Analysis

Work in an Era of Intelligent Tools and Systems: Finding the Path to an Equitable Economy

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Intelligent digital tools are transforming economies, creating crucial challenges for today's leaders. Most significantly, platforms are fundamentally redefining work, value creation, and value capture, as factories did in centuries past. But technology is not destiny; policy can shape how intelligent tools are designed and deployed, which will determine outcomes.[1]

The BRIE (Berkeley Roundtable on the International Economy) / CITRIS (Center for Information Technology Research in the Interest of Society) team on the future of work addresses a crucial question facing communities and societies across the globe: what is the impact of new intelligent tools on jobs and economies? Will they exacerbate economic inequality and spark widespread social unrest? Or can they facilitate abundance and rising living standards in communities and societies?

This question is not new. As the computerization of workplaces in the 1980s shows, intelligent tools have been shaping jobs and economies for decades.[a] But over the last two decades, abundant computing power, storage, telecommunications bandwidth, and data have given rise to a new generation of intelligent tools and systems that are far more powerful and pervasive than before.[2,b] These new tools include a range of technologies from basic IT and software to advanced robotics and sensors, 3-D printers, platforms, artificial intelligence (AI), interconnected cyber-physical systems, and many others. Together, they are transforming employment and competition in all sectors of the economy, including services, manufacturing and agriculture.[c] They have likewise intensified fears and hopes about what the future has in store for the global economy and social order.

1. A Project of the Berkeley Roundtable on the International Economy and the Center for Information Technology Research in the Interest of Society and the Banatao Institute
2. Zysman, John and Kenney, Martin. (2018). "The Next Phase of the Digital Revolution: Intelligent Tools, Platforms, Growth, Employment." Communications of the ACM 61, no. 2, 54-63.

In this note, we highlight three points that have emerged from our work with BMAS (German Federal Ministry of Labour and Social Affairs) and several German research institutes.[d]

First, digital platforms are reshaping the economy and redefining work and value creation and are central to any discussion of the impact of intelligent tools. *Second,* while narrow artificial intelligence (AI) applied across all domains is indeed very powerful, fears about general AI replacing human beings are unfounded. *Third,* the impact of platforms, AI, and other intelligent tools on work and workers is not inherent or predetermined but depends on how and for what purpose the tools are deployed.

While nobody can project the ultimate impact of intelligent tools, they bring disruptive challenges such as changing skill requirements, worker dislocation and reorganization of industries, as BRIE co-founder Laura Tyson and Susan Lund of the McKinsey Global Institute wrote in a recent editorial.[e] However, a hypothesis of our research is that intelligent tools can also be harnessed to promote the equitable and prosperous communities that make a healthy society. The trajectory of intelligent tools' impact is malleable, and will be shaped by choices; in turn, policymakers must consider who has the power to make these choices, and their goals and incentives.

The rise of the platform economy

Digital platforms' reorganization of the economy is the most significant transformation of the era of intelligent tools. Diverse in structure and function, multi-sided digital marketplace platforms are online "places" where participants can act, interact or transact; they rest on cloud computing, big data, advanced algorithms and a vast and ever-increasing number of connected devices.[3] Using platforms, companies like Amazon, Apple (App Store), Facebook, Google, Microsoft, Salesforce, Uber, Flexport, Airbnb and Spotify are radically changing how we work, create value and compete for the resulting profits.

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Platform firms are pervasive, challenging sectoral boundaries and transforming the architecture of industries from automotive and retail to aviation and health care. Fully understanding the extent of platforms' reach across the economy is critical. BRIE is developing strategies for measuring platforms' impact and our recent work estimates that 31 of the most significant digital platform firms theoretically affect 70 per cent of business establishments in the United States.[4] The impact is profound: to illustrate, Amazon has remade publishing, retail and logistics; Google Maps has changed how we think about location; Google Search has changed the roles of the library and the press; and restaurants depend on favourable reviews on Google Search and Yelp to attract diners.

3. Kenney, Martin and Zysman, John. (2016), "The Rise of the Platform Economy." Issues in Science and Technology 32, no. 3, pp. 1.
4. Kenney, Martin, Bearson, Dafna, and Zysman, John. (2019). "The Platform Economy Matures: Pervasive Power, Private Regulation, and Dependent Entrepreneurs." BRIE Working Paper Series, pp. 10. Retrieved from https://brie.berkeley.edu/sites/default/files/platform_economy_matures_final.pdf

Platforms transform firm strategy

BRIE has studied three major aspects of platforms' effects on the economy. *First, platforms remake how firms create and capture value.* With their scale and ease of use, platforms are becoming the default intermediaries for a massive and growing number of business transactions. This trend is accelerating the services transformation, wherein firms that once captured value by selling products increasingly differentiate by embedding services with products. For example, consider how a company selling port cranes now provides "port management services" to clients, using digitally-enabled sensors, analysis and user interfaces, or how a farm equipment company now adds on sensor-enabled "crop management services".[f] In addition, platforms are reshaping economic geography from local communities to the global map, akin to how factory development in Midwestern states defined the United States' economic map. Within this geographic reorganization, corporate decisions shaping global work and value creating activities are being made in a few hubs on the US West Coast.[5]

Platforms redefine work

Second, platforms are redefining work and income generation. To illustrate this transformation, BRIE has developed a taxonomy of work and value creation in the platform economy.[6] The taxonomy separates the platform firms and their employees, who enjoy high compensation and relative job stability, from other workers and businesses operating over platforms, the preponderance of which receive relatively low levels of compensation, whether they sell goods on marketplaces such as Amazon or Etsy, perform in-person services through Uber or Eldercare.com or receive a share of ad revenue for posting original creative content to platforms such as YouTube or SoundCloud. Meanwhile, billions of people post content to services such as Google, Yelp and Facebook, providing essentially free value to the world's largest companies. Altogether, BRIE's taxonomy demonstrates how platforms' impact on work extends far beyond the much-discussed "gig economy".

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Digital platform firms have exacerbated the long-term trend of workforce fragmentation and the rise of precarious work.[g] Increasingly, platform firms employ workers core to their mission as traditional employees while employing often heavily-monitored and distributed networks of peripheral workers in non-standard arrangements, opening a divide between "insiders" and "outsiders" in the labour market.[h] It seems certain that many of the workers in non-standard work contracts have been undercounted, possibly because much platform-mediated work is done on a part-time basis. Growth in IRS 1099-K tax filings in the United States (tax filings for workers that are

5. Kenney, Martin and Zysman, John. (2020). "The Platform Economy and Geography: Restructuring the Space of Capitalist Accumulation." Forthcoming in the Cambridge Journal of Regions, Economy and Space, pp. 1.
6. The taxonomy describes platform firm workers, platform-mediated workers, platform-mediated content creators, and platform-mediated funding recipients. Bearson, Dafna, Kenney, Martin, and Zysman, John. (2019). "Labor in the Platform Economy: New Work Created, Old Work Reorganized, and Value Creation Reconfigured." BRIE Working Paper Series. pp. 38. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3363003

paid electronically) compared to other tax filings is one indicator of the rapid growth in platform workers relative to the overall workforce.[i]

Platforms' redefinition of work and value creation challenges the goals of social equity. The increasing number of well-paid jobs at platform firms remain a small share of all platform-enabled work. Moreover, it is unclear whether platform-mediated jobs, though they may at times offer flexibility, independence and opportunities for creativity, will pay a living wage in any but a few cases. Finally, the free provision of value by users to platforms in the form of data and content warrants examination for its impact on shared prosperity.

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Platforms amass regulatory power

Third, platform firms are by default becoming private regulators of large swathes of economic activity. Within their ecosystems, platforms' terms and conditions and the computer code implementing them, are effectively law. Consider the example of ride-hailing services. Taxis are legally prohibited from discriminating against potential passengers based on race. Does this law apply to Uber drivers? If so, who should enforce it: Uber or the state? If, as Larry Lessig observed, code is law,[j] how to represent social, political and economic goals and values in that code is unresolved.

Amazon's marketplace exemplifies the challenges that private regulation poses for workers and entrepreneurs. While millions of vendors can find immediate markets for their products on Amazon, the platform can monitor their activities and introduce competitive products that it can favour in terms of page placement, rankings or various other stratagems. They can also change the independent vendors' selling fees, control their product displays and terminate their accounts. Platform decisions can be announced or unannounced, immediate and difficult to appeal – a Kafkaesque environment for any business. BRIE has termed the plight of those dependent upon a platform for their business as "platform-dependent entrepreneurship". For a platform-dependent entrepreneur, the next "paycheck" and indeed the very existence of their job, is always uncertain.[k]

Private regulation by platforms raises complex issues of public economic governance, in general, and of digital marketplace platforms.

Private regulation by platforms raises complex issues of public economic governance, in general, and of digital marketplace platforms, in particular:

- → What public entity, if any, should determine the goals and values that should be represented in code, and how?
- → Should platforms be allowed to change their terms and conditions indiscriminately or access the data of businesses with which they may compete?[l]
- → Is new legislation required, such as California's AB5 and the UK's proposed "dependent contractor" classification?[m] Or should existing policies and regulations, such as minimum wage laws and benefits, apply to platform ecosystems.[n]

Policy approaches to platform challenges

Governments have a role to play in promoting good jobs and social equity with private regulation of entire industries by a small number of firms. Some of the proposals currently circulating include:

→ **Terms and conditions:** Governments could limit the terms platforms may impose on participants. They could also loosen the platform's ownership over customer-seller relationships by requiring that a platform-dependent entrepreneur's private contact information be shared with clients as a part of transactions.

→ **Data:** Many of the issues turn on the rules about data. Some propose portability of data, for example, to ensure that fair competition is protected against the platform economy's monopolistic tendencies.

→ **Antitrust:** Does antitrust need to be rethought in platform ecosystems where winner-take-all strategies, network effects and powerful lock-ins are common?

→ **Ownership models:** Governments could support the development of platform cooperatives, a potential alternative to platform firms.[o]

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Taken together, the power of platforms calls for a reconsideration of competition policy, from the perspectives of what harms must be addressed and how market power is measured. In any case, platforms' status as private regulators in the economy requires governments to act as a counterbalance.

Platforms are to the early 21st century what factories were to the 19th: a new model for organizing work and value creation built on our era's new core technologies. This analogy frames the scale of our challenge. The rise of industrial production reorganized societies, creating new economic and social hierarchies that demanded considerable innovation in governance. With platform owners achieving power that is perhaps even more formidable than that of early factory owners, similarly bold thinking and action from stakeholders is called for today.

Addressing AI fears

One of the tools used by platforms is AI, which has attracted enormous attention in recent years. Recent technical advances have led to excitement and anxiety about AI's possibilities. But while AI has transformational potential, the hype surrounding AI in its current form has outstripped reality.[7] To assess the near-term effects of AI, it is essential to understand both its promises and fundamental limitations.

AI is indeed powerful: advanced robots, drones, image and voice recognition software and other AI-enabled tools are changing life all around us. It has had an enormous effect on our economy and society, significantly affecting domains as broad-ranging as agriculture, retail and criminal justice. AI's progress raises critical questions as to

7. Nitzberg, Mark, Seppala, Timo, and Zysman John. (2019). "The hype has eclipsed the limitations of third-wave artificial intelligence." ETLA: The Research Institute on the Finnish Economy. Retrieved from https://www.etla.fi/en/latest/the-hype-has-eclipsed-the-limitations-of-third-wave-artificial-intelligence/

its transparency, robustness and accountability, in addition to its workforce impact. Shaping this technology so that it is trustworthy remains an important ongoing concern.

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But AI has fundamental limitations. Most importantly, the basic function of most AI systems remains rooted in statistical inference. For the foreseeable future, AI will be limited to solving problems in narrow domains.[p] Human-level artificial general intelligence, which has been an inspiration for much fear about the impact of digital technology, is not on the immediate horizon. In addition, AI is only one of a great many powerful digital tools that have a profound impact on work and the economy; we caution against too much focus on one at the expense of others.

Deployment of intelligent tools

The impact of any intelligent tool is not predetermined or guaranteed. Despite the hype and despair surrounding intelligent tools, both positive and negative outcomes for workers and economies are possible.[8] The crucial question shaping which possibility transpires is how tools are developed, deployed and used. This is the subject of our ongoing research.

Intelligence augmentation: using tools to enhance workers

The potential power of intelligent tools to replace workers has received outsized attention. A common narrative is that as soon as a worker's task can be performed more cheaply and quickly by a tool, he or she can no longer add value to an enterprise. But the mere deployment of new tools does not mean workers will be replaced or marginalized: depending on how deployment unfolds through corporate strategy and management philosophy, intelligent tools can make workers more essential while making firms more productive.

This is because workers often possess value-adding capabilities that go beyond narrow task performance. These include well-defined technical skills, deep informal knowledge and experience, understanding of the immediate context in which work is done, the ability to explain the function and/or output of tools to others and many other abilities that tools cannot replicate. If managers ignore these capabilities, tools that replace workers may not work as well as intended. In a well-known example, production problems in Tesla's highly automated factory resulted in managers acknowledging the value of humans' adaptability to unforeseen circumstances in complex environments.[q] Conversely, if tools are deployed to augment and amplify these human capabilities, workers can add more value and firms can be more productive.

Firms that aim to augment worker capabilities tend to observe certain strategic practices. Often, these firms will engage workers early and often in the process of deployment, integrating their input into how and where tools could add value. These firms might also invest in workforce development

8. Zysman, John, Kenney, Martin, and Tyson, Laura. (2019). "Beyond Hype and Despair: Developing Healthy Communities in the Era of Intelligent Tools." Munk School of Global Affairs & Public Policy, University of Toronto, Innovation Policy White Paper Series 2019-1. Retrieved from https://munkschool.utoronto.ca/ipl/files/2019/02/IPL-White-Paper-2019-01-Updated.pdf

or other human capital services to make sure workers have the right skills to use new tools. And they tend to view the deployment of intelligent tools as an iterative process, testing small solutions and seeking feedback from workers before expanding, rather than procuring a static, vendor-defined solution.[r] Both the complexity and positive potential of such deployments are evident in Danish construction equipment wholesaler AO Johansen, whose case of digital transformation was researched and documented by our collaborator in Denmark.

Beyond firm strategy and practice, the design of tools' user interfaces affects whether they augment workers. Intelligent tools, based as they are on the flexibility of programmable computers, are likely to be more malleable than earlier waves of technology. In many cases, these malleable interfaces can be shaped to amplify and extend the value-creating abilities of workers. Research by BRIE collaborators has found evidence of digital tools adding intuitive features which enhanced worker capabilities compared to older interfaces.[s]

Worker augmentation may benefit firms as well as workers. Preliminary research in the automotive industry from BRIE collaborators has shown that firms viewing workers as complements to information technology tend to obtain better performance from robots compared to firms that view information technology as a worker substitute, achieving greater cost reduction and faster changeovers. Conversely, on average, firms that see information technology as a labour substitute have $10,000 less in productivity per worker than firms that view information technology as a complement.[t] These initial results appear to indicate the "win-win" possibilities of intelligent tools deployment.

One effective measure could be to change the narrative about how intelligent tools can be used by firms to succeed in the market.

Encouraging intelligence augmentation: approaches for policymakers

What can stakeholders do to encourage win-win outcomes from automation? One effective measure could be to change the narrative about how intelligent tools can be used by firms to succeed in the market. The value of investing in workers as assets, rather than simply viewing them as costs to be cut, must be featured more prominently in business literature. As the next steps in our project, we will create and promote a library of cases illustrating scenarios where workers become more valuable and firms prospered as AI tools are deployed. Governments and philanthropists could also fund prize competitions encouraging intelligence augmentation and foster improved dialogue between those who study the human brain and those creating intelligent tools. Further policies that could support positive deployments include well-tailored R&D incentives, tax laws that focus on capital and evasion, workforce development investments and policies to better encourage a worker voice in deployment decisions through unions or other mechanisms.[u]

Some displacement of workers will almost certainly transpire, and investments in training will be a part of many effective instances of worker augmentation. But a new narrative about the positive possibilities of deployment can help minimize worker substitution while highlighting the path towards effective reskilling for those who need it.

The variable possibilities of automation illustrate an important overall feature of intelligent tools: their impact is not predetermined. And while in some cases, such as that of platforms, it is reasonable to conclude that intelligent tools are contributing to economic inequality, they also create opportunities.

Conclusion

The transformations in the era of intelligent tools are profound. Platforms are reorganizing the economy, redefining value creation for both people and firms and becoming private regulators of their growing domains. AI, while a powerful technology, has been somewhat overhyped. And the impact of platforms, AI and other intelligent tools is not predetermined, but depends heavily on exactly *how* they have been deployed and regulated and will continue to be in future.

The growth of inequality in advanced economies is driven by a skein of interconnected factors: certainly, the deployment of intelligent tools is widely considered to replace worker tasks, if not whole jobs, to the benefit of those with certain skills and the detriment of others; trade pressures encourage the search for quick productivity solutions; the weakening of unions creates conditions for firms to take the easy approach of replacement by automation rather than the more difficult, but potentially more productive, approach of augmentation; and tax policies encourage investment in capital rather than workforces.

But platforms are already concentrating societal wealth in the hands of the few, not just workers but companies as well. Jobs enabled by platforms are highly polarized, whether it is a technological and economic necessity or a social, political and economic choice. Moreover, with platforms' winner-take-all tendencies, increasing portions of the economy are being mediated by a few pivotal firms and these dominant firms capture an increasing share of economic value through rent extraction and superstar effects. In fact, nearly all of the recent gains in equity markets have been concentrated in five platform companies.[v] These tendencies, unless addressed by policy, have and will continue to play a role in furthering economic inequality.

At the same time, there is a wealth of positive possibilities for jobs and economies in the era of intelligent tools. New forms of work and value creation offer the opportunity for more people to work with more flexibility, independence and creativity than has ever been possible before. New forms of entrepreneurship are appearing. Firms and workers can partner in using technology to raise productivity and prosperity for all.

The impact of platforms, AI and other intelligent tools is not predetermined, but depends heavily on exactly how they have been deployed and regulated and will continue to be in future.

We can shape the development and deployment of intelligent tools and platforms. They can be allowed to benefit a narrow slice of citizens and workers at the expense of everyone else, or they can be harnessed to create good jobs, equitable communities and healthy societies in the coming decades. Research, policy and corporate governance all have a role to play. The future of intelligent tools may not be possible to predict, but it is ours to create.

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* *Because of space limitations, alphabetical references can be viewed at* ***brie.berkeley.edu/bmaseupresidency***

** *This note draws from BRIE / CITRIS work, much done in collaboration with BMAS, including see footnotes two to eight.*

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