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COMPLEXITY MEETS DEVELOPMENT – A FELICITOUS ENCOUNTER ON THE ROAD OF LIFE

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SUMMARY

Since before Adam Smith, economists have been concerned with development. However, they have seldom understood it or paid it enough mind. For example, the "sequence" economists, such as Marx in the 19th Century and Rostow in the 20th sought to force development everywhere into a rigid pattern. Since 1874, the marginalists and their Neoliberal descendents have emphasised comparative statics and steady-state equilibriums, not growth.

Although many new ideas popped up after WW II, none proved satisfactory. These included alleged "silver bullets" such as "free" trade, foreign direct investment, import substitution, industrialization and investment in human capital, as well as varied sets of "multiple drivers", whose individual effects proved hard to sort out.

Meanwhile, Neoliberal economics gradually took over the non-Marxist world. But it lost its credibility by spawning a mindless globalisation and long series of economic, human and social disasters. So today development economics is undergoing a "rebirth", with "the Barcelona Consensus", custom design, multiple objectives and sustainability among its guiding stars.

By happy coincidence, a new discipline called complexity began to emerge in the mid 1980's. Out of it has come a new kind of economics which is not only congruent with current thinking about development but also provides useful advice in the design and management of development programs, including those related to poverty.

Meanwhile the Commonwealth of Puerto Rico (USA) is trying a new approach to the eradication of this evil. Poor communities have been identified, organised and then made responsible for taking the lead in coordinating their own development. This coordination covers not only projects managed by the community but those sponsored by outside private- and public-sector organisations.

The "jury is still out" but the odds are that this approach will provide much more civic, economic and social development for the poor than previous attempts. And a major factor improving these odds, is that this approach is the one most compatible with a vision of Puerto Rican society as a complex system.

KEY WORDS

complexity, development, international economics, poverty

CLASSIFICATION

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A VERY BRIEF HISTORY OF DEVELOPMENT

Since before Adam Smith, economists have been concerned with development. However, they have seldom understood it or paid it enough mind. For example, the "sequence" economists, such as Marx in the 19th Century and Rostow in the 20th sought to force development everywhere into a rigid pattern. Since 1874, the marginalists and their Neoliberal descendents have emphasised comparative statics and steady-state equilibriums, not growth. And in the 1920's, J.W. Mitchell not only considered business cycles to be the dominant feature of economies but saw each one a unique event.

Nevertheless, after WW II, renewed efforts to understand and model economic growth spawned many alternatives, but none of them turned out to be satisfactory. Some people sought alleged "silver bullets" in "free" trade, foreign direct investment, import substitution, industrialization or investment in human capital, for example. Others identified sets of "drivers" for development but then had great difficulty in sorting out their individual effects. And almost nobody, except for Piana, has faced up to the serious deficiencies in international trade statistics and their implications for the many theories based on the latter [1-10].

Meanwhile, Neoliberal economics gradually took over the non-Marxist world. But out of arrogance and an obtuse infatuation with self-righting market equilibriums, it spawned both a mindless globalisation and long series of economic, human and social disasters, many under the banner of "the Washington Consensus", and so it lost its credibility. These disasters began in 1983 with defaults of developing countries which had borrowed "petrodollars" and continued on through yet another Argentine crisis in 2002. As a result, development economics is today undergoing a "rebirth", with "the Barcelona Consensus", custom design, multiple objectives and sustainability among its guiding stars. This rebirth coincides with a renewed effort to reduce poverty worldwide and hopefully will lead to a better coordination of the two than has occurred in the past [11-18].

In the West in fact, many different approaches to poverty have already been tried — ignore it, punish it, leave it to municipal charity, leave it to private charity, leave it to "trickle down" policies, militarise society, undertake general measures of economic development, undertake specific measures to benefit the poor as a class and/or undertake measures to benefit specific groups of poor people, such as the malnourished, poor farmers or the unemployed. So the typical national "anti-poverty program" [if one exists at all] is usually a hodgepodge of historical accidents, with performance and support varying greatly by approach. Last but not least, the relation between demography and poverty is usually ignored or given only lip service. So everywhere, for these reasons and others, poverty is still with us, and it is hard to distinguish business cycle effects from program impacts [19-21].

Meanwhile and by happy coincidence, a new interdisciplinary discipline called "complexity" began to emerge in the mid 1980's. Out of it has come a new kind of economics which is not only congruent with current thinking about development but also provides useful advice in the design and management of development programs, including those related to poverty.

And by another happy coincidence, the Commonwealth of Puerto Rico (USA), is trying a new approach to the eradication of poverty. Poor communities have been identified, organised and then made responsible for taking the lead in coordinating their own development. This coordination covers not only projects managed by the community but those sponsored by outside private- and public-sector organisations.

Despite a successful "field test" in 53 communities in San Juan, "the jury is still out" as to the eventual success of this approach. But the odds are that it will provide more civic, economic

and social development for the poor than any other approach tried to date. And a significant factor in improving these odds, is that this approach is the one most compatible with a vision of Puerto Rican society as a complex system.

COMPLEX SYSTEMS

A "system" may be defined as a set of components which interact much more with each other than with their "neighbors", whether by human design or natural happenstance. A system also includes boundaries [fuzzy to sharp] and one or more processes by which the components [a] interact with each other, [b] interact with neighbors and [c] transform inputs into outputs. Each process typically leaves one or more "tracks in the sands of time" (orbits, time series, trajectories.) [22].

Most common are the ubiquitous dynamical systems, systems whose state space and position in that space change with time. These range from nanosystems to the Universe itself. Unfortunately there is no agreement on taxonomy or definitions, so following is a revised version of a taxonomy which we developed for the convenience of business economists [23].

Non-engineered dynamical systems come in three basic "flavors" : the sporadic [avalanches, earthquake faults, volcanoes] the unimodal [pendulum clocks, toy trains] and the multimodal. The latter are legion, but three "families" —the chaotic (erratic deterministic) the random and the complex account for most ecologies, economies, human societies, large communications systems, living things and suchlike.

To confuse matters further, all three are "chameleon" systems. That is, within the time horizon of interest to the typical analyst and for line segments of significant length, the track of one may imitate at least one of the behavior patterns generated by another. A classic example is the price index of that complex system known as the New York Stock Exchange, which trended, fluctuated randomly, crashed chaotically and then trended again, all within the 30 months centered on October 17, 1987.

Chaotic systems are largely or entirely deterministic, yet their behavior is unpredictable beyond the short run, mainly because their processes are nonlinear and the evolution of their tracks is extremely sensitive to initial conditions. They are also prone to "crashes" whose "triggers" turn out to be inconsequential. [The "butterfly effect".] Surprisingly their processes are often simple, such as the logistic function, frequently used in biology and marketing. By way of contrast, the processes of random systems are always generate a sequence of completely independent events, but their tracks, especially those of cumulative realisations, may exhibit spurious trends and/or cycles.

Unfortunately with no agreement on definitions, how do we know a complex system when we meet one? The answer is, sometimes we don't! Indeed most of the 30 or so definitions of "complexity" and "complex systems" already "on the table" consist of a set of criteria in the form of dicta by eminent researchers. Although nearly all of these definitions "sound right", few of the criteria are quantifiable and many use undefined terms, such as "emergent properties" [24, 25].

The foregoing is not purely an academic matter. Failure to identify a system's pattern of behavior correctly or to anticipate changes in this pattern may not only cost one money. In the healing arts and sciences, the inability to "read" a track correctly can be a matter of life or death.

Given the foregoing, we provisionally define a complex system as one which has at least one nonlinear process which generates at least one output which exhibits at least four modes of behavior, within the time horizon of interest to the analyst. One mode should be chaotic,

another random and another trending. The other(s) may be biotic or periodic, for example, but not an exact Hamiltonion. Complexity is the study of complex systems so defined. (Biotic modes can be described by functions with at least one trigonometric argument.)

By comparison, other chameleon systems typically exhibit fewer modes. A weather system in the Aleutian Islands of Alaska will spend most of its time in a chaotic mode. A North Atlantic hurricane will spend most its time in a random or trending mode and the rest in a chaotic one [26-33].

The most interesting complex systems are also adaptive, evolutionary and have people as their participants [26-32]. Those CAE systems which meet our provisional criteria usually meet as well most or all of the criteria of popular dicta:

1) At a minimum, all that is required for a CAE system's "birth" is a critical mass of moderately rational participants with some characteristics in common, access to local information, a set of rules for their interaction and some positive feedback from their "decisions". This feedback may come from increasing returns to scale, networks, positive externalities or other factors.
2) Regardless of intelligence, participants often have limited information and/or face high incremental costs of information acquisition and processing. So for decision making, most of them rely on heuristics rather than fancy mathematical models. Their world is a far cry from that of the Walrasian auctioneer or that of the Neoliberal utility maximiser.
3) When the number of participants reaches a critical mass, they self-organise without any command structure or templates. The resulting CAE system may exhibit various levels of hierarchy, each with its own "emergent properties". These are properties which cannot be deduced from the characteristics of the participants, those of the adjacent levels or any combination thereof. Adam Smith's "invisible hand" is a classic example of an emergent property, including those frequent cases where a market does not meet Neoliberal standards for equilibrium and Pareto optimality [33-38].
4) A CAE system is likely to spend more time out of equilibrium than in it or near it. And being in equilibrium even may be dangerous to one's financial health! (Recall the US auto manufacturers on the eve of the first Japanese assault on their market share.) [23, 39]
5) The evolution of a CAE system reflects the complicated interplay of many different factors such as – chance events; co-evolution with its environment and/or neighboring systems; decreasing and increasing returns to scale; externalities; "lock ins" of infrastructure, institutions and/or technologies; nonlinear dynamics; path dependence; and "branch jumps" on the possibility tree, as when an economy based on herding discovers several large oil reservoirs on its premises.
6) As a result, multiple equilibria or none at all are possible, and the future of CAE system in the medium and long runs is more likely to be dominated more by events in the domains of uncertainty or by those which come "off the wall", than by those in the domains of certainty and risk.
7) As a result of the above, "best estimate" forecasting and the traditional planning based on it are "out". Scenario planning and periodic reoptimisation of capital improvement programs are "in". The most important people in the organization are not top managers but "antenna people", those who detect which scenario is unfolding, mutating or being replaced, especially if the replacement does not appear on the organisation's current menu of planning scenarios!
8) Strategically management must try to maintain its organization "in the zone of fruitful turbulence", wherein lie the greatest number of opportunities as well as threats. (An alternate metaphor "the edge of chaos" is used frequently in the literature, but we believe it is misleading, in part because it was derived from the study of chaotic, not complex systems.)

9) Organizational effectiveness will depend more on interaction between participants and on "bottom up" innovations than on the quality of the orders handed down from "above" by a management accustomed to command and control. In fact, a lot of knowledge will emerge out of interaction between the system's participants, rather than from specific participants or groups within the organization who claim to have certain "proprietary" knowledge. So leadership must be more indirect than direct. It must understand how the organization's functions in network terms and foster the right degree of and variation in "connectivity", between formal groups, informal groups and individuals within the organizational structure.

COMPLEXITY, DEVELOPMENT AND POVERTY

Very clearly complexity supports the current trends in development theorising and planning. The perception of murky futures and emergent properties unique to each CAE system, the stress on connectivity and bottom-up innovation, all clearly favor "custom made" development plans, flexibility in their implementation and a broad participation of the populace in both planning and execution.

The foregoing does not mean, however, that one should abandon all macro and intermediate-level attempts to help the poor. No development program can ever be the "rising tide which lifts all boats" but the right kind will certainly lift a lot of them. Minimum wages set by industry and judiciously jacked up from time to time, will certainly help many who are poor or close to it, maybe even more than the right to organize labor unions. And so on.

However, in a CEA-type economies, priority should be given to measures to eradicate poverty which are carefully targeted and which galvanize the beneficiaries into a fruitful interaction with each other and with the organizations providing assistance. The Puerto Rican program for Special Communities describe ahead is a good example of what we mean.

PUERTO RICO

The USA is a semi-federal, semi-national entity composed of 50 states, four jurisdictions under the direct control of the Federal legislature, two self-governing commonwealths and two associated republics. The Commonwealth of Puerto Rico lies between the Caribbean Sea and the Atlantic Ocean in the string of islands known as the Greater Antilles. The Island is 156 km long and 56 wide, with an irregular topography, 156 soil series and a subtropical climate. The great majority of its almost four million inhabitants of diverse ethnicities are US citizens, speak Spanish as their mother tongue, drive Japanese cars and travel frequently to the States, where several million of their descendents live. It also has 2,8 million vehicles, 40 000 retail stores, 2000 wholesale business and 1500 factories, more or less. Puerto Rico is a world leader in the manufacture of biological and pharmaceutical products. But it also makes a wide range of other products and has a large dairy industry and produces some of the best coffee in the world.

Personal income per capita for 2006 was estimated at $ 13 000, but the true number is probably closer to $ 17 000, due to underreporting. At 70 % of the latter, the median is $ 11 900, so given the cost of living, an estimate of 45 % or 1 776 000 for the number of people in poverty is probably close to the mark [40].

THE SPECIAL COMMUNITIES PROGRAM

Daughter of a self-made businessman, doña Sila María Calderón scaled heights of power and wealth seemingly beyond the reach of a woman of her generation, but never lost her conscience. Now retired, she not only was successful in business and public service but

became the first woman in the history to be elected first mayor of the capital, San Juan, and then governor of the Commonwealth 2001-2005. Starting as a private citizen with one poor "barrio", she developed the concept of special communities, extended it to 53 as mayor and then, as governor went Island wide with Law 1 of March 2001. Today there are 737 special communities in Puerto Rico with an estimated population of 488 000.

The basic ideas of this program are to [a] help people as members of their communities, not as atomistic individuals or families, and [b] simultaneously encourage them to take a leading role in the development of these same communities. This may be elaborated in terms of four principals: (1) the people of the communities should be empowered and learn to demonstrate self initiative; (2) they should be the axes of the planning and execution of their own development; (3) this development should be based on an alliance between the community, the enterprise sector and the various public sectors; (4) all of the foregoing activities should be thoroughly integrated.

To these four, the writer would add a fifth – the channeling into the special communities of public of private and public funds which would otherwise be expended for other purposes in the same municipality or for the same kind of purpose in another municipality. Needless to say, the fulfillment of this prinicipal depends heavily on the priority which the Governor gives to the program.

Community operations are the responsibility of an Office of Special Communities, reporting directly to the Governor. To date, the need to construct or rehabilitate 11 850 housing units has been identified, as has the need for 2005 civil works. As of May 2007, 9458 housing units had been completed, at a cost of $ 689 million, as had some 1600 civil works. The rest should be finished by December 2008. In addition, over 2000 community leaders had received a 30-day course, and some 4000 meetings of community councils had been held. This latter may not seem an achievement for readers who regard meetings as a wasteful, unpleasant duties, but it is quite a different matter for people who for generations have never had a say in their own destinies or any hope for the future.

Initial financing has been provided the by the income from a perpetual trust fund, created by a $ 500 million special dividend by the long-profitable Government Development Bank and by a $ 500 million loan from the Bank to be paid off by legislative appropriations [41].

This program has been subject to the usual problems caused by the complex coordination involved and by individuals and organization who don't do what they promise, don't do it on time or "all of the above". But there are also special problems such as those caused by jealous agencies or some of Puerto Rico's 78 mayors. Some have even tried to have the program abolished and the trust fund income transferred to the mayors or put to some other use. And some mayors want to expropriate community land without community agreement. So the success of this program very much depends on strong support by the Governor.

Reacting to criticisms of the program in the media, Carmen Villanueva, leader of the "Hill Brothers" Community in the municipality of Trujillo Alto, very much expresses its spirit: "Who among us has suffered from government bureaucracy? All of us. Who has not suffered from the problems caused by people without scruples? All of us. In this regard, nothing has changed – that contractors do not do what they are supposed to do, that public-sector employees steal money, that managers do not coordinate with others or do not pay attention to the requirements of the job. So what shows up in the newspapers is nothing new, but this may nevertheless hurt all who believe in social justice, by implying that the problem is the program, when it is not the program.

"The Office of Special Communities prepares a budget for each community and tells them: 'I

have the money. You decide how to use it.' It is an ambitious work plan which seeks to remedy [for example] 150 years of neglect in a community such as Tocones which never had asphalt on the streets and whose houses lacked storm drains, sewage pipes and electricity.

"If we talk about all that [the question naturally arises] – How much time do we need? I believe we are being dishonest, if we believe that this is a four-year job. It will take [most of] the time we left these communities abandoned, maybe 50 to 100 years [because] it is a project to create a new Puerto Rico. This is not about infrastructure. This is about creating a consciousness of belonging and [instilling in people] the power [of the belief] that you can do things yourself." [42].

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KOMPLEKSNOST SUSREĆE RAZVOJ – SRETNI SUSRET NA STAZI ŽIVOTA

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SAŽETAK

Još iz vremena prije Adama Smitha ekonomiste zanima razvoj. Međutim, rijetko su ga razumjeli ili mu psovetili dovoljno pozornosti. Na primjer, "linijski" ekonomisti poput Marxa u XIX. stoljeću i Rostowa u XX. stoljeću nastojali su razvoj uključiti uvijek u zadani obrazac. Od 1874. marginalisti i njihovi neoliberalni nasljednici naglašavaju komparativnu statičnost i stacionarnost, a ne razvoj.

Iako je nakon Drugog svjetskog rata nastalo mnogo ideja, nijedna se nije dokazala zadovoljavajućom. Neke od njih su smatrane univerzalnim rješenjem, poput slobodne trgovine, izravnih stranih ulaganja, uvozne zamjene, industrijalizacije i ulaganja u ljudske resurse, kao i različitih „višestrukih pokretača" čiji su neovisni učinci teško izdvojivi.

U međuvremenu, neoliberalna ekonomija polako je preuzela vodeću ulogu u nemarksističkom svijetu. Ali ona je izgubila svoju vjerodostojnost potičući besmislenu globalizaciju i niz ekonomskih, ljudskih i društvenih katastrofa. Zato danas razvojna ekonomija prolazi ponovno rađanje s konsenzusom u Barceloni, što uključuje uobičajeni pristup, višestruke ciljeve i održivost među vodećim postavkama.

Sretnom slučajnošću, nova disciplina nazvana kompleksnost počela se razvijati sredinom osamdesetih godina proščog stoljeća. Iz nje je nastao i novi pristup ekonomiji koji nije samo sukladan sadašnjem promišljanju razvoja nego također pruža korisne savjete u dizajniranju i menadžmentu razvojnih programa, uključujući i one vezane uz siromaštvo.

U međuvremenu, Portoriko primjenjuje novi pristup za iskorijenjivanje tog zla. Siromašne zajednice su identificirane, organizirane i učinjene odgovornima za preuzimanje vodeće uloge u koordiniranju vlastitog razvoja. Ta koordinacija pokriva ne samo projekte koje vodi zajednice nego i one sponzorirane vanjskim privatnim organizacijama i organizacijama javnog sektora.

Još se čeka na prosudbu takvog pristupa, ali začuđuje kako on vodi na više civilnog, ekonomskog i društvenog razvoja siromašnih nego raniji pristupi. A kao glavni čimbenik unaprijeđivanja, aktualni pristup je najusklađeniji s vizijom portorikanskog društva kao kompleksnog sustava.

KLJUČNE RIJEČI

kompleksnost, razvoj, međunarodna ekonomija, siromaštvo