practice as there were no water shortages but was it the most efficient? What were its limitations?

1. There were time lags in data from the other reservoirs which could cause non-linear behaviour.
2. The rules were unchangeable.
3. The priorities were fixed e. g. river first then x then y.
4. The data could be inaccurate.
5. In exceptional circumstances, there was little flexibility in the decision making.

If the supply moved to a fully decentralised model then each reservoir would look after its own interests and the overall results would be erratic.

Would a decentralized-centralised model (DCM) be better? In this case there would be a micromodel which encapsulates model the overall system. Using modern monitoring devices and telecommunication, it could be arranged that data can be fed into this model extremely quickly so much so that it could be regarded as instantaneous. This would deal with weaknesses 1 and 4. The best way to deal with weakness 5 would be to have a

decentralized system but this has been shown to be impractical. Using the DCM, we would place the micromodel at each of the five reservoirs and give the reservoir operator full autonomy. The system would avoid the chaos of full decentralization as the model would show the results of decisions not just on how a particular reservoir was operating but on the whole system. This acts as a self-correcting mechanism in a harmonious system.

5.1.2. A Health Service

There has been much debate about the relatively slow response of the UK to Covid-19 compared to that of say Germany and New Zealand. All systems employ highly professional and dedicated doctors and nurses so the differences must be attributable to other causes. We would like to examine this cybernetically i.e. examine the organisational structures of the three health systems.

Germany has a universal multi-payer health care system paid for by a combination of statutory health insurance (Gesetzliche Krankenversicherung) and private health insurance (Private Krankenversicherung). It is a mandatory system providing universal coverage funded by both employees and employers. Its decision-making powers are shared between national (federal) and regional (Land) levels, with much power delegated to self-governing bodies. Policymaking at the federal level is the responsibility of the Federal Ministry of Health ("*Bundesministerium für Gesundheit*" – BMG). Its tasks include developing laws and drawing up administrative guidelines for the self-governing activities. When it comes to matters concerning statutory health insurance, the Federal Joint Committee (G-BA) is the highest decision-making body. It includes members representing doctors, dentists, psychotherapists, the statutory insurers, hospitals and patients. As the central entity of federal-level self-governance, BMG makes decisions concerning which medical services will be covered by the statutory insurers and what form that coverage will take and is also responsible for health care quality assurance and the assessment of the benefits and risks associated with treatments and diagnostic procedures. The German Health System is this a complex network of interest groups from all interest groups both public and private, federal and regional. There is central planning in the form of the BMG but the views of all interest groups contribute to this planning [8].

The National Health System of the UK (NHS) was created in the aftermath of the second world war by a socialist government. It has veered between centralisation and decentralisation with alarming speed but dull predictability. Initially all NHS decision making was centralised. However, in the 1980's. the Thatcher Government's policy was that hospitals were given their own budget which they would manage according to local need. To qualify for this the hospital were awarded Trust status. Trusts work financially like private hospitals but with the security of having Government backing if they overspend. Foundation trusts were announced in 2002. By the end of 2012, the Monitor website listed 144 Foundation Trusts [42]. It was supposed that all NHS Trusts would become NHS Foundation Trusts by April 2014, a deadline which has passed. Fundamental features of the tax-funded system pulled the government and providers into a hierarchical relationship. But dissatisfaction with public sector hierarchies – their unresponsiveness and inability to innovate – was never far from the surface. In practice the model was under threat from its conception. Foundation trusts inhabited a precarious halfway house between the public and private sectors: independent corporations on

paper yet entirely dependent on the state in reality – for funding, capital investment and bailouts when things went wrong. The foundation trust pipeline dried up as NHS funding was hit by the economic downturn. This, along with a series of changes to government policy, has eroded the freedoms that foundation trusts fought so hard for. Tensions were apparent from the start. In theory, foundation trusts were supposed to be subject to powerful local governance by their members. In practice, the Department of Health and regulators played the main role in determining their priorities and overseeing their performance. So, the leaders of many foundation trusts continued to look upwards to Whitehall for direction, rather than inwards and outwards to their staff and their communities as had been envisaged. The primary responsibility for planning and responding a pandemic response rests with local organisations, acting individually and collectively through local "resilience forums." Thus, operational planning is guided by central government but implemented locally. However, can timely and effective implementation in a time of crisis be achieved under a devolved system? If it can, then preplanning is crucial, but such plans are strikingly absent from the government's otherwise extensive documents. Pre-existing pandemic plans, an official is quoted as saying, "never went into the operational detail" [41]. The emphasis is strongly on a centralised PUBLIC service. There also exists in the UK a private health system which members join by paying private contributions. This does not exempt them from the contribution paid to the NHS via their taxes. There is a very strong demarcation between the public and private systems and over the years, one could say that there has developed an obsession in the NHS about any form of involvement of private enterprises at any level.

The UK's proposed Foundation Trust system is very similar to the New Zealand System of District Health Boards. (DHB's) The Ministry of Health has a range of roles in the system in addition to being the principal advisor and support to the Minister. It funds a range of national services, including disability support and public health services, and has a number of regulatory functions. The district health boards are given a set of objectives by the Ministry of Health but have a degree of autonomy in how they choose to achieve these. Both the UK and New Zealand had pandemic plans which appear similar on paper but differed in the degree of operational autonomy, the time taken to make the plans operational and the forward planning e. g. a stockpile of ventilators [29].

When the corona virus erupted, the German and New Zealand system could move quickly and had no problems in bringing on board the major German pharmaceutical and diagnostic private companies. There were no political, ethical or historical barriers to a fusion of private and public bodies. The NHS structure could not respond as quickly and was initially reluctant to join with any private enterprises.

The national health service example and its comparative weakness compared with its German counterpart is essentially an organisational problem where the German system seems to replicate many of the virtues of the DCC system whereas the British version of the public health care/NHS, seems to have created via the internal market, a system of chaotic change in the delivery of medical care at the local level where power has been rested since the 1991 Major reforms.

The NHS example demonstrates inherent structural weakness compared with its German counterpart. These innate drawbacks are essentially organisational problems, whereas the German system seems to replicate many of the

virtues of the DCC system. The British version of the Public Health Care system/NHS, been created via advent of the internal market; a system of chaotic change in the delivery of medical care at the local level where power has been rested since the 1991 Major reforms. For the NHS the systemic problems may be configured terms of the DCC system. So in the NHS the centre and the nodes operate different models with regards to inputs and outputs of social-care. Thus, an excessive reliance on local solutions, has created a situation where Walras' Law – the notion that aggregate income must equal aggregate expenditure so that net excess demands for health care are zero -though maintained at the centre of the system is overridden in the nodes. Hence in a comparison with Germany which seems to be a fractalized so that where all stake holders follow an Ostrom like common unity of purpose unlike the British system. The NHS delivering greater autonomy for local trusts compared with the centre means that the operation of a Folk Theorem type stakeholder solution is unreachable, and the system naturally gravitates between chaotic disequilibrium with excess supply and demands for medical services in good times and bad. In the Covid 19 catastrophe, we see this to a large extent where the centres view of inputs and outputs and the local view seem to be completely at cross purposes. Therefore, any single NHS trust may make bids to other stake holders for restitutions which, despite being fully transparent and democratic in principle, means that if all trusts do this, the system may collapse.

6. Summary

The core result is the creation of Decentralised Central Control (DCC) which allows optimal control at nodes/regions and data transmission and decision implementation is optimised. The DCC is predicated on the assumption that technology advance can create a system of central planning which is essentially decentralised and is not inhibited by the fatal flaws of traditional Central Planning such as leads and lags in decision making and information exchange on the back of a static and unchanging technology. The fractal system envisaged in this paper is almost a clone of the rational expectations configuration of the perfect market where there is instantaneous market clearing and near-perfect foresight for all agents on the basis of common knowledge. In this paper, we have demonstrated the notion of the problem of externalities and the divergence between private and social cost in common scarce resources and the solution offered by Eleanor Ostrom which is in fact a qualitative version of the Folk Theorem of Game Theory [9] where perfect solutions arise once all parties realise a commonality purpose given a low discount rate and trigger price strategies.

Moreover, the DCC system predicated on the assumption of Mandelbrot's fractal theory is in fact our portrayal of the microcosm of the workings of the invisible hand from Adam Smith. This is insofar as it can achieve results that an unfettered market system can achieve in the Hayek/Walrasian type models but without the problems of income multipliers which degenerate the system into disequilibrium and equality. A theme of this debate is the resolution of the Prisoners dilemma and the self-interest versus cooperation strategies.

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ДЕЦЕНТРАЛІЗОВАНЕ ЦЕНТРАЛЬНЕ УПРАВЛІННЯ: НОВІ ПЕРСПЕКТИВИ ДИСКУСІЇ ЩОДО СОЦІАЛІСТИЧНОГО ПЛАНУВАННЯ

В ході пандемії Covid-19 актуалізувалася важливість обговорення питань централізації / децентралізації. Ця проблема не нова. Стаття розглядає два можливих рішення: планування з центру або з периферії і, нарешті, пропонує третій спосіб, який поєднує в собі найкраще з обох підходів. Обговорення ведеться з різних позицій – кібернетичної, соціально-політичної та економічної.
Ключові слова: центральне планування, децентралізація, фрактал, складна адаптивна система.

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ДЕЦЕНТРАЛИЗОВАННОЕ ЦЕНТРАЛЬНОЕ УПРАВЛЕНИЕ: НОВЫЕ ПЕРСПЕКТИВЫ ДИСКУССИИ О СОЦИАЛИСТИЧЕСКОМ ПЛАНИРОВАНИИ

В ходе пандемии Covid-19 актуализировалась важность обсуждения вопросов централизации/децентрализации. Эта проблема не новая. Статья рассматривает два возможных решения: планирование из центра или с периферии и, наконец, предлагает третий способ, который сочетает в себе лучшее из обоих подходов. Обсуждение ведется с различных позиций: кибернетической, социально-политической и экономической.
Ключевые слова: центральное планирование, децентрализация, фрактал, сложная адаптивная система.