Project Management Institute

AI Essentials for Project Professionals

Foreword

The project management profession has always evolved with innovation and technological progress. We've been through the Technological Age, the Computer Age. And now, we live in the "Exponential Age"—a time when disruptive technologies, innovations, and new ways of thinking and working are iterating exponentially.

There have been several hallmarks of this age. The advent of the internet changed the way we learn about and see the world. Social media changed the way we connect with one another. Mobile devices, widespread Wi-Fi, augmented and virtual reality, and new frontiers in microprocessing continue to close the gap between humans and machines.

And now, artificial intelligence is reaching an inflection point. What was once a niche tool leveraged by only the most technologically savvy among us has entered the mainstream. Massive investments by huge tech companies are taking AI from the margins to the main stage. AI is rocking every industry and every profession—from IT to the creative arts to manufacturing and, yes, to project management.

AI affects us all. It impacts our jobs, our lives, and our prospects. The AI revolution is both a threat and an opportunity, and our profession needs to be on the winning side. It is up to us to stand up and take charge of our own futures.

At PMI, this is the choice we made. We chose to lead the AI transformation of project management and empower project professionals to lead the AI transformations of their own organizations.

Hence, PMI is sharing our new ***AI Essentials for Project Professionals*** guide. Within these pages, you will learn the fundamentals of AI, the building blocks for a robust understanding of this powerful and disruptive new technology.

What is AI and how does it work? What are the key applications of AI? What terms do I need to know? How can I best use AI to communicate, coordinate, decide, and excel?

These lessons have been developed and vetted by a global community of experts and experienced practitioners who are applying their vast knowledge to benefit the project management profession. They answer the critical questions that will equip you to learn, grow, and lead as you leverage the latest AI platforms and tools.

Think of this guide as an "AI 101" for project managers and then leverage other PMI resources—our online courses, our thought leadership reports, and our PMI Infinity™ AI copilot—to take your AI experience to the next level.

Now is the time to take charge. Learn. Grow. Lead.
PMI is here to guide and support you along
your journey.

Pierre Le Manh, PMP
President and CEO, PMI

Introduction

The advent of AI, and most recently, the use of generative AI (GenAI) applications, is ushering in an era of unprecedented change, often referred to as the Exponential Age. It is increasing the technological change rate and resolving the workforce issues produced by those advancements. This transformation brings with it a myriad of unknowns and challenges, and project professionals are poised to play a pivotal role as both organizational leaders and agents of change.

How the project practitioner works—and the tools they work with—will change in this Exponential Age. With the advent of AI, professionals will recast how they perform their jobs and help their organizations navigate change in their respective functional areas.

This guide intends to provide a broad, general view for understanding AI from the context of the project professional, and some key uses of AI that are applicable to their daily tasks. A companion guide will explore other facets of AI to help project practitioners solve challenges they face in their roles and with the organizational adoption of AI.

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What Is AI?

Improvements in information technology have had a profound impact on the modern workforce. The job description of a salesperson, accountant, or project manager has not changed much from when Gordon E. Moore, cofounder of Intel, first observed that computing technology would roughly double in speed and capability for the same cost every 18 months.[1] However, the performance of those jobs has changed significantly and will continue to do so. The modern worker has a need to:

- Manage greater amounts of quickly evolving data and information;
- Have a greater level of productivity and ROI; and
- Extract greater value from the vast amounts of data being created.

Artificial intelligence (AI), the notion of machines that can be imbued with the same cognitive abilities as people, is one solution to the issues listed above.

The idea of thinking machines has been with us since the early 1900s. The term artificial intelligence was first used by John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon in 1955 to propose the Dartmouth Summer Research Project on Artificial Intelligence. They described the original concept of AI as "every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it."[2]

While the Dartmouth conference aimed to define artificial intelligence, there is currently no commonly and widely accepted definition of AI. As such, from that 10-day gathering and its original definition, the definition of AI has expanded to encompass a variety of concepts around intelligent machines. We are now in a moment when the reality of AI is closer than ever to the world's potential for it.

As our technological capabilities increase, AI's scope will also increase. This broad scope and constantly evolving capability have made providing a standard definition of AI difficult.

For this guide's purposes, we will define AI as a ***machine behavior and function that exhibits human intelligence and behavior***. We can more narrowly define AI as the ability of machines to:

- Perceive and understand their surroundings;
- Learn from teaching, training, and its own experiences;
- Make decisions based on stored memories and thought processes;
- Have natural conversations and linguistic communication with humans; and
- Develop "intuition" in situations that are vague and imprecise.

Key Elements of AI

There are three key elements of AI: perception, prediction, and planning.

- **Perception.** The ability to understand the environment and process the data that the environment provides.
- **Prediction.** Enabling a machine to recognize patterns and use that recognition to predict future events. The AI's overall performance can be improved by continuously observing iterations within the patterns—and learning from those iterations.
- **Planning.** Use what was perceived and the lessons from pattern observation to make decisions and develop plans.

For the project professional, these elements will change the various aspects of project management, including planning, determining outcomes for success, monitoring, and allocating resources.

Types of AI

AI can be categorized by its application and the underlying technology it uses.

AI Focused on Narrow Versus General Applications

There are two types of AI based on capabilities: narrow or weak AI and general or strong AI (sometimes called artificial general intelligence [AGI]).

Narrow AI

Narrow AI systems are designed to use various AI technologies to perform specific tasks such as conversational chatbots, predictive analytics, repetitive tasks, or facial recognition. Because their scope is limited, these systems are not meant—or able—to be applied to other tasks. All current implementations of AI in use today fall under the narrow AI type.

For project professionals, processes such as planning, cost management, project monitoring, and communication can all be enhanced and made more efficient through the implementation of an AI system.

Artificial General Intelligence

This type of AI is enabled with cognitive capabilities and mental dexterity that mimic those attributes in humans. These systems could generalize knowledge across domains, plan for future events based on their knowledge and experience, and adapt to changes. We have yet to build anything close to the capabilities of artificial general intelligence systems.

For project professionals, processes such as planning, cost management, project monitoring, and communication can all be enhanced and made more efficient through the implementation of an AI system.

Technology Underpinnings of AI

For AI systems to provide the capabilities of the key elements of AI, we utilize a variety of technologies relevant to the task they are required to perform.

Machine Learning

The ability to learn is key to exhibiting intelligence. Machine learning (ML) is the set of methods and processes that enable computer systems to learn patterns. These patterns come from stored data and are analyzed using different formulas called ML algorithms. The algorithms encode learning from training data into ML models, representing what the machine has learned from the data for a particular task.

There are various methods to enable a machine to learn:

- **Supervised learning.** Algorithms can learn by being trained from examples of data. Email filtering is a good example of supervised learning. The ML algorithm is trained with a data set containing both spam and legitimate email. The algorithm learns patterns to distinguish between spam and legitimate email using the email metadata, sender, subject, body, and other components. Once trained, it can be implemented in an email app to filter spam emails.
- **Unsupervised learning.** Algorithms are provided with unlabeled data, and hidden patterns or data groupings are discovered without human intervention. Image and video analysis is an example of unsupervised learning.
- **Reinforcement learning.** Machines can also learn through trial-and-error approaches. Autonomous driving algorithms use reinforcement learning to improve their capabilities.

Neural Networks

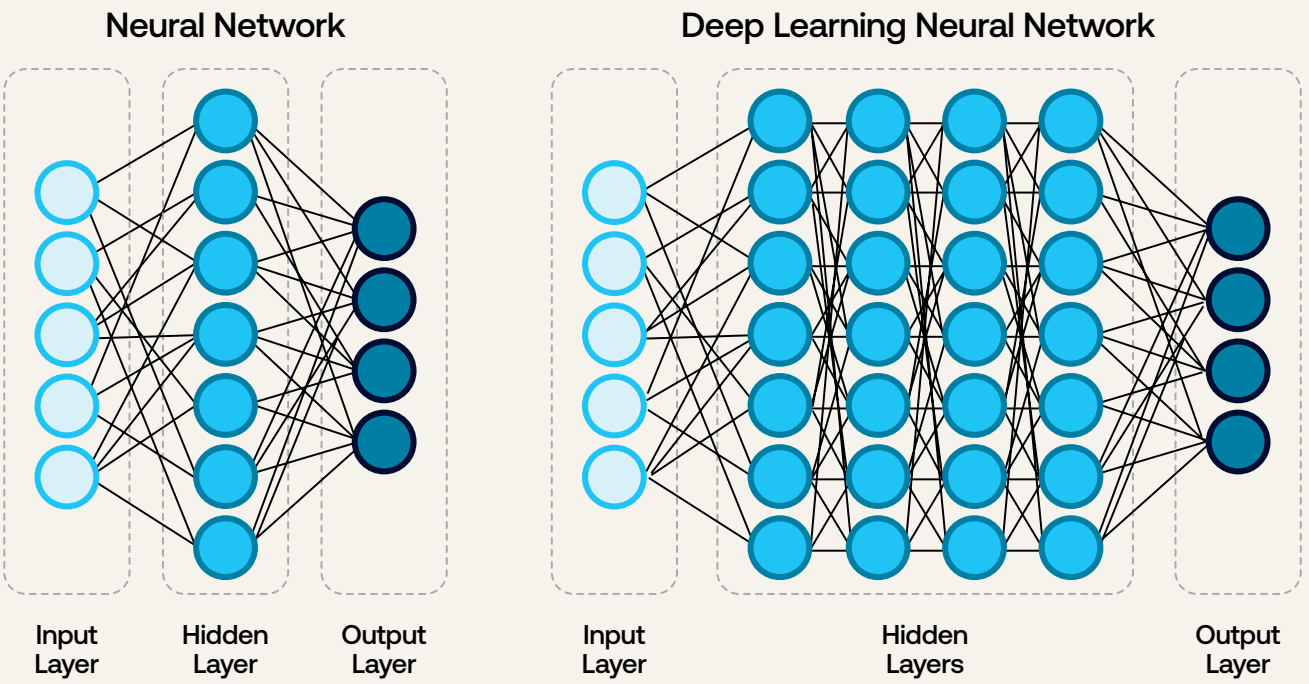
Our brains use neurons to connect the inputs from our senses and what we've learned. These connections enable humans to learn new skills based on their existing skill sets. Following this neural model, AI researchers created an ML algorithm called neural networks that can simulate how the brain works to encode learning.

With neural networks, machines learn using a set of connected artificial neurons; they input information, analyze it, and produce an output. Over time these networks quickly learn patterns.

Deep Learning

One of the challenges with neural networks is that they require a lot of data and computing to work efficiently. The more neural layers in the network, the more efficient and powerful it can be. The trade-off for this increase is that the network becomes challenging to manage and difficult to scale.

With the advent of big data and specialized graphics processing units (GPUs), we can create neural networks with many layers of artificial neurons to enable more complicated learning. This use of many layers of interconnected artificial neurons in a neural network is known as deep learning. Its name comes from the many artificial neuron layers. Deep learning neural network approaches to ML have proven successful at recognizing images, natural language processing (NLP), and other applications (see Figure 1).



Source: Cognilytica

Figure 1. Neural Networks and Deep Learning

Natural Language Processing and Generation

The advancement of deep learning and other approaches to ML have furthered our understanding and processing of speech and natural language. The result is a wide range of NLP applications that can unlock the power of spoken conversation and the written word. These applications not only can understand spoken and written words, but can also formulate those words into sentences and summarize volumes of content. Natural language generation (NLG) allows computers to communicate with humans in a conversational flow.

Applying NLP and NLG can enable the communication capabilities of chatbots, conversational interfaces, and a wide range of applications, which can unlock the power of unstructured information and spoken content in unprecedented ways.

Computer Vision

Computers have long had the capability to capture and store images and visual information. However, the challenge of being able to identify what is in those images is particularly complicated. The brain has a whole area of interconnected neurons and biochemical pathways dedicated to decoding the meaning of the electrical impulses from the retina, where humans perceive light and images. For a long time, getting accurate image recognition was a computationally difficult task. Developers and researchers found it challenging to program a way to classify images or identify faces in different positions, lighting situations, and expressions. Then, deep learning came and changed everything.

> *The use cases for computer vision capabilities are enormous, ranging from reducing costs and ensuring accuracy in construction and renovation projects to managing project assets.*

Using deep learning neural networks with large quantities of training data gives new meaning to computer vision, allowing systems to accurately identify and classify images, recognize faces, and detect specific objects inside images or videos. The use cases for computer vision capabilities are enormous, ranging from reducing costs and ensuring accuracy in construction and renovation projects to managing project assets.

Augmented Intelligence

Augmented Intelligence is the idea of machines and humans working together to enhance, rather than replace, humans for tasks. The term *augmented intelligence* provides a way to differentiate the goals of helping humans with AI technology from those AI approaches meant to operate independently of humans.

This approach is about enhancing the quality and scope of project management tasks, enabling managers to tackle more intricate challenges that require a deep understanding of business dynamics and project interdependencies. By utilizing augmented intelligence, businesses and organizations can do more with the people they already have. Consider augmented intelligence as assistive devices that can help humans perform tasks that might have previously been too difficult, dangerous, expensive, or tedious.

By combining AI's efficiency, scalability, and data-processing capabilities with the creativity, emotional intelligence, and ethical judgment of human professionals, organizations can create exceptional and human-centric customer experiences that resonate with their customers on a deeper level (see Table 1).

Table 1. Augmented Intelligence—The Balance Between Humans and Machines

	Humans	Machines
Strengths	• Intuition • Emotional intelligence • Common sense • Creativity • Learning adaptability	• Probabilistic thinking • Dealing with large volumes of information • Trainability and following instructions • Lack of selfish motivations
Weaknesses	• Probabilistic thinking • Dealing with large volumes of information • Bias • Responding reliably to training and instructions	• Intuition • Emotional intelligence • Common sense • Creativity • Bias • Hard to adapt learning to different situations • Dependence on quality of training data

Automation Versus Intelligence

Missing from the above technologies is automation. Automation does not equal intelligence. Automation is the act of repetition. It does not require intelligence and is mostly focused on handling the same inputs and producing the same outputs. Intelligence, on the other hand, is about handling variability.

We defined artificial intelligence as having three aspects: the ability to perceive, predict, and plan. An automated system does none of these; it simply follows the coded instructions given to it.

As an example, a company has an automated system that categorizes incoming customer issues. Based on keywords within the issue submission, the customer is either directed to a live customer support person or flagged for an automated email response. The automated response does not immediately resolve the customer issue but simply provides instructions on how to escalate the issue. This response system is automated but not intelligent.

Without adding additional human resources, management wants to find a means to resolve all customer issues within a shorter timeframe and without escalation. This requires introducing a level of intelligence into the existing system so issues not routed to a live support person can be resolved. By implementing an AI system, specifically NLP, the issue can be interpreted and a solution implemented.

To determine if a system is automated or intelligent, ask these questions:

- Is there any machine learning in the system?
- Can the system improve over time and with experience?
- Can the system determine the next steps and avoid exceptions without human intervention?

If not, the system is not intelligent.

Applications of AI

Having a broad understanding of how AI functions can be helpful, but for project professionals to capitalize on the benefits of AI it's important to have an overview of how it can be applied. These applications, called patterns, broadly define how AI can be used for project management tasks. Understanding them can help lead to greater efficiency and improved results when utilizing AI.

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Goals of AI in the Exponential Age

A technology or product's goals are typically determined by the intended audience's needs. The intended audience of AI is humanity itself, which can create a large set of potential goals. As AI has evolved, the community behind its growth and its end users have helped to define the goals. We look to AI to solve problems, automate tasks, and augment human shortcomings. A short but not exclusive list of AI goals is to:

- **Solve** complex problems;
- **Automate** and streamline operations with intelligent capabilities;
- **Utilize** data and intelligence continuous improvement;
- **Interact** with people using natural language conversation;
- **Replicate** human expertise; and
- **Foster** human–AI collaboration.

AI is not a new technology. The concept has been around since the early 1900s and different types of AI have been implemented since the 1960s. It has always been restrained by limited computational power and storage. Enter Moore's Law. As we began this century, we saw vast improvements in computing power and data storage, sometimes surpassing our current needs.

Artificial intelligence can help by providing a combination of intelligence, automation, creation, and prediction to make our lives easier and more fulfilled.

As the saying goes, solve a problem, create a problem. As computing power and data storage have increased, so have our technology demands. Customers expect near-instantaneous results, from next-day delivery of a product ordered online to immediate retrieval of bank statements. Businesses are awash in data that can only be useful if correctly analyzed, displayed, and integrated into their strategies. Corporations want workers to be more productive and achieve company goals on faster timelines. Researchers need assistance interpreting their discoveries as we delve further into the cosmos and the quantum. People want entertainment and news tailored to their likes; to connect through video with friends, family, and coworkers; directions to their destinations mapped; and so much more from this Exponential Age.

Artificial intelligence can help address these needs by providing a combination of intelligence, automation, creation, and prediction to make our lives easier and more fulfilled.

AI Patterns

Not all applications of AI are the same. In fact, there are seven primary ways in which AI systems are applied to the various application areas to solve the above challenges. From automated driving to facial recognition to data analytics, each AI project, at its core, can fit into an AI pattern. In 2019, researchers from Cognilytica categorized AI projects into seven specific patterns[3] (see Figure 2).

Figure 2. The Seven Patterns of AI

Autonomous Systems

Autonomous systems are physical and virtual software and hardware systems that can accomplish a task, reach a goal, interact with their surroundings, and achieve an objective with minimal human involvement. The goal of autonomous systems is to streamline processes with as little human interaction as possible. The autonomous system pattern requires ML capability that can independently perceive the outside world, predict future behavior of external elements, and plan how to deal with those changes.

Obvious applications of this pattern include autonomous machines and vehicles of all sorts, including cars, boats, trains, and airplanes. However, this pattern also includes autonomous systems like autonomous documentation and knowledge generation and autonomous business processes. These include systems that can operate near to how humans behave, including preferential decision-making.

Conversation and Human Interaction

The conversational/human interaction pattern is defined as machines and humans interacting in conversational ways. The interactive content can be created in various formats such as voice, text, and image. The pattern includes machine to human, human to machine, and human and machine. It can also be used to facilitate human-to-human interaction through translation features. This pattern enables machines to interact with humans the same way they interact with one another.

Examples of this pattern include chatbots; voice assistants; and sentiment, mood, and intent analysis. The objective is to understand the intent behind human interactions. Many businesses employ a chatbot on their website to engage customers as a frontline customer service option and to reduce customer support costs.

Goal-Driven Systems

Machines have proven particularly adept at learning game rules and beating human players. The key to this success is to provide the AI system with a goal or objective to achieve. Through the power of reinforcement learning and much more advanced computation capabilities, machines have learned and won games such as chess, checkers, and go; multiplayer games such as *Defense of the Ancients (Dota)*; and more complicated games. The goal-driven system pattern works under the theory that computers can learn anything through goals. Examples of the pattern can include game playing, resource optimization, iterative problem-solving, and bidding and real-time auctions.

With the power of goal-driven patterns, organizations can enable their systems to find, through trial and error, the optimal solution to a problem.

With the power of goal-driven patterns, organizations can enable their systems to find, through trial and error, the optimal solution to a problem. In 2022, scientists at Google's DeepMind division created AlphaFold, an AI system that can predict how every known protein can be folded into its three-dimensional (3D) shape. This problem was a long-standing blocker for biological research and Google's work has now opened the way for many biological discoveries.[4]

Hyper-Personalization

The hyper-personalization pattern creates systems that cater to the individual. The pattern is defined as using ML to develop a profile of each individual and having that profile learn and adapt over time for various purposes, including displaying relevant content, recommending products, providing personalized recommendations, and other services. The goal of this pattern is to personalize services for everyone.

Netflix utilizes this pattern in the user's dashboard, recommending shows that match the genre and type of previously watched shows. Artificial intelligence helps filter Netflix's catalog to present the appropriate choices to each user. The pattern is also used in other industries such as finance, healthcare, and personalized fitness.

As another example, in the United States, creditworthiness is determined by your FICO score. This system categorizes a wide range of individuals into a tier of creditworthiness despite their individual differences in saving and payment habits. AI, through the hyper-personalization pattern, can be used to create a process that more accurately determines an applicant's credit categorization.

Pattern and Anomaly Detection

Machine learning has become particularly adept at identifying patterns and finding anomalies or outliers in data and processes. The pattern and anomaly detection pattern is an approach to AI projects that has seen increasing adoption. The goal of this pattern is to use ML and other cognitive approaches to review patterns in data sets and the higher-order connections between data points.

This analysis can determine whether the pattern is an outlier or an anomaly from existing patterns. This AI service aims to find what fits with existing data and what doesn't.

Typical applications of this pattern are in fraud and risk detection, minimizing and fixing human mistakes, or in a predictive manner to suggest words to speed up the writing process. The last example is one many people will be familiar with, from Grammarly's writing assistant product to Apple's autocomplete capability on iPhones.

> *Machine learning has become particularly adept at identifying patterns and finding anomalies or outliers in data and processes.*

Predictive Analytics

The predictive analytics pattern uses ML and other cognitive approaches to understand how past or existing behaviors can determine the probability of a future outcome or provide predictive analysis to help in the decision-making process. The objective of this pattern is to help humans or processes make better decisions.

This pattern's uses include:

- Assisted search and retrieval;
- Predicting some future value for data;
- Predicting behavior;
- Predicting failure;
- Assisted problem resolution;
- Identifying and selecting best fit;
- Identifying matches in data; and
- Optimization activities.

The predictive analytics pattern helps to make better decisions by utilizing ML to provide augmented intelligence capabilities.

For example, the ad slots on a web page, such as *The New York Times,* are auctioned off each time the page loads. Ad tech companies have created predictive analysis services to determine the optimal bid price to win the auction for an ad slot.

Recognition

A major advancement in ML is using deep learning to improve the accuracy of recognition-related tasks. The recognition pattern utilizes ML and other cognitive approaches to distinguish different images, video, audio, and objects, including classifying and identifying objects. The pattern determines and classifies objects and identifies an object within an image, video, audio, text, or other unstructured data. The objective of this pattern is to have machines identify and recognize things.

Examples include image and object recognition, facial recognition, audio and sound recognition, handwriting and text recognition, and gesture detection. This pattern has been well developed and is widely used. Many people are familiar with this pattern through the facial recognition feature that unlocks mobile phones and other devices. Google employs the feature to isolate items in an image and search the internet for that item's best shopping price.

Utilizing the Seven Patterns for AI Project Success

These patterns can be implemented individually to help organizations with everything from business strategy to customer retention. However, the chances of success are heightened when an organization combines one or more of the patterns.

Assessing these patterns will help organizations better approach, plan, and execute their AI projects. Emerging methodologies are focusing on the use of these seven patterns to expedite AI project planning and execution. For example, knowing that you're utilizing a recognition pattern can expedite the planning process. Planning teams can strategize on:

- Solutions that have been applied to that problem;
- Data required to power the pattern;
- Use cases to explain the problem and solution; and
- Algorithm and model development tips.

Categories of AI

As AI evolves and branches into diverse types that transform the interactions among machines, humans, and data, two distinct categories have arisen. In broad terms, these categories are dependent on the output from the AI models employed. Is AI being used in a creative or generative process or an analytical or predictive one?

At times, these categorical distinctions can be blurred. Is autocorrect generative or predictive? The same question applies to a process that predicts sales for a period and then outputs those predictions in a report.

These categories help us—the humans in the AI equation—to understand the overall goal of a process and determine if its end result is a success or failure.

Generative AI

Generative AI (GenAI) represents a specific, vital application subset within the broader domain of AI, focusing on the creation of new content. Generative AI is the application of ML techniques to the creation of new data based on learned patterns. The most popular GenAI solutions in the market are large language models (LLMs) trained on a huge amount of internet data.

The generative models are usually specific to the kind of thing you want to generate. Text generators are optimized for text and can't really generate images. Image generators are optimized for images and can't really generate text.

Prompts are natural language instructions for an LLM provided by a human so that the AI will deliver the desired results.

GenAI Foundation Models

Foundation models are large, pretrained models focused on a general domain such as language or computer vision. These foundation models have changed how data scientists approach ML development. Rather than build an AI system from scratch, they can utilize a foundation model as a starting base, reducing up-front time and costs.

These models must be very large to address a wide range of tasks. They are pretrained using a massive amount of unlabeled and generalized data and can perform multiple tasks like NLP, answering questions, or generating images. Compared to the singular focus of a standard ML model, foundation models' adaptability and ability to get a project started quickly make them attractive for various projects.

Training these huge foundational models requires enormous computing power and carefully curated training data sets. Once trained, they can be adapted or fine-tuned for more specialized tasks through additional training on relevant data. They are adaptable through prompting to generate different required responses.

Foundation models can be used for a single task or combined with the output from multiple models. They can also be refined for specific applications or enhanced with databases to customize them for an organization's content.

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Large Language Models

Large language models (LLMs) are trained foundation models—a deep learning neural network model configured to generate human-understandable text from human-provided prompts. They use large data sets to understand, summarize, generate, and predict new content.

Large language models leverage transformer models. These models track the relationships in sequential data, like a sentence, to learn the data's order and meaning. These models have proven especially powerful for NLP applications and image generation. They are also versatile and proving to be helpful for a variety of processes, including:

- Content and text generation;
- Text summarization and translation;
- Searches and information retrieval;
- Questions and answers on documents;
- Classification and categorization of content;
- Code generation; and
- Art generation.

Generative Pretrained Transformer Models

Generative pretrained transformer (GPT) models are foundational models that utilize neural network ML models to transform input prompts into text, image, audio, or other types of content. Transformer models are quickly becoming the preferred model for a wide range of applications that require transforming one sequence into another. The GPT models can be used to transform a text sequence, such as a prompt, into another text sequence or a text prompt into an image.

Models like ChatGPT from OpenAI, Copilot from Microsoft, or Llama from Meta are powerful LLMs driving many current AI applications.

How GenAI Works

GenAI models are a type of deep learning neural network. The underlying ML model outputs the data that users want to generate. The most popular GenAI solutions in the market are powered by LLMs. These models are trained on a massive amount of data sourced from the internet. This process is known as pretraining. This data enables the AI to understand the nuances of the text. These pretrained, big, neural network AI models can use their patterns to generate new text, images, or other content. Using natural language prompts, users can generate these outputs without having to do any coding or building of specialized models.

Figure 3 shows the relationship among all of the different technologies needed to make these GPT systems work.

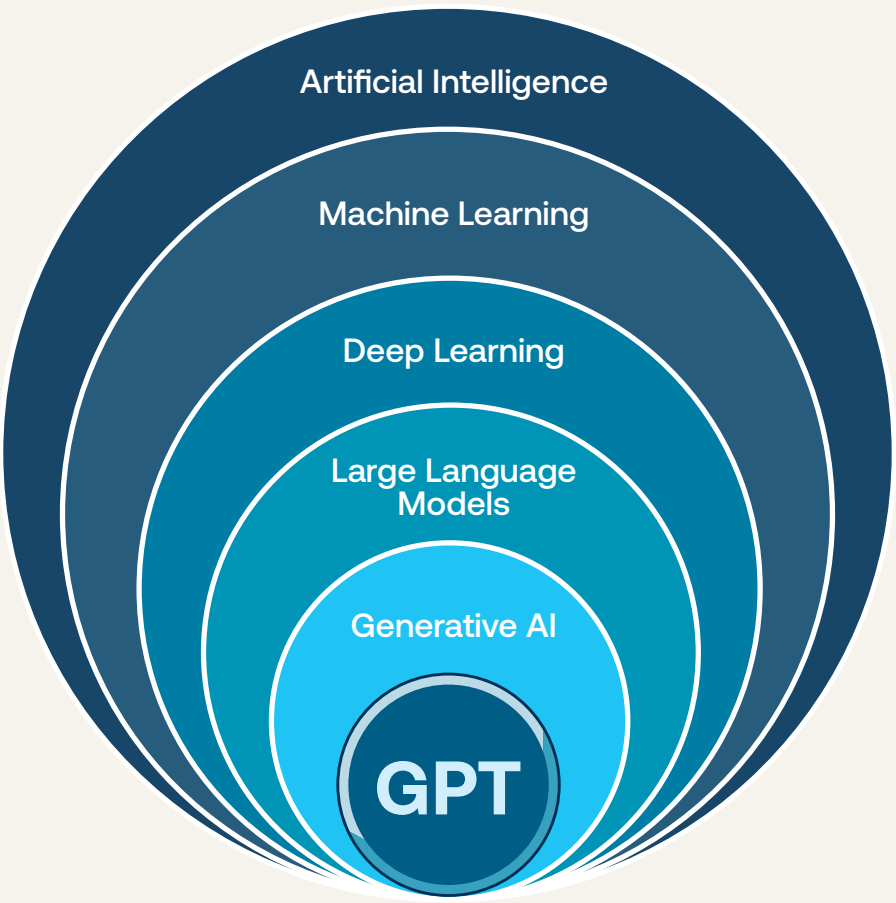

Figure 3. The Relationship Among the Technologies Needed to Make GPTs Work

Prompts and Prompt Engineering

A GenAI system can be a useful tool for assisting or augmenting the needs of project professionals. Its value, however, can only be realized through the instructions provided to it. These instructions, called prompts, supply the system with context and guidance as well as constraints to the responses they provide. Prompts can help format and personalize the responses as well as make interactions with AI systems more efficient.

What Is a Prompt?

A prompt is a request a user submits to a GenAI system to perform a task. If you have used ChatGPT, then you have written a prompt. A GenAI system is powered by LLMs that enable the AI to analyze massive amounts of data and output detailed responses.

Having such a deep breadth of content to draw from can be both beneficial and detrimental for a GenAI system. It is beneficial as the system can provide an answer, even with a single-word prompt. It is detrimental because of the vastness of its training data; the less specific a prompt, the more likely the results will be vague or unhelpful.

As an example, this prompt: "I am a project manager and I need help with planning my project" is too vague to generate any helpful response.

Changing the prompt to be more specific, such as "I am a project manager and am in the planning phase of my project. I don't know which project management approach to use. What are the key considerations for selecting one?" will enable the AI system to generate a more detailed response.

The ability to input specific requests is one of the keys to optimizing an AI system. With practice and some simple guidelines, good prompt writing can become second nature. The following points should be considered when formatting a prompt:[5]

Organizations have begun to realize that good inputs are just as critical as the underlying ML and data within an AI system. Companies are training staff on the proper way to write a prompt and a new role has emerged related to AI: the prompt engineer.

- **Use a "diverge and converge" approach.** Start with a broad, open-ended question to utilize the GenAI tool for its exploration capabilities. Once the tool provides a general framework, converge on each element. Use the following steps to generate more effective answers. Project teams can also design a sequence of prompts to address distinct outputs and objectives.
- **Provide more context than you would to a human.** Detail the problem or question well, and be specific about things such as industry, region, type of project, and the task. Outline the project's background, describe the person using the GenAI tool (like a project manager), and say how and where the answer will be used. The granularity of the input will be directly proportional to the utility of the output received.
- **Give examples.** Embed specific examples in the input text to aid the LLM in understanding the desired output format or preferred answer. It can be something as simple as: "Use this as an example." This proves especially beneficial for tasks demanding a particular structure or format, like generating code or crafting specific types of text. As OpenAI says in its GPT-4 guide:[6] "The less the model has to guess at what you want, the more likely you'll get it."
- **Make it a conversation, not a command.** Per the OpenAI GPT-4 guide: "These models can't read your mind. If outputs are too long, ask for brief replies. If outputs are too simple, ask for expert-level writing. If you dislike the format, demonstrate the format you'd like to see." Interact with the LLM like it's an intern who needs constant instructions. Note what types of prompts give the best results and refine the input accordingly.
- **Incorporate a "reliability check."** Include a request for references and sources in the ask. Even though some LLMs don't browse the web in real time, this can still prompt them to provide the name of a source that can be verified via a simple online search. It also prompts the model to assess the output as a "sanity check" and helps ensure that the generated content aligns with the desired accuracy and reliability standards.[7]

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What Is Prompt Engineering?

Consider this scenario: An investment bank that employs tens of thousands of wealth managers wants to utilize a GenAI system to help them find information in the large number of annual reports and earnings-call transcripts they need to review. The company provides training for wealth managers in writing good prompts. They also hire prompt engineers, specialists that can help fine-tune the underlying LLMs with specific prompts and recommended responses.

In essence, prompt engineers help train the ML system on not just the industry-specific language, but also the nuances and intent of a query. This process helps calibrate the AI system to provide optimized response quality and reduce bias and hallucinations.

For example, in the scenario above, a wealth manager might prompt the AI chatbot with: "Summarize company XYZ's most recent annual report." Within the code for this application there could be an engineered prompt that is more specific and replaces any generalized summary request with: "Summarize the key performance metrics of company XYZ's most recent annual report, including sections for revenue, net incomes, and earnings per share."

By combining prompt training for the end users to create specific prompts and incorporating prompt engineering to help train and adjust the LLMs, an organization can optimize its use of AI to get the most efficiency and productivity from it.

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Limitations and Challenges of GenAI

The quality of outputs from GenAI systems is remarkable. Again, we can see Moore's Law in effect. The pace of AI improvements keeps accelerating and the capabilities of the models to be customized for a wide range of tasks is increasing. Despite its growth and recent success, GenAI still has limitations and challenges. From a functional point of view, AI can pose issues for organizations due to:

- **High degree of variability.** GenAI systems are meant to create new outputs from inputs. Despite advances in this area, there will always be an element of variability in the output. A GenAI system will not produce the same, consistent output each time. For example, GenAI systems struggle with basic math calculations and with spelling text correctly in images.
- **Incorrect outputs.** When a GenAI system provides an incorrect output, it is known as a hallucination. These models are trained on data, but if the data are incorrect or incomplete, the model can learn incorrect patterns and produce a hallucination. GenAI models don't understand what they are generating; they simply follow a series of commands to output something. More advanced LLMs have some processes that could help catch falsehoods in the data, but all GenAI models are susceptible to hallucinations.
- **Informational and data biases.** GenAI is susceptible to biases and stereotypes that usually arise from the data it is trained on. This can, in turn, reinforce biases and stereotypes within the model and generate results based on these biases. There are also concerns regarding moral and ethical issues in both the inputs and outputs. Developing guidelines and safeguards is crucial as this key application of AI advances and becomes more accessible.
- **Misappropriation of intellectual property.** GenAI is trained on data from many sources, including protected intellectual property (IP). GenAI results can include protected IP without permission or proper citations.
- **Potentially inappropriate responses.** GenAI systems can generate text, images, and other formats that could be inappropriate such as not-suitable-for-work (NSFW) content, images or depictions of violence or gore, and hate imagery. Popular GenAI models are increasing their use of moderation filters to ensure the outputs are not inappropriate. However, open-source models might not have those restrictions, posing problems for text and image generation.
- **Leaking confidential and private data.** Public models such as ChatGPT don't necessarily guarantee the privacy or confidentiality of data submitted to their systems. A session's chat history is stored and might be used for

additional training data. Be cautious when entering proprietary or personally identifiable information (PII) into any GPT system.

- **Security vulnerabilities.** LLM systems embedded in third-party applications could be open to malicious text prompts that cause the models to do things or respond in ways they shouldn't. Prompt-injection attacks can get the LLM system to reveal proprietary or private data used for the system, including data used to fine-tune the model.

> *The process of organizational learning through GenAI is challenging and necessitates a symbiotic relationship between humans and machines.*

In addition to functional issues, GenAI can present challenges from an operational perspective. The process of organizational learning through GenAI is challenging and necessitates a symbiotic relationship between humans and machines, wherein both entities engage in continuous reciprocal learning. This interaction, when conducted properly over time and within suitable contexts, enhances the intelligence, relevance, and efficacy of both humans and machines. The essence of success in GenAI endeavors lies in the ability to facilitate this mutual learning. Project professionals should endeavor to learn new techniques such as prompt engineering for interacting with GenAI.

Keeping Humans in the Loop

While AI can significantly augment and enhance project management processes, it is unlikely to fully replace human project practitioners in the foreseeable future. Human oversight, judgment, and decision-making will still be crucial, particularly in complex or high-stakes projects. The project professional's experience and industry knowledge play crucial roles in interpreting AI outputs and integrating them into strategic planning and execution, ensuring that the insights and outputs provided by AI are aligned with the company's goals and market conditions.

The role of AI should be as a copilot to human thought to increase the power of data, and particularly in complex situations where the most important factor is the understanding of the situation, which can only be provided by a human. The "human in the loop" (HITL) is an essential element.

Implementing AI in project management ought to be met with a balanced approach of weighing both the innovative potential and the ethical responsibilities. The HITL is an essential aspect of the integration process and it is crucial that project professionals understand the level of involvement that is required to convert the output of a GenAI exercise into a usable artifact.

In addition, while GenAI outputs can mimic human-like language and communication, true empathy and emotional intelligence are still challenging for AI systems. Human customer service professionals can provide the emotional support, understanding, and genuine connection that customers often seek, especially in challenging or sensitive situations, in collaboration with GenAI via the human in the loop.

> *The role of AI should be as a copilot to human thought to increase the power of data.*

The adoption of AI should follow a gradual approach utilizing incremental and iterative testing. This helps ensure that stakeholders' expectations are managed, while also ensuring that the project team is not becoming overly dependent on the technology. Such measures will be adopted by organizations to enable team members to use AI effectively in decision-making.

Predictive AI

As its name implies, predictive AI is an AI system that makes predictions or recommendations. These models use historical data to forecast future events or to classify those events.

Predictive AI is a process to address problems such as:

- **Classification.** What is the probability of an event, such as a loan default, occurring?
- **Forecasting.** Determining the quantitative impact of events or attributes on one variable (for example, a home's value, which can be determined by its attributes, the age of the house, number of rooms, and local schools, but also events, local market fluctuations, Federal Reserve interest rates, and other factors).
- **Anomaly detection.** Identifying data points that are outside the range of standard data (for example, determining if an insurance claim is fraudulent).
- **Clustering.** Grouping data that share characteristics or qualities (for instance, placing a hospital's patient population into a category based on qualifying characteristics such as insurance provider, illness, or age).
- **Time series.** A subset of forecasting where the model attempts to predict an event over a time range (for example, growth in sales over the next three months or number of new clients over the next week).

How Predictive AI Works

As stated above, predictive AI uses historical data to predict future outcomes. The more data the system has access to, the more accurate its predictive capabilities will be. As with GenAI, predictive AI returns the best results with clean data. Removing the outliers, incomplete entries, and anomalies improves the results.

Predictive AI generally uses three types of techniques to perform its tasks:

- **Regression analysis.** Regression is a statistical analysis technique used to study the relationships among dependent and independent variables, such as a home's value, and the attributes and events they are dependent on.
- **Decision trees.** These classification models categorize data based on their different variables. They are called decision trees because the model resembles a tree, with each branch representing a selection option and the leaf representing the result of that selection. These models are best used when trying to understand and predict individual decisions.
- **Neural networks.** When there are complex predictive relationships, ML can utilize neural networks. Neural networks are adept at pattern recognition and determining nonlinear relationships and can also be used to validate the results of other techniques.

Benefits of Predictive AI

Predictive AI is a game-changing technology for organizations and corporations that can save time, increase revenue, and lower costs with its analytical powers. Some of the benefits of predictive AI are:

- **Adaptability.** With its ability to consume real-time data, predictive AI can adapt to changes to variables, whether they are occurring in the marketplace or a science lab.
- **Interpretability.** This feature is the extent to which humans can understand how the models work and observe the relationship information discovered by the model, either in the data or through its learning.
- **Simplification.** Predictive AI manages the complex task of running statistical and probability models and provides humans with explainable answers and decision suggestions.
- **Automation.** Automation is the ability to provide predictive analysis, either on a timed cadence or through an event trigger.

Predictive AI is a game-changing technology for organizations and corporations that can save time, increase revenue, and lower costs with its analytical powers.

Limitations of Predictive AI

Though predictive AI can be an asset to help a business or organization grow, understand its customers and clients, or determine courses of action, it does have limitations. Understanding these limiting factors can enable organizations to optimize their use of predictive AI while safeguarding their strategies from an overreliance on AI. Some of the limitations or dangers of predictive AI include:

- **Overreliance on historical data.** The investment world's axiom that past performance does not indicate future returns can be taken to heart here. An organization's historical data is an excellent starting point for predictive AI. That data should be continually augmented with real-time and external data sources.
- **Data bias.** If the underlying data are biased, the model's results may be inconsistent or wrong. To mitigate the chances of bias affecting the model's results, the data should be analyzed thoroughly before being input, and there should be model governance practices instituted to reduce the risk.
- **Lack of explainability.** The more complex a model, such as neural networks, the higher the likelihood it will be less transparent and more difficult to explain. Part of the success of an AI system is having business leaders understand how it functions and arrives at the predictions it delivers.
- **Prediction bias.** If a model receives too much or too generalized training, its results can be skewed. Customer-purchasing predictions that are accurate for the produce section of a grocery store may not translate to a footwear store.

Applying AI in Project Management

The first section of this guide provides an overview of AI. If you haven't already, please read it for a foundational understanding of AI technology. This second part covers a range of AI applications tailored to project management tasks. Through case studies, it illustrates successful AI implementations in various industries, demonstrating how AI-driven insights can lead to more informed decision-making and improved project performance.

This section focuses on determining where AI can be most beneficial in project implementations. By following the insights and strategies outlined in this guide, project practitioners will be well equipped to harness the power of AI, drive innovation, and achieve superior project results.

The Role of Project Professionals in AI Projects

As organizations increasingly adopt and integrate AI into their work, the roles of project professionals are crucial in navigating the unique challenges and considerations that come with these cutting-edge projects. Project practitioners will not only benefit from AI as an assistive or augmenting tool, but will also play an integral role in the implementation of AI.

- **Governance and ethical oversight.** Project professionals will play a vital role in establishing robust governance frameworks and ethical guidelines for AI projects. Project practitioners will help ensure that both the development and deployment of AI systems align with organizational values, regulatory requirements, and societal norms. This alignment includes addressing potential biases, privacy concerns, and the responsible use of AI.
- **Risk management.** All AI projects carry inherent risks such as the potential for unintended consequences, model instability, or misuse. Project professionals will be responsible for identifying, assessing, and mitigating these risks through comprehensive risk management strategies, contingency planning, and close collaboration with AI experts and stakeholders.
- **Cross-functional collaboration.** AI projects often require a diverse set of skills and expertise, including data scientists, AI researchers, domain experts, legal and ethical advisors, and more. Project practitioners will facilitate effective communication and collaboration among these cross-functional teams, ensuring alignment, knowledge sharing, and seamless integration of efforts.

As organizations increasingly adopt and integrate AI into their work, the roles of project professionals are crucial in navigating the unique challenges and considerations that come with these cutting-edge projects.

- **Change management.** The integration of AI systems may require significant changes to existing processes, workflows, and organizational culture. Project professionals will play a crucial role in managing these changes, addressing resistance, and ensuring a smooth transition by providing training, communication, and support to impacted stakeholders.
- **Performance monitoring and evaluation.** As AI systems are deployed and integrated into various applications, project practitioners will be responsible for monitoring their performance, evaluating their impact, and making necessary adjustments or refinements. This includes establishing metrics, collecting feedback, and continuously improving the AI systems.
- **Resource management.** AI projects often require specialized hardware, computing resources, and access to large data sets. Project practitioners will need to effectively manage and allocate these resources, ensuring optimal utilization and cost-effectiveness.
- **Continuous learning and adaptation.** The field of AI is rapidly evolving, with new breakthroughs and advancements happening regularly. Project professionals should stay current with the latest developments, foster a culture of continuous learning within their teams, and adapt project management plans and strategies as needed to leverage emerging technologies and best practices.

As AI technology becomes more prevalent, project management practitioners will play a pivotal role in ensuring the successful delivery of these complex projects, while balancing technical considerations with ethical and organizational priorities.

As AI technology becomes more prevalent, project management practitioners will play a pivotal role in ensuring the successful delivery of these complex projects, while balancing technical considerations with ethical and organizational priorities. Their leadership, communication skills, and ability to navigate cross-functional teams will be essential in unlocking the full potential of GenAI while mitigating risks and fostering responsible innovation.

How Can AI Best Enhance Project Management?

AI is best applied where there is a need for machines to provide automation, assistance, or augmentation of human abilities in key areas across the seven patterns of AI:

- **Autonomous systems.** Systems that can accomplish a task.
- **Conversation and human interaction.** Machines and humans interacting in conversational ways.
- **Hyper-personalization.** Catering to individual customers.
- **Goal-driven systems**. Enabling AI to learn through the attainment of goals.
- **Pattern and anomaly detection.** Finding anomalies or outliers in data and processes.
- **Predictive analytics**. Determining the probability of a future outcome.
- **Recognition**. Distinguishing different images, video, audio, and objects, including classifying and identifying objects.

For a detailed overview of each pattern, see the section on AI Patterns in the first half of this guide.

Figure 4 shows that AI systems are most efficient when used in an assisting or augmenting capacity. These systems are better at handling processes with a high degree of variability in inputs and outputs than repetitive tasks requiring high accuracy.

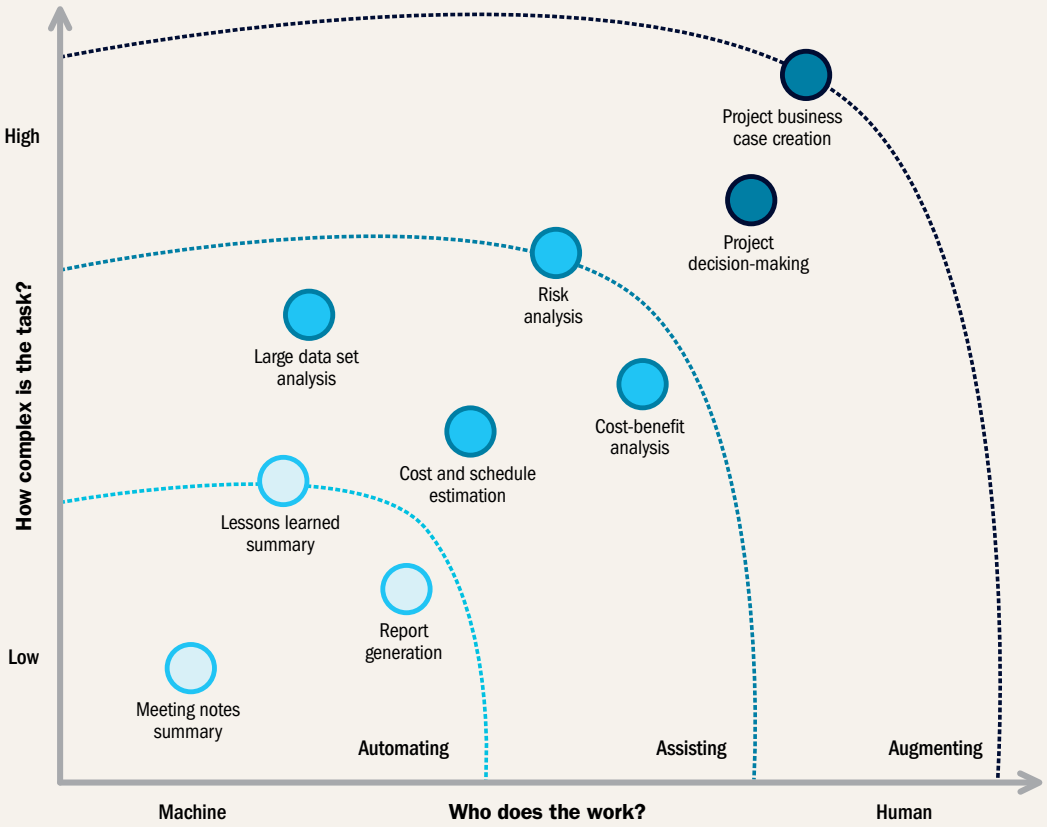

Figure 4. AI's Efficiency in Automating, Assisting, and Augmenting Processes

The next section will review how AI applications can perform or assist with various project management tasks, providing a starting point for any project practitioner to begin integrating AI into their routines.

As project practitioners begin to explore AI use for their own projects, a helpful resource is the PMI Prompt Engineering Exchange, which contains vetted prompts used by a community of project professionals.

AI in Project Management Planning

Every project has unique challenges and requirements and is performed by a specific team that has unique strengths and weaknesses. GenAI can analyze past and current organizational and project data to tailor project management approaches and methodologies to better suit the current project's needs and format a cohesive project management plan.

> *Artificial intelligence is an excellent fit for helping with project planning as it can quickly analyze vast amounts of data, predict future resource needs, and optimize schedules.*

A detailed project management plan can be the determining factor between a project's success and failure. A plan with well-defined requirements, roles, schedules, resource allocation, risk recognition, contingency actions, and dependency awareness can help ensure a project meets its objectives. Project planning is so important to project success that it has been noted as the primary function of project management.

Artificial intelligence is an excellent fit for helping with project planning as it can quickly analyze vast amounts of data, predict future resource needs, and optimize schedules. By applying AI, including GenAI, project management plans can be dynamically adjusted in real time, enhancing flexibility and accuracy and contributing to more efficient resource use and improved project outcomes. Some of the project planning tasks that AI can assist with or augment are:

- **Project prioritization.** When multiple projects are happening at once, it can be difficult to prioritize the work. Every stakeholder wants their project's work sent to the top of the list. AI can help prioritize work through data-driven analysis of return on investment and success potential. Using predictive analytics, an AI system can quickly provide a hierarchical list of project tasks based on the input criteria.
- **Risk identification and management.** Every project has some inherent risks, but identifying those risks and developing contingency plans is time-consuming and imperfect. AI can analyze historical project data and current project conditions in real time to predict potential risks and suggest mitigation strategies.
  - Example prompt: Generate a risk assessment report for the project: [Upload project management plan and historical project data]. Include a detailed analysis of identified risks, their potential impacts, and recommended mitigation strategies.

- **Resource allocation.** How many projects have started as simple ones, only to become more complex over time? The more complex the project becomes, the more difficult it is to plan for resource allocation. AI can create an analysis of the project needs, current capabilities, and potential dependency roadblocks to create an optimized resource management plan.
- **Scheduling.** The project team has allocated the resources; now they must create a schedule. This is easier said than done. What if the project has multiple teams across business units or incorporates shared resources? How do they account for dispersed teams and time zone differences? The automation pattern can create a schedule based on project milestone dates and resource availability.

  AI can create an analysis of the project needs, current capabilities, and potential dependency roadblocks to create an optimized resource management plan.

  - Example prompt: Generate a project schedule that accommodates the following multiple teams across different business units, ensuring no resource conflicts. [Provide team names and their availability and a list of shared resources, project milestones, and deadlines.]
- **Creating business use cases.** Business use cases help to understand a project's benefits or the step-by-step interactions between the product and clients. Use cases can be difficult to write and may require in-depth research. GenAI, with proper prompting, can help create business use cases for various personas.
  - Example prompt: Identify popular trends in the industry of [product or service] that an audience of [target audience] will be interested in this [upcoming season].
  - Example prompt: How would you create a case study for [client] that focuses on their last four years of growth in both products and employees? Include sections on challenges, solutions, and outcomes.
  - Example prompt: Create a case study of [client] and their partnership with [partner]. Include details on collaboration, processes, challenges, benefits for each party, and expected outcomes.
- **Vendor selection.** The selection process can be difficult when a project requires a third party to provide a work component. Research on the industry, pricing, competency, capacity, and other factors will be required. GenAI can assist in this process, from creating a checklist of required items from a vendor to quickly listing vendors, services, and prices.
  - Example prompt: As a project manager, you need to select a vendor for [activity]. There are two vendors currently in the running. Each of their proposals is attached. Provide a comparative analysis of the two vendors in table form.

AI in Decision-Making

Each project, at every stage, requires a multitude of decisions, from vendor and resource selection to budgets and timelines. Analyzing the factors involved can create delays at each decision-making inflection point.

An AI solution can help remove some of the delays and uncertainty in the decision-making process. By utilizing combinations of the autonomous system, predictive analytics, and pattern and anomaly detection patterns, the time spent on decision-making, from gathering to analyzing data, can be reduced. AI can contribute to better decisions to help improve the overall success of a project.

The integration of GenAI into the decision-making process requires evaluation of ethical and security concerns to make sure data are secure and unbiased, as this can give AI the credibility it needs. High-quality and robust data governance is key to the success of GenAI because performance is significantly influenced by the data used. GenAI should be explicitly defined in the decision-making process, and the institution should maintain transparency and develop directives to deal with bias as well as ethics.

- **Data-driven decision-making.** Project management involves handling vast amounts of data, including timelines, budgets, resources, and project outcomes. Having a lot of data can present problems with how they can be filtered, measured, and visualized to be useful in the project management decision-making process to make critical and strategic data-driven decisions. GenAI can analyze these data more efficiently than traditional methods, providing insights that might not be immediately apparent.
  - Example prompt: Generate a dashboard that visualizes key performance indicators (KPIs) such as project progress, resource utilization, budget adherence, and risk factors. [Upload relevant data.] Provide insights into areas needing attention.

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- **Automated testing.** Quality assurance is a key phase in the product life cycle, particularly for technical products. AI-driven quality automated testing significantly enhances quality assurance by using AI to analyze code, predict potential issues, and execute comprehensive test scenarios. AI can use historical data to generate and prioritize test cases, adapt to changes in the codebase, and provide real-time feedback.
- **Analyzing project trends.** To help ensure success, project practitioners analyze project trends to make informed decisions, track progress, and identify potential issues. These trends can often be found in historical data but can be difficult to identify within spreadsheets and reports. An AI service can filter through the data, find trends and anomalies, and provide an analysis and course of action for them.

AI in Project Monitoring

Project monitoring ensures a project is meeting milestones and deadlines. It assures the project manager, key stakeholders, and others that the project is progressing as planned. AI-assisted project monitoring can provide timed reports and overviews on the state of a project, enabling the monitoring process to be leaner and more efficient.

- **Project reports.** Reporting is essential for project professionals as it provides insights into a project's health and the actions necessary to keep it on track. It is a vital information flow for team members, key stakeholders, and executive staff. GenAI can automate tasks such as scheduling, generating reports, and updating project statuses that practitioners can then review for accuracy. This automation allows project professionals to focus on more strategic aspects of their projects, such as risk management and stakeholder engagement, thereby enhancing overall productivity. Project professionals can enhance their efficiency by automating the creation of reports with GenAI.
  - Example prompt: Create an executive summary for the project's monthly review. [Upload project progress data.] Highlight key achievements, budget status, resource utilization, and any critical risks.
- **Project tracking.** Project reports require detailed tracking of project data. The data can be momentous, such as when a milestone has been reached or a project component has progressed, like the number of remaining Jira tickets. These reports can take time to compile and may potentially be outdated by the time they are delivered. AI can track project data in real time to create live reports that reflect a project's actual status and progress.
- **Project health statistics.** The health of a project can be determined by reviewing key metrics such as schedule adherence, budget performance, resource allocation, risk assessment, scope management, and other data points.
  - Example prompt: Generate a dashboard that visualizes the overall health of the project. [Upload project data.] Include charts and graphs showing progress, budget status, resource allocation, and risk levels.

AI-assisted project monitoring can provide timed reports and overviews on the state of a project, enabling the monitoring process to be leaner and more efficient.

AI in Communication and Collaboration

Effective communication is crucial in project management. GenAI can facilitate improved communication by generating status updates, reports, and tailored messages to stakeholders. It can also translate technical jargon into simpler language, making information more accessible to all project stakeholders, thereby ensuring everyone involved in the project is working with the same information.

- **Automating communications.** One key to a successful project is providing the right information to the right people at the right time. Information synergy, ensuring all decision makers have the same data on which to make their decisions, is vital. With dispersed teams, having the ability to find the knowledge they need through trusted sources enhances productivity and saves time. AI systems are uniquely positioned to assist and augment the communications strategy of any project management team. They can run chatbots that enable users to get the information they need or automate the distribution of project data in real time.
- **Note-taking and dictation.** The business world can, at times, seem like an endless series of meetings, both on-site and virtual. One of the leading uses of AI has been meeting assistance, specifically taking meeting notes. Some of the benefits of allowing an AI meeting assistant to take the meeting minutes include:
  - **Transcription.** Through NLP, the AI can convert the meeting conversations into accurate text, eliminating the need for manual transcription.
  - **Organization.** Meeting assistants can categorize and tag notes to organize them.
  - **Search.** Using AI to create the meeting notes enables meeting summaries to become searchable within a notes archive.
  - **Integration.** Meeting notes can be integrated with other productivity tools and used as part of ML training.
- **Aggregating information.** Projects produce large amounts of information, and aggregating, organizing, and distributing it can be a time-consuming task. An AI system can aggregate and organize the information in real time and distribute it to the correct recipients on a cadenced or event-triggered schedule.
  - Example prompt: Collect and aggregate feedback from project stakeholders. [Upload feedback data.] Organize feedback by theme and priority and distribute a summary report to the project manager.
- **Automated to-do lists and reminders.** Task reminders are great for helping workers create a hierarchy of their work—if you can remember to create the reminder. AI can create task reminders on various event triggers such as milestone completion or ticket closures.

> *GenAI can facilitate improved communication by generating status updates, reports, and tailored messages to stakeholders.*

AI in Document Management

Every project has various documentation needs, from regulatory requirements to user guides. An AI system can monitor the current state of both required and added documentation and can even create needed content.

- **Identifying documentation needs.** Documentation is often overlooked until the near completion of a project, particularly in software development. Engineering teams, often burdened with tight capacities and deadlines, can struggle, even with a documentation team on hand, to create basic content or even determine what content to create. An AI model can review the code base or project details to decide what content is needed and, in some cases, generate the content.
- **Analyzing key insights from documentation.** Project documentation analytics is ripe with actionable data. Reviewing page views and search queries can indicate what features users value most and indicate where learning modules can be of value. A combination of views and document age can prioritize which content needs to be reviewed. This analysis takes time and resources. An AI assistant can gather the necessary metrics and provide a report with actionable items.
  - Example prompt: Analyze the page views of all project documentation over the past month. [Upload page view data.] Identify the most- and least-viewed documents and provide insights into user engagement.

AI in Cost Management

Keeping a project within its allocated budget is a prime responsibility for project professionals. There are countless stories of projects that have gone over budget or were shut down due to cost overflows—and the impact of a shutdown goes beyond the project. Pricewaterhouse-Coopers found that when a corporation announces a shutdown of a capital project, there is a correlating average reduction of 15% in share price.[8]

By using predictive analysis and pattern recognition, GenAI can help generate a first draft of a cost-benefit analysis that highlights potential returns and costs associated with a project.

AI can assist the project professional in monitoring project expenses through up-to-date financial data presented in spreadsheets and reports.

- **Budget optimization.** Allocating resources as efficiently and effectively as possible is a key goal of any project. A comprehensive budget analysis requires data about an organization's revenue, expenses, assets, and liabilities. These data will need to be combined with factors such as project budget, market trends, consumer behavior, competitors' efforts, and other information. Gathering this data can be time-consuming. Analyzing this information may require a specialist.

- Utilizing an AI system can streamline this task as well as provide project practitioners with detailed analysis such as identifying potential budget overruns, optimizing resource allocation, automating budget tracking, and other budget-related tasks.
    - Example prompt: A software development project has a US$100,000 budget and a timeline of six months. After three months, the actual cost (AC) is US$60,000 and the project is 50% complete. What are the risks of not completing the project on time and on budget? Am I over or under budget at this point? Am I behind or ahead of schedule? What is the earned value (EV), estimate to complete (ETC), and value-added control?
- **Cost-benefit analysis.** Determining whether a project is worth the cost can be daunting. From gathering the information to crunching through spreadsheets and reports, a cost-benefit analysis is not for the meek. By using predictive analysis and pattern recognition, GenAI can help generate a first draft of a cost-benefit analysis that highlights potential returns and costs associated with a project. AI can also utilize predictive analysis and pattern recognition to analyze financial data, project metrics, and market trends. With GenAI, organizations can create a more detailed cost-benefit analysis of a project that a project practitioner would then need to investigate deeper into the initial figures, considering various scenarios and integrating additional data points to ensure the analysis is thorough and accurate.

An AI system can make the cost-planning process more efficient by reviewing historical project costs and providing a predicted cost analysis for the proposed project.

- **Cost planning.** Every project needs a cost management plan to determine the project scope and what tasks can be accomplished within that scope. An AI system can make the cost planning process more efficient by reviewing historical project costs and providing a predicted cost analysis for the proposed project. It can also assist the project practitioner in listing the financial approval requirements, locating approved financial resources, and generating required financial documentation.
    - Example prompt: Compare the current project's cost management plan with historical projects of similar scope. [Upload historical cost data and current project cost management plan.] Highlight any significant differences and provide recommendations.

AI in Training and Development

GenAI can also play a crucial role in the training and development of project professionals and teams.

- **Scenario-based learning.** By providing simulations and scenario-based learning, GenAI can help project professionals improve their skills in a risk-free environment. This training can cover various aspects of project management, from stakeholder engagement to risk assessment, ensuring that project teams are better prepared for real-world challenges.
- **Project simulations.** Project management simulations can analyze current projects and serve as a training tool for project practitioners. In real-world projects, simulations can help reduce risks and optimize project management plans. AI can be utilized to create a model and simulate different scenarios using project data. The model can then be used to predict the outcomes of the different scenarios and provide the organization with information to make a data-driven decision.

Getting the Most From AI

Organizations often find themselves caught in the wave of the latest trend and invest in resources without thoroughly investigating if those resources are appropriate to support their business strategies. The use of AI throughout the business world is no exception to this rule.

AI is a formidable asset that can contribute to an organization's overall goals and success.

AI is a formidable asset that can contribute to an organization's overall goals and success. However, before implementing and integrating AI solutions, the KPIs and success criteria should be defined. Focus on the business problems first and the AI solutions second.

As a Project Professional

As a project professional, understanding how to effectively leverage AI within your projects is crucial. By aligning AI initiatives with clearly defined business objectives and KPIs, you can help ensure that your AI investments drive meaningful outcomes.

Think Big but Start Small

As the saying goes, success begets success. Starting with smaller, easier-to-manage implementations can save a company money and time as it ramps up its AI integration. An organization's first foray into AI should mimic the goal-driven system pattern, where trial and error eventually lead to learning and can provide a blueprint for scalable success.

- Take inventory of all your projects, including the latest status updates.
- Create a portfolio of use cases that will be impactful, measurable, and can quickly be implemented to provide an immediate solution.
- Utilize the seven patterns of AI outlined in this guide to help plan those use cases.
- Ensure your engineering staff has the capability to handle the data needs as well as the AI installation and support.
- Create cross-functional teams with the right mix of skills in subject expertise, business skills, analytics, engineering, and AI.

Focus on the Data

Regardless of the type of system installed or patterns utilized, data are required to get the most return on an AI investment. The more data an AI system can access, the better it can perform, particularly for predictive and comparative analyses.

One of the more important preimplementation tasks is conducting a data assessment and curation. AI systems still operate on the "garbage in, garbage out" axiom. Detailed, relevant, and focused historical data will enable a company's AI system to achieve more optimal results. The following tasks should be performed:

- Gather your data, including content in spreadsheets and reports;
- Clean the data by removing or correcting missing values, outliers, or inconsistencies;
- Format the data to make them compatible with ML algorithms; and
- Reduce the complexity of data without losing the information.

As an Organization

Utilizing AI as an organization requires a strategic approach to ensure successful integration and alignment with overall business goals. By carefully planning AI initiatives, organizations can harness the power of AI to drive innovation, improve efficiency, and achieve long-term success.

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Augmenting AI Systems to Get More Value

Many of the use cases and examples described in this guide can be used with off-the-shelf AI technology and public LLMs. However, there are situations when those off-the-shelf solutions can't be used as-is or at all, or there is an organizational need to get more from the off-the-shelf solution. In this case, project professionals should seek more sophisticated approaches to extract value from AI systems.

Retrieval-Augmented Generation

There will potentially be scenarios where organizations need more from their AI system than what was provided with the core implementation. When a project requires critical data, such as domain-specific accuracy, up-to-date information, and contextual relevance, the training data on which the LLMs have been built might not have the information needed. For example, in complex project management tasks requiring detailed knowledge from proprietary documents, historical project data, and industry-specific regulations, project practitioners need approaches that augment LLMs with domain-specific, proprietary, or other custom data.

Retrieval-augmented generation (RAG) is an approach that leverages a data repository of custom information that can be used to enhance the accuracy and relevance of generated content. When a query is presented in a RAG system, the AI first retrieves content from a database containing relevant data. This information is then used to inform and guide the generation process, producing responses that are contextually appropriate and factually accurate.

A RAG-augmented AI can dynamically retrieve and integrate specialized information to generate precise and contextually appropriate responses. In contrast, public LLMs, which rely on a static knowledge base up to their last training cut-off, may not provide the specificity or current data needed for these tasks.

Project professionals might find RAG particularly beneficial for several reasons:

- **Enhanced accuracy and relevance.** Unlike traditional prompt engineering, which relies on crafting specific prompts to elicit desired responses from a generative model, RAG ensures that responses are grounded in up-to-date and relevant information. This is crucial for project management, where accurate and contextually relevant information is essential for decision-making and planning.
- **Access to the latest information.** RAG models can integrate the newest information dynamically by retrieving the most current data available. This capability is especially valuable in fast-paced project environments where conditions and information change rapidly. Using RAG, project practitioners can ensure that the AI-generated insights and recommendations are based on the most recent and pertinent data.
- **Reduced need for extensive prompt engineering.** Crafting effective prompts for generative models can be time-consuming and requires a deep understanding of the model's behavior. RAG simplifies this process by relying more on retrieving relevant documents to inform responses, reducing the burden on project practitioners to develop and fine-tune complex prompts. This allows project professionals to focus more on strategic tasks than on the intricacies of prompt engineering.

Fine-Tuning AI

When the available AI models cannot provide the specific results needed and RAG solutions aren't applicable, organizations might need to tailor the models to fit their specific needs.

General-purpose LLMs are good for general-purpose NLP tasks. What if an organization needs them to provide specific responses for non-NLP applications or other specific requirements? LLMs generally don't work well out of the box for highly specific tasks since they are trained on general text data from the web.

For instance, if an LLM is to be used in a specialized industry, such as legal or medical fields, fine-tuning is necessary to ensure the model understands and accurately processes the industry's terminology and nuances. Similarly, when a model must adapt to specific organizational data or user preferences, refinement helps enhance its performance and relevance.

Prompt engineering and RAGs might not work well in some situations, including:

- AI assistance with highly technical, specific, or proprietary information;
- Tasks that require interaction with a very specific set of information;
- Training in languages that isn't well covered by the mode;
- Avoiding publicly available LLMs for cost or privacy/security reasons; and
- Increasing response time and speed.

When a model must adapt to specific organizational data or user preferences, refinement helps enhance its performance and relevance.

In these and other scenarios, LLMs can be tweaked to be better aligned with target applications, more accurate, and more context-aware about what NLP responses are needed.

Fine-tuning AI systems involves several steps, beginning with collecting and preparing a relevant data set. This data set should be representative of the specific tasks or domains where the AI will be applied. For LLMs, this might involve gathering domain-specific texts or user interactions that reflect the language and context the model needs to understand.

The model then undergoes a training process on this data set, adjusting the various model parameters to better align with the new information. Monitoring performance metrics during this process is crucial to avoid overfitting, where the model becomes too tailored to the fine-tuning data and loses its generalization.

Fine-tuning AI models, particularly LLMs, can be resource-intensive, requiring significant computational power and time. Organizations should have the necessary infrastructure to handle these demands such as powerful GPUs or access to cloud-based AI training services. They also need the requisite skills and experience to run fine-tuning projects.

Monitoring the training process closely is also beneficial and teams can use tools that visualize performance metrics and model behavior to make real-time adjustments.

After fine-tuning, it is crucial to rigorously evaluate the model to ensure it meets the desired performance standards. This involves testing the model on a separate validation data set that it has not seen during the fine-tuning process to check for overfitting and assess its generalization ability.

Using Other Off-the-Shelf Models

While the popular LLMs are powerful and continue to evolve with increasing capabilities, they are still primarily focused on prompt-based interaction styles for generating or analyzing content in one or more modes. Needs for different AI patterns, such as pattern and anomaly detection, predictive analytics, autonomous systems, goal-driven systems, and hyper-personalization, might not be able to effectively or efficiently use the general-purpose LLMs.

In many cases, pretrained models have already been built to address those specific needs. Off-the-shelf, publicly available, pretrained ML models are an excellent resource for many applications, especially when time, resources, or expertise to develop custom models are limited. These models, trained on large data sets by reputable institutions or companies, can be quickly deployed to solve various problems across different domains. They are particularly useful for tasks like image recognition, speech-to-text conversion, and sentiment analysis, where pretrained models provide state-of-the-art performance without requiring extensive training.

One of the primary benefits of using off-the-shelf models is reduced development time. For instance, pretrained models like ResNet or Inception can be readily used in image recognition tasks such as classifying objects in photos or detecting defects in manufacturing lines. These models come with well-documented application programming interfaces (APIs) and integration guides, allowing project professionals and developers to implement them into existing systems quickly. Similarly, other models exist that have been built for forecasting applications, anomaly detection, and other applications that can be directly applied. Many of these models are posted on model-sharing and repository sites.

While off-the-shelf models offer significant advantages, there are key factors to consider when deploying them:

- Evaluating whether the pretrained model's training data and performance metrics align with your specific use case is essential. For example, organizations deploying a sentiment analysis model for a niche industry should ensure the model has been trained on relevant data sets or be prepared to fine-tune it with domain-specific data.
- Consider the ethical implications and potential biases inherent in pretrained models. These models may carry biases from their training data, so assessing and mitigating any unintended consequences is crucial.
- Ensure the models adhere to the organizational and industry privacy and data security regulations.
- Organizations should consider the support structure for these models. Many support structures are small teams or individuals who may be unable to offer the assistance or incident help that a larger company offers.
- Review the end-user license agreements, citation requirements, and other legal requirements associated with the model.

Risks of AI in Project Management

Adopting any process involves potential risks, and organizations should conduct a full risk assessment to determine whether the correct solution is available. AI systems are no exception to this rule.

Data Privacy Issues

AI systems often require vast amounts of data to function effectively, and this data can include sensitive information about individuals and organizations. Compliance with data privacy regulations, such as General Data Protection Regulation (GDPR) or California Consumer Privacy Act (CCPA), is paramount when implementing an AI solution. Project professionals should implement robust data-protection measures, including encryption, anonymization, and access controls, to safeguard personal and confidential data. Regular audits and assessments can help identify and mitigate privacy risks, ensuring that the use of AI systems does not compromise the privacy of stakeholders involved.

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Personally Identifiable Information in the Data

Data collection can inadvertently capture sensitive or personally identifiable information if not properly managed. For instance, an AI system that analyzes customer feedback might collect names, addresses, and other private details from user reviews or social media interactions. If data are not adequately anonymized or encrypted during storage, they can become a target for cyberattacks, leading to potential data breaches. Unauthorized access to such data can result in significant privacy violations, impacting individuals whose information has been exposed—and the organization's reputation.

Individual Identification Through Inference

Even when data are anonymized, AI systems can sometimes infer sensitive information through data patterns. This process, known as inference, involves using seemingly innocuous data to predict private attributes. For example, an AI system analyzing purchase histories might infer a person's health conditions or financial status. Additionally, advanced algorithms can reidentify individuals by combining anonymized data with publicly available information. This risk is heightened when AI systems access and cross-reference multiple data sources. Such capabilities pose significant privacy threats, as individuals might unknowingly have their personal lives reconstructed and exposed through AI inferences.

Third-Party Data Risks

AI systems often operate within ecosystems involving multiple stakeholders, including third-party vendors and cloud service providers. When data are shared across these entities, the risk of compromising data privacy increases. Each transfer point introduces a potential vulnerability, whether through inadequate security measures or differing privacy standards across organizations. Furthermore, third-party AI tools might have embedded tracking mechanisms or data collection practices that are not transparent to the primary user. This lack of visibility and control over data handling by third parties can lead to unintentional data leakage or misuse, exacerbating privacy concerns.

Lack of Data Usage Transparency

One of the fundamental issues with AI and data privacy is the lack of transparency regarding data usage. Users are often unaware of how their information is being collected, processed, and utilized by AI systems. This lack of informed consent can violate privacy expectations and legal standards. AI systems might also employ complex algorithms that are not easily understandable, making it difficult for users to grasp the extent of data usage and its implications. Individuals cannot make informed decisions about their data without clear communication and consent mechanisms, leading to ethical and legal challenges.

The Chilling Effect of Hyper-Personalization

AI systems have the capacity to create detailed profiles of individuals by analyzing their behavior, preferences, and interactions. While this capability can enhance personalization and user experience, it also raises significant privacy concerns. Detailed profiling can lead to intrusive surveillance, where individuals feel constantly monitored and their behaviors scrutinized. This can result in a chilling effect, where people alter their behavior due to privacy concerns, impacting their autonomy and freedom. Moreover, in environments where AI-driven surveillance is used by employers or governments, the potential for abuse and privacy invasion becomes even more pronounced, necessitating robust oversight and ethical guidelines.

AI systems have the capacity to create detailed profiles of individuals by analyzing their behavior, preferences, and interactions.

The Data Life Cycle

How information is managed throughout its life cycle in AI systems can compromise privacy. Many organizations lack clear policies on data retention, leading to the indefinite storage of sensitive information. Prolonged retention increases the risk of data breaches over time, as older data may not be subject to the latest security protocols. Additionally, improper data-disposal methods can lead to residual data being recoverable by unauthorized parties. Effective data life cycle management involves establishing clear retention schedules, regularly purging outdated data, and ensuring secure disposal practices (see Figure 5). Organizations can mitigate the long-term privacy risks associated with AI systems by addressing these aspects.

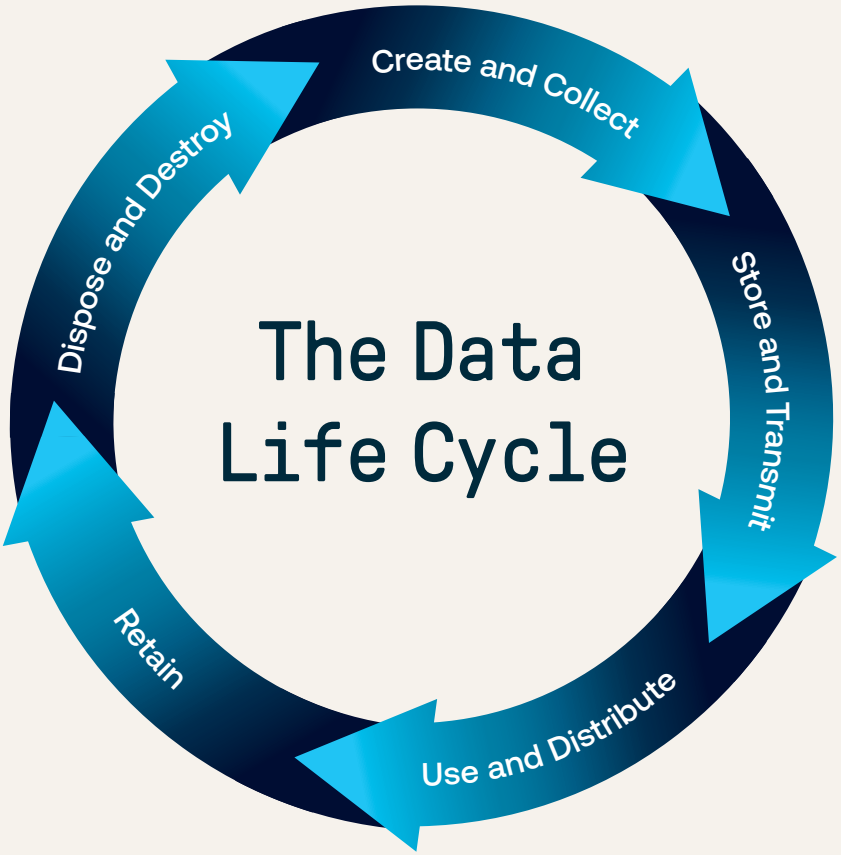

Figure 5. The Data Life Cycle

Data Ownership Concerns

Data ownership is another crucial aspect that project practitioners should consider when deploying AI systems. Determining who owns the data used and generated by AI is often complex, involving multiple stakeholders such as data providers, AI developers, and end users. Clear agreements and contracts outlining data ownership rights are essential to prevent disputes and ensure transparency. Project practitioners should work closely with legal teams to draft comprehensive data ownership agreements that specify how data can be used, shared, and stored. This not only protects the interests of all parties involved but also ensures that the project adheres to ethical standards and legal requirements.

To address data privacy and ownership concerns, project professionals should foster a culture of ethical data practices within their teams. This involves promoting awareness about the importance of data privacy and ownership, and training team members on best practices for handling data. Additionally, implementing strict data governance policies helps maintain control over data usage and ensures compliance with relevant laws and regulations. By prioritizing ethical data practices, project practitioners can build trust with stakeholders and enhance the credibility of their AI initiatives, ultimately leading to more successful and sustainable project outcomes.

Data Bias and Fairness

Machine learning models use existing data to support decision-making. Bias in the models represents a serious point of consideration when adopting AI, given the multitude of data sources and the lack of a single source of truth regarding data quality validation. Bias represents challenges and risks for the following reasons:

- There is a lack of accurate and complete data throughout the organization. No organization has complete insight into its existing data or its underlying uncertainties.
- As humans, project professionals and the sources of data used are prone to different forms of bias, which can present problems for AI inputs and outputs.

By prioritizing ethical data practices, project practitioners can build trust with stakeholders and enhance the credibility of their AI initiatives, ultimately leading to more successful and sustainable project outcomes.

Can AI Counter Bias?

As a society, we accept bias in some situations. An example is car insurance premiums. Two people with cars of the same make, model, and year who live in similar homes on the same street and work for the same employer doing the same job may pay different rates. Age, gender, and marital status are considered when applying for insurance rates.

With an AI-based system, it's possible that none of your personal characteristics would factor into your car insurance rate. Instead, the rate would be based largely on your driving behavior. If car insurance companies had comprehensive data on how often you drive, how fast you drive, how hard you brake, and how closely you follow the vehicle in front of you, they could establish rates based on performance rather than just demographics.

Project practitioners should be trained in bias mitigation as a prerequisite to using AI.

Hallucinations, Misinformation, and Disinformation

A critical factor of AI systems is that they can often produce outputs that are incorrect. Without knowledge of the subject material, project professionals might take outputs from AI systems without realizing that the results are incorrect or misleading.

When an AI system generates incorrect or nonsensical information without any basis in the training data or real-world context, it is called a hallucination. This happens because AI systems are trained to provide outputs, even if they aren't completely confident in those outputs. When the training data cannot provide content for the requested information, the AI system will confidently produce an incorrect response. For project professionals, this means that reliance on AI-generated insights must be tempered with a critical review and validation process to ensure that decisions are based on accurate and relevant information.

To mitigate the risk of AI hallucinations, project practitioners should adopt several strategies:

- Ensure that AI models are trained on high-quality, diverse data sets that accurately represent the project's scope;
- Regular model validation and updating should be conducted to maintain accuracy and relevance; and
- Human oversight should be integral in the decision-making process to catch and correct AI hallucinations.

Using ensemble methods, where multiple AI models provide input, can also reduce the likelihood of erroneous outputs. By implementing these practices, project professionals can enhance the reliability of AI systems.

Misinformation

Misinformation from AI systems represents a significant risk in project management. Misinformation occurs when AI provides information that is incorrect or misleading due to errors in data processing or interpretation. These errors can stem from biases in the training data, flawed algorithms, or insufficient data quality.

It is crucial for project professionals to implement checks and balances such as cross-referencing AI outputs with human expertise and ensuring transparency in how AI systems derive their conclusions.

When project practitioners use AI-generated reports to make strategic decisions, misinformation can lead to misallocated resources, missed deadlines, and failed projects. It is crucial for project professionals to implement checks and balances such as cross-referencing AI outputs with human expertise and ensuring transparency in how AI systems derive their conclusions.

Combating misinformation involves establishing robust AI practices prioritizing data integrity and algorithm transparency. Project professionals should advocate for using explainable artificial intelligence (XAI) systems, which provide insights into how AI decisions are made. This transparency allows for better scrutiny and understanding of AI outputs. Furthermore, maintaining a rigorous data governance framework ensures that the data used by AI systems is accurate, up to date, and free from bias. Regular training for team members on AI literacy can help identify and address misinformation promptly, thus maintaining the accuracy of project deliverables.

Disinformation

Disinformation is when data sources intentionally have incorrect or misleading information to steer AI systems to desired but incorrect outputs. Disinformation involves intentionally spreading false information, and AI systems can be exploited for this purpose. Malicious actors can manipulate AI systems by feeding them biased or fabricated data, leading to the dissemination of harmful falsehoods.

In the context of project management, disinformation can undermine trust, create conflicts, and derail project goals. Project professionals should be aware of the potential for AI systems to be targeted by such attacks and should incorporate security measures to protect the integrity of their data and AI tools. This includes regular audits, data verification processes, and educating team members on the risks of disinformation.

Proactive measures are essential to address disinformation in AI systems, such as:

- Establishing protocols for detecting and responding to disinformation such as anomaly detection systems that flag unusual patterns indicative of data manipulation;
- Collaborating with cybersecurity experts to safeguard AI infrastructure against attacks; and
- Fostering a culture of critical thinking and skepticism toward AI outputs that can empower team members to question and verify information before acting on it.

By understanding and addressing these vulnerabilities—hallucinations, misinformation, and disinformation—project professionals can harness the full potential of AI systems while mitigating risks. This balanced approach ensures that AI remains a valuable asset in achieving project goals.

Manipulation and Deepfakes

AI systems, particularly those involved in content generation and analysis, have increasingly been used for manipulation. These systems can generate persuasive text, fake news, and misleading information at scale, impacting public opinion and spreading misinformation. Advanced NLP models can create realistic, human-like narratives that deceive readers into believing false information. This manipulation can influence decision-making, shape consumer behavior, and sway public discourse. The ability to generate convincing, tailored content makes AI a powerful tool for those looking to manipulate information.

Deepfakes represent a particularly concerning application of AI for manipulation. Utilizing deep learning techniques, deepfakes create hyper-realistic audio, video, and images of individuals, making it appear like they are saying or doing things they never did. These manipulated media can be incredibly convincing, making it difficult for the average person to discern what is real from what is fabricated. Deepfakes can be used to discredit public figures, spread false information, and create sensationalized content for malicious purposes. The ease with which deepfake technology can be accessed and used poses a significant threat to the integrity of information and personal reputations.

Enhancing detection and verification tools is paramount to minimize the misuse of AI for manipulation and deepfakes. Researchers and technologists are developing sophisticated algorithms and forensic techniques to identify manipulated content. These tools analyze inconsistencies in pixel patterns, lighting, and audio-visual synchronization that often indicate deepfakes. By investing in and deploying these detection tools, organizations can better identify and mitigate the impact of manipulated content.

Promoting media literacy and awareness is another crucial strategy to combat AI-driven manipulation. Educating peers and coworkers on how to evaluate information sources critically, recognize signs of manipulation, and verify content through trusted fact-checking services can reduce the spread of false information. By fostering a more informed and discerning work environment, the effectiveness of manipulative AI content can be significantly diminished.

AI and Data Security

AI systems also present significant data security and cyber threat concerns. The vast amounts of data needed to train and operate AI models often include sensitive and confidential information. This makes AI systems attractive targets for cybercriminals. Data breaches can result in unauthorized access to personal information, proprietary business data, and intellectual property. Additionally, the complexity and opacity of AI models can introduce vulnerabilities, as identifying and mitigating security flaws within these systems is often challenging. Furthermore, AI systems can be used maliciously to automate cyberattacks, such as phishing and malware distribution, exacerbating the threat landscape.

By fostering a more informed and discerning work environment, the effectiveness of manipulative AI content can be significantly diminished.

To mitigate data security issues associated with AI, organizations should adopt a multifaceted approach to data protection. First, employing strong encryption methods for data, both in transit and at rest, is crucial. This ensures that even if data are intercepted or accessed without authorization, they remain unreadable and unusable. Second, implementing strict access controls and authentication mechanisms can limit who has access to sensitive data, reducing the risk of insider threats. Regular audits and monitoring can help detect unusual access patterns and potential breaches early. Additionally, anonymizing data used in AI training processes can protect individual privacy and reduce the impact of any potential data leaks.

Securing AI models and the systems that interact with them is also essential in mitigating data security concerns. Organizations should conduct thorough security assessments of AI systems to identify and address vulnerabilities. This includes testing for adversarial attacks, where malicious inputs are designed to deceive AI models and produce incorrect outputs. Techniques such as adversarial training, where models are exposed to and trained on adversarial examples, can enhance their resilience. Furthermore, implementing secure development practices, such as code reviews and penetration testing, can help ensure that AI systems are robust against cyber threats. Keeping AI software and libraries updated with the latest security patches is also critical.

Human factors play a significant role in data security, and enhancing employee awareness and training is crucial. Organizations should invest in regular cybersecurity training for employees, emphasizing the importance of data protection and the specific risks associated with AI systems. Training programs should cover best practices for handling data, recognizing phishing attempts, and responding to security incidents. Creating a culture of security awareness can empower employees to act as the first line of defense against data breaches and cyber threats. Encouraging employees to report suspicious activities without fear of repercussions can also help in the early detection and mitigation of security issues.

Strong data governance policies are fundamental to securing AI systems and the data they handle. These policies should define clear data collection, storage, processing, and sharing guidelines. Ensuring compliance with relevant regulations, such as GDPR or the Health Insurance Portability and Accountability Act (HIPAA), is essential to avoid legal repercussions and protect user privacy. Data governance frameworks should also include regular audits and compliance checks to ensure data practices align with established policies. By maintaining rigorous data governance, organizations can create a structured and secure environment for AI operations, minimizing the risk of data security breaches and ensuring the integrity of their AI systems.

Finally, collaboration and information sharing among organizations, industries, and government bodies can enhance data security in AI systems. Sharing information about emerging threats, vulnerabilities, and best practices can help organizations avoid potential security issues. Participating in industry consortia and working groups focused on AI and cybersecurity can provide valuable insights and resources. Governments should also play a role by facilitating public–private partnerships and supporting research into advanced security measures. By fostering a collaborative approach to data security, the broader community can collectively address the challenges posed by AI systems and create a more secure digital ecosystem.

By maintaining rigorous data governance, organizations can create a structured and secure environment for AI operations, minimizing the risk of data security breaches and ensuring the integrity of their AI systems.

Emerging AI Regulations and Laws

As AI technologies rapidly evolve, governments and regulatory bodies worldwide are beginning to establish laws and regulations to manage their impact. These emerging regulations address many concerns, including data privacy, ethical AI usage, accountability, and transparency. The European Union (EU) has proposed the EU Artificial Intelligence Act, which seeks to classify AI systems based on risk levels and impose corresponding regulatory requirements.[9] Similarly, the United States is considering various legislative measures to ensure AI systems are developed and used responsibly. These regulations are designed to protect consumers, ensure fair competition, and prevent harm caused by AI applications.

Organizations should continuously monitor regulatory developments and adapt compliance strategies to meet changing requirements.

One of the primary challenges organizations face in keeping up with AI regulations is the rapid pace of technological advancement. AI systems evolve quickly, often outpacing the regulatory frameworks designed to govern them. This can lead to a compliance gap where existing regulations do not adequately address new capabilities or potential risks of emerging AI technologies.

Organizations should continuously monitor regulatory developments and adapt compliance strategies to meet changing requirements. This demands significant resources, including legal expertise, compliance infrastructure, and ongoing employee training. Additionally, the global nature of AI means that organizations operating across multiple jurisdictions must navigate a complex web of regional regulations, each with its own standards and enforcement mechanisms.

Table 2 captures a snapshot of AI regulations and guidelines from various countries and regions.

Table 2. Existing AI Regulations and Guidelines

Regulation	Issuing Body	Year Issued	Summary
AI National Strategy	China	2017	A roadmap for AI development aiming to make China a global leader in AI by 2030, with a focus on ethics, safety, and the use of AI in various industries.
GDPR (General Data Protection Regulation)	European Union	2018	Comprehensive data protection law that includes provisions affecting AI, particularly concerning data privacy, consent, and the right to explanation.
AI Ethics Guidelines	European Commission	2019	Nonbinding guidelines promoting trustworthy AI and emphasizing human-centric AI, accountability, transparency, privacy, and robustness.
Executive Order on AI	United States	2019	Promotes AI development in line with American values, emphasizing research, development, and ethical considerations, but not a binding regulation.
Ethics Guidelines for Trustworthy AI	Japan	2019	Provides ethical guidelines for AI development, focusing on respect for human dignity, privacy, and transparency, promoting AI that is beneficial to society.
AI Development Plan	South Korea	2019	Strategy to advance AI technology, emphasizing ethical considerations, transparency, and the use of AI for public good.
AI and Privacy Policy Framework	Canada	2020	Sets principles for AI use, including accountability, transparency, and respect for human rights and privacy, as part of a broader digital charter.
AI and Data Ethics Framework	Australia	2020	Provides principles for ethical AI development, including transparency, accountability, privacy protection, and human-centric values.
Artificial Intelligence Act	European Union	2021	Aims to regulate AI systems based on risk levels, with strict requirements for high-risk AI systems and prohibitions on certain harmful AI practices.
AI Regulation Proposal	European Union	2021	Proposed regulation for high-risk AI applications, including strict requirements for data quality, transparency, human oversight, and robustness.
NIST AI Risk Management Framework	National Institute of Standards and Technology	2023	Provides guidelines for identifying, assessing, and managing risks associated with AI systems, with an emphasis on trustworthiness and accountability.
AI and Algorithm Transparency Law	United Kingdom	2023	Mandates transparency in the use of AI and algorithms in decision-making processes, ensuring fairness and accountability.

Governments and regulating bodies face the challenge of keeping up with the fast-paced evolution of AI technologies. Traditional regulatory processes are often slow and deliberative, designed to provide thorough oversight and public consultation. However, this approach can be too slow to address AI's rapid advancements and new risks effectively. There is a growing recognition of the need for more agile and adaptive regulatory frameworks that can evolve with AI technologies. This strategy might involve creating regulatory sandboxes where new AI applications can be tested under supervised conditions, fostering collaboration among regulators and industry stakeholders, and utilizing AI to enhance regulatory monitoring and enforcement.

Striking a balance between fostering innovation and ensuring robust regulation is a key challenge in AI. Overly stringent regulations can stifle innovation, making it difficult for companies to develop and deploy new AI technologies. Conversely, insufficient regulation can lead to misuse, ethical violations, and public harm. Policymakers should work closely with industry experts, researchers, and civil society to craft regulations that protect public interests without hindering technological progress. Public consultation processes and multistakeholder dialogues are crucial in developing balanced regulatory frameworks encouraging responsible innovation.

Striking a balance between fostering innovation and ensuring robust regulation is a key challenge in AI.

Given the global nature of AI, international coordination and harmonization of regulations are essential. Disparate regulatory approaches across countries can create barriers to innovation and complicate compliance for multinational organizations. Efforts are underway to develop international standards for AI, led by organizations such as the International Organization for Standardization (ISO) and the Institute of Electrical and Electronics Engineers (IEEE). Harmonizing AI regulations can help create a level playing field, promote best practices, and facilitate cross-border collaboration. However, achieving international consensus is challenging due to differing national priorities, legal traditions, and levels of technological advancement.

AI Resources

Table 3 lists some of the currently available organizational and project management tools with an AI component. From writing assistants to cost management, there is a tool that can meet your organization's needs.

Table 3. Common AI Organizational Tools Currently Available

Product	Writing Assistance	Task Management	Forecasting	Resource Planning	Cost Management
Asana	✓	✓			
ClickUp	✓	✓		✓	
Coda	✓	✓			
Forecast		✓	✓	✓	✓
Grammarly	✓				
HubSpot	✓	✓			
Jira		✓		✓	
Kantata		✓	✓	✓	✓
Microsoft Project	✓	✓			
Monday	✓				
Notion	✓				
ProofHub		✓		✓	
Sembly	✓				
Scoro		✓	✓	✓	✓
Taskade		✓			
Teamwork		✓	✓	✓	
Wrike	✓	✓			
Writer	✓				
Zapier		✓			

PMI Infinity™

PMI Infinity™ is the PMI GenAI platform, packed with features that will help teams and organizations achieve more. It is designed with features to help make project teams more productive and efficient, such as:

- Smart navigation to the most relevant, proven, and up-to-date project management practices, with an expanding content database that has been vetted by the PMI global community;
- Cited original content for fast and easy validation;
- Recommended queries and a prompt library to explore prompts searched and tested by the PMI community;
- Contextual understanding that differentiates between “learning” and “task” mode to obtain more detailed responses focused on helping you get things done or diving deeper into a topic; and
- Built-in measures to protect organizational data. The AI chatbot exclusively learns from PMI proprietary content, providing the cybersecurity you want.

PMI Resources

PMI has a selection of resources to assist project professionals in mastering AI for their roles as well as a strategic tool for their organizations, such as:

- AI @ Work: New Projects, New Thinking
- AI Innovators: Cracking the Code on Project Performance
- Generative AI and Prompt Engineering
- Prompt Engineering Exchange

Visit the Artificial Intelligence in Project Management page of the PMI website to review all our AI training and reports.

Taking the Next Steps With AI

The most effective way to leverage AI technologies is to gain hands-on experience. AI, particularly GenAI, offers a user-friendly entry point with its low learning curve, making it accessible even for those with minimal technical background.

Start by identifying small, manageable projects where AI can add value such as automating routine tasks, enhancing data analysis, or generating creative content. By starting small, your team can experiment with AI tools, understand their capabilities, and build confidence in using them. This initial exploration will provide valuable insights and lay the groundwork for more ambitious AI initiatives.

One of the most significant advantages of GenAI is its encouragement of experimentation. As a project professional, foster a culture where your team feels comfortable experimenting with AI applications, regardless of their experience level. Encourage team members to explore different AI tools and techniques, test various scenarios, and learn from successes and failures. This iterative process enhances the team's understanding of AI and uncovers unique ways AI can be integrated into projects. By rewarding experimentation, you can cultivate an innovative mindset that continually seeks improvements and new opportunities, driving project success and team growth.

Once your team has gained initial experience and confidence with AI, the next step is to scale its integration across more complex and critical projects.

Once your team has gained initial experience and confidence with AI, the next step is to scale its integration across more complex and critical projects. Leverage the insights and skills developed during the experimentation phase to identify larger-scale applications of AI that can significantly impact project outcomes. This could involve advanced data analytics for strategic decision-making, automating complex workflows, or developing AI-driven solutions tailored to your project's unique challenges. As you scale AI integration, ensure that continuous learning and adaptation remain core principles. By doing so, your team will keep pace with AI advancements and maintain a competitive edge, delivering innovative and efficient project solutions.

Further AI Guidance

Our companion guide will provide further guidance on organizational adoption of AI and how AI impacts project management processes, approaches, and methodologies.

References

1. Moore, G. E. (1965, April 19). Cramming more components onto integrated circuits. *Electronics, 38*(8), 114–117.

2. McCarthy, J., Minsky, M. L., Rochester, N., & Shannon, C. E. (1955, August 31). *A proposal for the Dartmouth summer research project on artificial intelligence.* https://www-formal.stanford.edu/jmc/history/dartmouth/dartmouth.html

3. Cognilytica. (n.d.). *The seven patterns of AI.* Cognilytica. https://www.cognilytica.com/the-seven-patterns-of-ai

4. Jumper, J., Evans, R., Pritzel, A., Green, T., Figurnov, M., Ronneberger, O., Tunyasuvunakool, K., Bates, R., Žídek, A., Potapenko, A., Bridgland, A., Meyer, C., Kohl, S. A. A., Ballard, A. J., Cowie, A., Romera-Paredes, B., Nikolov, S., Jain, R., Adler, J., Back, T., ...Hassabis, D. (2021). Highly accurate protein structure prediction with AlphaFold. *Nature, 596*(7873), 583–589. https://doi.org/10.1038/s41586-021-03819-2

5. Project Management Institute (PMI). (2020). *Talking to the machine: The impact of AI and machine learning on project management*. PMI. https://www.pmi.org/learning/thought-leadership/prompt-engineering

6. OpenAI. (n.d.). *Prompt engineering*. OpenAI Platform. https://platform.openai.com/docs/guides/prompt-engineering

7. Project Management Institute (PMI). (2020). *Talking to the machine: The impact of AI and machine learning on project management*. PMI. https://www.pmi.org/learning/thought-leadership/prompt-engineering

8. PricewaterhouseCoopers (PwC). (2013, April). *Correcting the course of capital projects: Plan ahead to avoid time and cost overruns down the road* [PDF]. PwC. https:// www.pwc.com/gx/en/capital-projects-infrastructure/pdf/pwc-correcting-the-course-of-capital-projects-v3-pdf.pdf

9. European Commission. (2021). *Proposal for a regulation laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) and amending certain Union legislative acts*. EUR-Lex. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52021PC0206

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