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A framework for designing sustainable urban communities

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Shann Turnbull PhD,
sturnbull@mba1963.hbs.edu

Abstract

The objectives of the paper are to show how the sustainability of urban settlements can be improved by treating as a variable the design of: (a) property rights to realty, corporations and currencies and: (b) their communication and control governance architecture. System science provides the basis for showing that the governance of complexity is improved by increasing the richness and variety of communication and control channels. The new variables introduced also provide a way to integrate the design of the built environment into the design of its governance architecture. The scope of orthodox economic analysis is extended to include the value of assets and liabilities to provide additional feedback signals. This more holistic economic framework increases the richness of the "semiotic" channel of social communication and control that complements those based on senses, words and prices. The analysis reveals self-reinforcing feed forward and feedback channels between the use and maintenance of the built environment and its governance architecture not available in less holistic design frameworks. This identifies the need for urban planners to extend their discipline to become governance architects and how the knowledge of system scientists can be applied to improve the design of capitalism. The analysis indicates how a design paradigm that does not accept the nature of property rights as a given, but a design variable, can enhance the ability towns or suburbs to become self-financing, self-governing political units. It also shows how capitalism can be made more efficient, equitable, responsive and democratic.

Key words: capitalism, economics, governance, property rights, social system, system science, sustainable communities, urban planning.

JEL: A10; D31; D63; E42; E62, K11; O21; P10; Q15; R51

Shann Turnbull PhD, Principal:
International Institute for Self-governance
http://www.linkedin.com/pub/0/aa4/470
PO Box 266 Woollahra, Sydney, 1350
☎+61(0)2 9328 7466, 🖷 +61 (0)2 9327 1497, +61 (0)418 222 378

1. Introduction

This paper shows how the ability of an urban community to be sustainable is facilitated by a design framework that introduces time limits, as found in all living things, for property rights to realty, corporations and money. Ownership and control rights that terminate over time or "die", as exist for all intellectual property, are described as "ecological". The framework also introduces as a variable the design of the communication, control and decision making architecture of communities – referred to as its cybernetic or governance architecture.

Social analysis is traditionally undertaken on the assumption that the nature of property rights is fixed, rather than being a variable subject to design. By making property rights and the cybernetic architecture of communities a design variable, a different framework or paradigm is introduced to extend the study of economics, urban design and other disciplines that implicitly assume that the existing designs represents the "natural order of things".

Instead of implicitly assuming that property rights are static, exclusive and perpetual the innovation of this paper is that they can be designed to become dynamic, inclusive and time limited. Dynamic rights increase the variety of feedback and feed forward channels to increase the importance of the science of communication and control in the design of sustainable urban communities. This makes it important to also design their governance architecture.

The process of design is defined by Ashby (1968: 252) as "what *determines* the final model, of how it comes to be *selected*" (emphasis in the original). The act of designing means that maker of a machine or the architect of a social organization is involved in selecting from all possible varieties. Ashby describes the design process as selecting in stages and this contribution follows this approach by first selecting a framework that determines how the more traditional details of design are executed.

The criteria for the economy of an urban precinct to become self-financing also provide design criteria for the built environment. The interdependency of the visible and invisible structures of society requires that town planners acquire the knowledge of system scientists. System scientists in turn need to acquire knowledge of: (i) the operating characteristics of the four cybernetic channels (senses, semiotics, words and prices) that modern societies use to co-ordinate and govern their activities, along with (ii) the limitations of humans to reliably receive, store, process and transmit signals. With this knowledge they can apply the laws of requisite variety of communication channels, decision making and control to design organizations that can mitigate the unreliability and inconsistency in human communications, control and decision making.

To increase the richness and variety of social cybernetic channels, property rights to realty, corporations and money are considered a design variable. To take into account changing economic values introduced by dynamic property rights when transactions do not occur to generate a price signal, the scope of orthodox economic analysis is extended to include the value of assets and liabilities. The traditional remit of economics has been limited to the production and exchange of goods and services that ignore the windfall gains that accrue in property and how investors can get overpaid (Turnbull 2006: 451).

The holistic approach to both economics and property rights creates a design framework for improving the economic efficiency and equity in sustaining urban communities. The framework

also provides a way of improving the responsiveness and participation of citizens in governing themselves in using, managing, maintaining, and developing the built environment.

For a town or suburb to manage its affairs on a sustainable basis it needs a degree of political independence to take into account feedback information from its host environment, its citizens and trading partners. Political independence of an urban community is dependent upon resident ownership and control of its land, sites, services and productive processes. It also depends on the ability of its residents and their local government to operate on a self-financing basis to make them independent of, or being excessively controlled by, higher orders of government or private sector agents.

Self-financing urban communities can be viewed like a micro economy and/or a "holon" (Koestler 1967). Politically they could represent a local government body, suburb or a component of one. To further their financial and so political independence communities needs to eliminate or minimize the loss of economic value from: (i) imports exceeding exports. (ii) migration of its citizens; (iii) wages, salaries, and fees paid to guest workers; (iv) rents, profits, dividends, royalties, and fees paid to external property owners; and (v) interest payments to external lenders. These considerations provide criteria for designing the built environment, its governance architecture and its economic institutions, each of which provides feed forward and feedback information to each other as recognized by Howard (1946) in designing both the visible and invisible structures of Letchworth.

The design of the invisible communication and control architecture of urban communities needs to take into consideration the limited ability of humans to receive, store, process and transmit data, and its higher derivatives of information, knowledge and wisdom. Humans have five senses of taste, touch, smell, sound and sight for detecting signals from others and their environment. The amount of data that can be communicated in bytes/second by each of these five senses has been measured by the Research Laboratories of British Telecom (Cochrane 2000). No matter what technology is used to communicate between humans their ability to receive and transmit data and so information, knowledge and wisdom is limited by the physiology of their input and output channels.

The export of data from humans is in practice limited to body movements and sounds because it is difficult to vary ones taste and smell and like touch requires intimacy. Communication through movement creates signs and symbols described as "semiotics". A highly specialized form for semiotics developed by humans is writing/typing and an even more specialized communication channel is through the use of prices. The data intensity or "band width" of each channel decreases as its specialization increases.

The richest input channels are the sense of sight and sound, then semiotics, words and price. The band widths, operating characteristics, limits and benefits of each of the four channels provide criteria for designing the invisible cybernetic architecture of urban communities as identified by Turnbull (2000b: 96). Different combinations of the four channels create different social outcomes that are characteristic of different political systems (Turnbull 2000b: 277).

Humans also have limited ability to store or process bytes (Kurzweil 1999). The design of human social organizations must therefore accommodate their limited neural ability to store and process bytes in this context[1] (Turnbull 2000b: 111).

Not only do humans have physiological and neural limits in transacting bytes but they can be inconsistent in how they interpret, process or use the data and/or create omissions, biases and errors in their communications with others. However, the cybernetic laws of requisite variety in communications, decision making and control provide the organizational architect with design strategies to mitigate these problems.

The manner in which humans convert bytes into data, information, knowledge and wisdom is determined by nature and nurture with nurture being subjected to cultural conditioning. For example the meaning of ownership is culturally determined. Traditionally nomadic Australian Aboriginals did not even have a word for ownership (Turnbull 1986). The concept of ownership has evolved over time from the use and/or control of land. In squatter settlements the rule is "if you do not use it you loose it". This rule introduces a dynamic dimension to the concept of ownership that is consistent with the efficient and equitable use of land or any other resource. An option not considered by George (1912) who sought the same objective but assumed that the rules of ownership were fixed rather than variable. As a result his solution of taxing the underutilized value of land introduced the dead weight cost of valuing each individual land title and administrating a tax system.

Time limits promote efficiency because they can avoid a resource not being used. Time limits promote equity as it avoids a non-user-owner being over-paid by receiving rents in perpetuity or from non-owner-users being excessively exploited.

Property rights without time limits only exist in regards to realty and corporate shares. All productive assets wear out, all intellectual property has time limits, and ownership of art and other collectable is limited to the span of human life. The introduction of time limited ownership of realty and corporations minimizes the loss of value from communities to external owners and so furthers their ability to become self-financing. It also increases the efficiency and equity of allocating resources within the community to support the hypothesis of this paper that ecological ownership facilitates the sustainability of urban communities.

Another way value can drain out of communities is through interest payments. Households may spend up to a third of their income in paying mortgage costs or rent. Over half of household income can be spent on other goods and services. A community currency provides a way of identifying these costs and/or reducing payments outside the community.

During the Great Depression (1929−1939) when the US banking system did not provide sufficient credit, thousands of communities created their own currencies described as "Stamped Script" (Fisher 1934) that had ecological property rights. Stamp Scrip was not created by banks but by local government authorities or Chambers of Commerce in the form of a voucher that lost all its value unless a stamp was fixed to it at a specified interval. Various rules were designed in different communities but typically a voucher or script valued at one dollar would loose all its value every Wednesday midnight unless a one cent stamp was attached each week.

[1] Excludes the transaction of bytes through reproductive processes or therapeutic therapies using DNA.

Stamp scrip was *given away* to citizens who could redeem them for their face value of one dollar after two years. However, during this time the issuer of the scrip would collect income from selling stamps for 104 weeks that would amount to $1.04. So a 4% gross profit was made on redeeming the scrip that was given away! Merchants accepted the 1% cost of the stamp per week as it represented only a fraction of the charge from a modern credit card that cost around 3% *per transaction*. Citizens accepted scrip and its 1% "demurrage" charge per week because it cost them nothing to acquire the scrip. The cost of the demurrage charge per transaction decreased with use of the scrip to make it more attractive than official money − even when it was available. If Stamped Scrip was used 20 times in a week its 1% cost reduced to 1/20th or 0.05% *per transaction*.

The adoption of Stamped Script spread rapidly because it created credit without an interest charge. For this reason it posed a serious threat to the banks licensed by the Federal Reserve Act of 1913 who created credits that generated profits from earning an interest rate in perpetuity rather than fees for a limited time. As a result, local currencies were squeezed out by "The New Deal" legislation introduced in 1933. However, local currencies are now appearing again around the world (CC, 2007).

A currency with a demurrage charge provides an incentive to convert money into tangible assets that increase in value over time like trees, breeding cattle and man made productive assets. Demurrage money inhibits monetary speculation and eliminates discounting the future. This provides additional support to the hypothesis that ecological property rights facilitate sustainable communities.

The ability of money to earn interest undermines sustainability because future values are discounted from the ability to earn interest today. As recognized by Islamic banking, the ability of money to increase in value from interest independently of any increases in real assets is inconsistent with the laws of nature. It would be difficult to explain to a visitor from another planet why an artificial token should be designed in such a way.

Especially when it is the cost of money that disadvantages investment in sustainable energy sources as discussed in Section 3. As a result the design of the current monetary systems is creating market forces to exacerbate climate change.

Another design problem in the current monetary system is that it is based on central banking that represents a specialized form of central planning. As described by Jacobs (1985: 156−81) a centralized monetary system in a diversified economy can misallocate resources in different regions from the feedback signals that it creates which must be based on the aggregate of all regions. This problem would be overcome with competing regional currencies as described Hayek (1976a, b).

The following Section 2 considers a framework for designing self-financing self-governing urban precincts. The attraction for introducing a local currency defined in terms of sustainable energy is considered in Section 3. Section 4 illustrates how urban design framework creates the need for urban planners to become system scientists and how cybernetics provides criteria for designing self-governing sustainable urban communities. Concluding remarks on the interdependency of "cybernetics and design" is presented in Section 5.

2. Design framework of property rights to urban spaces

This Section considers the how the design of property rights to: community sites; services; dwellings; public areas and commercial developments can further the ability of an urban precinct to become self-financing.

The design of the current land tenure system creates private profits from public money invested in infrastructure to introduce gross economic inefficiency and gross inequity. This is illustrated by the building in 1999 of the Jubilee underground train line in London. Eleven new stations were built at a cost of 3.5 billion pounds sterling. Riley (2002) reports that the aggregate uplift in the value of land within 1,000 yards of the new stations was 13 billion pounds, 9.5 billion pounds in excess of the cost of the whole project. If the land was held by community owned corporations, as described below, (i) all residents instead of a few land lords would have captured the windfall profits and (ii) the 13 billion pounds in windfall profits could have been used as collateral for the community owned corporation to borrow the project cost of 3.5 billion to make the project self-financing.

The value of urban land is created by how well it is serviced with: water; sewerage; power; roads; transport; communication; hospitals; schools; places of employment, entertainment and recreation. The value is not in the land but how well the site is serviced by external public and private investment. The site also obtains value from the improvements on it which may be a dwelling, home unit, shop, office, factory or entertainment facility. To establish equity and efficiency property rights need to be designed to separate the externally created values in a site from those created by improvements on the site.

The separation of private and community property rights is a common feature of condominium, company or "strata title" systems and in Community Land Trusts (CLTs). However, these "duplex" ownership systems do not provide separate publicly negotiable title deeds to each type of property right. Nor do they operate over an area sufficiently large to capture most of the values generated externally to any single site.

What are required are two separate title deeds with one deed being represented by a share in a corporation that owns all the sites in a contiguous viable precinct. The other title deed would provide negotiable rights to a specific volume in space like an Australian "strata title". One share in the land owning corporation could be issued for every square meter occupied by each *residential* strata title. In this way residents would own all the land occupied by non residents, trusts, partnerships, corporations and higher levels of government.

Another way of thinking about the arrangement is that it represents an incorporated unit of urban government that issues voting shares only to its residents be they home owners or tenants. Unlike a CLT and other forms of duplex tenure, its scale is sufficient to establish a public market for both private and community spaces to provide collateral for conventional lenders.

There is no necessity to introduce any new law to create the duplex system of property rights described above that creates a Co-operative or Community Land Bank (CLB). Corporate constitutions possess replaceable rules and the rules can be designed to provide the most desirable

property rights for the particular built structures in each precinct. Competition for investment between precincts would provide a way of determining the most efficacious designs.

A CLB represents a design framework in which detailed rules can be designed. The "use it or loose it" approach could be applied to the property rights to strata titles and the CLB shares. Surprisingly, such dynamic ecological property rights could be used to attract investment in apartment buildings or in commercial improvements. The attraction for investors is that they would not need to purchase the site they occupied. The cost of a site in advanced economies is typically half the cost of a dwelling as reported in the US by Davis and Palumbo (2006). For pioneer home owners in a CLB this creates half price housing as sites become self-financing and only the cost of the dwelling needs to be financed by its owner (Tunbull 1976; 1983).

Commercial investors in a CLB can significantly reduce the size of their investment in return for relinquishing their ownership rights at the same rate that they write off their investment for tax purposes. Their rate of profit is not reduced for their investment in shopping centers, office blocks, recreational facilities or factories because they are not incurring any additional cost. However, their rate of return could increase as they are reducing the size of their investment. On the other hand, any windfall gains or "surplus profits" that arise from their investment operating for a longer time than the tax write-off period, transfers to the CLB − and so to all its shareholders. Mass asset transfers can be achieved in this way not identified or explained by orthodox economic analysis to democratize the wealth of nations (Turnbull 1975, 2006).

"Surplus profits" is a concept not recognized by economists because it is different from the various ways the concept of "economic rent" is defined. Economic rent is typically described as the revenues required to maintain or produce production. Surplus profit is a complementary concept because it is the revenues <u>not</u> required for an investment in either productive or non productive assets. Surplus profits are those in excess of the incentive required to attract investment in production, or other assets, that provide windfall gains (Turnbull 2006: 455).

Only residents in the precinct can own and so vote CLB shares to control their precinct. In this way external ownership and control can be almost eliminated. The ownership of the strata titles in investment dwellings transfers, as they are written off for tax purposes, to the tenants rather than the CLB. The CLB transfers ownership of the shares "stapled" to the strata title to tenants at the same rate. If investors wrote off the cost of their investment over 25 years, their tenants would obtain 100% ownership of both their dwelling and the CLB shares without paying any more than a normal competitive rent. This creates an incentive for the tenants to take over the maintenance cost of their dwellings to increase the return to investors.

The incentive for buying a home rather than renting for pioneer residents in a CLB arise from obtaining half cost housing. If they leave their home and rent it out then they would loose ownership rights in both their strata title and the associated CLB shares at 4% per year to become co-owners with their tenants. This creates an incentive for non-user home-owners to sell their property rights.

The price paid for the strata title on the open market would take into account the cost of buying the associated shares from the CLB who would price them in the same manner as a Real Estate Investment Trust. The CLB would purchase its shares back from the seller at a discounted price to

capture back some of the windfall gains created in the community by either public or private investment and/or by improvements in the quality of life created by how the CLB is governed.

The values captured back from trading in its shares assist in making the CLB self-financing in a way not available to CLTs. CLTs also do not borrow money secured by the equity created from uplift in its land value like a CLB.

Ideally, the CLB precinct will include a rich mix of commercial activities to provide rent/rates to service any borrowings to finance its infrastructure and/or cross subsidize residents and/or pay them a dividend. Ideally also, the number of dwelling in the precinct would be sufficient to support educational facilities up to a basic tertiary level with supporting health care services to sustain its mix of residents over generational changes. This would typically mean a population of from say from 50,000 to 100,000 residents.

The above considerations indicate how the design of the visible structures in a community that seeks to be sustainable over generations needs to keep an appropriate demographic balance to maintain efficient use of its assets. This also implies an appropriate balance of dwellings for single people, families and retirees with a demographic equilibrium of migration in and out of the precinct. The challenge for system scientists/town planners is to design the architecture of the property rights and the architecture of community governance to automatically create self-correcting feedback signals and incentives to maintain the community on a sustainable basis. The failure of urban communities to achieve this over the last two millenniums has been documented by Jacobs (1985).

Some of the variables which community planners could include in their design framework are the design of property rights of firms and currencies as is next considered.

3. Design framework for firms and currencies

The previous Section considered how to design property rights to eliminate external ownership and control of land to further the self-governance and self-financing of urban communities. This was achieved by only residents obtaining voting rights in a CLB. The use of ecological property rights provided a way to minimize the export of windfall and other surplus profits from external ownership of the built environment. This Section considers how ecological property rights can be introduced to firms and money to likewise increase local ownership and control to minimize the export of surplus profits, interest payments and the import of goods and services.

The problem of “foreign” ownership of firms was identified by Penrose (1956) who pointed out that they introduced "unlimited, unknown and uncontrollable foreign liabilities”. To minimize this problem and the unnecessary export of value, incentives need to be designed for shareholders to vote to change their corporate charters to relinquish their property rights to introduce an ecological form or ownership and control. The incentive required to make it attractive for shareholders to adopt ecological ownership is not excessive as shown by Turnbull (2000a: 409) because investors discount future cash at equity discount rates and then discount the future again for uncertainty. A bigger, quicker less risky profit in a limited time is more attractive than a slow, smaller and more uncertain profit over the indefinite future. The attraction for investors to accept limited life property rights is illustrated by investments in: a bet, theatre productions, films,

research and development syndicates, patents, mining leases and mines, leasehold improvements and Build Own Operate and Transfer (BOOT) infrastructure projects.

CLBs can provide incentives for firms to adopt ecological ownership from the terms on which they provide access to its sites and services and the rent/rates payable. Arrangements could be provided to shareholders similar to those outlined above for commercial property investors to make it attractive for them to transfer ownership to the CLB and/or its residents. In addition, corporations could issue shares to the CLB and/or its residents as part payment for the use of CLB sites and services.

In the case of firms, there are operational advantages in designing the transfer of ownership to individuals involved with the firm such as employees, suppliers and customers (Turnbull 1997, 2000a). No operating business can exist without such individuals who by definition become strategic stakeholders. The inclusion of strategic stakeholders in the governance architecture of US firms was recommended by Porter (1992). Ownership of firms by strategic stakeholders provide competitive advantages not available to investor owned firms (Turnbull 2000b 228−34, 2001).

Besides exporting value through their profits, dividends and windfall gains, firms can drain economic value out of their host community through interest payments. This drain is magnified by externally financed home loans and borrowings by the CLB. The export of value from the community through interest payments can be minimized by the establishment of an ecological community currency and the CLB becoming a provider of mortgage finance.

A review of the various community currencies listed by the Complementary Currencies data base (CC 2007) reveals that they are designed in various ways that result in different operating characteristics, benefits and disadvantages. Most forms of local currencies represent a "shadow" complementary exchange system that operates in parallel with the official legal tender system to define its unit of value − as was done with Stamped Scrip.

Ideally, a local currency should be designed to provide an independent unit of value to control inflation as described by Hayek (1976a). However, Hayek (1976a, b) did not consider how a national currency can misallocate the value resources of different regions and cities. This was pointed out by Jacobs (1985: 161) who stated that "Because currency feedback information is so potent, and because so often the information is not what governments want to hear, nations go to extravagant lengths to try and block off or resist the information". Jacobs (1985: 163) explained:

> Individual city currencies indeed serve as an elegant feedback controls because they trigger specifically appropriate corrections to specific responding mechanisms. This is a built-in design advantage that many cities of the past had but which almost none have now. Singapore and Hong Kong, which are oddities today, have their own currencies and so they possess this built-in advantage.
> (Emphasis added).

On way to design a currency signaling system is to define its unit of value in terms of a sustainable resource like the Kilowatt hours generated by energy obtained from the sun, wind, water, waves, geothermal, hydrogenases and/or fusion sources. As every community in the world has access to some source of sustainable energy it provides a global unit of value but one that can have a different value in each community (Morehouse 1997: 167−77). While providing a unit of value best suited for each location it need not necessarily carry out the other functions of money such as being a medium of exchange or a store of value.

The reason why renewable energy sources have difficulty in competing with non-renewable sources is because they require over twice the amount of money invested for the same output. This makes the financial cost of renewable energy higher than the financial cost of non-renewable energy per unit of output. If the cost of money was eliminated with neutral or negative cost money then renewable energy generation obtain a greater economic advantage (Turnbull 2007). The cost of writing off the value of the generators over their operating life can be similar from either source.

A currency without an interest cost makes sustainable energy sources more economic. This creates a virtuous self-reinforcing mechanism to support a currency defined in sustainable Energy Dollars. There are many factors to consider in selecting a local currency. These and the design criteria for building a local banking system are considered by (Morehouse 1997: 149−83). The governance of the local financial system in turn needs to be integrated into the governance of the local economy.

A CLB provides a framework for the governance of a local monetary system to be integrated into the design of the cybernetic architecture of an urban precinct and its built environment (Turnbull 2007). The governance architecture of CLB is next considered.

4. Designing the governance of local urban precincts

This Section considers criteria for designing the decision making centers and the communication and control channels in a CLB to facilitate its self-governance.

The design features would be written into the legal constitution of the CLB corporate entity. As such they could be changed by the members of the CLB. This means that the rules for making changes in its constitution need also to be appropriately designed. Some rules could be subject to by-laws that could be more easily changed than changing the constitution. Other rules could be subject to various decision making bodies that may be designed into the governance architecture of the CLB. The need for multiple decision making bodies also arises from the need to provide a division of power, checks and balances with distributed intelligence.

Different types of decisions need to be handled by different people at different times in different ways as described by Gibson (1998) and other publications of the Neighbourhood Initiatives Foundation. This approach needs to be designed into the legal architecture of a CLB.

The dominant cybernetic architecture of local government and corporations in general is a command and control hierarchy. As noted by Hock (1994):

> Industrial Age, hierarchical command and control pyramids of power, whether political, social, educational or commercial, were aberrations of the Industrial Age, antithetical to the human spirit, destructive of the biosphere and structurally contrary to the whole history and methods of physical and biological evolution. They were not only archaic and increasingly irrelevant, they were a public menace.

The assertion by Hock is supported by an analysis of the ability of centrally controlled hierarchies to have requisite variety of decision making, communications and control to govern the complexity of urban settlements. That is, hierarchies are “structurally contrary” to the cybernetics architecture of living things and so of cybernetic laws.

Centrally controlled hierarchies also do not possess a division of power to provide checks and balances to meet the conditions for self-governance (Turnbull 2000b: 113–26; 2002). The need to design a division of decision making power is also dictated by the limited physiological and neural ability of humans to transact bytes discussed in Section one. This problem and the lack of variety of communication and control channels can be overcome by the decomposition of decision making labor into a number of decision making centers. This facilitates the allocation of decision rights as suggested by Gibson (1998). An approach that also creates a division of power required for self-governance as organizations with centralized control possess absolute power to manage their own conflicts of interest to allow absolute corruption.

The resulting cybernetic architecture is described as "network" governance. All non-trivial employee controlled firms that have sustained their existence over generations possess network governance (Turnbull 2000a: 177−98). This provides evidence that employee owned firms with a traditional command and control architecture cannot be sustained over generations and/or cannot be competitive. The theory and practice of network governance is not taught at schools of management as management implies a command and control structure. There is also a practical reason for this educational gap as there is an insufficient market to attract either graduates or educational institutions.

However the emergence of network governance arises organically from operational and competitive forces among many small firms with command and control architectures in industries subject to rapid changes and intense competition as found in entertainment, construction, electronics and bio-technology (Jones, Hesterly and Bogatti 1997). A striking feature of network governance is that its application within a firm seems to be limited to those controlled by its stakeholders as would be appropriate for a CLB.

Another feature is that the existence of network architecture within a firm would seem to be more important in sustaining it than the details of its design as documented in case studies (Turnbull 2000b: 177–98). However, one group of firms has grown by adopting a common design template that allows design variations to take into account differences in their stakeholder constituencies created by differences in their activities. The first stakeholder controlled firm in this Spanish group was established in 1956 and now there are over 200 described collectively as the Mondragón Corporación Cooperativa (MCC).

Likewise, only some general principles can be provided in developing a design template for a CLB. Design details would depend upon the characteristics of the built environment, its economic base, the nature of its trading partners, political context and demographics of its residents. However, one over arching general principle is the need to focus the self-interest of various constituencies that have conflicts with each other to force them to compromise their interests to make cooperative alliances for furthering long term sustainability of the CLB. In this way, competition for control over various interests can be used to negotiate long term efficiencies without the need for market competition for goods, services or corporate control to achieve this end. This outcome is made possible by network governance being able to introduce a number of control centers/boards/councils and other forums with different constituencies.

For example, tenants have an interest in promoting incentives to maintain an adequate stock of rental properties and/or easy terms for buying a home. On the other hand, home owners do not want the value of their home reduced by making it too easy for people to purchase a home.

As both home owners and tenants obtain equity interests in all the sites of the CLB they both have an interest in providing incentives to attract commercial activities to increase the cross subsidy of the rates, share in the uplift in value of the sites, capture surplus profits and perhaps even earn a dividend on their CLB shares. However, if the share value increases too much it could decrease the sale value of dwellings as buyers must also buy the CLB shares stapled to the dwelling. In this way the design of property rights in a CLB can introduce self-correcting forces to maintain an equilibrium position.

The opposing interests of various constituencies provide a basis for competition for control of its governing organs to promote economy, efficiency and effectiveness with responsiveness and accountability to sustain self-governance. The challenge is to design cybernetics networks to facilitate contestability and sustainable equilibrium between the various opposing interests in the CLB as well as between CLBs and other urban precincts. Equilibrium between opposing interest within the CLB is facilitated and promoted by the dynamic nature of the property rights described above to force changing alliances of its residents and corporate stakeholders.

5. Concluding remarks

Because the CLB provides a framework for furthering the self-governance of urban citizens it also allows them to be responsive to the needs of their host bio-region. In this way signals from the natural environment can provide feed forward and feedback information to allow contributions from nature to govern society to introduce elements of "Environmental Republicism".

If urban communities are to maintain themselves over generations on a sustainable basis they need to receive not only feed forward and feedback information from nature but from all stakeholders on whom they depend for their existence. Residents are the primary stakeholders but external investors, and stakeholders in resident firms and trading partners represent secondary stakeholders on who the community depends for its existence. Beside these "lateral" stakeholders there are also "vertical" stakeholders such as higher levels of government. In this way urban communities designed as a CLB can become a "holon" in a "holarchy" (Koestler 1967) to mimic the architecture of nature as illustrated by examples in Turnbull (2000b: 130; 221).

The CLB can itself be composed of almost self-governing holons that could be represented by apartment complexes, shopping centers, firms, schools, hospitals and community centers. A rich diversity of activities assists in making a CLB self-financing as discussed earlier. This introduces complexity. Nature governs complexity by adopting holonic architecture because "The reduction in data transmission, and in data complexity, achieved by the holonic architecture, is prodigious" (Mathews 1996: 30).

This observation provides an answer to the first question posed by the guest editor for the current issue of this journal who asked: "How does cybernetics throw light on design, and leads to developments and improvements in our understanding of an ability to act in design". The observation by Mathews means that holonic architecture needs to be designed into the governance systems of complex activities found in a CLB. Holonic architecture also provides a framework for designing requisite variety in communications, control and decision making to govern complexity as reliably as required. A corollary is that centrally organized command and control systems cannot deliver requisite variety to govern complexity.

The second question raised by the guest editor was "How does design inform us in our understanding of cybernetics and its potential to parallel and throw light on design?" The answer to the question is provided by the architecture of the MCC which provides an outstanding example of a governance architecture that mimics nature with nested holonic networks supported by lateral holonic networks as found in living things (Turnbull 2000b: 221). In this way the MCC informs us of the efficiency and effectiveness of following the architecture of nature as the MCC has proven to be more efficient, competitive and sustainable than hierarchical controlled firms. Cybernetics in turn explains why the architecture of the MCC is successful for the reasons noted by Mathews and because its networks provide a way to de-compose decision making labor to a level sufficiently simple to allow humans to govern complexity on a sustainable basis.

The third question raised by the guest editor was: "What is the mutualism that may hold between them when questions 1) and 2) are seen as part of the same whole?" As pointed out above, the CLB creates a design framework for designing both the visible and invisible structures of society to create a virtuous self-reinforcing process to sustain each other. It does this in way to enrich the participation of citizens in the decision making processes of their community to create a more efficient, equitable and democratic form of capitalism as indicated in Turnbull (1976).

Another element of mutualism arises from designing dynamic property rights to realty, firms and money so that they take on ecological characteristics. As indicated in the last Section, dynamic tenure can fundamentally change decision making in the use and control of realty, firms and money. It introduces continuous change but at the same time introduce incentives to maintain sustainable equilibrium between opposing interests. Mutuality arises as this can only be achieved by designing a governance architecture that can use and act on the emergent behavior that dynamic tenure introduces. However the most compelling reason for introducing dynamic ecological property rights is to stop economic value being drained out of communities.

Mutuality is inherent in the design of property rights, the nature of the built environment and its governance architecture for creating self-governing sustainable communities. This provides a compelling reason for town planners to become system scientists and governance architects.

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