iS
CHANNEL

Digital Technology and Inequality

The Last Promethean Gift?

Matteo Ronzani
MSc Public Management and Governance (2014/15)
Department of Management
London School of Economics and Political Science

KEYWORDS

Diffusion
ICT
Inequality
Information
Resource Distribution

ABSTRACT

This paper aims to assess the impact of the diffusion of ICTs on resource distribution on a global scale. The exponential improvement trajectories of digital technologies are making devices and computerised means of production cheaper and more efficient. This is drastically reducing the competitive advantage of human labour over machines. This issue has significant implications in terms of resource distribution and inequality; that is because digital technology is creating immense wealth for a small fraction of the population. Since capital now has higher rates of return than economic growth, it is possible to consider digital technology as a force that is aimed at preserving the status quo, through a replication of the existing pattern of resource distribution.

Introduction

ICT is often perceived as a mere means through which incredible ends can be achieved. Something similar can be said about technology more generally: in the last two centuries technology has dramatically increased productivity and, as a consequence, wages have increased. For this reason, there tends to be a sense that, from a historical point of view, technology has helped everyone. However, judging technology and ICT in the light of a means/ends dichotomy overshadows the often perverse effects that such technical ways of mastering the physical and intellectual environment can have on society. The reduction of ICT to a mere 'technology' is not neutral. That is because using ICT as a technical means is possible to achieve opposite ends, and insofar opposite ends are opposite because they use the same means, the ends are subjected to the means. It seems necessary to look at the effects that ICT has on society from a disenchanted perspective, avoiding the ceremonial rhetoric that celebrates the 'intrinsic goodness' of digital technology, conceived as an emancipatory force.

This paper argues that ICT diffusion on a global scale can have ambivalent societal consequences, which are often concealed under the rhetoric of free accessibility of information. The first part of this paper aims to give a perspective on the development of digital technologies, which takes place at an accelerating rate, and the exponential diffusion of digital devices. These improvements relate to increasingly more systematic computerisation of jobs. The second part intends to correlate the issues of computerisation and inequality in resource distribution. This view challenges the assumption that technology is intrinsically beneficial and historically benefited almost everyone. The third part attempts to connect the patterns of evolution of digital businesses and their social consequences. The final section argues that the domain of economic action is becoming more and more abstract because of digitised information. Moreover, it is argued that it is necessary to find a way to pay the monetary value of information to the people who create it in order to challenge the existing state of affairs, which is characterised by an intolerable level of inequality.

The Exponential Improvement Trajectories of Digital Technology

A fundamental concept that helps making sense of the history and development of digital technology is Moore's Law. The simplified version of Moore's Law states that the processing power of computers increases at an accelerating rate and doubles approximately every two years (Moore, 1995). This 'law' is not an immutable scientific law, rather an illuminating observation about technological development on which there is substantial agreement (Brynjolfsson & McAfee, 2012; 2014; Lanier, 2014; Sneed, 2012). Moore's law suggests that technological improvements do not accumulate linearly, but they increase exponentially. The exponential increase in processing power relates to increasing the capacity of computers to process and manipulate always bigger amounts of data (Moore, 1995). These improvements - in connection with other technological upgrades - are changing the ways in which things are done on a daily basis in virtually every economic activity.

As Ian Morris (2010) points out, a fundamental trigger of the Western social development* was the Industrial Revolution. In this context, the systematic

Corresponding Author
Email Address: M.Ronzani@lse.ac.uk (M. Ronzani)

* Namely: "a group's ability to master its physical and intellectual environment to get things done" (Morris, 2010, p. 73).

application of technology as a means of manipulating the physical environment led to a dramatic social change that overshadowed all previous discoveries in the radicalism of its impact. In that context the invention and perfection of the steam engine and other technological developments "made mockery of all that had gone before" (Morris, 2010, p. 246). Contrariwise, the digital revolution is based on technologies that have hardware, software and networks as their basis. These technologies are influencing our world in a way that might be considered even more radical than what happened before. As Brynjolfsson and McAfee (2012) point out, the main difference between the two revolutions is in that the digital one not only is multiplying the power of our muscles, but also the power of our brains, extending the domain of our intellectual environment. Computers are now reaching power and sophistication that can outperform humans in many tasks, which are not strictly 'computational' but also eminently 'human' (Levy & Murnane, 2004) – e.g. driving a car or automatically generate a report. Not only algorithms are always more refined, but machines are becoming capable of mastering complex abilities of pattern recognition, complex communication and artificial intelligence (Levy & Murnane, 2004).

The set of activities that can be performed resorting to digital technologies is increasing, and digital capabilities[†] are more and more crucial in business practices. Notwithstanding this, there is a rather counterintuitive constraint in computerisation, known as Moravec's Paradox. According to Moravec (1988, p. 15), "it is comparatively easy to make computers exhibit adult-level performance […] and difficult or impossible to give them the skills of one-year-old when it comes to perception and mobility". This paradox highlights that highly computational/logical processes are translatable into algorithmic language, whereas 'basic' sense-making and sensorimotor abilities need incredibly high amounts of resources and processing power. This paradox explains why 'knowledge work' is more threatened by computerisation than other professions that are eminently practical (McKinsey Global Institute, 2013).

Both in the industrial and digital revolutions technology reduced the comparative advantage of human labour over machines (Levy & Murnane, 2004). However, the impacts of technologies and their social consequences are substantially different in the two cases. Items that fall under Moore's Law increased dramatically in recent years: everything that has moved from the analogue domain to the digital one (e.g. cameras) became a computer component, and "as they did so, they became subject to the exponential improvement trajectories of Moore's Law" (Brynjolfsson & McAfee, 2014, p. 51). In the light of Moore's Law, it is possible to argue that "eventually most productivity *will* become software-mediated. Software could be the final industrial revolution" (Lanier, 2014, p. 3). When it comes to digital technology a difference in *degree* – namely the progressive application of technology as a means of production – became a difference in *kind* (Brynjolfsson & McAfee, 2014) – namely it has become something qualitatively different from what it was before. That is because technologies not only are making production always more efficient, but are progressively eroding always more domains of human activity.

The Connection between Computerisation and Inequality

For almost two hundred years, wages did increase alongside productivity. This has created a sense that technology helped (almost) everyone. But more recently, median wages have stopped tracking productivity, underscoring the fact that such a decoupling is not just a theoretical possibility but also an empirical fact in our economy.

(Brynjolfsson & McAfee, 2014, p. 128, emphasis added)

It is possible to break down the issue of the decoupling highlighted by the quote above into two parts. One is computerisation and the social consequences that derive from it; those consequences are profit rises of firms and dismissal of workers. The second issue relates to inequality. It is possible to establish a causal link between the systematic application of computerization and the accumulation of immense wealth, at the expenses of the well-being of the 'middle class'.

Research has shown that both low-skills (CBRE & Genesis, 2014) and middle-skills level jobs (McKinsey Global Institute, 2013; Tüzemen & Willis, 2013) are threatened by computerisation. Moreover, according to Frey and Osborne (2013), 47% of jobs in the US is at risk because of computerisation. Technological advancement is making mechanisation cheaper; as result initial investments in setting up mechanised plants significantly decreased over the last three decades (Grant, 2012). Thus the cost of capital associated with mechanised plants is decreasing and the outputs are comparatively higher in many sectors[‡] (Grant, 2012) – Moreover, this way many constraints associated to the unionised workforce are avoided. As a result, owners of the 'means of production' accumulate more wealth with less human labour involved.

The fact that mechanisation is cheaper devalues labour because the imperative of profit maximisation implies that an economically rational employer would not pay an hour of work to a person more than the cost that is incurred by machines. It is worth pointing out that virtually every economy in history has been resorting to technology in order to exchange

† Digital capabilities are "time and space-contingent abilit[ies] to perform a particular productive activity" (Jacobides & Winter, 2012, p. 1635) resorting extensively to IT-based processes.

‡ This relates both to the 'hard' side of production, namely machines used to produce goods, and IT investments associated to ERPs and information systems. In the particular case of substantial IT investments, in order to see the performance benefits it seems to be necessary to wait approximately 5-6 years (Brynjolfsson & Hitt, 2003); however in the long run these investments seem to be worthwhile.

capital for labour, however, the changes that we are experiencing now for the first time undermine the role man is playing in regulating technologies. Moreover, "when a technology becomes software-mediated, the structure of the software becomes more important than any other particularity of the technology in determining who will win the power and the money when technology is used. Making fabrication software-mediated turns out to be a step toward making the very notion of a factory, as we know it, obsolete" (Lanier, 2014, p. 77).

Computerised production is among the causes of decoupling between average salary and global GDP (Brynjolfsson & McAfee, 2012; 2014; Lanier, 2014). According to Piketty & Saez (2006), the share of wealth owned by the top 1% of the population in the US doubled since the 1980s, reaching a peak in 2012 when the top 1% earned 22% of total income. Moreover, according to Piketty (2014), in the 30 years 1977-2007, 60% of US national income went to the top 1% earners. This leads to the fact that, over the same period, the earnings of the top 1% increased by approximately 270%, whereas the middle class saw an increase of just 35% of income (Brynjolfsson & McAfee, 2014). For these reasons – and many others including inherited wealth – the level of inequality in the US "is probably higher than any other society at any time in the past, anywhere in the world" (Piketty, 2014, p. 265).

It is not possible to attribute the issues mentioned above to the systematic use of digital technology because *correlation does not imply causation*; however the existence of a causal link is undeniable. The next paragraph will clarify the sense in which the evolution patterns of digital business are contributing to this disproportionate distribution of wealth.

The Patterns of Evolution of Digital Business and their Social Consequences

To identify the patterns of evolution of digital business, it is necessary to give a definition of the category. McDonald and Hartman (2013) define digital businesses as based on "digitalization as the transformative process for turning digitized resources into new sources of revenue, growth and operational results. Creating a competitive premium is the goal of a digital business. Digital businesses create competitive edges based on unique combinations of digital and physical resources. They do things that others cannot and in ways that build comparative advantage".

It seems in the very nature of digital business to be associated to comparative advantage, which in turn is connected to the process of disruptive innovation. The notion of disruptive innovation can be interpreted as a contemporary reformulation of the broader concept of *creative disruption* presented by Schumpeter (2010) as fundamental aspect of capitalist societies. Disruptive innovation is more context-specific, in the sense that it seems inseparable from the domain of technological development (Christensen e*t al.*, 2004). Disruptive innovation is not to be confused with break-through innovation or invention of totally new and superior products/services, rather it relates to the transformation of an expensive and complicated product into something that is not necessarily better, but easier to use and cheaper (Christensen e*t al.*, 2004; Yu & Hang, 2010).

As the name itself suggests, disruptive innovations have the tendency to subvert existing market balances, as they erode competitive advantages of established players in the market. The unexpected imposition of disruptive innovations in the market, due to the fast-evolving nature of technology, has made market changes faster, more radical and less predictable (Grant, 2012). The macro-level outcome of the frenetic market dynamics of digital businesses – in connection with phenomena such as network externalities and competition for standards – is the so-called 'winner-taking-all distribution' (Anderson, 2009). This configuration, which is a situation in which very few firms do well and the vast majority fails or barely survives, is typical – for instance – of tech start-ups (Burns, 2010). In the tech start-ups context, which is characterised by an approximate failure rate of 80% (Burns, 2010), among the few survivors only an incredibly small number succeeds – and as a consequence quickly amass incredible fortunes (Lanier, 2014).

In the recent past these factors led to the creation of a 'star system' or 'winner-taking-all' distribution (Anderson, 2009), which has made the rich richer and penalised the middle class. In this sense the "new digital economy, like older feudal or robber baron economies, is thus far generating outcomes that resemble a 'star system' more often than a bell curve" (Lanier, 2014, p. 34). Conversely, a bell-curve distribution is dominated by a prominent bulge of average earners and few super-rich and poor people at the extremities. This distribution, apart from being more balanced, is also functional to the development of a thriving economy because there are more people in conditions to purchase goods and sustain economic growth (Rifkin, 2014; Stiglitz, 2013). As it has been pointed out, winner-taking-all distribution is typical of digital businesses, which additionally have the tendency of engulfing smaller thriving businesses. These tendencies of digital corporations relate directly with the accumulation of immense wealth of small elites, and this pattern of distribution seems to assert itself progressively (Lanier, 2014; Stiglitz, 2013).

Economic analysis confirms this trend: nowadays capital tends to produce rates of return in the 4-5% range, whereas economic growth is in the range of 2-3% (Piketty, 2014). The consequence is that owners of great fortunes (and their heirs) are better off because their fortunes grow more and faster than the economy[§] (Stiglitz, 2013 and 2014; Piketty, 2014). Moreover, these issues have great impact in terms of political economy: political systems seem to go in the direction

§ These figures do not relate only to 'digital businesses', but include the category. The reference is not only to the 'usual suspects' (Google, Amazon, Facebook, etc.), but to all business who highly resort to IT-based resources and capabilities, as well as to automation based on IT.

of serving the interests of the owners of capital, hence this resource distribution has the tendency of undermining democracy (Stiglitz, 2013; 2014; Piketty, 2014).¶ This is even more dangerous in relation to digital businesses that highly resort to Big-Data and 'Siren Servers' (Lanier, 2014): if those elites not only have control on capital itself, but also on confidential information about individuals, the situation might be even worse. The next paragraph relates the issues mentioned above with digital economics, and the significance of digitized information in relation to resource distribution.

The Value of Information

Digitised information, namely information encoded "as a stream of bits" (Shapiro & Varian, 1998, p. 3), is a fundamental dimension of our economy. Information has always been crucial in business and all the domains of knowledge; for this reason information is regarded as a source of power (Buchanan & Huczynski, 2010). However, the importance of information in the digital age has changed, creating a different and new domain of economic action (Jacobides & Winter, 2012). Digitised information is based on bit-strings, namely "everything that can be stored in computer memory and transmitted over the Internet" (Quah, 2003, p. 2). In light of that, a digital good can be defined as a set of bit-strings that is relevant in terms of payoff (Quah, 2003). Some of the most striking features of digital economics caused by digitised information are: 1) 'elimination' of costs related to gathering information;** 2) elimination of transaction and reproduction costs; 3) 'perfect' information flow among economic agents; 4) resizing of the role played by scarcity in economics; 5) information tends to be non-rival and does not get 'used-up'; 6) intelligent infrastructures and markets (cf. Quah, 2003; Anderson, 2009; Brynjolfsson & McAfee, 2014).

The significance of digitised information is evident when it comes to big data. Big data technologies are "a new generation of technologies and architectures, designed to economically extract value from very large volumes of a wide variety of data by enabling high-velocity capture, discovery and/or analysis" (IDC, 2011). Many fierce criticisms towards big data relate to the issue of privacy. However the focus here is the ownership of information, which is more relevant in relation to resource distribution. One of the most subtle analyses in this regard is Jaron Lanier's (2014). There seems to be a lack of understanding and regulation in relation to the information that people share online; however there are companies that made fortunes out of the manipulation and interpretation of these data. The most important misconception relates to the label '*free*', which is often associated to many online services. Lanier frames this 'misconception' as an 'accounting fraud'; that is because big data is not the product of digital parthenogenesis, rather they are built on information willingly provided by people who do not know the aggregated value of what they are sharing. Thus "dominant principle of the new economy, the information economy, has lately been to conceal the value of information, of all things […] [for this reason] your lack of privacy is someone else's wealth" (Lanier, 2014, p.11). In fact business models of many thriving digital corporations – such as Google and Facebook – are based on the assumption that information is free; however they are making billions out of something free, hence there is a logical fallacy in the process which is functional to their interests.

Conclusion

The issue of ownership of information relates to what has been said before about computerisation in the following way: if the 'physical' dimension of production is progressively removed from the domain of human activities by machines, the only dimension of economic interaction that remains is the one that relates to information. Tolerating a *status quo* that – under the rhetoric of free accessibility of information – contributes to sustaining the above-mentioned level of inequality by eliminating the ownership of information, seems to be irresponsible and naïve. Since the competitive advantage of human labour over machines appears to be gone for good, it is not possible to neglect that the new domain of economic action is intrinsically *abstract*, and is achieved through a process of progressive emancipation from 'objective' reality.†† Thus, it seems necessary to find a way of paying the monetary value of information to the original creators, in order to contrast the disproportionate distribution of resources that characterises the 21st century.

In this sense, academic disciplines of digital business and information systems have the occasion of unveiling their potential of fostering a social change that is in the interest of the betterment of society. In order to achieve this goal, it seem necessary to understand that ICT is not a mere means for achieving comparative advantage. The means overtakes the end because it becomes what is to be acted upon; thus the way of deliberating about the means is technical. In this sense, the reduction of ICT to mere 'technique' is not neutral, because using ICT as a technical means is possible to achieve opposite ends, and insofar opposite ends are opposite because they use the same means, the ends are subjected to the means. As long as ICT is regarded as a technical means, it is uncontrollable and passible of being used to realize contradictory ends – which are in favour of preserving the existing *status quo*.

In order to achieve this goal it necessary to foster a critical interpretation of the role information systems

¶ It is worth pointing out that US government revenues from corporate income taxes has plummeted from around 39% in 1943 to below 10% in 2012 (Stiglitz, 2014).

** It is not correct to say elimination of costs, rather it seems to be more appropriate to talk about cost shift. Research in behavioural science has shown that, especially in online shopping, great availability of options and the fact that is possible to gather information for free, has dramatically increased the time spent choosing (Fasolo *et al.*, 2009). Hence digitised information, thanks to hyperlinks, has 'eliminated' the cost of acquiring information but has increased the cost of 'making-sense' of information.

†† Separated from the 'physical referents' of information.

and ICT play in society. Since these technological constructs play a crucial role as part of communicative social practices, they "can properly be viewed as having both emancipatory and repressive effects at any instant of time" (Gallhofer & Haslam, 2003, p. 13). Instead of focusing on the ethical ends these technology can achieve, it seems more meaningful to analyse the assumptions that characterise such technologies, as *media* to achieve specific ends in organisations and society. This form of analysis is intrinsically critical, and questions the mainstream view that considers digital businesses and ICT emancipatory in nature.

References

Anderson C. (2009), The Longer Long Tail: How Endless Choice is Creating Unlimited Demand, New York, NY: Random House Publishing.

Brynjolfsson E., L. M. Hitt (2003), Computing Productivity: Firm-Level Evidence, Review of Economics and Statistics, Vol. 8 (4), pp. 793-808.

Brynjolfsson E., A. McAfee (2012), Race against the Machine: How the Digital Revolution is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy, Digital Frontier Press.

Brynjolfsson E., A. McAfee (2014), The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies, New York, NY: W. W. Norton & Company.

Buchanan D. A., A. A. Huczynski (2010), Organizational Behaviour, Upper Saddle River, NJ: Ft/Prentice Hall.

Burns P. (2010), Entrepreneurship and Small Business. Start-up, Growth and Maturity, Basingstoke, UK: Palgrave Macmillan.

CBRE, Genesis (2014), Fast Forward 2030: The Future of Work and the Workplace, URL: <http://www.cbre.com/o/international/AssetLibrary/Genesis%20Report_Exec%20Summary_1029.pdf>, [Accessed 09/11/2014].

Christensen C., S. D. Anthony, E. A. Roth (2004), Seeing What's Next: Using the Theories of Innovation to Predict Industry Change, Boston, MA: Harvard Business Review Press.

Fasolo B., F. A. Camerici, R. Misuraca (2009), The Effect of Choice Complexity on Perception of Time Spent Choosing: When Choice Takes Longer but Feels Shorter, Psychology and Marketing, Vol. 26 (3), pp. 213-238.

Frey C., M. Osborne (2013), Improving technology now means that nearly 50 percent of occupations in the US are under threat of computerisation, LSE American Politics and Policy (USAPP), Blog (30 Sep 2013).

Gallhofer S., J. Haslam (2003), Accounting and Emancipation: Some Critical Interventions, London, UK: Routledge.

Goethe, Von J. W. (1999), Faust: a Tragedy in two parts & The Urfaust, Ware, UK: Wordsworth Editions.

Grant R. (2012), Contemporary Strategy Analysis: Text and Cases, Hoboken, NJ: John Wiley & Sons.

IDC (2011), Big Data Analytics: Future Architectures, Skills and Roadmaps for the CIO, URL: < http://idcdocserv.com/1142 >, [Accessed 09/11/2014].

Jacobides M. G., S. G. Winter (2012), Capabilities: Structure, Agency, and Evolution, Organization Science, Vol. 23 (5), pp. 1365-1381.

Lanier J. (2014), Who Owns the Future?, London, UK: Penguin Books.

Levy F., R. J. Murnane (2004), The New Division of Labor: How Computers Are Creating the New Job Market, Princeton, NJ: Princeton University Press.

McDonald M. P., G. Hartman (2013), Defining Digital: Technology's Current Tower of Babel, URL: <http://www.accenture.com/us-en/blogs/digital-business/archive/2013/08/09/defining-digital-technologys-tower-babel.aspx>, [Accessed 07/12/2014].

McKinsey Global Institute (2013), Disruptive technologies: Advances that will transform life, business, and the global economy, URL: <http://www.mckinsey.com/insights/business_technology/disruptive_technologies>, [Accessed 10/11/2014].

Moore G. E. (1995), Lithography and the Future of Moore's Law, SPIE's 1995 Symposium on Microlithography, International Society for Optics and Photonics, Vol. 2348.

Moravec H. (1988), Mind Children: The Future of Robot and Human Intelligence, Cambridge, MA: Harvard University Press.

Morris I. (2010), Why the West Rules – For Now: The Patterns of History and What They Reveal about the Future, New York, NY: Farrar, Straus & Giroux.

Musil R. (2011), The Man Without Qualities, London, UK: Picador Books.

Piketty T., E. Saez (2006), The Evolution of Top Incomes: a Historical and International Perspective, National Bureau of Economic Research, Working Paper 1195, URL: < http://unpan1.un.org/intradoc/groups/public/documents/APCITY/UNPAN027111.pdf >, [Accessed 07/12/2014].

Piketty T. (2014), Capital in the Twenty-First Century, Boston, MA: Harvard University Press.

Quah D. (2003), Digital Goods and the New Economy, URL: < http://eprints.lse.ac.uk/2236/ >, [Accessed 07/11/2014].

Rifkin J. (2014), The Zero Marginal Cost Society. The Internet of Things, the Collaborative Commons, and the Eclipse of Capitalism, Basingstoke, UK: Palgrave Macmillan.

Schumpeter J. A. (2010), Capitalism, Socialism and Democracy, London, UK: Routledge.

Shapiro C., H. R. Varian (1998), Information Rules: A Strategic Guide to the Network Economy, Boston, MA: Harvard Business School Press.

Sneed A. (2012), A Brief History of Warnings about the Demise of Moore's Law, URL: <http://www.slate.com/blogs/future_tense/2012/05/03/michio_kako_and_a_brief_history_of_warnings_about_the_end_of_moore_s_law_.html>, [Accessed 04/12/2014].

Stiglitz J. E. (2013), The Price of Inequality, London, UK: Penguin Books.

Stiglitz J. E. (2014), Reforming Taxation to Promote Growth and Equity, URL: < http://rooseveltinstitute.org/sites/all/files/Stiglitz_Reforming_Taxation_White_Paper_Roosevelt_Institute.pdf >, [Accessed 07/12/2014].

Tüzemen D., J. Willis (2013), The vanishing middle: job polarization and workers' response to the decline in middle-skill jobs, Kansas City Federal Reserve Bank Economic Review, Q1, pp. 5-32.

Yu D., C. C. Hang (2010), A Reflective Review of Disruptive Innovation Theory, International Journal of Management Reviews, Vol. 12 (4), pp. 435-452.