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Beyond Hype and Despair: Developing Healthy Communities in the Era of Intelligent Tools

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Abstract

There is much we do not know and cannot know about the socioeconomic impacts of intelligent machines. The impacts will be driven by business strategies that differ by sector and country. "Good jobs" strategies are possible. It is important to identify and strengthen the factors, including policies, that encourage them. Demographics will certainly affect the outcomes. Powerfully and importantly, the narratives about the benefits and costs of the technologies will affect the speed and breadth of the deployment of intelligent tools.

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Intelligent tools are diffusing through our economies and society. Some of the developments are powerfully changing how our economies work and how we live our lives. Some of the purported developments are simply hype. Amid the froth, many believe that our current social and economic arrangements will be swept aside and, at the extreme—that we will become the metaphorical "pets" of super-intelligences.[i] Others, ourselves included, assert that the world is ours to create.[ii] That is easy to assert but difficult to demonstrate and harder still to implement.

This essay is meant as a step toward developing sustainable and equitable communities in the era of intelligent tools.[iii] This exploratory essay proceeds in three steps. *First*, we offer clear conclusions about the impact of intelligent tools on work, the economy, and society, in terms of how much is uncertain and how little we know. Technology is not an ineluctable force, and, though not entirely plastic, development trajectories can be shaped.[iv] A key conclusion, from consideration of the literature and observation of current technologies, is that choices about their deployment, the purposes to which they are put, and how they are used are central to their trajectories and hence their socio-economic impacts. *Second*, we argue that those choices will turn, in substantial measure, on how we view our communities and workforces. Are our workforces assets on which the competitiveness of firms can be built or simply costs that must be cut? Those choices of deployment will be filtered through the business models of firms and the policies and values of governments and non-profit organizations. The greatest impact of the technologies on society will, arguably, be through the reconfiguration of business models and the resulting employment choices and consequences of the newly conceived business strategies. *Third*, the interpretative narratives about technologies, particularly business literature about what firms can and must do to win in the markets, will be as important as the concrete "facts" of the case. Will the narratives suggest that technologies must be resisted, or will the narratives tell us that they can be harnessed to our advantage? Therefore, we end this essay with suggestions on the importance of narrative and what must be done to create a factual foundation for narratives that can sustain healthy and equitable communities.[v]

Beyond the Hype

        We live in an era of intelligent tools and systems. Our focus here is the impact of intelligent tools on work, which also implies the impact on competition and firm strategies as much as the consequences from their deployment directly on the shop floor, in the office, and on the labor market.

        The phrase "intelligent tools and systems" points to the toolbox, not individual tools. The toolbox itself is constantly expanding, and the tools are constantly gaining power. There is an array of labels and debates as well as hype associated with each. Consider several technologies and the types of questions and issues swirling around them.

- *Robots*: Is this the end of jobs, or the end of drudgery? What sort of transformation do we envision? The key robots may not be those in the factory but software robots deployed in services. In fact, every modern machine is already, in some sense, a robot.
- *Blockchain and cryptocurrency:* Is this a giant con? The end of banks? Or, in the case of blockchains, a tool with some applications?
- *Artificial intelligence (AI):* Will mankind be subordinated to these new intelligences or will humans deploy these instruments in achieving objectives, treating them as tools like many others?
- *Platforms:* The platform-generated disruptions that often reorganize markets and business may be seen as the promise of the internet delivered or the disturbing foundations of a winner-take-all economy.

Lurking behind all these tools, and the debates and hype associated with them, is the expanding power of the base technologies—in particular, computing power, digital networks and cloud computing, and the capacity to generate and manage data. It is evident that "[Our] daily lives are already powerfully shaped by digital platforms such as Amazon on which we buy goods and services; Facebook through which we track our friends, even as we are tracked; and Google through which we access a world of information. And the press is replete with tales of automated factories run by robots."[vi]

        The focus in this essay is platforms and AI, two technologies that are, for our purposes, partners. Platforms are the nexus for interactions of all types. They are disrupting competition, often including the disruption of existing rules and regulations, encouraging innovation in business models, and, in the process, accumulating vast amounts of data. In practice, AI draws upon and gives great power to the data that are often generated and orchestrated by platforms. Machine learning, the core of AI, rests

less on algorithmic innovation (though the algorithms certainly matter) than on combining algorithms with computing power and data.[vii] So, to ground our discussion, we comment on each of them, even at the risk of stating the obvious.

Platforms[viii]

Let us vastly oversimplify and focus narrowly. Before the internet fully blossomed, Microsoft Windows was the classic platform integrating multiple functionalities. Now, online digital platforms, the focus of current debates, can be thought of as shopping malls. Less simplistic language emphasizes that platforms are multisided virtual nexuses of connections. Some can operate like a "shopping mall." For example, Amazon connects its own products and third-party vendors, on the one hand, to buyers, on the other hand.[ix] These virtual malls drive policy and business strategy debates. For example, antitrust or competition issues are being raised because Amazon transacts 49% of all online US retail for its own account and with countless other vendors using the site.[x] In a different case, Uber, which connects drivers and clients, raises questions concerning labor law and transportation regulations. In a real sense, Uber exemplifies the mantra "Don't ask for permission; ask for forgiveness," with a conscious business strategy of ignoring existing regulations. Airbnb connects those seeking accommodations and those offering them, ignoring, among other things, zoning regulations.

The consequences of all this are addressed below. First, we dispose of some hyped labels. "The sharing economy," a sympathetic label that suggests a more equitable and ethical world, begs the question of who shares what with whom for how much. Platforms such as Uber transfer risk and capital costs from firms to workers, hardly a form of social sharing. "The gig economy," a more pejorative term, disguises the fact that temporary work is not a new development in the digital age. Digitization certainly makes temp work more visible and measurable. However, as Louis Hyman's excellent book, *Temp* makes clear, temp work has slowly broken apart the dream of full-time employment with a living wage for a growing number of workers and occupations.[xi]

We should not understate the matter. There are real consequences of firms such as Uber, Upwork, TaskRabbit, or Thumbtack for how we organize the economy, the range of activities that can be sliced and diced into temporary-ad piecemeal work arrangements, the implications for worker livelihoods, and what the appropriate labor market rules

should be.[xii] Yet digital technologies can also produce gains for many workers, whose skills can be augmented. Consider independent professionals. In part as a function of expanding digital technologies, doctors are increasingly organized into health-care companies and lawyers gather in global legal firms, rather than operating as independent contractors. In any case, that might change rapidly. Digitally enabled gig work, as the research of JPMorgan Chase Institute indicates, is a very small portion of total employment, around 1%.[xiii] So, at least for now, the hype over "sharing" is misplaced, and the promise or threat of "gig" work is more limited. In general, uprooting existing rules and regulations means not only that new policy battles must fought but also that older battles will be refought, often with different outcomes. Google has many more contract workers than employees!

There are consequences, certainly. Platforms are changing competition, encouraging or forcing the reorganization of work and the terms of compensation, shifting which groups and individuals work, where they work, who has power in the marketplace and in company operations, and which groups win and lose. Consider Uber and Lyft. Their transient drivers of diverse backgrounds, some of them students, are part-time coming in and out of the market. The transients compete with drivers seeking to make this a full-time profession. The competition is even more evident with drivers of black cabs in London, who take years to build up the knowledge to pass the test required for getting a license and compete with lower-cost services. Digital mapping enables a less-experienced driver, at least in part, to compensate for a lack of knowledge. Platforms such as Upwork and Amazon Mechanical Turk facilitate the performance of Individual distance task or piece work becomes possible through platforms such as Upwork and Amazon Mechanical Turk. This can be distinguished from the long-standing business practice of off-shoring and outsourcing practiced through an array of service providers.[xiv]

Although the actual scale and dimensions of the impact of platforms on work remain unclear, the significance, power, and consequences of the platforms and platform-based companies are expanding dramatically. As stock market prices have shown, in 2002 only two of the ten largest firms by stock market valuation were digital/tech firms, and only one, Microsoft, was a platform firm. By the end of 2017, seven of the ten firms, by market capitalization, were directly dependent on platform-based business models for their competitive advantage.

Artificial Intelligence

AI is the center of much debate, focusing the fears and possibilities of the digital story writ large. AI is an exceptionally powerful tool in an ever-growing digital toolbox, expanding and amplifying the consequences of ongoing digital transformation. Olaf Groth and Mark Nitzberg present it clearly, and simply, in *Solomon's Code*: "at their core, all the various types of AI technologies share a common goal—to procure, process, and learn from data, the exponential growth of which enables increasingly powerful AI breakthroughs."[xv]

The term "artificial intelligence" has such power to drive imagery and speculation that it drives conversation, making its impact more difficult to assess. In a real sense, we take the original ingredients of the era of intelligent tools and the digital revolution more generally—computing power, big data, and cloud and networks—add the algorithms of the machine learning, neural network approaches, and stir. The algorithms and approaches have quickly become more sophisticated, but the approach is not new. What is new is the ability to apply the approach.

As we turn to the consequences for work, we must separate the notion of "general AI" from the narrow and specific applications. Tyson and Zysman in an Afterword to *Solomon's Code* wrote that:

> Fears about the possible domination of humans by machines embodying artificial general intelligence are stoked by news stories, fiction and movies. And the spectre of artificial general intelligence is raising profound questions about what it means to be human. Whether, if ever, we arrive at artificial general intelligence, narrow AI tools that imitate human intelligence in specific applications are developing rapidly, resulting in what the press calls the "appearance of intelligent behavior in machines and systems."[xvi]

General AI and the fears of the singularity, the triumph of general AI, are for tomorrow, if ever.[xvii] The speed and power of particular applications of AI will be quite varied and debated. Voice recognition with Alexa and other such tools has advanced quickly, as has face recognition. Driverless vehicles in very defined and constrained environments have been here for a long time, as, for example, in the trains at airports between terminals. More generally driverless cars on US streets are likely to be a long way off.

An assessment of AI possibilities is not simply a matter of the ability of the tools to calculate or assess particulars, which often can be done faster and more effectively by machines than by humans. Assessing the socio-economic implications of AI requires a much longer and deeper conversation, a conversation that focuses on the character of human intelligence[xviii], on how we learn as individuals and as communities and groups combining and integrating perspectives that create uniquely human advantages. [xix] The advantages of what our colleague Ken Goldberg calls Multiplicity, bringing to bear on questions multiple vantages and perspectives from varied contexts and narratives that creates the basis of innovation.[xx] The pundit Steven Johnson refers to this as helping to avoid blind spots embedded in a particular perspective.[xxi] These are important debates that hinge on the very character of human intelligence, and while beyond the scope of this essay are important to assessing the implications and consequences of AI.

Today, whatever the conclusion of that larger debate, narrow specific applications are central, usually under the label of machine learning. Their impacts are evident. Particular applications of AI will resolve problems at different speeds with varied capacities to apply across diverse circumstances. Driverless vehicles trying to interpret complex situations may simply "abandon" their journeys—in the middle of the freeway at rush hour!

Platforms, which provide new methods of global communication and access to information, target messages and advertisements to particular groups, even individuals. The intent, often, is to influence political outcomes and discourse, not just to sell more goods and services. Tyson and Zysman have noted that there "…. are also disturbing signs of the makings of a surveillance society as well as evidence that even the smartest algorithms may systemize rather than counter human biases and flaws in judgment."[xxii]

Intelligent Tools—Platforms and AI: The Latest Phase in the Digital Transformation

Platforms and AI represent the latest phase in an ongoing digital revolution, a transformation that is creating an ever more turbulent environment for economies and work organization. Information and communications technologies were critical for the ability undertake and manage virtual work. The very creation of foundries for semiconductor production, such as TSMC (Taiwan Semiconductor Manufacturing Corporation), depended on the ability to transmit/transfer standardized and digitized

design and production information.[xxiii] These foundries profoundly changed the character and logic of global competition in semiconductors. Smaller design-centered companies could access full-scale production facilities even when they could not afford the billions of dollars normally required to do so. Some of the larger firms simply decided not to build facilities but to access the foundries.   The offshoring surge in past decades provided many labor-rich economies with entry points to the global economy. The well-detailed decomposition of production of goods and services with contracted manufacturing and services created intense competition at many points in value chains. This intense competition an industrial commodity trap, as many steps in the value networks became effectively commodities. [xxiv]

The efforts to escape this commodity trap connect that earlier era of decomposition with global production networks with the current era of intelligent tools. Critically, in part as a response to the commoditization of many aspects of production, ICT (Information and Communication Technologies)-enabled transformation of services began to permit commodity goods and services to be differentiated and to provide distinctive value. Products and value became embedded in networks and, later, platforms, and now those platforms are armed with AI tools. iTunes and iPod represent a clear instance of goods creating distinctive value by providing portals to services though Apple still makes most of its money on the product. However, but the story is much more sweeping.   Rather than just selling cranes, some equipment firms began, for example, to sell port management services [xxv] or construction site services, in which equipment collects and interprets data on the environment in which it is embedded.[xxvi] The fundamental business models changed, therefore the skills required for competition were altered.

The story of platforms and AI is only now unfolding. At present, we should note, American and Chinese firms dominate the business-to-consumer platforms. They run on effectively parallel tracks, with Chinese firms hard pressed to break fully into global markets and Western firms unable to penetrate Chinese markets.[xxvii] In the domain of business-to-business (B2B) platforms, one could argue that we have yet to see the emergence of dominant players or standards. Amazon and Alibaba are already organizing portions of B2B. Perhaps the best way to think about it is in terms of many chains and parts—there may be "no ring to unite them all." Whether Chinese firms will, as the

technologist/businessman Kai Fu Lee projects, come to dominate AI, or not, for now the United States and China are the two dominant players, with Europe on the side.[xxviii]

Implications and Consequences: What We Know, What We Don't Know

We turn now to an evaluation of the consequences for the economy and society of intelligent tools and systems, platforms, and AI. Together, they are altering business models and changing approaches to work organization. More generally, they are altering and reflecting shifting balances of power in society. If we focus only on lists of tasks and jobs in existing firms and activities, examinations based on our current production system and work organization, our analysis can go awry.[xxix] The changes in business models in all sectors, with a reconfiguration of competition, not only changes the demand for labor but opens the possibility of rethinking work as new tools are developed and deployed. Robots on the automotive shop floor have consequences for the auto industry and workers, while the introduction of electric vehicles represents, or at least presages, equally sweeping changes in competition and production in that industry. Amazon reconfigures competition but also creates delivery and warehouse jobs while also leading to changes in the character and location of work in retail.

What we do know is that many jobs and tasks and many existing businesses will be eliminated. The estimates of displacement range from 50% of "tasks" to 9% of employment.[xxx] New jobs, as yet unimagined tasks, and new firms, in markets yet to be envisioned, will be created. Most work, most firms and their business models, and most sectors will be profoundly transformed.[xxxi] There is general agreement that there will not be broad technological unemployment; new jobs will offset lost jobs.[xxxii] For now, it appears in aggregate, that intelligent tools are skill biased, with the largest burdens of job loss and wage compression falling on the middle skilled and lower skilled workers. However, many highly skilled jobs may also be transformed or suffer wage compression.[xxxiii] However, many highly skilled jobs may also be transformed or suffer wage compression. The ultimate consequences for the well-being of individuals and communities are open to debate. As Tyson and Zysman have written: "A critical question is how the new tasks and jobs enabled by intelligent tools and systems will affect the quality of jobs—even if most workers remain employed, will their jobs support their

livelihoods."[xxxiv] And, of course, this is ultimately a political issue regarding how the value created is distributed.

Despite the many studies, and these broad conclusions, we in fact know less than we need to formulate responses. The conclusions of the diverse studies differ with method and perspective. We do not know _when_ or how fast the changes will occur, whatever the eventual scale. Some studies suggest that this will take place in the course of ordinary economic transformation, while others suggest a more urgent drama.[xxxv] An immediate displacement of workers in the course of a few years can be socially and political uprooting. An "ordinary" structural transformation of the economy will be difficult to manage but need not incite panic and fear. Moreover in a real sense there is no agreement on why jobs are being displaced or why skill mixes are changing; are the dramatic changes driven by trade or by technology?[xxxvi] German manufacturing, despite the introduction of new technology, sustains itself through exports.[xxxvii] American manufacturing has maintained the total value of production, but with less employment for each unit of production.[xxxviii]

We certainly do not really know _how much_ employment/work will be created, or _where_ it will locate, or the _workforce skills_ that will be required.[xxxix] Many of the differences in the predictions from existing studies hinge on how the problem is defined. Do we consider _tasks_ that may be automated? If so we should note that tasks may be recombined within jobs or new skills may be added, hence shifting skills mixes or requiring new digital interfaces. Neither the number of jobs nor the implications for income are then evident. That of course assumes that we can clearly define where the demand for goods and services will come from and how production and distribution will be organized.[xl]

Perhaps it is inevitable that we are left trying to understand the future through a lens crafted by looking backward at the past.. Efforts to look forward begin with our current understanding of tasks, with only guesses about how jobs or tasks will be recombined. Recognition that new sources of demand will emerge to drive employment can likewise only speculate, as the McKinsey research does very well, on the possible domains in which new work may emerge . So, we are left in the realm of analytic speculation, which has its own—potentially positive—implications and risks. Some looks into the future have been successful, such as Douglas Englebart's vision of the future

digital world.[xli] But, consider all the futorologist technology projections of past years that envisioned flying cars, but never even imagined the Internet or digital technologies. What is certain, it is important to be cautious in our speculations about the future direction and adoption of technology.

Indeed, we may need to reframe the debate. We certainly need a new vocabulary and analysis. For example, *income generation,* activities categorized in diverse ways, may need to be an overarching notion,complementing if not substituting for a traditional vocabulary of tasks, jobs, and employment.[xlii] Rather than jobs, tasks and employment, we may really observing changes in how income is generated and the channels through which it is distributed. How do we categorize the 7-year old who makes millions testing toys on YouTube.[xliii] Indeed, Kenney and Zysman have tried to provide a frame for examining income generation and work in the platform economy. The parallel question, to use a more conventional, if vague term, is how platforms are changing *value creation*, who, how, and where.

So, we must acknowledge that we have little sense of the transformations that will occur.   Let us consider a few examples of past sectoral transformations.   Start with insurance. The hand calculations of the insurance actuary developing insurance policies disappeared with the introduction of mainframe computers. And so the jobs changed. While the hand calculations are gone, actuaries manage the process of devising competitive insurance plans, training algorithms to identify risk, monitoring algorithms that make foolish decisions or illegal decisions such as using racial or gender categories to deny or provide policies.[xliv]

Or consider trucking in the years to come. Some suggest that long-distance truck drivers will become a thing of the past[xlv] – likely quite premature prediction. Yet, even in such a scenario, one might speculate that in a future enabled by AI and driverless technologies, truck drivers would be able to perform critical management tasks at the beginning and end of their journeys, sleep as their trucks move across restructured highways, highways likely paid for at public expense, and make deliveries along the way?[xlvi] Also, critically, we don't know *where* the new work will locate, in the rich north urban areas or diffused in rural communities that can engage by new technologies with fragmented work processes. And, we do observe that there will be significant inter- and

intranational variation in outcomes, with the extent of the hollowing middle being significantly different across countries, but we can only speculate on why.[xlvii]

Again, by way of emphasis, since this is one of the takeways from this discussion, the character of the transformations will depend on the business models that are innovated and the implications for work of those models, as well as on the technologies themselves. Successful business models determine or, at least, shape how the tools are deployed. They are in their turn shaped by state action in various forms and public support and acceptance. The approaches to financing those businesses, even startups, have implications for work organization. As Kenney and Zysman have argued, the current surfeit of investment capital, and low cost of startups, particularly, those using cloud technologies have made pursuit of market share with little regard to profitability and employment a dominant entrepreneurial strategy.[xlviii]

Deployment Strategies Will Drive the Outcomes

The ambiguity suggested by the various studies points to choices and options before us. We have choices about how to develop, deploy and use these technologies. The business models and strategies of firms and public agencies will shape both the social outcomes and the technologies. The firms and agencies making these technology decisions, both which technologies to develop and how to use them, are "deployment agents." As strategies are reconceived, and new possibilities discovered, the production of goods and services will be reconceived, as new products and services are imagined and created. Critically, the substitution of machines for workers will not be a "one-to-one" process but inevitably part of a deeper reorganization of work. The character of those reorganizations will depend on "business models." Those business models will, in turn, be influenced by the value we place on worker knowledge and skills. Listing the existing jobs, or tasks, as current studies do, is simply the beginning of the discussion.

"Good job strategies", argues Zenep Ton, that simultaneously create good jobs while lowering costs and boosting profits are possible even in commodity retail businesses.[xlix] That leads us to ask whether "good job strategies" are possible in a broad variety of sectors and businesses. If so, one of the research challenge is to identify examples across sectors and countries with good job strategies and identify the factors that led to their adoption. The policy challenge is how to promote those strategies.

What will influence deployment/development strategies? A start is to simply state the strategic question: Are workers assets or costs; assets are building blocks; costs must be controlled and cut. Looking across a set of cases, an *initial hypothesis*, then, could be that there are firms that successfully and innovatively implement the new technologies by considering their workforces to be assets whose capacities and talents can be promoted and augmented. Their core business strategies are then to create advantage by developing the capacities of their workforces rather than by containing their costs. Of course, that raises the question of why such strategies emerge in some firms and sectors and not in others. others. Such strategies may be easier to implement in some market segments than in others, specialty manufacturing of particular components for example depends on worker knowledge and capacities. In a recent presentation by a representative from Trumpf, a German toolmaker, the importance of its workforce was emphasized.[1] In another case, Unimeroco, a Danish tool support firm emphasized knowledge creation and transfer through the capacities of workforces.[li] Some Japanese firms, confronted with outright skill shortages, are already turning to AI, machine learning, and digital platform systems to permit less experienced, workers to take on more difficult tasks. I am not sure I would use a quote to a paper that then refers to the next sentence. For example, Komatsu, a Japanese construction equipment firm not only invests heavily in training its workforce, but cycles some of the shopfloor workers through sales teams and post-sales support. There is variation within sectors and across countries in how technologies are deployed. The question is whether the particular experiences in firms that build on their workforces' capacities, in which workforce knowledge and skills are valued, can be generalized.

A second hypothesis is that "user interfaces," a crucial part of the story about how sophisticated equipment is integrated into operations from design through distribution, will reflect that judgment of workers as assets or costs. Which tools are developed, how intelligent tools and systems are deployed, and the work organization and strategies that shape those choices are all involved with the user interfaces between people and technology. "User interfaces", we propose, will reflect the requirements of lead users and principal markets, and about their judgments of the importance of drawing on worker knowledge and insight. Some years ago, John Zysman observed an Italian machine tool firm that had built a simple system to allow worker engagement in operations on top of

the sophisticated system that ran the production system. Digital technologies do not emerge "fully formed." Rather, they are implemented by control systems and user interfaces. Microsoft Office is one such set of "user interfaces," tools designed for specific functions that allow the power of the underlying digital technologies to be brought to bear. Forty years ago, printing a document stored on a Unix machine was no simple task, but now, when we wish to print document, we need only send it to a printer and select "print." Without specifying how work will be organized and to what end, and without clarifying how user interfaces and tools are developed, we cannot conclude much about either the workforce skills or the employment consequences.

This leads to a *third hypothesis*, perhaps really a proposition, not exactly an hypothesis, but a premise. The history of science and technology suggests, demonstrates may be too strong, that the underlying science and technologies represent, if you will, ingredients in recipes; the recipes, and the menus can be created to the tastes of particular communities. It is not just that how technologies are deployed is shaped by choices, but often that the development of the technologies themselves follows different trajectories in different communities. To illustrate, German, Japanese, and American machine tools followed very different logics in the 1980s/90s, representing quite distinct manufacturing strategies and approaches to work forces. The differing needs of the final users shaped the technologies. As an hypothesis, then, we would propose that the technologies, perhaps in different sectors or countries, will themselves follow distinct trajectories of development because of the purposes of those that develop and deploy them. Again, in this context, different judgments about the value of workforce capacities are potentially important. That suggests, for example, that the character of platforms and AI, apart from robotics, will reflect the national market, industry, function, and social context in which they develop.

Now we come to an outright speculation and assertion. The assertion is that the story line in business discussion – not just the formal financial analysis – but the narrative storyline of what creates advantage, the narrative of business models and effective work organization, will help shape the choices and deployment of the tools and the user interfaces. Indeed, it even shapes how the financial analysis is done; what is observed and measured. The history of the emergence of "temp" work in the US suggests that consulting firms such as McKinsey and temp agencies were carriers and creators of a

narrative that this form of labor organization was efficient and cost-effective, thereby spreading the adoption of temporary work as good management practice. [lii]   Today, systems integrators such as Accenture, as Professor Susan Helper contends, may be key players affecting deployment choices.[liii]   Effectively, it was simpler to "sell" cost savings in an existing organization or strategy than to envision imaginative new approaches that involve recasting the role of workers.   As new digital tools for management, production/distribution, and retail are adopted throughout the economy, the question of what is possible becomes all the more crucial.   Some analysts focused at the moment on HR, emphasize that the truly successful companies will be those that prioritize their own workforces, in order to best serve their customers[liv]. The jobs of the future will not likely even exist today.

That said, it may be our policy and research challenge to help suggest how to structure incentives and to shape the narrative, the story and interpretation of events, encouraging the deployment agents, as we called them, as well as consultants and integrators, to innovate in business models and work organization, to envision "good job" or "good livelihood" strategies as ways of engaging with their clients.

Moving Beyond Hype and Despair

The policy objective for governments in this era of intelligent tools and systems remains classic and enduring: sustain the growth of employment and productivity to assure expanding real incomes and livelihoods of their citizens in equitable and sustainable communities.[lv] Success requires effectively developing and deploying these intelligent tools to support and sustain expanding incomes and competitive firms.

 Pursuing these objectives during fundamental economic and technological transformations is tricky. Designing policy for sectors or segments that do not yet exist or building skills training for jobs that have yet to be created or imagined involves guesswork and speculation. As many routines become automated, or more precisely as the domains of routine activities shift, training people to address non-routine, complex problems becomes essential. Identifying the problems that emerge in even seemingly routine environments, and the skills required to address those problems, is ever more central.[lvi] Addressing those problems certainly requires understanding the basics and the

potential of new technologies, but the skills required to use them may depend at least in part on the user interfaces between people and technology.

The principle, therefore, should be that policies urge or support the deployment agents, firms and agencies, to design business models and organizational strategies that build on workforces as assets. Treating workers simply as a cost that must be contained or eliminated should be discouraged. Policies should promote strategies that augment workforce skills, generating user interfaces to transform tasks that were impossible into tasks that augmented workforces can address.

Policies should promote positive narratives of development and deployment of intelligent tools and systems that influence how "the agents of deployment" implement them and their consequences for work and workforces.[lvii] Note again, it certainly can be argued that the drive toward temp work and outsourcing was driven as much by consulting firm and temp agency thought leadership as by the narrowly economic necessities for the firms. Policies that now encourage the agencies, consulting firms, and technology integrators to guide their clients onto good job strategies will be important in creating essential narratives alongside material incentives, rewards, or regulations that encourage choices to support the augmentation of workforce skills.

 We might, for example, consider how government procurement policies might be specified to encourage upgrading of workforces. Or, following the efforts of Breznitz, Ornston and Stamford, [lviii] perhaps an explicit innovation agency should be created to develop workforce improving deployment/development strategies.

The choices and strategies certainly need to be different in each specific national or regional context. Some contexts may be "mutable"—that is, the context for choice can be influenced by policy or discourse. "Mutable contexts" include the policy environment from tax and financial practice to labor law, labor market rules, and welfare policy. Such areas of policy create the contexts and influence the narratives in which deployment decisions are made. Some contexts are immutable, have fixed parameters. Demographics are the most immutable, emerging over generations and slow to change. Hal Varian, the chief economist at Google and Professor Emeritus at Berkeley, calls the dynamic "dialogue" between emerging intelligent tools and demographics a story of "bots and tots."[lix] Abundant unskilled workforces may slow the introduction of intelligent tools; that is, an economic calculus that relies on abundant low-cost labor may make the

deployment of expensive capital less attractive.[lx] Introducing robots may not be worthwhile if low-cost labor will suffice. What robots are deployed to do is influenced by the capacities of the available workforce and firm strategies. However, shortages of skilled labor, as in Japan and Germany, inevitably encourage the introduction of intelligent tools. In that case, we propose that the leaders in the introduction of intelligent tools will come at least in part from countries such as Germany and Japan where skilled labor is in short supply. The solutions developed in these communities might spread elsewhere and be adapted. We need to look carefully at places with skill shortages, as they likely have clues for others about what is possible.

The policy challenge now is to create both a narrative about the terms of change and a set of technical solutions to implement a narrative vision of possibility and shared gain. Again managing change means both integrating the new technologies and trade arrangements while helping communities and the citizens find and understand a path forward that maintains both their economic well-being and their dignity.

Notes

i See, e.g., "The Future of Humanity with Elon Musk" (41:24), StarTalk Radio, March 22, 2015, where he says that, as a result of artificial superintelligence, "we will all be like a pet Labrador."

ii Tim O'Reilly takes the same position in his excellent book, *WTF What's the Future and Why It's Up to Us* (New York: HarperCollins, 2018). We present our version of the same argument in work with colleagues, including Laura Tyson and John Zysman, in the afterword to *Solomon's Code: Humanity in a World of Thinking Machines,* by Olaf Groth and Mark Nitzberg (New York: Pegasus Books, 2018); and Martin Kenney and John Zysman, "Intelligent Tools and Digital Platforms: Implications for Work and Employment," *InterEconomics,* 52, no. 6 (2017), 329–334.

iii This term was developed by Laura Tyson, Olaf Groth, Ken Goldberg, and John Zysman, among others. See the ongoing effort at Berkeley Work in an Era of Intelligent Tools and Systems (WITS), wits.berkeley.edu.

iv See, e.g., Wiebe Bijker, Thomas Parke Hughes, and Trevor Pinch (eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge: MIT Press, 1987).

v At a discussion at Berkeley, Max Neufeind, a German policy analyst and political strategist, remarked that what we need is more Antonio Gramsci (the Italian political theorist), narrative, and interpretation, and fewer arguments about facts alone. The basic point is that we need interpretative narrative, not just a set of facts or data.

vi This essay draws on language and arguments by Laura Tyson and John Zysman in the afterword to *Solomon's Code*. Op.citl

vii See, e.g., Kai-Fu Lee, *AI Superpowers: China, Silicon Valley, and the New World Order* (New York: Houghton Mifflin, 2018); and Groth and Nitzberg *Solomon's Code*.

viii See, for example, Martin Kenney and John Zysman, 2016. "The Rise of the Platform Economy", *Issues in Science and Technology* 32 (3): 61-69.

ix Martin Kenney, Petri Rouvinen, and John Zysman, in the introduction to a forthcoming Special Issue of *Industry and Innovation* on platforms and industries (2019), use a narrow but more elaborate definition: [for the platforms of interest to us] "as an extensible cloud-based software stack enabling multi-sided interaction among contractually independent parties." In other words, the platforms of interest are those that are online and based in the cloud and accessed through a wide variety of edge devices, in particular, for now smart phones and personal computers, but in the future may increasingly consist of things. Each of these platforms provide boundary resources such as APIs and software development kits to third parties to build further applications upon them with the goal of creating ecosystems of complementors." A. Ghazawneh & O. Henfridsson, O. (2013). Balancing platform control and external contribution in third-party development: the boundary resources model. *Information Systems Journal*, 23(2), 173-192.

x See Ingrid Lundin, "Amazon's Share of the US e-Commerce Market Is Now 49%, or 5% of All Retail Spend," *TechCrunch,* July 13, 2018. https://techcrunch.com/2018/07/13/amazons-share-of-the-us-e-commerce-market-is-now-49-or-5-of-all-retail-spend/

xi Louis Hyman, *Temp: How American Work, American Business and the American Dream Became Temporary* (New York: Penguin Random House, 2018).

xii For a recent general statement of the basic political economy principle that rules shape markets, see Steve Vogel, *Marketcraft: How Governments Make Markets Work* (Oxford: Oxford University Press, 2018).

xiii Diana Farrell, Fiona Greig, and Amar Hamoudi, "The Online Platform Economy in 2018: Drivers, Workers, Sellers, and Lessors," JPMorgan Chase & Co. Institute (2018). K. G. Abraham, J. C. Haltiwanger, K. Sandusky, & J. R. Spletzer, (2018). Measuring the Gig Economy: Current Knowledge and Open Issues. NBER Working Papers, 24950. doi:http://www.nber.org/papers/w24950.pdf

xiv M. Kenney, S. Massini, and T. P. Murtha, 2009. "Offshoring administrative and technical work: New fields for understanding the global enterprise." *Journal of International Business Studies*, *40*(6), 887-900.

xv Groth and Nitzberg op cit. *Solomon's Code. Zysman fixes what page is quote etc.?*

xvi Tyson and Zysman, *Solomon's Code.* Afterword

xvii This is an important debate that hinges on the very character of our intelligence. See Gary Markus, "Deep Learning: A Critical Appraisal," Cornell University https://arxiv.org/abs/1801.00631 (2018); Ken Goldberg, "The Robot-Human Alliance," *Wall Street Journal,* June 11, 2017; and Alison Gopnik, "Can

Machines Ever Be as Smart as Three-Year-Olds?" Edge.org https://www.edge.org/response-detail/26084 (2015).

xviii The term intelligence is meant to avoid the loaded, and fundamentally subjective, notion of consciousness.

xix Ken Goldberg, *op. cit.*, and Steven Johnson, *Farsighted: How We Make the Decisions that Matter the Most* (Penguin Random House, 2018).

xx Vinod Kumar and Ken Goldberg, 2018 "Cognitive Diversity: AI & The Future of Work," *Tata Communications.*

xxi Ibid. Steven Johnson, *Farsighted: How We Make the Decisions that Matter the Most* (Penguin Random House, 2018).

xxii Tyson and Zysman, *Solomon's Code*; Selena Silva and Martin Kenney, 2018 "Algorithms, Platforms, and Ethnic Bias: An Integrative Essay," *Phylon: The Clark Atlanta University Review of Race and Culture* 55(1&2): 9–37.

xxiii Sturgeon, T. J. 2003. What really goes on in Silicon Valley? Spatial clustering and dispersal in modular production networks. *Journal of Economic Geography*, *3*(2), 199-225.

xxiv Zysman,John, Kenji Kushida, Jonathan Murray, Niels Christian Nielsen, Stuart Feldman "Services with Everything" in *The Third Globalization* 2013 Op. Cit.

xxv John Zysman first heard this story from the then-CEO of Cargotec, a Finnish equipment producer. Cargotec bought Navis, an Oakland, California-based port management software company. Komatsu, the Japanese construction equipment firm, is an example of the latter.

xxvi Effectively, the same story is now told by Komatsu, which provides construction site platforms.

xxvii See Martin Kenney and John Zysman, "The Rise of the Platform Economy," *Science and Technology*, 32(3), 61-69; Kai Jia, Martin Kenney, and John Zysman, "Global Competitors? Mapping the Internationalization Strategies of Chinese Digital Platform Firms," in Rob van Tulder, Alain Verbeke, and Lucia Piscitello (eds.), *International Business in the Information and Digital Age* (Bingley, UK: Emerald, 2018), 187–215.

xxviii Kai-Fu Lee, *op. cit.*, holds a view that China will not only break out of the Chinese markets on the back of advantage in AI, but dominate the technology and, by implication, global markets.

xxix Martin Kenney and John Zysman, "Work and Value Creation in the Platform Economy," in A. Kovalainen and S. Vallas (eds.), *Research in the Sociology of Work* (Bingley, UK: Emerald, 2019).

xxx Carl Benedikt Frey and Michael Osborne, 2017. The future of employment: how susceptible are jobs to computerisation? Technological Forecasting and Social Change, 114, 254-280; James Manyika et al., "Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation," McKinsey Global Institute (2017); Melanie Arntz, Terry Gregory, and Ulrich Zierahn, "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis," OECD Social, Employment and Migration Working Papers no. 189 (2016).

xxxi Tyson and Zysman, *Solomon's Code,* and John Zysman and Martin Kenney. 2018. The Next Phase in the Digital Revolution: Abundant Computing, Platforms, Growth, and Employment. *Communications of the Association of Computing Machinery* 61(2): 54-63 have discussed this more fully. Kenney and Zysman wrote:

> Optimists proclaim that the future is ours to create. Easy to say. The difficulty is that there is great uncertainty about the possibilities and challenges in a world of increasingly sophisticated AI tools and applications. Consider the impact of AI-driven automation on work and jobs, which is the focus of an interdisciplinary faculty group at UC Berkeley called Work in An Era of Intelligent Tools and Systems (WITS.berkeley.edu). There is broad agreement in research by McKinsey Global Institute, the OECD, the World Economic Forum and individual scholars including Kenney and Zysman among others that some work will be eliminated; other work will be created; and most work—and the terms of market competition among firms — will be transformed. There is also broad agreement that intelligent tools and systems will not result in technological unemployment—the number of new jobs created will offset the number of old jobs destroyed—but the new jobs will differ from those that are displaced in terms of skills, occupations and wages. Moreover, it appears likely that automation will continue to be skill-biased—with the greatest risk of technological displacement and job loss falling on low-skill workers. A critical question is how the new tasks and jobs enabled by intelligent tools and systems will affect the quality of jobs—even if most workers remain employed, will their jobs support their livelihoods.

xxxii David Autor and Anna Salomons "Robocalypse Now – Does Productivity Growth Threaten Employment?" in *ECB Forum on Central Banking* (2017).

xxxiii Richard Susskind and Daniel Susskind, *The Future of the Professions: How Technology Will Transform the Work of Human Experts* (Oxford University Press, 2015).

xxxiv Tyson and Zysman, *Solomon's Code.*

xxxv

xxxvi Spence and Tyson argue powerfully in Laura Tyson and Michael Spence "Exploring the Effects of Technology on Income and Wealth Inequality" in: Heather Boushey, J. Bradford DeLong, and Marshall Steibaum (eds.) *After Piketty: The Agenda for Economics and Inequality* (Harvard University Press, 2017), pp. 170-208 that the core driver is technology. Brad DeLong has argued that we underestimate the importance of trade in the story

xxxvii Wolfgang Dauth, Sebastian Findeisen, and Jens Suedekum, "The Rise of the East and the Far East: German Labor Markets and Trade Integration," *Journal of the European Economic Association,* 12, no. 6 (2014), 1643–1675.

xxxviii Richard Hernandez, "The Fall of Employment in the Manufacturing Sector," *Bureau of Labor Statistics Monthly Labor Review*, (August 2018); and Autor and Salomons, "Robocalypse Now."

xxxix Enrico Moretti, *The New Geography of Jobs* (Houghton Mifflin Harcourt, 2012).

xl James Manyika, *op. cit.*

xli Thierry Bardini. *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing*. (Stanford: Stanford University Press, 2000).

xlii Martin Kenney and John Zysman are developing this idea in upcoming papers.

xliii "Schoolboy, 7, is YouTube's Top Earner, Making £17 Million a Year Reviewing Toys", *Mirror,* 4 December 2018.

xliv Jean Marion Ross "Technology and the Relocation of Employment in the Insurance Industry", BRIE Working Paper 16 (1986); Barbara Baran, Jean Ross, Arianna Van Meurs and Stephen Cohen "Technological Innovation and Deregulation: The Transformation of the Labor Process in the Insurance Industry", BRIE Working Paper 9 (1985). See also, Martin Kenney and Selena Silva, *op. cit.*

xlv Steve Viscelli "Driverless? Autonomous Trucks and the Future of the American Trucker" *Center for Labor Research and Education, University of California, Berkeley and Working Partnerships USA* (2018).

xlvi Rephrased from Laura Tyson and John Zysman afterword to *Solomon's Code*, *op. cit.*

xlvii A large body of literature documents the hallowing out of middle-income jobs and polarization of occupations into low- and high-wage jobs in the late 20th and 21st century, including David Autor and David Dorn "The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market", *American Economic Review* Vol. 103 No. 5 (2013), pp. 1553-1597.

xlviii Martin Kenney and John Zysman "Unicorns, Cheshire Cats, and the New Dilemmas of Entrepreneurial Finance" *Venture Capital: An International Journal of Entrepreneurial Finance* (2019). See, also, Ewens, M., Nanda, R., & Rhodes-Kropf, M. (2018). Cost of experimentation and the evolution of venture capital. *Journal of Financial Economics*, 128(3), 422-442.

xlix Zeynop Ton *Good Jobs Strategies: How the Smartest Companies Invest in Employees to Lower Costs and Boost Profits* (New York: Houghton Mifflin Harcourt in collaboration with Amazon Publishing, 2014).

l ICE/IEEE ITMC International Conference: Engineering, Technology and Innovation Stuttgart, Germany June 18, 2017.

li See Niels Christian Nielsen and Maj Cecilie "Spoken About Knowledge: Why It Takes Much More Than Knowledge Management to Manage Knowledge" in: John Zysman and Abraham Newman (eds.) *How Revolutionary was the Digital Revolution? National Responses, Market Transitions, and Global Technology* (Stanford University Press, 2006), pp. 253-278.

lii Louis Hyman, *op. cit.*

liii Susan Helper, Raphael Martins, Robert Seamans "Who Profits from Industry 4.0? Theory and Evidence from the Automotive Industry" (2018).

liv This was particularly clear at Tim O'Reilly, O'Reilly Media's Initial Radar Conference in November 2018.

lv We argued this many years ago in Stephen Cohen, David J. Teece, Laura Tyson, and John Zysman, "Competitiveness," in *Global Competition: The New Reality*, vol. 3 (Washington, DC: President's Commission on Industrial Competitiveness,* 1985), 11–25. (This commission, chaired by John Young, then

CEO of HP, led to the creation of the Council on Competitiveness.) Later, Dan Breznitz, Niels Christian Nielsen, and John Zysman argued from the same premise in "Building on the Past, Imagining the Future: Competency Based Growth Strategies in a Global Digital Age," BRIE Working Paper 181 (2007).

[lvi] Sabine Pfeiffer, "Industry 4.0: Robotics and Contradictions," in Paško Bilić, Jaka Primorac, and Bjarki Valtýsson (eds.), *Technologies of Labour and the Politics of Contradiction* (New York: Palgrave, 2018), 19–36; idem, "The 'Future of Employment' on the Shop Floor: Why Production Jobs Are Less Susceptible to Computerization Than Assumed," *International Journal for Research in Vocational Education and Training,* 5, no. 3 (2018), 208–225.

[lvii] The WITS projects at Berkeley (wits.berkeley.edu) has as part of its mission to identify firm strategies that use good jobs as competitive tools and to promote them.

[lviii] Dan Breznitz, Darius Ornston, Steven Samford "Mission Critical: the Ends, Means, and Design of Innovation Agencies", *Industrial and Corporate Change*, Vol. 27 No. 5 (2018), pp. 883-896. In addition, the Work in an Era of Intelligent Tools and Systems (WITS) projects at Berkeley (wits.berkeley.edu) has part of its mission to identify firm strategies that use good jobs as competitive tools and promote them.

[lix] See, e.g., Hal Varian, "Bots and Tots" Lecture, CITRIS and the Banatao Institute, University of California, Berkeley January 31, 2018.

[lx] Often when the proper machines come along, providing, for example, precision operations that human labor cannot accomplish, labor costs are not crucial.