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Tools and Digital Platforms:
Implications and Consequences for Work**

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Venture financing, a form of entrepreneurial finance, has played a central part in the story of the digital revolution. Indeed, Silicon Valley, the global center of the venture capital industry, draws its name from the substrate of the contemporary semiconductor, which is the computational engine for all digital products. The continuing performance improvements characteristic of Moore's Law provided ever new potentialities for new generations of startups. While improvement in processing power was the core engine for this venture capital-financed entrepreneurship, the new firms were not only in semiconductors, but also in layers in stack above the processor itself. There were semiconductor firms of various generations including Intel and AMD, Cirrus Logic, and even later NVidia. There were computer firms ranging from Tandem Computers to SUN Microsystems and Silicon Graphics on to Apple and Osbourne. As there were more computers, users wanted to network them together and with this came 3Com, Cisco, and many other firms; all of which used semiconductor chips. In addition to semiconductor components, they needed disk drives, input devices, printers and many other devices – many of which were also pioneered in Silicon Valley. However, the most powerful development of all was the establishment of an independent software industry – the most successful of these would be Microsoft, but there would be many, many more, including Oracle, Adobe, Intuit and others successfully established in SV. Eventually, these technologies would be united in the Internet, whose technologies were developed at CERN in Switzerland and the University of Illinois. At each stage, in this development venture capitalists could be found that were willing to invest in the new firms (Kenney 2011). These entrepreneurial financiers had, of course, only one goal – capital gains. The vehicle for these capital gains was, quite

simply, a firm whose product grew so rapidly that other investors would be willing to buy that firm, or equity in that firm, at massive capital gains multiples.¹

Over last two decades, we have been gradually moving into a phase in which the technology has progressed to the point at which the ongoing digital revolution is resulting in a business environment within which platforms, intelligent tools, and their application to manufacturing and services is becoming ubiquitous and even transformative. The rapid development and adoption of robotics and intelligent systems with self-learning algorithms are not only automating tasks associated with blue-collar work but also less-routine tasks that have been considered knowledge-intensive.² This digitization process seems to be inexorably diffusing into more sectors of economic and social life. Though there is a debate about the extent and speed of the transformation, much of this work will be re-organized on digital platforms and undertaken with digital tools. These developments are a backdrop for considering the role of finance in this process.

As we enter an era in which platforms and intelligent tools become important for the entire economic system, the computation-intensive automation of services and manufacturing is upon us.

¹ The US economy gradually evolved to incentivize a capital gains-driven system and, by extension, a turn away from a long-term earnings-based system of corporate governance. The most important of these incentives was the dramatic lowering of capital gains taxes in the late Carter and early Reagan Administrations. The lobbying effort was largely driven by American Electronics Association and the prime mover in Congress was Edwin Zschau, an entrepreneur that then became a Congressman from the district that included Silicon Valley. For a detailed discussion, see Johnson, R., 1980. *The passage of the Investment Incentive Act of 1978: A case study of business influencing public policy*, Doctoral dissertation, Harvard University, Graduate School of Business Administration. Of course, there were other important initiatives such as loosening interpretations of the Employment Retirement Income Security Act, easing rules on granting stock options, and easing various rules regarding stock trading and listing.

² Brynjolfsson, E., and McAfee, A. (2012). *Race against the Machine: How the Digital Revolution Is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy*. Lexington, MA: Digital Frontier Press; Brynjolfsson, E., and McAfee, A. (2014). *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. W.W. Norton; Ford, M. (2015). *Rise of the Robots: Technology and the Threat of a Jobless Future*. Basic Books. See, also, Arnold, D., Arntz, M., Gregory, T., and Steffes, S. No need for automation angst, but automation policies. In this volume.

Moreover, given that this phase is transforming work and, dare we say, value creation, broadly, it is important to consider whether the firms born in this hot house of entrepreneurship, motivated by capital gains, and driven to establish unassailable market positions will also facilitate, let alone consider, the augmentation and promotion of the societal work force.

The ability of financial actors to fund firms introducing new disruptive digital technologies over relatively long periods of time, while experiencing large losses is having a powerful impact on the relations and conditions of work and employment.³ Suggesting that it is important to consider the role of finance in the growth of digital platforms does not mean we must engage the larger question of the role of finance in the US economy or to enter into the more general debate over the financialization of the US economy, though these are an important context for our essay.⁴ We focus on the implications of the enormous sums of venture capital (and private equity) available permits investors to provide massive sums of capital to firms intent upon restructuring (or, in the current vernacular, disrupting) existing businesses or value chain organization.⁵

Finance, the Trajectory of Tech Firms, and Consequences for Work

³ It was, perhaps, with the success of Yahoo! that venture capitalists came to realize that giving a service away for free would work, if one could convince advertisers that they could reach customers through the Internet. For a discussion of this realization, see McCullough, B. 2015. On the 20th Anniversary – The history of Yahoo’s Founding. <http://www.internethistorypodcast.com/2015/03/on-the-20th-anniversary-the-history-of-yahoos-founding/> The discovery in 1994 by the elite venture capital firm, Sequoia Capital, that a free service could, if successful in capturing the market, generate enormous capital gains led to a rethinking of the economics of venture capital investment. The VCs were convinced that even with enormous losses could, if the market was captured, be monetized in some way.

⁴ Davis, G. F., and Kim, S. (2015). Financialization of the economy. *Annual Review of Sociology*, 41, 203-221; Lazonick, W. (2010). Innovative business models and varieties of capitalism: Financialization of the US corporation. *Business History Review*, 84(4), 675-702.

⁵ Christensen, C. (2013). *The innovator's dilemma: When new technologies cause great firms to fail*. Harvard Business Review Press.

Investment euphoria is not unique to the current era. Carlota Perez, in her *Technological Revolutions and Financial Capital*⁶, and William Janeway, in his *Doing Capitalism in the Innovation Economy*⁷, have argued, that due to the infrastructures built and technologies introduced during the investment euphoria, the political economy is permanently altered.⁸ The underpinnings of the current investment euphoria are important to consider. Financial conditions and start up tools in this era permit a novel investment strategy that has real consequences for labor and work. The first element is that the cost of building digital “tools,” including platforms, has dropped dramatically. Cloud computing provides low-cost infrastructure for “users” while vast libraries of open source software are available online at repositories such as GitHub or Source Forge.⁹ Together they permit low-cost experimentation in the name of disruption, seeing what sticks and creates enough market position quickly to drive capital valuations. Sustainable market positions for these firms can be a concern for a later day.

The “Disruption” meme suggests that a new more efficient business model is being introduced to bypass the old-fashioned existing businesses. The automobile disrupted the horse-and-carriage business; digital search engines and digitization of content displaced or

⁶ Our discussion draws upon the studies of investment euphoria and current studies of financialization and the separate discussions about how differences in national financial systems influence the relations between business and state structure See Perez, C. (2003). *Technological Revolutions and Financial Capital*. Edward Elgar.

⁷ Janeway, W. H. (2012). *Doing Capitalism in the Innovation Economy: Markets, Speculation and the State*. Cambridge University Press.

⁸ Soskice, D. W., and Hall, P. A. (2001). *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage*. Oxford: Oxford University Press; Zysman, J. (1983). *Governments, Markets, and Growth: Financial Systems and the Politics of Industrial Change*. Ithaca: Cornell University Press.

⁹ Murray, J., and Zysman, J. (2011). Cloud computing: Policy challenges for a globally integrated innovation, production and market platform. Berkeley Roundtable on the International Economy, University of California, Berkeley.

altered library operations. In this narrative, disruption is positive; it compels existing businesses to adapt or vanish. For example, Amazon dramatically shrank the number of physical bookstores.

Of course, the ultimate question is: why should we care? If consumers gain and the disruptors are financially benefitted, who should complain? Certainly, Uber makes finding a ride in London easier for a visitor from San Francisco and vice versa. Google changes our attitude and approach to information. LinkedIn replaced the Rolodex and the job board by transforming the manner by which professional connections are maintained.

This logic that progressive “disruption” advances society however comes with consequences. Let us note at least a few. As the newspaper business struggles, some have argued that investigative and international journalism is declining, and, some argue has contributed to a decline in our democracy. Alternatively, others might argue that entirely new sources of information from outside the mainstream are now available allowing for new perspectives. If there is a problem, then perhaps a solution is to subsidize journalism with the result that it becomes dependent upon the government, rather than private interests. Uber drivers lack protections, so perhaps we rejigger employment law.

What is particularly interesting is that the current financial euphoria is concentrated on funding platform economy firms. One of the characteristics of digital platforms is that they exhibit powerful network effects that often lead to winner-take-all (WTA) outcomes.¹⁰ It is the WTA outcomes that allow the young firm to outpace its larger competitors and, if it is successful in the market, often establishes a monopoly or near-monopoly position. For

¹⁰ Eisenmann, T., Parker, G., & Van Alstyne, M. W. (2006). Strategies for two-sided markets. *Harvard business review*, 84(10), 92; Gawer, A., & Cusumano, M. A. (2008). How companies become platform leaders. *MIT Sloan management review*, 49(2), 28.

example, consider the position of Google in search, maps, YouTube, and a variety of other services, Amazon in online retail, Facebook in social networks, eBay in online auctions, LinkedIn in professional networks, Yelp! in online reviews, OpenTable in restaurant reservation services, and the like.¹¹

The start-up process in such WTA environments assumes that the startup will initially be cash-flow negative as it grows and competes against other startups and incumbents that are also seeking to restructure the new business space that the technology's progress has made possible. Such startups begin by "bleeding" money. Investors are wagering upon the firm establishing a powerful market position—or what could be termed a "proto-monopoly." These firms are not expected to win via early, sustained operating profit but by absorbing operating losses during their growth phase financed by venture investment with the aim of driving incumbents and other new entrants out of the market. Investors are increasingly comfortable with absorbing the exceptional losses, if convinced that it will be possible to lock in a position to generate proto-monopolistic profits and, by extension, enormous capital gains.¹²

Because many of the startups must sustain operating losses over long periods, it is possible to question the narrowly economic, as much as the social, benefit. Are the disruptions, if they are driven by extended losses, really justified as welfare generating? These firms are structured to pursue growth at all costs as they endeavor to achieve market domination. In one sense, this appears a predatory, but it is also a natural outcome in many of these markets. For example, would the economy have been better off with ten different

¹¹ Of course, we have seen similar dynamics in earlier digital industries with Microsoft in the personal computer operating system and office productivity software; Intel in personal computer microprocessors; Cisco in computer networking, Oracle in relational databases.

¹² We would suggest that current antitrust/competition policy is completely unprepared to address the types of business strategies these small entrepreneurial firms use.

incompatible personal computer or smart phone operating systems? Similarly, would the economy be better served with ten search engines –moreover, technically in the case of search, there is learning from each search so ceteris paribus a search engine that attracts more searches is likely to enter a virtuous circle of improvement that is impossible for laggards to overcome. Importantly, operating losses with the goal of market dominance may also encourage business strategies of transgressing established marketplace and social rules, because locking in a winning position is everything.

Financing losses as a way of overcoming existing systems via social disruption and long-term operating losses forms a treacherous environment for incumbents that are judged by the profits they make. To illustrate, in 2017 (last annual report) Walmart had \$486 billion in sales and operating income of \$23 billion, while its greatest competitor Amazon in 2016 (last annual report) had \$136 billion and operating income of \$4.1 billion. However, though Amazon has grown significantly in the last year it still trails Walmart in both profits and especially in income. And yet, Amazon had a stock market valuation of \$608 billion, while Walmart had half the valuation at \$301 billion. Effectively, the stock market valued Amazon twice as highly as Walmart, despite Walmart having five times as much income. This stock market valuation allows Amazon to make far less profit, thereby allowing it to undercut competitors that are forced to generate profits to keep investors satisfied.

The point is not to dismiss the enormous value that digital technologies and platform-based business have created. Rather, it is to interrogate the enthusiasm for backing entrepreneurial start-ups, losses or not, and for seeking to turbo-charge their growth to the point that they become a so-called “unicorns,” i.e., a firm whose most recent venture capital round valued the young firm at more than \$1 billion (see below).

The Decline in the Cost of Technological and Business Experimentation

Over the past twenty years, the cost of establishing a start-up or experimenting internally has decreased dramatically. As important as the cost decline, incidentally, is how the abundance of software tools and cloud-based operations speeds the time from forming the firm to actually launching a digital service.¹³ The reasons for this cost decline are numerous, of which a technical one is the secular decline in the cost of computation—a long-standing tendency encapsulated in the shorthand of Moore’s law but far deeper than just the dynamics of semiconductors. The economics of information technology (IT) start-ups, it is evident, have fundamentally changed. Previously, a start-up had to purchase and build an entire IT infrastructure, which was a capital cost and, as difficult, write original software for whatever product it was introducing. However, the emergence of merchant cloud-computing offerings allows a new firm to rent server capacity from a vendor, such as Amazon Web Services. What previously was a capital investment is now a variable cost, and capacity can be scaled up or down without any capital investment.¹⁴ Cost and time to market were further reduced by the availability of downloadable open-source software modules from sources such as GitHub. This open-source software eliminates the need to write code from scratch, thereby reducing

¹³ Murray, J. 2014. Cloud computing PowerPoint presentation. BRIE-ETLA Conference, Helsinki, Finland, 29 August.

¹⁴ Murray, J., and Zysman, J. (2011). Cloud computing: Policy challenges for a globally integrated innovation, production and market platform. Berkeley Roundtable on the International Economy, University of California, Berkeley.

cost, providing opportunities to customize, and avoiding vendor lock-in.¹⁵ The availability of low-cost infrastructure and open-source software dramatically decreases the cost of establishing a new digital business. Thus the technical changes permit the entry of far more new firms than ever before and encourage internal experimentation in existing firms. Of course, being able to easily enter does not guarantee success – there can be many more experiments, with only a few survivors.

Abundant Capital and the Toleration of Operating Losses

The ample available capital and the belief that many industries are poised for disruption because of developments in information and communications technology (ICT), such as big data, machine learning, and the Internet of Things (which, with smartphones, are new classes of computers), and the development of new business models have convinced investors that start-ups offer the opportunity for great potential capital gains. This has resulted in an enormous flow of capital into private equity, of which venture capital is one type.

Not only is the sheer amount of capital available remarkable, but there has been a proliferation of start-up funding mechanisms (Arrington 2010).¹⁶ Let us begin with conventional venture capital firms. Before the internet bubble that began in the mid-1990s, traditional venture capital (VC) firms were the predominant funders of successful technology

¹⁵ Northbridge and Blackduck. (2016). The future of open source.

<https://www.slideshare.net/blackducksoftware/2016-future-of-open-source-survey-results/>.

¹⁶ Arrington, M. (2010). VCs and super angels: The war for the entrepreneur. TechCrunch.

<https://techcrunch.com/2010/08/15/venture-capital-super-angel-war-entrepreneur/>.

startups.¹⁷ As the elite VC firms became more successful, many of them-raised and managed mega-funds with \$1 billion or more in assets. These firms could no longer invest in early-stage firms, where an appropriate investment is \$1 million or less simply because of the management time needed to ensure the investments were prudent.

The market gap created by the emergence of mega-funds evoked four institutional responses. *First*, a group of angels or “super-angels” emerged easily able to invest up to a few million dollars in a firm’s early stages, particularly in Silicon Valley.¹⁸ Many of these angels were successful entrepreneurs that had already started a company that generated sufficient capital gains so that they could now invest in a new generation of entrepreneurs. *Second*, accelerators, which vet and then accept aspiring entrepreneurs, and then provide small amounts of capital and coaching in return for a small tranche of equity, emerged. Their goal was to assist in the growth of the entrepreneurs’ idea to the point that they could “graduate” and form a proto-firm, able to raise money from super-angels or venture capitalists.¹⁹ *Third*, a wide variety of digital platforms for crowdfunding have been established, ranging from Indiegogo and Kickstarter—where funds are contributed to a project, but the funders receive

¹⁷ Kenney, M. (2011). How venture capital became a component of the US National System of Innovation. *Industrial and Corporate Change*, 20(6), 1677-1723.

¹⁸ Manjoo, F. (2011). How “super angel” investors are reinventing the startup economy. *Fast Company* (February), <https://www.fastcompany.com/1715105/how-super-angel-investors-are-reinventing-startup-economy/>.

¹⁹ Radojevich-Kelley, N., and Hoffman, D. L. (2012). Analysis of accelerator companies: An exploratory case study of their programs, processes, and early results. *Small Business Institute Journal*, 8(2), 54-70.

no equity—to other platforms, such as, AngelList—where only certified investors invest in return for equity.²⁰ Fourth, a proliferation of smaller, seed-stage VC firms have created a functional segmentation of the VC industry. In this sense, an ecosystem of organizations and networks now exists to provide funding for entrepreneurial experiments made possible by the technological changes reducing the cost of starting an ICT firm.

With the reduction in the capital necessary to enter a market and the increased number of channels for securing seed capital, more firms can be established, thereby increasing the number of experiments. If these experiments experience initial success as signified by rapid adoption, measured by the number of users or extent of use and not necessarily by revenue, access to far greater pools of capital is likely because, as we note, many of these digital markets have WTA characteristics. For the startup, it is imperative to grow as quickly as possible to occupy the space before other start-up competitors or an established firm can introduce a competitive product.²¹ During this phase, profitability is not as important as

²⁰ Belleflamme, P., Lambert, T., and Schwienbacher, A. (2014). Crowdfunding: Tapping the right crowd. *Journal of Business Venturing*, 29(5), 585-609.

²¹ For the incumbent firm in an industry receiving the attention of the new entrants the challenge is daunting. Each of the entrants is likely to have a somewhat different business model. Thus, the incumbent faces not a single entrant with one model, but multiple entrants with different models. If any of these models shows any promise of success, then the venture capitalists will provide further funding for its growth. It is these multiple experiments/challenges that contribute to making the current environment so treacherous for incumbents. The further challenge is that the new entrants may not challenge the incumbent across its entire business, but rather only certain particularly valuable parts of its business

growth that captures the market. As this stage, success demands even more capital as the start-up grows as expenditures out-strip revenue growth. Angels and incubators can no longer provide the capital necessary for such growth, and thus the expanding start-up must secure much larger investments from the big VC firms.

The entrepreneurial environment is particularly munificent today as venture capitalists have been raising huge sums for investment. Fundraising in 2014, 2015, and 2016 were the largest since 2006, with a total of \$51 billion raised by 314 funds in the U.S. and Europe.²² Effectively, there is an enormous amount of capital searching for investment opportunities.

In the current environment, firms are resisting making an initial public stock offering, remaining private for longer periods. It is possible to secure the required funding, because there has been a remarkable growth of pools of available capital through the large private equity firms, some of which such as Blackstone are listed on public markets. In 2017, the PE capital available for investment (so-called “dry powder”) \$739 billion.²³ This massive inflow into private equity and VC funds creates a need for fund managers to find opportunities with the promise of significant returns. The returns to investors in earlier platform firms tells investors that they can expect to earn similar returns going forward precisely because platforms have network effects and can result in winner-take-all markets, with their concomitant monopoly dynamics. In the next section, we explore the proliferation of privately held start-ups whose value is over \$1 billion—the so-called unicorns.

Unicorns

model, which if successful could relegate the incumbent to the commodity portions of its business.

²² Pitchbook. 2017. 2017 PE & VC Fundraising Report. <https://pitchbook.com/news/reports/download/2017-pe-vc-fundraising-report?key=oOCJkjmyXX>

²³ Pitchbook. 2017. *ibid*

The availability and low cost of capital, the technical changes, and the belief in the possibility of disruption has resulted in a remarkably large number of startups that are not publicly traded but whose valuation at the last private funding was \$1 billion or more. Silicon Valley venture capitalist, Aileen Lee termed such firms after the rare mythical creatures “unicorns” –a term that has now passed into common parlance. In 2013, Lee identified 39 US public and private firms that were founded between 2003 and 2013 that had achieved \$1 billion valuations in 2013. Remarkably, the number of unicorns grew quickly.²⁴ In 2017 Verena Schwartz (by combining a number of lists) found that in February 2017 that there were 267 unicorns globally.²⁵ While the number of unicorns fluctuates, as do valuations and in the by 2018 – the sheer number of unlisted firms with such a high valuation was remarkable.²⁶

The point of this discussion is not to answer as to whether this is a bubble, but to examine a related phenomenon, namely the willingness of investors to fund firms that are either losing money or not making profits at such high valuations. Of course, the assumption is that eventually the firms will generate sufficient profits in the future to compensate for the lack of profits currently. There are both public and private firms without any or only minimal profits. While Apple, Facebook, Google, and Microsoft have large profit margins, Amazon only barely breaks even. Other important public platform firms, such as, Pandora, Blue Apron, Snapchat, and others have never made a profit and

²⁴ Lee, A. 2013. Welcome to the Unicorn Club: Learning from Billion--Dollar Startups. *Tech Crunch* (November 2, 2013).

²⁵ Schwartz, V. 2017. Determining characteristics of unicorns in light of different profiles of ‘money burnt’: Introduction to a new matrix. Master Thesis in the Master in Innovation Management, Scuola Superiore Sant’Anna. (June).

²⁶ Recent research suggests that the clauses in the financing contracts dramatically lower the true valuation of the most recent investment to such an extent that nearly half of the “unicorns they studied were not, in fact, worth \$1 billion or more. Gornall, W., & Strebulaev, I. A. (2017). Squaring venture capital valuations with reality. (July 16, 2017) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2955455

have no discernable path to profitability. More significantly, nearly all of the unicorns appear to be losing money.

The amount of private equity available, much of it raised from pension funds, also has made it possible for firms to stay private longer and lose money longer. The firm Airbnb is interesting from this perspective because, it was founded in 2009 and become profitable in 2016 – a long period of unprofitability that was funded by private equity. Given its growth and crossover into profitability, it would appear to be ideally suited for an initial public offering. However, in 2017, rather than going public, it raised \$1 billion capital at a \$31 billion valuation. The massive influx of capital allowed it to acquire a smaller competitor and continue to grow without offering stock to the public – the traditional venture capital exit strategy – or worrying about profitability.

The large number of private unicorns is remarkable and differs in an important respect from the dot.com boom from 1997-early 2000, as during the dot.com bubble newly funded firms rushed to make an initial public offering. In the current period, now more common unicorns can remain private for a much longer period because they are able to raise capital privately. An ability to raise capital is vitally important, because a company with continuing influxes of capital can continue to offer its product or service without being profitable. This provides a tremendous advantage against incumbents already listed on markets, firms that under normal conditions are expected to generate profits.

Financial weapons in digital markets: Consequences for labor

We wend our way through this complexity by focusing on investment and business strategies that rest on enduring operating losses. The ability to access enormous sums of capital or an elevated stock valuation provides the focal firm with a powerful tool for undercutting its rivals, as it can lower

prices or even purchase its competitors, as the platform giants such as Facebook did with Instagram, WhatsApp, and a host of smaller firms. The structure of competition is important not only for investors but also for labor. *How* firms compete can determine how much of what kind of labor is needed, who will deploy that labor, and where.

Establishing and contributing to the growth of start-ups and internal firm experimentation by investors willing to incur long-term operating losses pose many questions. Rapid growth strategies by platform economy firms have, by implication, raised questions for government regulators in a wide variety of sectors, in practice an aggressive assault on regulatory boundaries, even as the labor platforms place significant and often effective wage pressure on parts of the workforce. Current strategies seem to suggest less attention to developing the talents and ability of workforces or forming structures that support workers. The implications are profound.

In the case of Uber, Google Maps, a set of pricing and dispatching algorithms, and a smartphone app, for example, has transformed citizen drivers with limited knowledge of a locale into “contracted” transportation providers creating a compelling service. These new Uber drivers freed from the constraints of a taxi being a public conveyance put downward pressure on prices for all. Unfortunately, there is no single narrative here except for the ineluctable fact that platforms and intelligent tools are shifting the grounds upon which all economic activities are undertaken. By extension, this suggests the two fundamental conditions in a capitalist society – labor and competition. Beyond knowing that these two conditions and everything built upon them will shift, the implications are contingent and continue to evolve.

The consequences for labor will vary dramatically depending upon activity and the evolution of the technology, and this will vary across applications and market segments, and, indeed, among firms. What appears common to all is that loss-driven market domination strategies that can generate capital

gains without attaining even mid-term market sustainability appear certain to encourage strategies that will treat labor as a commodity whose cost is to be minimized rather than as an asset whose value can contribute to long-term competitive advantage for the firm and superior social outcomes.