The Solow Paradox

By Sam Vaknin

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The PRODUCTIVE HARDWARE

The world is debating the Solow Paradox. Named after the Nobel laureate in economics, it was stated by him thus: "You can see the computer age everywhere these days, except in the productivity statistics". The venerable economic magazine, "The Economist" in its issue dated July 24th, quotes the no less venerable Professor Robert Gordon ("one of America's leading authorities on productivity") - p.20:
"...the productivity performance of the manufacturing sector of the United States economy since 1995 has been abysmal rather than admirable. Not only has productivity growth in non-durable manufacturing decelerated in 1995-9 compared to 1972-95, but productivity growth in durable manufacturing stripped of computers has decelerated even more."

What should be held true - the hype or the dismal statistics? The answer to this question is of crucial importance to economies in transition. If investment in IT (information technology) actually RETARDS growth - then it should be avoided, at least until a functioning marketplace is there to counter its growth suppressing effects.

The notion that IT retards growth is counter-intuitive. It would seem that, at the least, computers allow us to do more of the same things faster. Typing, order processing, inventory management, production processes, number crunching are all managed more efficiently by computers. Added efficiency should translate into enhanced productivity. Put simply, the same number of people can do more, faster, more cheaply with computers than they can without them. Yet reality begs to differ.

Two elements are often neglected in considering the beneficial effects of IT.

The first is that the concept of information technology comprises two very distinct economic activities: an all-purpose machine (the PC) and its enabling applications and a medium (the internet). Capital assets as distinct from media assets are governed by different economic principles, should be managed differently and be the subject of different philosophical points of view.

Massive, double digit increases in productivity are feasible in the manufacturing of computer hardware. The inevitable outcome is an exponential explosion in computing and networking power. The dual rules which govern IT - Moore's (a doubling of chip

capacity and computing prowess every 18 months) and Metcalf's (the exponential increase in a network's processing ability as more computers connect to it) - also dictate a breathtaking pace of increased productivity in the hardware cum software aspect of IT. This has been duly detected by Robert Gordon in his "Has the 'New Economy' rendered the productivity slowdown obsolete?".

But for this increased productivity to trickle down to the rest of the economy a few conditions have to be met.

The transition from old technologies to a new one (the computer renders many a technology obsolete) must not involve too much "creative destruction". The costs of getting rid of old hardware, software, of altering management techniques or adopting new ones, of shedding redundant manpower, of searching for new employees to replace the unqualified or unqualifiable, of installing new hardware, software and of training new people in all levels of the corporation are enormous. They must never exceed the added benefits of the newly introduced technology in the long run. Hence the crux of the debate. Is IT more expensive to introduce, run and maintain than the technologies that it so confidently aims to replace? Will new technologies be spun off the core IT in a pace sufficient to compensate for the disappearance of old ones? As the technology mature, will it overcome its childhood maladies (lack of operational reliability, bad design, non-specificity, immaturity of the first generation of computer users, absence of user friendliness and so on)?

Moreover, is IT an evolution or a veritable revolution? Does it merely allow us to do more of the same only in a different way - or does it open up hitherto unheard of vistas for human imagination and creativity? The signals are mixed. IT did NOT succeed to do to human endeavour what electricity, the internal combustion engine or even the telegraph have done. It is also not clear at all that IT is a UNIVERSAL phenomenon suitable to all climes and mentalities. The penetration of both IT and the medium it gave rise to (the internet) is not uniform throughout the world even where the purchasing power is similar and even among the corporate class. Countries post communism should take all this into consideration. Their economies may be too obsolete and hidebound, poor and badly managed to absorb yet another critical change in the form of IT. The introduction of IT into an ill-prepared market or corporation can be and often is counter-productive and growth-retarding.

The CYCLE OF THE INTERNET

Then, of course, there is the Internet.

The internet runs on computers but it is related to them in the same way that a TV show is related to a TV set. To bundle to two, as is often done today, obscures the true picture and can often be very misleading. For instance: it is close to impossible to measure productivity in the services sector, let alone is something as wildly informal and dynamic as the internet. It is clear by now that the internet is a medium and, as such, is subject to the evolutionary cycle of its predecessors. Central and Eastern Europe has just entered this cycle while the USA is the most advanced.

The internet is simply the latest in a series of networks which revolutionized our lives. A century before the internet, the telegraph and the telephone have been similarly heralded as "global" and transforming.

So, what should the CEE countries expect to happen to the internet globally and, later, within their own territories? The issue here cannot be cast in terms of productivity. It is better to apply to it the imagery of the business cycle.

As we said, every medium of communications goes through the same evolutionary cycle:

It starts with Anarchy - or The Public Phase.

At this stage, the medium and the resources attached to it are very cheap, accessible, under no regulatory constraints. The public sector steps in : higher education institutions, religious institutions, government, not for profit organizations, non governmental organizations (NGOs), trade unions, etc. Bedevilled by limited financial resources, they regard the new medium as a cost effective way of disseminating their messages.

The Internet was not exempt from this phase which is at its death throes. It started with a complete computer anarchy manifested in ad hoc networks, local networks, networks of organizations (mainly universities and organs of the government such as DARPA, a part of the defence establishment, in the USA). Non commercial entities jumped on the bandwagon and started sewing these networks together (an activity fully subsidized by government funds). The result was a globe encompassing network of academic institutions. The American Pentagon established the network of all networks, the ARPANET. Other government departments joined the fray, headed by the National Science Foundation (NSF) which withdrew only lately from the Internet.

The Internet (with a different name) became public property - with access granted to the chosen few.

Radio took precisely this course. Radio transmissions started in the USA in 1920. Those were anarchic broadcasts with no discernible regularity. Non commercial organizations and not for profit organizations began their own broadcasts and even created radio broadcasting infrastructure (albeit of the cheap and local kind) dedicated to their audiences. Trade unions, certain educational institutions and religious groups commenced "public radio" broadcasts.

This is followed by the Commercial Phase.

When the users (e.g., listeners in the case of the radio, or owners of PCs and modems in the example of the Internet) reach a critical mass - the business sector is alerted. In the name of capitalist ideology (another religion, really) it demands "privatization" of the medium. This harps on very sensitive strings in every Western soul : the efficient allocation of resources which is the result of competition; corruption and inefficiency which are naturally associated with the public sector ("Other People's Money" - OPM); the ulterior motives of members of the ruling political echelons (the infamous American

Paranoia); a lack of variety and of catering to the tastes and interests of certain audiences; the equation private enterprise = democracy and more.

The end result is the same : the private sector takes over the medium from "below" (makes offers to the owners or operators of the medium - that they cannot possibly refuse) - or from "above" (successful lobbying in the corridors of power leads to the appropriate legislation and the medium is "privatized").

Every privatization - especially that of a medium - provokes public opposition. There are (usually founded) suspicions that the interests of the public were compromised and sacrificed on the altar of commercialization and rating. Fears of monopolization and cartelization of the medium are evoked - and justified, in due time. Otherwise, there is fear of the concentration of control of the medium in a few hands. All these things do happen - but the pace is so slow that the initial fears are forgotten and public attention reverts to fresher issues.

A new Communications Act was legislated in the USA in 1934. It was meant to transform radio frequencies into a national resource to be sold to the private sector which will use it to transmit radio signals to receivers. In other words : the radio was passed on to private and commercial hands. Public radio was doomed to be marginalized.

The American administration withdrew from its last major involvement in the Internet in April 1995, when the NSF ceased to finance some of the networks and, thus, privatized its hitherto heavy involvement in the net.

A new Communications Act was legislated in 1996. It permitted "organized anarchy". It allowed media operators to invade each other’s territories.

Phone companies will be allowed to transmit video and cable companies will be allowed to transmit telephony, for instance. This is all phased over a long period of time - still, it is a revolution whose magnitude is difficult to gauge and whose consequences defy imagination. It carries an equally momentous price tag - official censorship. "Voluntary censorship", to be sure, somewhat toothless standardization and enforcement authorities, to be sure - still, a censorship with its own institutions to boot. The private sector reacted by threatening litigation - but, beneath the surface it is caving in to pressure and temptation, constructing its own censorship codes both in the cable and in the internet media.

The third phase is Institutionalization.

It is characterized by enhanced activities of legislation. Legislators, on all levels, discover the medium and lurch at it passionately. Resources which were considered "free", suddenly are transformed to "national treasures not to be dispensed with cheaply, casually and with frivolity".

It is conceivable that certain parts of the Internet will be "nationalized" (for instance, in the form of a licensing requirement) and tendered to the private sector. Legislation will be enacted which will deal with permitted and disallowed content (obscenity ? incitement

? racial or gender bias ?)

No medium in the USA (not to mention the wide world) has eschewed such legislation. There are sure to be demands to allocate time (or space, or software, or content, or hardware, or bandwidth) to "minorities", to "public affairs", to "community business". This is a tax that the business sector will have to pay to fend off the eager legislator and his nuisance value.

All this is bound to lead to a monopolization of hosts and servers. The important broadcast channels will diminish in number and be subjected to severe content restrictions. Sites which will not succumb to these requirements - will be deleted or neutralized. Content guidelines (euphemism for censorship) exist, even as we write, in all major content providers (CompuServe, AOL, Prodigy).

The last, determining, phase is The Bloodbath.

This is the phase of consolidation. The number of players is severely reduced. The number of browser types will be limited to 2-3 (Netscape, Microsoft and which else ?). Networks will merge to form privately owned mega-networks. Servers will merge to form hyper-servers run on supercomputers. The number of ISPs will be considerably diminished.

50 companies ruled the greater part of the media markets in the USA in 1983. The number in 1995 was 18. At the end of the century they will number 6.

This is the stage when companies - fighting for financial survival - strive to acquire as many users/listeners/viewers as possible. The programming is shallowed to the lowest (and widest) common denominator. Shallow programming dominates as long as the bloodbath proceeds.

In hindsight, 20 years hence, we might come to understand that computers improved our capacity to do things differently and more productively. But one thing is fast becoming clear. The added benefits of IT are highly sensitive to and dependent upon historical, psychosocial and economic parameters outside the perimeter of the technology itself. When it is introduced, how it is introduced, for which purposes is it put to use and even by who it was introduced - largely determine the costs of its introduction and, therefore, its feasibility and contribution to the enhancement of productivity. The CEE countries better take note.

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Conmathematical Resolution of Russell's Paradox by Dr Kedar Joshi

Russell's Paradox -

'A paradox uncovered by Bertrand Russell in 1901 that forced a reformulation of set theory. One version of Russell's paradox, known as the barber paradox, considers a town with a male barber who, every day, shaves every man who doesn't shave himself, and no one else. Does the barber shave himself ? The scenario as described requires that the barber shave himself if and only if he does not ! Russell's paradox, in its original form considers the set of all sets that aren't members of themselves. Most sets, it would seem, aren't members of themselves - for example, the set of elephants is not an elephant - and so could be said to be "run-of-the-mill". However, some "self-swallowing" sets do contain themselves as members, such as the set of all sets, or the set of all things except Julius Caesar, and so on. Clearly, every set is either run-of-the-mill or self-swallowing, and no set can be both. But then, asked Russell, what about the set S of all sets that aren't members of themselves ? Somehow, S is neither a member of itself nor not a member of itself.'

(See David Darling : The Universal Book of Mathematics, 2004)

Conmathematical Resolution -

The term 'Conmathematics' means conceptual mathematics (invented by Dr. Kedar Joshi (b. 1979), Cambridge, UK). It is a meta - mathematical system that defines the structure of superultramodern mathematics. It essentially involves a heavy or profound conceptual approach which is in striking contrast with the traditional symbolic or set theoretic approach.

Now conmathematically Russell's paradox is quite easy to resolve. The conmathematical resolution could be stated in just one sentence : As there is no barber who shaves every man who doesn't shave himself, and no one else, likewise there is no set of all sets that aren't members of themselves.

This sentence is justified or explained below.

Suppose there is a barber who shaves every man who doesn't shave himself, and no one else. Now the barber himself is a man and the supposition requires that the barber shave himself if and only if he does not ! This contradiction straightaway implies that the supposition is false. That is, there is no barber who shaves every man who doesn't shave himself, and no one else.

The justification of the sentence 'there is no set of all sets that aren't members of themselves' goes on similar lines.

Conmathematial foundations of mathematics, being very profound and deep, easily absorb shocks of such fuzzy paradoxes, where the set theoretical foundations need to be reformulated.

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