

CHAPTER 2

The Blind Spots of Digital Innovation Fetishism

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Introduction

Innovation is a central keyword of economic policy planning in advanced capitalist countries. Above all, it signifies a call to reform all economic branches and social institutions in ways that make them more supportive of national competitiveness. Accordingly, universities are today not only sites for the study of innovation, but they are also increasingly imagined as business-oriented innovation powerhouses, especially by industry lobbies that find universities lacking in entrepreneurial vigour. Legions of educational and business publishers have answered these calls by churning out books and guides that aim to enhance innovation activities in private companies and public institutions. Adding to the same trend, the business press and the media in general frequently publicize stories on firms and entrepreneurs that are considered model innovators. As a result of these combined ideological efforts, public discussions and the media are today filled with calls to transform state institutions, labour markets, education and even basic cultural values so that these would better

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serve the spirit of innovation, upon which not only the health of the economy but whole societies is seen to depend.

Due to the phenomenal growth of innovation rhetoric, it is no wonder that the concept has recently aroused critical interest. Paul A. David, professor emeritus of economics at Stanford University (2012: 510), writes of 'the innovation fetish': an 'excessive fixation upon innovation' among the economic, political and educational elites, who have endowed it 'with seemingly magical or spiritual powers associated with animistic or shamanistic rituals'. Pointing to similar aspects, Valaskivi (2012) writes of the rise of 'innovationism', a quasi-religious discourse focusing on innovation that is carried forward especially by social media gurus, information and communication technology (ICT) company leaders, management consultants and researchers working in think tanks and business schools. It promotes the entrepreneurial values of individualism, inspiration, risk-taking and competitiveness, and attaches these to the key symbols of innovation, such as successful start-up companies and Silicon Valley. The latter has served as the 'spiritual' centre of innovation enthusiasm, while ICT entrepreneurs have been singled out as public role models that, together with new ICT and digital innovations, represent capitalist dynamism. These discourses form the core of contemporary digital innovation fetishism.

But why call such discourses fetishistic? In traditional anthropological terms, a fetish refers to a religious object that is assumed to possess supernatural powers. Yet, the Durkheimian conclusion that innovation discourses offer 'an accepted, self-evident, future-oriented—and collective—way of imagining a better future' (Valaskivi 2012: 150) is not sufficient by itself. It registers a 'religious' dimension of innovation discourses—a means by which a collective may symbolically worship itself—but leaves out their ideological nature and how this effort takes place under the specific social relations determined by capitalist commodity production. Leading innovation discourses and practices have different effects for different groups of people, depending on their material and cultural capacities. The appeals to innovation and creativity may thus be empowering for the so-called high-net-worth individuals who invest in start-up companies, or for the motivational speakers who cash in on those appeals on the business speaking circuit. However, they are much less empowering and more discouraging for low-paid workers who work long hours for those companies or in the gigantic warehouses of digital platform capitalism.

For Karl Marx, the essence of fetishism was that, in the capitalist mode of production, the relationships between workers and capitalists take on the form of social relationships between things. He argued that the implications of this could only be understood if 'we take flight into the misty realm of religion' where 'the products of the human brain appear as autonomous figures endowed with a life of their own' (Marx 1990: 165). In capitalism, the workers are forced to sell their labour power to the capitalists, who use it to produce commodities for the market. Because the workers do not decide what is produced, for whom or why, what they labour for will in the end only serve the process of

capital accumulation. This is so both in terms of the manufacturing of articles of consumption and the manufacturing of means of production, including the innovative ‘results from science, inventions, divisions and combinations of labour [and] improved means of communication’ (Marx 1993: 307). Because of this, the entire regulation of social production is handed over to the dynamics of things produced, which become an ‘alien power’ that is used to control and enslave workers (Haug 2005: 162; Rehmann 2014: 40; for a critique of the increasing alienation of academic labour through new productivity-enhancing technology, see Hall, Chapter 7, in this volume).

Commodity fetishism thus has a real material basis, and is therefore not mere illusion. Yet, it is still attached to various ideological distortions and mystifications regarding what is going on around us (Harvey 2015: 4). Such mystifications are part of our daily existence: We encounter goods that support our daily life without much knowledge about the specific conditions under which they have been made. Advertisements concerning digital innovations or the very design of how these products appear to us (e.g. the ‘individualized’ plastic covers of smart phones or the shiny graphic interfaces of apps) masks the exploitation in which their production is enmeshed. Ideological discourses and practices that surround such commodified innovations and their systems of production aim to naturalize and make us ‘feel at home’ with these alien, ‘estranged forms’ (Rehmann 2014: 49).

New digital information and communication technologies have often been singled out as the defining technologies of the current age, allegedly based on knowledge, sharing and the freeing up of human creativity. It is especially due to this dominant role that digital technologies have been endowed with fetishist characteristics. In what follows, I will call into critique the fetishism that comes forward in contemporary innovation-speak and practices surrounding new digital technologies and innovations. My critique takes aim, first, at the most fetishist type of innovation discourses, which are based on neoliberal conceptions of the market. I will reconstruct these pro-market notions of (digital) innovation, focusing on the economic and management theories on which they are based. Second, I will offer a contrast to the dominant views by examining Mariana Mazzucato’s work concerning the ‘entrepreneurial state’, which offers an influential antidote to neoliberal innovation perspectives. However, Mazzucato’s ideas are uncritical of state power and undeveloped from a state-theoretical perspective. Third, I will elaborate on these critiques by examining innovations that most clearly run counter to the sanitized perspective from which they are typically viewed (see Gripenberg, Sveiby & Segercranz 2012). This will help to expose the blind spots of both mainstream pro-market accounts and the state-centred perspectives. I will use two innovations intimately tied to digital technologies as examples, namely, financial innovations and military technology. I will conclude the chapter with remarks concerning features that need to be included in a critical theory of digital innovations that is capable of shedding light on the mentioned blind spots.

Innovation, Entrepreneurship and Neoliberalism

Today, the mainstream public, political and managerial understandings of innovation are organically connected to market-oriented assumptions and claims, for which reason they cannot be understood without references to neoliberal ideology. The defining feature of neoliberalism is its collapse of separate economic, social, political or cultural spheres to a single economic logic and concept of value (Davies 2014). Accordingly, there are no separate forms of rationality and no room for pluralistic political discourse that questions the existence of private markets: The advocates of neoliberal policies want to remove existing barriers to capitalist activities and value judgments. This happens not in the absence of state power, but with the help of a neoliberalized state that sees its role as the facilitator of markets through privatization and deregulation. Demonstrating the power of such conceptions, the recent decades have witnessed a simultaneous attack on the welfare state and the promotion of government intervention to extend the reach of markets and competition across all social and cultural spheres, including education. As mainstream innovation-speak and policies are founded on an idealistic understanding of the benevolence of competitive markets, corporate CEOs and entrepreneurs have become objects of capitalist idolization (Bloom & Rhodes 2018). By contrast, the welfare state and the public sector form the main enemy of the neoliberal project, conceived as inertial and inefficient bureaucratic behemoths that suck the lifeblood out of entrepreneurs.

These characterizations need to be specified in the context of existing innovation policies and discourses, which are heavily indebted to (neo)Schumpeterian theories of innovation—in other words, to evolutionary economics that spring from the early 20th-century works of Austrian economist Joseph Schumpeter.

Schumpeter was interested in the instability of capitalist development, of the waves of ‘creative destruction’ that periodically shake up the capitalist order. For him, such changes were not created by ‘exogenous’ shocks such as natural catastrophes or wars, as was assumed by neoclassical economists. Arguing against them, Schumpeter (2008: 166) proposed that ‘there was a source of energy within the economic system which would of itself disrupt any equilibrium that might be attained’. He credited Marx with the realization that capitalism is an evolutionary process and emphasized that change was a constant, endogenous feature of capitalism. It is based on innovations of various kinds:

The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumers’ goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates. (Schumpeter 2010: 72–73)

For Schumpeter, the main historical subject of capitalism was the dynamic capitalist businessperson. Supported by credit markets, risk-taking entrepreneurs

were the key agents of the capitalist economy, who ‘reform or revolutionize the pattern of production by exploiting an invention or, more generally, an untried technological possibility’ (Schumpeter 2010: 117). While capitalist entrepreneurs were not driven purely by economic motives, the ‘excess profits’ promised by new innovations (e.g. superior production technologies) when they gain a temporary monopoly position in the market formed the main motivation for the corporations, financial institutions and venture capitalists who invest in their development. Today, dominant digital technology and platform companies such as Microsoft, Apple, Google and Facebook offer striking examples of such types of ‘Schumpeterian returns to innovation’ (Garnham 2005: 22).

Schumpeterian ideas do not necessarily lead to market-liberal conceptions of innovation, but they have nonetheless been elevated to the highest level of economic reasoning today. This is because they can easily be linked to the neo-liberal worship of ‘free markets’, wealth and creative businesspeople. One of the most influential management theorists of the 20th century, Peter Drucker developed such understandings during the Reagan era in the 1980s. Claiming that the state-planned ‘managerial’ economy had come to an end and was gradually replaced by an ‘entrepreneurial’ one, he argued that this necessitates ‘an economy full of innovators and entrepreneurs, with entrepreneurial vision and entrepreneurial values, with access to venture capital, and filled with entrepreneurial vigour’ (Drucker 2015: 316). This can only be achieved when such features take root as basic civic values, particularly through schooling that is based on the realization that ‘individuals will increasingly have to take responsibility for their own continuous learning and re-learning, for their own self-development’ (ibid.: 325).

Such managerial ideas have since become official policies. In EU-wide competitiveness rhetoric, innovation refers to the dynamism of capitalism and the harnessing of human creativity for business purposes, which aims at success in ever-tightening global competition. Echoing Drucker, official EU innovation policies promote the view according to which innovation is based on entrepreneurship and entrepreneurial values. Thus, for example, the National Innovation Strategy of Finland states that ‘it is precisely the entrepreneur who has the ideas, capacity to take risks and other necessary abilities that are tied to a clear view of the needs of customers’, for which reason ‘innovation policy needs to be entrepreneurial policy, which is also an important standpoint for reforming public services’ (MEAE 2008: 8–9). The report goes on to lament that the ‘entrepreneurial activity’ is weak in Finland, caused by ‘too egalitarian’ educational institutions and innovation policies, which do not encourage ‘top individuals and units’ (ibid.: 30).

These conceptualizations demonstrate a shift from a Keynesian welfare state model to a ‘Schumpeterian workfare state’, which focuses on ‘the promotion of product, process, organizational, and market innovation’, together with supply-side policies that subordinate social policy ‘to the demands of labor market flexibility and structural competitiveness’ (Jessop 1993: 9). The real structural

changes that have followed from this shift have engendered new forms of subjectification, such as the imperative that all citizens need to become entrepreneurs in one way or another. Dominant motivational narratives of innovation have centred on ‘freewheeling entrepreneurs and visionary venture capitalists’ (Mazzucato 2014: 63), especially those that are in the business of developing and commercializing ICT products, software, social networking sites and mobile applications.

Taken together, these hegemonic perspectives assume that the market and creative businesspeople form the well from which innovations spring up. Yet, the pro-market views on innovation reserve a role for the state. It should fund basic research and also more directly support and subsidize commercial innovation through various mechanisms. This is as far as it should go and no further: The state should be kept from interfering too much with how innovations are developed. As one Finnish economist puts it from a neoliberal viewpoint: ‘The task of the state is to create the conditions in which entrepreneurship and innovations can flourish’—its role is to ‘take care of the playing field and oversee rules, but not take part in the game itself’ (Pursiainen 2017). Similarly, a neo-Schumpeterian economist emphasizes that, while universities or government laboratories may provide valuable information for innovation, only private firms ‘can combine them into a plan for innovation and execute that plan’ (Metcalf 2007: 945).

Such ideas form the mainstream of current policy formulations and media discourses concerning innovation. They offer a pro-market view of how and for what ends innovations are and should be developed, presenting a positive image of commercialized, market-driven ‘creative destruction’, spearheaded by digital innovation entrepreneurs and digital technologies of all kinds. Presenting a positive legitimization of market-centred innovation that is imagined as the inspirational universe of heroic entrepreneurs, these views are blind to systematic production of destructive innovations and the structural reasons why such production takes place. I will focus on these issues in later sections. Before that, we need to gain a deeper understanding of current public debates on innovation by way of examining challenges to the pro-market perspectives.

The State as a Risk-Taking Entrepreneur

Following the global financial crisis that exposed the public to the negative consequences of deregulated markets, in the 2010s there was a renewal of Keynesian calls to increase state involvement in the economy. As part of this, the view that the state should also take the lead in innovation has gained more ground. In a popular and much discussed book entitled *The entrepreneurial state* (2014), economist Mariana Mazzucato wants to demolish the prevalent neoliberal perception according to which the state should take the backseat and restrict itself to creating the conditions in which market actors can flourish. She emphasizes

that the state has for a long time been important not only as the public financier of innovation activities, but as an active risk-taker that has initiated important science and technology projects, whose fruits the corporate giants, such as Apple, have taken advantage of. Mazzucato's views have been strongly criticized by mainstream economists and neoliberal policymakers, but they have gained a foothold among some high-ranking politicians and innovation officials and experts (especially among European social democratic parties). Recently, the European Commission invited her to draft strategic recommendations on mission-oriented research and innovation in the EU (Mazzucato 2018a).

Contrasting her perspective against standard Keynesian principles, Mazzucato (2014: 31) argues that it is not enough to direct government spending for demand management, nor to rely on redistributive policies or to spend on welfare such as health and education. What is also needed is a left-Keynesian 'growth agenda' that supports a productive economy, and this can be done by connecting together 'Keynesian fiscal spending and Schumpeterian investments in innovation' (ibid.). Mazzucato does not deny the importance of private entrepreneurial activity, but notes that it is not enough and that it should not be considered in reverential terms. Referring to the Internet, Mazzucato points out that it happened not only because the private sector in the United States could not finance its development, but because the government had a vision 'in an area that had not yet been fathomed by the private sector' and was willing to invest in its commercialization against the unwillingness of the private sector to do the same (ibid.: 22).

Mazzucato turns common Schumpeterian conceptions around by comparing the state to a bold tiger and businesses to domesticated animals, in reference to John Maynard Keynes' famous notion of 'animal spirits' (which refers to the gut-instinct assumptions that guide business investments). Against the view that such animal spirits are characteristic of businesses, she claims that the opposite is often the case, and nowhere more so than in the world of innovation, where uncertainty is high. Thus, 'even during a boom most firms and banks would prefer to fund low-risk incremental innovations, waiting for the State to make its mark in more radical area', such as green technology or ICT, which have required 'a bold government to take the lead' (Mazzucato 2014: 7). When it comes to most radical, path-breaking innovations, the state has been far more than just the facilitator of the 'dynamic' private sector; it has been the most courageous risk-taker, while market actors are typically too timid and much too concerned with short-term profits to be able to engage in the development of radical innovations that require long-term commitment.

Apple, the largest company in the world by market value and the producer of some of the most emblematic digital devices today, offers an interesting example of this. Celebrated as the paradigmatic example of a company that combines an expansive market orientation with a creative culture of innovation, its products are actually based on decades of state support of research and development (R&D). iPhones and iPads are hybrids of a dozen or so different technologies,

including silicon-based semiconductor devices, liquid crystal displays, lithium batteries, the Internet, cellular technology, global positioning systems (GPS) and multi-touch screens. All of these technologies that have made Apple's products and profits possible derive from major, mostly US government-sponsored research programmes, state-funded military projects, public procurement contracts or research done in various public research institutions (Mazzucato 2014: 87ff). While it did not develop these technologies, Apple innovatively integrated them into well-functioning consumer product designs, based on the skills of its engineers and, no doubt, on Steve Jobs' ideas about simplicity of use.

Media accounts and biographies focus exclusively on this latter aspect of Apple's success story. What gets lost in these tales of visionary entrepreneurship is the fact that the history of digital communications technology bears the mark of the very visible hand of the state. Besides the basic technology, Apple received cash support from the US government for product development and it benefited from its tax, trade and technology policies. For Mazzucato, the constant bashing of the state's assumed incapacity to be efficient and innovative ignores the inherent risks of massive state investments, which have been instrumental in the development of digital technologies. Such state-averse discourses have real material effects, for the endlessly perpetuated free market myths have assisted financial and corporate lobbyists in their successful effort to lower capital gains taxes, which has undermined the state's capacity to fund further R&D (Mazzucato 2014: 19).

Here, Mazzucato touches on a crucial aspect that is for ideological reasons ignored in pro-market innovation discourses: tax avoidance. It is typically conducted with the help of tax havens that offer a low-charge or non-existent tax environment for capital owners. A recent study focusing on the largest US corporations revealed that Apple booked a whopping US\$215 billion to tax havens in 2015, 'a sum greater than any other company's offshore cash pile' (Phillips et al. 2016: 2). Apple is far from being a lone example, for the overwhelming majority of the world's biggest corporations, including the main digital platform companies, rely on similar schemes. In 2015, some 367 US companies out of the Fortune 500 maintained over 10,000 tax haven subsidiaries, which would 'collectively owe US\$ 717.8 billion in additional federal taxes if the money were repatriated at once' (ibid.).

Corporate tax evasion is not limited to the United States, and it has strong negative consequences in terms of innovation at large. When the big ICT companies that have profited from big state-initiated technology projects avoid paying taxes, they prevent the state and the taxpayers from being rewarded for their key role in investing in digital innovations (Mazzucato 2014: 171–175). Tax avoidance undermines the capacity of the state to fund valuable public programmes, including goal-oriented technological R&D that opens up possibilities for the development of future technologies. This is curiously self-defeating, since the short-term profit opportunities offered by tax havens erode the funding base for major state-based innovation activities that private

companies themselves have taken advantage of. Obviously, the need to accumulate and compete against rivalling capitals overrides long-term rationalities.

More recently, Mazzucato (2018b: 213ff) has examined the ways in which digital companies such as Google, Amazon and Facebook operate their businesses by collecting and analysing huge amounts of online data for advertising purposes, which has resulted in the centralization of the digital networks and concentration of profits into the hands of few corporations (for a critical discussion of Facebook's targeted-advertising revenue model, see Dahlberg, Chapter 4, in this volume). Mazzucato advocates increasing the state regulation of digital platforms through anti-trust legislation, which is conspicuously absent in the realm of digital economy, and with the help of coordinated political action against tax avoidance. At present, many states compete with each other in attracting corporations by offering the lowest corporate tax rates. For example, as was widely reported in the news media, Ireland gave Apple a 0.005 per cent tax rate in 2014 and was for a long time unwilling to go along with European Commission demands to get the company to pay more taxes to the country.

Mazzucato reminds us that digital technology innovations are the result of collective processes, for which reason its rewards should also be collectively distributed, rather than privately appropriated. However, her work has some eye-catching blind spots itself. While she examines innovation as a collective process, she views this from a perspective that lacks attention to capitalist production relations. Due to this, the state comes forward in her analysis 'as an external, super-societal entity, representing "the public" and "collective interest"' and she also neglects workers and the structural inequalities between labour and capital in the collective process of innovation (Pradella 2017: 66). In a sense, Mazzucato offers a mirror image of neoliberal myths of digital innovation, by dethroning the markets from their ideologically pre-eminent position and by offering a positive image of the entrepreneurial state in its place. This view is much less radical than it initially seems, however. Lacking a critical dimension of capitalist production relations and a political concept of the state, she does not ask such questions as who controls innovation and for what purposes, which are more critical questions than 'who gets the return?' (ibid.).

Such questions lead to the need to conceive of digital innovations not as essentially good and desirable things, but as technologies whose development is embedded in the political-economic context of capitalist commodity production and social relations. Because of the presence of structural inequalities and asymmetrical social power relations in capitalism, which the liberal-democratic state by its nature cannot fully transcend even in the best of conditions (Wood 2012), innovation and technological development bears the mark of such hierarchies. Next, I will focus on these aspects by examining, first, financial innovations, and second, military technology, both of which are currently enmeshed in the digital mode of production.

Destructive Creation I: Financial Innovations

Today, economic and social reproduction have become dependent on the financial system and the increasingly complex financial innovations associated with it. Financial activities were not foreign to the previous Fordist–Keynesian accumulation regime that lasted until the late 1970s in advanced capitalist countries. However, neoliberal market deregulation since the 1980s has opened the doors for a huge growth of the financial sector globally. In the 1960s, the financial sector's share of gross domestic product in the United States was under 4 per cent, while in 2010 (three years after the beginning of the global financial crisis), the same figure was 9 per cent, a trend that is visible across industrialized nations in general (Godechot 2016: 504). This has led to a growing disparity between the industrial ('real economy') and the financial sector. The latter's share of total domestic profits in the United States has grown from 10 per cent in the 1950s and 1960s to over 40 per cent in the 2000s, which has also made financial elites, such as hedge fund managers, supremely wealthy, well ahead in earnings compared to top managers in industry (Hossain-Zadeh 2014: 67; Smith 2017: 243).

These shifts among competing capitals and capitalists testify to the forceful financialization of the global economy since the 1970s. With declining real wages and purchasing power, households have resorted to 'privatized Keynesianism'—borrowing money from credit markets to maintain their standards of living. This has led to a huge rise in private indebtedness. The everyday life of ordinary workers and citizens, their daily reproduction, has become pervaded by financial products of all kinds, such as consumer credits, mortgage loans and privatized pension arrangements (Brand & Wissen 2018: 60). This has made labour all the more vulnerable to the neoliberal goal of increasing the rate of exploitation of workers and dismantling welfare state provisions. At the same time, the growth of the financial sector and the attempt of the industrial sector to secure profits through investing in financial assets in lieu of investing in the real economy has further strengthened the importance of the financial sector relative to the overall economy (Smith 2017: 240). It is not only that the financial sector has grown by itself. It has been accompanied by new managerial and business practices whereby traditional manufacturing firms have increasingly turned to financial services to boost their profits, becoming financial firms themselves in the process (Mitchell & Fazi 2017: 133).

The increasing flow of money into financial markets and the hands of top investors and managers has created 'the need for finance and the super-rich to continually develop new forms of value extraction' (Davis & Williams 2017: 15). Since the 1980s, with the help of neoliberal deregulation policies and the introduction of new ICT, financial companies have contributed to the massive expansion of financial investment by ceaselessly developing new financial innovations. Assisted by new computer technology and statistical software that eased the burden of complex price calculations, financial firms set off 'an

unprecedented acceleration of financial innovation': In the late 1980s, 'a fundamentally new type of financial instrument was launched in every two weeks' (Sveiby 2017: 145). While financialization is primarily the outcome of political decisions, new digital ICTs were central to its intensification and in shifting the centre of gravity of innovative activities away from the productive sectors and towards financial markets. As Smith (2017: 241) points out,

any serious discussion of the contemporary 'knowledge economy' must begin with the fact that the fastest rate of product innovation, the largest private-sector investment in information technologies, and the greatest private-sector concentration of advanced knowledge workers, has been found in the financial sector.

New ICTs have been central to one of the most destructive aspects of financialization: securitization. It refers to the practice of bundling ('collateralizing') a huge amount of individual loans, such as mortgages, car loans and credit card debt, into larger financial products, which are then sliced, with the help of computer-assisted calculations, into other financial instruments ('securities'), such as collateralized debt obligations (CDOs). These products created by major multinational investment banks in the 1980s and 1990s promised high returns at low risk for investors. In the mid-1990s, financial experts hailed CDOs as 'the most successful new security product of all time' (Sveiby 2017: 145), and they were bought and sold in huge quantities on Wall Street in the lead-up to the 2008 financial crisis. Their success overshadowed the fact that 'securitization led to a dizzying array of extremely complex instruments that—quite literally—no one understands' (Papadimitriou & Ward 2010: 21). This prompted Warren Buffet, one of the world's most well-known investors, to dub them 'financial weapons of mass destruction.' Although certainly not the sole reason behind the global financial crisis, the destructive power of these innovations became evident when the credit-fuelled US housing bubble burst in 2007 and the value of CDOs quickly collapsed, triggering the meltdown of banks in the United States, and then around the globe, that had invested in the various interconnected financial products.

Besides assisting in the creation of new financial innovations, digital technologies are at the heart of current global financial market infrastructure. Financial trading is digitalized, and an interesting innovation in this regard is high-frequency trading (HFT). This differs from earlier electronic forms of financial trading in that, instead of direct human involvement, trading is conducted fully automatically via computer algorithms and programs. HFT represents 'the culmination of decades of technological innovation and regulatory developments encouraging financial automation' (Lange, Lenglet & Seyfert 2016: 154). The appeal of HFT is based on its ability to execute financial orders at very high speed and to detect small trading opportunities in the markets. HFT systems do this by comparing available prices and price fluctuations

between exchange venues and by taking advantage of temporary price inconsistencies to make profits (Bajpai 2014). HFT involves small individual trades in high volume, which has significantly increased the overall volume of financial trading in the 2000s (Chaparro 2017). The quantities are awe-inspiring: Typically, messages concerning bids to buy or sell shares are sent by computer algorithms at a rate of millions per second between the main US share-trading data centres. According to current estimates, about half of US share trading is done via HFT (MacKenzie 2018: 1636–1637).

Speed and thus computing capacity are essential for HFT companies, which has resulted in an arms race between them as they seek to keep ahead of each other in digital-technological development. In the case of HFT, the advantage is measured in milli- or microseconds. For instance, an HFT company that monitors the trade of comparable financial products (e.g. treasury bonds and futures) between the New York Stock Exchange and Chicago Mercantile Exchange can earn a small profit by optimizing the material communication connections between these marketplaces to be able react faster to price changes in those products (Lange, Lenglet & Seyfert 2016: 154). HFT firms are compelled to continuously invest in ultra-fast fibre-optic cable connections and microwave technology to ‘shave off a few milliseconds in the transmission of data’ (*ibid.*), in an attempt to gain an advantage over rivals. Similarly, high-frequency traders want to have their computer servers as close to stock exchanges as possible, because this also decreases the time of digital data transmission.

Such financial and finance technology innovations exemplify the high risks attached to financialization in the conditions of neoliberal market liberalization. The sheer amount of new digitalized financial innovations and their voluminous use at amazing speeds make them inherently difficult to supervise, regulate and control. Due to the fast rate of financial innovation, some post-Keynesian economists have suggested that, instead of even attempting to regulate certain complex financial instruments that encourage ever-riskier activities, they should simply be banned (Papadimitriou & Wray 2010: 26). Overall, digitally driven financial innovations have contributed to the destabilization of global economy, with severe negative social consequences. Present government policies that lead to the bailouts of speculative financial institutions when they go bankrupt encourages these institutions ‘to go further in their reckless financial ventures and precipitate new financial bubbles’ (Hossain-Zadeh 2014: 69). Under this systemic logic, the risks are privatized, but the losses are socialized, in a way that has clear class character. The global financial crisis has been used not as a reason to dismantle the neoliberal policies as dysfunctional, but as an opportunity to justify austerity cuts in social spending and public services. The latter are falsely blamed for escalating public debts and deficits—whereas, in reality, the crisis was caused by the financial sector—which is then used to justify further redistribution of national income in favour of the rich (*ibid.*: 76–81).

In light of this, conceiving digital financial innovation in terms of positive Schumpeterian creative destruction seems misplaced; it should more aptly be called destructive digital creation. Again, digital technologies by themselves are not the fundamental cause of financial bubbles and crises, since the ways in which they are employed are embedded in broader capitalist social relations and structures, together with politics regarding their development. Yet, the digitally assisted creation of ever-more complex products of the ‘dealer economy’, together with how financial markets are structurally interconnected via global ICT networks, means that the systemic risks associated with financialization have grown considerably as local crisis-inducing events quickly spread from one place to another, often with catastrophic cumulative effects (Johannessen 2017: 151–152).

In historical terms, financialization is an attempt by the capital to compete against falling profit rates by investing in fictitious capital. This has made some capital owners supremely wealthy, at the same time as the capitalist economy is increasingly based on computer-assisted financial innovations that construct value within the credit system, without any concern for the social value and consequences of such fictitious capital formation (Harvey 2015: 110–111, 240–241). More and more capital is invested in speculative profit-seeking through financial instruments, rather than in productive innovation. Due to its uncoupling from productive activities, this interest-bearing capital formation is also the most fetishized and the most ‘insane’ form of capital (Marx 1992: 547; Marois 2012: 139). Digitalized financial innovations are a weapon in the hands of financial elites who aim to circumvent government regulations in a search for quick profits in the financial sphere, in ways that have enormous negative effects on the economy and society at large.

Destructive Creation II: Military Technology and Digital Information Warfare

The core institutions of capitalist business, such as modern corporations or financial markets, are not the only sites of systematic innovation. As Mazzucato reminds us, the state has been a major supporter of R&D, out of which many central innovations of current high-tech capitalism have emerged. However, Mazzucato does not focus on technologies towards the development of which the state has most prominently contributed in many leading countries: military technology. This is no less important an area of innovation than the development of innovations that serve capitals’ never-ending need to raise productivity due to the laws of market competition. Although capitalist corporations and state apparatuses are interlocked economically and politically, we need to analytically separate the expansionary tendencies of capital from the geopolitical struggles for power that drive forward the development of military technology.

This form of destructive innovation is typically left undiscussed in mainstream academic discussions, which tend to focus on ‘good’ innovations.

Many of the biggest industrial nations are also major weapons technology producers, supported by sizeable military budgets. The United States is the global leader in this regard. In 2017, its official military spending was US\$610 billion, worth more than the military spending of the next seven countries combined. Following the United States were China, Russia, Saudi Arabia, India, France, the United Kingdom, Japan, Germany and South Korea. Most of these countries have increased their military spending in the past decade. In 2016, the EU member states spend roughly US\$200 billion in defence, while the total global military expenditure was US\$1,739 billion in 2017, which represents the highest level since the end of the Cold War (Eurostat 2018; Tian et al. 2018). While these figures are considerable by themselves, they are underestimations. The actual levels of US military spending are much higher when all military-related costs, such as nuclear and space weapons production, maintenance and research costs, Homeland Security costs and satellite reconnaissance and intelligence gathering costs are added to the official numbers (Cypher 2007; Smart 2016). The United States is a somewhat special case, owing to its status as the main military-imperial power with bases all over the world. Yet, in terms of innovation-related activities and national innovation systems, military R&D has been important for many leading countries. At the end of the 1990s, for example, military research absorbed nearly 30 per cent of France’s government-funded R&D efforts, while the same number for the United States was 55 per cent, and it was nearly 40 per cent for the United Kingdom (Bellais 1999). (For more recent numbers and discussion of defence R&D ‘as a key channel through which governments all over the world shape innovation’, see Moretti, Steinwender & Van Reenen 2016.)

Military technology is closely tied to ICT. Ever since the 1940s, military R&D has been essential for the development of many important ICT and digital innovations, while today, weapons and weapons command-and-control systems are, in turn, increasingly digitalized and based on the use of ICT. This has ‘resulted in a relocation of R&D and procurement spending, away from traditional weapon platform and weapon system producers and towards electronics and computer companies’ (Brzoska 2005: 15). This development is often discussed under the notion of a *revolution in military affairs* (RMA), which refers to ‘the marriage of new technologies with organizational reforms and innovative concepts of operations’ (Goure 2017). As part of this discourse, the Pentagon and US military planners today emphasize the application of the newest ICT in warfare. A strategy researcher working for a defence-focused Washington think tank enthuses about the benefits provided by 21st-century digital warfare:

[D]igital technologies have become the linchpin of U.S. weapons, tactics, and strategy. Soldiers on the battlefield coordinate air strikes using

digital datalink and a tablet. Headquarters commanders, once reliant on radios to receive battle updates, watch digital feeds of streaming videos on common operating pictures populated by terabytes of near real time digital data. Cruise missiles and bombs receive satellite relays of digital navigation and targeting updates to destroy enemy targets day and night, in rain and snow, in foliage-covered jungles and dense urban centers. Digital data and the networks that store, process, and disseminate that data have made the U.S. military extraordinarily capable. (Schneider 2016)

Such developments advance the interests of both the US imperial state and its corporations, and they have long historical roots. From the times of the Truman administration and the Korean War onwards, ‘military Keynesianism’ became accepted by the US elites as a macropolitical framework: It refers to the ties of the US economy to military spending, military-supporting research and overseas wars. Military Keynesianism was a policy that not only helped to advance US geopolitical interests, but also profited private corporations and accelerated technological innovation, giving a great boost to the US economy in general. In the early days, the policy was ideologically supported by the Cold War confrontation, but as can be seen from the figures referred to above, its end did not spell the end of a high level of military spending in the United States. The post-Cold War regime of ‘global-neoliberal militarism’ exists as a means to generate profits for the private sector (Cypher 2007). A large number of private US companies (between 20,000 and 60,000) operate as contractors that benefit from Pentagon orders. High-tech digital companies in Silicon Valley and elsewhere are deeply involved in them, for the reason that there are huge profits to be made from military R&D projects and military contracts ordered by the armed forces. Linda Weiss (2014) shows that the United States’ current capacity for high-tech innovation derives from its ‘hybrid political economy’, in which the ‘national security state’ and its federal agencies collaborate closely with the commercial sector in pursuit of military- and security-related objectives.

In recent decades, the nature of high-tech military development has changed, in tune with the so-called War on Terror and the byzantine threats associated with it. ‘Information warfare’ has now become a growing business, leading to an evolution from ‘military-industrial’ to ‘military-information complex’ (Smart 2016: 458). Between 2001 and 2013, US spending on intelligence doubled, and the digital data capture by the National Security Agency (NSA)—heavily involved in spying scandals that have undermined civil liberties through global monitoring of digital communication networks—has constantly increased, with an increasing amount of government intelligence work outsourced to private contractors (Bloomfield 2013; MacAskill & Watts 2013).

Those who want to defend high-level military and intelligence spending often claim that military R&D has positive economic effects, since it creates spin-off technologies for the civilian sector, as in the case of advanced defence research

projects that gave birth to the Internet. There is no need to disprove this argument completely, but it is very problematic from the perspective of democracy and citizen well-being. Indeed, one of the key reasons why the US elites have favoured military Keynesianism and its continuation in various forms is that massive state spending on the military is a better alternative for them, for reasons of power and privilege, than spending on social welfare. This is because social spending may

arouse public interest and participation, thus enhancing the threat of democracy; the public cares about hospitals, roads, neighbourhoods, but has no opinions about the choice of missile and high-tech fighter planes. (Chomsky 1994: 100–101)

In other words, spending on the military helps to keep power and profits in the hands of coercive state and corporate elites, rather than distributing them more democratically.

Spending on the military has also had undesirable effects for higher education. Writing about the United States, Henri Giroux (2008: 58) argues that ‘the university has become an intense site of militarization.’ The repercussions of this are not limited to the United States, for besides military research contracts in the home country, in 2006, the US Department of Defense had contracts with 161 universities in 33 other countries around the world, while a study found that, in the early 2000s, 26 UK universities had 1,900 military-related research projects, amounting to a total value of £725 million (Smart 2016: 467). In the countries so affected, the militarization of universities has a negative influence on academic freedom and democracy, especially in the current neoliberal conditions where direct government funding for higher education for civilian purposes is decreasing and funding for research with military purposes, with private sector weapons-manufacturer involvement, is increasing (*ibid.*). What this means in concrete terms is demonstrated by an event involving Johns Hopkins University, the largest recipient of Pentagon funding of higher education. In 2013, a professor of computer science was asked by the dean of the university to take down from the university’s server his blog post that was critical of the NSA’s effort to defeat the encryption of online communication (Rosen 2013).

Today, former military enthusiasm with war machines made of steel and aluminium has given way to digital war imagery that is displayed in tech magazines, tech sections of mainstream news sites and military industry advertisements. Thus, a Fox News report lists ‘the 5 coolest military innovations of 2016’, including ‘surveillance drones that terrorists cannot escape’ and synthetic ‘Superman-style vision for combat helicopter pilots’ (Barrie 2016). Similarly, an online brochure of Accenture, a global consulting firm, waxes lyrical about ‘five trends that stretch the boundaries of digital defense’. These include software intelligence and data analytics that ‘apply computer vision algorithms to video surveillance feeds’ to ‘enhance response capabilities’—innovations that

can be used both on the battlefield and for crowd control in the cities, as the same brochure favourably notes (Accenture 2015). Even US President Trump's megalomaniac and racist 'border wall' idea is welcomed by tech magazines and Silicon Valley start-ups as an opportunity to develop advanced digital surveillance technologies with state backing. For example, a *Wired* article from 2018 draws a flattering portrait of a start-up company that works on a pilot programme for the US government to develop an all-seeing 'digital wall' at the US–Mexico border, with the help of virtual reality and artificial intelligence (Levy 2018).

How technological rationality has become fused with collectively destructive actions and undemocratic structures of social control was a central theme for early Frankfurt School critical theorists. Ernst Mandel continued on this theme in the 1970s in light of the centrality of 'permanent arms economy' for late capitalist societies. For him, the ideological sphere of late capitalism is infested with beliefs in the omnipotence of technology to offer solutions to complex economic and social problems and 'to integrate rebellious social classes' (Mandel 1975: 501). In terms of military technologies, such 'fetishism arises when it is presumed that all geopolitical problems have a military solution and that military solutions are guaranteed by superior technologies' (Harvey 2003: 9). In reality, however, such solutions are partial and temporary ones at best, and 'superior' military technologies have often been defeated by less-advanced countermeasures. Such persistent ideological thought forms demonstrate how modern capitalist rationality is split between partial rationality and overall irrationality. The most dramatic military expression of this is the development of ever-more effective weapons systems in an 'effort to organize the collective nuclear suicide of the humankind with the greatest possible "economy of human labour"' (Mandel 1975: 510). The overall social irrationality of capitalism—the preference for short-term profit-making and military spending on warfare instead of general welfare—is now carried forward with the help of the latest digital technology innovations, without proper discussion concerning the (in)human purposes that they serve as fetishist objects of capitalist and authoritarian state desire.

Conclusion

In the above, I have focused on the blind spots of digital innovation fetishism, especially the widespread incapacity to observe the negative social implications of key areas of current digital high-tech innovation. The belief in the benefits of commercialized innovations of all kinds remains strong, with little attention to their negative consequences and how these are connected to basic capitalist tendencies. The examination of computer-assisted financial innovations and new digital trading practices shows the destructive power of neoliberal financialization. Rather than expressing a supposedly benevolent capitalist spirit

that nurtures the innovation of new financial instruments, the high risks associated with them testify to the need to keep such profit-seeking spirit at bay, although this is increasingly difficult in the present political configuration. The pervasion of the everyday life of consumers by financial products and credit has entrenched the logic of ceaseless risk-taking and speculation as a new social norm (Konings 2018).

The case of military technology demonstrates how deeply current digital innovation is linked to the advancement of the security interests of coercive state apparatuses such as the military and the intelligence services, together with the private companies that benefit from such interests. Mazzucato's analysis of the entrepreneurial state offers a necessary corrective to market-centred innovation discourses, but her work proceeds 'without even mentioning developments in military and surveillance technologies' and fails to register that 'surely nuclear weapons, depleted uranium and drones also need to be taken into account if we are properly to assess the character of the entrepreneurial state' (Pradella 2017: 68). In brief, Mazzucato operates with a strangely depoliticized concept of the state (Pfothenauer & Juhl 2017).

A critical assessment of the role of the state and corporations in the development of military technology and other innovations needs to start from the realization that, like capital, the state is a social relation, a 'specific material condensation of a relationship of forces among classes and class fractions' (Poulantzas 2000: 129). From such a perspective, one can avoid viewing the state as a subject that has autonomy and that acts as a rational agent of civil society (as in Mazzucato's views concerning the 'entrepreneurial state'). On the other hand, the state is also not a thing, a tool so completely without autonomy that it is purely at the service of monopoly capital and corporations (*ibid.*). When viewed from a relational perspective, the state is an active field of political struggle, whereby 'the exercise and effectiveness of state power is a contingent product of a changing balance of political forces', conditioned by the wider political-economic system (Jessop 2009: 428). This means that, in any historical conjuncture, some agents, actions and interests have priority over others in the policies of the state. Luckily, the state is not only coercive or only in the service of capital, for it has historically also had more democratic features, such as providing health care, education, labour laws, cheap food and so on. Concurrently, what functions and interests the state prioritizes is indeed subject to collective political will formation.

These contingent forces guide the forms that technological innovations take in different historical and national contexts. The case of military Keynesianism and state-directed military R&D, out of which the key ICT innovations of current high-tech capitalism arose, is illustrative in this sense. As noted, it reflected the preferences of US elites to subsidize that part of the economy that was conducive to the maintenance of corporate class and military state power, rather than civilian welfare. Today, the R&D of digital technologies is affected by the weakening of civilizing, educational institutions and the increasing influence

of neoliberal business orientation over them. As Smart (2016: 464) observes, 'higher education has been recast as the institutional nexus for producing highly qualified labour power ready for inclusion in corporate enterprises integral to a digitalized, informational, neoliberal capitalist economy' (see also Hall, Chapter 7, in this volume). At the same time, the general political shift towards authoritarian populism in Western democracies further weakens the prospects of developing innovations that serve democracy and human emancipation.

Thus, there is no guarantee that 'national innovation systems' and the development of digital technologies within them serve democratic ends. Digital innovations become fetishes when perceptions regarding their production are divorced from the context of capitalist social relations and the formation of state power as the outcome of political struggles. Digital innovations are conceived fetishistically when they are imagined as solutions to complex social and environmental problems, when they are idealistically discussed as things that have benefits for 'everyone' and when it is assumed that such benefits will proliferate when educational institutions of all kinds focus on indoctrinating their subjects to become market-oriented entrepreneurs. In order to avoid such fetishisms, digital technological innovation and the role played by the 'entrepreneurial state' need to be politicized, and those working and studying in the universities need to ask critical questions concerning the direction of digital technological innovation and the systems of production and consumption that surround them.

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