Reading the limits P.F. Henshaw

(Sweet & Plentiful to Scarce and Sour)

From the perspective of a plan to make limitless use of any limited resource and the relative scales of the multiplying system and the dwindling resources it relies on, it is the explosion of complications in following the plan that is the best long term signal of natural change in the plan. That the world's economic theories largely agree that at points of diminishing returns for material growth one can then decouple wealth from physical processes rely on information growth without resources is indeed mysterious. So very much about the unexpected appearance of wealth is such pure magic to us it seems to overwhelm our ability to reason. Anything real does still take a physical process, even information-based illusions of real growth like housing bubbles and tulip bubbles.

This is about a simple general model for reading the real progressions of what might otherwise seem like 'magical' processes of development. It lets you foresee things like the tragedy of bio-ethanol and how that dream of boundless renewable energy added to straining the world food supplies. Along with other plans for the same resource it helped push up the general level of world food prices before it 'ran out of gas' itself. That is a kind of natural emergence of conflict as growth systems collide with each other and vie for diminishing shared resources and all get a much reduced disappointing share. Every plan has a point of diminishing returns, the point were it runs into complications, we don't tend to plan on looking for and responding to them. For sustainable plans the point of diminishing returns has much the opposite meaning it has for limitless growth plans. It then means recognizing the point of satisfaction and of 'enough', signaling a switch to from expansion to refinements as the kind of complications that arise, rather than erupting conflicts. Plans with no horizon amount to seeing the future as always operating in the conditions of the past, removing your ability to look for or look over that horizon.

You would think that for physical systems there would be some well defined physics for their physical limits, and there certainly is for the limited cases of well defined systems like machines. It's called thermodynamics, a name coming from how it was derived in relation to energy as heat. Economic and natural systems are not well defined, though. They depend on their own original developmental processes in indefinable environments. The same universal physics principles apply but don't come with a way to mathematically define the relationships. Economic and natural systems are 'complex' and essentially create their own worlds as they explore their own environments. What limits them depends on how they develop. A useful substitute for deterministic equations is a set of forecasting tools based on the observed 'local physics' of the individual systems themselves, their own developmental 'learning curves'[i]. It begins with learning how to recognize their learning curve reversals and the environmental signals of that approaching.

As any new market or other unplanned system emerges it expands in its environment, invariably beginning by multiplying freely, finding more and more resources the more it expands. Without that initial experience there would be nothing to begin. That means that all beginnings start with 'unlimited' growth. The developing system and its resource uses may later stabilize for a period, or

not. The first evidence of responding to limits is a reversal in the curvature of the trend from one of 'multiplying increase' to one of 'diminishing increase', finding less and less new opportunity rather than more and more. Those trends can be drawn as if mathematical logistic curves, but refer to experience data curves, which never cleanly follow formulas. Figure 1. shows what might be upper and lower bounds for a range of growth and decay experience curves. It might represent the range of behaviors observed in one kind of natural system, or one kind of business enterprise or industry. If you could define them as physical machines, then this envelope of learning curves might represent a range of potentials corresponding to thermodynamic limits of initial and terminal development, tracing maximum and minimum entropy potentials.

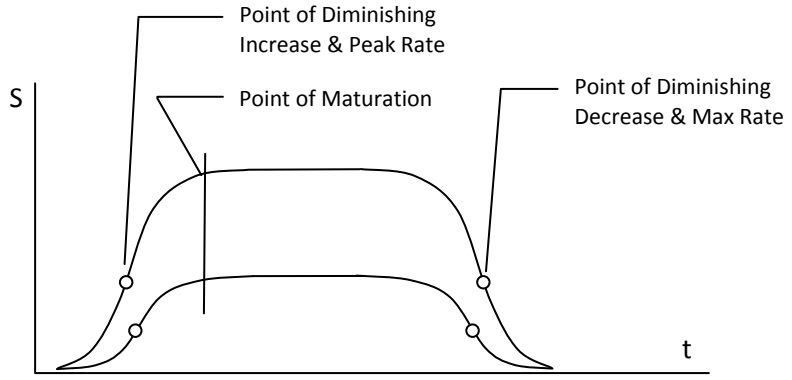

Fig 1. General Envelope of System Development [S units]

This is a very large subject. It actually opens something like an added dimension of the universe to explore, or more precisely, of many small universes to explore. It treats each development process as a little universe of relationships in its own right, changing throughout it's own development from beginning to end. The internal designs of development systems tend to have their own locally originated sets of rules created in negotiating their own environments, each such small universe has its own local "laws of nature", or "local rules" that piggy back on the more general laws of nature. We've all noticed that our own personal families have their own rules, practices and styles. Their local rules serve to make them identifiable as small universes that got that way by their own development. We've also noticed that our businesses, the unfamiliar places we visit and the social groups we belong to, etc. do as well. We seldom stop to think of how they develop. We may see that they started from somewhere, and so a place to start understanding them. Any local system's local rules also incorporate the local rules of the systems within them and in which they're embedded. That means you begin studying them with a very large menu of questions you might explore. Development curves provide a simplified place to start that looks at them as a whole.

Of course people all naturally notice and respond as their personal opportunities multiply and then contract. Looking for the signals pointing to those changes in direction is a matter of being ready for surprise, not prediction. In personal things it's generally easy to notice the "point of diminishing returns" for, say, adding charcoal to the grille, putting ornaments on a Christmas tree, or even "lipstick" on the pig… :-) We don't generally need to make a study of it. We just notice some point when we've done enough, and switch to doing something else. The basic idea isn't whether your own stopping point means having done a good job or as having made a mess, really. It's just that when you see there's not much else left to do you've found the point of "enough" and you switch to something else.

In terms of the diagram, the point where you stop a enlarging a process may be somewhere before or after the maximum rate of return on effort. It depends on whether ending it with lots of room left or the least possible room left is how you think of the point of wasting your efforts.

The oddest thing about this rough sketch representing any life history of developments for any little universe of relationships and their developmental turning points is that nearly any continuous measure of them will fit the same diagram. What it represents is a very simple but very basic set of physics principles. The basic physics that creates this shape is the implication of the conservation laws that accelerations can't come from infinite forces or instantaneous work and energy flow so, changes in energy flow then needs to follow smooth curves. That then defines this simplest shape of change possible from beginning to end, represented in figure 1. as an envelope of change to show the real and the theoretical ideas together[ii].

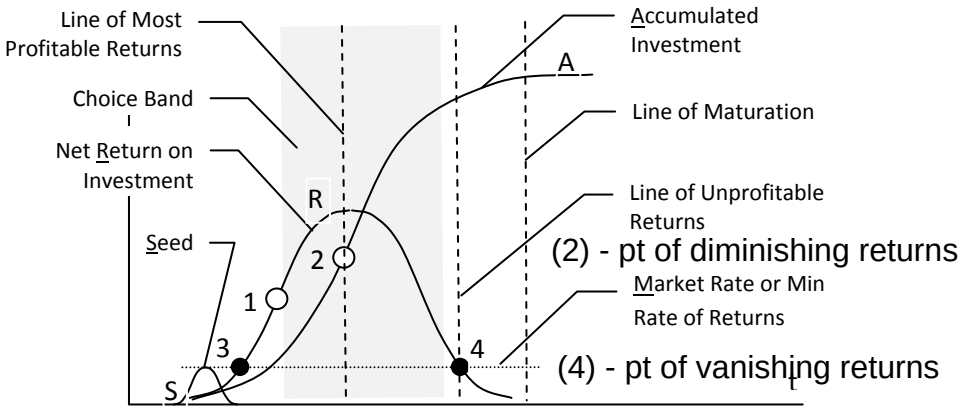

Figure 2. Development Sequence for Sustainable Development [S,M,R,A Scales]

Figures 2 & 3 show ways developmental learning curves can be used. In figure 2 shows three development curves for a system that grows to maturing, S for the use of the seed resource, R for the system's returns on self-investment and A for its accumulated investments. The earliest clear signal of the eventual level of the system is point 1 , the curvature reversal point of the business's surplus. The real reason this tends to come as shown early in the first half of the growth curve is that growth systems tend to use the easiest and most productive resources available first. It's finding the 'sweet spot' of the opportunity that is the earliest sign of finding what remains. That means their growth periods then progress by finding uses for the somewhat less available and somewhat less rewarding ones. It makes the net returns on investment "front loaded", applying the MEP principle for the "local rules" of the system considered.

All system developments begin with one or another kind of non-renewable 'seed' resource, as well as a 'seed' of organization, to get a start. As development for a small business or for using a sustainable resource use the best parts of the opportunity, the potential value for expansion becomes limited. Sometimes a small business or institution will grow as a sustainable system by choosing to not use it's profitability to grow beyond the need it was intended for, like supporting a family or achieving the scale needed to provide a particular service. Typically the surpluses for building a sustainable business would grow and then fall as it fulfills it's purpose or saturates its market. If it had been built with 'micro-loans'

or investment partners or other credits, the costs of that would likely be steady as the business develops and then repaid to stop taxing the development before or as its earnings growth stops. For planning that it's good to watch the signals as it approaches!

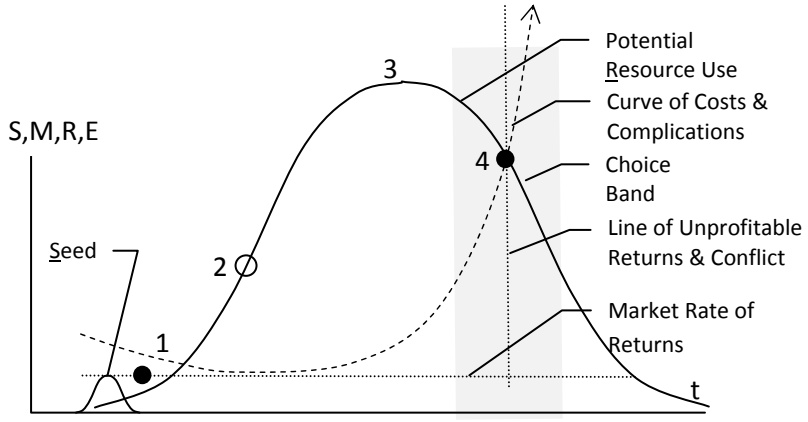

Figure 3. Limiting Cost as Peak Capacity of Depleting Resource [S,M,R,E scales]

Figure 3. shows the case of consuming a limited non-renewable resource, perhaps even the original seed resource for some larger sustainable system. Non-renewable resources have a particular self-deceiving end. They rapidly become unprofitable near the peak of their availability, most especially for a growth system. Think of eating a plate of food, that a fork finds quite plentiful to just before the last bite. As the complications of achieving increased use of more scattered, smaller and lower quality reserves explodes, conflict with others in the same situation who tend to move to eating off someone else's plate then explodes too. The long lead signal of the first turning point (fig. 3 pt 2) is a far better time to respond than either the peak of the curve (fig. 3 pt 3) or the point of disruption (fig. 3 pt 4). Then only extreme price rises to cut others out of the market will be able to restore the. In the flow of things, it appears we are now just passing 'peak oil', or point 3, in the development of consumerism. For some reason the planners of long range development decisions have acted like they "had no clue" that there would be limits to any resource that couldn't be easily replaced, even as we doubled our uses of them regularly forever. So, perhaps we're at one of those switch points where we switch from "when you see it dodge it" to "when you see it do it". That's the survivalist's successful scheme.

[i] Learning curves – http://en.wikipedia.org/wiki/Learning_curves
[ii] Continuity & Divergence Theorem - http://www.synapse9.com/drtheo.pdf