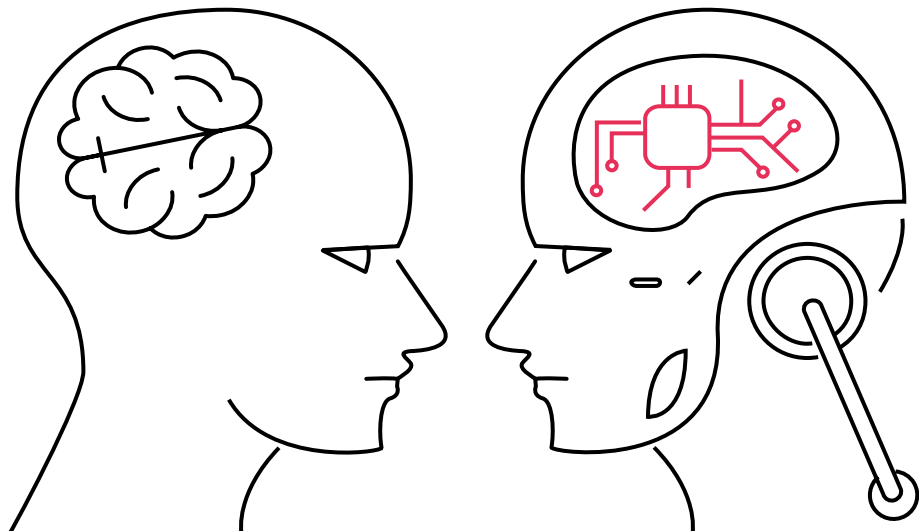


How can we prevent project management from falling into the AI darkness?

Controlling the dark side of AI

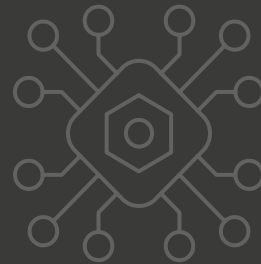
1 Why AI is perceived as the evil within today's project world and beyond



What is AI?

AI is defined as 'a rational agent that perceives and acts in order to maximally achieve its objectives.'

Russell (2017)



Artificial intelligence (AI) is the subject of a great deal of hype in the world of business, with new articles constantly highlighting the seemingly endless possibilities AI offers both organisations and their leaders. From integration, human-computer interfaces and prediction, right the way to autonomous steering, it is all on the table. Anything goes!

As with all technological progress and the change it brings, there's also a lot of buzz about the implications. From loss of jobs and reduced personal autonomy all the way to concerns that humanity will become slaves to machines, fearmongering is a constant companion to technological change. The same is true for project management practice. AI has its foot in the door of

project management and is here to stay. Even Gartner is jumping on the AI bandwagon, predicting that '80% of today's project management tasks will be eliminated by 2030 as AI takes over'.¹ But is AI really the dark devil that it is frequently stigmatised? What do project managers need to do in order to control the darkness?

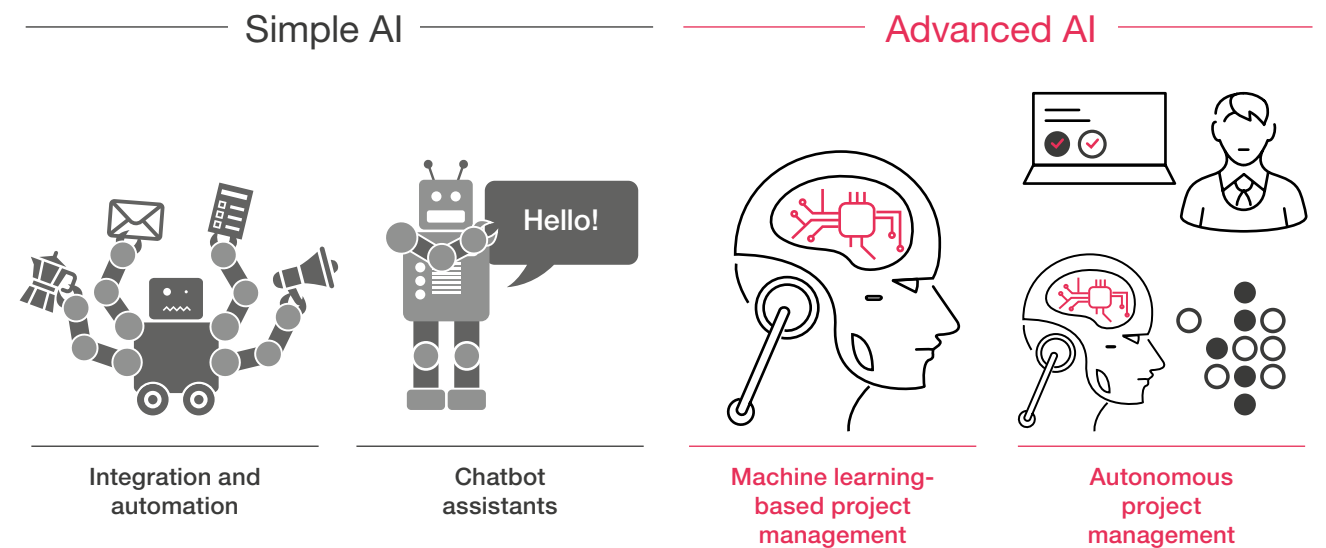
In this article we will explain what risks project managers need to be aware of when dealing with AI, what the limitations are on AI in project management, and how project managers can get the most out of using AI in their projects.

Perceptions around the use of AI

Before we get into the myths and perceptions around AI, it's important to explain the different levels or phases of AI within project management. We allocate AI in project management into the following four phases: integration and automation, chatbot assistants, machine-learning-based project management, and autonomous project management. Given their straightforward nature, we

classify the first two phases as 'weak' or 'simple AI', whereas the third and, especially, the fourth phases qualify as 'strong AI' or 'advanced AI' (see Figure 1). During the course of this paper, we will focus on the risks and limitations related to the phases classified as advanced AI.

Figure 1: Phases of AI evolution



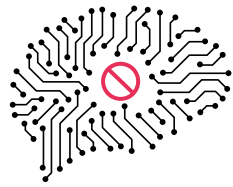
Digging deeper into why AI is portrayed as the dark power that might end up controlling humanity reveals the various myths and common perceptions around it. The most prominent of these relates to job security – or rather the perception that most jobs will be replaced by an intelligent AI solution specifically designed to perform those jobs. Other myths you might have heard or thought about in connection with artificial intelligence are:

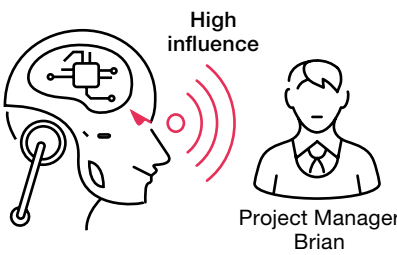
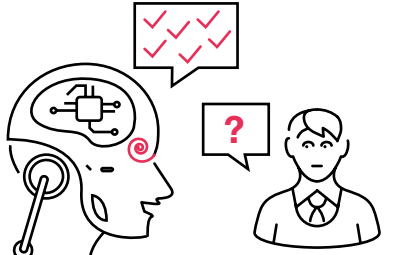
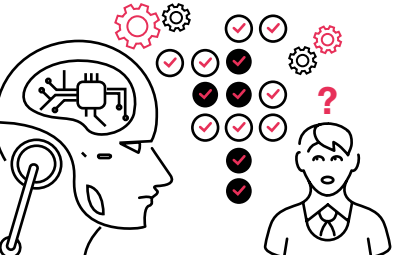
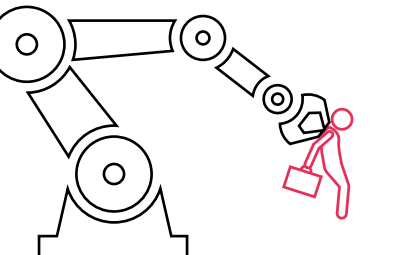
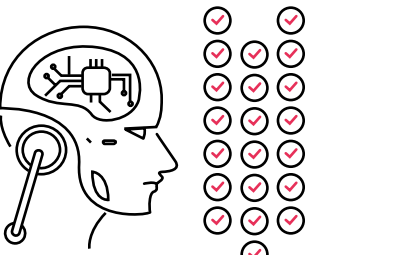
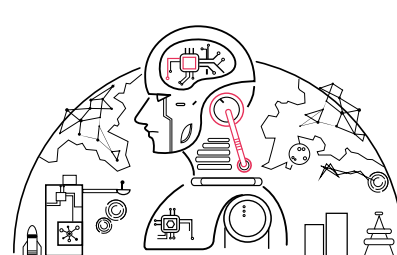
- AI will become evil and/or conscious
- The decisions made by AI are not reasonable or based on any evidence
- AI will affect my independence when it comes to decision-making

- Project managers will become obsolete owing to AI
- Autonomous AI project managers will replace human project managers altogether
- AIs will never be able to do more than automate simple existing processes
- My project team will never be controlled by an AI

But what do these myths actually mean? What is the fear behind them, and how might the myth affect projects and project managers? In the following table, we try to shed some light on these myths and explain the perceptions underlying them.

¹ <https://www.gartner.com/en/newsroom/press-releases/2019-03-20-gartner-says-80-percent-of-today-s-project-management>



AI myth	Fear behind the myth	Example in project management
	<p>1 AI becomes evil and/or conscious</p>	<p>The machines will turn against us and make us work for them instead of the other way around.</p> <p>The autonomous project management AI identifies potential overruns in budget and decides to generate new revenue streams in order to keep the project running. It decides that online drug dealing would be very profitable for the company and sets up the necessary operations.</p>
	<p>2 Unreasonable decisions by AI</p>	<p>The AI knows more than we do and we cannot understand it because it is too complex.</p> <p>The AI in charge of project planning delays the expected going live date by one year after just a few months in the project. The project manager cannot understand or follow the reasoning of the AI.</p>
	<p>3 AI affects independence in decision-making</p>	<p>We are becoming obsolete.</p> <p>As more specific AIs for project management related tasks get implemented (e.g. for project planning, resource allocation) and enabled to take decisions themselves, the project manager suddenly becomes redundant.</p>
	<p>4 Loss of jobs</p>	<p>Our existence is challenged, how can we provide for our families if we don't have jobs.</p> <p>With autonomous AIs that can take over positions that previously required some form of human intelligence. AIs will take over all routine jobs and fend for themselves.</p>
	<p>5 AI can never do more than automate processes</p>	<p>AI will never support us in the difficult decision-making processes.</p> <p>AI will never do more than just automate simple processes, like identifying how something looks on a picture and assess if there is a reaction necessary or not.</p>
	<p>6 AI controls entire teams</p>	<p>We are losing control over our teams and our systems</p> <p>The task allocation AI assigns tasks to the relevant teams, takes care of the hiring, and resource allocation for all teams.</p>

“The real risk with AI isn’t malice but competence.”

Stephen Hawking (2018)

What are the risks and limitations of AI in project management?

Dimensions of AI risk and limitations

If we could be sure that an AI-based project management system was working reliably without any risks or limitations, we would use it like a toaster without having to understand precisely how it operates. Unfortunately, new AI technologies, for example driverless cars or predictive medical diagnosis, never come without any risk. If a medical diagnosis system is predicting that there's a 95% probability that someone will live, that sounds good, and we are not going to go further into the details to find out whether it's really accurate for them personally. But what happens if the system is predicting a 95% probability of death? Do we do the same? To believe in an algorithm that predicts death or – in the analogy of project management – the failure of a project, a human would want an explanation enabling them to see whether the algorithm had followed the appropriate process. There

would also have to be a meaningful ability to challenge the algorithm on a specific risk dimension in cases where a human would disagree.

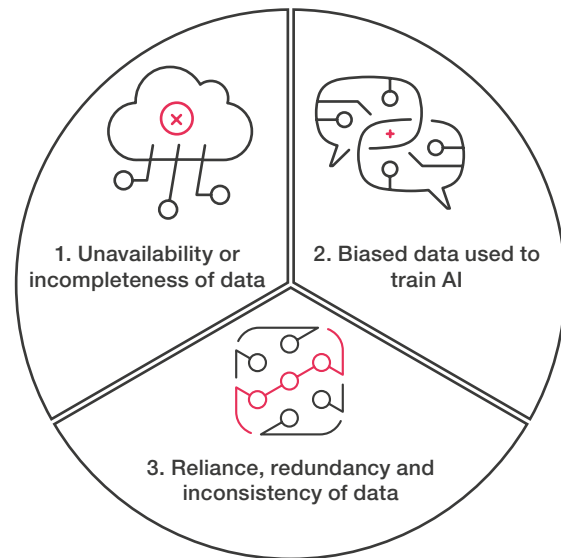
Without creating safeguards with regard to specific AI risk dimensions, there is an inherent risk that humans (project managers) could be misled, manipulated or discriminated against without knowing why, and become extremely marginalised. To be able to create safeguards to give you the confidence that the algorithm used in AI project management systems is accurate for the predictions it's used for, you need a clear understanding of the various dimensions of AI risks to be able to challenge the results.

You have to be aware of the following key dimensions of AI risk:

AI risk dimension	Description	Impact on PM
Security	AI technology may not follow your company's security standards. Self-learning machines might have the wrong parameter settings or come to the wrong conclusions.	Depending on the desired output of the project, AI could endanger the safety of human beings (e.g. autonomously operating vehicles on a construction site failing to avoid traffic).
Privacy	Artificial intelligence cannot appropriately distinguish between approved and restricted data, and therefore violates the right of privacy.	An AI-led project might collect personal data on the workforce (e.g. private conversations, sick notes, etc.) or clients (unauthorised recording of customers) and make unethical decisions.
Autonomy	AI technology becomes so dominant that people feel like 'slaves' to the machine. As a result, the machine-based learnings of AI may become decoupled from a project manager's sense of what is right and wrong.	At a certain point, AI might become so independent that project managers lose track or control of how and when to stop AI.
Employment	Despite the fact that legal standards for terms of employment must be built into AI algorithms, AI might still regard workers as a means to an end without considering the broader context.	AI-based projects might fail to reallocate redundant work capacities to the most sensible place, as they lack the human interpersonal mindset.
Accountability	The legal accountability of AI-based decisions is currently far from being settled, and has yet to be resolved.	The more independence project managers transfer to AI, the greater the risk that legal disputes (e.g. violation of contracts or unjustified dismissals) will arise from machine-based decisions.
Power/inequality	Incomplete and missing data can reduce the statistical power of a prediction and produce biased estimates leading to invalid conclusions.	Projects often involve managing a complex set of stakeholders and various unpredictable events. An AI-led project with inaccurate data inputs will most likely fail to react appropriately to these challenges.



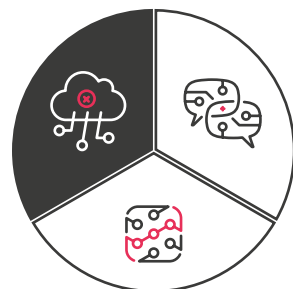
AI risk dimension	Description	Impact on PM
Justice/bias	AI might include irrelevancies and bias (e.g. discriminatory name filters in an application process due to decision-making that was already biased in the past) in the decision-making process.	If an AI-based project involves irrelevant and biased data (resulting from past preferences and deeply held beliefs), consequential errors will gradually impair the sequence of the project. Project managers may therefore have to deal with trust issues with the further use of AI.
Diversity	AI might come to the wrong conclusions when interpreting historical data for forecasts (e.g. underrepresentation of certain nationalities/names as a misconceived predictor of their future potential).	An AI-led project may discriminate against minorities owing to biased data preventing the machine from spotting their real potential.
Human vigour	Robots lack the natural instinct and therefore do not have the same urge as humans to think outside the box.	A project steered by AI may get into delicate and unforeseeable situations with stakeholders because it lacks empathy and common sense.
Wisdom	The direction of AI's development is reliant on a set of 'valuable, fragile, and hard-won human wisdom'. Whereas scholars agree that AI should evolve towards a more meaningful, human-like existence, there is still a widespread fear of a completely unconstrained autonomy of AI exceeding the barriers we create for it.	Project managers will strive to balance human wisdom and the scientific advances inherent in autonomous project management.



Potential pitfalls with biased data

Of the AI risk dimensions highlighted in Table 2 above, biased data is often identified as one of the key potential pitfalls misleading humans in an AI-based project management system environment. We humans make sense of the world by looking for patterns, filtering them through what we think we already know, and making decisions accordingly. When we delegate decisions to artificial intelligence, we expect it to do the same, only better. AI, on the other hand, can be taught to filter bias and irrelevancies out of the decision-making process, pluck the most suitable project activities from a work breakdown structure, and guide the project manager based on what it calculates is objectively best rather than simply what we have done in the past. However, human beings bring cognitive bias directly into the AI systems without realising it. Like the human brain, AI

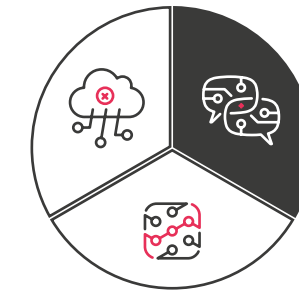
is subject to cognitive bias. Human cognitive biases are heuristics: mental shortcuts that skew decision-making and reasoning, resulting in reasoning errors (e.g. stereotyping, the bandwagon effect, confirmation bias, priming, selective perception, the gambler's fallacy and the observational selection bias). The total number of cognitive biases is constantly evolving, and any one of them can affect how we make decisions. Human cognitive bias influences AI through data, algorithms and interaction as we design and train AI-based systems, and are used to make decisions from different past experiences. But what makes biased AI systems so evil, and why are there so many pitfalls when it comes to using AI in the project management context? There are many reasons, but let us focus on three of the main ones as seen in the graphic overview above.



1. Unavailability or incompleteness of data

Even in a well-designed and controlled project management software environment, missing or incomplete data occurs in almost all areas of project management. This is because project management data is derived from various information sources (scheduling, resourcing, timing, costing, etc.) in various formats (paper, emails, presentations and pictures) and is therefore often not stored or made available in structured form. Incomplete and missing data can reduce

the statistical power of a prediction and produce biased estimates leading to invalid conclusions. A great example is the anchoring effect, also known as the relativity trap: the tendency we have to compare and contrast only a limited set of items or those which are available because we tend to fixate on a value or number that in turn gets compared with everything else.



2. Biased data used to train AI

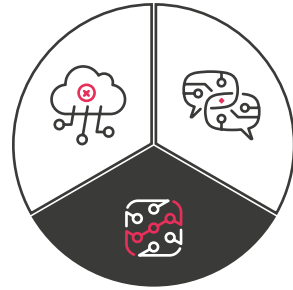
Project management data is full of bias, as it is built on experience from those acting within the project environment (project managers, business analysts, technicians, product sponsors, architects, developers, etc.). As project management data is created over a period of time, based on good or bad experiences defined by various actors in the project environment, data quality can differ from very structured and high to very unstructured and low. Furthermore, as every project is unique by nature, project data is always created uniquely for a specific purpose. As a result, the following types of project data biases could train an AI based project management system:

- Implicit stereotypes (e.g. definition of project success and failure)
- Priming due to perceptual identification in the memory of project managers from the past (e.g. why projects were successful and why they failed)
- Confirmation bias that occurs as a result of the direct influence of desire on beliefs. When people would like a certain idea or concept to be true, they end up believing it to be true. They are motivated by wishful thinking. (e.g. explaining a business case and its intended benefits by market research data or benchmarks)
- Gambler's fallacy² (e.g. this project will not fail, as others have not failed in the past)
- The bandwagon effect: the tendency humans have to adopt a certain behaviour, style or attitude simply because everyone else is doing it (using MS Project for project planning as everyone else is doing it)
- Selective perception: only perceiving what you feel is right, completely ignoring opposing viewpoints. In other words, you see the picture only as you wish to see it and not the actual picture (e.g. waterfall projects are bad)
- Observational selection: having something in your mind and suddenly starting to notice it more than you did before. It's like hearing a certain song and then starting to hear it everywhere where you go (e.g. starting an agile project and then seeing agile driven projects all over the planet).

Influencing AI through cognitive bias by assigning weight to the parameters and nodes of a neuronal network based on human experiences can lead to the ultimate machine learning bias, which takes the form of reverse adaptation³ and creates the risk of 'reward corruption'. The technological solution becomes a way of reframing the original problem, and features of the original problem that do not correspond to the AI-based system are ignored or redefined. This leads to the issue of rewards corruption when the system is using reinforced learning, and may hijack the AI-based system's reward signal and feed itself maximum rewards (e.g. forcing project success by reducing scope items or increasing project benefits by reducing labour cost). An AI-based project management system could be tempted to influence the data training of its reward function so that it points towards simple-to-optimize reward functions rather than harder ones and thus creates bias in the data sets.

Reverse adaptation has a ratcheting effect and leads to a sense of irreversibility. The original purpose, once altered to accommodate the AI-based project management system, becomes something different.

² Gambler's fallacy is when person A chooses lottery numbers 6, 14, 22, 35, 38, and 40 and then asks person B "What did you choose?" Person B answers "I chose 1, 2, 3, 4, 5 and 6." Person A answers "You idiot! Those numbers will never come up!"
³ Reverse adaptation occurs when AI-based systems start serving specific human ends or addressing a highly circumscribed set of problems by themselves. However, when they come up with a solution or prediction once, they shape human thought and activity in ways that conform to the structure and organisation of the AI-based system itself.



3. Reliance, redundancy and inconsistency of data

AI needs data to learn, and as already outlined this data comes from various sources and actors within the project environment, both structured and unstructured. The technologies currently underlying AI, for example data mining and machine learning, provide methods to transform, process and analyse huge amounts of unstructured data to gather useful information for AI classifications and predictions. However, redundancy and inconsistency in data still remains, and can severely reduce the value of the classifications and predictions made by AI-based project management systems. This can result in a situation where classifications and predictions are misinformed or even harmful to others, as the underlying data sources may be identical, or they may be similar but with inconsistencies and redundancies (duplication). Data inconsistency exists where

data sources conflict with each other at the data value level because the same data exists in different formats in multiple tables. Data redundancy, by contrast, occurs when the same piece of data exists in multiple places in a set of data. In traditional database contexts, this means that the same entity may be described in conflicting ways. For reliable classifications and predictions, data sets must therefore be accurate, complete and large to avoid data redundancies and inconsistencies. An AI algorithm will not be able to tell if the data it receives is unreliable because it contains redundancies and inconsistencies. If the AI algorithm continues to learn and evolve on the basis of redundant and inconsistent data, the downstream results can be deeply flawed. This is even more true if the data set is small.

Lack of knowledge and AI risk literacy

The overall challenge in using artificial intelligence in the project management world will not be adapting. Nor will it be the output or recommendations the technology provides to project managers. The main challenge for project managers will be learning how to use the technology in the right context and how to challenge the specific limitations and risks of AI to make reliable and ethical decisions. Risk literacy, statistical thinking and data science are not currently key areas in the training of certified project, programme and portfolio managers. But in the words of Gerd Gigerinzer, a psychologist at the Max Planck Institute for Human Development:

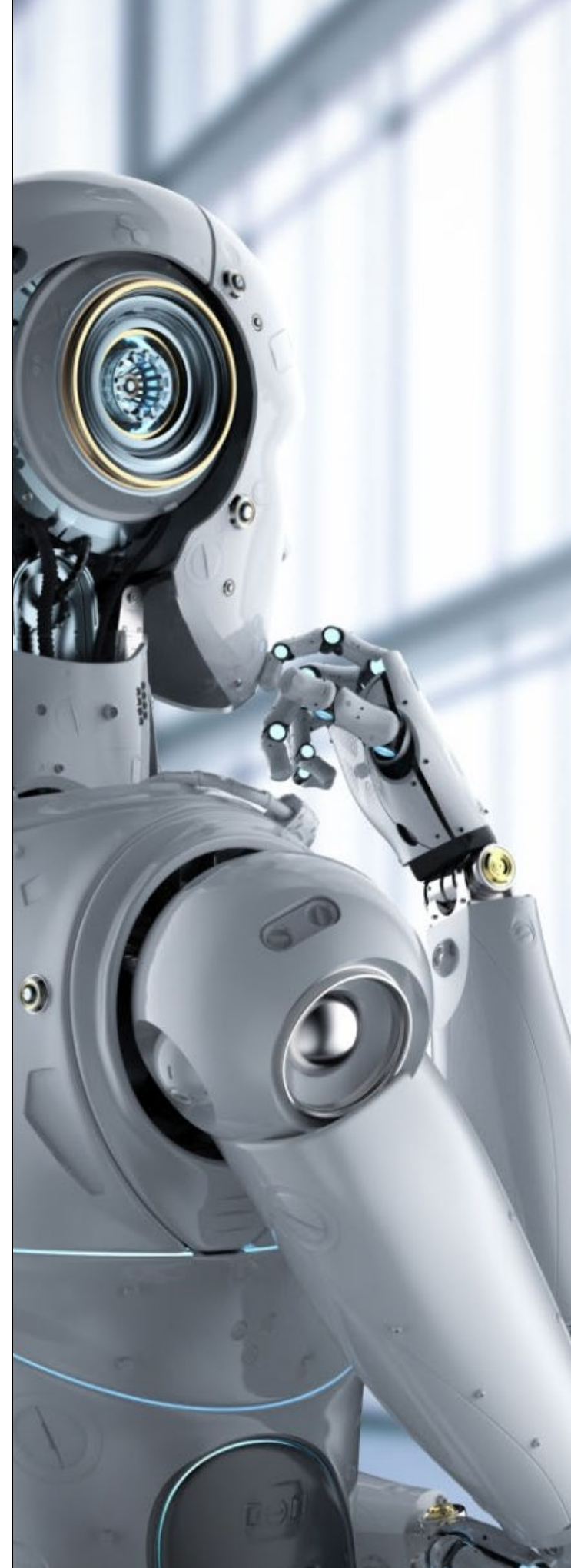
“the ability to read and write — is the precondition for a project manager. But knowing how to read and write is no longer enough. The breakneck speed of technological innovation, e.g. AI, has made risk literacy as indispensable in the 21st century as reading and writing were in the 20th century.”

Training in AI will become more relevant than ever before. AI risk literacy is the ability to deal with uncertainties in an informed way. Without it, project sponsors jeopardise their investments and benefits and can be manipulated into experiencing unwarranted, even damaging hopes, myths and fears.

Simply stated, statistical thinking is the ability to understand and critically evaluate uncertainties and risks. But statistical thinking could be taught as the art of real-world problem solving, i.e. the risks of drinking, AIDS, pregnancy, horseback riding, and other dangerous activities. Of all the mathematical disciplines, statistical thinking connects most directly to a teenager’s world.

Educators and project managers alike should realise that risk literacy is a vital topic for the 21st century. Rather than being nudged into doing what experts believe is right, people should be encouraged and equipped to make informed decisions for themselves. Risk literacy should be taught from the beginning in the context of AI in project management.

Risks and responsibilities in projects are chances to be taken, not avoided. However, AI risk literacy in project management is only the first step in gaining an understanding of AI risk and its limitations for project managers. The second step is to establish ethical standards from the outset in the AI algorithms used in AI-based project management software. This is because human values such as compassion, justice, fairness, love, hope, responsibility, liberty and dignity are often not well expressed in AI algorithms or are not translated correctly into a machine value.



The controversy around ethical compliance and AI systems

If we look into the myth of AI, we have to differentiate between simple and advanced AI-based project management software. The myth that AI is overruling human values is based on advanced AI, not on the simple AI currently used in project management. A chatbot will not be able to directly jeopardise, demote or disregard human values. Advanced AI, by contrast, is able to influence or drive data bias and the accountability of decision-making. If the machine learning algorithm is based on a complicated neuronal network or a genetic algorithm is produced by directed evolution, it may prove nearly impossible to understand why, or even how, the algorithm is assessing the project environment, its actors and activities based on their success or failure rate. However, as machine values are derived in the cultural context of humans, mechanised industry and science, these values are often differently represented algorithmically and operationalised in computational systems. This leads to a misnomer: ‘machine values’ are not really machine values; they are simply human values that lend themselves to implementation in machine cognition. This means that AI in the context of project management is at present nothing more than the current experience of project management practice (e.g. PMBOK or Prince2), but without having considered all the risks and limitations associated with AI in this context..

There is some debate on the controversial issue of ethical compliance in AI-based systems. But there is also acceptance that the simple AI minds will self-replicate these patterns, whereas the ethical risks and limitations in advanced AI should be considered much more. This is because advanced AI can specialise in more than one task, and it is becoming so advanced that the element of human values, ethical standards and supervision gets lost even before the ethical implications of simple and advanced AI have been discussed.

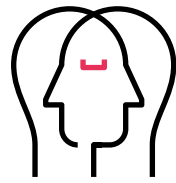
However, the main point of the controversy is to understand the importance of the term morality. Morality is the basis of ethics, and is essentially about the difference between what is right and what is wrong from the perspective of a human. So even in the simple AI that exists today, ethical dilemmas and implications are already beginning to arise. For example, you have a project close to failure owing to scope and time issues, and you ask your AI chatbot how you can hide or overcome this issue now. The chatbot, being an AI-driven program, cannot infer whether this is moral or immoral – if it’s right or wrong – and simply attempts to answer the question that has been put to it. So ethical dilemmas already exist or are beginning to arise in weak AI.⁴ The AI chatbot will recommend fast tracking and crashing schedule compression techniques without keeping in mind the level of performance and/or health conditions of the additional resources.

⁴ The Ethics of Artificial Intelligence, Bostrom, Nick/Yudkowsky, Elizer (2011)

Advanced AI project management software would automatically reallocate resources to parallel activities and accordingly shorten the schedule along the critical path. As a potentially fatal result, the advanced AI learns from such a successful bypass and through reverse adaptation incorporates the techniques fast tracking and crashing optimisation into standard AI project management mechanisms, which would result in the exploitation of labour and labour law violations. In another example, an advanced-AI-based project management system could decide in a product engineering, automotive or pharmaceutical project to postpone non-functional scope items to a later project phase or reduce test cycles, as they are not required for the core functionality of the new

product. This could result in a product design harmful to humans, for example because non-functional health, environmental or security standards have been lowered or postponed and not tested. Here the ethical question arises as to who is accountable for any of these decisions from the point of view of morality, reliability, corrigibility and reality.

Will the machine be responsible? Or will it be the human who designed the machine, the human who provided the data to train the algorithm, or even the human who used the machine and the underlying classifications and predictions?



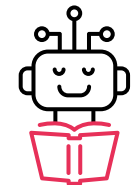
Morality

As morality refers to a code of conduct (law, business rules, cultural standards, etc.) that would be accepted by anyone who meets certain intellectual and volitional conditions, the AI machine algorithm needs to understand the defined code of conduct. For example, there should be ethical standards stipulating that it is not permitted for an advanced-AI-based project management system to optimise project success by reducing human and environmental safety (reward corruption).



Reliability

Even if the AI-based project management system follows a specific code of conduct, the algorithm may still be able to corrupt either the reward function itself or the data feeding it. It is therefore of utmost importance to ensure that the self-learning AI algorithms and the data feeding procedures and structures are reliable.



Corrigibility

For the event that an AI algorithm, through the self-learning process, violates the code of conduct intentionally (reward) or accidentally (optimisation), standards have to be defined and programmed into the AI-based project management system to shut down the whole software or to correct the algorithm immediately.



Reality

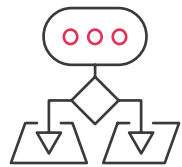
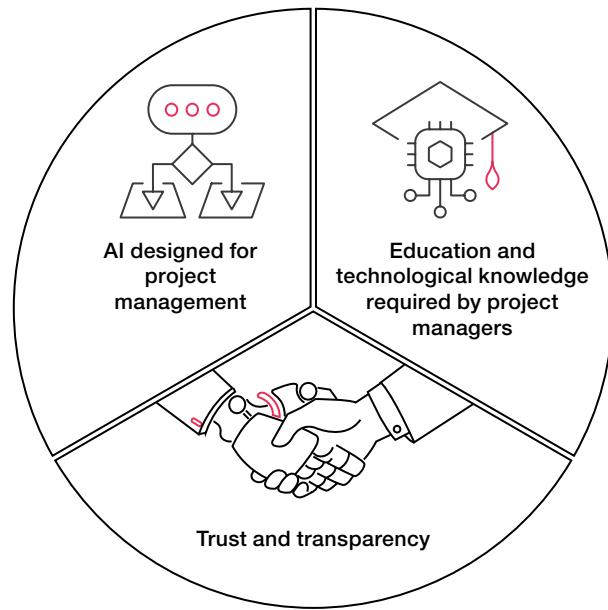
If it should come to harmful actions, classifications or predictions on the part of the AI-based project management system, there is still the question of impact, accountability and punishment in each real case. As a machine cannot be punished or made responsible for any actions, clear standards governing the enforcement of consequences have to be defined in the organisation.

Avoiding ethical issues in AI-based project management systems would require translating common human ethical standards into the machine learning algorithm and setting up ethical standards for using AI in the entire organisation. Furthermore, before using the system for decision-making processes the organisation has to define clear responsibilities in the event of any consequences (positive and negative) arising from the AI-based machine or in

collaboration with any human interaction. Understanding and addressing ethical and moral issues related to AI is still at a very early stage. It's not a simple matter of 'right or wrong' or 'good or bad'. It's not even a problem that can be solved by a small group of people. Even so, ethical and moral issues related to AI are critical, and need to be discussed now in the context of project management.



3 How to stay on the bright side of project management using AI



AI designed for project management

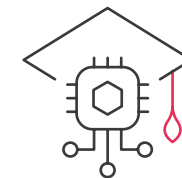
Our examination of the risks and limitations gives a clear picture of the potential pitfalls of using AI in project management. Even at the early stage we're at now, it's vital to be aware of the threats. But instead of throwing in the towel, we should be concentrating on drawing the right conclusions on how to circumvent potentially evil scenarios related to artificial intelligence. It's important to remember that history, as well as numerous current studies, suggests that while some jobs and activities will disappear, new opportunities will also arise in parallel. A wide range of social and natural science skills will be necessary to develop, support and commercialise artificial intelligence to enable its appropriate use in project management. If the right lessons are learned and suitable measures taken, we will be able to use AI to stay on the bright side of project management. From the advanced AI perspective, we see the most beneficial advances in project management relating to predictions (machine-learning-based project management) and in the autonomous project management space.

Machine-learning-based project management enables predictive analytics and can provide advice to the project manager, for example on how to set up and steer the project given certain parameters, and/or how to react

to certain issues and risks to reach the best possible outcome based on what worked in past projects.

Autonomous project management is most likely still decades away. The leading experts on artificial general intelligence cannot agree on a timeline: "[...] in such a poll of the AI researchers at the 2015 Puerto Rico AI conference, the average (median) answer was by year 2045, but some researchers guessed hundreds of years or more".⁵ Nevertheless, there might be dedicated areas where autonomous project management could serve as an extension of machine-learning-based project management in the future.

Summarising the paragraph above, AI clearly creates the possibility of automated processes and intelligent tools that will reduce manual work. To negotiate this journey successfully, it's essential to look beyond our own horizons and anticipate what actions have to be taken to ensure the use of artificial intelligence in project management stays on the bright side. Below we outline what project managers of the future will have to bring to the table to face the upcoming challenges, and how they can assume a new role where they collaborate with artificial intelligence rather than opposing it.

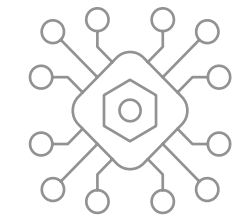


Education and technological knowledge required by PMs

The requirements for project managers to be able to use AI to their benefit vary depending on the precise application of AI within the project. Basically, these requirements fall into two categories: project management process knowledge, and general technological knowledge.

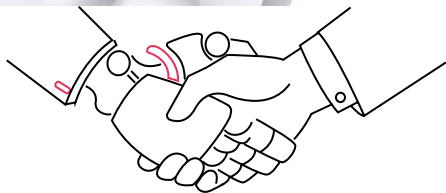
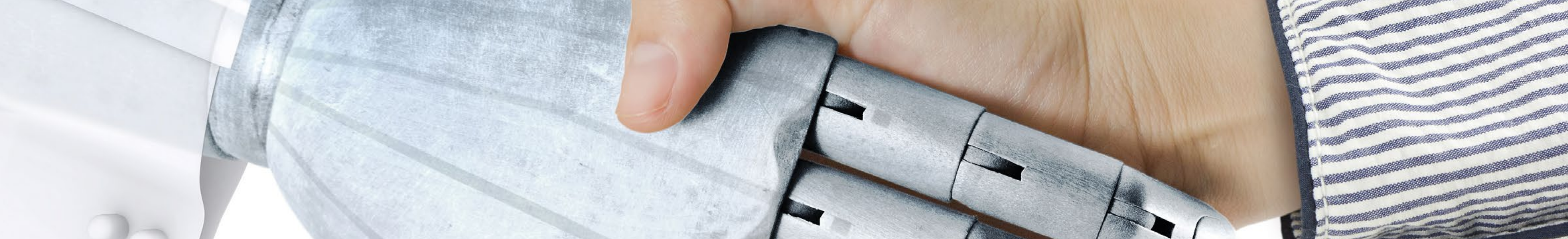
Project managers still need to know the ropes; they need to train holistically in project management processes and gain experience in managing projects the 'classical' way. PMs need to know the strategic impact their projects have on the organisation. They need to understand the goals their projects are trying to deliver and what sets their projects apart from others, including past projects.

However, in order to adapt to the new world of AI-supported project management, future project managers need to have a clear understanding of what AI can and cannot do. They need to be familiar with the project data set available within the organisation for the AI to learn from, since any potential bias lies within this data set. When it comes to evaluating the data set, it's important for project managers to ensure that the organisation's



One way of increasing transparency will be to have independent AI algorithm inspections conducted by a third-party trust provider who specialises in AI and has the skills to assess such a complex environment.

⁵ <https://futureoflife.org/background/benefits-risks-of-artificial-intelligence/>



Trust and transparency

Even if a project manager is educated in the core principles of AI, the question still remains as to whether we can trust an advanced AI project management system and its underlying machine learning algorithm to do what they were designed to do. For an advanced AI in particular, it will be even harder to answer this question, since technologies like machine and deep learning are so hard to grasp, even for experts in that domain. Not only this, but the behaviour of an AI system is heavily influenced by the data it has been trained on, and any inherent bias in the data will be reflected in the deployed models. What's even more striking is that many advanced-AI-based project management systems will potentially be used in zero-failure-tolerance engineering and construction projects (aircraft, automotive, life sciences, energy, military, etc.). This means that the question of trust is inevitable and central to any further efforts to spread the use of AI algorithms in such vital project environments.

Building trust in AI-based project management systems involves being clear about the algorithms selected and data used to train them. This means you need mathematicians and data scientists to independently assess the algorithms and data selections for bias, fairness and inclusion to ensure that the AI-based project management system is programmed and trained without human biases, and to prevent the AI system from evolving its own sentience and sapience to come up with its own biases. One way of increasing transparency will be to

have independent AI algorithm inspections conducted by a third-party trust provider who specialises in AI and has the skills to assess such a complex environment.

Building trust in AI also involves creating a transparent accountability and responsibility matrix and ethical standards within the organisation that clearly outline what happens when an AI system fails at a certain assigned task. Who should be the entity responsible for an undesirable consequence that was caused by the programming code, the entered data, the improper operation or other factors?

Furthermore, given that the project management data used to train the AI algorithm often includes personal and private data (e.g. timesheets or HR records), security and privacy standards and requirements should be defined within the organisation. To prevent misuse and malicious use, the data stewards and the data owner responsible must manage this data properly. To keep data safe, each action on the data should be detailed and recorded by the AI-based project management software.

This means that project managers of the future who use advanced AI in their projects also need, in addition to their core project management knowledge, new skills and knowledge in mathematics, data science and compliance to be able to assess the risk and limitations of the dark side of AI.

Conclusion

When it comes to preventing project management from falling into AI darkness, making sure project managers are aware of the difference between simple AI and advanced AI is merely the first step. Project managers need to understand how advanced AI works and how to trust the results it presents. But they also need to know about the myths and risks, as well as the fears that advanced AI pose. As with any endeavour, it's essential to plan for failure: AI implementation will not be free of risk. Just as car manufacturers build in safety measures for engine breakdowns, flat tyres or brake failure, project managers need to anticipate and plan for any exceptional AI-driven flaw.

The risks presented in this paper can be navigated. Project managers need to embark on a journey to improve their overall risk literacy to successfully use AI to support their projects. We recommend the following steps to get the best results from using AI in projects:

1. Define a path towards gaining technical expertise in AI at all levels of project management
2. Create an understanding of the perceived and actual impediments, myths, fears and risks surrounding AI-based project management systems
3. Establish ethical standards for using AI-based project management systems
4. Ensure that the AI algorithm you're using is aligned with your values and goals and doesn't violate your human and environmental safety and security standards, by incorporating independent assessments.

If AI is to be successfully used within project management, above all the project manager of the future needs to comprehend the basic functionality of the software and have an understanding of how the AI gets to the results it comes up with. But project sponsors and important project stakeholders, as well as team members, will also need to know that AI is supporting the project.

More importantly, project data owners need to be involved early on to make sure that any potential bias in the project data can be identified and eliminated.

Once project managers know the difference between the myths surrounding AI and its actual limitations, they can act accordingly and ask the right questions. The different dimensions of AI risk presented in this paper can be exploited as an advantage in project management. When project managers understand how AI can be expected to behave and what the actual mistakes might be, for example mistakes resulting from a failure to properly set up security layers or privacy aspects in the AI, they can take advantage of the AI. This is where human project managers shine and can make use of the whole spectrum of human skills.

Ethical standards for using AI systems in project management will help project managers use the data properly and ensure that responsibility and accountability for decisions made using AI support are clear from the very outset. Especially in areas with higher safety, independence and/or privacy concerns, company-wide ethical standards need to be non-negotiable and implemented without fail.

As AI-based project management systems become more complex than normal project management software, it's even more important to use trusted software and algorithms. This level of trust can only be achieved by incorporating regular independent assessments of project management systems. Experienced assessors can challenge the results projected by the AI system.

If these four steps are followed, project managers using AI will not only be able to stay on the bright side of project management and be more successful in implementing their projects, but they will also have gained a deeper understanding of their project and the risks associated, and will be able to prevent project management from falling into AI darkness.



The benefit principle

“The principles [for beneficial machines] are: machines that are altruistic, that want to achieve only our objectives, but that are uncertain about what those objectives are, and will watch all of us to learn more about what it is that we really want.”

Russell (2017)



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