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Responding to the will of the machine: Leadership in the age of artificial intelligence

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Abstract. The advent of artificial intelligence in the modern economy will revolutionize the workplace of tomorrow. It will alsocreate never-seen-before challenges for leadership. The current leadership theory is extensive but it does not address on how to lead in a workplace composed of intelligent machines. However, it can be observed that leadership theory tends to develop in tandem with the developments in technology - metaphorically termed as *will of the machine* in this article. Specifically, two phases of leadership require analysis. First, the leadership needed to lead firms through the great transformation from industrial/information to a cognitive economy. Second, leadership needed to manage and lead firms once a relative degree of stability and maturity is reached where intelligent machines occupy the central positon in the workforce. While extensive work exists in leadership theory, this article fills the gap that bridges thefield of applied artificial intelligence with the leadership theory.
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1. Introduction

The first century of the Machine Age is drawing to a close amid fear and trepidation. Its fabulous material success was due to the willing, indeed the enthusiastic, subordination of man to the needs of the machine". These words may very well describe our times but they were written by Karl Polanyi in 1947 (Polanyi, 1947). They formedthe opening of Polanyi's essay *Our Obsolete Market Mentality: Civilization Must Find a New ThoughtPattern*– the article that became the precursor to his seminal book *The Great Transformation*.

Today, a different type of Machine Age has dawned upon us (McAfee & Brynjolfsson, 2016). Known as the cognitive era or the fourth industrial revolution (Schwab, 2017), what makes this age different is the advent of the intelligent machines. And like the previous Machine Age, this too is destined to subject and subordinate humankind to its needs and will. How to organize the human society as this intelligent machine revolution unfolds is a question in dire need of being addressed– and this essay is an attempt to address one critical element of the quandary: leadership.

2. Leadership and the need of the machine

What Polanyi meant by subordination of man to the needs of machine is no longer a mystery. Once machine became the centerpiece of human activity, it didn't take long for humans to congregate around the production centers (Williamson, 1988), to establish urbanhubs and build communities, to focus human efforts to enhance and protect machines, to establish institutions that promoted and safeguarded machines (Mokyr, 2009), to adjust social institutions around machines (Abramson & Boix, 2014), to create market mechanisms that worked in tandem

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with the demands of the machine (Desmet & Parente, 2012), to develop infrastructure conducive for machines (Garrison & Souleyrette II, 1996), and to cultivate sophisticated organizations and bureaucracies that managed both machines and man (Bendix, 1963). This change, which can metaphorically and poetically be termed as an obedient response to *the need of the machine*, is also clearly evidenced in the way the leadership theory developed and adapted to what machines needed.

The concept of leadership was not new to humans. Various forms of political, royal, military, and even academic leadership had existed for millenniums. When the need of the machine was recognized, what first emerged was a crude blend ofa reaction to the need of the machine and the previous human experience with leadership (military, political etc.). Thus, it shouldn't come as a surprise that before the *need of the machine* was widely known, the Great Men Theory (Carlyle, 1993) occupied the human imagination. Absence of machine from the equation created a natural descend for both logic and emotion to conveniently roll down the ancient lane where leadership was a birth right or had magical qualities. What rapidly followed was the Trait theory (Kirkpatrick & Locke, 1991) – which kept the limelight on leadership vs. on the need of the machine.

The need of the machine was clear. It needed inputs in the form of raw materials and labor. It needed maximization of revenues and returns. It needed capital. It needed production and it needed optimization across the value chain. As both capitalism and Marxist leaning ideologies swept through the world and the interdependence of employer and employees was understood, the focus of the leadership theory shifted from leaders to followers. The need of the machine could not be fulfilled without getting the followers to cooperate – and authority alone could not achieve the required conformance (Cohen & Bradford, 1989). Tapping into the behaviors of followers and leaders – including from the viewpoint of a leader (self-reflection) – became necessary. The leadership theory complied and hopped from Influenceto Situational to Contingency to Transformational (Avolio, 2007; Van Seters & Field, 2001). All along, the theory development focused on leaders and followers – for that relationship was key to getting the work done and achieving business goals. Just as Marcuse described the One-dimensional Man in his seminal work astheman created by the technological times whether the person evolved from communist or capitalistic ideologies (Marcuse, 1964) – leadership in business too was a creationof technological evolution.

As the story of machine and technology moved forward, the story of leadership tagged along. The economic theory evolved to embrace markets and firms as extension of machine (i.e. production units). Specifically, Coase introduced the theory of firm and described it as alternative to price mechanism and composed of a system where long-term agent-principal relationship might be more efficient than a market based instantaneous contract (Coase, 1937). Unlike markets, the cost of discovering prices and credibility of counterparties would exceed their utility – and hence a firm stood as a better structure. Expanding on that concept, it was also realized that transaction cost theory was about human behavior and that most importantly it expanded the thinking to view business function as a governance function instead of a production function (Williamson, 1989). Thus, it was natural to bring that thought process into leadership and Transactional leadership was born.

Perhaps the only thing about the leadership theory that remained consistent all along is that it never stayed static. It changed with times. As recently as the past few decades, it progressed when machines evolved to become information centric machines. As the computer revolution was born, leadership theory jumped to move from the industrial era to the knowledge era (Uhl-bien *et al.,* 2007). Various manifestations of leadership were born to accommodate the new needs of the machine – including Complexity Leadership (Uhl-bien *et al.,* 2007), Emergent Leadership (Carte *et al.,* 2006), Altruistic Leadership (Sosik *et al.,* 2009), Service Leadership (Shek *et al.,* 2015), Neuroscience Leadership (Rock & Schwartz, 2007) and Realist Leadership (Reed, 2005).

3. From need of the machine to the will of the machine

Humankind now stands on the eve of yet another major industrial revolution – but this revolution is different than all others. In this revolution, the need of the machine is transitioning into the will of the machine. The change is strikingly conspicuous. Artificial Intelligence technology is creating smart machines, i.e. machines capable of autonomously learning, making decision, and taking actions (Naqvi, 2017). Such machines were once part of the Hollywood fiction, but now they are a reality. Augmenting, or even replacing human work on both ends of physical labor and cognitive function, the machines are proving to be reliable workforce that will work hand in hand with humans and are projected to replace approximately 50% of human jobs soon (Frey & Osborne, 2013). The question of leadership can be segmented into two parts:

* What will be the leadership challenges to lead companies through the upcoming technological revolution?

* What will leadership look like when artificial intelligence becomes part of the decision-making in the firms?

4. How to lead during the greatest transformation?

Technological revolutions come with a cost (Perez, 2002). While they eventually create prosperity, during their formation periods, they also can lead to events such as wars, deaths, poverty, revolutions, migrations, and economic crashes. Because technological revolutions can create significant social and economic costs, leading and managing effectively through the formative periods of revolutions needs to be a foremost consideration. Governments and firms that don't adjust to the paradigm change or to the new environment can lose market share, fail to perform in accordance with shareholder expectations, and even go bankrupt. Thus, leading and navigating a firm through a major technological change requires leaders to operate in uncertain times. While leadership, crisis, and uncertainty are not new topics and have been studied from extreme situation (Hannah *et al.,* 2009), change management (Gill, 2003), and crisis (Walker *et al.,* 2016) – leading through a technological transformation remains a less travelled path.The goal for such leadership is to skillfully sail their companies through the stormy waters and deliver them safe on the other side of the revolution.

The sheer enormity of change imposed with technological revolutions compels executives to both relearn and unlearn. Just as a leader who still functions with the mindset of the twentieth century will likely not go far, a leader who fails to embrace the subtleties of the cognitive revolution will not make much progress. Learning can be both process centric (i.e. technical and business) and strategic (business strategy and models). The following will be considered critical for leadership development:

4.1. Rules of Competition

As early as 1985 Michael Porter correctly predicted the rise of information technology to alter the competitive dynamics and become a new source of competitive advantage (Porter & Millar, 1985). Just as the advent of information technology altered the competitive dynamics, technological revolutions shift the basis and rules of competition. The cognitive revolution will be no different (Naqvi, 2017). It will be critical for leaders to understand the new rules of competition for the artificial intelligence revolution. These rules will emerge from changes in the market structures, the configuration of the firm, and the nature of competition.

4.2. Management Process

Themanagement process of technology will require bold risk taking, cross-functional involvement, capital investment plan, vision, and direction. Given that unlike other technologies, artificial intelligence technology is composed of

intelligent artifacts that learn, and one perfected manifestation of an artifact can serve the entire market, prospective competitors will not get a second chance. For example, a world-class philosophy professor bot will constantly learn from its environment and will become smarter with each interaction – until one such artifact will be able to serve the needs of the entire global population that wants to learn philosophy. Leaders would need to be original and not copycats. Thetraditional fads and fashions style adoption (Abrahamson, 1991) will be ruinous for firms. A well thought out and clear strategy will be required. The spirit of experimentation will be key to learn from mistakes.

4.3. Objective Risk Management

Not too different than leading high uncertainty and mission critical projects (Shenhar *et al.,* 2002), leaders would have to manage the overall risk of transformation. However, one of the extra risks will be of managing continued evolution of the firm along with the revolution of the innovation. Tushman and O'Reilly called such firms Ambidextrous Organizations (Tushman & O'Reilly, 1996). Furthermore, risks associated with AI will extend to the entire society and therefore will carry a higher responsibility for leaders. Not only leaders will have to lead their firms but also do it in a manner that minimizes the overall social and economic costs to the world.

4.4. Product and Business Model

Unlikethe previous times, the cognitive era will require direct product leadership from executives (Porter & Heppelmann, 2015). The primary reason for having leaders directly impact innovation is not just competitive – but also because product development in the cognitive era would require two extra challenges: 1) bias proofing products such that human biases do not transfer into cognitive productswhile keeping applications ethical, responsive, and sensitive (Luxton, 2014); and 2) to structure and envision new business models.

4.5. Ethics

The leaders' ability to manipulate the artificial intelligence technology is profound. Recent allegations of foreign countries interfering in elections of other countries and using smart bots to influence people clearly shows that leaders can easily exploit the artificial intelligence technology to gain an edge to influence others. That is why ethics will be utmost important both during and post transformation stages.

Not being able to maneuver their companies through the third industrial revolution resulted in monumental failures – and a graveyard full of companies like Blockbuster, Borders Bookstore, Blackberry, Yahoo, Polaroid, Myspace, and Xerox is a stark reminder of those misfortunes. Leaders can avoid such a fate by preemptive planning and a higher level of awareness.

5. How to lead when transformation has stabilized?

Once the turmoil of the revolution settles down and things become more stable, leading takes a different form. This part addresses the question of how to manage when artificial intelligence has matured and has become part of the workforce. The keyword for leading with the artificial intelligence is decision-making. Herbert Simon, a Nobel Prize recipient, could have approached the study of organizations from several angles – but when he wrote his seminal book Administrative Behavior (Simon, 1976), he realized that decision-making is key to leading. Intuition, for Simon, was a subset of thinking and thinking, for both human and machine, performed three functions of scanning data for patterns, storing them, and making inferences from the patterns (Frantz, 2003).

Needless to say, Artificial Intelligence machines will play a major role in decision-making. They will be able to process different types of data, analyze

massive information, learn, and develop insights that are not possible with human intelligence. If technology is designed to be bias-free or close to bias-free, it will help in making very objective decisions. Herbert Simon's concept of bounded rationality offers a unique insight: people are limited by the information they possess, their cognitive abilities, and the time they have to make decisions. The same three will apply to an artificial intelligence artifact. With machines helping, and sometimes independently making decisions, leaders will need to overcome the evolutionary instincts deeply ingrained in human consciousness. These instincts have served us well – alerted us of danger before bad things happened and gave us that "gut feel" – but leaders will need to learn on how to approach decisions from a machine and data determined objectivity outlook. Pilots are trained to do that – as Federal Aviation Authority reports that in challenging flight situations "pilots are taught to rely on their primary instruments, rather than their senses when controlling the aircraft." (Wiegmann *et al.,* 2005)– and executives would need similar training.

Machines will become a source of augmented intelligence. With augmented intelligence, leaders will have to learn to function with machines that may at times, and for specific tasks, display more intelligence than the human leaders. The human leaders may find their own judgment biased, wrong, or challenged by machines. They will need to rely upon machines to augment their own intelligence.

An interesting model of leadership known as a Systems Model of Leadership has been proposed by Sternberg (Sternberg, 2007). In that he presented leadership as a synthesis of Wisdom, Creativity, and Intelligence – all the three attributes that will soon be imbued in the AI machines. With recent articles acknowledging the rise of machines as decision-makers (Agrawal *et al.,* 2017; Parry & Cohen, 2016) – we must consider the possibility of machine leaders.

Going forward, the legacy of future human leaders may not be tied to their fame, stardom, or popularity. Such esteem and prominence may very well be reserved for the machine leaders. For we can now observe the rise of machine leaders, who will perform and perfect leadership, side by side their counterparts, the human leaders.

6. Discussion

The most consistent factor of leadership theory is that it is always changing and in flux. With so many competing theories, it is understandable to lose faith in all of them (all wrong) – or to believe that all might have a place (all right). But even with those beliefs, it is hard to tell if the viewpoints emerged because no satisfactory and reasonable explanations were provided or because the *all wrong* and *all right*

positions are truly legitimate. While these, and other, positions are still being debated – a paradigm change is taking place. With the advent of artificial intelligence, the fundamental basis of leadership theory will change. The challenge for leaders will be to lead their companies through the transformation and minimize the social costs, and to learn and adapt the skills necessary to operate and lead in the post-transformation cognitive era. More than anything else, objectivity and ethics will be of paramount importance. Finally, the human civilization should be prepared to accept machine leaders in addition to human leaders – and hopefully their commissioning and inclusion will improve leadership.

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