Screen-shot

SUSTAINABILITY & THE TRIPLE BOTTOM LINE (TBL)

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This is the "*1*-15" template: One notion, Sustainability; 15 line items (or facets), 15 prominent dimensions — for the time being. One TOP line (CAPITALIZED); 14 subsequent supports, widening out from the local and personal [T1] to the global of Earth Systems Analysis [T14].

[T0] THE TopMost LINE (TmL): ORGANIZATIONAL LEARNING

Never do we get it entirely right, especially not with respect to grasping what Sustainability is (defining it) and putting those *Takes* into practice. Nor do we make decisions "once and for all", neither just "once" in time, nor always, if ever, to the benefit of "all" (as each sees it). Our loadstone is: "Always Learning: Never Getting It Right"!

Such learning should be universal: as much for you and me as individuals; as for the organizations to which you and I belong or for which we work.

This is about acquiring an appropriate mental complexity, sufficient to grapple with the labyrinthine and comprehensively irreducible complexity of Sustainability (*Take 7*): progressing from the socialized mind, which learns to follow; through the self-authoring mind, which has learned to lead; and on to cultivating the self-transforming mind, which leads to learn.

This is about being bold enough to abandon any one of the following 14 line items, when palpably they are no longer capable of generating fresh and relevant insight and guidance.

All this we seek — granted certain existential necessities.

[T1] Personal Aspirations

We aspire to survive, albeit perhaps only to experience life with its debilitating, hence self-absorbing, inward-looking, personal ill health. We aspire then to experience life with good health. And beyond this, we aspire to attain a growing sense of well-being — a well-being sufficient, in particular, to enable and promote self-reflexive apprehension of the "big picture" — hence to begin to care (when previously we may not have cared) to engage in pondering the big and the global issues, such as Sustainability its very self (Do I/we want it? Is it all it is made out to be?), climate change (Is it happening? What can

I/we do about it?) and, for that matter, Earth Systems Analysis.

[T2] Citizen Participation

In contemporary societies with a healthy democratic turn, those in power (in government) urge us as individual citizens to participate, on our own account or through participation and representation in a group. And we, in turn, are encouraged by society to favor governments inclined to do such "urging", as opposed to those inclined otherwise. Each group of citizens, or each individual, should have a seat at the (metaphorical) table for debating Sustainability and determining how to become less unsustainable. Participation thus in governance — in which government participates as but one agent at the table — is today regarded as central to attaining Sustainability.

Each thus legitimated group has a voice, as it were, to which each other voice will duly listen, take note, and respond in reasoned terms, prior to the decisive action being taken. In the asymptotically reachable ideal, the brunt of this "doing" is to be borne by none who were not represented at the table of the prior debate.

[T3] Social Bonds

We surely do not start from consensus and — arguably — we should not seek to end with it. A plurality of perspectives on the Man-Environment relationship is the inescapable given (*Take 2*). People and institutions will align themselves with a particular perspective. We might label as a "solidarity" their clustering around this single, coherent set of convictions. Argumentative, disputatious interaction amongst the solidarities — each essentially convinced of the rightness of its own outlook — provides opportunities for the constructive harnessing of disagreement. Not *cogito ergo sum*, but *dissentio ergo sum*: I disagree, therefore I am.

Archly opposed, never fully reconcilable, there are plural wisdoms here in these plural solidarities on how Man should live with Nature (Environment) and how Man should live with his fellow Man. It makes sense to benefit from *all* of them in fashioning policies and actions for Sustainability.

[T4] Quality in Governance

We have been told, in no uncertain terms (at least in the water sector), that attaining Sustainability is today a matter of governance, not any technology or engineering.

Just as well then that there are ways in which "quality" can be apprehended and gauged within the processes of governance. They have been gathered together under what has come to be called the "refurbished pluralist democracy of Robert Dahl". Such processes should allow for measures of experimentation, while yet steering stewardship of the Environment in some "desired" direction — for some, for a while (*Take 2*; *Take 6*). The experimentation should serve the purposes not only of learning about the Man-Environment relationship, but also of (self-reflexive) learning about the Man-Man relationships amongst the plural solidarities. It should serve to identify and discriminate between those elements of governance that are enabling of change and innovation away

from unsustainability and those that stifle them.

[T5] Ethics & Equity

These govern and measure our personal and collective conducts in all the many relationships into which we can enter: Man-to-Man; Man-to-Nature; individual-to-group; present-to-future generation; present-to-past generation; seller-to-buyer; and on (and on).

We *ought* to care for many more of the entities in the world — in Nature — than merely the self. And that should strike one as the well-spring of the concern for Sustainability *in toto*.

[T6] Valuation

What should we write into our "final *environmental* wills and testaments"? What is it in the world — what in Nature and Environment — that we value sufficiently to determine it should be passed on to our children and, in turn, their children (*Take 3*)? Can we value such things, in particular, in ways that might (just might) reflect the values of our children and their children in turn; or at least value them in ways maximally insensitive to changes in fashions of what constitutes "good" over the generations? According to which of the several styles of Economics should valuation be implemented? That of engineering (within just the "factory fence-line"); that of the predominant style lumped under the rubric of "neo-classical"; the environmental; or/and the ecological?

Just as in "Citizen Participation" above, valuations dissonant with our own are going to have to be acknowledged, entertained, and dealt with.

[T7] Environment Within the Language of Business

A contentious and disputable language for valuation has emerged (*Take 3*). It is contentious because it has about it the whiff of just a *single* perspective on the Man-Environment relationship: "It is OK to make money while doing good by the Environment", whispers this voice. "Nature (the Environment) is beneficently resilient"(*Take 2*).

Yet this "business speak" is providing us with a vocabulary for conceiving of the pragmatic mechanics of valuing what it is in Nature we should pass on to our descendants. The world has a stock of "natural capital", from which are derived a bundle of "ecosystem services", just as we derive services from electricity, manufactured chemicals, and the like, with which to operate city infrastructure. These ecosystem services are subject to the customary risks of business: that the business may become bankrupt and fail — failure of the "ecosystem service providers" through the loss of biodiversity — and that would surely not be "business as usual".

[T8] Supply-Value Chains

Each entity — business, public utility, non-governmental organization — requires supplies of materials and services in order to conduct its affairs in society and in the economy. It must enter into relationships with these other entities. Its suppliers will be "subservient" to it in the purchaser-supplier relationship of commerce (just as this given entity will be subservient to those

it supplies). What the entity chooses of these principles of Sustainability to guide its conduct and behavior in this relationship — its ethics, that is — so it may oblige its suppliers to adopt and exercise.

The mayor who champions Sustainability may oblige the city government to let contracts only to those construction companies who likewise champion Sustainability.

[T9] Commercial Sectors

The city is the eye of the needle through which so many and so much of the global flows of materials and energy (and the money attaching to them) are threaded. There, they become intimately — and nearly inextricably — intertwined. Assuring our very human existence depends upon the water-food-energy nexus. It entails the undivided embrace of the water, food, energy, waste-handling, and forestry commercial sectors, if not several others. There are synergies to be had amongst these commercial sectors and infrastructures, through social and technological innovations and change. And there are antagonisms to be avoided.

For two decades we have successfully made the Water sector a stand-alone focus on the world stage, with its accompanying water-centric administration, institutions, policy, businesses, and technologies. In the round, this is not supremely sustainable. In contrast to what is desired, it is disjointed (*Global Water Crisis*).

[T10] Space

We are urged to eat less meat, entreated to generate a designer sewage, told that divorce is green, and threatened with devices that will alarm us if we are about to use too much water (hence energy) in our daily shower.

The small and very personal things in life can affect the big things. For want of the smallness of a nail, the king's horse could not be shod with a shoe; the king could not ride out to lead the battle; and so the largeness of the kingdom was lost.

A urine-separating toilet could be the metaphorical, minuscule "nail", given which certain kingdoms (of Sustainability) might be attained. It could enable significant inroads to be made into the "kingdom" of uncoupling the largeness of the metabolism of the city and the globe from the quarrying of virgin phosphorus ores and the expenditure of vast quantities of energy in bringing nitrogen out of the atmosphere into "new-manufacture" fertilizers (*via* the Haber-Bosch process).

For Sustainability, "Thinking Globally, Acting Locally" is decidedly *not* a trite, intellectually empty slogan.

[T11] Life Cycle and Time

We appeal increasingly to the metaphor of the biological organism (as opposed to the clockwork mechanism) to conceive of how to organize, analyze, and design things.

Projects, infrastructure, and technologies have life cycles, from cradle to grave; but yet better cradle to cradle, in the spirit of eternal renewal, if not reincarnation. Birth — the blueprint for designing something to be built for subsequent operation in the fabric of the city — should be effected with the *fore*sight, *fore*knowledge, and

*fore*thought (no matter how uncertain) of eventual closure, disassembly, recycle, and re-birth. Immature infrastructure, like the child passing through its teenage years and on into the productive richness of adulthood, should be primed to learn: to acquire ever greater "smartness", hence Sustainability (disputatiously so, as always, of course).

History records otherwise. "If a thing is meant to stay put", it has famously been said, "that is Civil Engineering". Staying put is to remain invariant with time, never to be adapted through any learning during all those long years in the adulthood of the operational stage of a life cycle (*Take 5*).

[T12] Function

There is engineering resilience. The functions of the city's infrastructures are tightly maintained in the vicinity of some desired performance targets, much to our liking of the 24-7 frequencies in the pulsating life of the city. Such optimized resilience may have a brittleness about it, however. All useful functions, so much to our liking and comfort, may be at risk of being altogether lost when the unexpected happens, as it does.

And then there is ecological resilience: a kind of resilience in which some levels of tolerably acceptable functions are maintained, irrespective of large (and persistent) excursions from the norm, when disaster might otherwise have ensued, with no cherished and comfortable functions whatsoever. The metaphors of Engineering, Ecology, *and* Cellular Biology have insights to offer to our engineered infrastructures, hence our cities, in their becoming less unsustainable. Imagine a self-healing infrastructure.

Function can be adapted by changing the form: the "hard path" of building the city's infrastructure; demolishing some parts, re-building them (and demolishing them again), with all the implied negatives of material and embodied energy flows thereby unleashed.

"Smartness" and intelligence should be bent towards the complementary ideal of the "soft path" (*Take 5*). Never a brick should be rent asunder, as the infrastructure continually tailors and re-tailors its functions to suit the ever-evolving appreciation (across the generations) of what it may mean to be sustainable.

[T13] Gauging Environmental Benignity

Once was the time (the 1950s through the 1970s) when what was to be done about the inherent environmental "bad" of the city was to curb its pollution of the land, the air, and our water. The city was a necessary industrial (clockwork) bad planted destructively in its Environment. We planned then for infrastructure capacity according to how much polluting BOD (a measure of our personal and very human organic "waste" matter) was to be cut back, from a given number of rather abstract, inanimate "population equivalents". What constituted pollution evolved with our capacity to measure ever more of the pollution and to "solve" the preceding problems: from pathogenic, to gross, to organic, to nutrient, to toxic pollution. We took advantage, up to a point, of a river's "self-purifying capacity" — its ecosystem services, as we would say today.

Now we have biomimicry. We are invited to conceive of the city as a large animal grazing in its pasture, with an appetite (or footprint), a metabolism, and a pulse (*Take 4*; *Take 5*). Just as that metaphorical animal may have imposed its 24-7 pulse-rate on the city's surrounding environment, so its infrastructure may be re-engineered for the animal to give back benefits to the environment: to issue nutrient supplements to the river, with the express intention of not just restoring the ecosystem services of the aquatic environment, but going above and beyond, deliberately to enhance them (*Take 8*).

[T14] Cycling of Materials

This is the century of material cycles and, above all else, that of the global carbon (C) cycle.

Cities are participants in these cycles, in particular, and most prominently, the C cycle itself, the water cycle, the nitrogen (N) cycle, and the phosphorus (P) cycle. Thus are the threads of our existence in the city deeply intertwined, not least through its intake of "our daily bread and our daily water". Thus intertwined are the cycles of our daily intakes of nutritious C, N, P, and so on. And when water is employed to carry our C, N, and P residuals (and our pathogens) out of our households, to preserve our (and our fellow citizens') public health, so are the C, N, P *and* water cycles even more deeply interwoven.

Yet these materials are resources — water *and* C, N, and P materials — to be extricated from the entangled ball of the city's metabolism, and thereby most gainfully recovered, hence to begin a cycle of renewal: as they (the C, N and P) are passed on into the food sector, the energy sector, and the ecosystem services sector, eventually to come back to us, in the cycle of things (*Take 4*).

We can seek to be maximally eco-efficient in this: to rein in the profligacy in our resource use; to lift back the city's negative footprint to some neutrality close to zero — to "tread more lightly on the Earth" and "do more with less". The latent moral compass is one of "shouldn't do", with an accompanying sense of things beneficially narrowing and contracting — altogether a metaphorical "tightening of our belts".

And we can pursue too the complement of eco-efficiency, namely the principle of eco-effectiveness: the art, the science, and the engineering of focusing on "doing more good" instead of becoming ever less bad; to experience therein the sheer *joie de vivre* of being inspired to "do" according to the ever-spreading field of burgeoning opportunities — for imagining the impossible, of making the city "walk on air".

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