

A NEW AGE OF TECHNOLOGICAL PROGRESS

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To seize the opportunity of our great surge of technological development, we need a national and global consensus between business, government and society that will do for the 21st century what social democracy did for the 20th.

The world appears to be changing at an unprecedented pace. Information technology is displacing or reshaping industry after industry; rapid globalisation is leading to power shifts between nations, and the threat of global warming is becoming ever more present.

In fact, we have been here before. A deeper understanding of both history and technology can help us respond to these challenges and find a prosperous path ahead. What we can see is that there is nothing inevitable about how these forces will reshape our world. This will be dependent not on the technological, global and environmental forces, but on the socio-political choices we make to take best advantage of them.

FIVE TECHNOLOGICAL REVOLUTIONS

Technological advance might appear as a continuous process, but in fact the world has gone through five technological upheavals since the Industrial Revolution in the late 1770s.¹ Each of these shifts (see figure 2.1) brought with it a whole set of powerful new industries and infrastructures—canals, railways, electricity, highways, tele-coms and the internet—which have enabled a quantum leap in productivity and quality in all industries. These technological leaps have also widened and deepened market spaces, shifted the centres of industrial dynamism and changed the rankings in world power.

The Industrial Revolution introduced mechanisation, changing the role of skills in production, and initiated the era of British power. The following railway age led to the rise of the educated and entrepreneurial middle classes. The third, from the end of the 19th century, was the first globalisation based on empires and saw the emergence of Germany and the US as challengers of British hegemony. Subsequently, the US led the age of the automobile and mass production, bringing the American way of life to the working classes and increasing the role of the State in economic stability. The current information and telecommunications technology (ICT) revolution has enabled the second globalisation; yet its full transformative impact on society is still to be defined.


As Schumpeter rightly noted—echoing Marx—capitalism is “incessantly revolutionising the economic structure from within, incessantly destroying the old one, incessantly creating the new one.”² However, in each case, after two or three decades of frenzied experimentation with the new technologies and a bubble collapse or two, society has had to learn to facilitate and guide the unleashing of these new forces in order to increase the social benefits that can be gained from their stable deployment.

TWO DIFFERENT PERIODS

Each of these revolutions has driven a *great surge of development* that takes half a century or more to spread unevenly across the economy. Each occurs in two distinct periods—installation and de-ployment—with a transitional phase in the middle that is marked by a major bubble collapse and recession. Figure 2.1 shows the historical sequence of the great surges with their equivalent periods in parallel.

It is important to note the difference between the “gilded” nature of the prosperities that characterise the initial decades of each great surge and that of the golden ages that follow after the bubble collapses and the subsequent recessions. The installation period is one of extravagant “Great Gatsby” prosperity that sets up the new infra-structures and spreads a new common sense practice across the business world and across society. It is finance that leads the investment process, backing the new entrepreneurs, spreading new technologies and forcing the old to modernise. This period also results

GREAT SURGE	Year Technology Core country	INSTALLATION PERIOD	TURNING POINT	DEPLOYMENT PERIOD	
		Bubble prosperities	Recessions	“Golden Ages”	
1st	1771 The Industrial Revolution Britain	Canal mania	1793-97	Great British leap	
2nd	1829 Age of Steam and Railways Britain	Railway mania	1848-50	The Victorian Boom	
3rd	1875 Age of Steel and heavy Engineering Britain / USA Germany	London funded global market infrastructure build-up (Argentina, Australia, USA)	1890-95	Belle Époque (Europe) “Progressive Era” (USA)	
4th	1908 Age of Oil, Automobile and Mass Production USA	The roaring twenties Autos, housing, radio, aviation, electricity	Europe 1929-33 USA 1929-43	Post-war Golden age	
5th	1971 The ICT Revolution USA	Dot.com and Internet mania 1990s Emerging markets financial casino/housing bubbles 2000s	2007-08 -???	Sustainable global “golden age” ?	



We are here

Figure 2.1. Five Great Surges: Bubbles, Recessions and “Golden Ages”

in an increasing polarisation of income through differential asset inflation, financial manipulation and major shifts in the location of jobs and in the types and levels of skills required.

The prosperities of the deployment period of each surge, by contrast, are seen as “golden ages” because they tend to reverse some of the destruction and polarisation resulting from installation. It is in these later periods that the potential of the revolution enables innovation, investment, jobs and expansion across the economy. These are the times when synergy is attained between the new industries, the modernised old industries and complementary activities that complete the new fabric of the economy and create the new jobs that counteract those displaced by technical change.

The fabric of the economy is neither pre-determined nor defined by technology. It is a socio-political choice, and one that arises out of the collapse of the bubble (or bubbles) that end the period of installation. This collapse reveals the inequalities that arose in that period, along with the decoupling of the speculative financial casino from the production economy. The recession that follows results from the structural changes brought about by the revolution. As the 1930s showed, this cannot be reversed by markets alone. Reviving the flagging economy and going back to business as usual is impossible because economic growth post-bubble requires a fundamental redirection. In these transitional periods, leaders need to recognise the irreversible changes and to design a socio-institutional framework that achieves a good match with the specific new potential installed.

THE SHAPING OF THE POST-WWII BOOM

The post-War mass production revolution is the most recent example of a full cycle of installation and deployment. The potential of those technologies was shaped very differently by the Western democracies, Hitler and Stalin. In the West, the power of mass production and the infrastructure enabled by the automobile was turned into a consumer-led process of continuous innovation, investment

and expansion. Yet in the middle of the depression it was difficult to recognise the vast range of viable innovations connected with plastics, energy intensive materials, energy using devices and the new mass production methods, capable of creating a consumerist way of life that could fuel economic expansion for decades. At the time, assembly line manufacturing and the mechanisation of agriculture had generated the same fears of “secular stagnation”³ that today arise from globalisation, ICT and robotics.

The revival success resulted from a synergistic combination of institutional innovations such as the credit system, labour union-secured salaries, unemployment and mortgage insurance, free or subsidised education and healthcare, and a progressive tax structure. The state funded many of these institutional innovations as well as the Cold War, the other direction of innovation mostly funded by the state. It was a positive-sum game established between business and society that led to the greatest boom ever seen, aided by international innovations that included the World Bank, the International Monetary Fund, the dollar being used as “gold standard,” the General Agreement on Tariffs and Trade, and the United Nations.

We are now in an equivalent moment in history, requiring similarly bold thinking and measures. The levels of unemployment and inequality brought about by globalisation and ICT technologies, along with the increasing environmental challenges resulting from the previous technological revolution, threaten social cohesion and security. The installation period of the current revolution established the worldwide web, enabling planetary financial markets and the organisation of industry in global value networks. Yet the capacity of information technologies to transform every single industry and activity, and to spawn innovations across the board, has only barely been applied. The current growth and innovation potential in industry after industry, in old and complementary activities is huge, but its profitability is too uncertain to attract massive finance. Unleashing that potential in a coherent direction could lead to a sustainable global golden age that would do for developing economies what the post-war boom did for advanced countries of the West. What is lacking is a set of policies to tilt the playing field in a clear direction

in order to generate synergies—suppliers, distribution, skills and other shared factors—as occurred with suburbanisation in the post-war boom. At present, most of the many diverse and disparate innovations that are technologically possible are seen as uncertain in terms of markets and profitability. It is the combination of dynamic demand and convergent direction that will provide the conditions for innovation and investment to thrive, bringing a global economic revival.

“GREEN GROWTH” AS THE NEW DIRECTION FOR INNOVATION

The most promising direction for a global boom is “green growth.”⁴ In my understanding, this does *not* mean simply applying renewable energies to the economy and the social institutions of the oil age. Rather, “green” is a direction for deployment in which, as suggested at the start of this chapter, technology, globalisation and the environmental challenges turn from obstacles to solutions for the current problems related to growth, jobs and competitiveness. Green growth would act as a selection mechanism to guide the trajectories of innovation in a convergent direction that creates externalities common to all. In the process, it would involve a complete redefinition of “the good life.”

What does this mean? Historically, every technological revolution has led to a radical change in consumption patterns consistent with the range of products shaped by the new technologies: from Victorian living in the mid-19th century to the cosmopolitan style of the Belle Époque and to the American way of life. If what motivates the new billions of middle-income consumers in the emerging world is aspiring to the same suburbanised, disposable living that drove the mass production boom in the 20th century, they—and their Western counterparts—will soon stumble against resource scarcity and unaffordable prices. Instead, the technologies enabled by ICT provide a wide range of possibilities for changing the proportion of tangible and intangible goods and services in the patterns of both

consumption and production. This could enable a vast increase in the productivity of resources at the same time as a significant reduction in energy and materials consumption through the redesign of products and the optimisation of logistics.⁵

The growing use of renting and collaboration is already lengthening the life of products and encouraging a multi-user model of distribution, diminishing the amount of materials and energy required to satisfy individual consumption needs. Smart electric grids are beginning to allow the interactive production and consumption of energy and could do much more. Experiments in the “circular economy” are yielding impressive business results. Nano-materials and other advances are promising leaps in quality and durability of products. The long predicted reduction of paper consumption might finally begin to happen, through e-books, tablets, internet information and other intangible means of communication. Alongside the ever more versatile ICT devices, local organic food, sustainable design, electric cars, bicycles and healthy living form the new aspirational lifestyles, replacing consumerism, passivity, obesity and disposability.

THE SHAPE OF THE FUTURE

Today, the prevailing conventional wisdom, based on recent experience, is a poor source of inspiration. The new weak trends, especially those led by the young “digital natives,” are the shape of the future. At times of unused technological potential, it is safer to be bold than to be restrained by “realism.”

At present, the jobless rates in many advanced countries are unacceptable and the current policies are, at best, only bringing anaemic and unstable growth. A courageous policy of funding green growth research and procurement,⁶ plus strong measures stimulating innovation and investment in the revamping of the built environment and a redesign of products, services, distribution and maintenance systems along green lines, would radically reduce the jobless rate in each country. Imagine regulation clearly favouring true dur-

ability of electrical appliances, for instance, by requiring the manufacturer to take responsibility for disposal—as the EU's Waste Electrical and Electronic Equipment Directive ⁷ partly does. This is likely to spawn at least three innovative high employment processes: a rental and maintenance service, a disassembly industry favouring component and material reuse and the redesign of all products for ease of maintenance, recycling and upgrading. All those activities are already growing at a slow pace in industries large and small and in different countries at different rhythms. The circular economy, ⁸ industrial symbiosis (in which one industry uses the other's by-products), cradle-to-cradle ⁹ and other experiments are spreading among pioneering companies that recognise the trends of the future. The shift from ownership to rental is already visible in the so-called “sharing economy”; it is easy to imagine it evolving with an Amazon-like used-products, web-based system and with chips identifying products and recording their use history.

As for producers, they may soon realise that they no longer need the “planned obsolescence” strategy. With the continuous entry of millions of new middle-income consumers across the world, they are more likely to confront resource price hikes than market saturation. Besides, what a rental model can do is to transform the high-quality luxury upper end of the market into the entry point. The richest will want the latest models, with all technological advances and design features, but from there on, each model would move to second-hand use, third-hand and so on, until those entering the consumption ladder can access it at very low cost.

We need to look at the trends initiated by the young and the pioneers, in the advanced and emerging countries, and imagine how to create the conditions that will accelerate such changes so they reach the tipping point and become a strong, transformative social and economic force. We need policies that tilt the playing field, making economically profitable what is technologically possible and can be socially beneficial.

THINK GLOBAL; ACT NATIONAL AND LOCAL

Green growth can also lead to a global re-specialisation—with enough markets for all to grow, while addressing the increasing risks of food, water and raw material scarcities and climate change. If the process of full global development intensifies, demand for goods, equipment, engineering and infrastructure would be enough to mobilise the—also growing—economies of Asia, as well as those of the advanced world. In turn, the rising demand for materials and food would provide dynamic markets for natural resource producers at increasing prices. This would allow them to fund their own development, closing the feedback loop of demand for capital goods from the more advanced countries.

Of course, that complex process of interactive global market growth is only realistic if it is environmentally sustainable. It will need to use more expensive and specialised materials, in order to require less quantity per product and to allow for greater durability. It will mean more infrastructure and equipment, but adapted to the climatic conditions using low or no-carbon renewable energy and energy storage. This green direction, in turn, would widen the market for that sort of equipment, reducing costs and expanding markets even further.

The same holds for consumption patterns. The focus would shift from the old consumerism to healthy lives, with a high proportion of intangibles in consumption, including more communication and creativity, more exercise and community activities, more education—both face-to-face and computer-based—more caring and sharing activities and so on, as well as significantly greater durability and recyclability of all tangible products. The “good green life” has to be creative, healthy, pleasurable and comfortable. It cannot be based on guilt or on sacrifices. It has to be what people aspire to as they climb the income ladder and the ladder has to be functioning for all, both the new climbers and those that have slid down. All that will require the support of adequate and imaginative institutional innovations.

The green transformation would also involve the gradual redesign of cities and the improvement of rural quality of life, stimulating both wealth-creating and community activities, so that migration is no longer the best option. The shift would probably be as gradual as suburbanisation was in its time and would need as much support from governments, business and the media as was required then, demanding complex consensus processes and wide-ranging alliances.¹⁰ Both processes would call forth investment and jobs.

This direction for innovation makes sense not only for environmental, social and economic reasons but also because it is consistent with the nature of the ICT paradigm. The old hierarchical pyramid with top-down control is obsolete. We see the concept of networks being applied all around us by new entrepreneurs, in the thousands of apps connecting through the smartphone platforms. We also see it in the way global corporations organise their value chains and power structures. Under the radar, there is the flourishing of the sharing and the collaborative economy, the open source movement and the many imaginative ways of using the internet for improving the quality of life. The eventual combination of these complementary ways of using the transformative power of ICT—including in the organisation of government—may define the quality of life and the quantity of jobs.

THE TASK FOR LEADERS TODAY

Today it is not possible to bring stable long-term growth in the context of an isolated national economy. The ICT revolution has already created the conditions for the globalisation of the economy, such that national policies are now mostly defined as choices within the global space. Those choices would be more likely to bring a global sustainable golden age if they are coherent and mutually reinforcing across countries. And within each country, the quality of life of citizens must be prioritised over the no longer national interests of the financial world.¹¹

Thus, the question today should not be: Can we afford the welfare state with less money? In that case, the solution can only be austerity and giving up on a fair society. The adequate question, from the perspective of history and innovation, is this: How can we use the new technological potential to put the economy on a growth path towards full employment and increasing well-being? That is the question that will call forth the required imagination towards technological, social, organisational and policy innovation.

It is time to create a national and global consensus between business, government and society that will do for the 21st century what social democracy did for the 20th. The legitimacy of capitalism rests on fulfilling its promise of achieving the common good through individual pursuit of wealth and power. Installation periods, and especially bubbles, bring the system to extreme individualism and to insensitivity to the plight of non-winners and the impoverished; bubble collapses and the ensuing deployment periods tend to rein this in and put a stronger focus on the common good. Conditions are now set for a global synergistic and sustainable growth process. But achieving it successfully requires the right socio-political choices. That is the challenge for leaders in this generation.

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NOTES

1. See Schumpeter, J.A. (1939:1982) *Business Cycles*. Philadelphia: Porcupine Press; Freeman, C., and Perez, C. (1988) "Structural Crises of Adjustment: Business Cycles and Investment Behaviour" in Dosi et al. (eds.), *Technical Change and Economic Theory*. London, Pinter. pp. 38–66; and Perez, C. (2002) *Technological Revolutions and Financial*

Capital: The Dynamics of Bubbles and Golden Ages. Cheltenham: Edward Elgar.

2. Schumpeter, J.A. (1942:1987) *Capitalism, Socialism and Democracy*. London: Unwin. p. 83.

3. The term was used recently by L. Summers in "Why stagnation might prove to be the new normal," *Financial Times*, December 15, 2013, available from <http://www.ft.com/cms/s/2/87cb15ea-5d1a-11e3-a55800144feabdc0.html#axzz35Bf2xOBb> (accessed 22.04.14). This term is also part of the argument of the techno-pessimists such as Gordon, R. (2012) "Is U.S Economic Growth Over? Faltering Innovation Confronts The Six Headwinds," Working Paper 18315, National Bureau of Economic Research, August 2012. <http://www.nber.org/papers/w18315>.

4. For a thorough discussion of the various meanings attributed to the term, see Jacobs, M. (2012) "Green Growth: Economic Theory and Political Discourse." Working Paper No. 108, Centre for Climate change and Policy, October. Available at <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2012/10/WP92-green-growth-economic-theory-political-discourse.pdf> (accessed 16/07/2014).

5. If energy and materials prices continue to vary at a much higher level than in the 20th century, it could become more profitable to innovate for increasing resource productivity than for increasing labour productivity.

6. See Mazzucato, M. (2013a) *The Entrepreneurial State: Debunking private vs. public sector myths*. London: Anthem Press (discussing the need for an entrepreneurial state).

7. European Union (2012) Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE), in the Official Journal of the European Union, L 197, 24 July 2012. Available from <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=OJ:L:2012:197:TOC> (accessed 11.04.14).

8. Ellen MacArthur Foundation (2012/2013) Towards the circular economy: Economic and business rationale for an accelerated transition, *Circular Economy Report* Vol. 1&2.

9. Braungart, M., and McDonough, W. (2009) *Cradle to Cradle. Re-making the Way We Make Things*. New York: Northpoint Press.

10. For interesting discussions on the political issues of the green transformation, see Lockwood, M. (2014) "The political dynamics of green transformations." EPG Working Paper No. 1403, University of Exeter.

Available at <http://projects.exeter.ac.uk/igov/wp-content/uploads/2014/04/WP-8-The-political-dynamics-of-green-transformations.pdf> (accessed 16/ 07/2014); and Schmitz, H., and Becker, B. (2013) "From Sustainable De-velopment to the Green Transformation: A Rough Guide." Grey Literature, IDS. March 8.

11. The current national-populist tendencies (and the anger against finance) are understandable and echo the 1930s. The perception of personal decline always leads to searching for culprits. Only bold policies that over-come the decline of the majorities will defeat the political shift.

