The Importance of Being Catalytic – A Common Sense of Digital Diffusion

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ABSTRACT

This essay is a call to action - catalyze the diffusion of digital building blocks on national levels to improve quality of life. Blocks refer to the foundations - renewable energy, education, health, water, agriculture, communication, finance and infrastructure. It will be a loss for investors and waste of resources if we fail to adapt the blocks to the digital global economy. It is pivotal to provide paths for socio-economic growth by transforming imagination to innovation and social entrepreneurship. Rather than dwelling on Adam Smith\(^1\) it is imperative to serve the 21\(^{st}\) century markets\(^2\) without relinquishing human values or our sense of dignity. The philosophical\(^3\) assumption is that positive values\(^4\) may act as purveyors of civilization and dignity may be used as an instrument of goodwill.

INTRODUCTION

This is not a missive about welfare economics\(^5\), old or new, “frankness necessitates the regrettable admission that neither the old nor new welfare economics qualifies as sprightly conversation in the Dale Carnegie, the Oscar Wilde, or even the Oxford Movement sense” (Samuelson responding\(^6\) to work by Stigler\(^7\)). The author has limited\(^8\) exposure\(^9\) to the vast\(^10\) nexus\(^11\) of knowledge\(^12\) between philosophy\(^13\), justice\(^14\), social systems\(^15\), economics\(^16\), networks\(^17\) and information growth.\(^18\)

This is not a philosophical treatise\(^19\) either. The trigger to disrupt classical\(^20\) transaction cost\(^21\), seed innovation, re-structure\(^22\) investment to drive socio-economic development, social business\(^23\) and entrepreneurship\(^24\) was ignited by the numerical cleavage between the haves\(^25\) vs the have-nots.\(^26\)

Haves (left) vs Have-nots (right) – In 2000, top 2\% owned half of the total global wealth (reported in 2006). If that is correct then about 140 million people (assuming global population of 7 billion) owned half of the world’s wealth. About 15 years later, only 62 people (?) own half of the world’s wealth! Shall we extrapolate what might happen in the near term (2020) or medium term (2050)?
TREND DU JOUR

The deep abyss between the haves and the have-nots is getting deeper in bits and bytes, each day. It is not meant to be a facetious pun but an indicator of the reality of the digital divide. It pays to be cognizant of this vicious cycle and build bridges. The chasm between getting ahead and falling back is mired in economic complexity and we need a logarithmic scale to illustrate!

The tsunami of digital transformation must find roads to converge with ethical globalization without regions or organizations holding progress as hostage for petty ethnic protectionism. It is not essential to emulate any nation or subscribe to dogma or reach the highest bar as a proof of success. It is unwise to be cowered by security issues or public diffusion or its protection.

We can achieve significant strides by creating systems which can interact with, extract from or connect to the digital tapestry related to economic indicators, industry and business. The systems in question must have credible security and operate on a large scale (not the entire nation, at once).

System design must incorporate or integrate or include [1] the ability to analyze metrics relevant to emerging performance indicators, [2] tools to connect, communicate and network with ecosystems to foster interoperability [3] provide defined path for reproducibility, replicability and scalability, [4] operate at a sufficient scale to reduce transaction cost [5] provide public solutions to real-world problems (as opposed to “pilots” reflecting an outdoor experiment), [6] map to one or more global digital platforms [7] capability to twin with ecosystems to gain data/information transparency.

Foundational blocks (energy, education, health, agriculture, telco, SCM, finance, infrastructure) must align economic futures with the global digitization paradigm. It may improve oversight, efficiency, savings from risk pooling, supply chain optimization, reduce waste, enhance security and cybersecurity, spur new lines of social business, create new jobs and spark innovation.

It is prudent to avoid the utopian melodrama leading to autonomy or the dystopian role of AI when AI rules the world or similar gibberish advocated by glib individuals as disruptive. One may wish to learn the limitations of “disruption” and how that buzz word was fabricated.
TELLING A HAIR-RAISING STORY TO A BALD-HEADED MAN?

This essay is intended for leaders in global organizations, for example, The Bretton Woods institutions, Asian Development Bank, European Bank for Reconstruction and Development, African Development Bank and UN umbrella of agencies with influence over development. The author hastens to acknowledge and applaud the herculean tasks, in progress, without much fanfare, involving thousands of astute personnel at multiple levels, committed to lift many boats, globally.

The dimension that the author expects to add is the need to create – or at the very least provide provisions to create placeholders for – digital interfaces – when building infrastructure or investing in public goods. Digitization is not a panacea and one shoe doesn’t fit all. Digital transformation is a cacophony of ideas. It is difficult to extract creative and useful paradigms from the quagmire. But, the dreams of numerical instrumentation which started with the Abacus (circa 14th century) found its way through Ada Byron King and Charles Babbage (circa 1850) to reach the 20th century in the form of the Atanasoff-Berry computer (1939). Is the 21st century digital dream unstoppable?

The process to help nations (lagging behind the bleeding edge) to build infrastructure must avoid the dead weight of old technologies. It may be incisive to leapfrog development, when possible.

Mr Obama: And finally, what’s fascinating about African development is the opportunities that they have to leapfrog certain technologies and skip certain phases of development, and we are very good at the technologies that allow countries to potentially leapfrog development. So a classic example being in the telecommunications sector.

The Economist: They’re very good at doing mobile money, though, aren’t they? They’re much better at banking than —

Mr Obama: Well, when we were out the last time—I started in Senegal during my tour, and talking to small farmers about how they’re now getting weather reports, market reports, information on the latest seed technologies, all through their smartphone—those are the kinds of things that we excel at. And to meet a woman who started off with a small plot, who’s able to leverage that into a thriving—still small, but profitable operation, those are the kinds of things that I think we can do better than just about anybody else.

Hence, we must remain cognizant about (a) building infrastructure and foundations on which one may build bridges to digital futures and (b) seeking opportunities to leapfrog development. Thus, leaders must be cautious about status quo and include multi-disciplinary out-of-the-field team members to develop a sense of the future informed with imagination. The difficulty lies in not so much in developing new ideas as in escaping from old ones (Keynes). Executors and planners may wish to re-weigh formulas, balance hype and recognize the distinction (may not be true, always) between “planners” and “searchers” in quest of new roads, as discussed by William Easterly.

Easterly has, and still continues to point out, the difference between “planners” and “searchers” in economic development. “Planners” are those who believe they already know the correct policies, and can effectively implement them. “Searchers,” meanwhile, don’t have such concrete plans in place. As the name suggests, they instead search out different ideas, methods, and plans via trial and error.
The reality on the ground, nations seeking loans, grants and assistance from august institutions, may be driven by market, social and humanitarian needs and quagmire, which are pressing and depressing, respectively. It may leave little room for ideas, imagination and innovation from pontificating academics in face of the fire-fighting *modus operandi* which must be adopted to adapt and rise to the challenges. The feasibility of paving the road to digital transformation is a key fiscal constraint. Yet it behooves to be pointed out that the ability of digital tools to reduce transaction cost and usher competition is ultimately of socio-economic value to the customer or end consumer.

Having said that, one must hasten to add that pepperimg unprepared paths with digital tools devoid of secure integration\(^80\) planning\(^81\) may lead to a productivity paradox.\(^82\) Avoiding the latter may be prudent and a moral and ethical fiduciary responsibility for the grantor and grantee. Digitization must be viewed as a systemic change, albeit in phases and stages, which embraces the principles of systems engineering and pursues the digital on-ramp as general process technologies\(^83\) (GPT) to stimulate or accelerate total factor productivity (TFP). Hence, the need for metrics to measure TFP. Tempting as it may be, TFP is not a panacea. Metrics are not the last word on development. The well-worn aphorism\(^84\) "not everything that can be counted counts, not everything that counts can be counted" must be integrated with transaction cost analysis and the investment for public goods.

**NOT ANOTHER ROADMAP – EQUIP NATIONS WITH A COMPASS**

The suggestions below refer to various domains. Writing about them is easy. Even simple forms of digital design, connectivity and integration are immensely challenging to implement in a real world.

The grantee must be aware, informed and educated about trans-disciplinary confluence that future demands and how to grow markets\(^85\). That knowledge must be sufficiently reflected and included as digital footprints in their incisive vision. Concurrently, the grantee must adopt a strategic phased approach to adapt to funding decisions, if the vision may not be accomplished in one funding cycle.

The grantor must possess the spectrum to recognize cross-pollination of convergence and the penchant to transform vision into reality using the financial tools at its disposal. In parallel, the grantor may consult with groups devoid of commercial interest to optimize infrastructure and the foundation by planting digital pegs on the horizon, without succumbing to paralysis by analysis.

Creating a collaborative approach to employ a non-commercial team as an observer of digital progress may add credibility both at the discussion stage and during project execution phase.

Some domains may be slightly more pressing for immediate action than others. But, it is well nigh impossible to claim systemic progress, development or growth, unless most of these domains can rise up to similar levels of proficiency. The latter is catalytic to bootstrap symbiotic convergence.

For example, without energy infrastructure and significant access to energy at a sustainable cost, almost anything else is equivalent to polishing the chrome, without tuning the engine. The ROI from other investments will be sluggish without an energy plan. Similarly, however non-sexy it may be, the diffusion of education to empower long term growth must be a constant appendix in all funding decisions. Coordination of this piece-meal funding is pivotal to install robust systems which may avoid the mistakes, follies and political pitfalls exposed in *The Elusive Quest for Growth* by William Easterly. Support for credible foresight must be an integral part of the plan. The process must avoid myopia, must not inspire foreboding and aspire to reduce global socio-economic disequilibrium.\(^86\)
ENERGY – HOW TO INCULCATE THE EMERGENCE OF THE DIGITAL MITOCHONDRIA?

The bio-inspired quest by utility generators for energy homeostasis\(^8\) has evolved\(^8\) over time. The concept of mechanical mitochondria\(^8\) may segue to the digital mitochondria to manage “energy arbitrage” in the future. It seeks to combine layers of data, information and analytics which are a long way from the vision, design and operation\(^8\) of energy producers, distributors and consumers.

The induction of global economic oscillations due to energy\(^9\) and the status\(^\) of renewables\(^\) as well as the impact of carbonomics\(^\) on the environment\(^\) makes it a naiveté to pursue energy\(^\) as a scientific issue. The geo-politics of energy is inextricably linked to daily lives of billions\(^\) of people.

The leaps in energy density using nanomaterials\(^\) coupled with decreasing unit cost of solar PV\(^\) makes the combination attractive for mass deployment while queueing for hydrogen and fusion. Applicants for energy must be directed to these “green” investments\(^\) and coupled with the notion of mobility. For example, at the dawn of the 21st century we anticipated that an ordinary citizen may drive a vehicle to the home and plug it in the home to re-charge the vehicle. By the dusk of the 21st century it may be the norm that you drive your vehicle to the home and plug in the home to your vehicle to re-charge the home (storage).

The global grantors must drive the dynamic paradigm shift from the grid (locked) view of energy distribution to a mobile replenishment \textit{modus operandi}. Users must be weaned off the idea that proximity to the old world grid is a pre-requisite to access energy. Mobility eliminates these limits.

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The mobile nano-grid capable of dynamic reconfiguration may have the same impact as the invention of printing. Your poetry may be read wherever printed material could reach. One need not travel to the proximity of the poet or the novelist to enjoy excursions into fantasy or tales from the crypt. The Great Library of Alexandria may have been the next medium where Hypatia\(^\) could travel to access knowledge. The internet (and Google) changed the medium. Knowledge was unlocked, unleashed and unloaded on the world agnostic of location wherever people, atoms and bits could come together.

The mobility of energy coupled with the modularity of the medium is poised to offer advantages to communities and nations which are lagging in development. The task for global leaders is to design the future to prevent diffusion of infrastructure which harks back to the era of Thomas Alva Edison\(^\) (who also founded GE) and built the first grid in 1882 on Pearl Street in Manhattan, New York City.

Mobility and modularity enhances feedback\(^\) regulation\(^\) (control theory) and equips the system to sense, predict, load balance and maintain. The digital advantage offers micro-, meso- and macroscale data from monitoring consumption by device (micro), by units (homes) and regions (macro). On the supply side, the storage centers are distributed hubs which are modular due to design of batteries. The mobility of batteries (or other future receptacles) are not tethered to generation points or zones.

The freedom to produce, package, transport and access energy-on-demand, anywhere, anytime, is a Brahma-esque allegory. It is a metaphor\(^\) for the future of creation and progress of civilization. The iconography transcends cultural barriers. The symbolism is evident in the naming of the “Vishnu\(^\) Basement” which refers to Brahma, Vishnu and Rama schists in the Vishnu basement\(^\) rocks of the Grand Canyon formed about 1680-1840 million years ago as the foundational layer of the continent.
AGRICULTURE AND WATER

We may not need robots planting seeds but the ability to use drones\textsuperscript{109} to scan the health\textsuperscript{110} of crops may make the difference between food and famine. The measures\textsuperscript{111} adopted for food safety must be relative. It is good to explore but remain cautious to deploy efforts\textsuperscript{112} marketed by behemoths.

The ability to sense the critical elements for agriculture and ecological preservation (such as soil composition, water saturation, chlorophyll content) may be essential to protect the investments and prevent diseases.\textsuperscript{113} The task of feeding about 10 billion people circa 2050 may not be trivial.

Digital dividends for agriculture without education spells disaster. Access to education must be digital in order to enhance diffusion. Without communication infrastructure\textsuperscript{114} neither agriculture nor energy or education can pursue digital paths or harvest benefits from digital transformation.

Access to clean water\textsuperscript{115} and desalination are equally critical. Advances\textsuperscript{116} from nano-filtration\textsuperscript{117} and use of nanostructures for desalination\textsuperscript{118} and purification may be standard or structured as core\textsuperscript{119} investments, if appropriate. Digital tools for waste reduction, pollution monitoring and consumption metrics are to be considered standard in any water related investment or upgrade.
HEALTHCARE

Platforms for healthcare and education may be a part of the vision of the grantor which may be implemented when there are grantees seeking funding for these domains. Use of general platform approach augments collective standards and reduces re-inventing the wheel for basic public goods.

The problems in healthcare may not be the same or even similar but lack of access to healthcare may be common for a variety of developing and emerging economies. Human intervention in case of accidents and emergencies may not have digital representative solutions but the vast number of low acuity instances and preventive medicine may be well served using digital or remote tools.

Diabetes, cardiovascular ailments, respiratory disorders, kidney malfunctions, arthritis and osteoporosis are a few common ailments which may be predicted years in advance by using common assays and detection techniques from metabolomics. The mortality and morbidity due to these diseases may be reduced through remote monitoring. Access to mobile imaging and digital consultations will reduce cost if telecommunication infrastructures are widely available. It is wise to prepare for telecommunication tools such as 5G and 8K by outlining an integration path in infrastructure projects. Elderly citizens can live in their own homes. Their vital signs may be monitored and digitally “observed” if they are walking, sitting or falling, without any sensors on their body (using algorithms to detect patterns from the reflection of ambient radio frequency).

EDUCATION – THE DIGITAL COMPASS

Digital learning and online courses are tools waiting to be discovered and deployed in many parts of the world where education is still a light shining in obscurity. Plethora of digital formats makes it daunting to connect all the dots. The use of a few key platforms may be prudent to align the medium and focus on outcome and expectations. Diversity of opinions about the reach, range and results of online education are similar to TV in the 1950’s when TV was black and white, fuzzy and spotty, novel and uncertain.

The potential for digital diffusion to improve basic education, workforce development, job re-training and skills development, remains untested, unproven and perhaps still in unchartered territory. Yet the aspiration to reach the luminous summit is evident even if the evidence appears to be anecdotal but certain not apocryphal. For many nations it is essential to build foundation from ground up and for people to learn how to learn in order to adapt, un-learn and re-learn.

Grantors and grantees may wish to design education programs without discrimination and with help from credible individuals who may be scientists, engineers, economists, mathematicians, philosophers and historians. It will be an egregious error if grantors allowed schools of education to influence their plans (eg Gates) or sought advice from “used car” salesman (eg Zuckerberg). The schools of education are void of content, replete with buzz words and pedagogical changes championed by the schools of education are akin to rearranging the deck chairs on the Titanic.

The dramatic outcome from pushing out the envelope on digital education to the farthest corners of the world is that girls and women will get educated. Inclusion of women in the workforce may add as much as $28 trillion to the global economy, under optimal gender parity in the workforce.

The education of a boy may change the destiny of a man but the education of a girl can change the destiny of a nation.
TEMPORARY CONCLUSION

Kahneman\textsuperscript{138} and Tversky spurred a great deal of research by economists on systematic departures from rational behavior even if it appears that they may not\textsuperscript{139} have fully reconciled their work with the rational choice model proposed\textsuperscript{140} half century ago by Herbert Simon. Simon’s model in his 1955 paper substantiates the “rich gets richer” paradigm, albeit with minor\textsuperscript{141} modifications.

The issue in this article and this discussion concerns the diffusion of emerging digital tools.

One expects (?) these tools to catalyze the process necessary to stem the rapid progression of the extreme polarization of wealth (table below). In 2015, 62 individuals possessed half of the world’s wealth (as wealthy as half of the world’s 7 billion population, according to Oxfam Davos Report\textsuperscript{142}).

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<th>Year</th>
<th>2010</th>
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Digital diffusion calls for and advocates systemic insertion of “digital pegs” in basic public goods while promoting development and building capacity (infrastructure) in emerging economies. The rationale for digital advocacy assumes (?) that digital pegs may facilitate growth of digital diaspora which may, in turn, bootstrap the economies of the emerging nations to experience the dividends from the digital boom, concentrated\textsuperscript{143} in the hands of coastal elites mostly in US and few in Europe.

The single most crucial digital tool at our disposal is digital learning and digital tools for education. The single most crucial infrastructure tool is access to energy. The single most crucial economic foundation for advancement is healthcare that does not start with the patient but with the person. The single most crucial social fabric is the education of girls and workforce balanced with women.

It bears repeating, the education of a boy may change the destiny of a man but the education of a girl can change the destiny of a nation.

\textbf{Irrational Exuberance ?}

\textbf{How the cookie crumbles – Women on Street}

\textit{If you are thinking a year ahead, sow seeds. If you are thinking ten years ahead, plant trees. If you are thinking a hundred years ahead, educate the people} ● Kuan Tzu (circa 500 B.C.)
3. Every system of scientific theory involves philosophical assumptions - Talcott Parsons, 1949. Cambridge, MA
4. https://assets.aeaweb.org/assets/production/journals/aer/top20/53.5.941‐973.pdf
7. Every system of scientific theory involves philosophical assumptions - Talcott Parsons, 1949. Cambridge, MA
8. https://archive.org/stream/structureofsocia00pars/structureofsocia00pars_djvu.txt
27. http://isites.harvard.edu/fs/docs/icb.topic572311.files/Mon%2022%20June%201/Gerschenkron.pdf
30. http://yaleglobal.yale.edu/about/stiglitz.jsp
33. https://www.behance.net/gallery/37932461/TRUCK-FOR-AUDI
34. https://krebsonsecurity.com/2016/10/source-code-for-iot-botnet-mirai-released/
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