

**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 6

***The limits of the Brynjolfsson and McAfee policy recipes:
Proposals on human capital***

Carlota Perez

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*What follows is the first of the concluding series of posts on [Erik Brynjolfsson and Andrew McAfee’s influential book, *The Second Machine Age* \(2014\)](#). These posts have not been intended as critique of their analysis of the new technology systems and their transformative potential; rather, my intention has been to examine how different historical understandings of technological revolutions – and of the role of markets and government – end up providing different policy guidance in the present. The series started by examining different approaches to [the periodisation of industrial revolutions](#), and the particular differences between seeing the present moment as the start of a Second Machine Age, as Brynjolfsson and McAfee hold, or as the midpoint of the fifth revolution, as I understand it. I then discussed the [patterns of repetition](#) identified by the Neo-Schumpeterians in the diffusion of successive revolutions. Then [post 3](#) analysed the profound nature of the transition we are going*

through, while [post 4](#) focused on how what Brynjolfsson and McAfee call ‘bounty’ (leading to growth) and ‘spread’ (leading to inequality), have repeatedly occurred in the process of creative destruction’ that has characterised such major shifts. Finally, in [post 5](#) argued for the importance of understanding the role of socio-political shaping over technological determinism; the wide range of the viable provided by each new paradigm; and the subsequent possibility – and indeed necessity – for government to set a congruent and synergistic direction for ‘the market’ (or markets) to function in a positive-sum game between business and society. It is now time to examine Brynjolfsson and McAfee’s policy prescriptions in the light of the richer understanding of the social assimilation of technological revolutions proposed in this series. After a general assessment of the limited nature of their proposals, this post will begin the final series of four, dedicated to discussing their recommendations.

Introduction: The limits of Brynjolfsson and McAfee’s policy recipes

Most of *The Second Machine Age* focuses on describing current and future technical change, accompanied by warnings about its speed, depth and worrying social consequences. From the potential of robotics and artificial intelligence (AI) to [decimate jobs](#) for humans to the multiple negative effects of increasing [inequality](#), Brynjolfsson and McAfee share the concerns of all those who care about our socio-economic future, from those focused primarily on economic growth in general to those campaigning for social justice. The surprise comes on discovering that, after such a vivid, complex and, to an extent, apocalyptic rendering of the future, the two chapters dedicated to meeting and mitigating this future put forward policy recommendations that are timid in scope and surprisingly divorced from the technologies that they depict so well.

The authors themselves admit the modesty of their suggestions. At the end of ‘Policy Recommendations’, in the chapter that specifically looks at the government actions to apply, they note:

“The policy recommendations we outline above share one simple and modest goal: bringing about higher rates of overall economic growth. If this happens, the prospects of workers and job seekers alike will improve.” (p. 227).

They are, of course, working from a premise which I have spent the past three posts [[here](#), [here](#) and [here](#)] contesting: that the dwindling employment and increasing inequality brought by the technologies which they describe as ‘spread’ will inevitably remain into the future, and that the changes to the fundamental structure of unequal income distribution can be expected to be permanent (Ch. 9). Taking that as a given, many of their recommendations are only ways to temper such enduring changes. So, while there is nothing wrong with their statement that if growth happens ‘the prospects of workers and job seekers alike will improve’ (p. 228), it is disappointing that they cannot move beyond standard economic orthodoxy, when advancing policies for growth, and that they do not dare think out-of-the-box to define a future that will benefit all, given the major changes in technology.

Instead, in search of new solutions for the future, Brynjolfsson and McAfee go back to the tired pure market theories of the ‘Economics 101’ textbooks. They are extremely cautious about taking an

interventionist approach, tentatively advocating ‘government policies ... in a few key areas’ (p. 208), while claiming that, right or left, economists share more common ground than the media leads us to believe. Such caution and reliance on existing formulas is understandable if all you want is to gather as much of elite opinion as possible around non-controversial proposals. Consensus is indeed important, but it is only worth the effort if it is around effective policies.

Yet, the uniqueness of each new technological paradigm requires a public policy response that is fundamentally different each time. And here we see perhaps the most short-sighted result of applying the Economics 101 prescriptions: as Robert Solow famously noted, dominant economic theory ignores the role of technological change.¹ Engineers should be the first to reject this blind spot, and yet they claim that:

“...many of the things that we should do in a time of brilliant technologies are not related to the technologies themselves. Instead, they're about promoting growth and opportunities more generally” (p. 208).

In contrast, I argue that it is crucial to recognise and understand the specific nature of the revolution in question in order to design policies that are uniquely appropriate for the new circumstances they create and the possibilities they offer. In what I call the third revolution, the science-based Age of Steel and Heavy engineering from the 1870s to the 1910s, the governments of Germany and the US engaged in a massive programme of specialised university education and highly skilled worker training, which was fundamental in their successful forging ahead of Britain. Furthermore, they both applied huge tariff protection, as much as – and more than – 50% on most advanced products. Those were the appropriate policies for that particular revolution and for countries that had to confront what had been British superiority and British global hegemony. By contrast, in the surge before that, during the Victorian boom in mid-19th century, the British government was making policy decisions based on an economy that was unrivalled in productivity; it was therefore in British interests to promote the notion of the free market outside its borders, signing free trade agreements in Europe and using gunboat diplomacy to force open the markets of the Far East. Becoming the ‘factory of the world’ was not the triumph of the industrialists alone; the strength of the Royal Navy ensured the cheaper goods of the British could flood the globe.

In the posts that follow, I will examine one by one the individual policies recommended in *The Second Machine Age*, focusing primarily on their limitations in the light of the understanding of technological revolutions that I have presented. For each, I will indicate some directions for action that, in my view, are both more appropriate to the challenges posed and more socially ambitious. However, these come with the caveat that they are not simple replacements for those suggested, which can be applied individually, but rather part of a process of systemic change that needs to cut across society in the same way as the process, organisational, institutional and societal changes that followed WWII.

Before beginning the discussion of the policy recommendations, however, it is important to clarify that I am not against Brynjolfsson and McAfee’s ‘techno-optimism’. I agree with them in seeing technology as the most powerful tool we have to achieve wellbeing, and believe that these particular technologies can be shaped for such a man-machine interaction that the fears of total

¹ Robert M. (February 1956). ‘A contribution to the theory of economic growth’. *Quarterly Journal of Economics*. Oxford Journals. 70 (1): 65–94.

replacement of human beings will not be fulfilled. I too see major breakthroughs ahead, and disagree with the more pessimistic scholars of technology such as [Robert Gordon](#) who warn of an end to growth. It is on the basis for optimism that I differ with Brynjolfsson and McAfee. My historical studies have led me to a different conclusion about how society reacts to such a mix of threat and opportunity so as to reach the best outcome. The choice, as I see it, is between a path of adapting to the new technologies and their apparent consequences on society, or one of engaging in the socio-political shaping of the new potential to achieve the greatest social wellbeing they can sustain.

I also differ on the relative roles of markets and the state in the process of making the technologies serve the whole of society. As this series has emphasized, the range of the viable with any technological revolution is very wide and markets do not necessarily choose the most sustainable paths, socially or environmentally. Based on the historical evidence, I hold that it is society, through the power of the State, that must provide the context and the direction that enables the best of possible futures. This also distances me – together with Brynjolfsson and McAfee – from those who simply dismiss the threats of unemployment claiming that history shows that sufficient new jobs are always created. In fact, what history shows is that – as exemplified by the difference between the 1930s and the 1950s – the right policies can lead business to exploit the technologies in the direction that will both create greater wealth and the many supplementary jobs. It does not happen automatically; markets operate in a context which shapes the potential outcomes. If governments do not shape the context, the worst fears expressed in *The Second Machine Age* and of the techno-pessimists could come to pass.

I do not pretend to have all the answers. What I do claim is that a deeper grasp of the historical record provides an understanding of the calibre of the solutions required when a technological revolution wipes out numerous jobs and skills and leads to deeply deteriorating lives and regions. History has also helped me to understand that it is the technology itself that provides the paradigm and the potential for the achievement of beneficial change. Just as the big corporations have needed to change both their organisation and their strategy to take advantage of the new paradigm, so governments must follow suit if they are to achieve their social objectives. The modernisation of the State that occurs at each turning point implies precisely a process of ‘creative destruction’ in the institutional and policy spheres, capable of bringing the benefits to the great majorities at the same time as supporting the further flourishing of business. Not doing so is a wasted opportunity that inevitably leads to conflict and decline.

In this post I will discuss Brynjolfsson and McAfee’s recommendations in the areas of human capital, relating to employment and education. In subsequent posts I will deal with R&D and innovation (centred on the production and use of knowledge); after that, with taxation, infrastructure and basic income (centred on government income sources and uses); and finally with the major omissions in the prescriptions of *The Second Machine Age*: the environment, global development and global governance. This final post will include the need for systemic directionality, the recognition of globalisation – as well as localisation – and the need to modernise government itself – including the social safety net – to make it fit for purpose in the information age.

Human capital: education, employment and 'brain gain'

EDUCATION: Yes, teach the children well; but shouldn't we rethink the whole education system?

It is only when looking at what to do in education that Brynjolfsson and McAfee seem to be most aware of the potential of the current paradigm. With the purpose of 'teaching the children well', they propose the massive use of digital technology, beginning with the use of MOOCs (massive online open courses) to replicate the best teachers; 'flipping the classroom' by watching MOOCs at home and doing assisted 'homework' in school – which would include discussions, experiments, group projects, and so on (p. 209-210) They also recommend increasing teachers' salaries in order to increase prestige and attract the best and most qualified to the profession; and introduce tests in order to increase accountability (p. 211-212).

Those are good recommendations indeed, although the emphasis that they place on the need for the US to 'move its students to the top of the international rankings' in order to 'boost GDP growth' (p. 208), seems to counter the arguments made by them earlier in the book about outdated metrics for growth and the need, in the new machine age, for humans to leave the '3Rs' behind in favour of creativity and communication-generating self-organised learning environments.

Yet, these proposals fall short of touching the organisation of the academic world and the need for continuous adult education. Are we to keep the mass production model from kindergarten to PhD, with various final exit points along the way, which was designed at a time of jobs-for-life, in which everyone had a relatively fixed place in the hierarchical system? Is that really suitable for our more horizontal, networked world with portfolio careers? Do we retain the once and for all education for human capital in what [Joel Mokyr](#) calls the "clay model" of skill forever or rather the "putty model" that makes people adaptable and capable of retraining? Should we keep the classroom for those pursuing a degree only or do we open the doors to people in work to come back to one class or another and join the young, bringing their desire to learn and sharing their experience? If not, how are we to guarantee the frequent reskilling that they warn will be required?

Could we perhaps question the current academic model and move to a more diversified system, in which the education of children relates to their flourishing in the current paradigm, as described above, while lifelong learning becomes as 'common sense' as the current mass production exit model currently is? A wide-ranging educational network could grant certificates of all sorts – from pottery to home agriculture and from languages to engineering – locally nationally and globally, in person or through internet – or both or none – making learning both a desirable consumer product and the most important personal and societal investment. Surely the learning system of the Knowledge Society cannot be a mere digital updating of the one that trained the assembly-line workers and their bosses.

Lastly, given the importance of human capital for creating value and increasing demand, shouldn't tax exemption be considered for any expense – i.e. investment – in education? The tax exemption of mortgage payments encouraged home-ownership boosting demand for consumer goods and the construction industry. The knowledge society needs to create a context that encourages a constant increase in human capital.

EMPLOYMENT: Promoting startups and connecting with offers or radically changing the incentives for private finance to help create jobs?

When looking at the problem of job creation, Brynjolfsson and McAfee focus on promoting entrepreneurship and enabling the proliferation of startups. “As old tasks get automated away, along with demand for their corresponding skills, the economy must invent new jobs and industries. Ambitious entrepreneurs are best at this, not well-meaning government leaders or visionary academics.” (p. 213). Having restricted the role of government in job creation, they have three suggestions to achieve that aim: multiplying start-ups, reducing regulation and increasing visas for skilled immigrants.

The examples of start-ups that Brynjolfsson and McAfee give are the giant entrepreneurs successful in the revolutionary industries: “Thomas Edison, Henry Ford, Bill Gates, and many others” (p. 213). Having reviewed a significant amount of literature on the topic, they identify them as the main job creators, even as they recognize that many start-ups do not end up employing anyone beyond the founding entrepreneurs, while those that make it as SMEs still see a lot of ‘churn’ in their workforce.

However, as we saw in [Post 3](#) the new high tech industries have the highest productivity levels and create much wealth but are not the source of most new jobs. The relevant question is whether the banks will lend to the job-creating industries associated with the environment and the emergence of new lifestyles such as renewable energy projects or learning centres or projects in recycling or urban agriculture or new building materials or a rental business model or personal healthcare services or simply a gym. (see [here](#) for further explanation of the role of lifestyles in demand and employment creation in each revolution).

Yet, even if we were to understand that their notion of start-ups includes such firms, their recommendations still fall short. They are certainly not wrong in asking for every bit of regulation to be re-examined to see if it is (still) working. That is part of what the modernisation of government implies. We need to assume that most of the old policies – and especially the old ways of applying them – are likely to be obsolete. But this is not the same as saying that government should get out of the way, which, as we saw in the [last post](#), is a refrain that has arisen at a similar point in every technological transition – and which does ‘work’ during the creative destruction period for the new tech firms, if not for the rest of society. The point is that regulation adapted to the conditions and in the context of mass production – homogeneous, Fordist, unionised, job-for-life, national, and so on – does not suit the networked, customised, flexible, diversified and globalised present. In that sense, the small businesses and farmers who have felt frustrated and restricted by government regulation – like some who voted for Brexit and Trump – are correct to a degree, although eliminating all regulation is not the answer.

Indeed, there are multiple cases of regulation that induce entrepreneurship, such as [the Energiewende programme](#) in Germany – which has not only stimulated renewable energy innovation and investment but also innovation in other industries (such as steel), and social innovation, (such as community managed energy systems). Equally, the vigorous cutting-edge petroleum services industry in Norway was the direct result of ambitious government regulation, as

have also been the recent leaps made in sustainable housing and energy-efficient construction in various countries. It is true that new regulation – such as that related to sustainability – can have a negative impact not only on the coal and oil giants but also on some small businesses in the short-term. But, if done systemically, these effects can be mitigated: take the case of the paper industry in [Finland](#), where the closing or streamlining of plants has been done under a tripartite management of state, businesses and employees, and included reskilling, compensation and the creation of new jobs.

Their other very specific recommendations are really to do with aspects of the labour force, rather than the creation of more jobs. The exhortation to allow more immigrant entrepreneurs (or startup visas) is an intelligent policy that has been applied historically by governments bent on forging ahead. In the early 19th century, many nations determined to compete with Britain – including Prussia, France, Belgium and the US – welcomed skilled experienced migrants from the UK (in spite of a UK law prohibiting such movements). In the 1980s-90s, the government of Singapore actively engaged in attracting not only highly skilled migrants, but also key companies to the city-state, offering publicly funded R&D support and other advantages; China is today intensively scouting and giving incentives to high tech specialists. Brain gain, as well as avoiding brain drain, are effective government policies worth pursuing, perhaps even more so in the current knowledge society.

Their other recommendation is to enable information flows through advanced databases in order that graduates looking for jobs and companies searching for specific skills find each other quickly and easily. “The federal government could use prizes to spur development of these databases. We should also encourage and support private companies to develop better algorithms and techniques for identifying skills and matching them to employers” (p. 217). That would indeed be useful and, as they say, it’s happening in the established LinkedIn as well as in newer platforms such as Knack. Yet, like visas for potential entrepreneurs, Brynjolfsson and McAfee would be the first to acknowledge that skill-matching is a solution at the fringes of the real problem of employment volume, especially given their predictions of job destruction. Far more important is increasing the number of employers and the demand that will entice them. And that has to do with systemic policies favouring a general direction that will create synergies, reduce risk and increase profitability – to which I shall return in the final post.

Other than these small and very specific recommendations, when Brynjolfsson and McAfee say that “government, businesses, and individuals can do more to fuel high-growth entrepreneurship” (p. 216) they do not specify what exactly is to be done. Indeed, if governments are to get out of the way of the market as they imply, I would argue that there isn’t much that *can* be done.

Promoting new businesses and creating employment – jobs that have not previously been imagined, across the entire socio-economic spectrum – needs widespread investment, relevant regulation and supportive institutions. Without finding ways of enticing the current casino world into consistently funding the real economy instead of [extracting value by moving money around](#), millions of potential projects promising jobs in the US and across the world will not get off the ground. The change will not happen as the result of piecemeal regulations, but through systemically tilting the playing field in clear directions and, within those directions, engaging in [‘mission oriented’ policies](#) – i.e. complex goals that involve multiple projects and multiple actors. Isolated band-aid solutions are not likely to induce innovation, investment and, therefore, employment in the magnitudes required by the

technological transformations that Brynjolfsson and McAfee describe so well. I will return to this in the final post.

In the following post I will discuss the policy proposals of The Second Machine Age on science, technology, innovation, production and infrastructure. Despite their expertise in the field of technology, Brynjolfsson and McAfee often fail to recognise the connection between new technologies and their potential application in solving many of the problems that their book discusses. Even when they refer to government investment in infrastructures, they only refer to the ones of their 'First Machine Age' ignoring those related to the new digital world. The post will also highlight how a backward-looking fear of association with Keynesian economics can hinder a forward-looking approach to solutions.