

Artificial Intelligence: The Path for Entrepreneurial Opportunities

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ABSTRACT

This purpose of this paper is to influence entrepreneurs, especially would-be entrepreneurs, to explore, identify, and take advantage of artificial intelligence (AI) technology-based opportunities to create new business ventures. AI is a growing field of scientific knowledge with technological applications that help entrepreneurs create products and generate further opportunities. This paper attempts to discuss the implications of AI in entrepreneurship and why it's such a critical new tool in the hands of business owners. It also connects the link between AI and disruptive technology. Lastly the paper talks about how AI is connected with big data.

Key words: artificial intelligence, disruptive technology, big data, entrepreneurship.

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INTRODUCTION

Artificial intelligence (AI) - often referred to as machine learning - has in recent years become a strategic window of opportunity for entrepreneurs in the United States and elsewhere around the world. The window is strategic because it paves the way for ample economic benefits for entrepreneurs, their ventures, and the country. Entrepreneurship is a fascinating domain of human activity that focuses on the pursuit of opportunities (e.g., Kruger Jr., and Brazeal, 1995). As such, the business of entrepreneurs is to identify, assess, and exploit opportunities. Many entrepreneurs operate in a resource-constrained environment, yet are able to deliver unique services by combining available elements for new ends and purposes; they create resources from nothing and bring value to otherwise worthless assets (Baker and Nelson, 2005).

Advancement in AI has transformed the entrepreneurial process by opening new windows of opportunities for entrepreneurs to cultivate. AI-based applications have also facilitated the creation, growth, and survival of entrepreneurial firms. Entrepreneurial awareness of opportunities - engendered by the impact of AI on market demand for goods and services and the expansion of worldwide economy - is imperative. Entrepreneurs, particularly would-be entrepreneurs, should realize the fact that AI has emerged as a potent engine for new investment, consumption, and wealth creation. AI could also help entrepreneurial firms (and other enterprises) to deploy their limited resources more efficiently. Salim (2005), for instance, pointed out that a key goal for the firm is to achieve sustained utilization of its available resources.

AI is a growing body of scientific knowledge which includes disruptive technologies, and valuable new applications. Its primary goal is to deliver convenience and efficiency in all walks of life and, in the process, generate entrepreneurial opportunities. AI presents opportunities for entrepreneurs in at least two distinct ways: (a) by utilizing AI applications (e.g., smart phones) in the creation, maintenance, and growing the business venture, and (b) the initiation of business activities that involve the development, production, and marketing of AI products. Consequently, AI is changing the way that ventures are identified, structured, launched, and managed for competitiveness.

Undoubtedly, there will always be negative ramifications for AI utilization including the elimination of many jobs as well as inefficient industries. For example, Reuters news agency reported on May 13, 2019, that Amazon.com Inc. had deployed a new AI-based application that automates the jobs of about 2,000 of its employees. The application is an advanced machine that performs the task of boxing up customers' orders. Conversely, Wilson *et al.* (2017), conclude that AI machines are also creating brand new human jobs that require training and skills that have never before been needed. In any event, it is necessary that the entrepreneurial spirit be reignited to create more employment and sustainable growth.

ARTIFICIAL INTELLIGENCE

Many definitions have been introduced to capture the essence of artificial intelligence. Barbera (1987, p.17), for example, defined AI as a "field of science and technology". The author added that AI encompasses three sets of technologies: (a) natural languages communications, (b) robotics, and (c) expert systems. Srivastava (2018, p.1) viewed the term as "concerned with understanding the nature of human intelligence and designing intelligent artefacts which can perform the tasks which, when performed by humans, are said to require intelligence". Agrawal *et*

al. (2017, pp. 27-28) elaborated that the “task that AI makes abundant and inexpensive is *prediction*” and “the environment with a high degree of complexity is where machine learning is most useful”. Whatever the definition one might adopt, AI is an inherently complex and multidisciplinary field. It is also widely recognized that AI development is dependent on advancement in such disciplines as computer science, mathematical logic, advanced analytics, and cognitive neurosciences.

Origin and Applications of AI

The term artificial intelligence was coined in 1956 (Srivastava, 2018). John McCarthy (2006) pointed out that he actually coined the term in 1955 but introduced it in a working group meeting at Dartmouth College in summer 1956. McCarthy also mentioned that the ultimate goal of AI is to reach human-level intelligence and that the best hope for achieving the target is the formalization of commonsense knowledge and reasoning with the help of mathematical logic. Brock (2018, p. 3) stated that, “The AI field began with a set of ideas like a Big Bang about the nature of human thought and how to model it by computer”. Shi and Zheng (2006) have credited four individuals - Marvin Minsky, John McCarthy, Herbert Simon, and Allen Newell - as the grandfathers of AI.

The range of AI applications is vast and growing rapidly. Applications are as simple as a chatbot for account activation to a highly complex system as self-driving car. In 2019, AI research and applications are found in such fields as education, management, web security, insurance, healthcare, defense, and law, just to mention a few. Moreover, AI-based approaches have been used to help business firms identify global market opportunities (e.g., Fish and Ruby, 2009). Airbus has applied AI-based methods to reduce production disruption for its A350 aircraft (Ransbotham *et al.*, 2017). In a more recent paper, Topol (2019) studied the use the big data and AI in the field of medicine and found that these are beginning to have an impact at three levels: for clinicians, predominantly via rapid, accurate image interpretation; for health systems, by improving workflow and the potential for reducing medical errors; and for patients, by enabling them to process their own data to promote better health. In another study, specifically construction and demolition waste. Jaksic and Marinc (2019) investigate the role of AI in relationship banking and how it helps banks compete with finance tech (FINTECH) companies.

It is worthwhile to note that of the 2019 CNBC Disruptor 50 companies*, 29 companies, or 58 percent reported that their key technology is AI, and 6 companies, or 12 percent reported that their key technology is AI or machine learning. The companies concerned operate in different industries, including the following table 1.

Table 1

Wire-transfer service	Finance service	Software development
Fashion	Public transportation	Insurance
Retailing	Agriculture and food service	Drones
Education	Genetics testing	Cybersecurity
Health and fitness	Big data/data mining	Biotechnology
Shared workplace	Carbon recycling	Hotels and hospitality

* CNBC.com, <https://cnbc.com/cnbc-disruptors>.

The creation of AI technology-based entrepreneurial ventures has several requirements. For instance, Ransbotham *et al.* (2017) asserted that successful deployment of AI demands more than just data mastery. Essential ingredients include, but are not limited to the following:

- Long-term planning;
- Managerial knowledge of the nature, benefits, and risks associated with AI adoption;
- Strong vision and leadership
- AI physical infrastructure; and
- A willingness to merge business and technological strategies

As evidenced in their study only 5% of companies investigated in this study had extensively integrated AI technology into their business processes, even though the vast majority of executives believed that AI could make a significant contribution to their business.

AI: innovation or disruptive technology

In his book, *The Diffusion of Innovation*, Rogers defined an innovation as “an idea, practice or project that is perceived as new by individual or a unit of adoption” (Rogers, 2003, p.12). According to Rogers, the rate that an innovation diffuses is determined by five factors (relative advantage, complexity, compatibility, observability, trialability and compatibility).

Cockburn, Henderson and Stern(2018) discuss the impact of artificial intelligence on innovation. According to the authors, “Rapid advances in the field of artificial intelligence have profound implications for the economy as well as society at large. These innovations have the potential to directly influence both the production and the characteristics of a wide range of products and services, with important implications for productivity, employment, and competition. But, as important as these effects are likely to be, artificial intelligence also has the potential to change the innovation process itself, with consequences that may be equally profound, and which may, over time, come to dominate the direct effect.”

The contributions of innovations to the world are immense and growing. They are the fruits of human efforts and ingenuity. Innovations help entrepreneurs to capitalize on existing market opportunities or create new opportunities through the creation of business ventures. The online Merriam-Webster dictionary defines innovation as the introduction of something new (i.e., idea, method, device). Joseph A. Schumpeter viewed innovation as a process by which new technologies replace old technology that he labeled ‘creative destruction’. Schumpeter (2008) also posits that innovation takes the form in five human activities, which include:

- Introduction of new goods;
- Introduction of new methods of production;
- Opening new markets;
- Capturing new sources of supplies; and
- Organizing an industry through, for instance, the creation of monopoly.

Quite often, innovations that lead to artificial intelligence-based technology are, at the same time, original disruptive technologies. Clayton Christensen coined the term disruptive technology and, in cooperation with colleagues, the term was expanded and clarified further (e.g.,

Christensen, 1977; Christensen, 2002; Christensen and Raynor, 2003; Christensen, 2006; Christensen, Raynor, and McDonald, 2015).

In essence, disruptive technology refers to the following outcomes:

- Introduction of innovative, low-cost, products primarily designed to satisfy consumers' unmet needs;
- Creation of new markets; and
- Deployment of new business models.

For entrepreneurs, AI presents numerous opportunities and it can be described as one of the most desirable paths toward innovation and entrepreneurial venture creation. Entrepreneurs are expected to satisfy customers' needs, create new products, utilize effective business models, and craft innovative strategies.

Entrepreneurial Intention

A small segment of entrepreneurs is guided by an entrepreneurial spirit at birth while others need to be led, trained, and educated to initiate entrepreneurial intention. Bird (1988) emphasized the notion of entrepreneurial intention, which he clarified as the entrepreneur's state of mind that directs his/her attention, experience, and action toward a business concept. According to the author, entrepreneurial intention sets the form and direction of the business venture at its inception. The author also indicated that intention is a psychological process aimed at either creating a new venture or creating new values in existing ventures. Basically, the quintessence of the entrepreneurial intention is the entrepreneur's mindset that is directed toward innovation and wealth creation.

The subject of entrepreneurs' intention has long been an important field of research and investigation in entrepreneurship literature. Busenitz and Lou (1996) observed that the way one thinks could have a significant impact on the intention to start a new venture, while Zhang and Cain (2017) declared that entrepreneurial intention is considered a valuable and practical approach to understanding entrepreneurial behavior. Boukamcha (2015) studied the linkage mechanism by which training influences intentions. Quan (2012) makes a distinction between two levels of entrepreneurial intention: (a) impulsive entrepreneurial intention and (b) deliberate entrepreneurial intention. Impulsive intention, according to the author, is swayed by the individual's cultural background and personal characteristics, while deliberate entrepreneurial intention is influenced by prior experience and social networks of the individual.

The creation of a new venture to pursue an opportunity is labeled the *entrepreneurial event*, while the individual who perceives an opportunity is called an *entrepreneur* (Bygrave and Hofer, 1991). Some scholars (e.g., Low and MacMillan, 1988) use the term *entrepreneurship* to mean the creation of new ventures. Sarason *et al.* (2006), asserted that the act of entrepreneurship occurs as the entrepreneur specifies, integrates, and acts upon the sources of opportunity. Shapero and Sokol (1982) pointed out that the entrepreneurial event encompasses the following attributes:

- Initiative taking;
- Consolidation of resources;

- Management of the venture;
- Entrepreneurs' relative autonomy; and
- Risk taking.

Clearly, the entrepreneur must first recognize (or identify) an economic opportunity prior to initiating the entrepreneurial process that leads to the creation of a venture.

This paper posits that aspiring entrepreneurs must develop the necessary mindset to identify, assess, and exploit economically viable AI-related market opportunities. It is likely that AI inventions and innovations will drastically affect the lifestyle of people around the world and become the dominant source of venture productivity and national prosperity. It has long been recognized that venture creation is, in itself, an indispensable source of innovation, investment, and job creation in the United States (e.g., Forbes, 1999). It is likely that the greater the number of new ventures founded in the country, the faster the adoption rate and progress.

According to a 2018 McKinsey survey, global adoption of AI is occurring at breakneck speeds. While some businesses indicate that AI adoption is "a standard business practice", many are still in the infant stages of the adoption process. The report further states that for digitized companies the adoption rate is even higher than non-digitized businesses.

Opportunity Recognition

The subject of opportunity recognition is both intricate and intriguing because entrepreneurs pursue different approaches to identify and capture opportunities. Therefore, many theoretical models have been developed in past decades to explain the phenomenon. Chelly (2011), for example, pointed out that the factors that influence entrepreneurial opportunity recognition include the following:

- Individuals' prior knowledge of the industry and market;
- Past experience;
- Social networks; and
- Motivation.

Similarly, Nerine *et al.* (2016) identified the following approaches to entrepreneurial opportunity:

- Individuals' prior knowledge of the industry and markets;
- Systematic environmental search;
- Alertness to opportunities;
- Cognitive personality characteristics of the individuals and
- Social capital.

Although he notes "shovels built America," one must also acknowledge that "perceived opportunities helped make them possible". Baron (2006, p. 107) defined an opportunity as a "perceived value (i.e., profit) that previously has not been exploited and is not currently being exploited by others". Opportunity recognition should be viewed as a process (i.e., a series of activities) by which entrepreneurs seek to create value for their ventures. The process is greatly enriched with skills, or competency, that the entrepreneur could acquire via training and education.

One effective method to identify opportunity recognition is by using a two-dimensions model labeled “inside-out, outside-in”. The model, because of its utility, has been applied in many contexts in recent years. For example, Brink (2014), discovered that the model had a significant positive impact on innovation and growth in small- and mid-sized firms. This paper refers to inside-out as the entrepreneur’s skills and strategic thinking that enable him/her to capture market opportunities by creating and/or deploying AI-related applications. Outside-in, on the other hand, refers to the entrepreneur’s understanding of the industry/market environment including consumer needs and demand for specific goods or services. The “inside-out, outside-in” model could help the entrepreneur formulate the venture’s concept and its business model.

Entrepreneurs are expected to be problem solvers. A problem or gap exists if the actual situation or outcome (e.g., consumer satisfaction for a product) is different from a desired situation. A problem often presents an opportunity for the entrepreneur. Baron (2004) observed that opportunities emerge from a complex pattern of conditions including technological, social, political, and economic environments. An entrepreneurial search for an opportunity begins when the entrepreneur formulates a viable idea to solve an existing (or potential) problem, and then assesses his/her capability to tackle the issue. This typically begins after the problem recognition phase and is followed the idea generation phase. In order to fully understand the problem, an entrepreneur must engage in extensive research combined with intuition, vision, and informative judgement.

This paper suggests that entrepreneurs search for (and take advantage of) AI technology-based opportunities because these kinds of opportunities, if well managed and cultivated, are likely to provide some of the most promising opportunities for venture survival, growth, and profitability. The attractiveness of AI opportunities should be assessed on the basis of at least two criteria: (a) appropriateness of the technology to be sought, and (b) market size and growth potential. Entrepreneurs tend to view the attractiveness of opportunities differently depending on their vision and goals. As Gruber et al. (2015) asserted, there are significant differences in opportunity preferences of individuals with technological, managerial, and entrepreneurial skills. On the other hand, Lindsay and Craig (2002) referred to the following attributes as qualities of worthwhile opportunities:

- Opportunities should be attractive and durable;
- They should be timely; and
- They should be anchored in goods or services that add value to customers.

Chandler et al. (2005) recommended four approaches to entrepreneurs who seek to exploit opportunities. They must:

- Innovate a product and inform/educate consumers about it.
- Study the market needs and innovate a product.
- Study the market needs and replicate the product.
- Study an income stream (e.g., existing business venture) and purchase it.

Numerous authors (Ray, 2018; Umesh *et al.*, 2005; Gonzales-Alvarez & Rodriguez, 2011) have discussed various approaches to assess (or evaluate) opportunities. Ray (2018) stressed that entrepreneurs should follow a four-step process. First, he/she must conduct a thorough self analysis to identify and understand one’s talents, skills and goals. Secondly, the individual must conduct a full market analysis to ensure the feasibility of the planned venture. Third,

a risk analysis must be performed to better assess the potential risks involved for the venture. Lastly, the entrepreneur must examine that amount of external support that is available in order to assess the probability of desired support from financial institutions and other sources.

Umesh *et al.* (2005) further emphasized that entrepreneurs must consider (a) growth rates of the targeted market, (b) timing of market entry; (c) near-term revenue potential; and (d) the impact of the planned product/service on the industry. Gonzales and Rodriguez (2011) even posited that gender differences impact one’s ability to identify entrepreneurial opportunities. According to their study, men are more likely to identify entrepreneurial opportunities. Although many studies have focused on male entrepreneurs and the literature is replete with studies that indicate gender bias in entrepreneurship and opportunities recognition exists, more recent studies (Saini and Jain, 2018; Solesvick, Iakovleva and Trifilova, 2019) have challenged the concept that gender is a significant factor in entrepreneurial opportunity recognition. According to Saini and Jain (2018), advances in technology and better communication have created over 200 million opportunities for female entrepreneurs, even those in developing countries. For women the motivation to pursue entrepreneurial opportunities are often driven by “choice and necessity” as well as the desire for fair and equal compensation and a host of other factors.

Perceived risk has long been a factor in entrepreneurial studies. Scholars have emphasized the critical role of risk in venture selection and creation. Das and Teng (1997, p.70) emphasized that “risk taking appears to be one of the most distinctive features of entrepreneurial behavior, since creating new ventures is by definition a risky business”. Keh *et al.* (2002) further stressed that entrepreneurs are likely to evaluate a business idea more favorably when they perceive less risk in the execution of the idea. Furthermore, Campos *et al.* (2015) investigated the relationship between creative thinking and the kind of opportunity selected. The authors found out that the entrepreneur’s pattern of creative thinking influences the type of business opportunity that he/she would tend to select. Serviere-Munoz *et al.* (2015) elaborated on the entrepreneurial ‘opportunity fit model’ by proposing that the closer the entrepreneur’s personality attributes (e.g., knowledge, skills) are to those of the opportunity (e.g., financial rewards, market potential) the greater the probability of achieving strong fit and, hence, venture success.

AI opportunities

Recent inventions and innovations in the AI field have make it possible for entrepreneurs to deploy (or create) AI-based technologies. Veatch (2018, p.1) recognized AI in the legal field of equipment leasing and documentation as “developing software applications that can analyze legal issues under the Uniform Commercial Code Article 2A and Article 9 and ‘think like a lawyer’ and assist with document origination, as well as modification, reporting, transfer, and securitization.”. Table 1 illustrates some of the current industries and the entrepreneurial opportunities that exist. While this list is not exhaustive, it does provide some insight on potential industries and opportunities for entrepreneurs to explore.

Table 1. Current Industries and Opportunities for Entrepreneurs	
Industry	Entrepreneurial Opportunities
Agriculture	<ul style="list-style-type: none"> • Food production
Art	<ul style="list-style-type: none"> • Paintings, drawings
Apparel	<ul style="list-style-type: none"> • Sports apparel

	<ul style="list-style-type: none"> • Footwear (comfort shoes, sneakers and baby shoes)
Electronics	<ul style="list-style-type: none"> • Electronic games
Food and beverage	<ul style="list-style-type: none"> • Food delivery systems,
Health and beauty	<ul style="list-style-type: none"> • Hair augmentation • Barber/beauty salon tools and products
Home	<ul style="list-style-type: none"> • Smart appliances, • Home furnishings • HVAC systems, • security systems
Information Technology	<ul style="list-style-type: none"> • Web development, security, and monitoring
Jewelry	<ul style="list-style-type: none"> • Unique jewelry designs and personalized jewelry features
Medical	<ul style="list-style-type: none"> • Physical therapy/massage equipment and product development • Disease treatment and diagnosis • Vision treatment and enhancement
Print	<ul style="list-style-type: none"> • 3-D printing for books, household items
Transportation	<ul style="list-style-type: none"> • Enhanced and low-cost transportation

AI and big data

Big data refers to large volumes of scientific data that can be visualized. IBM defines big data as a data that can be characterized by any of the three V words- volume, velocity and variety. Volume refers to larger amounts of data being generated from a range of sources. For example, big data can include data gathered from the Internet of Things (IoT). As originally conceived, 3 IoT referred to the data gathered from a range of devices and sensors networked together, over the Internet. RFID tags appear on inventory items capturing transaction data as goods are shipped through the supply chain. Big data can also refer to the exploding information available on social media such as Facebook and Twitter.

Variety refers to using multiple kinds of data to analyze a situation or event. On the IoT, millions of devices generating a constant flow of data result in not only a large volume of data but different types of data characteristic of different situations. For example, in addition to RFID, heart monitors in patients and location information from phones all generate different types of structured data. However, devices and sensors aren't the only sources of data. Additionally, people on the Internet generate a highly diverse set of structured and unstructured data. Web browsing data, captured as a sequence of clicks, is structured data. However, there's also substantial unstructured data. For example, according to Pingdom, 4 in 2011 there were 555 million websites and more than 100 million blogs, with many including unstructured text, pictures, audio, and video. As a result, there's an assemblage of data emerging through the "Internet of People and Things" 5 and the "Internet of Everything."

Velocity of data also is increasing rapidly over time for both structured and unstructured data, and there's a need for more frequent decision making about that data. As the world becomes more global and developed, and as the IoT builds, there's an increasing frequency of data capture and decision making about those "things" as they move through the world. Further, the velocity of social media use is increasing. For example, there are more than 250 million tweets per day. 4 Tweets lead to decisions about other Tweets, escalating the velocity. Further, unlike classic data warehouses that generally "store" data, big data is more dynamic. As decisions are made using big data, those decisions ultimately can influence the next data that's gathered and analyzed, adding another dimension to velocity.

Like big data, AI is about increasing volumes, velocities and variety of data. Under situations of large volumes of data, AI allows delegation of difficult pattern recognition, learning, and other tasks to computer-based approaches. For example, over one-half of the world's stock trades are done using AI-based systems. In addition, AI contributes to the velocity of data, by facilitating rapid computer-based decisions that lead to other decisions. For example, since AI-based systems rather than people make so many stock trades, the velocity of the trades can increase, and one trade could lead to others. Finally, simply parallelizing and distributing the problem don't solve variety issues. Instead, capturing, structuring, and understanding unstructured data using AI and other analytics mitigate variety.

Entrepreneurs looking to start their own business with the aid of AI, can look at various sources for big data that can help them do research and market surveys before they start. Big data is generated from Internet clicks, social media, mobile transactions, user-generated content as well as business transactions, sales queries etc.

DISCUSSION

For all new business ventures it is extremely important for aspiring business owners to understand the business climate, challenges and opportunities. The same is true for entrepreneurs with a desire to utilize AI. Each entrepreneur should:

- Understand the nature, purpose, and possibilities of artificial intelligence.
- Analyze the industry and market to identify and assess customers' needs (e.g., individuals, business firms, government agencies) for the product, that is, goods and services.
- Develop a clear vision with three -to-four specific goals, and a few strategic initiatives for the planned venture.
- Specify the business concept and business model for the venture.
- Assess availability of skills and other necessary resources to match the needs of the venture.
- Explore sources of venture financing.
- Craft a pragmatic business plan

Balancing Risks and Rewards

According to various scholars (Namimpilli, 2017; Taddeo and Floridi, 2018; Russell, Dewey and Tegmark, 2015), there are numerous benefits associated with AI. AI technologies can also accelerate production, enhance work processes, and help increase efficiency. As a formidable technological engine, AI has become a key source in the emergence of the fourth industrial revolution (e.g., Daemrich, 2017). As Varga and Velencei (2018) stated, expert systems -

a field of AI - have grown in applications in recent years to include such areas as accounting, management, finance, agriculture, banking, medical, and a host of other industries.

In logistics companies, AI can provide real-time data on shipments. In the medical industry, AI can help triage patients based on the severity of their medical condition. In banking and finance, it can monitor client activity, identify suspicious behavior and alert customers quickly. New product development companies can utilize AI to help ensure product standardization. In the mining industry, AI can help reduce the danger associated with mining deep underground (Nadimpalli, 2017). and other dangerous industries such as military operations and public safety. According to Taddeo and Floridi (2018), AI provides tremendous benefits including cost reductions, improves reliability and reduce cyberattack response times from over three months to a few hours.

Although the benefits of artificial intelligence has been well documented, the literature is also buttressed with information describing the risks. Privacy issues, unemployment, potential gender or racial bias as well as concerns about the quality of the data are all key concerns that have been addressed by scholars around the world.

Privacy Concerns

Privacy has long been on of the biggest concerns relating to AI. Digital consent remains one of the premier issues relating to the use of AI. Numerous scholars (Barocas and Nissenbaum, 2014; Stahl and Wright, 2018; Miller and Wertheimer, 2010; Schermer, Customers and van der Hof, 2014) have debated the use of responsibility or consent and questioned owns the data that collected as a result of these technologies and whether companies should be able to collect data without consumers' knowledge. According to Jones, Kaufman and Edenberg, "digital consent fails to do more than disclose the wide range of potential uses the company has for an individual's personal data" and does not address the moral issues."

Ethical issues

According to Taddeo and Floridi, (2018), the issue of ethics in AI dates back to the 1960s. Almost six decades later, the debate over the design, regulation and use of AI continues. More recently, these debates have expanded to include deliberations on whether machines can be ethical (machine ethics). Winfield, Pitt and Elders (2019) indicate that the debate is so critical that it has expanded beyond academia into political and public spheres. Mantelero (2018) and others even suggest that new risk assessment models may be needed to fully assess the ethical impact of AI on humanity and society.

Data Integrity

For most entrepreneurs, the assessment of data quality will be a major concern. AI is only as good as the data and information collected by the algorithms. Consequently, it is difficult to make effective decisions with flawed data or when using algorithms that may provide biased or incomplete information. Wachter and Brent (2018), argue that new data protection measures are needed to address accountability issues associated with high risk inferences made by AI, especially those relating to medical decisions. What happens when the data is flawed, or a patient is given an improper dosage of medication? Siapka (2018) further expressed concerns about data

trustworthiness and defined such issues as “a ethical and legal paragon in the face of biased or discriminatory AI”. Many of these issues are beyond the scope of this paper and the skill sets of many entrepreneurs. However, these concerns must be considered when an entrepreneur deliberates whether to integrate AI technology into his/her business.

CONCLUSION

This paper is intended to raise the entrepreneurs’ awareness, especially would-be entrepreneurs, of AI technology-based opportunities. The advancement of AI technologies facilitates the recognition of market opportunities and their exploitation. This ultimately leads to promising new innovations and accelerates production, enhances work processes and improve efficiency. As a formidable technological engine, Ai has become a key source of the Fourth Industrial Revolution (e.g. Daemrich, 2017). Varga and Velencei (2018) acknowledged that the field of AI applications has grown exponentially in recent years and includes such areas as accounting, management, finance, agriculture, banking, medical and a host of other industries.

Training and education can help foster entrepreneurs’ AI awareness so that they gain the necessary insight, knowledge, and skills to create new venture. Education in entrepreneurship can also foster entrepreneurial intention (e.g., Hou et al., 2018). As is the case with educational institutions, governmental agencies can play an important role to enhance entrepreneurial intention. In a 2014 study of Chinese entrepreneurs, Lin and Si revealed that there was a positive effect of institutional environment (e.g., government training and education programs) in advancing the pace of entrepreneurial activities. Undoubtedly, AI activities (research, development, and applications) can be of great value to entrepreneurs, consumers, and the economy. According to Liu (2017, p. 112), the U.S Council on Competitiveness declared, “Today’s competition is a race to see who will innovate and develop key technologies in artificial intelligence”. However, informed entrepreneurs must also understand that along with the benefits and the race to innovate come certain risks.

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