

**Second Machine Age or Fifth Technological Revolution?
Different interpretations lead to different recommendations**
Reflections on Erik Brynjolfsson and Andrew McAfee’s book
The Second Machine Age (2014).

Part 9 – Final

**The socio-political shaping of a better future
with an understanding of the nature of the new technologies**

Carlota Perez

December 2018

<http://beyondthetechrevolution.com/blog/second-machine-age-or-fifth-technological-revolution-part-9-final>

Contents

| | |
|--|----|
| Not only growth but massive institutional innovation..... | 2 |
| A time to be bold: setting a new direction to create new demand..... | 3 |
| Smart green growth..... | 4 |
| Redesigning the welfare state | 6 |
| Facing income inequality | 8 |
| Full global development and supranational institutions..... | 9 |
| Modernising the State | 12 |

This is the final instalment in a series of posts (and Working Paper in progress) that reflect on aspects of [Erik Brynjolfsson and Andrew McAfee’s](#) influential book, [The Second Machine Age](#) (2014), in order to examine how different historical understandings of technological revolutions guide different policy recommendations in the present. The previous three posts examined the limitations of the book’s policy prescriptions in light of the more nuanced understanding of the process of technological change that the rest of the series has proposed: in the fields of [human capital \(education, employment and ‘brain gain’\)](#); [science, technology, innovation, production and infrastructure](#); and in [taxation and welfare](#). In this last post, I look at the bigger picture in order to address key problem areas that I believe Brynjolfsson and McAfee overlooked, namely, sustainability and globalisation. I suggest that in these ‘problems’ lie solutions for growth that are crucial to a more positive future.

And I put forward ideas for a more systemic approach to policy change, one that involves both a reimagining of the welfare state and the need to modernise the State itself, in a similar process to that which occurred in the socio-political sphere in previous revolutions.

Not only growth but massive institutional innovation

The posts in the last weeks have looked at the policy suggestions made by Brynjolfsson and McAfee in *The Second Machine Age*. As noted, even they see these as modest (p. 228). In fact, even implementing them all, the results would be meagre, in relation to the challenges the authors present. Indeed, if they were faithful to the subtitle of their book: *Work, Progress and Prosperity in a Time of Brilliant Technologies*, they would indeed be much bolder.

Each of the four previous technological revolutions has brought radical change beyond the economy, with innovations in policy as well as in institutions and forms of organisation, in government as much as in business. Systemic change in the economy requires a systemic response across the board, not just band-aid solutions for each of the problems encountered in the process of creative destruction that characterises such major technology shifts.

It is true that in the most recent posts, I have been looking at Brynjolfsson and McAfee's policy responses problem-by-problem, as they did, and suggesting other solutions that I believe are more in keeping with the new paradigm. However, in this concluding post, I would like to move above these individual prescriptions and look again at the broader picture; at a potential near-future in which Brynjolfsson and McAfee's concluding 'wild ideas' for policy do not seem so wild.

I am far from having all the answers; rather, my main objective with this entire series of posts is to point to a more fruitful way of searching for them. Fortunately, for every policy response (wild or not) of Brynjolfsson and McAfee, there are currently hundreds of innovative experiments in new ways of living and methods of organisation, new forms of welfare, new institutions, methods of government and measures to promote sustainable growth and/or wellbeing at various stages of incubation. As I discussed back in [post 3](#) of this series, the impact of the ICT revolution across society is only half done, and it is indeed possible that, as Brynjolfsson and McAfee assert, this revolution is different in kind to those preceding it. The potential inherent in this technology is huge. What is needed now, as I have argued [elsewhere](#), are not just policies for growth, but for a whole new direction of growth.

In what follows, I would first like to discuss the crucial role of demand at this particular stage of each revolution, when many of the possibilities are clear but not yet realised. It seems to me that Brynjolfsson, McAfee and many other futurologists focus on employment as an end in itself, overlooking the role that the nature and dynamism of demand play in both growth and job creation. That was one of the crucial Keynesian insights, as Brynjolfsson and McAfee acknowledge with the ['money buried in bottles' story](#)¹, but then ignore it when it comes to recommendations.

I will then discuss the issue of the Welfare State under the new conditions, followed by the other burning social issue that Brynjolfsson and McAfee call 'the spread', which is the growing inequality produced up to now by the information age.

¹ Keynes, J.M. (1936) *General Theory of Employment, Interest and Money*, Chapter 10

Finally, I will focus in turn on the two main elements of our current historical context that are missing from Brynjolfsson and McAfee's analysis: the environment and globalisation. I believe that these are key to the demand-pull forces shaping technology and the economy in the near and further future. I have touched upon both in previous posts; it is time to bring them to the fore.

I will conclude with a note on the modernisation of government – and something that is both a debt of gratitude and an apology for using Brynjolfsson and McAfee's work to buttress my interpretation of the nature of the present revolution – mostly shared with them – and my understanding of how to shape it – where I differ.

A time to be bold: setting a new direction to create new demand

In the earlier posts, I have held that after the inevitable financial bubble and crash of each technological revolution, all the ills brought by the 'creative destruction' period of the early decades become visible and social unrest makes them urgent for governments. This is the time when the new technological potential is recognised, and society must choose which path to follow among the alternatives offered by that potential. It is a time of socio-political choices and countervailing pressures. The winners will push for maintaining the status quo and the negatively affected will push for changing the context and their life chances. The golden ages of the past were unleashed by bold and determined policies that were imaginative and well suited to the nature of the technologies at hand.

I am not advocating technological determinism. The social shaping of technologies implies understanding them deeply, respecting their logic and being as creative in using them for institutional innovation as successful entrepreneurs are in their business ventures. Determinism is about accepting and assuming that, whatever technology can do, it will do anyway, so we can at most find lines of defence for adaptation. This is what the recommendations in *The Second Machine Age* seem to do. The social shaping option, by contrast, recognises the whole range of what technology can do and, without opposing its new power, modifies the context selecting a directional path from within the range of the viable.

Such shaping is necessary to tilt the playing field in a clear direction that will make innovation less risky in terms of demand, and investment more profitable. I have previously talked about the difference between investment in the 'casino' of the current financial markets and in 'real' production. In [post 8](#) I suggested changing the tax treatment of capital gains to favour long-term investment. That is indeed important, but it is the pull of demand rather than the push of production that is crucial in the deployment phase of every revolution. Demand creation, supported by intelligent, appropriate taxation and regulation, signals the most advantageous direction for innovation and investment. The stability of those measures reduces risk and induces finance to finally come out of the casino and fund the real economy. Currently we have a dearth of demand, which is partially obscured in the West by excess financial trading and an overinflated property market that falsely bolsters GDP. It is also compensated by the debt mountain – carrying serious long-term risk – and the explosive demand growth in the emerging markets, mainly in China, which makes global corporations insensitive to the stagnation of solvent demand at home.

If we look at consumer demand in the US in particular, we can see that the dominant lifestyles are still primarily those that served mass production. This direction – [of mass consumption and](#)

[suburbanisation](#) – still drives demand for Asian-made low-cost clothes and appliances, while American salaries stagnate. Yet the Trumpian ‘Make America Great Again’ direction, of protectionism and reinvestment in American fossil fuels and mass production, is a losing game. It will not work, not only because ‘the market’ is now predominantly a global system (more on that shortly), but also because, even in the East, the mass production revolution is facing limits. True, the emerging middle classes of the developing countries are still copying the consumerist way of life. But we only have one planet; mass consumption will soon confront the scarcity of raw materials, even if fracking and other fossil fuel extraction technologies keep up supply and oil prices down for some years longer.

Yet there is a huge potential for demand in the range of the viable provided by the new raft of technologies combined with our current historical context. Like the development of individual innovative products and processes, a viable direction for growth in each new technological paradigm first presents itself in niche endeavours. We are now at the point where the direction which I believe to be the most appropriate for our current context is approaching a tipping point, a moment at which supportive policies – equivalent to those that accelerated the spread of the previous ‘American Way of Life’ – can induce synergies, reduce risk for investors and, in doing so, generate profitable demand in a positive-sum game across society.

Smart green growth

As mentioned in some of the previous posts in this series, the direction I advocate is one that takes advantage of both the nature of digital technologies and the increasing need to counter the environmental damage done by the industrial revolutions of the past. [Elsewhere](#) I have written on the direction of what I call ‘smart green growth’, but to summarise it here: smart green growth can be defined as increasing the proportion of intangibles in GDP and lifestyles, while transforming the threat of global warming and the limits to resources into opportunities for new patterns of consumption and production. It means turning more products into services, as has already happened with music, books and film. With the power of ICT, we can generalise the [circular economy](#), and reduce the amount of materials per product by redesign and/or by shifting to customised materials, especially biomaterials, bringing forth a raft of innovations in the various stages of processing. Today’s recycling and upcycling is only the start of a process that could see products made truly durable and upgradeable, with a massive revival of the maintenance industry, using digital diagnostics and 3D printing of spare parts on demand.

Smart green growth involves moving our notion of the ‘good life’ away from the existing one of mass consumption to ‘smart green’. As discussed in posts [four](#) and [five](#), and in an [article with T. Murray Leach](#),² lifestyles have been key to creating demand and employment in previous revolutions – and the shift must be one of aspiration, not sacrifice. As in each previous shift, such ways of life are already emerging among the rich, the educated and the young. The smart green life focuses on health, nutrition, exercise, creativity, experiences, participation and access (sharing or rental) rather than possession. And the demand for the associated services is potentially huge.

² Perez, C. and Murray Leach, T (2018) “Smart & Green: A New ‘European Way of Life’ as the Path for Growth, Jobs and Wellbeing”. In Re:Thinking Europe. Positions on Shaping an Idea, Austrian Council for Research and Technology Development. Vienna: Verlag Holzhausen. Pp. 208-223

Yet, this move towards intangibles and sustainability is not yet vigorous enough to encourage massive investment and command higher salaries. It also remains challenged by anachronistic policies that support the dinosaurs of the previous paradigm: the oil companies, energy-intensive construction, materials-intensive products meant to be soon discarded and so on. In the post on [taxation policies](#), I listed some more forward-looking alternatives that would promote a smart green path – ‘flipping’ the tax on VAT, for example, so that instead of taxing wages and profits we tax energy, materials and transport, while encouraging employment; giving tax breaks on recycling, maintenance and reuse, as is already being done in [Sweden](#), or passing legislation facilitating repair with proper manuals, such as was recently done in [California](#).

Reorienting the policy direction towards smart green includes more than encouraging product and process innovation; it means suitable regulation, such as favouring durability and recycling through requiring manufacturers to be responsible for their waste products –as in the EU’s [WEEE](#) directives for electrical and electronics products. It also means the shaping of taxation to entice systemic innovation and converging investments. In addition, it requires government investment in R&D and following further along the innovation path, as Mazzucato has [identified and proposed](#).³ And it is likely to imply direct government funding through development or environmental banks to get the ball rolling. In other words, promoting innovation and entrepreneurship by changing the context and facilitating synergies, not just by assuming markets will eventually get there.

An important aspect of the environmental direction is that it encompasses the whole range of innovations, from the most advanced, based on frontier ICT and other technologies, to the revival of traditional practices as well as those based on purely human qualities and skills. In agriculture, for example, innovation includes highly sophisticated solar houses around cities, using hydroponics and other technologies; zero-tillage and biotech-based agriculture; and organic back-to-basics. Equivalent spans of technological coexistence can be promoted in healthcare, education, exercise, energy, transport, architecture and so on, with the range of innovations and businesses similarly varied in complexity, size and location.

Incorporating the most advanced technologies, in particular those such as artificial intelligence, robotics and all the others discussed by Brynjolfsson and McAfee that do have the potential to ‘take’ human jobs, is crucial in order to increase productivity at one extreme of the spectrum and hence increase average productivity and potential for wealth creation. [Widening the spectrum of activities](#) (see New products, new lifestyles, new jobs), adding new ones, is also crucial as the way to incorporate all varieties of knowledge and all citizens into work that is beneficial across society⁴. Making sure that both satisfaction and remuneration reward everyone’s effort will also make sure that demand is there for the explosion of investment that policies strongly supporting smart green growth could stimulate.

³ Mazzucato, Mariana / Directorate-General for Research and Innovation, European Commission (2018) ‘Mission-oriented research & innovation in the European Union: A problem-solving approach to fuel innovation-led growth’, 21 February 8

⁴ Perez, C. and Murray Leach, T. (2018) “Smart & Green: A New ‘European Way of Life’ as the Path for Growth, Jobs and Wellbeing “ in Re:Thinking Europe. Positions on Shaping an Idea, Austrian Council for Research and Technology Development. Vienna: Verlag Holzhausen. Pp. 208-223

Redesigning the welfare state

Changing direction includes reinventing the policies of the welfare state, providing a safety net for a world where temporary, irregular work and self-employment are becoming normal and frequent, where life expectancy has increased, medical costs have soared and – as Brynjolfsson and McAfee rightly noted – education is no longer fit for the prevailing technological paradigm.

Indeed, Brynjolfsson and McAfee do express a humanist point of view when they look into the far future and imagine that: “As more and more work is done by machines, people can spend more time on other activities. Not just leisure and amusements, but also the deeper satisfactions that come from invention and exploration, from creativity and building, and from love, friendship, and community” (p. 257). My point is that they need not look so far into the future; such ‘other activities’ might be characteristic of the ‘smart green lifestyles’ that could both mobilise investment and enhance social wellbeing now.

In fact, societies cannot wait until that imagined future arrives. Anger, unrest and populism will multiply, because a decline in the standard of living – particularly at a time of high wealth – breeds resentment. Despite the [‘rising of boats’](#) elsewhere, it is not easy to accept that your children will live a worse life than you did. Yet a better future is not likely to happen without determined social policies that ensure the benefits of the technological advances are widely shared. In this sense, the question of the social safety net is of great urgency in order to face an economy where technological unemployment is likely to increase – as Brynjolfsson and McAfee clearly explain – and where the so-called gig economy can become the lot of a significant portion of the working population, voluntarily or as a last resort.

Healthcare, old age security and education are three of the necessary elements of any welfare system. ICT used in a holistic direction allows us to imagine a preventive and individually tailored, healthcare system, based on ‘big data’, which upends the old ‘factory parts’ model of social services and replaces it with a systemic, networked approach. An approach actively incorporating the recipient, such as that proposed by [Hilary Cottam](#),⁵ which moves beyond theory and is based on beta stage experiments already undertaken.

In education, Brynjolfsson and McAfee hold that Massive Open Online Courses (MOOCs) and the possibility of ‘flipping the classroom’ into the more participatory activities, are opening a new route that could eventually transform access to learning and reduce the excessive costs of higher education today. I couldn’t agree more. Knowledge and skills of all sorts are becoming the most important societal investment as well as the most desired personal consumption item as the knowledge society develops. The old mass production model of massive, once and for all education, with various exit points defining the future options of each person, is obsolete and inadequate. The level of provision of high quality, life-long education, with multiple routes and forms of certification, is likely to define the potential future of each country. And MOOCs can play a big role in the transformation.

But none of that is enough if there is the income uncertainty that could be a characteristic of paid work into the future. As discussed in [post 8](#), I see Universal Basic Income (UBI) as the most adequate solution for the Information Age. Contrary to the Brynjolfsson and McAfee assumption, [experiments](#)

⁵ Cottam, Hilary (2018] *Radical Help*. London: Virago

[in basic income](#) have not proven that people would choose not to work if they had an income cushion,⁶ while the experience with negative income tax (or [tax credits](#)) does suggest that business may pay low wages if it counts on a government subsidy.⁷

While there are certainly calls for caution worth taking into account, the UBI system as a replacement for unemployment benefits would be much simpler than the old bureaucratic one. Every citizen in the advanced countries would receive – in the bank, accessible through an ATM – a modest income, from birth to death, that is enough to cover food, transport and a minimum of shelter. This would create a safety cushion for an irregular income stream, a subsistence income for training or volunteer work, and would be a minimum launching pad for potential artists and innovators. It would also help parents to stay with their babies and old people with insufficient pensions. It would favour increased productivity by enabling a better match between skills and jobs, because people can continue searching until they find the job that matches their skills and needs, rather than being forced to take the first job at hand.

To avoid penalizing work, people should be able to earn another one and a half or two basic incomes before reaching the tax threshold. The first layers of tax would be to gradually return the original basic income. And taxes would be modified so that basic income is fully returned by all those who earn four basic incomes and above. This means that, without having to discriminate who should receive basic income, the only ones that will not return it are the ones who really need it. So, the arguments about not being able to afford must take that as the basis for calculation. Surely, if [TARP](#) and quantitative easing could be provided for the banks, the initial round of UBI can surely be ‘printed’.

This should not touch disability allowances or any other current benefits that are not unemployment insurance. But it would save on the personnel that today carries out the task of making people prove that they are out of work and looking for it. Additionally, it would save on policing, jails and health care for those who have been pushed into the wrong paths in life by dire poverty or by feeling rejected, ignored or left-behind.

Most of all, a universal basic income would provide dignity for all citizens, while recognizing the new employment patterns. It is only a part of the new safety net needed for the information age.

Interestingly, the increasing debate and experimentation on basic income has brought other proposals such as the [Universal Basic Opportunity Fund](#) (UBOF) advanced by the RSA in the UK,⁸ to fund every citizen under the age of 55 with a £5,000 (\$6500) opportunity dividend for up to two years, taken at a time of their choosing over the course of a decade, to engage in a life project. The authors see this as an initial step towards a future basic income and they propose various ways of creating the fund that could cover the cost, including wealth taxes and using the opportunity for setting up a sovereign wealth fund by borrowing at the current ridiculously low interest rates and investing. Many other proposals are out and many more will come. The need is increasingly acknowledged, and the success of the populists makes it even more obvious.

⁶ D. and Marinescu, I. (2018) ‘The Labor Market Impacts of Universal and Permanent Cash Transfers: Evidence from the Alaska Permanent Fund’, NBER Working Paper No. 24312, February 2018

⁷ Paul, R. (2016) ‘Investigating the relationship between tax credits and wages offered by employers’, Report for Civitas: Institute for the Study of Civil Society, February 2016

⁸ Painter, A., Thorold, J. and Cooke, J. (2018) Pathways to Universal Basic Income: the Case for a Universal Basic Opportunity Fund. London: RSA

Of course, imaginative funding methods will have to be found. However, when the Welfare State was originally established, it was understood that growth and profits depended on dynamic demand and relatively high taxes that would sustain such demand, either directly as government procurement or indirectly through public salaries and the benefit system. In the 1950s in the US, as shown in [post 8, the top rate of income tax was above 90%](#). None of the calculations made for funding UBI out of taxes go anywhere near that level. The general rejection of taxation and of State intervention would make it very difficult now. But perhaps the electoral success of the populists will move many to rethink their resistance to social policies and the practical failure of those same populists, when they do not deliver on their promises, will move their followers to search for new leaders with real solutions.

In any case, if the application of such measures seems utopian, just imagine someone in the depth of the 1930s depression looking at the long line in a soup kitchen and saying that 'in a decade or so, all those people will be able to have a well-paying permanent job and own a suburban house full of electrical appliances with a car at the door. And they will be protected by pensions and unemployment insurance.' It would have sounded impossible. Indeed, in times of post-bubble distress due to major technological upheaval, it is safer to be bold and imaginative than to be timid and 'realistic'.

Facing income inequality

In the advanced West, one often hears complaints about the 'middle-income' jobs that were taken to China. But most people do not remark on the fact that those jobs became low-income jobs as soon as they got there. The truth is that the 'middle-income' condition was not in the nature of the jobs themselves but the result of the socio-political choices that were at the root of the post-war boom. These included industry unions, progressive income tax, unemployment insurance and pensions, education and health that was free or partly subsidised, public backing of mortgages – with Fannie Mae and equivalents – and many other measures. We are at the point where a new set of choices must be made. The smart green growth direction will imply a much greater proportion and variety of service jobs. They must become middle-income and be perceived as a safe bet for each worker's future, and for the futures of their children. Otherwise, the legitimacy of capitalism will be seriously put into question, as populists are already showing.

Another assumption common in the West is that the initial consequences of the diffusion of new technologies are the shape of the future; that social precipices cannot be avoided. The most typical of these is the structural unemployment expected to result from artificial intelligence and robotics. Yet, that is exactly what contemporaries feared from mass production and the mechanisation of agriculture, even if it sounds wrong and incredibly simplistic to us today. Once again, it was the socio-political choice of a high tax society of consumerist home owners and the engagement in the Cold War that overcame the social risk and created a full employment society.

An example of this form of passive determinism is Brynjolfsson and McAfee's description of the superstar economy as an expected trend stretching into the future: "In a superstar economy, the distribution of income isn't just more spread out; [...] It's also a change in the fundamental structure of the distribution [...] when income is distributed according to a power law, most people will be below average" (Ch. 10, p. 162). It so happens that in every surge there has been a strong income

polarisation during the bubble times of the installation period. As discussed in post 4, thanks to the work of Piketty and Saez we have [a clear picture](#) of the concentration of income at the top in the Roaring Twenties and in the equally 'roaring' nineties and noughties. In both periods the top 1% of taxpayers in the US, received – or rather, declared for tax purposes – 24% of all income; but during the post-war golden age their portion went down to 10%. An equivalent evolution can be found for the top ten percent of income earners who got 60% of the total during both 'roaring' periods and 34% when the context was changed in the 1950s and 60s.

If the Second Machine Age were so different from the first and the peculiarities of ICT were so unique, one would not expect to find an almost identical income distribution in the 1920s. And similar spreads were seen in the Gilded Age in the US, in the 1880s-90s, and during the railway mania in the UK in the 1840s. The spread is due more to how capitalism assimilates major technology shifts than to the specific technologies. Just watch Charlie Chaplin's *Modern Times* to see the effect of the 'Power Law' in the installation of the fourth technological revolution.

Polarisation in the 1920s and 30s was the result of the deskilling of the assembly workers, the mechanisation of agriculture, the concentration of capital and financialisation. The Welfare State modified that situation radically, considering the nature of the technology and countering its initial effects, while giving it a path for innovation and growth that was both profitable and socially beneficial. Making historical parallels, based on recognised regularities, is a good insurance policy against misunderstanding the present and the range of possible futures. It also helps the search for bold and more optimistic solutions.

However, as I noted in Post 5, [in learning from the patterns of history](#), we must not ignore the uniqueness of each period – not merely technologically, but also in the broader context. What is a unique contributing factor this time that has intensified inequality is an ideological obstacle developed when maturity of the mass production revolution set in and the erstwhile successful Keynesian policies became impotent in a context of stagflation. It was the time when the Friedman way of thinking found the space to prevail and [maximising shareholder value](#) as the main – and sometimes only – objective of the corporation became the norm. Such a shift cannot be ascribed to the nature of the Second Machine Age because it spread across the economy of the West in the Reagan-Thatcher years, when the ICT revolution was barely beginning. This shift in values requires special socio-political attention as [Mariana Mazzucato](#), [Steve Denning](#) and many others have been arguing. Fortunately, there is already a rebellion within the business world. Many companies are now measuring and publishing the '[triple bottom line](#)' – financial, social and environmental – while the [B-Corporation movement](#), committed to accompany profits with the improvement of workers, customers, suppliers, community, and the environment, has been spreading.

Full global development and supranational institutions

As mentioned in the individual policy area posts, apart from the environment, there is another significant aspect of our current context overlooked in the analysis of *The Second Machine Age*, which is global development. Although in the discussion of the diffusion of robotics the authors often refer to their use in China and the possible repercussions in the US, when they come to recommendations, they write as if the US were still a self-sufficient prime mover and the shaper of the world (pre-dating Trump's declared aspirations to return to such times). Their policy

recommendations for education, immigration and so on are restricted to the US; China is barely mentioned, much less the developing world. But, in the age of global internet, the global corporation and global finance, this is not only anachronistic – it misses another opportunity to think of how to create new demand for innovation and growth. By this, I do not only mean trading in existing products with the emerging markets, I also mean participating in the wave of innovation required to face the limits on natural resources that will confront the developing countries as they try to catch up.

I noted [elsewhere](#) that it would be a win-win strategy to fund investment in innovation and sustainable development in the lagging countries, which would in turn create demand for equipment, infrastructure, engineering and other customised products from the advanced ones.⁹ (For my views on the complex issue of development, not treated in these blogs, see for example my [2013](#)¹⁰ and [2016](#)¹¹ articles). In the 1940s, the Welfare State created a feedback-loop that turned the safety net into uninterrupted worker wellbeing and growing consumer demand for business. So today, funding the development of the rest of the lagging countries would take them out of poverty and drastically cut migration, at the same time as providing top-end markets for the advanced ones. China's [Belt and Road Initiative](#) is a bold project in that direction. After WWII, the Marshall Plan for the reconstruction of Europe created a huge demand for American equipment; in the 19th century, the spread of Empire can also be seen as demand-creating and growth-promoting policies for the core countries. China's investment policies have been likened to these trading thrusts. This time the nature of technology – networked, decentralised, open-source – and the nature of global corporations, bent towards optimising global value chains, could have the potential to support a fairer win-win game.

One method for the West to help fund full global development today is a financial transactions tax, which would capture some of the excess profits and of the untaxed income that currently flees to tax havens. Cutting across all of Brynjolfsson and McAfee's growth promoting policies is the unmentioned problem that the financial system is now globalised, yet still regulated at the national level. Unless there is a move towards an effective supranational authority with taxing power, most national policies meant to promote investment and growth confront this constraint. And most 'free trade agreements' are trying to give global corporations the power to sue governments if their new policies can harm their profits, thus turning global trade into a policy straightjacket.

Unfortunately, although it is obvious that finance is currently operating in a global casino mode, countries are unlikely to move towards global institutions. Instead, nationalism is growing everywhere. Timid steps have been taken towards eliminating tax havens; discussions have taken place about introducing a [Financial Transactions Tax](#), but resistance has been intense, as was to be expected of the all-powerful world of the financial 'masters of the universe' that, having become

⁹ Perez, C. 2016 "Capitalism, Technology and a Green Global Golden Age: The Role of History in Helping to Shape the Future". In Jacobs, M. and Mazzucato, M. (eds.) *Rethinking Capitalism*. London: Wiley Blackwell. Pp. 191-217

¹⁰ Perez, C. (2013) "Innovation systems and policy for development in a changing world", in E, S, Andersen, J. Fagerberg and B. Martin (eds.) *Innovation Studies: Evolution and Future Challenges*, Oxford: Oxford University Press, pp. 90-110

¹¹ Perez, C. (2016) "Could technology Make natural resources a platform for industrialization? Identifying a new opportunity for Latin America (and other resource-rich countries)?" In Noman, A. and Stiglitz, J. (eds.) *Efficiency Finance and Varieties of Industrial Policy*. New York: Columbia University Press. Pp. 353-389

too-big-to-fail, consider themselves immune to any control and, in addition, wield power over politicians whose campaigns they fund.

In the meantime, waves of migration to the advanced world have increased, propelled by a combination of economic hopelessness and military conflicts – either the ones that Mary Kaldor calls ‘[new wars](#)’ or those (Afghanistan, Iran, Syria, etc.) that have replaced the Cold War for the military markets. While in the 19th century, such migration from Europe helped America populate and grow, on this occasion the migration is in the direction of the advanced countries. Coming from different cultures, religions and races, the migrant inflows are easily portrayed as a threat, when there is already a climate of resentment due to austerity, technological unemployment, the globalisation of jobs, the polarization of incomes and regions, as well as the weakening of the Welfare State and of the mechanisms for social mobility. Such conditions have become fertile ground for nationalist populist leaders, at both extremes of the political spectrum.

Today, national policies spill over into the rest of the world and, equally, the policies of other countries affect the results. Even a policy like quantitative easing (QE), which poured about 8% of GDP of annual helicopter money on the American banks, ended up disturbing the economies of India, Brazil, Japan and others, without significantly mitigating the troubles of US Main Street. Banks and the major companies are now global. The economy is global. The interests of such global corporations no longer coincide with those of the population in their country of origin. And the United States, however powerful still, can no longer see itself as the power that shapes the rest of the world or as an economy that is not influenced by what happens elsewhere. In fact, the ‘America First’ policies of Donald Trump seem a declaration of weakness by a declining power in a changing world.

We should all be acknowledging the new global stage for policy. Just as the Bretton Woods agreements in 1943 created inter-national institutions that stabilized the world after the war, appropriate supra-national institutions are now needed to tackle an inevitably globalised world. In fact, just as each global corporation learned to empower its ranks from the highest to the lowest, the ICT world calls for subsidiarity in government, from the global all the way down to the local, with national governments serving as brokers between the various levels. Each national government might need to set up the framework that defines its particular advantages and its areas of competitiveness in a consensus process with business and society, with its regions and its cities and with its allies in the world. The old planning and deciding role of central government might need to give way to a participatory set of institutions capable of catering to all the interests involved. Instead of getting government out of the way to have markets continue doing so little to decrease inequality, we may need government to promote a broad consensus for reshaping the context, to entice massive investment and innovation nationally and worldwide. Immigration only becomes rational and stops being a problem when conditions improve both in the sending and the receiving ends.

Unfortunately, all these years of austerity and free markets, without doing much for rescuing the victims, have made nationalism inevitable and any attempt at supranational institutions chimerical. However, it is worth taking solace from the fact that in the 1930s any idea of breaking up empires and reaching independence in most colonies looked equally impossible. On the contrary, Hitler planned to form a new empire of his own. Within the next two decades, after the war was over, practically every colony had achieved independence in one way or another.

Modernising the State

If we are indeed in a transformation as profound as Brynjolfsson and McAfee describe, the policies to guide it should be at least as innovative as those that Keynes, FDR and others proposed and created for what I consider the fourth technological revolution – what, for Brynjolfsson and McAfee, would be merely the final phase of the first machine age. We desperately need to make the break with the mass production revolution, and policy recommendations must include that direction of change. In the mid-19th century, urbanisation and mechanisation drove the Victorian boom and made the UK into the successful ‘workshop of the world’; massive suburban home-ownership and the Cold War shaped mass production in the 20th. We can now conceive of global sustainable production patterns and lifestyles as the aim of policies for the future. The new conditions of this paradigm demand opening the future wide, not merely defining how the old products will be produced with robots or intangible services but promoting the new lifestyles that will require new services and will create new jobs.

Yet, to make all these changes, government must transform itself, modernising its organisation – as the old bureaucratic corporations had to do (see [the case of IBM](#)) – not just computerising it. If the technology is about platforms, networks, participation, adaptability and big data, you cannot address it with bureaucratic pyramids isolated from citizens, or with band-aid solutions from the previous technological age, which can, at best, only function as temporary palliatives for the new problems. Instead, you transform government itself into flexible participatory systems functioning as platforms for the various services (see [Tim O’Reilly](#)). We need modern institutions that incorporate citizens and business into consensus-building processes. Ultimately, the objective is to induce business to profit by innovating and investing in a widely defined synergistic and socially beneficial direction – which, having been tested by business and society already, will now be favoured and accelerated.

That is exactly what Roosevelt did by making government into a complex ‘divisional’ structure, like General Motor and General Electric, and choosing to favour innovation for catering to the suburban way of life and serving the purposes of the military (eventually in the form of the Cold War). Thus, the Welfare State, infrastructure building – especially the highway system – and government procurement were the big demand-creating paths that underpinned the post-war golden age. Legalising and encouraging labour unions by industry – rather than by trade – helped maintain collective pressure for wages to rise in all companies in unison and at the rhythm of productivity. This resulted in augmenting consumption potential while favouring the prevalence of oligopolistic forms of competition on brands and other elements rather than on salary levels.

All that means a profound [rethinking the old institutional framework](#) in its organisation and its methods¹², while re-examining the ideas underpinning the existing structures. The choice is not between free markets and ‘politburo’ government – as Brynjolfsson and McAfee seem to suggest in chapter 14 – but between ‘winner takes all’ and decent capitalism; between market fundamentalism and a win-win game between business and society. It is the turn of this generation to make that choice.

Many authors and practitioners are now acknowledging the radical change in circumstances brought by the digital revolution, and the accompanying need to make radical institutional innovations to match the nature of those technologies and overcome the negative consequences. [Nicolas Colin](#) proposes designing Safety Net 2.0 to replace the obsolete one; [Hilary Cottam](#) suggests replacing the bureaucratic forms of the Welfare State with participatory ones; [Steve Denning](#) recommends generalising the ‘agile’ model to government; and [James Plunkett](#) looks at new forms of consumer protection to face the personalised pricing being used on the web. Others focus on green growth: [Kate Raworth](#) proposes ‘doughnut economics’ occupying a space defined by social and environmental sustainability; the [Ellen MacArthur Foundation](#) aims to accelerate the transition to a circular economy; [Nick Robins](#), proposes new forms of funding the green economy; [Michael Jacobs](#), has just published the results of a two year-long report advancing a whole range of innovative policies for prosperity and justice in the UK; [Mariana Mazzucato](#), is reconceptualising the ‘entrepreneurial’ state and there are many, many others. It is time to engage in an intense debate to be followed by experiments, by the scaling up of the many already occurring and by decisive policy action.

- - -

I must now acknowledge a debt of gratitude to Brynjolfsson and McAfee. *The Second Machine Age* is a carefully considered and excellent exposition of many of the ways in which technology and the economy have changed and, especially, are likely to change. I have not written this long series on their work because I think it is inaccurate, but rather because, while providing one of the best analyses of the direction being taken by technology and the threats it poses, they fail to take the further step in terms of social action and policy prescriptions. My diagnosis of the reasons for that decoupling was, first, their interpretation of history as divided into only two machine ages, rather than several revolutions to learn from, and, second – perhaps, because of being engineers – their excessive respect for their economist colleagues. Their work has therefore allowed me to use the nature of their recommendations to show how neither pure engineering nor the current economics orthodoxy can provide the right recipes for facing the challenges of the technological revolution.

An understanding of history and of the underlying patterns at work can help us to see the relationship between techno-economic and socio-institutional change. It can also help us to avoid simple technological determinism, trusting instead in the socio-political shaping of technological revolutions as the way to solve many of the problems posed by technology. Such an understanding also enables us to find the way to benefit society, moving from policy prescriptions rooted in the past to new ones suited to the future.

There are currently many minds at work trying to tackle forward looking solutions to the technological, economic, social and environmental challenges that are already facing us. The time has come to build – and pay attention to – new positive narratives that will help the leaders and the majorities to understand that now is the time for bold policy design and action, to construct a better future. Capitalism only gives such opportunities to society once or twice in a century. Let us make sure we do not waste this one.