

BOOK REVIEW

The Technology Trap: Capital, Labor, and Power in the Age of Automation by Carl Benedikt Frey (2019) Princeton University Press, Princeton NJ, 465pp., \$US30 (hardback) ISBN: 978-0-691-17279-8

Introduction

Carl Benedikt Frey takes us on a historical journey through several centuries of technological progress to help us understand the political economy of technology, and its impacts on the nature of work, the labour market, the incomes of human employees, capital accumulation, economic development and social (in)equality. The book consists of 13 chapters grouped into five parts that shed light on technological progress before the industrial revolutions (Part I), during the first (Part II), second (Part III) and third (Part IV) industrial revolutions, and in the forthcoming age of artificial intelligence and robotics (Part V). Frey discusses how technological progress was blocked or stimulated by political elites and why populations resisted or embraced new technologies. He emphasizes the fact that attitudes towards technology depend on its impact on people's livelihoods and wellbeing. The first industrial revolution in the eighteenth and nineteenth centuries was driven largely by factory-based technologies that were replacing human employees, thus causing resistance and social unrest. The second industrial revolution brought technologies to people's homes. The decades that followed it were the period of a growing middle class and improved quality of life for significant portions of the population, who showed little resistance to technology. After World War II, computers and industrial automation started to eliminate many blue- and white-collar jobs. The newly created jobs were highly geographically concentrated. Advances in artificial intelligence and robotics raise additional challenges and threaten to replace many employees in the future. They are forcing governments to look for various solutions to the social and economic problems that automation is causing.

Evaluation

The book can be evaluated from several perspectives. From a research perspective, the book provides an excellent historical account of the relationships among technology, labour, economic development and power in Western societies, mostly Britain and the US. Frey delves into the enabling (enhancement) and replacement (substitution) effects of automation, and how technological progress shaped the economic wellbeing and power of different social groups. His conclusions are well supported by ample examples, statistical data, an impressive reference list and relevant theoretical discussions.

From a pedagogical perspective, the book allows students to understand how technology has shaped societies and economies. The clear and straightforward language of writing, useful examples, an extensive bibliography, visuals (tables and figures) and in-depth analyses make the book appropriate as additional reading material for undergraduate and graduate studies related to economic history, technology or political economy. The book may also inspire PhD students to delve deeper into the political economy of automation and technology's impacts on the labour market, social inequality and power.

From a managerial perspective, the book informs managers why and when technology is perceived as a threat to human employees. Technology is likely to cause resistance if it decreases the incomes of people, replaces human employees and does not leave them with sufficient options

to find jobs elsewhere. If technology improves the productivity and incomes of employees, they perceive it positively as an enabler, which would facilitate technology adoption.

From a policy perspective, the book sheds light on the politics surrounding technology, and how technology can be a source of power and change in the power of various social groups. In this sense, the book informs policy makers on the possible ways to mitigate automation's negative repercussions on the labour market, as with free education and requalification courses for displaced employees, by decreasing occupational licensing practices, through tax credit/universal basic income, mobility vouchers to stimulate geographic relocation of labour where it is needed, removal of land zoning restrictions, investing in linking geographical regions and industrial renewal. Previous studies (e.g., Ivanov, 2017; Stevens and Marchant, 2017; Nam, 2019; Ivanov *et al.*, 2020) have identified additional instruments in the arsenals of governments to mitigate the fears of automation and the negative consequences of technological unemployment, such as financial incentives to companies to use human labour rather than automation, taxing automation technologies, government-created employment, etc. Frey supports the solutions that require less bureaucracy, stimulate employees' mobility across industries and regions, but also decrease social inequality. This is why he does not support the introduction of universal basic income, unlike other studies (McDonough and Bustillos Morales, 2020). The solutions Frey supports seem feasible in the short run when the social and economic impacts of growing automation are still manageable – i.e., when people who lose their jobs in one industry/geographic region because of automation might be hired in another industry or region. However, short-run solutions may not be effective if (when) automation becomes pervasive and its substitution effect is so profound that the number of displaced workers is higher than the number of jobs that are available or could be created for them. In such a situation, societies may need to look for more creative solutions, including universal basic income, redefinition of human rights or birth right patents (Ivanov, 2017).

Why is the current situation with automation different from previous industrial revolutions?

Frey (p.366) argues that the AI-induced industrial revolution is not essentially different from the preceding revolutions. As with the previous three industrial revolutions, we see enabling and replacing technologies that enhance or replace human employees. However, there are at least two factors that make the current industrial revolution different from the preceding three – autonomous decision-making by intelligent agents and the demographic crisis.

The first and the second industrial revolutions significantly improved the productivity of companies and allowed them to produce more goods and services with fewer employees. Although the benefits of the new technologies were not equally distributed and many people lost their jobs to machines, the machines remained human-dependent. In the first and second industrial revolutions, the relationship between humans and machines was 'human-in-the-loop'. This means that it was up to the human to do the decision-making. The human decided when a steam engine or an internal combustion engine was to be used, when to start it, when to turn it off, when to increase or decrease the speed of the production line. The human was part of the production process and was responsible for strategic and operational decision-making. Through computerization during the third industrial revolution, the human employee was moved to one side, but not completely removed. Computers shifted more decision-making powers to automation and kept humans in the loop. Computers were taking automated decisions based on their programming, but a human could always interfere and override the decision. Computers also lacked learning capabilities and improvement in their performance required human intervention.

However, this is not always the case with the fourth industrial revolution – artificial intelligence effectively excludes humans from the decision-making process. Algorithms open and close trade positions in financial markets within milliseconds (Budish *et al.*, 2015), a speed beyond the processing capabilities of the human brain. Travel agency chatbots answer customer queries,

provide customers with travel offers and book hotels for them (Ivanov and Webster, 2019). Autonomous vehicles make decisions about speed, route, brakes usage, etc. (Maurer *et al.*, 2016). Autonomous weapon systems take life-or-death decisions (Crootoof, 2015). It is evident that the human is often shielded from the decision-making process. Humans transfer to machines decisions that are simple and repetitive (e.g., chatbots answering frequently asked questions), require speed (e.g., high-frequency trade in financial markets) or involve a lot of real-time data (e.g., automated traffic control). The machine makes the decision, not the human. As machines can make buy-and-sell decisions (algorithms trading in the financial market, a chatbot booking hotel accommodation for tourists) without human involvement, a question is raised: Who is the buyer and who is the seller? Should we treat autonomous intelligent agents (algorithms, robots, chatbots) as customers (Ivanov & Webster, 2017)? Should robots have rights (Gunkel, 2018)? Should we rewrite our books on economics, marketing, management and organizational behaviour to incorporate these artificial autonomous agents that take economic decisions independently of their human owners? The involvement of artificial autonomous agents in the economy will only increase in the future, paving the way to robonomics – the automated economic system that relies on automation technologies, robotics and artificial intelligence as production factors, while the use of human labour is minimized (Ivanov, 2017).

The second difference between the current and the previous industrial revolutions is the demographic contexts in which they unfold. All three previous industrial revolutions occurred during periods of growing populations. Hence, the substitution effect of new technologies raised concerns among politicians and economists about employment opportunities and fuelled fear among employees of being displaced by machines. However, the demographic background of the fourth industrial revolution is completely different. Since the 1960s, fertility rates have been plummeting globally and in all developed economies the number of children per woman is below the replacement rate (2.1 children/woman). In 2018, the average number of children per woman in OECD countries was only 1.69, or 19.5% below the replacement rate (World Bank, 2020). In South Korea, the fertility rate is below 1 (0.98), insufficient to replace even the mothers of the children. Other countries, such as Italy (1.29), Portugal (1.42), Japan (1.42), Russian Federation (1.57), China (1.69) and the US (1.73), have low fertility rates as well. These countries face a demographic tsunami in a decade or so when their populations will start to shrink significantly because the extended life expectancy of their populations will not compensate for the lack of born children. The number of people leaving the labour market will be much higher than the number of those entering it. This forces societies to look for solutions to the demographic crisis.

In practice, societies have three possible options – produce people, import people or substitute for people (Webster and Ivanov, 2020). Producing people through the natural biological process is probably the best strategy in the long term but time is required (at least 35–40 years) before this strategy will have any significant impact on the labour market. Importing people through immigration is an easy short-term solution, but it may cause social, cultural and religious tensions between the immigrants and the local population. Substituting for people as a production factor for automation is a politically correct solution that many societies and companies are looking for. In practice, because of low fertility rates, companies will be forced to use automation technologies, not because they want them, but because there are too few human employees in the labour market. In this sense, automation technologies will have not only an enabling (enhancement) and substitution effect on current employees, they will also have a compensating effect on future employees who would never have entered the labour market because they had never been born. Automation technologies will compensate for unborn children!

Recommendations

I have several recommendations which the author might find useful in a revised edition of the book. First, the book would benefit if it provided a conceptual framework in the form of a concept map to show the relationships among technology, skills, enabling (enhancement) and substitution effects,

the exact mechanism of enhancement/substitution, and so on. This would make it easier to follow the thinking of the author. This conceptual framework might be complemented by a table summarizing the key issues – key technologies that drove the revolution, key ways in which these technologies enhanced or substituted human employees, who were the main winners and losers of technological change, key political/social/economic outcomes of technological change and other relevant issues. This would allow the reader to compare the essence, drivers and outcomes of the technological changes and would improve the pedagogical value of the book.

Second, the book would be enriched by examples outside Britain and the US. The book is very focused on the history of Britain and the US. It is true that the first industrial revolution started in Britain and that the US is currently the largest economy and at the technological forefront. However, the economic history of many other countries – in Europe (Germany, France, the former Soviet Union), Asia (China, Japan, Taiwan, South Korea), Latin America (Mexico, Brazil) – would provide useful insights on the impact of technologies on labour, social (in)equality, capital accumulation and political power.

Finally, the book would benefit from some discussion of the ‘ironies of automation’ and technological sunk costs. Introduced by Bainbridge (1983), and later developed by Baxter *et al.* (2012) and Strauch (2017), the ironies of automation refers to the fact that automation may expand rather than eliminate problems with the human operator. Human operators may be left with arbitrary collections of tasks which system designers could not automate (Bainbridge, 1983). Automation projects may fail, their implementation may be seriously delayed or the benefits that were expected from them (e.g., labour cost savings and improved productivity) might not be fully realized. In practice, it may turn out that automation increases the demand for human employees to deal with process tasks that have been left unautomated. Furthermore, the sunk costs incurred by companies for automation in the past may prevent their investments in new technologies, especially if they have not fully recovered their previous investment. Hence, they may continue to use old technologies. Although the ironies of automation and sunk costs are mentioned in the book, they need explicit and in-depth elaboration.

Even so, Frey’s book is an excellent contribution to the body of knowledge on the political economy of automation technologies. At the time of writing this review, the book has been cited over 100 times in Google Scholar just a year after its publication. Its impact on research, education and policy making will grow in the future.

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Stanislav Ivanov
 Varna University of Management, Varna, Bulgaria
 e-mail: stanislav.ivanov@yumk.eu.