WORKING PAPER

ITLS-WP-17-19

A radical reappraisal of transport and land market basics

By
Alastair Stone

Institute of Transport and Logistics Studies (ITLS), The University of Sydney Business School, Sydney, Australia

October 2017

ISSN 1832-570X

INSTITUTE of TRANSPORT and LOGISTICS STUDIES

The Australian Key Centre in Transport and Logistics Management

The University of Sydney

Established under the Australian Research Council's Key Centre Program.

NUMBER: Working Paper ITLS-WP-17-19

TITLE: **A radical reappraisal of transport and land market basics**

ABSTRACT:

The current foundation narrative of land transport service established in 1960s, focused on projections of existing demand, equilibrium models, and projects with feasibility based on the value of time savings exceeding costs. This works reasonably for inter-urban infrastructure. However in urban areas, communities observe that the benefits of capacity improvements are short lived while wider community costs are substantial and long lasting.

Exceptions to the 1960's narrative exist places like Amsterdam. Distilling the principles underlying these exceptions produces a new framework, with a foundation narrative that focuses on broad objectives to develop liveable, resilient and sustainable cities.

The paper analyses the systems framework in which urban economic action takes place including insights of behavioural economics in the cost functions used. It then analyses the institutional arrangements that govern urban economic decisions. Then follows analysis of the product markets that constitute urban transport service, namely land, facilities, vehicles, and trips. Then models useful for investment analysis for each product are analysed. Finally the paper summarizes what transport service decision making would look like applying these changes and how this could be expressed in a new foundation narrative for our perspective on urban land transport service.

KEY WORDS: ***Product; goal; social; utility; ecology; Phronesis; governance; scale***

AUTHORS: **Stone**

CONTACT:

INSTITUTE OF TRANSPORT AND LOGISTICS STUDIES (H73)

The Australian Key Centre in Transport and Logistics Management

The University of Sydney NSW 2006 Australia

Telephone: +612 9114 1824

E-mail: business.itlsinfo@sydney.edu.au

Internet: http://sydney.edu.au/business/itls

DATE: October 2017

1 Introduction

The current foundation narrative for land transport established in the 1960s goes something like: ***"We can project demand for trips using origin-destination surveys of existing demand, and with equilibrium models determine the optimal supply of land transport infrastructure projects where the feasibility is based primarily on benefit of value of time savings outweighing the infrastructure cost"***.

If our purpose is to establish the rank ordering of alternative investments against a typically unstated goal of growth in the economy, this still works reasonably for the supply of inter-urban land transport infrastructure. However in urban areas, there is considerable push-back from communities against, for example, decisions to reduce congestion by adding new transport infrastructure including with compulsory acquisition of land. This pushback is based primarily on the much observed fact that against the narrow objective of efficiency of the transport service facility (corridor at best) the benefits of capacity increase are short lived as congestion returns. There are just too many anomalies in the forecast results (and even the objectives) to continue down the path of the current foundation narrative.

There are exceptions to the narrative and Amsterdam is an example. In the 1970s the community, responding to congestion and an horrific child accident rate, rejected the proposed solution of more high level limited access roads to the CBD that required new right-of-ways (ROWs) including the filling of some canals, and opted for a solution in the CBD of compatible pedestrian/bicycle/mass-transit/road service using existing right-of ways. Compatibility in this situation meant that each mode of service had similar speeds and protocols (constraints) on network operations to minimize conflict between modes. In other words pedestrians, bicyclists, cars, and light rail were all constrained to operate such that decisions on traffic conflicts were all being taken in similar time frames with similar feedback characteristics. This approach to the existing CBD was complemented by the development of business park type centres on the outskirts linked to the broader transport network by high level transport service facilities that did not cut through the CBD zones of dense economic activity.

The Amsterdam decision process was driven primarily by political power to achieve broad community objectives for urban living. This paper is about distilling the underlying principles of process such as used in Amsterdam to begin to define a new theoretical framework. With the new framework, determining the supply of land transport service in urban areas would be based on an updated foundation narrative that - after a deep breath - would be something like: ***"To develop urban communities that are liveable, resilient and sustainable, we need to supply a network of transport services that is a combination of land, facilities, vehicles and management protocols, which is determined, financed and governed by an informed community where decisions are based on***

detailed simulations, fed by real time data inputs and knowable relationships among variables, to analyse the cost/benefit impact of alternative land transport service supply scenarios on the urban political welfare economy".

To end up with this foundation narrative requires some radical changes to how we think about the basics of transport service and land use. The setting throughout the paper is in a representative democratic society. Discussion of such changes requires high discipline in defining words used and assembly of concepts of known phenomena to reach a new paradigm closer to the current reality of how urban communities operate. The general analytical approach is that of systems thinking. The lexicon is in general economic, of the broad political welfare variety, and the paper outlines a path from the current narrow neo-liberal "free market" framework to what might be broadly labelled "Systems Economics". It uses existing established theory from fields that have been forgotten, or yet to be fully integrated, and in that sense it is a step towards assembling integrated institutional arrangements to better serve urban communities.

It should be stressed that the analysis offered below should not be seen as containing imperatives; at most they are a cautionary indication of direction for researchers who would like to introduce an element of Phronesis (Aristotle 1976) in their work.

The paper begins with the definition of a framework that is a summary of current general thinking on firstly ***Economic Action***, and then ***Institutional Arrangements*** for such action. It then uses that framework to analyse ***Urban Transport Service Product Markets*** divided into ***Land, Facility, Vehicle, and Trip markets***. This is followed by comments on ***Investment Appraisal Models*** and finally, ***Urban Transport Services Summary & Path from Existing to new Systems Economics Framework***.

Woven throughout the paper are calls for changes to four major elements of our current narrative. Namely to:

1. broaden, and clearly specify, our goals beyond increasing the financial output efficiency of the monetized elements of service provision (often misleadingly called "economic growth");
2. incorporate in our cost/utility functions the unit values established by behavioural economics and the impact of approaching the limits to growth such as from climate change;
3. shift modelling from optimisation/equilibrium (with often unstated assumptions to achieve instrumental rationality with a goal of financial growth), to simulation with explicit dynamic assumptions on utility that can be varied by the decision maker to explore and achieve value rationality with a clearly defined goal in wellbeing with sustainability and resilience. The proposed model would be structured with "dashboard" attributes to allow decision makers to

apply their own unit value/utility over time to determine growth in rights to all valued resources; and

4. design governance around institutional arrangements that enfranchise the demand community with responsive decision control including strong feedback mechanisms to deal with the dynamics of ongoing change.

2 Framework

The current narrative for transport service distinguishes among economic, social, and environmental impacts as if they were separate phenomena with little functional interconnection. Economic value under neo-liberal economics has become equated solely with net financial gains or losses to users. Social value is in turn equated with community rights and fairness with governments providing finance from general tax revenue; and environmental impacts such as global warming get generally ignored because local impacts are small and deemed irrelevant. It gets worse, with society being offered false binary choices between public and private supply with the former characterized as regulated and the latter unregulated. "Market" is a term reserved more and more for so called "free market" exchange in the private sector. And as wider economic impacts are used to prove project investment feasibility in Cost Benefit Analysis (CBA), it is changes in economic output (final goods) measured with the rule based estimation of Gross Domestic Product (GDP) that prevails. What a semantic and phenomenological mess.

Systems thinking language can help to bring clarity by categorizing each subject in terms of stocks, flows, delays and feedback loops. Then we can talk of entities in society ranging in scale from individual households through private cooperatives of many corporate forms from service associations through common stock limited liability companies, to local to regional and national governments. Each entity can hold stocks of wealth consisting of rights to resources characterised as capital, labour, and land. In systems thinking these stock owning entities should be where the decision making control that initiates economic action in the form of exchange between entities resides, and is where the feedback loops should be anchored to educate future decision making for exchange. The mechanisms of exchange include; free (more or less) markets all the way to monopoly and forced acquisition. Flows cover the amount and timing of the passage of resources from one entity to another. Delays witness the finite time it takes to exchange and assemble resources into new forms of capital and capture the dynamics of exchange between entities as they move from one level of wealth to the next.

Capital can take many forms from: money as a store of value; social behavioural customs including the distribution of power to enforce or change rights to resources; to natural resources both exhausting

finite resources and renewable, and ecological systems that maintain balance among competing forces including the needs and wants of humans.

Labour can be seen as a special form of human capital covering the resources that are internalized in individuals and teams including the interrelationship protocols and problem solving skills that have been learnt and retained by individuals in society.

Land (and other stocks in nature such as minerals and water) has the distinction over other resources of being finite in the amount available. Land has the further distinction of being immovable. Collectively, capital, labour and land are all valued stocks of resources.

So in this paper the mention of the "economy" includes what in the past been called the "political welfare economy" and encompasses all entities exchanging all types of valued rights to resources over time – not just monetized ones. Exchange will be used to describe the trading of resources between entities, and market will be used exclusively for exchange of similar goods and services with many entities competing to participate.

So with this system economics lexicon a general framework for economic action can begin to be defined.

2.1 Economic Action

This paper's summary of economic action is much broader than the somewhat truncated version of economics branded neo-liberal. As defined, for example, in Wikipedia, "the term Neoliberalism refers primarily to the 20th-century resurgence of 19th-century ideas associated with laissez-faire economic liberalism. These include extensive economic liberalization policies such as privatization, fiscal austerity, deregulation, free trade, and reductions in direct government spending in order to increase the role of the private sector in the economy and society. These market-based ideas and the policies they inspired constitute a paradigm shift away from the post-war Keynesian consensus which lasted from 1945 to 1980".

The current neo-liberal theory of economic action is divided into two regimes, micro and macro using resources whose value can be expressed in monetary terms as a primary descriptor. The goal is ***growth*** in economic action measured in many forms from the impact on growth of output to jobs but rarely for its impact on the total stock of rights to resources valued by society, namely its capital wealth.

In the micro-economic appraisal regime neo-liberal economics is confined to exchange between user demands and supply entities located preferably in the private sector. The cost and utility functions are usually rising or falling linearly over the range of values being considered as experienced directly in monetary terms by the entities involved and all other action in the economy is assumed to be constant

or at least changing in identical ways irrespective of the alternative exchange option being considered. That is if you are lucky enough to be ranking options rather than justifying a single proposal originating from an elected representative's desire to be re-elected.

Then there is the addition of so called "externalities" to catch impacts on other valued community concerns such as pollution or loss of habitat or more broadly natural eco-systems, using, depending on policies operating, many devices from estimation in monetary terms of changes in output derived from GDP reporting, to the cost of meeting contractual obligations to replace such natural capital in another location. And to manage the temporal dynamics of the time value of money over time a simple uniform discount rate is applied.

In systems terms, at least there is an explicit goal in micro economics that the exchange will not occur unless the value of benefits exceeds costs thereby seeking to assure the population at large that there is an increase in wealth measured as the value of the stock of rights to total resources held by entities in the relevant economy.

In the macro-economic regime the growth goal is measured in terms of final output in a defined period, usually a year, irrespective of the desirable or undesirable nature of the output, as long as it can be measured in monetary terms. For example an increase in the cost of treating illness caused by pollution will be included as growth in the economy. There is no assurance to the population at large that say when the money supply is increased and Gross Domestic Product (GDP) grows that there will be a net increase in the value of total resources (wealth) held by entities in the economy. To be fair the GDP growth goal is typically defined at its heart as needed to guide the growth in money supply to support increased monetized exchange activity that results in growth of monetized economic output and full employment whilst maintaining the value of the currency specie (no inflation).

To emphasize this point, in systems terms (Meadows 2008) most macroeconomic goals are expressed as impacts on flow with little focus on the stock of wealth or rights to valued resources held by the entities that make up the economy. Neo-liberal economists would argue that increases in the net flow of rights to resources to an entity will increase the stock of capital held but without knowledge of the existing stock held, this tells us little about the exchanges worth in terms of wellbeing of the entity.

Overall the community's neo-liberal economics based political dialogue concerning policy and investment decisions, uses a confused combination of microeconomic and macroeconomic terms measured variously in stocks and flows without clear definition of goals, feedback loops and control or the dynamic effects of the economy. A feel for causality is hard to come by in these circumstances. Systems analysis can bring some discipline to the discussion but given the dynamic (evolutionary) nature of economic action it, like most system descriptions can only be partial, requiring some attributes particularly forecasts of alternate unit values to remain outside the quantitative descriptive

model as exogenous variables. As such they are available in the overall model for experimentation by the collective minds of the decision making process control mechanism.

The remainder of this section is on what we know about fundamentals that can be modelled. Again, the economic setting of the discussion is a liberal representative democratic society. Discussion of the structure of the analysis of economic action will be as follows:

1. goal,
2. description of the decision making process leading to exchange,
3. product definition arising from exchange,
4. physical and temporal scale of products,
5. nature of the cost/utility functions covering physical (Newtonian) and value unit quantification of the impacts, including behavioural economic insights into the measurement of each term over time, and finally
6. selection of options for consideration for exchange.

2.1.1 Goal of Economic Action

The goal of neo-liberal economic action is growth in economic output as measured by GDP. Many analysts including Kuznets (1934), the definer of the modern rules to measure GDP were well aware of both its constrained measurement of only monetized output, a flow; its exclusion of much unpaid economic activity that is valued by society such as housekeeping; and the total stock of capital (wealth) held by an entity expressed as rights to resources. GDP lacks any goal defined discrimination between different types of output, for example, increased criminal activity resulting in increased legal activity defending criminals, is counted as positive using the same units as say the cost of reductions in infant mortality from diseases such as smallpox with each monetary unit having equal positive weight as a contribution to society.

The use of GDP as a measure of growth made some, but not a lot of sense in the industrial age when broad social and ecological impacts were either not known or not valued and hence ignored (Stiglitz et al 2010). As society's needs and wants changed and knowledge of value of resources began to accumulate, distinctions in the valuation of monetized exchange and non-monetized exchange of capital and labour began to blur. As a consequence the growth sought by society has expanded to a broader set of valued resources that have been measured against many different goals (not all of which lend themselves to monetary measures), which together are being called "***wellbeing***". The defining of a general measure of wellbeing is far from settled. There are some similarities in its goal to that used by political welfare economic theorists in cost benefit analysis (CBA) to broaden their framework of analysis by using such devices as shadow prices for goods and services that were not traded. Further development in investment appraisal resulted in processes such as Environmental

Impact Assessment, Economic Impact Assessment and Social return on Investment all seeking to measure the broader results of exchange. They will be further discussed below in CBA and Option Selection.

The move to the broad goal of wellbeing includes subsidiary goals of ***sustainability*** and ***resilience***. The essential long term nature of sustainability has meant the inclusion of the costs (labelled externalities in neo-liberal economics) of rights to resources lost in an exchange that were previously considered not significant enough to change the rank ordering of product options being considered.

The goal of resilience on the other hand, using systems' thinking, exposes the risk in seeking one single optimal exchange between entities when the dynamics of exchange calls for consideration of alternate exchanges between entities in the network to achieve the goal of ***resilience*** when variables may change. This may result in less than optimal efficiency in the quantum of rights required for the exchange but at lower risk (greater certainty of outcome).

The impact of the goals of sustainability and resilience will be discussed further below in Utility/Cost Functions.

If growth of the stock of capital that produces wellbeing, sustainability, and resilience is the systems economic goal of the economic actions of society, where do our existing models in microeconomics and macro economics sit?

Again, a first step towards clarity requires that the discussion be founded on precise definition of the elements used to describe economic action.

Exchange of rights between entities is the fundamental human action in economics. Such action is ultimately aimed at improving the outcome in the sense of the utility of the total stock of rights to resources held by the participating entities from exchange between these entities. At the heart of exchange lies a decision making process used by each entity to determine what rights to resources will be exchanged.

Hence the starting point of assessing the existing models is to look at this decision making process (Stone 2007).

2.1.2 Decision Making Process

In an exchange, each of the two entities separately undertakes some form of a process of analysis of options to choose which rights to resources under its control to exchange for rights to resources under the control of the other entity, with the expectation of growth of the utility of the stock of rights to resources under its control, which they value in their own terms as shown below in Figure 1.

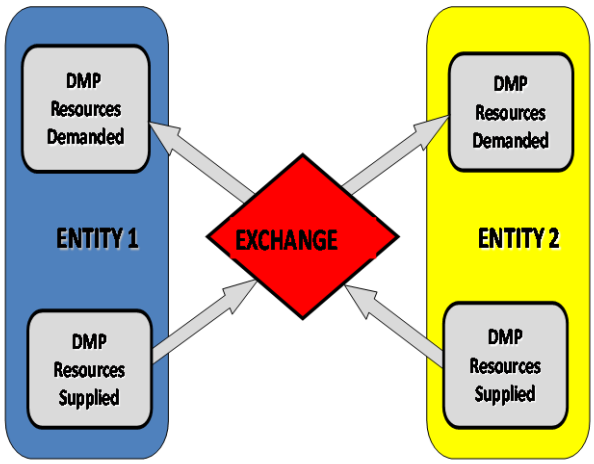

Figure 1 DMPs by ENTITY

In contemplating the exchange each entity has in mind a measure of utility to it of rights to resources to be given and their utility/value in exchange. This utility is verified at the time of exchange in accordance with neo-classical price theory. And similarly the same entity has a general concept of utility of the resources to be received that is also precisely quantified in utility to that entity at the time of exchange as exceeding the utility to it of the resources to be supplied in exchange.

Each entity in the exchange transaction is acting as both demanding and supplying resources. This extends comprehension of motivation for the process of exchange to a system of ongoing two-way flow of resources between entities along the lines described as entrepreneurial discovery by economists of the Austrian school, such as Kirzner (1997).

Each entity in the exchange is undertaking two decision making processes (DMPs) one for what it is demanding and one for what it is giving or supplying in return, as represented in Figure 2.

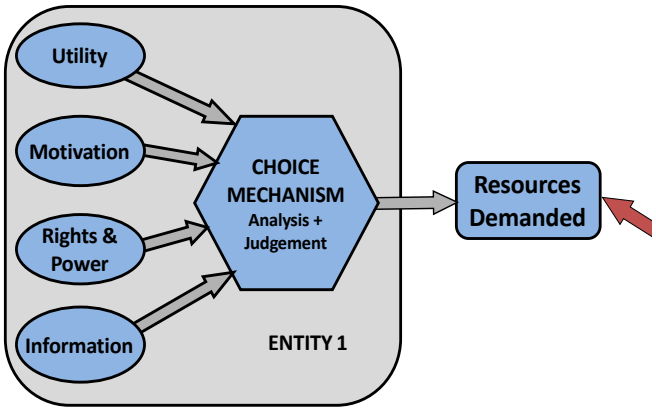

Figure 2 Demand DMP ENTITY 1

Each DMP of an entity can be described as using the four input attributes of: utility, motivation, rights and powers, and information.

In systems terms, utility is the name of the units used to measure rights to resources, motivation is the goal, rights and power held is the stock, and information the functional description of exchange rights and powers at different levels of quantities.

These attributes are inputs to the final element of the process, a choice mechanism that is some combination of analysis, and the exercise of judgement (or intuition assembled in the subconscious, to

use the nomenclature of cognitive psychology) to rank alternative exchange actions being contemplated by the entity.

So what are the economic characteristics of these rights to resources defined in the exchange?

2.1.3 Product Definition & Scale

Importantly these bundles of rights to resources that are exchanged by the entities define the attributes of what economics calls the "product". And these products come in various forms with their dimensions expressed as physical quantities, and variable value through time in the sense of value at each point in time over its useful life to capture whether or not its value is increasing or decreasing. These dimensions also have a major bearing on defining the type of exchange mechanism.

In neo-liberal economics we already distinguished between market and non-market exchange of rights. Current practice also distinguishes between infinite (renewable) and finite exhausting resources, and exchange of rights to the resources of jointly owned commons. And private and public sector entities as the holders of stocks of rights are where control of the DMP is located.

These alternative exchange worlds have characteristics that can be extended and generalized using the "product" defining view of exchange to talk of categories with similar dimensions measured as quantities valued both physically and over time as established above by exchange. Then the entities participating in society's political welfare economy can be divided into categories beginning with the low scale of the ***individual*** but perhaps more usefully, ***household***, seeking exchanges with other entities of products with physical dimensions varying from household scale up in through shared use products such as regional infrastructure and on up to national products such as defence. Each product category is also dimensioned by its economic life.

A picture of economic action emerges as a multi dimensional matrix of such entities of varying scales exchanging with other entities through networks of exchange relationships defined by relative size and power of each and the strength of the feedback loops constrained by the delays of the natural world and cultural constraints, including regulations, imposed by society.

The boundaries of each entity and the network of relationships they have with each other are inevitably arbitrary but the existing division in representative democracies into individual (household), local, regional, national and planet scale will be used here as a working model.

Systems thinking applies, identifying the archetypal efficient structure of self organizing open hierarchical order (SOHO) of connected subsystems (Koestler 1967) that will be discussed further below in section titled SOHO.

It is now useful to look at the nature of the utility/cost functions relating to varying quantities of the products with which we are dealing.

2.1.4 Utility/Cost Functions

There are two systemic changes that have occurred since the seventeenth century Age of Enlightenment in how we express phenomena including economic action. The first is the accelerated development of mathematical symbols and relationships originating in mechanistic Newtonian science that has emerged as the "gold standard" of rationality in all science. It came to be associated with Max Weber's duality of instrumental rationality as means to achieve ends as distinct from value rationality related to ends or goals. In economics the branch known as econometrics interpreted this to mean that expressing economic utility/cost functions in mathematical form was essential for rational analysis, often irrespective of the judgements on approximations required to fit observed behaviour to the mathematical form. The second is the development of digital computational power which has made possible graphical expression of functional relationships between variables and made explicit the approximation contained therein.

The paper limits its focuses to four aspects:

- graphical shape of functions
- Newtonian rationality & value rationality
- Behavioural Economics insights
- Utility/Values over time.

2.1.4.1 Graphical Shape of Functions

Many of the neo-liberal economic functions (demand/supply) are limited in the range of values considered. They assume steady states for the period of interest, and are described more accurately as projections rather than forecasts. The resulting advantage is that they can be represented as mathematically equations that are more manageable especially as they are most often applied across many entities of varying size. Significant temporal changes in the relationship between variables are ignored or dealt with by applying uniform time preference discount factors. This typically presents diminishing returns with increases in demand and economies of scale with increase on the supply side. Increasing elegance presents with power functions being introduced but rarely curves that model reversal of economies of scale to describe constrained phenomena such as the capacity of water bodies to disperse sewerage to an acceptable level. As we move back to broader political welfare economic concepts this state of affairs becomes unacceptable especially now that we have the computational power to model the utility/cost functions more accurately.

So what needs to change?

2.1.4.2 Newtonian & Value Rationality

The distinction between instrumental rationality and value rationality in philosophy (Weber 1978) is between means and ends. In economics this distinction has been transformed into an over emphasis on means as analysed with Newtonian scientific mathematical (instrumental) rationality and diminution of expression of ends or value rationality in terms of goals. In terms of functions used in analytical models describing utility costs and benefits, the Newtonian based variables of the mechanistic world have less leverage over the outcomes than the choice of utility per unit. And yet as a discipline under a neo-liberal framework, we are more inclined to accept the output of econometric models with functions containing many hidden approximations than those from digital simulation models with variables with explicitly identified unit values over time.

Examples of this disconnect between our knowledge of functions and those used in neo-liberal economic analysis will now be considered with reference to time, material, ecological and social costs.

2.1.4.3 Time

This discussion is limited to variation in the utility of time savings as a function of the size of the saving. Time preference of consumption is discussed below in **Values over Time**. Newtonian measurement of variation over time in economic production functions is relatively straight forward and lends itself to calculation of efficiency and hence optimization calculations. Again, we make this easier still by using constant unit utility measures irrespective of the size of the increment. The sum of time savings in a mechanistic activity that arise from say, investing in a robotic machine that produces a large number of units, is an appropriate measure of increases in physical productivity and financial productivity in the exchange DMP leading to the decision to invest. However in labour cost elements of production functions it is far from clear that all increments of savings are equally valuable. The indivisibility of work, say the length of a shift, sets a minimum unit constraint on what savings can be realized as having economic value. And at the other end of the scale larger increments may have less utility per unit as fatigue impacts productivity. These types of considerations that can be represented by varying the value of time savings as a function of the size of the increment of time saved and other variables are being incorporated in leading edge CBA.

2.1.4.4 Materials

Again the issue here with the neo-liberal version of CBA is the use of functions with easily measured physical units at an assumed constant unit value. It is rare to see discrimination in functional terms between the value of renewable and finite resources, nor any representation of changes in unit value as resources become exhausted as for example the ability of the atmosphere to accept pollution. This

again reinforces the comment that the shape of cost functions for long term investment is not as simple as those used in many neo-liberal CBAs.

Experiences such as the recognition of the impact on the ozone layer of chemicals used as refrigerants, demonstrates society's ability to take such phenomena into account in the DMP (Downie et al 2011). The challenge is to incorporate the phenomena into cost functions as early as possible once they are identified. This applies in DMPs of all products at all scales in the hierarchy of systems they impact, using functions that show the rate of change in the value of the variable of interest, in this case the rate of breakdown of ozone in the atmosphere. Such rates of change are rarely constant (linear growth) and can accelerate dramatically for the worst as "tipping" points are reached.

2.1.4.5 Ecology

Ecological systems have been singled out for comment as having importance in political welfare economics beyond the sum of their component parts such as mentioned above in regard to ozone. This significance is their worth to the community as evidenced in the Holocene age (Raworth 2017) as a balanced resource systems that nurtured us homo-sapiens as part of nature. Once we entered the anthropocene age, disruption of ecological systems using new technology was possible and negatively impacted natural stocks such as fisheries, water catchments etcetera. Given the goal of sustainability this has not always been to society's benefit as an increase in the stock of rights to valued resources. The changes exhibit characteristics which are being identified as archetypical (Raworth 2017) problems in systems analysis for which archetypical solutions are being developed. For example, the various sometimes conflicting goals held by individual systems such as in manufacturing can be overcome by an overarching goal as occurred in commanding industrial production in World War II.

2.1.4.6 Social

The inclusion or exclusion of social values in utility/cost functions again brings to the fore the philosophic discussion of means and ends as modes of rational discourse. The consensus appears to be that while instrumental rationality provides the means of determining efficiency it can't say anything about goals and hence the utility/values expressed in goals. Extending this discussion we come to that about truth and what is just which brings us to the question of rights. This is a discourse (Weber (1978); Rauls (2001); Sen (2009); Nozick (1993)) beyond the scope of this paper but raising it provides a path to an explanation of the seemingly opposing views of neo-liberals who tend towards instrumental rationality and economic sociologists who tend towards recognition of intrinsic rights to an ever extending list of fundamental rights of man.

Neo-liberal fixation on the efficiency of economic action that can be monetized, rules out consideration of the consequences in economic action of "intrinsic" rights to resources. An example is those rights expressed in the Millennium Goals (2005) that signatory nations commit to grant to

their member population whether or not they individually hold monetary rights to participate in the economic action to gain new rights such as shelter. These conflicting approaches often results in passionately held views being debated between conservatives and progressives and is usually resolved by a test of power/control over the DMP to decide the policies adopted to guide the form of exchange for many so called public goods, with the conservatives with their large and economically powerful corporate base often winning.

The analysis now turns to how to use the insights of behavioural economics on the framework of economic action.

2.1.4.7 Behavioural Economics Insights

In general neo-liberal economics has used the behavioural model of rational man as the all knowing "homo-economicus" despite the work of such as Simon (1978) on bounded rationality that drew on the recognition of cognitive limitations of man. Then there is the work such as Prospect Theory by Kahneman and Tversky (1979) that inter alia shows entities value unit losses around twice as much as unit gains. There is also the important work that shows values vary according to the size of the entity, and many more in the field. See Thaler's book on the recent history of the field (2010). Collectively these differences from the rational behaviour of homo-economicus have been labelled cognitive biases and the list is extensive (Wikipedia 2017).

Many in the financial economic space were influenced by and still hold to the neo-liberal views of the Chicago School led initially by Eugene Fama (1970), and their impact on political decision making in regard to the economy remains strong. This makes some sense if your goal is to inform the financial economy but it is not defensible in political welfare economics given its limited view of the economic world.

In sum the insights of behavioural economics on utility/value need to be incorporated in the framework for analysing economic action. This leaves one remaining aspect of behavioural economics that needs to be discussed given its mathematical leverage over the outcome of CBA (sensitivity analysis) in the DMP to rank alternatives being considered for exchange by an entity. That aspect is the temporal value of rights to resources.

2.1.4.8 Values over Time

The term "time value of money" has been a feature of economics for centuries. Discussion of its incorporation in investment decision making as a constant time based discount rate has produced libraries of books containing clarifications of the tool. Of note in these clarifications is the comparatively recently proposed use of hyperbolic discount rates that model the variation in time

preference of consumption as time increases as established in Behavioural Economics (Loewenstein 1992).

While estimation of varying (hyperbolic) discount rates remains contentious, the underlying concept can be observed and supported empirically by political commitment to many large infrastructure investments which are not feasible using constant discount rates in CBA.

In summary it would be appropriate to include experimenting with variable discount rates to get a picture of economic performance of alternate exchanges between entities that matches observed reality in the spirit of Phronesis. And from the broad based political welfare viewpoint, to do this requires the features of the agent based open simulation modelling that is emerging from the theoretical analysis of this paper.

The remaining issue in this general description of economic action is how entities go about selecting options for analysis in the DMP prior to exchange.

2.1.5 CBA and Option Selection

The model of the DMP used in this paper to ***rank alternative exchange products*** based on increasing the stock of rights to resources is designed to support the goal of growth in well-being, with sustainability, and resilience. It is ***not*** to establish the feasibility of a single product for exchange based on an exercise of power by one entity to expand the stock of wealth of that entity. This will be discussed further in the section below on Urban Transport Service Product Markets.

The DMP used can take many forms depending on the dimensions of the rights involved in a mooted exchange. The form of DMP can range from applying heuristics or rules of thumb for small exchanges e.g. food, to detailed feasibility studies using various forms of CBA processes, e.g. for transport infrastructure. The choice of an efficient DMP model and the institutional arrangements in which it takes place can be explained in terms of the transaction costs involved and will be discussed further below in the section 2.2.2 labelled.

Underpinning all practical analytical models used in DMPs is the involvement of experts whose presence recognizes the fallacy of a singular all knowing "homo-economicus". Given the general population's finite cognitive capacities we use experts to apply their experience (distilled wisdom) and training in a particular field to help select a small number of feasible options of products for further analysis from the total set of feasible alternatives. Again feasibility is defined as net increase in the stock of rights to resources held by the entity. The techniques of CBA have evolved from incorporating only immediate monetized cost and benefits, to include wider monetized costs and benefits, and on to include social and ecological costs and benefits as in the techniques of Social Return on Investment (SROI)(UK Cabinet Office 2009) . Another analogous technique is the many

forms of Economic Impact Assessment. Similarly Environmental Impact Assessment seeks to provide the DMP with broad investment appraisal information to rank alternatives.

These approaches can be represented graphically by taking the set of feasible options from each field and combining them we get an even smaller set of alternatives that exhibit feasibility in all fields as represented below in Figure 4.

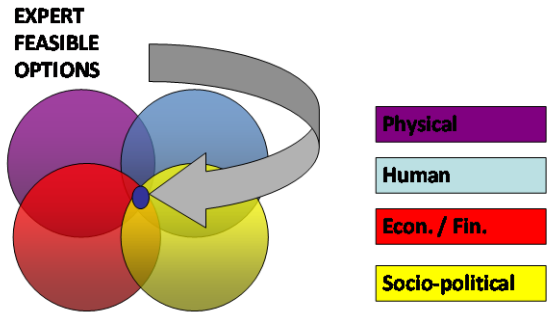

Figure 3 Combined Fields of Feasibility

To this point in the general discussion of a framework for economic action we have established:

- Broad goals of growth in wellbeing, sustainability and resilience.
- Multiple variable inputs to a decision making process model.
- Exchange as the means of defining products.
- The form of utility/cost functions describing products incorporating, measurement of variability distinguishing between physical (Newtonian) and behaviourally based value units, and temporal variation.
- How expert selection of options reduces the transactional cost.

In systems terms at this point we can conceptually describe stocks, flows and feedback mechanisms, and the wellbeing, sustainability and resilience goals of entities for the exchange of products of varying scales. What has not been covered and where the focus now turns is on the design of the institutional arrangements to facilitate exchange with emphasis on arrangements to accommodate exchange between entities of varying scales.

2.2 Design of Institutional Arrangements

In the broad framework of political welfare economics, with the goal of growth in wealth of entities as measured in wellbeing, sustainability and resilience, the design criteria for the framework of Institutional Arrangements (IAs) in which exchange takes place changes significantly from that for a neo-liberal monetized economy. Gone is the simplistic narrative based on static one-way exchange between all knowing "homo-economicus" demand entities and their equivalents on the supply side. Gone is the "gold standard" of open unregulated markets, where products are either simply private or public and any adjustment of reality to accommodate anomalies is emotively labelled as compensating for "market failure". In their place is a narrative of dynamic two-way exchange between entities of

varying scales, with DMPs bounded by limited information, exchange, and even in open markets subject to the constraints of various forms of regulation, for products defined by their quantitative material and temporal scale at unit utility that also varies over time and scale.

The field of IA research attracts many disciplines both within and without economics to research many and varied aspects. The aspects of interest here are ***control mechanisms*** and ***feedback loops*** which lie within the broader field of ***governance*** which covers all the processes of governing exchange.

Control mechanism design divides into firstly who should, given our goals, have the power firstly to ***control*** the DMP ***within*** an entity; and secondly, to control or regulate the relationship ***between*** entities of different scales when exchanging product, for example a water catchment entity's relationship with individual users.

Feedback loops have characteristics that are determined by their utility/cost functions as either balancing or reinforcing (positive or negative). Importantly they also require knowledge flows to be included in their design to efficiently provide to an entity the means to evaluate one exchange product to gain insight for later use in adjusting inputs and/or goals to future DMPs for similar products.

The discussion of Control Mechanisms and Feedback Loops draws on four bodies of research that have made substantive contributions to designing the two aspects of interest. They are;

- the Institutional Analysis and Development (IAD) framework that emerged from research led by Elinor Ostrom (2009) that highlights systems thinking and the goal driven desirability of user involvement in control;
- the Transaction Cost Economics (TCE) approach led by Oliver Williamson (2000) that highlights the goal of efficiency of exchange when organizing action among many entities and the differences in neo-liberal terms between "ideal markets" and "hierarchy" or the "firm" ; and at a broader level
- the Phronesis approach led by Bent Flyvbjerg (1998) that inter alia highlights the general nature and role of power in the control of the DMP of entities; and finally
- the Self-organizing Open Hierarchical Order (SOHO) arising from research in philosophy of systems by Arthur Koestler (1978) and others on design of hierarchical networks in natural systems

An examination of relevant parts of each contribution follows in turn.

2.2.1 Institutional Analysis and Development

The framework for institutional analysis developed by Ostrom et al for common-pool resources (CPRs) can be adapted using the terms defined in this paper to describe the framework for general use as follows in Figure 4:

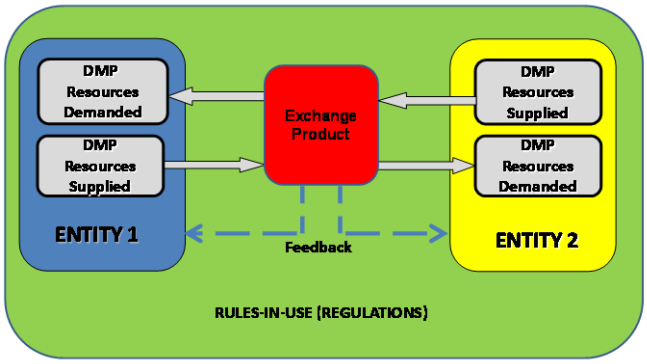

Figure 4 Framework for Institutional Analysis

The products of exchange ("interactions" in Ostrom's terms) can be expanded from her public/private/common pool resources (CPR) goods and services categorization to two general descriptors: multi-dimensional scale, (see above Product Definition & Scale) and variation of utility with use (consumption), (see above Utility/Cost Functions). With the latter descriptor we can cover demand products for individuals that diminish with use (subtractability of use such as CPRs) up to those that are unaffected by use, (difficulty of exclusion such as community policing). Between the two lie the neo-liberal economics "private goods" exchanged in a so called "open" market.

2.2.2 Transaction Cost Economics

To interpret the contribution of Transaction Cost Economics (TCE) within the adapted IAD framework, it is necessary to go behind the organizational duality of ideal open competitive markets and hierarchical structures of the firm used by Oliver Williamson (2000) to look at the governance (control, power, feedback) mechanisms operating albeit within a broader set of rules (Constitution, Regulation) in use .

In the case of open competitive markets regulated by price signals in the neo-liberal economic formulation, transaction costs are optimized when the product has several close substitutes and hence participants as suppliers and demanders. Control, power and feedback to a participating entity in the exchange are derived by price signalling, which has low transaction cost given the opportunity of shifting from one entity to exchange with an alternate entity for a similar product. This is the operation of the "invisible hand" of the popular interpretation of Adam Smith's model.

In the case of the firm (corporation) transaction costs of production are optimized where control, power and feedback relationships are internalized within the boundaries of the corporation.

To generalize TCE allows the evaluation of the optimality of the IAs by providing the means of describing and evaluating in terms of utility, the control, power, and feedback design criteria necessary for different product scales.

2.2.3 Phronesis

The framework of economic action emerging in this paper is located in the Phronetic world of applied practical wisdom attributed to Aristotle. In Aristotle's words, Phronesis is an intellectual virtue that is "reasoned and capable of action with regard to things that are good or bad for man" Phronesis concerns values and goes beyond analytical, scientific knowledge (episteme) and technical knowledge or knowhow (techne) and it involves a DMP containing a decision mechanism that includes judgement.

Aristotle did not specifically mention power but subsequent researchers in this space have expanded on what they saw as strongly implied in his writings. This is best summed up in the words of Flyvbjerg (2004):

"The main question is not only the Weberian: 'Who governs?' posed by Robert Dahl and most other students of power (Dahl, 1961). It is also the Nietzschean question: What 'governmental rationalities' are at work when those who govern govern? (Foucault, 1979). With these questions and with the focus on value-rationality, Phronetic planning researchers relate explicitly to a primary context of values and power. Combining the best of a Nietzschean/Foucauldian interpretation of power with the best of a Weberian/Dahlian one, the analysis of power is guided by a conception of power that can be characterized by six features:

(1) Power is seen as productive and positive, and not only as restrictive and negative.

(2) Power is viewed as a dense net of omnipresent relations, and not only as being localized in 'centres,' organizations, and institutions or as an entity one can 'possess.'

(3) The concept of power is seen as ultra-dynamic; power is not merely something one appropriates, it is also something one reappropriates and exercises in a constant back-and-forth movement within the relationships of strength, tactics, and strategies inside of which one exists.

(4) Knowledge and power, truth and power, rationality and power are analytically inseparable from each other; power produces knowledge and knowledge produces power.

(5) The central question is ***how*** power is exercised, and not merely ***who*** has power and ***why*** they have it; the focus is on process in addition to structure.

(6) Power is studied with a point of departure in small questions, 'flat and empirical', not only, nor even primarily, with a point of departure in 'big questions' (Foucault, 1982, p. 217). Careful analysis of the power dynamics of specific practices is a core concern."

With the goals of wellbeing, sustainability and resilience for each participating entity, exchange for products of various scales that increases wealth in terms of these goals, will come in systems terms from a balance of power between the entities. This balance can be represented as the system attaining a state of dynamic equilibrium through a balancing feedback loop. The alternative is the existence of a reinforcing or positive feedback loop that reinforces the direction and quantum of change. The result is either a virtuous or vicious cycle commonly talked of in the former as "success to the successful". Less commonly observed are the often complementary accelerating "losses to the losers". A current example in many OECD economies is the growing awareness of the disparity in wealth between the wealthy and the poor.

To achieve a balancing feedback loop with its accompanying power balance is, as observed by Flyvbjerg, typically specific to the system and no worthwhile theory generalizations have been found. Which is not to say that any inputs should be ignored? ***The essence of Phronesis is to analyse problems as they are not to ignore them.*** Again the call is for value laden judgement in an open (transparent), as compared to instrument constrained (black box), DMP.

2.2.4 SOHO: Self-organizing Open Hierarchical Order

The IAD framework uses a systems representation and as with all real world systems boundaries are arbitrary. The "Holon" concept (Koestler 1967) from philosophy provides a useful basis to show that in this discussion of entities and products each type of exchange (Holon) sits within a network of sub-networks (nested systems) taking inputs from smaller Holons such as local households and influencing higher scale Holons such as a regional entities, and vice –versa. This two-way influence both up and down in scale has been labelled the "Janus" effect (Koestler 1978) and will be further examined below in the section on Urban Transport Service Product Markets using boundaries useful to the analysis of transport service problems. What are significant here, given the goals adopted, are answers to the questions of what constitutes a goal satisfying hierarchy of Holons and where to locate power over the DMP. The general answer is that Holons (subsystems) should serve the greater whole (system) of which they are a part and that power over the DMP or agency resides in the smallest Holon which in this discussion is the household.

As observed above in the discussion on Phronesis, the particulars of individual cases dominate further analysis and will be applied below in Urban Transport Service Product Markets. In that context, the nested systems in ascending scale are a household, local groups of households, regional groups and finally national groups.

2.2.5 Governance Control Mechanisms & Feedback Loops

All exchange is subject to rules of some sort including regulation of varying degrees with control coming from various mechanisms (Stone 2016). These mechanisms are usually functions of the scale of the entity and the scale of the product. Again for general discussion it suffices to nominate two types of entity; households as exhibiting individual agency of self directed behaviour; and entities that aggregate individual agents for scale reasons of economic efficiency.

The control characteristic of individual agency of households is well known as is the feedback loop when participating in an exchange. The whole constrained edifice of neo-liberal economics is built upon it. Where IA becomes interesting is in designing entities that aggregate the individual agents.

The contractual arrangements around the transfer of agency from individual to a group span the corporate spectrum from informal associations through common-stock companies to Governments of local regional and national scale, even international as in the United Nations. In terms of DMP control again these can be informal or voluntary all the way to formal exchange specific legal contracts utilizing the rule of law. They can be open in the sense of containing mechanisms to allow adjustment as dynamics of information, utility, wealth and power present themselves, or they can be closed "complete" contracts where no change is possible. How openness is achieved can vary including from formal with a fixed cycle of review or informal where interpersonal relationships can dominate.

In systems terms the design of feedback loops, particularly in regard to delays, will influence the responsiveness of control to change and hence the timeliness of change. The knock-on effect is that it will also influence the strength of control as well.

This becomes critical when an individual Holon, in this discussion a household, is exchanging with a higher scale Holon say a transport service supply entity. To overcome the asymmetry of resources and hence power requires one of the following:

- mitigation through prompt (acceptable feedback delay) enforcement of legal ***regulation***, as in anti-trust laws;
- the existence of many entities with similar products offering the flexibility of price driven changes in choice as in the ***open market*** case; or
- control of resources and power being held ***contractually*** by the individual agents (households) who are users or receivers of the goods and/or services being exchanged – again with acceptable delay in feedback allowing prompt changes.

In sum the characteristics of nested systems for particular products tells us that the design of control should be focussed on identifying the location of individual agents and that when aggregated each

entity (Holon) should influence the entity at the next highest scale of the system through a contractual arrangement and vice versa .

3 Urban Transport Service Product Markets

3.1 Introduction

With the general outline of economic action and associated institutional arrangements described above it is now possible to turn to the "Radical Reappraisal of Transport and Land Market Basics of the title, as a particular case.

The first application of the framework to the urban transport service product results in its disaggregation into the major constituent products of; land for right of ways (ROWs); facilities for appropriate modes; vehicles for relevant modes; and trips in the relevant vehicle on the relevant facilities in the relevant ROW.

This disaggregation comes from observation of discrete exchanges for products as discussed above in Product Definition & Scale which includes Coase's (1960) slowly recognized revelation that it is the ***rights*** to resources that get exchanged and are then held by the entity not necessarily immediately ***consumed*** by the entity. This division of the transport service product serves to divide the discussion that follows into manageable parts.

To get some feel of which products are most deserving of research attention, it is desirable to put some scale on the relative size of each. So assuming transport service network geometry of a regular grid, each product will be proportional to those of a unit length of, say 1 kilometre. In urban Sydney for a four lane limited access road, the order of magnitude value of a kilometre is: - right of way for a four lane limited access road is say AUD 36,000,000 (60,000sq.m @ AUD 600 per sq.m.); the construction cost of a four lane road itself is say AUD 10,000,000; the vehicle say AUD 30,000; and the operating costs for a kilometre trip say AUD 0.75. The resources in each product providing transport service will depend on many location specific variables so the figures are definitely ***wrong*** and have a mix of units with respect to economic life, but from an exchange decision making point of view the relative orders of magnitude of resources involved in each decision, taking facilities as 100 are:

ROW	360
Facilities	100
Vehicle	0.03
Trip	0.00000075

Clearly the economic leverage in improving the exchanges for ROW and Facilities is at a much greater level of significance than the vehicle and trip exchanges even when their multipliers are applied to roughly adjust for differences in economic lives.

3.2 Land Market for Row

The current practice of determining the amount of land required for transport service is some combination of the use of historic two dimensional boundaries of similar existing facilities to define the area, the compulsory acquisition of new land for new facilities, and/or by shifting into the third dimension of tunnels and above ground structures where value of land in other uses and the disruption costs justify the additional resources to do so. The key exchange is between the transport service entity and the entity controlling allocation of land for other uses.

The entity initially controlling the allocation of transport ROW and "other use" land is typically a Planning Department backed by government and for simplicity in the current discussion (and for attention at another time) assume the Government owns all the land. Then, in such a "green fields" site, planners make their allocation decisions with input from various expert groups including the entity demanding land for transport facilities. The amount of land required for facilities is currently driven by engineering technical issues such as number, width and geometry of lanes with little micro analysis of the economic consequences. For example, the inclusion of the land requirements of a shoulder lane on a limited access highway for safety consideration to handle breakdowns is a classic example of what is typically put forward as a technical imperative with rare CBA of alternatives such as increased surveillance and number of emergency response vehicles.

The utility of land in non-transport use is a function of utility of land in transport service use. In systems terms there is a feedback loop operating between users and suppliers and it is usually seen as a reinforcing loop that produces congestion when user demand grows. To convert this loop into a balancing feedback loop that tends to keep operations in the efficient non-congested phase requires changes in how costs are signalled to users. With greater knowledge of the functions relating utility of land in transport and other uses, and how they interact, planners could more accurately determine the appropriate allocation between the two uses. The time scale of the impact of the allocation is long term. Even with the adaptation mechanism of compulsory acquisition of land when transport demand requires it, the problem remains that the user pays pricing mechanisms in use to signal the cost of trying to accommodate growth in transport demand, are not working. Even with adoption of behavioural economics (Kahneman & Tversky 1979) conclusion that loss per unit of existing (use) rights are valued about twice as much as per unit gains, the mechanisms may still not work due to the IA surrounding them.

The current transport service price signalling IAs are based mostly on trips which are, in economic systems linkage terms, a long way from land exchange in both the scale dimensions of quantity and economic life as noted above. Systems economics would have price signalling at the point of exchange which, in this case is for the right of access to the ROW product of transport service not the right to make a trip.

If we are to improve the mechanism for signalling when, due to projected growth, there is a need to shift the location of the origins and destinations of demand for trips then something like an annual charge for access to transport service imposed on "other use" land may be a better (in TCE terms) way of signalling this aspect of the cost of location. Research into a combination of land value theory, alternative network configuration of nodes and linkages, and travel time budgets would appear to hold some promise in defining the appropriate division of land uses and a feedback loop that signals the cost of location in terms that are closer to the user's location DMP.

3.3 Facilities Market

Having taken out the land cost ROW component from how to provide IA for the facilities product market, we are left in systems economic terms with exchange for the facility's structural formation and associated infrastructure. If the land use planners have done a good job of determining the ROW that will meet our transport service political welfare goals of wellbeing, sustainability and resilience, then the ROW becomes a constraint on what facilities are appropriate at different times in the life of the ROW. In practical terms it is easy to conjecture that choice of facilities will vary over time from road based for low demand to high density mass transit modes with compatible operating protocols where different modes intersect. This line of analysis of facilities with an agnostic view of modal choice for efficient transport service harks back to the nineteen-sixties before the false debate between public and private transport developed and it is heartening to see its resurrection in the new found enthusiasm for MAAS (mobility as a service)(Hensher 2017).

The discussion of facilities then proceeds along similar lines to that for ROWs. The IAs should include a price signal for access to the particular facilities in place, and it should be received in a form that registers when the "access" product exchange is taking place. Such an arrangement would tend to help convert the feedback loop from "reinforcing" to "balanced". To achieve this we need a price signal for the facilities product that together with the access product, acts on location decisions that causes demand to locate (re-locate) such that transport service remains efficient over time. Again an annual charge to "other use" land for facilities combined with an annual charge for ROW may achieve this. Setting the level of charge will have many location specific values and will contain much political judgement including in regard to other social rights, that is beyond the scope of this paper.

3.4 Vehicles Market

The characteristics of the market for vehicles are well established and sit in systems economics terms towards the household end of the spectrum of scale and control. The use of the exchange for the vehicle product as a means of finance through inefficient sales tax would be overshadowed by the suggested access charges for land and facilities and would be dropped. The general move in economies towards shared products rather than sole ownership products will require IAs for vehicles taking on some of the characteristics of Common Pool Resources (CPR) and hence can be accommodated in the suggested framework of systems economics.

3.5 Trips Market

With the proposed access charges in place and set to cover long term costs, thus meeting financing objectives, the trip exchange (apart from the minor cost of operating the vehicle) has only the management of use as a goal. If the proposed access charge has been set correctly and is operating as a balancing feedback loop then in normal transport service regime the congestion problem should be much reduced. The impact of special event demand would still require to be dealt with as a special case as currently practiced.

Congestion pricing in whatever form applied requires the setting of both physical and temporal boundaries to delimit where and when the price applies. The setting of the level of price should support our broad economic goals of growth in wellbeing, sustainability and resilience to keep operations of the service network in a non-congested state and there has been a long held consensus that this should be based on short run temporal marginal cost of an additional unit of demand on the network. In the spirit of radical reappraisal of current thinking, a contrary argument can be constructed as follows.

The current narrative is that congestion costs national economies huge amounts. For example in Australia the Federal Government's Bureau of Infrastructure, Transport and Regional Economics estimates of the 'avoidable' social costs of congestion (where the benefits to road users of some travel in congested conditions are less than the costs imposed on other road users and the wider community) for the 8 Australian capitals (using an aggregate modelling approach) total approximately AUD16.5 billion for the 2015 financial year, having grown from about $12.8 billion for the 2010 financial year1 of resources through unproductive time spent on congested roads (BITRE 2015). Usually the discussion stops there. But if the discussion is extended to asking, "so who and by extension which parts of the economy are impacted?" then it gets a little more complicated.

To make the case that the answer is the whole (say regional) economy then we would have to argue that congestion costs impact the non-user regional economy of the resources. But collectively the users ***do*** cover the total cost of congestion they impose on each other and presumably rationally, they

have individually decided that enduring the congestion is economically rational for them and by extension the regional economy.

To make the case for charging each user the short run temporal marginal cost then it would need to be argued that the group of users not willing to pay this price would shift their preferred time of travel AND that they were able to apply the resources (price) savings to economic action that produces benefits that equal or exceed the savings – given that in the congested scenario presumably the marginal benefits of economic action after the congestion exceed the short run temporal marginal cost price of congestion endured.

Reality is that users are willing to endure congestion because the cost of changing the timing, and/or location of origin and destination of a trip far exceeds the perceived congestion cost. And we do not know a lot about the price elasticity of each economic action, or behaviourally the shape of preference curves that shape individual budgets for travel time and location decisions. We do know from welfare economics that many elements of the underlying cost/benefit functions in the urban economy are value laden, that economic action or exchange between entities depends on the existence of these differences, and crucially to capture these differences the decision making or choice has to be undertaken by an entity with a DMP focus as close as possible in scale to the products being exchanged.

Hence the proposed lumpy annual access charge for ROW and facilities may be an easier policy to justify as more appropriate IAs than the IA of current practice.

This leaves consideration of the setting of boundaries as an issue to be discussed.

3.6 Boundary/Scale Considerations

As noted above in the section on SOHO: Self-organizing Open Hierarchical Order, boundaries of sub systems (Holons) are arbitrary. All systems are subsystems of other systems. Further, economic stocks and flows are not uniform for entities within system boundaries but that is the state of the real world and the best we can do is to use observed behavioural patterns that approach stability.

Leaving aside physical variations such as in topography that may have to be accepted in boundary drawing due to the cost of overcoming them, there are some patterns in travel that are stable. UK statistics from the Eddington Report (2006) suggest that by length, around 65% of all trips (all modes) are less than around 15 kilometres and 90% less than 45 kilometres. So the definition of relevant network subsystems could, applying location specific trip statistics, be divided into areas or zones at say three interconnected scales: local, intra-regional, and inter-regional (including international gateways). Again the challenges of boundary effects and variation of trip length within the zone are recognized but these are not new problems and can be dealt with effectively statistically. Note that

this pattern of demand also points to the significance of the local and intra-regional networks in meeting the demand for service and hence in the economy suggesting more research into alternatives to the current public footpath, parking lane, traffic lane configuration are needed.

Using the lessons of systems analysis and the emergent archetypes produced suggests IAs with governance structures that grant households, as the smallest Holon in the transport service system, control over the next scale Holon at something like a Local Government level; thence to a Regional level Holon controlled by the Local Holon; in turn a National level Holon controlled by the Regional Holon; and if you will, an International level Holon controlled by National level Holons. Again the nature of this SOHO structure is that each Holon influences and is influenced by the next level Holon both up and down in scale. This is shown graphically below in Figure 5.

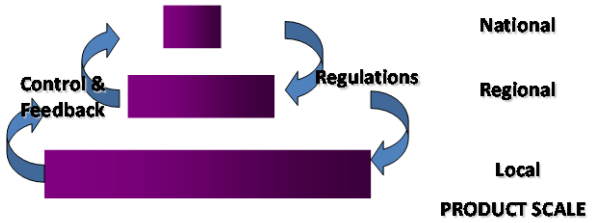

Figure 5 SOHO Governance Structure

In sum, for urban transport service this systems economics analysis identifies that a move to meet the broad goal of growth in wellbeing of the community in terms of the growth of stock of rights to valued economic resources held that produce wellbeing in a sustainable and resilient manner, would be achieved within IAs that place local, regional, national and international supply in a SOHO structure. Rights and power over the DMP would originate at the household land owning level and flow upwards to international scale. Households, as occupiers of land with access and use rights to the network of transport service would be financially responsible for ROW costs, facility costs on an annual basis as well as vehicle and trip costs as and when incurred. Importantly they would also, through control the DMP of the supply entity, control what transport service is supplied.

What has yet to be discussed is the choice calculus in the DMPs to participate in the necessary exchanges to receive transport service. The choice calculus of interest is what is known as an investment appraisal to which I now turn.

4 Investment Appraisal Models

Current practice in urban transport service supply is to respond to expression of demand for more service in a corridor by identifying alternative investments that will meet that demand and appraise their feasibility using CBA before using these analyses to choose the optimal investment alternative. As noted above in CBA and Option Selection, currently option selection in terms of size and location of ROW and facilities in the demand corridor is not constrained by prior economic analysis of unit

facility physical requirements – they are fixed on technical grounds. The ***only*** constraint is the need to prove that the alternatives under consideration are "feasible" in that economic benefits exceed the cost of the combination of ROW, facilities, vehicle and trips over some period fixed for all four products - and then to select the alternative that is "best" in terms of benefits exceeding costs – the classic CBA.

The proposed economic framework for urban transport service provision is different. It divides investment (allocation of rights to resources) appraisal into four separate products that get determined at different times. The Amsterdam population instinctively did this by saying investment in new transport service has to accept that the existing ROWS are a fixed constraint.

The proposed four part exchange regime places more significance and hence a great deal of power in the hands of those controlling the DMP of making the land-use allocation decision. The inference from the proposed SOHO structure of local, regional, national and international scales of IAs is that the goal of growth in economic wealth or wellbeing with sustainability and resilience is attained by placing most power in the hands of the local (supply) entity. This recognizes the ROW product as having the longest economic life (approaching fixed), with facilities the next longest followed way behind by vehicles and trips.

This inference comes from an heroic assumption based on the experience of actions such as in Amsterdam that households and individual firms (corporations) that comprise the local scale entities, value the established spatial patterns of economic action sufficiently to make the disruption costs of change unsupportable (CBA showing negative net benefits). The spatial dynamics of households and firms moving from one location to another are accommodated by the proposed lumpy price signal of an annual charge to landowners for access to the network of ROWs and facilities causing those whose wellbeing is no longer optimized by the current location to move to another which does optimize their wealth.

As signalled in the title of this paper the proposed change in the regime of investment appraisal would be "radical". However the analytical models for determining each product would be simpler than existing by reducing the complexity of the product. If ROW is fixed then the optimal facilities product question is dimensioned by answers such as which combination of mode and vehicles to choose.

It is beyond the scope of this paper to review detailed technical aspects of appraisal models for transport service but available techniques in use have the capacity to handle the simplified CBA required for investment appraisal. It is believed that research applying the systems economics thinking presented in this paper would tend towards exploring agent based simulation modelling with its capacity to transparently explore new insights on costs and benefits as from behavioural economics, using real time data to explore service improvements.

Several fundamental questions on model inputs remain. They include: how to measurement wider impacts of a proposed investment?; how to incorporate variation of values over time from the utility/cost functions?; and lastly how to include the additional attributes of the growth in wellbeing goal, namely, sustainability, and resilience?.

As introduced above in the sections on Goal of Economic Action and CBA and Option Selection, a wider CBA is possible given the fine grained data now available largely from output record keeping for GDP calculation. The "black box" and often proprietary nature of many current evaluation models makes it difficult to tell how the GDP data are being used. Combining with Economic Impact Assessment (EIA) models incorporating input-output analysis allows tracing of the wider impacts on the economy of interest. To maintain the integrity of the CBA and our stated goals, only the cost and benefit streams of the application of the net benefit from the output of the previous exchange should be included. This is a very different approach to CBA with wider impact evaluation than either the application of rarely well-defined multipliers to immediate net benefits or the simple addition to benefits streams of increases in GDP as if they are themselves net benefits. The mix of stock and flow units of measurement used in micro as distinct from macroeconomic analysis has resulted in a lack of clarity of outputs from some models for use in the DMP. Further research is needed but to this point it is clear that a Phronetic approach requires bringing the macroeconomic analytical inputs into line with the goal explicit microeconomic conceptual approach of CBA. The research would not be starting from scratch in that efforts in Environmental Impact Assessment (EIA) (Weisbrod 1997) and Social return on Investment (RSOI) (UK Cabinet Office of the Third Sector 2009) have developed techniques to manage the valuation of non-monetized rights to valued resources albeit not within the proposed framework.

The default framing of investment analysis in this paper has been as the ranking of expert chosen feasible alternatives. However this model is undergoing challenge. In many democracies the dominance of corporate/legalistic structures in decision making at both the political and expert bureaucratic levels has moved the analysis of infrastructure investment from rank ordering of alternatives to a focus on a single proposed option using an adversarial contest, often styled "public consultation" over minor variables with evidence presented for and against acceptance in a go/no-go test. Whilst the single option being considered has typically emerged from some form of analysis of alternatives, the proposed option has, in too many cases, been defined with party political objectives in the next election uppermost using naive ideas of cost and benefits not supported by expert facts.

In general the expression of objectives, the transparent generation of alternative scenarios for investigation, the distribution of power over the allocation decisions, and information on some of the critical relationships between variables in the urban economy, are missing from the decision process. Additionally, in terms of the type of models used, the dominance of spatially computable general

equilibrium (SCGE) models in urban economic analysis continues in part, to maintain computability in a nod to instrument rationality when a greater emphasis on Phronesis and value rationality is needed. The equilibrium feature at the heart of this class of models continues to exist against the background of and in spite of the wide observation of the dynamic and diverse nature of (particularly urban) economies, thus raising issues about their legitimacy in guiding the DMP.

To summarize, the proposed framework calls for the establishment of a supply organizations of local scale controlled by land owners in a SOHO structure through regional, national and international scales. Within each entity at these scales IAs will include governance control where the DMP is broken down into separate decisions on ROW, facilities, rules for vehicles and protocols for managing trips.

The issue remaining to complete this radical reappraisal of transport service and land market basics is to explore the path from where IAs are now to the self-emerging, open hierarchical order – SOHO - that has emerged from the analysis in this paper.

5 Urban Transport Services Summary & Path from Existing to Systems Economics Framework

The proposed framework for economic action on urban transport service and the path from existing framework to the proposed requires several significant changes in how we think.

The high order change is to return to broad political welfare economic fundamentals away from the narrow neo-liberal. Because political welfare economics comes with many different interpretations the proposed version defined herein has been labelled ***systems economics.***

The goal of economic action for the relevant entity of a local community is to increase the wellbeing of that community in a sustainable and resilient way. The dimensions of wellbeing are inclusive of ***all rights to resources,*** monetized, social, political, and ecological with utility to that community.

The decision making process (DMP) to allocate rights to resources to an exchange is the result of applying a combination of inputs from experts in that type of exchange, and utility or value unit assessment of the community to rank alternatives for exchange.

The subject of exchange in urban transport service is four separate products; ROW, facilities, vehicles, and trips, all undertaken separately and not on a project basis that combines all products.

The utility/cost functions used in analysing alternatives utilizing the familiar concepts of CBA, need to reflect all the monetized and non-monetized values of the community as revealed in Behavioural Economics, for each product being analysed reflecting its scale in terms of quantity and economic life. The functions need also to illustrate how continuing with current steady state functions that are applicable to the short term are not valid for the long term where there is mounting evidence, as in

climate change, that cost will accelerate with a negative impact on wellbeing with sustainability and resilience.

The governance structures of the institutional arrangements (IAs) in which exchanges for transport service occur, should locate control and power at the local scale with self organizing open hierarchical order (SOHO) from local through regional, national and international scales of product exchange. The inclusion of balancing feedback loops between entities in this structure is critical.

In summary the DMP of each entity uses concepts and techniques that are broadly known from CBA. Where the local entity is controlled by land owning households in a stable economy the process of transition is relatively straight forward. The "rent seeking" by local entities for finance from higher level Holons such as a state or national government, would cease when control of finance in the DMP is located at and would be replaced by accessibility charges on local land based on costs. However economies are not stable over time and the dynamics of, e.g. growth in number and density of local households would require governments to act as surrogates for future land owners and for the community as a whole to capture some of the increases in land value as zoning for higher intensity uses is approved to satisfy demand as revealed by the community.

The motivation for the analysis presented in this paper is the low level of satisfaction with our current narrative. While much research and analysis to tease out the ramifications of the proposed ***systems economics*** approach remains to be done, the multitude of disciplines involved in urban transport service provision may benefit from using the framework presented here to structure their existing and future contributions to growing the wellbeing of the urban community with sustainability and resilience.

Then the foundation narrative would indeed be something like:

"To develop urban communities that are liveable, resilient and sustainable, we need to supply a network of transport services that is a combination of land, facilities, vehicles and management protocols, which is determined, financed and governed by an informed community where decisions are based on detailed simulations, fed by real time data inputs and knowable relationships among variables, to analyse the cost/benefit impact of alternative land transport service supply scenarios on the urban welfare economy".

References

Aristotle 1976 *The Nicomachean Ethics*, pp. 1140a24–b12, 1144b33–1145a11).

BITRE (2015) *Traffic and Congestion Cost Trends for Australian Capital Cities* https://bitre.gov.au/publications/2015/files/is_074.pdf

Cabinet Office; Office of the Third Sector (2009) *A Guide to Social Return on Investment* ISBN: 978-0-9562274-1-6
https://www.bond.org.uk/data/files/Cabinet_office_A_guide_to_Social_Return_on_Investment.pdf

Coase R H (1960) *The Problem of Social Cost;* The Journal Of Law and Economics V3 No 1, pp 1-44.

Downie, D L. (2011). *In Wexler, Philip. Chemicals, Environment, Health: A Global Management Perspective. "Ch. 16: The Vienna Convention Montreal Protocol, and Global Policy to Protect Stratospheric Ozone".CRC Press. pp. 243–260.* ISBN 978-1-4200-8469-6

Eddington Transport Study Volume 2, Fig 1.2
http://news.bbc.co.uk/2/shared/bsp/hi/pdfs/01_12_06eddingtonvol2.pdf adapted from UK National Travel Survey 2005 data.

Fama, Eugene *(1970). "Efficient Capital Markets: A Review of Theory and Empirical Work". Journal of Finance.* ***25*** *(2): 383–417*

Flyvbjerg B (1998) *Rationality and Power: Democracy in Action*; University of Chicago Press, Chicago Il

Flyvbjerg B (2004) *Phronetic Planning Research: Theoretical and Methodological Reflections: Planning Theory & Practice, Vol. 5, No. 3, 283–306, September 2004*

Hensher, D.A. (2017) *Future bus transport contracts under mobility as a service regime in the digital age: are they likely to change? Transportation Research Part A*, 98, April, 86-96. This paper provides a timely example.

Kahneman D, and Tversky A (1979) "Prospect Theory: An Analysis of Decision under Risk", *Econometrica*, XVLII (1979), 263-291

Kirzner I M (1997) Entrepreneurial Discovery and the Competitive Market Process, An Austrian Approach. Journal of Economic Literature, March (1997).

Koestler A. (1967). *The Ghost in the Machine*. Penguin reprint 1990: ISBN 0-14-019192-5

Koestler A (1978) *Janus: A Summing Up, ISBN 0-394-50052-0.* Kuznets S, (1934). "National Income, 1929–1932

Loewenstein, G.*;* Prelec, D. (1992). *Choices Over Time. New York: Russell Sage Foundation. 3-34 ISBN 0-87154-558-6.*

Meadows D.H.(2008) *Thinking in Systems*, provides an accessible introduction to systems analysis.

Nozick, R (1993). *The Nature of Rationality*. Princeton University Press

Ostrom, Elinor (2009), "*A General Framework for Analyzing the Sustainability of Social-Ecological Systems*," *Science*, 325(5939), 419–422

Rawls, John (2001). *Justice as Fairness*. Belknap Press of Harvard University Press

Raworth, K (2017) *"Doughnut Economics: Seven Ways to Think like a 21st Century Economist"* See Ch 1 for an introduction to this subject matter.

Raworth, K (2017) *"Doughnut Economics: Seven Ways to Think like a 21st Century Economist"* See Ch 5 for a general discussion of archetypes

Sen, A (2009). *The Idea of Justice*. Belknap Press of Harvard University

Simon H A (1978) Rational Decision-Making in Business Organizations; Nobel Memorial Lecture, Carnegie-Mellon University

Stiglitz J.E., Sen A, Fitoussi J-P; (2010) *Mismeasuring our Lives: Why GDP does'nt add up*

Stone A.J.; (2007) *Institutional Reform: A Decision- Making Process View* Research in Transport Economics Vol22, Issue 1, pages 164-178

Stone A J (2016) *Market Rules: Rebalancing Power to Restore Fairness* http://sydney.edu.au/business/itls/thinking/2016/market_rules

Thaler R.H. (2010) *"Misbehaving: How Economics Became Behavioural"* for a general account of this field

United Nations Millennium Development Goals http://www.un.org/millenniumgoals/

Weber, Max (1978). *Economy and Society*. University of California Press. pp. 24–5

Wikipedia (2017) Leoliberalism *https://en.wikipedia.org/wiki/Neoliberalism*

Wikipedia (2017) *List of Cognitive Biases https://en.wikipedia.org/wiki/List_of_cognitive_biases* contains over 160 examples and 8 main causes

Williamson O E (2000) *The New Institutional Economics: Taking Stock, Looking Ahead, Journal of Economic Literature V 38 Sept* pp 595-613.

Weisbrod, G; Burton Weisbrod (October 1997). "*Assessing the Economic Impact of Transportation Projects*" (PDF). *Transportation Research Circular* (477).