3 Productivism and new industrial policies: learning from the past, preparing for the future

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1 Introduction[7]

Throughout history, economic ideology has swung from one end of the pendulum to the other, from the reification of markets to reliance on states and then back again. Superficially, we appear to be in the midst of one of these periodic realignments. It was perhaps inevitable that the excesses of neoliberalism – the increase in inequality, concentration of corporate power, neglect of the threats to the physical and social environment – would cause a backlash.

But new paradigms get established by developing novel approaches and not by just emulating the old. When after the 1930s, the New Deal and the welfare state replaced the freewheeling capitalism that preceded them, they did not simply revert to the mercantilist practices of old. They established new modes of regulations, new institutions of social insurance and explicit macroeconomic management in the form of Keynesianism.

Similarly, if the new turn to 'productivism'[8] is to be successful, it

7 This chapter is based on, and draws heavily from, Rodrik and Stantcheva (2021) (a report for French President Emmanuel Macron), and from Dani Rodrik, 'Getting Productivism Right', *Project Syndicate*, 8 August 2022, https://www.project-syndicate.org/commentary/will-productivism-supersede-neoliberalism-by-dani-rodrik-2022-08.

8 Dani Rodrik, 'The New Productivism Paradigm?' *Project Syndicate*, 5 July 2022,

will have to move beyond conventional social protection, industrial policies and macroeconomic management. It will have to internalise lessons learned from the failures of some of those policies in the past, and adapt to fundamentally new challenges.

State intervention aimed at reshaping the structure of an economy – so-called industrial policy – has traditionally been faulted for being ineffective and getting captured by special interests. 'Governments cannot pick winners', as the old adage goes. In reality, much of this criticism is overdone. While there have been notable failures, systematic recent studies find that industrial policies incentivising investment and job creation in disadvantaged regions have often done surprisingly well (Criscuolo *et al*, 2019).

Public initiatives have been behind some of the most startling high-tech successes of our time, including the internet and GPS. For every Solyndra – a solar cell manufacturer that failed spectacularly after half a billion dollars in government loan guarantees – there is often a Tesla, the phenomenally successful electric battery and vehicle manufacturer that also received government support at a critical phase of its development.

Nevertheless, there is much room for improvement. The most effective industrial policies are those that entail close, collaborative interaction between government agencies and private firms, through which firms receive critical public inputs – financial support, skilled workers or technological assistance – in return for meeting soft and evolving targets on investment and employment. This kind of industrial policy is likely to work much better – whether in promoting local economic development or in directing major national technological efforts – than open-ended subsidies or tax incentives.

As the name suggests, productivism focuses on enhancing the productive capabilities of all segments and regions of a society. While

https://www.project-syndicate.org/commentary/new-productivism-economic-policy-paradigm-by-dani-rodrik-2022-07.

traditional forms of social assistance, especially better access to education and healthcare, can help in this regard, connecting people with productive employment opportunities requires interventions that go beyond these. It requires improvements on the demand side of the labour market as well as the supply side. Policies must directly encourage an increase in the quantity and quality of jobs that are available for the less-educated and less-skilled members of the workforce, where they choose (or can afford to) live.

In the future, most of these jobs will come not from manufacturing, but from services such as health and long-term care and retail. Even if policy succeeds in reshoring manufacturing and supply chains, the impact on employment is likely to remain limited. The experience of East Asian manufacturing superstars such as South Korea and Taiwan provides a sobering example. These two countries have managed to rapidly increase the share of manufacturing value added in GDP (at constant prices), yet they have experienced steady declines in manufacturing employment ratios.

This is important since so much of the policy effort in the United States and Europe is focused on promoting high-tech manufacturing and digital industries. For example, the US CHIPS and Science Act provides $52 billion in funding for semiconductors and related manufacturing. The initiative is aimed at both enhancing national security *vis-à-vis* China and creating good jobs. Unfortunately, even if the first objective is met, the second objective is likely to remain elusive. A similar point can be made about the subsidies to green technologies that are a core component of President Biden's Inflation Reduction Act. Without question, the green transition is an urgent priority that the new paradigm needs to tackle. But here too, governments cannot kill two birds with one stone. Policies that target climate change are not a substitute for good-job policies, and vice versa.

Shoring up the middle class and disseminating the benefits of technology broadly through society requires an explicit good-jobs strategy. Such a strategy would not be so fixated on competition with China; it

would target services instead of manufacturing, and it would focus on incentivising worker-friendly technologies.

2 Business incentives with a good-jobs focus

Economists tend to be cautious, if not downright hostile, towards industrial policies. This attitude derives less from economic theory than from practical considerations. The externalities and market failures that industrial policy aims to fix – learning spillovers, coordination failures, agglomeration effects and, increasingly, the social benefits of good jobs – are widely understood to be widespread in contemporary economies. The concern is that governments lack the knowledge to identify accurately where these market failures are ('governments cannot pick winners'), or that they will be subject to political lobbying and capture once they put themselves in a position to select industries to support.

In recent years, policymakers have articulated the need for industrial policy more explicitly and forcefully. The challenges of transition to a green economy, geographic divides, digitalisation and, increasingly, the perceived threat of Chinese competition in high-tech industries, have highlighted the urgency of public action to stimulate investment and innovation in particular industries and regions. The European Union acknowledged the importance of industrial strategy explicitly in the Juncker Plan of 2014. The European Commission's Horizon 2020 Report targeted an increase in the manufacturing share of GDP in the EU from 16 percent to 20 percent (a target that was missed). The EU is already a massive provider of business incentives through a variety of funds. While the bulk of the EU's structural and cohesion funds are invested in infrastructure, about 10 percent takes the form of direct grants to firms, which makes the programme "*one of the largest enterprise subsidy schemes in the world*" (Murakosy *et al*, 2020).

In France, business incentives centre on three schemes. First, there are tax credits for R&D spending (*Crédit d'Impôt Recherche*), the stated objective of which is to increase the competitiveness of the country

through innovation. Second, there is investment support for SMEs (through the *Banque Publique d'Investissement*, BPI), which channels government and EU funds to support investment and innovation through various financial instruments (credits, credit guarantees or buying shares). The BPI works closely with client firms through the life cycle of projects, providing counselling and management training. Third, there are publicly funded 'competitiveness poles' (*Pôles de competitivité*). These are designed to promote clusters in specific regions or industries – bringing together small and large firms, training organisations and research labs – through financial support and tax incentives.

It is fair to say that while employment is almost always a subsidiary goal of these programmes, they are rarely designed with employment as the key objective[9]. In the main, they target increased productivity and global competitiveness and try to foster new digital and green industries. In the EU Industrial Strategy Package (2020), for example, high-quality jobs and employment are occasionally referred to, but the emphasis is clearly on digital innovation and green tech. Employment is generally viewed as part of the social agenda, distinct from the productivity and economic growth agendas.

A second consideration is that business incentives work best when they are customised and targeted to specific needs of firms, and when they are part of an iterative dialogue between firms and government agencies. The traditional conception of industrial policy is represented by the East Asian caricature: bureaucrats independently choose a set of economic activities to be promoted, select pre-determined incentives (tax rebates or subsidised credit), and then impose hard conditionality on the receiving firms (they either perform or else). This type of policy hardly works well, and in fact was never quite how industrial

9 This is a general feature of business promotion schemes. In a global review of such programmes, Robalino *et al* (2020) wrote: "*In practice, projects are seldom selected for public support based on the jobs impacts the investments are likely to generate … Often, the beneficiaries of demand-side programs are selected, subject to the size of the firm, on a first-come-first-serve basis.*"

policy was actually implemented in Japan, Taiwan, South Korea or China. Successful programmes tend to revolve around a process of strategic collaboration in which firms' needs, market opportunities, and appropriate remedies are discovered over time, with policies revised as learning takes place.

Tim Bartik of the Upjohn Institute has been a long-term observer of business incentives in the US, and his synthesis of the evidence provides a valuable perspective that applies equally well to Europe (Bartik, 2019, 2020). In summary: public policy focusing on job growth in distressed areas can be effective and generate persistent gains in employment-to-population ratios, but current systems are not very effective. They are based on significant tax breaks that often go to large corporations and are not properly targeted or designed. He makes several recommendations. First, business incentives should focus on areas that are distressed – that is, areas that truly need them. Second, the incentives should focus on sectors or firms that are likely to have high job-creation multipliers. Third, public assistance should focus less on tax incentives (and encouraging physical investment) and more on specific public services needed by firms, such as customised business services, zoning or infrastructure policies, local amenities and skills training. Fourth, business assistance should be viewed as a portfolio of services rather than a particular incentive, with the actual mix attuned to local conditions. The second, third and fourth of these recommendations are especially relevant to France (and Europe more broadly).

Bartik's recommendations echo ideas that have developed over the last couple of decades into a new conception of industrial policy (Evans, 1995; Hausmann *et al*, 2008; Rodrik, 2007, 2008; Sabel, 2007; Fernández-Arias *et al*, 2016; Ghezzi, 2017). Under this conception, the government is not presumed to know where the market failures are beforehand and, therefore, does not determine *ex ante* what the specific policy instruments are. Industrial strategy consists of a collaborative process of 'discovery' involving business and agencies of the state,

where the objective is to identify the constraints and opportunities over time, and to design interventions appropriately. As learning takes place, policies are revised, refined and sometimes reversed.

Rodrik and Stantcheva (2021), in relation to France, proposed the setting up of regional business promotion agencies that operate alongside existing public employment services (PES, *pôle emploi*) and cover the same territories. These could be called "*regional business bureaux*" (RBB). The main thrust is to create a structure for job-enhancing productivity assistance to firms that runs in parallel (and in cooperation) with the worker-oriented pôle emploi.

The objective of RBBs (or their equivalent) would be to provide a portfolio of services to local firms or prospective investors with the overarching goal of assisting them to increase productivity while creating good jobs[10]. Many of these services would normally be administered by other agencies, in which case the role of the RBBs would be mainly to coordinate those agencies and help firms navigate through them. For example, RBBs may cooperate with the PBI to help SMEs get access to financing or business advice. They may coordinate with the local PES to identify suitable workers and help recruit them. They may organise training providers to ensure the requisite skills are built up. They may help with infrastructure needs of SMEs, for example with respect to internet and cloud services where pooling of fixed costs could be an advantage. They may also act as a go-between with the local bureaucracy as regards local regulations such as zoning. And they could be provided with additional resources to provide other services as well, as the needs reveal themselves. In general, RBBs would be in a position to assist with the financing (through their own or other agencies' resources) of any productivity and employment-increasing

10 One question is whether EU state aid rules are sufficiently flexible to permit the kind of scheme we describe. We note that those rules allow a substantial number of exceptions, particularly with respect to smaller enterprises, funding of innovation and disadvantaged regions. 'Disadvantaged' regions presently cover about a quarter of the French population (European Commission, 2013).

spending or reorganisation on the part of firms. Investment subsidies would not be prioritised over other incentives.

The RBBs would take a customised, individualised approach to their relationship with firms, on the understanding that different firms/sectors have different needs. They would maintain an open-ended relationship with them, trying to understand their problems and opportunities.

Firms would make proposals to the RBB for use of one or more particular services, say a training programme or purchase of a particular advanced technology system. In return, they would make commitments on specific quantities of jobs they will create at different qualification levels (ie low-salaried employees, medium-salaried employees, etc). Firms would be encouraged to pool proposals when they make use of common inputs, as would be the case for workers with particular skills or infrastructure.

It is particularly important that the process of soliciting proposals be open to new or young firms. In particular, new firms may be deterred by regulations or sectoral agreements that act as entry barriers. In addition to encouraging proposals from such firms, RBBs might also be empowered to grant young firms certain temporary exemptions from sectoral regulations or agreements, in order to ease business formation. This would obviously have to be done in exchange for good-job conditionalities and in agreement with social partners. Failing agreement with social partners, new firms might be provided with financial incentives that compensate for the cost of the relevant regulations.

RBBs would then screen proposals for suitability. They would evaluate the overall desirability of the proposed project, paying attention to the quality of the project, its feasibility and plausibility, the additionality of the jobs that are to be created and the likelihood that the RBB can deliver the services needed on the timescale required. Larger, more expensive proposals might be evaluated by outside consultants. At this stage, the RBB might also negotiate additional requirements with the

firm. For example, the firm might be asked to work with its local suppliers to improve their management or technological capabilities. Or a firm that is considering outsourcing part of its production to a foreign county might be asked to delay doing so for a number of years, in case productivity improvements at home render those plans unnecessary. The firm could be required to arrange for additional training for some of its employees. The project would then be given an overall score, to compare with others on a single scale.

Once projects are approved and launched, there would be periodic audits designed to check whether firms are making sufficient progress towards their commitments, especially on employment. It would be understood that there is a certain provisionality – inevitable in light of uncertainty and unforeseen circumstances – to both the targets and the package of assistance being deployed. The audits would reveal that some projects are clearly not working out. Those would be terminated. Some other projects may underperform because of unanticipated changes but may still be salvageable with existing (or revised) support. Those would continue to receive support. In other words, the audits would be as much an opportunity to revise policies and targets as they would be an occasion to make binary, up-or-down decisions.

To the greatest extent possible, the proceedings of the RBB would be open and transparent. Packages of support and targets agreed to by firms would be public information. Any revision of supports or targets would also be carried out in a transparent fashion, with firms' justifications for revising targets open to public scrutiny. Transparency over these matters would be essential both to limit public corruption and to ensure firms have limited ability to game the bureaux.

Finally, at the end of the first five years (and each subsequent five years) a certain number of RBBs would be subject to rigorous evaluation. The objective would be to see whether the bureaux are achieving their central objective: creation of productive job opportunities. If the bureaux were being phased-in gradually, such evaluations could be carried out initially using randomisation or synthetic-control

(comparing each *région* with a synthetic control group) methods. Subsequently, evaluations could be carried out within *régions* using regression discontinuities (comparing firms just below and above the cutoffs on the overall score).

We note that much of the resources which the bureaux would help coordinate and direct are already allocated via other programmes, such as the BPI, *pôle emploi* or municipal budgets. Additional resources may well be needed for new initiatives along the lines we have suggested.

3 Governance considerations for RBBs

It is worth saying a bit more about the regulatory model that underlies this approach, since it differs from the standard, arm's length regulation model of economists[11]. In the conventional regulatory approach to the mitigation of externalities, firms have to meet clear guidelines, and consultation between the regulator and firms is limited typically to resolving differences. The costs of mitigation are known to firms but not to the regulator. Firms use this informational edge to minimise their adjustment costs while regulators devise ways of eliciting the cost information without being captured by the firms. There are fixed limits on permissible behaviour and a schedule of fines for violating them.

This model does not apply well to the present context because the objective itself ('good jobs') is imprecise and multi-dimensional; it needs to be operationalised in a way that is both evolving and context-dependent. Furthermore, creating good jobs depends on a wide array of decisions on investment, technological choice and business organisation, the consequences of which are unknowable *ex ante*. Technological and operational possibilities are highly uncertain, and neither firms nor government agencies have the information needed to devise concrete behavioural schedules from the outset. Hence the interaction between RBBs and firms must take as its starting point the

11 The discussion here follows closely Rodrik and Sabel (2019).

provisionality of ends and means and the need for disciplined review and revision. Targets and instruments for good-job creation must remain provisional, to be revised as new information comes in. The task of governance is to establish an information exchange regime that induces firms to cooperate with RBBs and adjust their strategies in the desired direction in a context of extreme uncertainty.

Instead of defining each party's obligations precisely, our proposed governance system would establish broad goals and a regime for evaluating their achievement. Such practices have become established in industries as diverse as biotechnology, IT and advanced manufacturing, and in policy regimes such as food safety, water quality, civil aviation and the promotion of advanced technologies (Gilson *et al*, 2009; Rodrik and Sabel, 2019). They entail:

> *"regular, joint reviews of progress towards interim targets or milestones, procedures for deciding whether and with what exact aim to proceed or not, and mechanisms for resolving disagreements. The information exchanged under such a regime allows the parties to develop a more and more precise idea of the shared goal while allowing each to assess with increasingly reliability the capacities and good faith of the other: to observe if the capable stranger can become a reliable partner and the long-trusted partner is capable of innovative tasks. As collaboration progresses, each party comes to rely increasingly on the capacities of the other, deterring opportunistic defection and generating or activating norms of reciprocity. Joint regular review and deliberate consideration of the interim results thus create the conditions in which informal norms and self-interested calculations bind the parties to continue promising collaboration in good faith. Trust and mutual reliance are the result of agreement to collaborate, not its precondition, just as the precise aims of cooperation are the outcome, not the starting point of joint efforts"* (Rodrik and Sabel, 2019).

In our specific context, the RBBs would consult local firms extensively and then establish an ambitious, open-ended outcome: 'good jobs,' as measured by a number of metrics that reflect community preferences and national standards. Firms would be encouraged to enter into partnerships with the RBB to gain access to RBB services (of the type discussed previously) customised to their needs. In return, they would be required to make plans to achieve 'good job' targets and to report their results regularly. RBB benefits would continue as long as firms report their progress (or lack thereof) accurately, and they make certifiable good-faith efforts to meet their targets. Targets would remain soft, and failure to meet them would not necessarily call for withdrawal of support during the early stages, as long as there is demonstrable progress and good-faith efforts. The objective of the regime would be to incentivise cooperation, information sharing and ongoing revision of instruments and targets. In the words of Rodrik and Sabel (2019), "*fostering good jobs is likely to depend on solving highly idiosyncratic, place-specific problems: failures of coordination between local firms and training institutions; between firms and their (potential) supply-chain partners; and the managerial breakdowns or skill gaps within individual firms and institutions to which the coordination problems point*." With enough success on some of these aspects, more firms could be drawn into such schemes, generating a virtuous cycle of new production practices and learning spillovers.

Beyond these broad governance principles, there is no how-to manual that can guide government officials in this work. Discretion on the part of government bureaucrats remains an integral part of such incentive regimes. But it is disciplined, on one side, by requirements of transparency and professional norms and, on the other, by the demands and needs of firms. Since experimentation by RBBs can add value, local autonomy is useful and can trigger learning across regions. Ultimately, success depends on the development of organisational cultures that internalise the behavioural norms of this type of governance.

Like all public policies, the proposed scheme may fail or turn out to

be ineffective. However, it is important to be clear that key elements of what we have sketched out exist already in the public-policy arsenal. For example, the BPI already has considerable experience of working closely with SMEs, using a wide range of instruments (loans, guarantees, equity participation, export credits, training, management counselling, access to technology and networks). The BPI has the capacity to screen firms, monitor their progress and intervene at various stages of their lifecycle. Effectively, the BPI acts as a public equivalent of venture capital. The proposed RBBs could leverage this capacity with additional instruments and resources, and in a more employment-friendly manner.

The RBB proposal does not entail a significant increase in capacity compared to institutional arrangements that have already proved feasible in other, similar contexts. The novelty, to the extent there is any, lies in the focus and orientation of the business-promotion programme: a closer coordination of business incentives with labour market/training policies, more customised business services instead of *ex-ante* tax incentives, explicit targets for employment and job upgrading ('good jobs'), greater room for revision in light of changing circumstances and more intensive evaluation.

4 Labour-friendly innovation policies

In 2016, Elon Musk announced that Tesla's Model 3 would be built in a new, fully automated car factory. Codenamed 'Alien Dreadnought,' with obvious connotations of science fiction and hyper-advanced technology far beyond current practice, the project would enable essentially workerless production. Complete automation would allow the factory to operate beyond human speed: "*raw materials would go in one end and finished cars would roll out the other. In between, robots would do everything, at very high speed – speeds too dangerous to risk around frail human bodies*"[12]. Only a few human experts would be

12 Matthew DeBord, 'Tesla's Future Is Completely Inhuman — and We Shouldn't Be

needed to ensure everything was running smoothly.

The factory was supposed to become fully operational by the end of 2018. But the plans proved hard to implement, and by mid-2018 it was clear that production bottlenecks would not be solved easily. The operation was experiencing "*production hell*" and was "*within single-digit weeks of death*," in Musk's words. The dire situation forced the company to launch a new assembly line inside a sprung structure (what Musk described as a "*tent*") on the grounds of the factory. Built in three weeks, the new assembly line increased production by 50 percent and returned the company to financial health.

When CBS News correspondent Leslie Stahl visited the "*tent*" sometime later, accompanied by Musk, she observed that the new Model 3 factory was in fact full of human workers. Musk laughed, responding "*people are way better at dealing with unexpected circumstances than robots*"[13]. On Twitter, he conceded that "*excessive automation at Tesla was a mistake … Humans are under-rated*"[14].

Tesla's automation mistake is revealing for several reasons. First, it highlights how production techniques relying on human labour can still dominate automation when it is impossible to fully account for uncertainty and routinise all tasks. Second, it is indicative of the excessive faith many business leaders often place on new technologies. Third, it reminds us that technology adoption is a choice: businesses face a range of options about what kind of innovations to use and deploy – choices that have significant implications for the workforce but are not typically internalised in the decision-making process.

In his magisterial book *Inequality*, the late Anthony Atkinson stressed that there are three reasons why the direction of technological

Surprised', *Business Insider*, 20 May 2017, https://www.businessinsider.com/tesla-completely-inhuman-automated-factory-2017-5?r=UK.

13 Simon Alvarez, 'Inside Tesla's 'Tent'-Based Model 3 Line That Set a Path to Profitability'. *Teslarati*, 10 December 2018, https://www.teslarati.com/inside-tesla-tent-based-model-3-production-assembly-line-profitability/.

14 See https://twitter.com/elonmusk/status/984882630947753984.

change cannot be left to firms and innovators alone (Atkinson, 2015, pp. 115-118). First, technology choices have distributional implications – the share of capital in value added and the level of wages – to which society may not be indifferent. Second, the replacement of labour with robots and other modes of automation typically entails the substitution for a joint product – a human service alongside manual labour – and there is no guarantee that laissez-faire is efficient in the presence of joint supply. Third, today's innovations have long-range implications for the future and may foreclose technological paths that are more friendly to human workers. The social benefits of good jobs we have already discussed can be considered a fourth broad reason.

Technological change is probably the single most important force that has been driving the polarisation of labour markets. As automation, AI and other new technologies alter the type and composition of skills demanded in labour markets, workers with skills that are in less demand face significant challenges.

The usual discussion around the labour-market implications of new technologies is curiously one-sided. The direction of technological change – whether it augments or replaces labour – is taken to be essentially exogenous and out of our control. All the adjustment, therefore, falls on the labour force. Typical statements exhort workers to acquire better education and training to ensure they have the skills required by new technologies. Here is, for example, how a McKinsey report (2020) on the future of work in Europe puts it:

> *"Automation will require all workers to acquire new skills. About 94 million workers may not need to change occupations but will especially need retraining, as technology handles 20 percent of their current activities. While some workers in declining occupations may be able to find similar types of work, 21 million may need to change occupations by 2030. Most of them lack tertiary education. Newly created jobs will require more sophisticated skills that are already scarce today"* (McKinsey, 2020, p. iv).

What is striking in such statements is the degree of technological determinism. It is as if technological innovations and their likely impacts on future jobs are completely exogenous, shaped by forces outside the economy, institutional arrangements and government policy.

In reality, the kind of innovations that are fostered depend on several conditions that may be amenable to control.

First and most directly, government-funded and directed innovation programmes make decisions about what kind of innovations to promote. Those priorities are often shaped by considerations about which activities are the industries of the future (eg *Programme d'investissements d'avenir in France*), or what specific societal goals need to be fulfilled (eg green technologies in the context of the European Green Deal, or defence-related technologies at the national level). These priorities in turn determine what kind of research projects are funded and developed. Employment-friendly technologies – those that augment rather than replace labour – could be part of those priorities, though they are not at present.

Second, private-sector innovation incentives can be skewed because of prevailing financing methods or policies. Venture capital, for example, plays a relatively important role in financing innovation in the US. VC naturally seeks areas where the returns can be capitalised relatively quickly by investors. As Lerner and Nanda (2020) pointed out, this may exclude innovations where the gains are longer term or reaped by society at large. There are also many policies that indirectly shape private-sector technological investments because of the market incentives they generate. For example, most advanced economies subsidise capital formation (through depreciation allowances and various incentives of the type we discussed previously) and tax labour (through personal income taxes and labour charges). An unintended consequence of the tax system is to induce firms to economise on labour by investing in machinery, to an extent that may be socially suboptimal. Acemoglu *et al* (2020) found that a shift to an "*optimal*" system of factor taxation would increase US employment by nearly 6 percent. There is no reason why

such indirect and unintended consequences on the direction of technical change could not be taken into account if tax (and other) policies were subject to a fuller evaluation.

Third, beyond the economic incentives they face, there is an informal set of norms that guide innovators' decisions. The high-tech community often operates under a shared set of values and expectations with respect to what is a desirable direction for technological change. In the US, groupthink is aggravated by the very high concentration of VC funding in a small number of firms and cities (such as San Francisco, Boston and New York City). "*Venture firms based in other cities might have chosen very different firms to invest in given their perspectives on their local economies*," wrote Lerner and Nanda (2020)[15]. Automation and replacing human labour or ingenuity can be prized beyond the true economic value. Elon Musk's misplaced confidence in the benefits of full automation was perhaps a reflection of such values. Such norms might be amenable to change as society begins to attach specific value to employment-friendly technologies. An analogy might be drawn here with the growing ecological consciousness households and firms have exhibited in recent decades, as the climate change challenge has become part of the everyday consciousness.

Finally, the direction of technological change also depends on the balance of power between employers and employees. When workers have a say in the workplace, management has to get buy-in from them before major technologies are deployed and work is restructured. This can reflect itself in a modern version of Luddism – aversion to any kind

15 Those who finance innovation are very unrepresentative of the societies in which they live. Lerner and Nanda (2020) reported about top venture firms: "*Eighty percent of partners are male; among the set of partners with at least one board seat, 91 percent are male. Three-quarters of partners with at least one board seat attended either an Ivy League school, or one of Caltech, MIT, or Stanford; moreover, nearly 30 percent of these individuals are graduates of just Harvard Business School or the Stanford Graduate School of Business. In terms of location, 69 percent are based in the Bay Area alone and over 90 percent are based in either the Bay Area, Greater Boston, or New York.*"

of innovation that appears to threaten jobs. But it can also be a useful counterweight to adverse incentives in the system encouraging too much automation or the adoption of what Acemoglu and Restrepo (2019) called *so-so technologies*. For example, businesses that take stakeholders' interests into account are more likely to deploy new technologies in a manner that empowers workers, rather than replace them or reduce them to mechanical, routine work. Sophisticated technologies can allow managers to monitor their workers' every movement and measure their efficiency, enabling companies to set ever-more demanding standards of productivity, at some cost to workers' physical and mental health. Alternatively, new technologies can empower workers to increase their autonomy and control their work environment.

In short, there are reasons to believe that the direction of technological change, in addition to its rate, depends on a wide range of factors, many of which could be influenced by societal and governmental decision-making. And if so, it may be possible to direct technology to better serve the existing workforce's needs, in addition to preparing the workforce to match the requirements of technology.

5 Margins of technological choice

Firms faced with the challenge of upgrading productivity face all kinds of decisions. Their options may range from installing robots (which kind?) to modernising existing capital equipment, to using advanced analytics to optimise performance. The technology that will work best is unclear *ex ante*, and rarely comes in ready-made, off-the-shelf form. These choices create the margins around which better or worse decisions can be made.

Technology choices that firms make are closely linked to the organisation of production and the degree to which employees benefit from autonomy and a learning environment. Under Taylorist production, workers perform repetitive tasks on the assembly line: jobs may be plenty, but they are hardly satisfying. Under lean production, machines replace routine human labour, but work remains under

hierarchical control and offers little autonomy.

In 'learning organisations,' by contrast, workers take part in decision-making, have considerable autonomy, and are engaged in problem-solving and continuous learning. The learning mode of production not only increases worker satisfaction, it is also more conducive to increased productivity and dissemination of innovations over time[16]. In particular, the introduction of new technologies along with organisational changes can allow less-skilled workers, such as shop floor operators, to identify productivity improvements and engage in appropriate actions. There are plenty of examples of firms that have made a conscious choice to move towards this learning form of organisation[17].

16 Based on data from European Conditions of Work Surveys (ECWS), France Stratégie (2020) reported highest levels of job satisfaction in 'learning organisations.' Also, rates of innovation seem to be correlated with proportion of learning firms at the national level.

17 A joint programme between the World Economic Forum and McKinsey focused on "*lighthouses*," firms that are introducing new technologies that have the potential to revolutionise production in a human-centred way, empowering workers and giving them greater agency in the process of introducing innovations (WEF/McKinsey, 2019b). Studying these lighthouses provides many valuable insights. For example, the French company Schneider Electric "*is implementing, testing and rolling out ideas for innovation in an organized approach in a 'Smart Factory Program' A strong focus on workforce engagement ensures that the changes and new technologies are supported by employees and therefore adopted quickly. For instance, at the company's Le Vaudreuil site in France, it has created a 3D virtual reality model of the entire factory to use in testing and validating innovative ideas. This is then used to engage operators so they can see how their day-to-day work will change…*". In another example, "*a large manufacturer had deployed autonomous mobile robots (AMRs) for a point-to-point material transfer workflow moving parts from kitting stations to an assembly cell. Workers in another cell noted that their colleagues experienced fewer delays waiting for parts, and they also noticed that the robots would wait in an idle queue between tasks. They approached the floor supervisor and requested that the robots also be assigned to support their cell…. As a result of their independent and collaborative action, the workers and local staff were able to increase their productivity and also increase the utilization of the robot, making it a win for all involved".* In the words of a machine operator at Foxconn, *"my role has changed from loading and other manual tasks to monitoring, diagnostics and problem-solving*" (WEF/McKinsey, 2019b).

Firms will have diverse motives in choosing among these modes: management capacity, organisational culture, relations with workers and not least imagination. Technological features themselves are rarely the sole determinant. A France Stratégie (2020) study noted that learning organisations have become common in Nordic countries but are still scarce in France[18]. The study highlighted the need for public policies that pay attention to how firms make choices over production modes, instead of treating firm organisation as a black box.

Moreover, different technologies can survive side-by-side. In a study of small and medium-sized manufacturers in Ohio, Waldman-Brown (2020) found her respondents took two different approaches to the competitive challenges they faced. One approach was to build new greenfield plants that were fully automated, typically in a different country, with the intention of phasing out existing operations. In her sample, one company was building a plant in Mexico and another in Romania. This strategy naturally resulted in job losses in Ohio (and did not create many new jobs in the outsourced countries in view of the extent of automation). But a second group of firms were engaged with "*ongoing tinkering with existing plants*," and this did not seem to result in much job loss. The retrofitting and modernisation of existing plants seemed to be a profitable strategy for those firms that took this path. The majority of the SMEs Waldman-Brown (2020) interviewed "*claimed to have found robust competitive niches*" and "*very few of these legacy firms seemed to be laggards*." Firms pursuing the tinkering strategy "*were constantly*

18 The report cites a rare French example, Favi, an automotive subcontractor: "*As early as the mid-1980s, [Favi] chose to focus its strategy on product quality and the use of innovative technologies, with a focus on the health and safety of its employees. It also focused on the autonomy of its employees – especially the workers – by creating 'self-organized units,' i.e., mini-plants of 5 to 25 employees, each taking charge of a production line in a customer/supplier approach. As at Volvo, employees developed their own methodological tools for monitoring and improving production processes. The operators themselves made contact with customers instead of the sales staff, thus acquiring greater control over their work and a cross-functional view of the production line*" (France Strategie, 2020).

on the lookout for new technologies that could meet their demands for affordability and versatility, and most were not concerned about being out-competed by automation at home or cheaper labor abroad." Such studies suggest the possibility of different technological paths to firm success, with sharply varying consequences for labour.

An important series of papers by Acemoglu and Restrepo (2018, 2019) argued that it is possible to resist present technological trends and push innovation in a direction that creates new, labour-absorbing tasks. They cited three areas. First, they suggested AI could be used in education to create more specialised tasks for teachers, personalise instruction for students, and increase effectiveness of schooling in the process. They noted that individual students have different learning styles, which requires teaching to be adapted to their specific needs. By generating real-time information on learning and making recommendations, AI tools can enable customised, smaller-group teaching. They can also allow instruction to respond more rapidly to evolving technologies and labour-market needs. Such tools are unlikely to replace teachers; they might in fact increase the demand for teachers (as well as redefine their roles) by enhancing the return to individual or small group instruction.

Second, Acemoglu and Restrepo (2019) noted a similar potential in healthcare, which is perhaps closer to realisation. AI tools can significantly enhance the diagnostic and treatment capabilities of nurses, physicians' aides and other medical technicians. They can, in effect, allow "*less skilled*" practitioners to perform tasks that only physicians with many more years of professional education have traditionally undertaken. The same logic also applies to other areas to boost job opportunities for those without the most advanced skills. For example, AI systems already enable the drawing up of simple contracts (such as wills) and the provision of many other services without the actual involvement of lawyers. To date, such systems have replaced primarily paralegals rather than lawyers themselves, but more advanced systems could enable paralegals to perform more advanced tasks, such as

document review, due diligence and document drafting (Remus and Levy, 2016). Machine learning and neural networks can enable mid-level finance professionals to do financial risk assessment, loan underwriting and fraud detection tasks that would otherwise be undertaken by more senior professionals (McKinsey, 2018).

Third, Acemoglu and Restrepo (2019) mentioned the use of augmented and virtual reality technologies in manufacturing, enabling humans and robots to work together in performing precision tasks (rather than the latter replacing the former). Such technologies are based on smaller, more nimble robots that also enable greater customisation of production in response to specific customer needs. "*This will not just help workers keep some of the tasks that might have otherwise been automated; it could also create new tasks in which humans, augmented by digital technology and sensors, can be employed and contribute to productivity*" (Acemoglu and Restrepo, 2019). More broadly, shop floor apps augment relatively unskilled labour by allowing workers to carry out operations that more-skilled employees typically perform. A WEF/McKinsey white paper (2019a) noted that such apps "*enable manufacturers to bridge the skill gap*." Real-time performance feedback and guidance through manufacturing analytics allow "*experienced and new operators* [to] *work side by side with manufacturing apps*" (WEF/McKinsey, 2019a).

Product customisation is one of the imperatives that have pushed some car companies to moderate their ambitions with respect to automation. Beyond Tesla, companies including BMW and Mercedes are building their automation plans around human work, which they have found allows both greater reliability and more customisation in production. McKinsey (2018) reported:

> *"after years of building robotic factories, BMW in South Carolina is ramping up hiring of human workers.* [BMW] *says that combining people with machines on its automotive assembly lines increases the flexibility to build multiple models in smaller*

batches and thus respond to shifting customer demands more quickly."

In new BMW factories, lightweight robots ('cobots'), which do not have to be physically separated from workers, allow humans and machines to perform complementary tasks. For example, to install the insulation inside a door, a worker may first put in place the foil with the adhesive bead, and then the robot applies the heavy pressure needed to seal it[19]. Similarly Mercedes-Benz has replaced some of its older generation robots with AI-enabled cobots, redesigning its processes around human-machine collaboration. This allows the company to build more customised S-class sedans, something that older systems could not do as well. In the plant, human workers customise cars on the fly using hand-held tablets, with the automated work being performed by the light-weight robots (Wilson and Dougherty, 2018). In general, lightweight robots have opened up new potential for human tasks that cannot be routinised.

In sum, there are many margins of technological choice. First, the kind of automation that amounts to replacement of labour, pure and simple, is far from destiny. Second, investing in 'learning organizations' can pay off in terms of both worker satisfaction and productivity. Third, many AI systems have the potential to complement low and middle-skilled labour instead of high skills. Fourth, appropriately steered innovation can lead to an increase in labour-requiring tasks through greater customisation in manufacturing and individualisation of services. Some of the examples we have provided suggest that firms can make innovation decisions that are simultaneously labour-friendly and profitable. But the mix of incentives they face is distorted by existing policies as well as by their lack of internalisation of the social benefits of good jobs.

19 BMW Group Press Release, 'Innovative Human-Robot Cooperation in BMW Group Production,' 9 October 2013, https://www.press.bmwgroup.com/global/article/detail/T0209722EN/innovative-human-robot-cooperation-in-bmw-group-production?language=en.

6 Is there a role for policy?

"*The direction of technological change should be an explicit concern of policy-makers, encouraging innovation in a form that increases the employability of workers and emphasizes the human dimension of service provision*," wrote Atkinson (2015). The question is what this implies for specific policies.

First, it would be useful to review the prevailing fiscal regime with a view to ascertaining whether there are excessive incentives for investment in automation (as appears to be the case in the US; Acemoglu *et al*, 2020). If the answer is yes, corrective instruments may need to be put in place. Possibilities would include an increase in the taxation of capital that directly substitutes for labour (eg robots), providing tax preferences for cobots over traditional robots and, of course, reducing labour charges.

Second, it may be possible to incorporate employment considerations directly into the existing regime of tax incentives for R&D. In the presence of a good-job objective, traditional R&D externalities have to be modified to take into account the likely employment effects of innovation. The selection criteria could revolve around the margins of choice we discussed previously: innovations such as automation that directly replace labour would be favoured the least, and innovations that augment labour of low and medium skills and create new, labour-absorbing tasks would be favoured the most.

While it may be difficult to ascertain those employment consequences, especially of different types of work, research does provide some rough guidelines. For example, Webb (2020) provided a mapping from different kinds of research in AI (measured through patents) to the employment structure. This kind of work could guide policymakers in providing a more differentiated structure of R&D incentives, favouring the kind of R&D that is more labour-friendly. Acemoglu (2021) suggested policymakers should look at the labour share of value added. None of the existing methods are likely to be particularly reliable at the outset. The expectation is that paying attention to employment in this context might lead eventually to the development of better

measurement frameworks regarding labour-market implications.

Third, and in a similar vein, governments could apply a 'prospective employment test' when determining their public-spending priorities for innovation. At the EU level, for example, employment considerations appear to play virtually no direct role in the construction of the innovation portfolio. Horizon Europe has identified five specific research and innovation missions for the 2021-2027 period: adaptation to climate change; cancer; climate-neutral and smart cities; healthy oceans, seas, coastal and inland waters; soil health and food[20]. No doubt each of these areas is important. But encouraging labour-friendly innovation is no less important. Its absence from the list reflects an unwarranted determinism about the direction of technological change[21].

The European Fund for Strategic Investments (EFSI) partners with the European Investment Bank (EIB) to finance investment in innovation. The areas it lists as priorities are *"infrastructure, energy efficiency and renewable energy, research and innovation, environment, agriculture, digital technology, education, health and social projects*." It also provides risk finance to small businesses to help them innovate. One possibility would be to devote a portion of EFSI funds experimentally to developing labour-friendly technologies – just as in the case of green technologies.

The European Green Deal (EGD) provides a more specific opportunity for making employment a focus of innovation. The social component of the EGD consists almost entirely of 'compensation,' the idea being that those regions and groups of workers that are adversely affected by investments in decarbonisation should be made whole

20 See European Commission, 'Horizon Europe (HORIZON),' https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/programmes/horizon.

21 Atkinson (2015) provided another example: "*Did the European-based Euroka consortium* [in autonomous vehicles] *consider the distributional issues when launching PROMETHEUS (Programme for a European Traffic System with Highest Efficiency and Unprecedented Safety)? The fact that 'efficiency' is picked out in its title suggests that 'equity' was not at the forefront.*"

in some way[22]. An equally important strategy might be to take good-job considerations explicitly into account in selecting investment priorities within the EGD. In particular, different decarbonisation strategies may have different implications for labour markets. Some programmes, such as retrofitting building and transport systems, waste management, and public transportation, tend to be much more labour-friendly than others, such as carbon capture and storage (CCS) or nuclear energy. Employment considerations may yield a different portfolio of innovations and investments within the EGD than would be selected in their absence.

Fourth, the government can directly encourage the introduction and dissemination in the private sector of learning organisations that empower workers. The goal would be for such organisational forms – based on teamwork, development of cognitive, social, and soft skills, workers' autonomy and continuous learning – to replace Taylorist or lean organisational models where feasible. Along these lines, France Stratégie (2020) recommended the creation of a French national programme for managerial and organisational innovation to raise awareness of firms and to assist in the implementation of the requisite organisational changes. Since the requisite investments may require both public assistance and skills training, it would be natural for such a programme to work together with the public employment services and the regional business bureaux we discussed previously.

Finally, public policy can play a role in shaping public consciousness about the social and employment consequences of innovation. A public that is more aware of the choices we have is likely to expect more from innovators. Acemoglu (2021) drew an analogy with environmental consciousness and concerns about nuclear weapons: "*in*

22 The EGD includes a Just Transition Mechanism to raise and transfer funds to regions dependent on coal, lignite, oil shale and peat, and greenhouse gas-intensive industries. Region-specific 'territorial just transition plans' are contemplated for reskilling, development and regional rehabilitation needs, though plans remain vague at time of writing.

the same way that millions of employees demand that their companies reduce their carbon footprint and in the same way that many nuclear physicists would not be willing to work on developing nuclear weapons, AI researchers should become more aware and more sensitive to the social consequences of their actions." One might also add to these examples the increasing concerns about privacy that digital innovations have created. The requisite change in public norms will have to come from within society at large. But the government can play an important role as well in articulating the appropriate narrative on the need for labour-friendly innovation.

The public narrative we might need is one that qualifies the single-minded focus on the imperative of adjustment by workers and their skills to new technologies. This is an oddly one-sided remedy. As a matter of logic, the gap between skills and technology can be closed in one of two ways: either by increasing education to match the demands of new technologies, or by redirecting innovation to match the skills of the current (and prospective) labour force. The second strategy, which gets practically no attention in policy discussions, might be worth a shot too.

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