

RESPECIALISATION AND THE DEPLOYMENT OF THE ICT PARADIGM

An essay on the present challenges of globalisation

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Paper for the IPTS FISTERA Project

November 2005

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1. ICT SHAPING AND BEING SHAPED BY THE GLOBAL CONTEXT

The future of Information and Communications technologies (ICT) is inextricably intertwined with the future of the global economy and of each regional and national economy. This is because the core industries of a technological revolution are much more than a set of new products, industries and infrastructures to be added to the previously existing ones. Each technological revolution provides a set of generic technologies, infrastructures and organisational principles –a new *techno-economic paradigm*– capable of gradually modernising and increasing the productivity of the whole economy.

Therefore, the specific market opportunities in the ICT innovation space will be increasingly defined by the direction and intensity of growth in other industries, while innovation in all other industries and activities will be dependent upon the new potential, its characteristics and the associated capabilities.

Current biotechnology and nanotechnology wouldn't even be conceivable without the contribution of swift and massive data processing software and extremely precise computer-guided instruments. The trend towards customising chemicals and materials, which is rejuvenating what were mature industries, is made possible by computer aided engineering and simulation techniques. The same can be said about most innovations today, from products and process equipment in manufacturing to practically all the service industries, from finance to retail. Even the creative and craft industries are innovating with ICT, while shepherds and fishermen far from modern cities use digital satellite data for their daily work.

A similar situation ensued from 1908-13, when the mass-produced low-cost Model-T became the example that shaped the techno-economic paradigm of that revolution. Standardisation and assembly-line production were soon applied in one industry after another. The other core elements of the constellation, the internal combustion engine, coupled with increasingly efficient oil refining technologies, guided the revolution in massive transport from trains, ships, carriages, bicycles and horses to automobiles, buses, trucks and airplanes. Universal electricity fuelled by hydrocarbons led beyond industrial equipment to a whole range of household appliances destined to transform lifestyles radically. Petrochemical materials increasingly replaced natural fibres in the textile industry; they also tended to replace many natural materials, from rubber and wood to leather and even glass, in one use after another. Disposable plastics became the staple diet of the packaging industry and agriculture was transformed by oil-driven machinery and petrochemical fertilizers, pesticides and herbicides. In other words, for over half a century, oil-based mass production shaped the direction of innovation towards the energy and materials-intensive patterns of production and living that the Knowledge Society has inherited.

But the relationship is mutual. Technology shapes the economy as well as society and these, in turn, are constantly shaping technology, guiding its development and selecting within the potential it offers. The space of the technologically feasible will be filtered by the economically profitable and the socially and culturally acceptable as well as modified by market and policy developments (including inaction, as much as action, by the various social agents).

Thus, in the process of examining the future path of ICT, it is important to refer to the characteristics of the specific techno-economic paradigm and to the way they may be influencing the opportunities in other sectors of the economy. Equally useful is making reference to the regular patterns identified in the diffusion process of earlier technological

revolutions. Both these frameworks can aid in assessing the options and the viable paths for action, depending on the goals of the different actors at play.

This essay is meant to go part of the way in that task. It will summarise some of the relevant aspects of the *great surges model* presented by the author in *Technological Revolutions and Financial Capital*.¹ On the basis of that framework, it will argue that, though the role of free markets was crucial in the early decades of diffusion of the ICT revolution, their continued unrestrained and unguided operation can only aggravate the tensions inherited from the casino economy and the income polarisation of the 1980s and 1990s. It will propose that a conscious, policy-facilitated and consensus-driven process of respecialisation in the developed economies can be the most effective way to overcome those tensions as well as the instabilities generated by the present uneven globalisation of production.

The intention is to share some of the concerns and ideas for action that emerge from observing the present circumstances with the aid of a historical model of recurrence. As such it is a personal contribution to a debate about shaping the future, the need for which is becoming more acute as globalisation proceeds.

2. THE RECURRING DIFFUSION PATTERN OF REVOLUTIONARY TECHNOLOGIES

There has been a technological revolution every 40 to 60 years, beginning with the Industrial Revolution in England at the end of the 18th Century; each has generated a great surge of development, diffusing unevenly across the world from an initial core country. The analysis of the previous four great surges of technical change, reveals regularities in their pattern of diffusion that are enlightening for understanding the process of propagation of the present fifth surge based on ICT and can provide criteria for strategic and policy action.

Double nature of technological revolutions²

An important element of this recurring pattern is the double nature of each technological revolution. The great wealth creating potential provided by each of them stems from the combination of the new technologies, industries and infrastructures with a set of generic technologies and organisational principles capable of modernising the rest of the economy. The resulting best practice frontier is superior to the previous one and becomes the new common sense for efficiency – a new *techno-economic paradigm*– that defines the guidelines for innovation and competitiveness.

This paradigm will transform the whole economy and will gradually bring it to a higher productivity plateau. The propagation is highly uneven in coverage and timing, by sectors and by regions, in each country and across the world. Whatever its shape and rhythm, the complete process of diffusion of each new technological constellation and its techno-economic paradigm constitutes a *Great Surge of Development*.

¹ Perez (2002). Given that the two following sections introduce the main concepts of the model presented in the book, the reader will be referred to the relevant chapters or pages in each case.

² Perez (2002) Ch. 2

Table 1 The five great surges of development: Technological Revolutions and Techno-economic paradigms

<i>Technological revolution</i> <i>Core country</i>	<i>New technologies and new or redefined industries</i>	<i>New or redefined infrastructures</i>	<i>Techno-economic paradigm</i> <i>'Common-sense' innovation principles</i>
FIRST: From 1771 <i>The 'Industrial Revolution'</i> Britain	Mechanized cotton industry Wrought iron Machinery	Canals and waterways Turnpike roads Water power (highly improved water wheels)	Factory production Mechanization Productivity/ time keeping and time saving Fluidity of movement (as ideal for machines with water-power and for transport through canals and other waterways) Local networks
SECOND: From 1829 <i>Age of Steam and Railways</i> In Britain and spreading to Continent and USA	Steam engines and machinery (made in iron; fueled by coal) Iron and coal mining (now playing a central role in growth)* Railway construction Rolling stock production Steam power for many industries (including textiles)	Railways (Use of steam engine) Universal postal service Telegraph (mainly nationally along railway lines) Great ports, great depots and worldwide sailing ships City gas	Economies of agglomeration/ Industrial cities/ National markets Power centers with national networks Scale as progress Standard parts/ machine-made machines Energy where needed (steam) Interdependent movement (of machines and of means of transport)
THIRD: From 1875 <i>Age of Steel, Electricity and Heavy Engineering</i> USA and Germany overtaking Britain	Cheap steel (especially Bessemer) Full development of steam engine for steel ships Heavy chemistry and civil engineering Electrical equipment industry Copper and cables Canned and bottled food Paper and packaging	Worldwide shipping in rapid steel steamships (use of Suez Canal) Worldwide railways (use of cheap steel rails and bolts in standard sizes). Great bridges and tunnels Worldwide Telegraph Telephone (mainly nationally) Electrical networks (for illumination and industrial use)	Giant structures (steel) Economies of scale of plant/ vertical integration Distributed power for industry (electricity) Science as a productive force Worldwide networks and empires (including cartels) Universal standardization Cost accounting for control and efficiency Great scale for world market power/ 'small' is successful, if local
FOURTH: From 1908 <i>Age of Oil, the Automobile and Mass Production</i> In USA and spreading to Europe	Mass-produced automobiles Cheap oil and oil fuels Petrochemicals (synthetics) Internal combustion engine for automobiles, transport, tractors, airplanes, war tanks and electricity Home electrical appliances Refrigerated and frozen foods	Networks of roads, highways, ports and airports Networks of oil ducts Universal electricity (industry and homes) Worldwide analog telecommunications (telephone, telex and cablegram) wire and wireless	Mass production/mass markets Economies of scale (product and market volume)/ horizontal integration Standardization of products Energy intensity (oil based) Synthetic materials Functional specialization/ hierarchical pyramids Centralization/ metropolitan centers-suburbanization National powers, world agreements and confrontations
FIFTH: From 1971 <i>Age of Information and Telecommunications</i> In USA, spreading to Europe and Asia	The information revolution: Cheap microelectronics. Computers, software Telecommunications Control instruments Computer-aided biotechnology and new materials	World digital telecommunications (cable, fiber optics, radio and satellite) Internet/ Electronic mail and other e-services Multiple source, flexible use, electricity networks High-speed physical transport links (by land, air and water)	Information-intensity (microelectronics-based ICT) Decentralized integration/ network structures Knowledge as capital / intangible value added Heterogeneity, diversity, adaptability Segmentation of markets/ proliferation of niches Economies of scope and specialization combined with scale Globalization/ interaction between the global and the local Inward and outward cooperation/ clusters Instant contact and action / instant global communications

*Note:** These traditional industries acquire a new role and a new dynamism when serving as the material and the fuel of the world of railways and machinery

Source: Based on Perez (2002) pp. 14 and 18

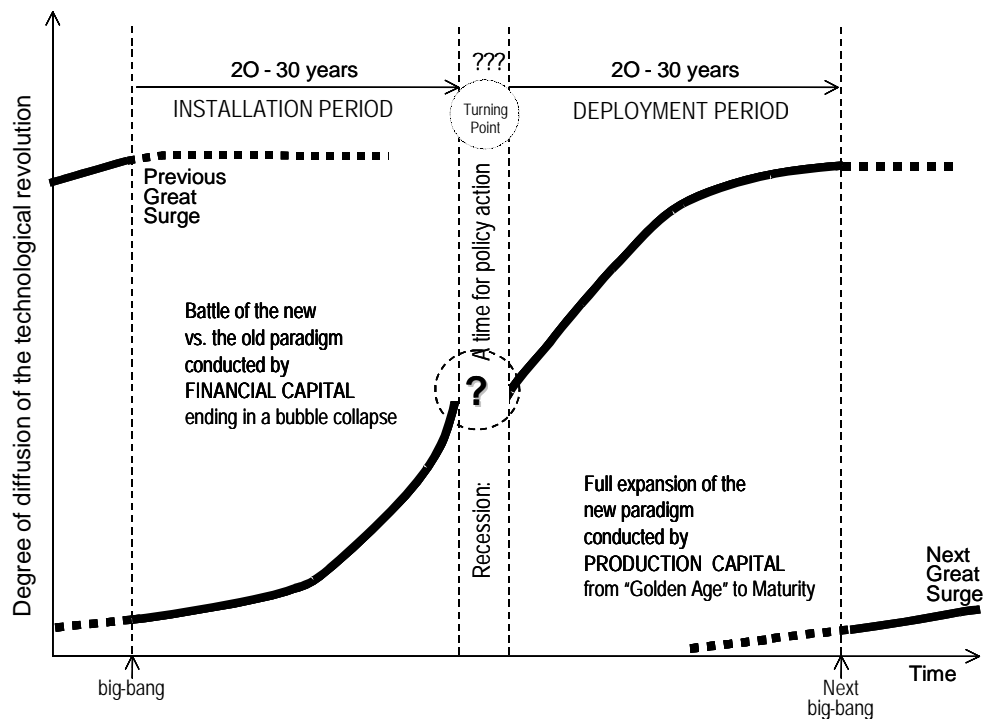
Table 1 summarises the elements of each of the five surges, indicating the core country or countries from which it is deployed, the date of the initial big bang –or initial breakthrough– that articulates the technological revolution, the main industries and infrastructures and the basic principles of each paradigm.

A similar sequence of propagation³

The other recurring element is the sequence of diffusion of each technological revolution in the core country. As shown in figure 1, the overall process of propagation takes the shape of the logistic curve characteristic of epidemic models, as does the diffusion of most individual technologies and technology systems. However, in the case of a whole revolution, the process is broken in two halves with very different characteristics.

Due to the depth of commitment to the previous paradigm –on the part of institutions, companies, individuals and the economy– the initial decades of emergence and installation of each technological revolution are a turbulent battle of the new against the old, involving Schumpeterian creative destruction both in the economy and in the institutional framework. That first half of each surge is the *Installation period*. It is after this battle against resistance has been won that the decisions are taken –through various social processes– as to the specific shape that the full flourishing of the new potential will take. This usually happens after the collapse of a frenzied bubble of intensified investment in the new technologies and infrastructures, which has regularly occurred midway along the propagation of each technological revolution: Canal mania, railway mania, the great booms in Australia, Argentina and other Southern countries, the roaring twenties and the euphoric 1990s.

Figure 1. *The social assimilation of technological revolutions breaks each great surge of development in half*



Based on Perez (2002) p.37

³ Perez (2002), Ch. 4

The following decades of diffusion constitute the *Deployment Period*; the “Golden Age” of each great surge, such as the boom after the Second World War, the *Belle Époque* at the turn of the 20th Century or the British Victorian boom in mid-19th Century. It is no longer a time of easy millionaires as during the bubble, but rather of increasing good feeling across a wider range of the social spectrum.

There are major differences in the characteristics of these two periods due to the relative roles and criteria of finance and production, which operate in capitalism as two distinct functions performed by two different sets of actors. During *Installation*, the economy is typically led by the short-term criteria of financial capital.⁴ Once the exhaustion of the potential of a techno-economic paradigm is approached, conditions are created for the articulation of the existing radical technologies into a technological revolution.⁵ Finance capital breaks away from the now mature and risk-averse production capital and goes in search of extraordinary profits backing the new entrepreneurs. The new technologies and industries can then flourish while the established ones are pushed to modernise (or are either destroyed as obsolete). It is the time when the new paradigm emerges and the old one needs to be “unlearned”. These early decades are marked by the emergence of innumerable new entrepreneurs out of which will grow the few new giants destined to become the engines of growth in the following Deployment period.

During *Deployment* the economy will once again be in the hands of production capital, now renewed and strengthened. The focus of attention will move from the stock market to the expansion of the world of production and employment, to growth and productivity as well as to its consequences in terms of wellbeing. It is such periods that have given rise to the term “golden age”. It is the time when the whole potential of the technological revolution and its techno-economic paradigm are deployed across the economy, led by the longer-term criteria of production capital.

Historically, *Installation* and *Deployment* have lasted around 20 to 30 years each, displaying deeply different characteristics.⁶ Between them, after the frenzied bubble at the end of *Installation*, there has been a lapse of uncertain duration (from two to thirteen years, the latter being the 1930s in the fourth surge), when the tensions left by the bubble need to be overcome. The way in which this is done and the direction taken by the institutional changes and policy decisions will shape the ensuing Deployment period. This lapse is the *Turning Point*,⁷ and those are the times the world is traversing now since the collapse of the NASDAQ in 2000.

The following section will examine some of the relevant characteristics distinguishing Deployment from Installation and the tensions that drive the shift from one period to the other.

⁴ The terms *financial capital* and *production capital* are used in the great surges model to represent the two complementary agents of the market economy: those that function by allocating or reallocating wealth in the form of money or paper assets and those that operate as generators of wealth by producing goods or services. For a full discussion, see Perez (2002), Ch. 7

⁵ For a discussion of why technical change occurs by revolutions, see Perez (2002) pp. 27-32

⁶ A figure with the approximate dating of the five surges and their periods can be found in Perez (2002) p. 57

⁷ Perez (2002) Ch. 11 and Epilogue

3. INSTALLATION AND DEPLOYMENT: DIFFERENT CONDITIONS AND BEHAVIOURS⁸

In the years preceding the first world war there were in common use among economists a number of metaphors ... 'Money is a wrapper in which goods come'; 'Money is the garment draped round the body of economic life'; 'money is a veil behind which the action of real economic forces is concealed'...

During the 1920s and 1930s ... money, the passive veil, took on the appearance of an evil genius; the garment became a Nessus shirt; the wrapper a thing liable to explode. Money, in short, after being little or nothing, was now everything...

Then with the Second World War, the tune changed again. Manpower, equipment and organization once more came into their own. The role of money dwindled to insignificance..

Pigou (1949) pp.18-19

In order to find the source of the significant differences between the two halves of each surge, it is important to understand the power of the techno-economic paradigm in influencing the behaviour of all agents in the economy, from engineers and managers, through investors and bankers, to distributors and consumers. In the process of Installation, the shared common sense of the new paradigm becomes embedded in the minds, in the actions and in the market behaviour of all the economic agents and rooted in the territory, lowering transaction costs through the infrastructural networks –of canals or railways, of telegraph or telephone, of ports and steamships or roads, airports and electricity or digital telecoms and internet. Further still, the whole institutional framework, from the forms of government policies, through the educational systems to the international trade and legal measures, the whole conditioning context for the operation of markets and for the styles of living and production is gradually made more and more compatible with the requirements for the full exploitation of the potential of that particular set of all pervasive technologies and their “common sense” paradigm.

When the potential of that surge is exhausted, the new one is articulated in circumstances that are unfavourable to it, because they have become over-adapted to the previous paradigm. That is why, it takes two or three decades of Schumpeterian creative destruction to demolish those obstacles and to prove the superiority of the new technologies and their capability to modernise the whole economy and increase its wealth creating capacities. Deployment is the relatively peaceful period after the battle has been won, when the paradigm has become common sense and all its advantages can be exploited, only to approach exhaustion in two or three decades and create conditions for the next revolution and the next turbulent installation period.

The basic differences

Since paradigms are all profoundly different, the battles waged to impose the new over the previous –both in the economy and in the minds and institutions– will be unique each time around. Nevertheless, with many caveats about its stylised nature, table 2 presents a set of features that, in general, can be said to distinguish the Installation and Deployment periods. History can never be put into neat and tight boxes, but the processes of abstraction that select

⁸ This section is based on Perez (2002) Chapters 8-12

aspects associated with deeper causal chains can provide useful heuristics for approaching the analysis of complex socio-economic processes. This whole section is written in that spirit.

Table 2. The different features of the Installation and Deployment periods

	INSTALLATION: From irruption to Frenzy Bubble collapse		DEPLOYMENT: From "Golden Age" to maturity
Main criteria for investment	Financial; short-term. Stock market focus; aim for rapid capital gains (with any sort of financial instrument)	TURNING POINT: Recession, instability and changeover	Long-term growth; production and market expansion. Search for dividends. Conscious of "fundamentals" and real long-term returns
Industry structures	Fluid, changing, unstable, constant challenges to incumbents; many participants		Increasingly stable; few firms (tending to form oligopolies). Successful business models identified; growing barriers to entry
Competition	Very intense, survival of the boldest: exploratory process; definition of dominant designs and best business models		Tempered by stable industry structures; battle for share of a growing market with dominant designs established
Innovation	Constant, both real and sham. Forced by investor expectations and by fierce competition Accent on supply-pushed new products and services.		Mainly real, in both products and processes; continuous improvement, driven by profit seeking and market expansion requirements
Productivity	Divergent by sectors and within industries. Natural consequence of the power of the new paradigm in the new sectors		Converging onto a higher plateau within and across sectors. Conditions for a conscious and successful drive to improve it in all sectors
Target markets	Very concentrated on top of the pyramid. Increasing sophistication		Wider and wider segments (homogenised or diversified depending on the paradigm); increasing functionality
Income distribution	Increasingly polarised: new rich, richer rich and poorer poor (persons, firms and regions)		Improving distribution; incorporating more and more layers and regions into prosperity
Social climate	Individualism; complacency of the rich; increasing resentment of the poor; violence brewing		Growing social awareness; increasing "good feeling" opening of opportunities for the excluded. Conditions for peaceful growth

Source: Based on Perez (2002), chapters 5, 8-10 and 12

The main criteria for investment initiate the table because they indicate the essential distinguishing feature of the two periods: the difference between the aims of financial and production capital, which are the leading agents in one and the other period. The criteria driving growth during Installation are those aimed at short-term quick gains through negotiating with paper assets. In Deployment, it is the accumulation of wealth creating power in the form of production capacity –be it railways or a fleet of steamships, of several major manufacturing plants or of thousands of experts organised in a service producing company. It is not the stock market index but the steady flow of dividends, together with the growth of production, employment and GDP that manifests the reality of that growing power.

The differences in industry structures and forms of competition are related to the exploratory mode in which all technological revolutions develop at first. It is market competition that determines the survival of the fittest. But once the process has resulted in defining patterns of production and consumption based on the new paradigm, Schumpeter's defence of oligopolies comes into its own. It is difficult to make and put into effect long term plans of investment, growth or R&D under cut-throat competition conditions.

Thus the approach to innovation will be different in the two periods. It will go from high-risk "technology push" to more demand-pulled innovation in products and services as well as to

greater attention to process innovation for accompanying market expansion.⁹ This will influence productivity, which during Installation changes very unevenly across and within sectors. During Deployment, as the paradigm diffuses more evenly across the production spectrum¹⁰ and the transaction costs of the whole economy benefit from the growing externalities provided by the infrastructure and better services, a synergistic process generates a more convergent trend towards higher productivity levels across the board.

Finally, the last three aspects indicated in the table are interrelated around a very important process that characterises the installation period: the polarisation of income. The extraordinary profits that become possible with each set of revolutionary technologies generate –with the intermediation of the financial agents of the period– a sort of whirlpool that gradually attracts all available money (from the host country or from abroad) towards those new technologies and to the geographic regions where they are developing.¹¹ This concentration in certain sectors and regions starves the excluded of investment funds (until they are forced to modernise with the new paradigm and join in, if they can). It also generates a centrifugal effect in the value of money separating the richer and richer asset owners from the poorer and poorer salaried and waged portions of the population. The latter are even worse off, given that some of the old industries have been made obsolete and eliminated by the new, while those that have survived are modernised through greater productivity and process changes, which lead them either to shed labour or to replace part of it with different skills (sometimes higher, sometimes lower skills, but often different from those of the incumbents).¹²

This polarisation of income will be at the source of the most important economic tensions and socio-political pressures that will have to be faced and overcome in order to unleash the deployment period.

Since the contrasts in innovation, target markets and investment criteria will be particularly relevant for discussing globalisation and respecialisation in the current paradigm, it is worth taking a closer look at those aspects.

Shift in Innovation and target markets

A regressive income distribution has a particularly pernicious and unexpected effect in relation to the direction of innovation. Increasingly, the solvent markets that are available to acquire and test the new products are those at the top of the income scale. This is the normal course of events in many consumer product industries and happens with most experimental products at all times. At first companies “cream” the expensive range, by aiming at the top of the income scale to get back some of the RD&E and introductory marketing expenditures. Then they move on to the wider markets with higher volume production and reduced prices.

⁹ This shift of focus was shown by Abernathy and Utterback (1978) in relation to individual technologies.

¹⁰ See an article by Hamm (2005) in *Business Week*, for an example of applying Toyota type methods for productivity increase in a service company doing outsourcing in India. This sort of cross-pollination of organisational models from sector to sector occurs also as personnel moves from one company to another and the new paradigm is increasingly socially assimilated.

¹¹ The process overshoots the mark and soon there are not enough projects to absorb the money coming to the feast. This leads to excess investment (canals or railways from anywhere to anywhere; dot com proliferation or unused fiber optics) but also and very importantly to the creation of other instruments that will artificially offer equivalent profits (futures, derivatives, pyramid schemes, and so on). It is this combination that generates the hyper-inflation of assets that is characteristic of the bubble.

¹² See Freeman and Soete (1997) Ch. 17

The problem is that if income is strongly skewed, as happens at Installation bubble times, then the wider markets are not available no matter how low the prices. This forces a high rhythm of innovation trying to force rapid obsolescence in order to convince the same high income consumers again and again. This happened in the 1920s with automobiles, radios and electrical appliances and in the 1990s with ever more powerful and smaller computers as well as with ever more versatile mobile phones. In both historical cases, though, markets for the new industries reached what can be termed *premature saturation*, as those top income layers of the population became less interested in having more technological gadgets or in once more upgrading the products they already possessed and began to turn to exclusive luxury goods and services (what Veblen referred to as “conspicuous consumption”¹³ writing during the Installation of the third surge).

From creating to spreading the new lifestyles

However, in practice, the concentration of income growth in the upper strata during Installation has two great advantages for the new producers: it provides markets ready and avid for experimentation with the new products and it gives the opportunity for setting the new standards and components of “the good life”. Both the products and the style of life that incorporates them will become the aspiration of the rest of the population. Prosperity is likely to depend on the expansion of the markets of the core industries of each revolution, since they will be the ones capable of serving as the engines of growth of the economy. But if institutional mechanisms to redress the income imbalances are not introduced, those wider markets will not develop.

One of the main features of the Deployment period is precisely market expansion, both due to the further reach of the infrastructure and to important modifications of the market context through the introduction of policy measures to facilitate market growth in the directions required by the paradigm.¹⁴

These changed conditions for the deployment period, will also modify the direction of innovation. Once the paradigm is established and the styles of life and main business models are more or less known, the core industries begin to make the transition from “supply push” innovation, of the sort that needs to create new markets by educating consumers and producers to a completely new way of functioning, to more of a “demand pull” model, where attention moves towards trying to fulfil consumer and producer’s needs by completing the new life and production styles with interlinking innovations or improving the ease of use of the existing products through complementary services and so on.

Thus, while Installation saw a strong concentration of innovation in the core industries and their surroundings –including the basic modernisation of the rest of the industrial structure–, Deployment will see a shift towards a wider range of innovation spaces while weaving a more harmonious and interlinked fabric of the economy.

The main innovation spaces are likely to be for new products, services, process technologies and business models:

- a. in the core industries (ICT in the current case), with further “user-oriented” applications for both producers and consumers

¹³ Veblen (1899)

¹⁴ For a further discussion of paradigm-guided institutional innovation, see Chapter 13 in Perez (2002)

- b. in the modernised industries, profiting from further applications of the new technologies and the new paradigm, changing their product profile and advancing their own technological frontier
- c. in what can be called the *induced branches* that flourish by supporting, complementing and interlinking the fabric of the new economy and
- d. in the radical new technologies that could become the next technological revolution

The last two merit special attention here, the induced branches because their importance for employment may warrant measures of directed support, and the radical new technologies – which in this case would be especially nano- and biotechnology– because the great surges model provides an interpretation of their role that can also be useful as an input to policy making.

Complementary role of the induced branches

The induced branches are a typical phenomenon of Deployment. They consist of all the activities that facilitate the functioning of business in the new conditions and the massive adoption of the emerging styles of life. In the mass production paradigm these induced branches were related to the intense agglomerations of the high-rise cities and to the sprawling suburban way of life; especially construction, retail trade and services. It could be inferred that in the ICT paradigm the induced branches may be linked around the requirements of the Knowledge Society and the global economy. Among the activities associated with the first would be education and training, intermediation in the use of the Internet, health, leisure and all the creative industries and services of what we could call “good taste” in food and decoration, which have become central aspects of the new style of living. Those in connection with the global economy are likely to include the systems of physical distribution of the objects of e-commerce and the environmental industries, among others. One important aspect of the induced branches is that they tend to absorb the layers of unemployed created by the higher productivity in the new or modernised industries.

Not all the induced activities imply innovation coming from R&D. They may be more of the organisational kind, perhaps in the form of new business models or they may involve design and creativity. What is very likely is that they will become active markets for the products and services of the engines of growth of the time. The “Laundromats” or the local food stores with refrigerators that accompanied the suburban living styles of the 1950s used electrical appliances and electricity services and served as test beds (and user training) for home washing machines and fridges. Something similar is likely to happen with the role of ICT in rendering efficient front end services of many sorts to people and businesses. What these new companies will certainly involve is entrepreneurship and risk. Given their probable role in creating employment, the mechanisms to facilitate their emergence can make an enormous difference for the rest of the economy and for the general welfare of society.

Gestation of the next technological revolution

The historical precedents allow an informed guess around some combination of biotechnology, bioelectronics, nanotechnology and new materials. As in previous cases, the future technologies begin –in what later is understood as a primitive form– in the midst of the dominant paradigm. They are shaped by it and at first depend on the type of markets it has created. Stationary steam engines were successfully used to move the locks of the very canals that steam powered railways would replace in the future. Semiconductors were profitably used during the mass production paradigm to make radios and other appliances portable and for the huge centralised mainframe computers. The companies that incorporated them in their

products were extremely successful, but no one could have imagined laptops, mobile phones, i-pods or even e-mail, without the major breakthrough of low-cost microprocessors.

These industries in gestation, in contrast with the induced branches, do increasingly rely on scientific research and are characterised by very high risks. They tend to require government –or private– subsidies in those costly early stages. It is thus crucial for both venture capital and governments to acknowledge that their rate of success is likely to be very much lower than that of any products of the current information revolution¹⁵ but also to recognise that successes can be extremely profitable and will be a welcome contribution to growth. In addition, the resulting alliances and connections as well as the efforts themselves will strengthen the required links and capabilities to advantageously participate in the surge that may irrupt two or three decades hence.

Shift in investment criteria

One of the most salient characteristics of the bubble economy at the end of Installation is the high rate of return in the stock market, be it in the form of capital gains when reselling stock or as returns on the many other forms of derivative investment that are typically invented –or reinvented, as Galbraith¹⁶ shows– in order to artificially spread to all financial investment the levels of profit obtainable in some of the core new industries. As in the 1990s, 1920s, 1880s-90s, 1840s and 1790s there is a “love affair” with technology and innovation, which almost guarantees high profits to investors in the new things even if the actual firms are not even breaking even or, in some cases, are still in the building process, as happened with many canals and railways. The dot.com bubble is perhaps the most extreme example of financial benefits without real productive backing. Many of the IPOs left the financiers with a huge gain and the entrepreneurs with a doubtful product and a company which could soon go bankrupt.

That casino atmosphere orients investment towards short-term gains and does not really engage the investor fully with the company whose equity is being acquired. Often in fact, given the aggregate nature of investment funds, many investors have no idea which companies their money is going to.

The collapse of the bubble usually brings back some sanity into the direction of investment while investors again seriously watch the so-called “fundamentals”, which somehow serve as indicators of the true health of the companies. An equivalent phenomenon is bound to take place in the practices of the publicly traded companies themselves. During the bubble, they are pushed to attain the unattainable: profits at the same level as in the core industries of the technological revolution quarter after quarter. They may attempt to achieve this by cutting personnel below what would be optimal or by selling assets or, if no legitimate means remain, then... by accountancy tricks and outright fraud.

Deployment, by contrast, sees investment become more sober and rational. The companies that emerged successful from the installation period invest to expand their scale of production and markets and to increase their productivity. The larger ones are likely to pursue mergers and acquisitions to stabilise markets in their industry and to occupy strategic territories to strengthen their competitive positions. There is a clear long-term view among decision-makers and innovation becomes a complement of such strategies.

¹⁵ See an assessment in Nightingale and Martin. (2004)

¹⁶ Galbraith (1990:1993) pp. pp.5 and 18

This switch in investment behaviour has a positive overall effect on the productivity performance of the economy, which is an issue of particular interest, not only in terms of potential growth and competitiveness but also because of its major influence on the capacity of a society to increase the economic and social welfare of its population.

The Turning Point as the space for the role-shift¹⁷

The discussion of the differences between the two halves of each surge opens the question of how the shift occurs between an economy led by finance capital and increasingly focused on the stock market and one where markets, expansion, full employment and growth take centre stage, with production capital at the helm.

It is precisely the tensions and instabilities that are the legacy of the frenzied bubble years that create the conditions for a shifting of roles, usually with the intervention of State regulation to control the excesses of finance, to counter its short-termism and to favour demand expansion and stable long term investment in production. That is the reason for the term *Turning Point*, referring to the tilting of the field away from favouring paper assets and towards favouring the flourishing of the real economy.

The world has been at that defining stage since the collapse of the NASDAQ in April 2000. The strategic and policy decisions taken to face its consequences by firms, governments and supra-national institutions will determine the way in which the potentials of ICT and its paradigm are deployed as wells the main trends in geographic and social distribution of production and wealth.

Positive legacy of the bubble: conditions for full expansion

Towards the end of Installation, in the midst of the bubble, the successful participants and their entourage celebrate the times as extraordinarily prosperous due to fundamental changes in the economy. In fact, on every occasion, the idea of a “new economy” has been advanced in different ways. In 1929, a couple of months before the crash, the so-called *Hoover Report* was at pains to argue against this widely held belief by showing that what was happening was nothing really new but only the intensification of pre-existing trends in the US economy. And yet, much of the report is dedicated to celebrating the newly achieved solid prosperity.¹⁸

Though the basic rules of the economy do not change during the bubble, by the time it collapses the economy is usually ready for the full flourishing of the wealth creating potential provided by the new paradigm. There is enough infrastructure for a decade or more (because bubbles are generally associated with overinvestment in the new networks), the new paradigm has been accepted as ‘common sense’, successful production, consumption and business models have been tested and copied, the winning companies in the core industries have become the new entrepreneurial giants and are ready to serve as engines of growth for the whole economy, while most of the old giants are rejuvenated. The new paradigm has been installed in the territory, in the economy and in the minds of the participants; the job of

¹⁷ Perez (2002), Ch. 11

¹⁸ Hoover (1929)

financial capital is done. It is time to rein it in and to hand control over to production capital. But that is easier said than done.

The Installation period led to those results through a process of massive credit creation¹⁹ that attracted, created and destroyed millionaires in the process of making the highly risky experiments required to define the trajectory of the technological revolution. The belief that those extraordinary profit levels are due to the free market itself (and to the entrepreneurial genius of the actors and investors in it)²⁰ rather than to the opening of a major new innovation space, is by then deeply rooted in the minds of most of the economic and political “elites”, but especially among the successful participants.

What prepares the terrain for accepting the policy measures that will achieve the shift and unleash the deployment period for the benefit of the many are the tensions inherited from the bubble period, which gradually become serious obstacles to growth, resulting in political pressures that may lead to a consensus about the need to overcome them. It is only by doing so that society can pursue the social welfare potential implicit in the higher levels of wealth and productivity attainable across the board with the new paradigm

Negative legacy of the bubble: three tensions making obstacle to growth

The building of the technology-spurred financial bubble generates very serious distortions of the economy, which involve three tensions that gradually intensify during Installation and become exacerbated with the bubble:²¹

Tension between the paper and the real economy

The first tension is the very essence of the bubble: a process of asset inflation in which the stock market (paper) values decouple from the real value of the companies they represent. Thus, rather than from dividends, profit gains come from reselling the assets or from participating in the many instruments (futures, derivatives, hedge funds or others) that are created in the casino economy that builds up during Installation.

Once the bubble collapses, this tension should disappear and the values should come back into line. The major losses bring the investors back to reality and the losers are likely to press for regulation. However, if the collapse is not big enough (as the author believes was the case with the NASDAQ in relation to the whole stock market) and/or if a healthy investment climate is not re-established after the bubble by an exemplary combination of punishment of fraud and “remedial” regulation, then the distorting influence of the financial world’s short-termism will weigh upon the economy and against growth.

At present, the CEOs of production companies find it extremely difficult and risky to embark upon long-term projects, not because of competition but because of the continued short-term profit pressures of the finance world.

Tension between the size and profile of effective demand and those of potential supply

The second tension occurs in the market and is the consequence of the polarisation of incomes. It means that as long as the strongly skewed income distribution remains, the

¹⁹ Perez (2004)

²⁰ Galbraith (1990:1993), pp. 20 and 95

²¹ Perez (2002), pp. 111-118 and Epilogue

potential supply of the products associated with the technological revolution will be disproportionately larger than effective demand. In fact, the range of products and services that are possible with each paradigm could cater to a much wider profile of users than those targeted during Installation. As was discussed above, this polarisation ends up in *premature market saturation*.

This tension however is not necessarily overcome by the collapse of the bubble. On the contrary, it can be exacerbated by it, because it effects major destruction of wealth in the most active section of a highly polarised market.

It generally has required government policies to begin redressing the balance by putting more money into the hands of middle or lower income consumers, be it through salary increases, job creation, tax policy, free education and health (thus freeing consumption income) or whatever redistribution measures, national or international, are appropriate to the specific paradigm. The Marshall Plan, established by the US to help rebuild Europe after WWII, did exactly that –together with the Welfare State– by expanding the markets that fed growth in the deployment period of the fourth surge.²²

In this particular surge, the outsourcing and off-shoring to China and India can be seen as a “miracle cure” for the advanced countries, especially for the United States. Not only do these practices reduce costs and lower prices to expand effective demand in the previously saturated markets, but also –and perhaps most importantly–these highly populated countries have become rapidly expanding markets in their own right.²³

As a result, the social problems at home can be ignored –and even increased through greater unemployment and downward pressure on salaries– while the paper economy can continue producing asset inflation (through housing bubbles, derivative mountains, hedge fund pyramids, etc.) and intensifying the income polarisation between the asset holders and the wage earners.

The political tensions between the poorer poor and the richer rich²⁴

This third tension is the inevitable social consequence of income polarisation. It is of a political nature but can have great influence over the course of the economy. The chasm between the richer rich and the poorer poor is not just about the profile of income distribution but about the direction in which that profile changes in time. What happens during Installation is a centrifugal process that gives a disproportionate share of the benefits of growth to those at the top of the income scale and leads to an actual worsening of the situation in the lower ranks of the scale.

Figure 2 serves to illustrate the sorts of processes that take place during Installation and Deployment. It shows the intense increases in the relative wealth of the top 0.1% of income earners in the US during the two Installation bubbles (of the 4th surge in the 1920s and of the current 5th in the 1990s), where this concentration reaches nearly 11%, while the moderation

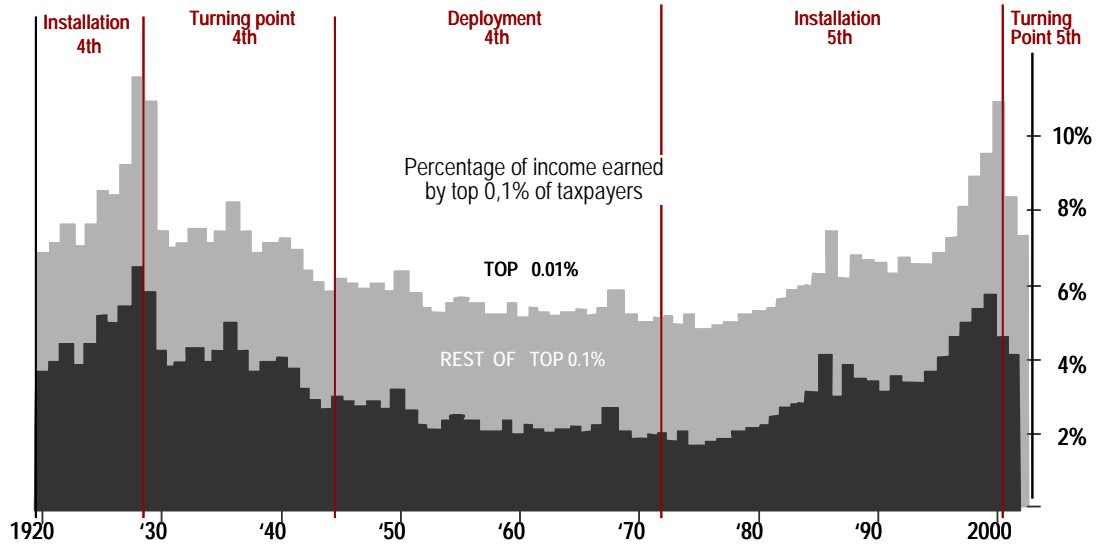
²² The European Union in the current fifth surge applied successful redistribution measures in the early period helping to lift Ireland and Spain as they joined. For an analysis of the consequences of abandoning that policy see Reinert and Kattel (2004)

²³ In addition, the reinvestment of the commercial surplus of China, Japan and others in the US financial markets, has created a virtuous cycle between the US and Asia that could turn vicious if something went wrong

²⁴ Tylecote (1985) called attention to the relationship between trends in income distribution and overall growth patterns.

down to below 6% in the Deployment period suggests a reversal of the polarising trend and an improving distribution.

Figure 2. Variation in the share of the nation's income earned by the top 0.1 percent of U.S. taxpayers 1920-2002



Source: Johnston (2005) in *The New York Times* (based on US Treasury data). See also Piketty and Saez (2003). The great surge period indications are by the author

This overall trend can also be seen in the behaviour of the Gini coefficients of inequality, which have risen during the Installation of the present surge in both advanced and emerging countries (with some interesting exceptions), while they had generally been decreasing in the previous Deployment period.²⁵

The phenomenon is partly due to the increasing disparity in the values of assets vs. wages and partly to the uneven spread of the new industries and to the equally uneven destruction of pre-existing industries and jobs brought about by technical change and intense, often cut throat, competition.²⁶

What Installation leaves in its wake is the resentment stemming from downward mobility in the face of affluence. The conviction that “my children will be worse off than I have been”, confronted with the conspicuous consumption at the other end, results in loss of hope and breeds anger, violence, problems of governance and an increase in the attraction power of messianic leaders who thrive precisely on intensifying that resentment.²⁷ There are also migratory pressures, as the most positive among the excluded run unimaginable risks to reach a place where –often accepting unacceptable conditions– they can hope for a better future.

²⁵ See the WIDER-UNU (2005) database on inequality and Atkinson (1997).

²⁶ See Freeman (2004). For the impact in the developing world see Palma (2005)

²⁷ As was the case with Hitler, Mussolini and others in the previous surge.

At this Turning Point, the phenomenon is of a global nature, both in terms of where it takes place and in terms of access to means of communication, information and transport. These can exacerbate the consequences as well as the reactions to them.²⁸ Whole regions of the planet have been excluded and allowed to descend to the levels they had forty years ago; other regions have been marginalised such as most of Latin America where there has been a reversal of many of the achievements of the 1960s and 1970s²⁹. But, through organised terrorism, the violence fed by global polarisation has reached the advanced countries too, while the internal income disparities have begun to surface in various forms of political rejection.

Free markets as intensifiers of the problems

Though Installation may indeed have created all the conditions for unleashing Deployment, it also resulted in these three tensions that can in practice turn into formidable obstacles to growth. Overcoming them becomes therefore imperative for society and for the economy.

What cannot be expected is to achieve this result by the action of the markets alone. Since the tensions are already the consequence of the free market, its continued unrestrained action will only make them worse. Left to themselves, free markets will continue taking production to China and India and feeding the housing, derivatives and hedge fund bubbles; they will continue putting pressure on companies to have high profits every quarter by whatever means and they will keep well away from the impoverished, within their countries and abroad.

This means that there is bound to be an increase in economic instabilities as well as in various forms of political unrest, from the anger of those losing their pensions (or their mortgaged homes in a bubble collapse) to outright violence from abroad or from within.

That is why such imbalances must be confronted through government intervention. Yet trying to halt globalisation is a self-defeating goal. The complex processes ahead need the action of free markets; no other agency could do the job. However, there is enormous scope –and need– for changing the context for the action of markets and reversing the conditions that may lead to further bubbles, through setting up an adequate institutional framework –in the current case, national, supra-national and global. Without such a framework, the growth potential already in place cannot be fully deployed and the present instabilities are likely to increase with possible catastrophic consequences.

4. GLOBALISATION, MARKET SEGMENTATION AND THE NATURE OF THE ICT PARADIGM

One of the basic features of this paradigm is the trend towards globalisation, which is a consequence of the characteristics and the potential of information and telecommunications technologies.

²⁸ See Kaldor (1999) for the emergence, across the uneven global scene, of what she calls “new wars”

²⁹ Palma (200?) about reversal of income achievements of 60s and 70s

It may be useful to make some parallels with the first globalisation in the third surge –from the 1870s to WWI³⁰– since similar features were present in the technologies. In both cases, the nature of the infrastructure facilitated –and indeed induced– global reach in those industries and activities that can most benefit from such world-wide externalities. In both cases, the opportunities were taken and investment from the centre led to significant leaps forward in faraway countries.

A look at the two globalisations

During the third great surge, the advent of cheap steel allowed the development of three infrastructural networks that made world markets a practical reality: trans-continental railways by land, rapid steamship transport by sea and global telegraph along the rails and by undersea cables.

The extraordinary possibilities offered by these communications technologies opened the markets of the North to counter-seasonal Southern hemisphere products. Refrigerated ships (using ice blocks from the Antarctic, for instance) facilitated developing Argentinean and Australian wheat and meat production for the world markets, while they could bring locomotives, steels rails and other equipment on the way over. And once those railway and sea routes were established it was easy to use them for other products in both directions and to incorporate neighbouring countries: New Zealand, South Africa, Chile (first exporting saltpetre as natural fertilizer and later copper for electrical networks) and others.³¹

Much of the early development in railways and ports in these countries was organised by the local governments and financed by the City in London, which gradually also organised the raising of equity funds for private projects, often promoted by foreign companies.³²

In that case, the bubble economy developed mainly in these emerging countries or in relation to investment in them. The Baring crisis of 1890, for instance, related to their investments in Argentina but practically brought down the whole British stock market.³³

What is important for our purposes is that the provision of major externalities for the formation of global markets led, in fact, to worldwide mobility and price competition for agricultural and meat products and influenced the location of production and the expected productivity levels. Meanwhile, international cartels and/or giant multinational firms were forming in the control of the infrastructure and in the basic materials industries, such as oil, steel, copper and others.

Another aspect of interest to note is that though Britain was the unquestionable leader of that globalisation, with the Gold Standard, the Bank of England and the Stock Exchange as the centres of global finance, it failed to complement that global drive with equally intense investment at home in the core industries of that revolution: chemistry, electricity and steel. By contrast, the US and Germany did concentrate in those industries while they also

³⁰ There is an overlap of about ten years between the third surge and the fourth, which begins in the US rather than Britain with the model-T in 1908. Perez (2002), p. 56

³¹ Wells (1889:1893), Hobsbawm (1987:1989)

³² A major study of this period is Davis and Gallman (2001)

³³ Powell (1915:1966) p. 522

participated in the globalisation process. These two countries ended up forging ahead of Great Britain.³⁴

Historical parallels do not lead to predictions; every paradigm and every set of circumstances is unique. They merely provide a useful frame of reference which points to aspects that may merit attention when analysing the corresponding period in another surge. The experience of the third surge shows that a powerful set of technological and infrastructural conditions facilitating worldwide expansion can function as an irresistible driver for global investment and trade. It gives a precedent showing that some well-endowed countries with appropriate policies can experience intense processes of catching up or forging ahead in connection with globalisation and the new technologies. It may also serve to warn that building finance-based empires abroad while neglecting advanced production investment in the home economy could later bring very unfavourable consequences.

The ICT paradigm and globalisation

The bottom row in Table 1 above, briefly summarised the main features of the current paradigm, shaped by the requirements and the potential of the Age of Information and Telecommunications. As tends to be the case, they are a coherent set of mutually reinforcing principles. *Knowledge capital and intangible value added facilitate heterogeneity, diversity and adaptability.* these in turn lead to -and interact with- the *segmentation of markets and the proliferation of niches.* Globalisation leads to the *interaction of the global and the local,* both in terms of comparative advantages for production and innovation decisions and in terms of adaptability of global products to local markets. Production is then conceived in a complex range that may go from “mass customisation” achieving *economies of scope and scale* to multiple niches geared to attaining *economies of specialisation.* These complex production and market profiles are achieved through *decentralised integration* and *network structures,* which characterise the organisation of giant global firms across the planet. Such complexity is made possible and efficient by the ease of *instant global communications,* allowing *instant contact and action.*

Still, the question may arise as to why globalisation should be inevitable. The answer is that reaching for giant global markets is a direct consequence of applying and taking full advantage of the potential and characteristics of information and telecommunications technologies (ICT). Intangible products, not only recognise no physical frontiers by travelling instantly and invisibly through communications channels, but also have no marginal cost (or it is negligible) and no structural limit to market growth. Yet they often have high research and development investment. Moreover, the greater the number of users of a particular network or product the greater its value and the lower the price of it can be, while maintaining growing profitability.³⁵ Such features provide a very powerful incentive to overcome the limits of any national market, no matter how large.

In terms of the size of firm that can be accommodated, ICTs offer coordination capabilities that go well beyond the maximum size that the old international or transnational corporations were able to achieve with their pyramidal structures. Not only is it now possible to guide,

³⁴ For a discussion of this issue see Freeman and Louçã (2001) pp. 248-256

³⁵ These changes are the real nature of the “new economy” and not an everlasting bull market, as many believed in the late 1990s. See Soete (2000) about the new economics of the new economy and Kelly (1998:1999) on the “new rules” governing market behaviour in the ICT industries.

monitor and control a truly giant organisation when it is networked, but territorial coverage and organisational complexity are relatively easy to handle with ICT and are likely to become much more so with further adaptive innovation. The technology itself is all-pervasive and can be incorporated into the most sophisticated processes for biotechnology, nano-technology or space travel as much as into the most traditional production systems, from global geo-positioning of sheep to information about fishing conditions for small fishermen.

But the maximum size of market for intangible products is defined by how far and how deeply the possession of adequate hard and software and the existence of communications links has reached, both socially and geographically. This means that hardware and telecom networks penetration are the true market frontiers for the ICT industries, rather than the digitally transparent territorial ones. The reach of such networks also constitutes the frontier of the “global” economy.

Thus, in relation to the size and scope of global firms, the logic of the potential leads toward assessing the whole planet for comparative advantages and estimating production, transport and transaction costs “as if” the economic space were unlimited and –through investment in the ICT infrastructure– making sure that it is so.

In this respect, it is interesting to note that out of the ten forces that Tom Friedman identifies as the triggers of globalisation (or, as he says, of the flattening the world), nine are either major ICT innovations or business behaviour changes based on ICT. Only the fall of the Berlin Wall is outside those categories.³⁶

ICT and the hyper-segmentation of markets: Outsourcing and off-shoring

Precisely because of the nature of ICT and the sort of flexibility it facilitates, globalisation is not necessarily about moving whole industries or companies to other countries, but rather about disaggregating them and relocating the segments. Seen from the point of view of a global corporation, as is well known, the process involves disaggregating the business into processes and these into ever more precise activities in order to assess their requirements, decide where each would be most efficiently and profitably performed and then finding the most effective ways of coordinating the resulting complex network that would span a good part of the planet, with infinitely varied nodes and many different types of links.

These outsourcing practices take place within the countries of origin and across frontiers and they multiply the opportunities for specialised micro-, mini-, small and medium firms, to perform activities that range from the most sophisticated R&D projects to cleaning services or call centres. They also represent a source of market growth for the ICT industries. Both the disaggregated activities themselves and the links between them and the rest of the value network are almost certain to make intensive use of ICT to maximise efficiency and minimise transaction costs.

Yet the industries that are being so disaggregated are at the same time catering to what are becoming hyper-segmented markets. The new potential for diversity and adaptability is dividing all industry markets in a kaleidoscopic fashion, where the bottom segment (which is the bulk of production in terms of volume) is the standardised, low price, narrow-profit-margin part of the market. Above it, there are the medium range segments gradually differentiating through innovation and/or brands, all the way to the splintering of the topmost

³⁶ Friedman (2005) pp. 48-172

range into multiple high-value specialised segments, adapted to specific sets of users and following their preferences. And this applies as much to what used to be considered commodity markets, which were primary sector raw materials, through manufacturing, to services. “Boutique” specialised steels are not commodities, whereas standard desktop computer components and call-centre services definitely are (see examples in figure 5 below)

This new potential for upgrading raw materials, not by fabrication but by achieving special qualities that will command a premium –and more stable– price, is seen by Kaplinsky³⁷ as an important window of opportunity for producers to escape the vulnerability of most raw materials markets.

At the meso level, this diversity dimension leads to diversified industry structures, where certain segments can be “sold-off” to a company in a country with decisive comparative advantages for that segment; others can be kept as core activities of the large corporations, while others may become the province of truly specialised small companies. There are likely to be redefinitions of traditional industries, either by major splits or by technology-induced merging of previously separate industries. There are, for instance, growing segments of the textile industry that are producing highly specialised materials for sails or extreme sports, which increasingly separate them from their traditional industry base and incorporates them into the networks of the sports equipment industry.

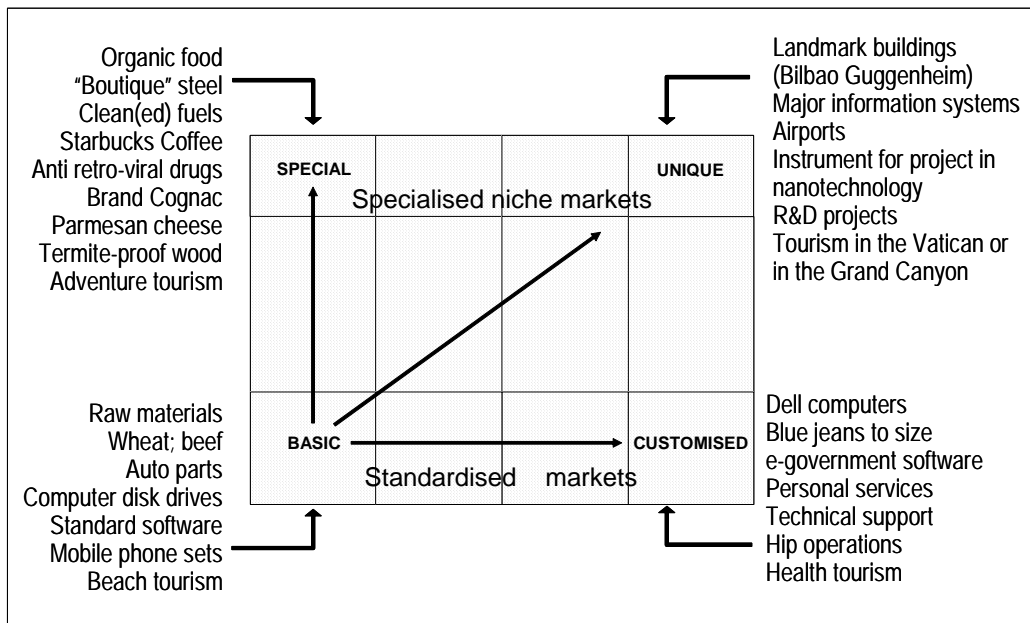
One can further analyse the process by distinguishing diversity from adaptability. The latter could be defined as front-end customisation. It involves catering to the specific demands of each individual user. In that sense it would seem to be the opposite extreme of mass commoditisation. And yet, such products as Dell computers and “made-to measure” blue jeans are adapted to each user but made from commodity components. It is what has been called “mass customisation”.³⁸ It also includes such products as SAP information systems, which make customised packages for companies on the basis of a set of standard modules or many software packages such as those for e-government functions, which also take advantage of the economies of specialisation and experience acquired in previous similar projects for other functions or other governments. At the other extreme one could find the Bilbao Guggenheim as a unique product designed by a uniquely qualified architect or the airport of a major city or perhaps a specialised instrument for use in a new nanotechnology product or any R&D project requiring experts, but also products that, though being in a traditional industry are unique in themselves, like tourism in the Vatican or boating in the Grand Canyon. In between, there are the many services that require personal contact with the client and/or the premises, such as the installation, maintenance and service front end of many products. The modular furniture to build a beautiful kitchen may be manufactured at a great distance, the actual design for the particular kitchen could even be done by Internet, but the transportation and the installation can only be done in place. This sort of case will become more and more typical of many complex products for both businesses and consumers.

It is important to note that what opens the possibility for developing niche markets and customised products is the shift towards intangible value characteristic of the ICT paradigm. Both the creativity that leads to differentiation and the special services that accompany the specialised or customised product or service are part of the general trend towards privileging intangibles as sources of value. During the mass production paradigm neither the market nor the transport conditions favoured relatively small quantities of any good. Constant innovation

³⁷ Kaplinsky (2005)

³⁸ Davis and Pine (1992)

Figure 4. Some examples of products in different market segments



5. THE CHALLENGE OF RESPECIALISATION IN A GLOBALISED WORLD

The policy dilemmas and the way forward

The process of globalisation has been both made possible and strongly induced by the potential and characteristics of the revolution in information and telecommunications technologies. In the early stages, from the 1980s it was mainly a question of tearing down all barriers to trade and finance. This in itself radically modified the map of world production, but it is only since the mid-1990s, and especially since the turn of the Century, that the real process of production globalisation has been taking place, though increasingly concentrated in the massively populated low-cost conditions of China and India.

At this stage, the advanced countries find themselves in a sorcerer's apprentice situation. The bigger and stronger the national corporations become by globalising, the greater the potential trade deficit, the more domestic unemployment problems this threatens to generate and the more unstable the economy becomes at home, while it is increasingly dependent on decisions taken abroad.

Neither free markets left to themselves nor setting up tariff protection can provide a sustainable solution. The former would ignore the unemployment problems in the advanced world and lead to serious political problems; the latter would bring loops of retaliation with unpredictable consequences. The only real solution is to lift all boats by moving globalisation forward to encompass more and more countries while also intensifying investment at home. This will open the space for growth by increasing demand and markets for all (while reducing the twin threats of violence and migration). Such a process supposes the respecialisation of the advanced countries, which is likely to require building a consensus vision involving

business, government and society around a set of promising opportunities aiming at full-employment growth.

There are at least three forces creating opportunities for successful respecialisation in the advanced world, all within the conditions facilitated by the ICT paradigm:

1. The increasing segmentation of each industry's market space
2. The "push" from globalisation
3. The "pull" from culture and quality of life at home

Let us take a look at the possible effects of each.

Global redistribution of market segments in all industries

This process induces the positioning and repositioning of each company (and also of each region and country) in those segments where they have advantages of one sort or another.

The present "migration to China" does not mean that all of manufacturing will be globalised and the advanced countries will have "hollow corporations". The process of segmentation of all industries into commodity markets at one end and a proliferation of specialised niches at the other, will lead to a global distribution of segments tending to have the bulk of commodity production in the less advanced countries and the bulk of specialised niche production in the more advanced, with several countries in between (though every country is likely to have some proportion of each).

It should be clear that even in the mass production world of the post-war golden age, both the US and the main European countries produced the bulk of their domestic automobiles, but for the truly high end luxury or racing and sports car segments it was Europe that kept the expertise (Mercedes, Rolls Royce, Porsche, Aston Martin, etc.). Something similar happened in relation to motorcycles, where it was Harley Davidson, the US firm that supplied the super-specialised top end of the market.

In the present conditions, one can expect that most commodity segments of the fabricating industries will tend to go to Asia, those of the resource based process industries, are likely to go to Latin America, Russia, and other resource-rich countries. But each of these industries has a whole range of specialised segments, from those with medium complexity to those of very high complexity and customised. What is likely to happen is that the emerging countries will make every effort to climb up to higher value products and will succeed in some of them. This would leave the bulk of the higher end products with the more advanced countries and a certain proportion of them scattered in the rest of the world.

There is also likely to be an "80-20%"⁴⁰ distribution of the value chain in most industries: Coordination, R&D and design would tend to be mainly (but not only) in the more advanced countries; production would be mainly in the emerging countries, whereas the front end of distribution, technical services, maintenance and customising would be in each country in proportion to its consumption.

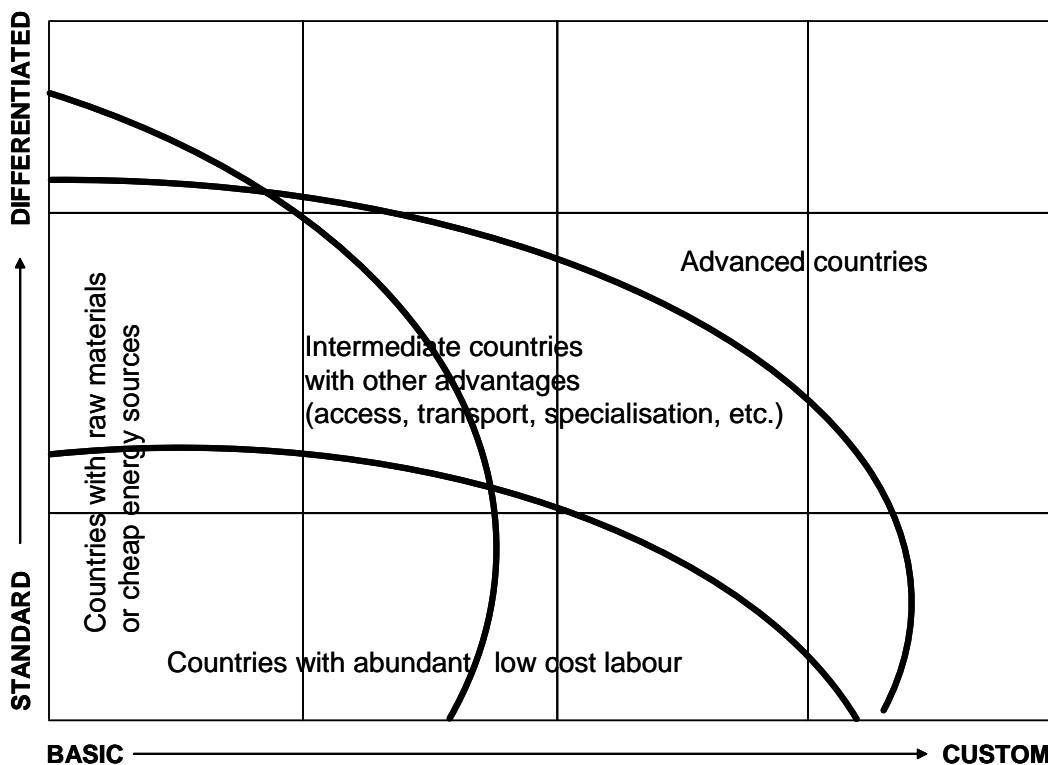
As mentioned before, the present obvious advantages that China and India have with significantly lower labour costs will be partly self-defeating through increasing the cost of

⁴⁰ This use of percentages is simply a convenient way of expressing a strongly skewed distribution, while trying to distinguish between 60-40, 80-20 or 95-5%

raw materials and transport. This will gradually tend to require coordinating the *redistribution* of manufacturing across the planet (looking for proximity to raw materials and markets in those products that warrant it) in order to optimise overall costs. Such a process will open opportunities for the many “middle countries” whose labour costs are much lower than in the advanced countries but not as low as in China and India; who possess some highly skilled labour or access to crucial raw materials (for particular products) or to energy supplies or are close to important markets and have good transport systems.⁴¹

Figure 5 presents a hypothesis about the way that markets could eventually be distributed by type of country or region in a process of respecialisation. It suggests that global distribution of production may be more by type of segment than by type of product. Each country or region would tend to cover a much wider part of the spectrum than its segments of specialisation would indicate, but in smaller relative proportions. This wider range not only stems from the natural preservation of traditional strengths, but also takes into account the complexity of innovation systems. To specialise in niche agriculture without biotechnology or in the bulk segment of chemical industries without the capacity to build basic process equipment would make little sense.

Figure 5. Possible trends in the global distribution of the hyper-segmented markets of each industry



⁴¹ The location of a significant part of European automobile “off-shoring” in Eastern Europe already announces that trend

Challenges and opportunities from “global push”

The globalisation process, by its nature, generates challenges and problems which turn into growth opportunities

Global distribution and transport: Global dispersion of production for maximum cost efficiency plus the proliferation of e-commerce demands an urgent increase in the efficiency of global distribution, massively and door to door. The productivity of distribution is at present very low (while it is labour intensive and its energy costs are high). New systems of packaging,⁴² transportation by various means and distribution will become an increasing proportion of the local, national and global economies.

Global coordination: The more complex the globalised networks, the more they will need various forms of coordination and management: supply chains, specifications, compatibility, research and design, global marketing, distribution chains, data sharing and storage, security, etc. This will in many cases be one of the main tasks of global corporate headquarters, but it will also be the object of service contracts from different parts of the world and one of the core services of independent networks. The latter could become the business model for strengthening the competitiveness of individual exporters all over the world.⁴³

Major engineering: The more that globalisation advances across the world, the more engineering will be necessary to design and build infrastructures, from basic highways, electric utilities, oil ducts and transport systems to bigger projects such as hydroelectric dams, satellites, oil refineries, water treatment plants for growing cities, bullet trains, major bridges and tunnels, intelligent buildings, major airports, automated port facilities, etc. Significant innovations in vastly superior transportation systems are likely to become an indispensable feature of a globalised economy.

Global contracting: The various processes related to global contracting are becoming more and more complex and will require specialist support, among them: organising bids and evaluating proposals; locating potential suppliers or customers and assessing relative advantages; evaluating the relative advantage of alternative locations; negotiating, preparing, applying and/or analysing contracts; monitoring commitments and projects; doing arbitrage in conflicts and many other similar or related activities.⁴⁴ This is already a big part of what big global corporations do and their demand for such services will grow. But next to it, a significant number of smaller companies entering the global arena will be requiring those services too and a growing demand for expert assistance will also come from abroad.

Global education: The more countries become involved in the globalisation of production, the more demand there will be for educational services. Up to now, the high level universities have been attracting foreign students in growing quantities, and a trend is beginning to emerge whereby that is combined with exporting education through expatriate teachers, university affiliates in various countries, internet-based or TV-based courses and degrees, teleconferencing, virtual systems training, etc. Equally, up to now, the transfer of technical skills is being done through internal corporate arrangements within global networks.

⁴² At present packaging is extremely intensive in the use of materials and energy (directly or indirectly). It could be expected that rising prices of both inputs may spur a wave of innovation in packaging.

⁴³ For wide-ranging studies of the issue of systems integration see the work of the CoPS Project, of which Andrea et al. (2005) and Hobday et al (forthcoming 2006) are representative

⁴⁴ This will pose the question of homogeneity and compatibility among national regulatory structures. It is not yet clear whether this will be a space for a standardising trend or the basis for national and regional differentiation (or both!)

Eventually, some of the displaced specialised and highly skilled workers in those segments of industries migrating from the advanced world could turn into highly paid international technology transfer specialists. In general, and depending on the policies adopted to stimulate it, the education industry is likely to grow in all its dimensions: formal and informal, preparatory and life-long, for individuals and groups, general and specialised, for work and for leisure, at a distance and person-to-person, in the public and in the private sector, local and global.

Environmental industries: The more China, India and other developing or ex-socialist countries industrialise, the bigger the environmental problems and the larger the market to prevent, moderate or overcome them. The advanced countries have the technological capabilities that can be concentrated in this direction and the most environmentally conscious populations. Yet, as was discussed above, the most powerful lobbies against regulation are also there: the present energy industry, the chemical industry, the automobile and air travel industries plus many minor ones from the mass production paradigm. The flourishing of the sector, which can be absolutely huge, will depend on increasing (and ever more stringent) national, regional or preferably global environmental regulation. This, in turn may ultimately depend upon the growing seriousness of environmental problems, the level of pressure from public opinion and the political will of the decision-makers in the advanced world.

The example of the environmental industries, as a major opportunity for growth which would also improve the quality of life for all, offers a powerful example of how policy actions or inactions can determine the context for market behaviour.

Opportunities created by “local pull”

The ICT techno-economic paradigm fosters two apparently contradictory trends: standardisation and adaptability. Both are global; both affect the local markets. They are, in fact, complementary and can even be combined as in “mass customisation”, as discussed above. The growing habit –and soon expectation– of the consumer to define the specifications of products and services will open a very wide space for local front end businesses based on fulfilling this expectation, wherever the original products may come from. The specific values, culture, lifestyles and demographic trends –resulting from the history of each country and shaped by the potential and character of the ICT paradigm– are already generating demands, which will increase with time and will create a wide opportunity space for growth and entrepreneurship.

There is obviously also the fact that many services do absolutely require the personal presence of the provider and these are also growing. Local culture and the need for personal contact form natural barriers to entry and/or make many products and services non-tradable at a distance.

Table 3 is an exercise that attempts to indicate the sorts of activities that may expand in the advanced countries (and some of the middle-range ones) as the Knowledge Society becomes established and intensifies. Such activities are all the more important given that they can absorb the personnel from the jobs lost to the lower cost countries.

Many of the activities can be ranged among what was termed above (in section 3) as “induced branches”. They facilitate overall growth in the deployment period by intermediating, interlinking, supporting and facilitating the operation of an increasingly dense fabric of the economy and the more fluid functioning of the various markets. They also

incorporate labour of all skill levels and, through their income, widen the markets for the main products.

*Table 3. The respecialisation of the advanced countries:
Local specificity as one of the forces guiding investment for the domestic market*

Local pull factor	Examples of industries
Capabilities and requirements of the Knowledge Society	RD&E and top-end high-tech in general Expert services: Business and personal Education for the Knowledge Society (recognising the end of the "education once-and-for-all" and "job for life" models) Highly efficient physical distribution services to complement e-commerce Intelligent buildings and living spaces Special financial services geared to the new conditions: venture capital as a "normal" service; recognising the value of intangible products and assets, catering to highly irregular incomes and to the proliferation of micro and mini firms, etc.
Quality of life as defined by national culture and values	Entertainment industries Environment industry: Clean air and water, safer waste disposal systems, alternative energies, etc. Creative industries Health industries and services: Orthodox and alternative; preventive and curing. Beauty, body care, sports and healthy living Habitat: Architecture, landscaping, interior design the spread of good taste (fashion, home and office decoration, etc.) Specialised tourism: for locals and foreigners Food: convenience and gourmet foods (in-restaurant, in-store, home delivery, made-to-order, etc.)
Economic Growth and demographic trends	Old age care and leisure time use Personal services Business services for the self-employed, micro and mini firms Construction and urban renewal Infrastructure (new and old) extension, improvement and maintenance

It is not easy to predict which will be the induced industries that will complete the fabric of the economy with the full flourishing of a paradigm. In the USA during the 1930s and right up to the first year or two after the war, there was great pessimism about the space for further

innovation and for full employment.⁴⁵ Yet, after 1947, there were three sectors that absorbed the growth in the active population: construction, services and government, so that full employment became possible even though both manufacturing and agriculture were still shedding labour as their productivity continued to increase.

Construction is likely to play a similar role in the present case but it is not yet clear in which aspects. At the end of the mass production surge, which combined the development of urban agglomerations for work with suburban living, there was a time when the energy crisis prompted a rethinking of those working and living patterns. Integrated living models, where people would walk or cycle to work by daytime and to entertainment by night were proposed and experimented upon. The possible environmental and energy pressures resulting from full globalisation may yet revive those attempts. For the moment, the bubbles in many housing markets are perpetuating the old model. But, whatever happens in the housing and office areas, global transport infrastructures are sure to mobilise the construction industry and its suppliers.

The other major activities related to the Knowledge Society, education or health, as in the case of the environmental industries, are likely to depend very much on the policies and regulations that will stimulate –or stifle– their intense development.

The role of ICT as the platform for the whole process

Given that digital information and communications technologies (ICT) will be the shaping force for whatever course the economy takes, its strong development is crucial for any country or region that wants to be in the front ranks. Yet, the areas to develop and the trajectories to pursue in ICT itself will be strongly shaped by the dynamic sectors or segments in the countries in question. It is in this sense that the context matters. Knowing the areas of specialisation in the global division of production becomes a powerful guide for the direction in which to strengthen ICT capabilities and in which to develop R&D in each case.

It should be clear, then, that segmentation and the activities resulting from global pull and local push almost without exception require ICT, both as supporting innovations and as basic platform for operation. The whole idea of a techno-economic paradigm (as the tool-kit and the “common sense” of a technological revolution) is that it is all-pervasive. All activities, from frontier research, through distribution and health –which will be more and more electronically tagged and computer-optimised– all the way down to high tech crafts or work-from-home arrangements, everything, absolutely everything will be using information technology and weaving into the fabric of the information-based Knowledge Society.

It will be like oil in the fifties and sixties. It was not possible to conceive of any transport system without gasoline diesel or jet fuel. Materials were generally synthetics. Electricity (basically produced with oil derivatives or coal) moved production machinery and home appliances, down to the electric can-opener. Agriculture used oil-driven machinery and petrochemical fertilizers, pesticides and herbicides.

⁴⁵ The debate about productivity and structural unemployment among US economists in the 30s and 40s was still present in 1947. For a sample see Ross (1937), Fleming (1939), Bakke (1941), Morgenstern (1941), Graham (1947). This last article was titled “National Productivity. Its relationship to unemployment-in-prosperity”

That's how the core –cheap!– inputs of each technological revolution shape product and process decisions and eventually also social decisions. It is the plentiful availability of ever more powerful and versatile "cheap chips" that make the ICT world possible... and inevitable!⁴⁶

So, there will be a constant need for computer savvy companies and personnel in the advanced world or anywhere on the planet, at least for the next two or three decades (until this paradigm reaches maturity). They might be innovating at the frontier or doing applications in (and for) other industries and activities or at the front end services of ICT. Those industries are the engines of growth of the whole –world! – economy; their services are the lubricating agent of the globalisation process.

Today, one could paraphrase Engine Charlie Wilson, the President of General Motors in the previous surge, and say that in the Golden Age that may lay ahead: what's good for global development is good for the ICT industries and *vice versa*!

6. POLICY ACTION TOWARDS A SUSTAINABLE AND COHESIVE GLOBALISATION

As discussed in section three, the collapse of the bubble leaves three tensions acting in the economy: that between paper and real values, that between potential supply and effective demand (or premature market saturation), and that within society between the richer rich and the poorer poor.

Since these three tensions define the conditions under which markets operate, free markets will only aggravate them. In the absence of conscious regulation and policies that will create conditions for redirecting investment towards a truly positive sum-game and a virtuous feedback cycle of global growth, the instabilities underlying the present performance of the various economies may produce collapses that could bring the world economy into recession or intensify the social tensions to the point of generating serious social unrest.

Three tensions: three policy areas

Faced by this scenario, there are three policy options which could significantly modify the context in such a way that markets will find it profitable to redirect investment towards greater, more even and more stable global growth paths. Such a major shift in policy focus would involve an intelligent combination of regulation, respecialisation and social-net policies.

Regulation

To begin redressing the balance between the paper and the real economy, regulation would be needed to discourage short-term financial gain and rapid movements of capital and to favour long-term investment. Lou Gerstner's suggestion about high taxes for capital gains realised within one year and declining to zero at five years⁴⁷ is an example of a possible measure in

⁴⁶ For the equivalent impact of cheap iron and cheap steel in earlier surges see Freeman and Louçã (2001) pp. 159-63 and 232-9

⁴⁷ Gerstner (2002:2003), p. 261

that direction. He argues that this would make investors act like owners and become interested in the future of the enterprises they fund, rather than see equity as a source of quick gains. Such a policy, if extended to real estate, would help weed out the speculative purchasers from the genuine home buyers and help eliminate some of the bubble pressures.

Complementary policies would be needed to moderate excesses in the derivative markets and other systemic threats to financial stability. In general, given the ease with which finance can move from one country or region to another without any possibility of national controls, Soros'⁴⁸ call for enforceable regulation at the global level is the obvious condition for any such policies to be effective.⁴⁹

Once the rules for stability are established one can expect a series of financial innovations that, in contrast with the current casino style derivatives, will be really destined to serve the purposes of economic expansion, locally and globally, and to cater to the specific needs of the Knowledge Society and the processes of respecialisation and globalisation of production.⁵⁰

Respecialisation

In order to generate a virtuous circle of growing jobs and markets both in the advanced and the developing world investment must be high on both sides. This means that the higher productivity possible with the new paradigm would be accompanied by enough additional investment in further activities so that full employment –or, rather, full-income earning work, because the self-employed are likely to grow in proportion – can once more become a reality in the advanced world and an attainable goal in developing countries.

As suggested above, it would seem that the way to move towards that outcome is conscious policy-guided and consensus-driven respecialisation.⁵¹

As the various parts of the value chain and certain segments of different production sectors are relocated in successive emerging countries, the advanced ones would shift their pattern of specialisation towards higher value added activities and to those services that define the culture and give support to the expected rise in the style and standards of living for all.

Such a process is unlikely to take place through the operation of markets alone, given that it implies a strong bias towards “real” production investment and a change in the rules of the game favouring the quality of life and the long term interests of society. It is more likely to occur by a consensus-building process with ample public and private participation to recognise both the problems and the opportunities and to create the conditions to overcome the first by taking full advantage of the second.⁵²

⁴⁸ Soros (1998 and 2000)

⁴⁹ For an analysis of the sources of financial instability and the case for global regulation see Eatwell and Taylor (2000).

⁵⁰ For a set of proposals to create financial instruments meeting some of the new forms of risk, see Shiller (2003)

⁵¹ Perhaps the time has come to revive interest in the participatory processes of foresight and focusing used by Japan, Korea and other countries that successfully reshaped their economies leaping forward through the fourth and into fifth surge competitiveness

⁵² In a more ambitious vision, respecialisation could also open the way for a positive sum game in the process of global development covering all continents and lifting all boats.

National and global social net policies

In order to remove all obstacles to the flourishing of investment in the Information Revolution, much of the Keynesian edifice that had been erected to facilitate mass production was demolished or weakened. One of the most dangerous casualties of this process has been the Welfare State, which had facilitated mass consumption and fuelled the post war Golden Age. The dismantling has been uneven among countries, but one could say that in terms of institutional creative destruction, what has mainly taken place is the “destruction” half. There is no reason whatsoever for supposing that the values of societal solidarity should be abandoned in order to foster growth and globalisation. What can be held is that, when there is a paradigm shift, just as business changes its organisational forms to achieve greater profitability, so societies must find more effective ways of achieving greater cohesion and social well being for all.

Reinventing the social net in a manner consistent with the current paradigm will contribute to social justice in prosperous societies, will increase security for all by reducing the conditions that can favour violence and through strengthening the wealth creating capabilities of all, including the weakest, will reopen the ample upward mobility routes that gave strong cohesion to the more developed societies until very recently. Finally, and in a more practical vein in relation to growth, the mechanisms of social redistribution generate new market spaces across the income spectrum and create further possibilities for investment and employment.

But in the present globalising economy, the national social nets are not enough. Historically the income polarising trends typical of the installation periods had been generally within each core country⁵³ to be later partly or wholly reversed in the deployment period (or Golden Age). In the present surge, income polarisation has occurred both within each country and across the world, in some cases with an even more acute effect at the global than at the national level. As a consequence, the social expression of that polarisation has been global. The whole world is witnessing – or suffering – the resentful violence and the desperate migratory pressures of the excluded as well as other phenomena such as various forms of “fundamentalism”, including the success of messianic leaders or the search for fanatical religious identities.

Previous success as the main obstacle

Introducing new forms of State intervention –national or global– after the experience of the installation period is difficult because of excess business confidence. A technological revolution brings such a wide space for innovation opportunities that it creates the perfect conditions for the success of free markets. When it gradually becomes an obstacle because all conditions are ready for longer term wider ranging stable growth, the business world is not ready to relinquish the “freedoms” gained. As noted before, the enormous successes of the installation period are seen as the creation of the market itself, rather than being ascribed to the temporary existence of a huge innovation space where free markets could thrive. For that same reason, State intervention is still remembered as an obstacle for the free explosion of the ICT revolution, due to its over-adaptation to the mass production paradigm.

⁵³ Though many impoverishing processes had been international, such as the ruin of the Indian textile producers by British mechanisation from the 18th Century or the ruin of natural rubber producers by synthetic rubber in the 20th, those cases were directly the result of market displacement by technical change.

In the present Turning Point it could be said that excess free markets are as obsolete and represent as much of an obstacle to maximise growth in Deployment, as excess State intervention was seen to be during early Installation.

Perhaps only serious recessions or other difficult circumstances that truly constrict profitability can shake the confidence in the present set up and move business towards favouring regulation and income distribution measures. But, policy makers need to be ready to propose and promote solutions that are truly adequate for a modernised economy following a paradigm that is fundamentally different from the previous one.⁵⁴

The ‘other’ globalisation, fully compatible with the paradigm and capable of unleashing a worldwide steady expansion of production, markets and well being, is waiting to be formulated. It would be production-centred and -led; pro-growth and pro-development; with dynamic, locally differentiated markets, enhancing national and other identities. But it will not be the creation of any invisible hand; it will work with the market but will require plenty of human imagination, ample participation, intense negotiations, much determination and collective political will.

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⁵⁴ In the 1930s, during the Turning Point of the fourth surge, Keynes' ideas and Roosevelt's New Deal proposals were met with ferocious resistance from economists and from business as attempts at destroying the market and moving towards communism. After the war, the Keynesian measures that facilitated the Golden Age were, if anything, more radical than Roosevelt's original ones, but were welcome after the war had shown the advantages of industry-government collaboration.

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