

Project Management in the Age of Artificial Intelligence ^{1, 2}

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Abstract

Have you ever wondered how the Project Management role will evolve after Artificial Intelligence (A.I.) is operational? Are you wondering whether Project Management roles will become obsolete with Artificial Intelligence?

This paper aims at presenting the ways in which the evolution of AI is likely to change the Project Management role. Project Management is globally accepted, used in various industries and translates distinctly in every industry. In the past few decades, it has become a highly desirable and sought-after role, as businesses demand that project work be completed on time, within budget and prescribed quality constraints. We constantly implement processes and changes that enable us to meet these demands. In doing so, we hear a lot about Artificial Intelligence becoming the ultimate game-changer across all industries and as Project or Program managers we wonder how it will change or eliminate our roles. In this paper, the author presents the evolution of AI, its components and how it is likely to change certain aspects of Project Management. It is based on the author's research on this subject.

VUCA – Volatility, Uncertainty, Complexity and Ambiguity

Our existence is characterized by VUCA now more than ever. Internet gained popularity at the start of the century and then came smart phones; smart gadgets and we are now headed into a more advanced era of intelligent machines or Artificial Intelligence (A.I.). 'Artificial Intelligence' signifies that which is manufactured but has the capability to learn just like humans and compute at a much higher capacity than an average human. As A.I. progresses, more people are contemplating that large sectors of workforce are likely to be taken over by machines, thus bringing mass scales of global unemployment due to the *volatility* and the *uncertainty* associated with it. How accurate is this conclusion? It is definitely not a simple answer as it cannot be common across all the industries across the globe, thereby making it *complex* and *ambiguous*.

This paper will address the factors of VUCA associated with Artificial Intelligence as applied to Project Management and is based on the author's research on the subject.

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Background: Rise of Artificial Intelligence

Artificial Intelligence is one of the emerging technologies that we increasingly hear about, along with others like Renewable Energy, Cloud Computing and Cryptocurrency. We begin to ask ourselves – Why is this so important? Why are the progressive countries gearing towards it? Why are governments reserving budgets for A.I. capability? The seed for A.I. enablement was planted in March 2016 when Lee Se-Dol, a South Korean master, was defeated by the board game AlphaGo. Google's AlphaGo is a complex computer program that generates a board game that requires intuition, strategic and creative thinking. It is trained to mimic human play by matching the moves of expert players to generate a more complex algorithm. The main objective of the gaming community that is comprised of scientists and researchers is for the computer to defeat an expert human player and then enhance the algorithms further as part of research for Artificial Intelligence systems. Prior to AlphaGo, some researchers had claimed that computers could never defeat humans, thus maintaining that a human brain is far more superior to a computer. The defeat of Lee Se-Dol had a profound impact on the political community in China whose main concern has been its decline in population owing to its one-child policy that was followed for decades until 2015. In May 2016, Google brought AlphaGo to China where it defeated Ke Jie of China. This paved the way for a fresh flow of investments from the Chinese government into strengthening A.I. According to a recent study, the U.S. tech giant IBM had the highest A.I. patent portfolio of 8,920 patents, followed by Microsoft at 5,930, whereas China accounted for 17 of the top 20 academic institutions involved in patenting A.I. With the world's largest economies competing for the top spot, the White House issued an executive order on February 11, 2019, announcing that it will encourage research in the field of A.I in the United States.

The key factor that differentiates the systems employing the latest capabilities of Artificial Intelligence is their ability to learn and apply these learnings progressively without any modifications to their algorithms. AlphaGo is more successful than its previous versions because of its ability to learn from other games and apply its learnings to the future games. The latest version of the game, called AlphaGo Zero is the most advanced. It is loaded with the rules of the game without any other data from the past games. It learns from the random games that are chosen until it is able to apply these learnings progressively.

What is Artificial Intelligence?

Before we go into the changes of technology due to Artificial Intelligence, let us understand what it is. A few decades ago, the term A.I. was synonymous to a robot. Then there is the question of types of A.I. In this section, we will see how the initial concept of robotics has evolved to today's A.I.

Artificial Intelligence in its simplest form is the capability of a machine to imitate human behavior. There are multiple ways to simulate human behavior depending upon how much intelligence is built into a system. The earliest form of machine intelligence was seen in robots that could do simple tasks like lift and shift. Then in the early 1980's we saw Machine Learning as the common form of artificial intelligence. Machine Learning is slightly more advanced than robotic operations. It recognizes trends from data or the categories that information fits in, so that when presented with newer conditions, it can make predictions. The information it collects is limited to the conditions it is exposed to. Its goal is to learn from information generated

around a particular task and maximize machine performance on this task. It is also called Narrow A.I, because of its narrow focus.

While Machine Learning helped automate several functions, it was still not close to human intelligence, for a machine cannot perceive information as humans do. Humans learn by observation and in processing information, our brains register the emotions associated with every situation. In 2012, with the increase in the availability of Graphic Processing Units (GPUs) that make parallel processing faster and cheaper, Deep Learning started gaining popularity. Deep Learning is the more advanced form of Machine Learning that is concerned with algorithms that are designed to mimic the structure and function of the brain called artificial neural networks. Commonly known systems like image recognition, recommendation systems and financial fraud detection systems all use the principles of Deep Learning.

Impact of Artificial Intelligence on Technology

The influence of the knowledge-based, self-learning machines on technology can be divided into three broad categories:

1. Ability to learn, understand and improvise.
2. Process gigantic amounts of customers' behavioral data residing in systems.
3. Use all the available information to process complex decisions in real-time.

The best way to understand the future of technology is to imagine the potential between A.I.-based systems, human behavior and emotions, and the resulting decisions. We can apply this to almost any field. Some of the IoT (Internet of Things) products that we use today provide important clues to what the future will hold. For instance, when one listens to YouTube videos on the go, YouTube makes a note of the genre, an individual's preferences and provides suggestions. Netflix does not provide a complete list of the movies available online to every customer. The displayed movies are a subset based on the historical movie choices of the user. Nest thermostat adjusts the temperature of a room depending on the user's preferences, for that time of the day and month, from the users' past behavior. All these systems learn from their existing customer base and then progressively apply those learnings. The future technologies will see exponential advances in machine intelligence. The success of the next generation intelligent systems will depend upon how much human intervention is involved. Lower level of human intervention will make them more transparent to the end user, thus making technology more successful than ever.

The key to building successful systems that can learn and improvise is to ensure that all the relevant data is available for them. Whether we look at small businesses like a coffee shop or a large organization like a bank, the success of an organization depends upon how it leverages the data from its existing customers. Data is available, where companies fail is, in not knowing how to leverage it. New products launch every day, but most of them last for less than twelve months in the stores. These products are a function of the marketing department's analysis and instincts. Most firms today blame this on their inability to harvest data to gain better insights. Advanced A.I. systems will be able to process industry-wide, gigantic amounts of data in record times and provide meaningful insights to the new product development teams. With their enhanced data analytics, they will be able to bring all the sub-systems like Marketing, Engineering, Manufacturing, Sales and Finance together to provide a consummate view of the new product even before its launch into the market.

Future A.I. systems are likely to process massive amounts of data leading to a considerable reduction of mundane, repetitive tasks. Consider the role of an actuary. When applying for homeowner's insurance, the application goes through a series of decisions by actuaries that design new insurance products, forecast the cost of loss, set premium rates or calculate risks. Applications go through several factors like the location of the property, historical data related to storms and floods, proximity of the property to railway tracks, duration of the owner at that residence and several more. Rather than subject an actuary to gather all this data, the subsequent A.I.-based systems will utilize the massive data stored in the organization's databases, process it from past judgements and use the learnings for the ensuing applicants. The role of an actuary will still require them to perform some basic checks on the results, but their time will be freed-up to design newer insurance products like Pay-As-You-Drive, which is usage-based insurance or in designing prospective products like those involving integrative statistics of user patterns from day-to-day behavior like driving a car or shopping at a store. These products will establish a user profile to determine the overall risk profile of a customer when applying for any type insurance, thus further enhancing the role of an actuary.

Consider another example. Every organization employs real-time monitoring of its critical systems to ensure that they do not escalate into operational emergencies. Most companies today utilize a portion of their human labor to actively monitor their systems in real-time. The advanced, knowledge-based, intelligent monitoring platforms will allow organizations to free-up their monitoring staff and use advanced algorithms to detect a possible system outage due to higher volumes or network resource constraints, rectify the problem, save the details of the root cause analysis and generate a communication log for the management.

Decisions play an important role in human lives. A typical human makes about 35,000 decisions per day, at an average. We make decisions based on our choices, logic and complex neurological data. While being able to make a choice is still considered a privilege, the constant battle of making decisions tend to build up unwanted stress. Decision-making remains a challenge for leadership in the work arena. In the age of agile business, even experienced leaders encounter challenges where choices lead to outcomes that are miles apart depending on a decision. Delegating decisions or following a process for decisions are the most popular options to reduce stress from having to decide. Artificial Intelligence can be utilized to address this issue. It can be programmed to use all the available information in the form of data and limitations, to predict outcomes for each of the available choices.

For example – In the corporate sector, most leaders have to go through the issues that budgeting presents every quarter or even annually. Individual departments or functional units are allotted a limited budget for capital expenses, labor expenses and expenses for new initiatives. As far as new initiatives are concerned, leaders often always face a challenge in prioritizing initiatives based on the probability of success and the overall benefits it is likely to provide to an organization, so that the allotted budgets may be used wisely. Some of the initiatives do not meet the expectations even after excessive brainstorming before deciding on an option. This is extremely stressful for all the stakeholders. By using the predictive analysis from A.I.-based systems, leaders may be able to reduce the stress emanating out of having to make key decisions. As the recommendations from these intelligent systems will be made on data and several permutations and combinations, the risk associated with reaching a conclusion will be considerably lower when taking into account the limited information available at the time of decision. If the outcome of a choice does not meet the initial expectations, leaders will have the option of providing the analysis from A.I. as opposed to an instinct from the management.

Need for Artificial Intelligence in Information Technology

The use of Artificial Intelligence is on a surge in businesses throughout the world. Every business employs a mix of flavors of A.I. that meet its needs. We are in a period of technology breakthrough that demands automation and reduction in costs. There are two sides to this: reduction in costs and increased efficiency through technological advancements. We have seen various models and methodologies that encourage this concept namely: Agile Methodology to increase efficiency, Lean Management to eliminate waste and reduce costs, Just-in-time manufacturing, Process Mining to keep efficient processes and discard the rest, and so on. All the concepts that exist today are dependent on how an organization chooses to adopt them. Although every organization employs a version of these methodologies, there is immense opportunity to improvise using increased automation. Artificial Intelligence Platforms will gain prominence. Some organizations are already gearing up to leverage cloud-based A.I. platforms so that they can take full advantage of these resources to deploy complex A.I. solutions. The technical community will see an immense growth in the availability of A.I. platform-based tools and applications. Some of the common A.I. platforms in use today are the AWS SageMaker, Microsoft Azure and TensorFlow.

The end-state vision of most of the leaders in Information Technology is that A.I. will transform all the key roles, from planning, development, testing to management. Every segment of IT involves tasks that are mundane in nature, for instance – those that involve organizing and storing data, sorting relevant data, manual data entry for testing purposes, planning and documentation, preparing and distributing reports, generating flowcharts, documenting results from multiple stages of testing, manual monitoring of systems in real-time to avert a potential issue – the list is endless. There is a strong need to automate the IT processes that involve intensive labor to such that require little or no manual intervention, thus reducing costs due to less use of manpower.

How will Project Management Change

Project Management has become a critical skill in the last few decades with the upsurge in technology. Now with the integration of Artificial Intelligence into our applications, there will be a shift in technology, but the true driver of our success will lie in the culture of our teams and in how we use the information that the A.I.-based systems provide. To understand how this role will evolve with A.I., we have to consider the features and information that A.I. will provide, like characterized data, for instance. With the availability of large amounts of data from within and outside an organization, our abilities to make decisions and identify risks will be greatly enhanced. PMs will be able to add a significant amount of creativity to their roles in terms of providing detailed guidance on integration of overall scope, instead of managing the various stages of a lifecycle in silo. The key areas of Project Management like Time Management, Scope Management, Communication Management, Stakeholder Management and Risk Management will continue to be more dynamic in the new world. As we add automation to our work, its support and management become all the more crucial to a successful delivery. Automation will provide faster, detailed insights, but we will still need humans to validate the results and ensure that the end-state is achieved.

In the following sub-sections, we will discuss the various tenets that will evolve.

Proactive Use of Data for Early Risk Detection

We have been using data reactively all along. Our systems have massive amounts of data that is used as and when needed. Once we have the information we need, we go back to our daily jobs to continue to perform our roles. With the advent of A.I., PMs will have data not just from their own organization, but also from competitors, users of similar products and in some cases, the entire industry. They will be able to enhance and condition the available information to find answers to some of the most pressing issues, like for instance – determining the health of a project at a given point in time as opposed to monthly or quarterly. If used well, it is very likely to promote early detection of risks – a very significant factor to ensure that the project stays within the boundaries of time, cost and scope. With the risks identified significantly sooner, PMs can start looking into the mitigation procedures, thus involving senior leadership as early as possible. Proactive use of data will help us become more enterprising than ever.

Faster Analysis and Resolution of Defects

Be it project management for software applications or releases of a new product, testing activities usually take the longest. With the additional information and automation that A.I. systems will provide, PMs are likely to see shorter test cycles because of the lower times taken to execute test cycles and resolve defects. This is likely to improve the Quality Management aspects of Project Management, but to use it more effectively PMs must ensure they have the correct algorithms built into the test systems. The new role of Project Managers will require them to be technically knowledgeable in some cases, in other cases it will require them to understand the complete lifecycle of the product that is being built, whereas in some projects a PM will need to understand the software applications that are in scope from a functional as well as non-functional perspective. It is appropriate to say that PMs will be required to be as dynamic as possible.

Managing Scope Creep and Increase in Expectations

The increase in automation and additional insights that A.I. will provide will most likely increase the expectations of the project stakeholders. The underlying assumption is that increased automation will allow more work to be done than was scoped originally. Effective management of the project stakeholders will become important to ensure that irrelevant scope is not added onto a project. Small changes will not affect the project as a whole, but for example – in a project where the original scope is to add a few data fields to a website, a new requirement to develop a dashboard to track customer logins may take up a sizeable chunk of the team's efforts and can be considered scope creep. Well-reasoned definition of requirements will thus be crucial to keep the project within its original scope.

Predicting and Experimenting

Most of us are familiar with the terms Proof of Concept (PoC), Pilots and Prototypes. While a PoC demonstrates the feasibility of implementing a functionality, a prototype shows how it will function after being developed. When organizations address projects that include massive investments, they usually like to validate the ideas presented during conception by investing in smaller projects for prototyping. The best way to get real data is to create a model that is close to the finished product and test it. A.I.-based tools will make it possible to create faster prototypes with the application of Deep Learning. As PMs, we will drive the relevant discussions to finalize the functionality that can be derived from a prototype. Our inputs will play a significant role in how the A.I. systems are configured to provide the relevant results. The role of a PM will further

evolve as a Project cum Product Manager in some cases. Pilot projects like these are also likely to reduce the complexities associated with a full-blown project. On the other hand, business units may dispense lesser funding which may result in a limitation of resources available for the pilot projects.

Team Empowerment to Replace Central Management

Typical projects in the past decades have consisted of a team of contributors with a Project Manager at the center of all the functions. Most project decisions still rest with the PM in most organizations. In the changing times when projects are so much more dynamic, requiring faster turnaround times, it is crucial that the team be empowered to make decisions. Another aspect of this is that with the increased amount of available information, the team can take better advantage of utilizing the information more creatively if it is allowed to agree and adopt its own approach. PMs will be required to provide increased support and space to their teams so that they can grow. They will need to ensure that the required resources with appropriate skillsets are available for the team. In most large organizations, team empowerment is still an impediment because of their bureaucratic nature of functioning. Key decisions rest with people of higher designations and those in authoritative positions. To successfully allow teams to make the day-to-day decisions from the data that is derived from algorithms, PMs will have to ensure that the project leadership including key stakeholders and Project Sponsors are aligned to this direction.

Focus on Objectives Instead of Processes

Management of projects and programs in larger organizations today requires the definition of Key Performance Indicators (KPIs). Tracking of KPIs during the project lifecycle enable the Project Manager to monitor the health of an ongoing initiative. Some organizations have defined elaborate processes that Project Managers must follow to enforce adherence to the more stringent organization-wide policies. For instance, a PM is required to create a weekly RAG (Red, Amber, or Green) status report indicating the health of a project through a status of the individual KPIs. Not only do PMs spend enormous amounts of time trying to stay within the processes, but as every project is unique, some of these processes do not work in every situation. In some instances, the objectives of project management are completely lost in the pursuit of processes. Instead of trying to follow a process and tailoring it to a project, the future PM will need to follow the central idea and adhere to it. If a process is in fact mandatory, the respective teams should create and enforce it to ensure success. Focusing on objectives will promote a better usage of the available information from the algorithmic systems.

Considerations when using A.I.

The journey of incorporating A.I. into our business processes promotes progress but brings forth as many concerns as does opportunities. As Project Managers, we manage projects involving various business areas and technologies. The risks discussed below may not be applicable to everyone but are worth thinking about. They can be broken down into the following categories:

Accessibility and Security

With a growth in the prowess of A.I., huge amounts of industry-wide data are likely to become available. The success of A.I. partly lies in how this information will be disseminated for use. For instance, will enterprises want to share part of their performance data or would they like to make all of their data available for competitors to learn and improvise?

Another consideration is around the security surrounding its use. As the number of systems connected to A.I. increases, internet security will have a novel role. Considerable amount of effort will have to be spent to ensure that the systems are protected from viruses when accessing information provided by A.I.-based systems. Preventive procedures will also have to be installed to shield the A.I.-based systems from letting in viruses from hackers and competition. Defense systems employed for Governmental use will have to have added features of cyber security to prevent data leaks.

Ethics

If utilized effectively, A.I. could prevent cyber-attacks. It can also be orchestrated to weaken the existing cyber security procedures by employing fake social engineering to manipulate a targeted population into performing actions that would otherwise be illegal or unethical.

An A.I. system can enforce the application of an algorithm based on the data that it has accumulated from other real-world scenarios. If it is looking at a subset of scenarios that do not involve any exceptions, it may draw an incorrect conclusion.

As humans, we apply emotions and logic when judging a situation that requires subjective judgement. While A.I. systems are designed to provide advanced computational capabilities, they are most appropriate in situations that involve objective analysis. Some circumstances call for a subjective judgement that may depend on ethical principles to arrive at an optimal situation. A.I. systems will have to be programmed to make decisions based on the distinction of right and wrong.

Accountability

Consider self-driving cars. If a self-driven car is involved in an accident, there is no law to determine the liability. In another example - a bank uses an A.I algorithm to recommend credit card applications for approval. A group of rejected applicants brings a lawsuit that claims that they were rejected because of their race or ethnicity. How does the legal department assess the validity of this lawsuit given the fact that the decision was based on a complex algorithm involving neural networks? Even if they are able to access the algorithm, finding an answer might not be so easy. All factors that apply to humans performing their roles in society must be applicable to machines when designing an algorithm that replaces humans.

Conclusion

The growth of Artificial Intelligence will change the world and move us past our processing capabilities and biases. Many jobs will change including Project Management. Our success as PMs will lie in our ability to think and create with the enormous amount of processing power that A.I. will bring forth. The most important aspects of our jobs lie in *leadership*, *collaboration*, and *communication* and these functions will not be entirely automated in the next decade.

All those that are fearful for their roles as PMs will become obsolete need to think of this as another revolution in the age of technology. Banks introduced Automated Teller Machines (ATMs), but that did not eliminate the jobs of human bank tellers. ATMs made it convenient for customers to access their accounts and promoted a way for the bank tellers to utilize their skills to market other banking products like Home Loans and Personalized Banking for a subsection of the clients. In a similar example - sewing machines enabled faster production of clothes, but that did not eliminate human intervention in the clothes manufacturing industry. On the contrary, it generated a new avenue in the fashion industry whereby the latest trends are implemented as

soon as possible via mass production of clothes. Similar to these examples, Project Management will evolve to a new level with the advent of A.I. PMs will be able to utilize the enhanced insights from A.I. to plan, execute and manage projects better than in the current world.

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