# Artificial Intelligence: Committing to achieving the next frontier[1, 2]

**Paul Grignon**

## ABSTRACT

Artificial Intelligence is exponentially empowering our decision support systems and many beneficial transformative applications are yet to come. However, concerns of disruptive use of AI have recently called our attention on major issues of responsibility, liability and transparency. This report surveys the landscape of risk assessment in contract management with AI and highlights 10 primary attributes of measure in order to identify best alternatives with the purpose to better forecast, prevent and mitigate these threats and maximize AI benefits. We analyze but do not conclusively resolve the issue of unpredictability. We focus instead on the criteria to build on and advocate for robust and ethically responsible AI contract management, recognizing the qualities of inconveniences so as to build great beneficial leading projects.

To this effect, we support 4 recommendations:

- Transparency in decision making
- Core ethical values
- Responsibility for mistakes
- Mitigating social/global dislocation

**Key words:** Artificial Intelligence, Ethic Management/governance, Responsible AI practices, Responsible research and innovation, Risk Assessment, Risk Management

## INTRODUCTION

Last June 26, 2018, on Capitol Hill in Washington D.C., the Subcommittee on Research and Technology and Subcommittee on Energy Hearing on Artificial Intelligence opened with the

[1] Editor's note: This paper was prepared for the course "International Contract Management" facilitated by Dr Paul D. Giammalvo of PT Mitratata Citragraha, Jakarta, Indonesia as an Adjunct Professor under contract to SKEMA Business School for the program Master of Science in Project and Programme Management and Business Development. http://www.skema.edu/programmes/masters-of-science. For more information on this global program (Lille and Paris in France; Belo Horizonte in Brazil), contact Dr Paul Gardiner, Global Programme Director, at paul.gardiner@skema.edu.

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statement "With Great Power Comes Great Responsibility"![3]

Since the first program[4] especially engineered to mimic the problem-solving skills of a human being by RAND corporation scientists in the 1950's, the development of Artificial Intelligence has been exponential in all industries. AI is now becoming an essential part of our lives and economy and has the potential to make our lives better in many ways. Algorithms are playing an increasingly large role and the capabilities and beneficial impacts at all levels are innumerable, from keeping spam out of your inbox or deciding what books or holiday destination to buy online to diagnosing and treating cancer. Artificial intelligence can also help us manage highly complex systems such as for instance the system at the heart of the Port of Los Angeles container terminal or similarly, monitor the share market for suspicious trading activity or assist with ground and air traffic control worldwide. In other words, as AI shapes our lives, it also links our future closely to its own in all fields - Education, Commerce, Energy, Agriculture, Space Travel, Transportation, Healthcare and many others.

AI projects and programs cover a wide size and complexity range of undertakings and large-scale assets.

| | Definition | Target | AI scope |
|---|---|---|---|
| Project | "A temporary organization that is created for the purpose of delivering one or more business products according to a specified Business Case"[5] | Producing outputs, deliverables<br>A single functional unit | Developing a smart watch / robotic lawn mower / specific single software application |
| Programme | "A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually"[6] | Multiple projects<br>Outcomes<br>Business benefits<br>RoI<br>New capabilities | Organizing the implementation of IT systems, critical people and process issues |
| Strategic Programme | Linked to a specific business goal or strategic initiative | Multiple functional units within an organization | Improving highway safety<br>Reducing traffic<br>Improving air quality |

[3] Subcommittee on Research and Technology and Subcommittee on Energy Hearing - Artificial Intelligence. (2018, June 26). Retrieved from https://science.house.gov/legislation/hearings/subcommittee-research-and-technology-and-subcommittee-energy-hearing-artificial

[4] History of Computers and Computing - The Logic Theorist. (n.d.). Retrieved from https://history-computer.com/ModernComputer/Software/LogicTheorist.html

[5] *Wideman Comparative Glossary of Project Management Terms v5.5 | Definition of a Project*. (n.d.). Retrieved from http://www.maxwideman.com/pmglossary/PMG_P12.htm#Project

[6] *GAPPS Program Typology*. (n.d.). Retrieved from https://globalpmstandards.org/wp-content/uploads/2014/12/GAPPS-Program-Typology.pdf

| | | | |
|---|---|---|---|
| | | | Enhancing port security |
| **Operational Programme** | Linked to day to day operations organization | Attaining the sponsoring's future state | Operational development of solutions |
| **Multi-project Programme** | Interdependent constituent projects (with shared resources) | Planning, coordinating, organizing, supervising the use of resources to create the product and dispatch it to clients | Multi-company development of medical devices |
| **Mega project** | Large-scale complex ventures | A specific asset for the sponsoring organization | Power plants, dams, oil & gas extraction projects, IT systems, weapon systems |

*Figure 1: AI projects and programmes structure*[7]

| Category | End product | Example of RoI / RoA / new capabilities |
|---|---|---|
| Revenue Generating / "Top Line" Projects | Multi-billion-dollar project Gordie Howe International Bridge connecting Detroit, Michigan and Windsor, Ontario[8] | Improved international transportation<br>Increased growth opportunities |
| | Intelligent robots in oil and gas extraction[9] | Improved productivity and cost effectiveness<br>Reduced worker risk and environmental impact |
| Cost containment / "Bottom Line" projects | Development of a container yard staff rostering for Hong Kong International Terminals[10] | Increased performance of staff availability/workload demands<br>30% increased work efficiency & productivity |
| | Development of Hong Kong AI-powered subway[11] | A 99.9 per cent on time record<br>Improved network & smart maintenance & compliance with regulation |
| Government mandated projects | City of Pittsburgh Scalable Urban Traffic Control[12] | Resulted in:<br>- a 25 % reduction in travel time<br>- a 34% increase in vehicle speed,<br>- a 31% decrease in traffic stops |

[7] By author

[8] Civil + Structural Engineer magazine. (2018, November 1). *Artificial intelligence drives project cost savings*. Retrieved from https://csengineermag.com/article/artificial-intelligence-drives-project-cost-savings/

[9] Sennaar, K. (2018, November 14). *Artificial Intelligence in Oil and Gas - Present and Future Applications*. Retrieved from https://www.techemergence.com/artificial-intelligence-in-oil-and-gas/

[10] CHUN, A. (n.d.). HIT: Staff Rostering - Artificial Intelligence Optimization Hong Kong. Retrieved from http://www.cs.cityu.edu.hk/~hwchun/AIProjects/stories/hrrostering/hitrostering/

[11] Hodson, H. (2014, July 2). *The AI boss that deploys Hong Kong's subway engineers*. Retrieved from https://www.newscientist.com/article/mg22329764-000-the-ai-boss-that-deploys-hong-kongs-subway-engineers/

[12] Desouza, K. (2018). *Delivering Artificial Intelligence in Government: Challenges and Opportunities*. Retrieved from http://www.businessofgovernment.org/sites/default/files/Delivering%20Artificial%20Intelligence%20in%20Government.pdf

| | | |
|---|---|---|
| | | - a 40 % reduction in wait time<br>- a 21 %decrease in emissions |
| | Hong Kong's Immigration Department[13] | Optimal processing of about 100 different application forms related to visas, travel documents and identity cards |
| Community service / "Good will" projects | Corporate social responsibility (CSR) projects & programs[14] | Establishing trust & continuous growth<br>Reducing carbon footprints to mitigate climate change<br>Aiding alleviate environmental issues<br>Developing Alternative fuels<br>Optimizing data centers power consumption<br>Boosting Renewable energy projects<br>Engaging in socially and environmentally conscious investments |

*Figure 2: Example of AI Portfolios*[15]

| | |
|---|---|
| **Information assets** | IT, Engineering, Research, all AI bodies of knowledge and information resources |
| **Human assets** | Human resources, capital and talents |
| **Physical assets** | Operations |
| **Financial assets** | Financial resources |
| **Intangible assets** | Sales & marketing<br>Legal protection, intellectual property |

*Figure 3: AI assets*[16]

| | Definition | Target | Examples |
|---|---|---|---|
| **Portfolio of projects** | A strategic investment set of coordinated project proposals / programmes / sub portfolios and operations | Achieve the organization's strategic objectives | -A Data Science portfolio to optimize investments on financial platforms<br>-Big Data portfolio to improve sales and marketing operations & performance of trading firms<br>-Portfolio of creative, innovative solutions to businesses' challenges<br>-Digital transformation of enterprises / Health sector/ Transport systems, ... |
| **Portfolio of assets** | Strategic assets & resources "dedicated" to | Maximize the expected returns and minimize the | AI resources allocated in supporting the Portfolio:<br>- Deep Learning |

[13] Desouza, K. (2018). *Delivering Artificial Intelligence in Government: Challenges and Opportunities*. Retrieved from http://www.businessofgovernment.org/sites/default/files/Delivering%20Artificial%20Intelligence%20in%20Government.pdf

[14] Sickler, J. (2018, November 16). *Powerful Corporate Social Responsibility (CSR) Examples*. Retrieved from https://www.reputationmanagement.com/blog/corporate-social-responsibility-examples/

[15] By author

[16] By author

| | | | |
|---|---|---|---|
| | Portfolio returns and performance | risk[17]<br>Provide a competitive advantage to the organization[18] | - Machine Learning<br>- Image recognition<br>- Speech / voice recognition<br>- Modeling<br>- Analytics<br>- Cloud computing<br>- Predictive modeling<br>- Data acquisition and collection<br>- Natural Language Processing<br>- Optimization tools and techniques |

*Figure 4: AI Portfolio of projects and assets' scope*[19]

This leads to some interesting questions worthy of analysis in the area of AI risk management and the implications for the future. It is acknowledged that AI poses significant risks, and we are not in denial of the potential for hazardous or disruptive risks even though there is very little evidence that AI poses a catastrophic existential risk to the survival of humanity. Indeed, as smart systems become involved in ever more decisions, there is a danger that the system is only as good as the data it learns from. For example, algorithms which are being used to make decisions such as when prisoners should be given parole are only as good as the data we feed them. In another sector, take a system trained to identify pneumonia patients with a higher risk of death which inadvertently discards patients with asthma as being at lower risk (because in normal situations, these patients are sent straight to intensive care reducing thus their risk of death). The machine learning tool took this to mean that asthma combined with pneumonia resulted in lowering the risk of death.

Similarly, there exists a number of challenging risks that demand effective understanding and mitigating. An important social criterion for dealing with organizations is being able to find the person responsible for getting something done. When an AI system fails at its assigned task, who takes the blame? The programmers? The end-users? In our modern world, issues of responsibility**,** transparency and auditability are often so widely distributed and diluted in established procedures that they are watered down, and no one can be identified to blame for the disruption that results.

[17] Samuels, M. (2018, November 27). *How big data is helping to power Mercedes to F1 glory*. Retrieved from https://www.zdnet.com/article/how-big-data-is-helping-to-power-mercedes-to-f1-glory/

[18] Samuels, M. (2018, November 29). How machine learning and data science give Bloomberg a competitive advantage. Retrieved from https://www.zdnet.com/article/how-machine-learning-and-data-science-give-bloomberg-a-competitive-advantage/

[19] By author

**Now how should we deal with AI responsibility, transparency and auditability when something disruptive happens?**

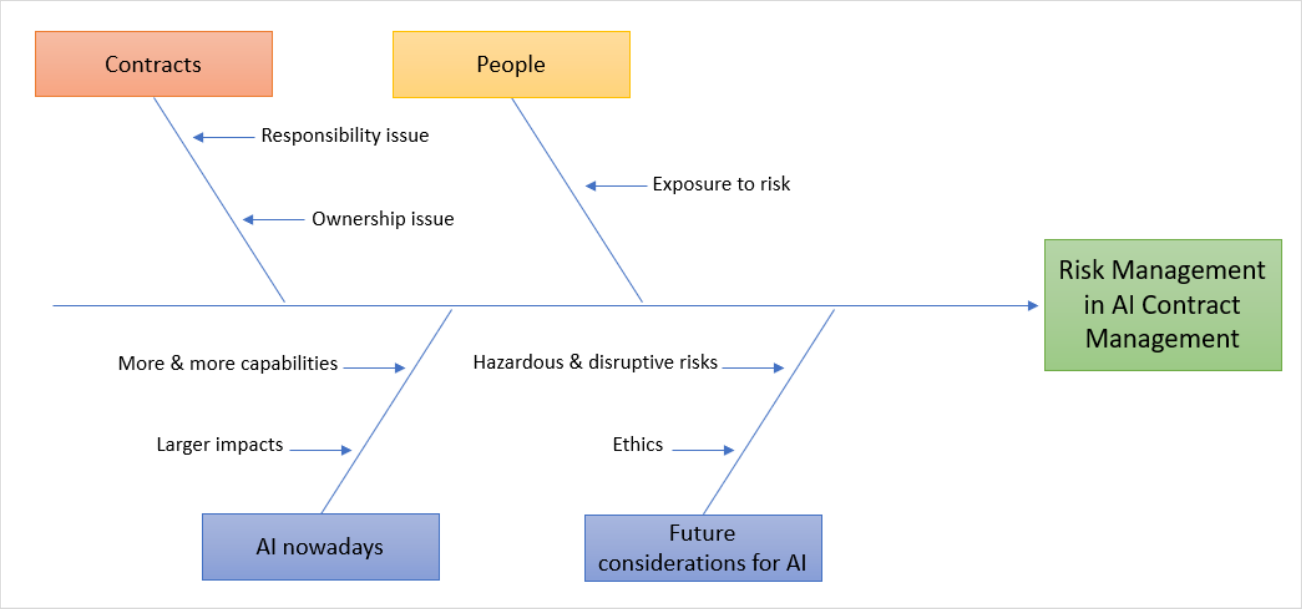


*Figure 5: Root Cause Analysis*[20]

Ethicists and researchers are currently examining these questions, dedicating serious effort and thought to the problem. The purpose is to anticipate, collect material for analysis, identify and evaluate these potential impacts.

It is after I investigated these concerns that I was led to ask myself where our efforts should best be directed in priority and Ethics designated itself as a major issue.
This paper aims to contribute to the debate by focusing on the fundamental issues of ownership and responsibility. To this end, it brings together several challenges where research is still needed and investigates 3 major questions at stake for the AI industry:

- What risk and opportunities exist with AI?
- Who is best positioned to manage those risks?
- How do we allocate those risks via the contract document?

[20] By author

## METHODOLOGY

### STEP 1: Problem Definition

As AI is exponentially empowering our decision support systems and many beneficial transformative applications are yet to come, concerns of vulnerability and breaches in AI contract management have recently emerged focusing on:

- The potential implications of AI technology in the race for Global Leadership
- Unregulated algorithm-focused development
- Data issues
- Fraud practices
- Fair treatment for all parties

### STEP 2: Possible Alternatives

1) The 12 alternatives which we reviewed to deal with risk in AI contract management included:
   a. Alternative 1: Do nothing (resort to in-situ arbitration)[21]
   b. Alternative 2: Regularize technical failures (verify Math properties, embedded ML, …)[22]
   c. Alternative 3: Rely on M2M persistent training and rounds of self-improvement (i.e. without any human involvement)[23]
   d. Alternative 4: Limit AI's autonomy[24]
   e. Alternative 5: Develop a human-based computation[25]

[21] Daws, R. (2018, May 11). White House will take a 'hands-off' approach to AI regulation. Retrieved from https://www.artificialintelligence-news.com/2018/05/11/white-house-hands-off-ai-regulation/

[22] Yudkowsky, E. (2001). *Creating Friendly AI 1.0: The Analysis and Design of Benevolent Goal Architectures*. Retrieved from https://intelligence.org/files/CFAI.pdf

[23] Risk Management Group. (2012, April). *The Top Five Fraud Risks Arising from M2M Communications for Telco Operators*. Retrieved from http://www.lavastorm.com/assets/trmg-top-5-risks-in-m2m-environment.pdf

[24] ICRC. (2018, April 10). *Towards limits on autonomy in weapon systems*. Retrieved from https://www.icrc.org/en/document/towards-limits-autonomous-weapons

[25] Emerging Technology from the arXiv. (2015, June 4). *The Emerging Science of Human Computation*. Retrieved from https://www.technologyreview.com/s/538101/the-emerging-science-of-human-computation/

f. Alternative 6: Slow down the current fast pace of development[26]
g. Alternative 7: Relinquishment (for containing the threat)[27]
h. Alternative 8: Accelerate AI development[28]
i. Alternative 9: Invest counter AI capabilities[29] (*Si vis pacem, para bellum* – "If you want peace, prepare for war")
j. Alternative 10: Build legal framing and enforcement of beneficial AI (Legal arbitration)[30]
k. Alternative 11: Make AI a virtuous cooperative project building ethical alignment and value framework for safe AI behavior[31]
l. Alternative 12: Establish Governance of AI & safety agreement compliance in AI[32]

2) Attributes to measure, assess or evaluate each alternative:

Primary objective: facilitate an insightful risks & rewards evaluation of each alternative

Secondary objective: establish ranking of alternatives

The attributes[33] [34] [35] we identified were:

- Safety & verifiability

[26] Browne, R. (2018, August 16). *Tech firms say A.I. can transform health care as we know it. Doctors think they should slow down*. Retrieved from https://www.cnbc.com/2018/08/17/healthcare-and-ai-doctors-warn-on-the-pace-of-technological-change.html

[27] Joy, B. (2000, April 1). *Why the Future Doesn't Need Us*. Retrieved from https://www.wired.com/2000/04/joy-2/

[28] More, M. (2001, February 21). *Embrace, Don't Relinquish, the Future*. Retrieved from http://www.kurzweilai.net/embrace-dont-relinquish-the-future

[29] Dickson, B. (2018, April 20). How to counter the threat of AI-based forgery. Retrieved from https://bdtechtalks.com/2018/04/16/artificial-intelligence-deepfakes-blockchain/

[30] Design for Values. (n.d.). *Responsible AI*. Retrieved from http://designforvalues.tudelft.nl/projects/responsible-artificial-intelligence/

[31] Future of Life Institute. (2018). *2018 AI Grant Recipients*. Retrieved from https://futureoflife.org/2018-ai-grant-recipients#Ermon

[32] Future of Life Institute. (2018). *2018 AI Grant Recipients*. Retrieved from https://futureoflife.org/2018-ai-grant-recipients#Ermon

[33] Design for Values. (n.d.). *Responsible AI*. Retrieved from http://designforvalues.tudelft.nl/projects/responsible-artificial-intelligence/

[34] Keeney, R. L., & Gregory, R. S. (2005, February 1). *Selecting Attributes to Measure the Achievement of Objectives*. Retrieved from https://pubsonline.informs.org/doi/abs/10.1287/opre.1040.0158

[35] Dignum, V. (2018, March 4). *The ART of AI? Accountability, Responsibility, Transparency*. Retrieved from https://medium.com/@virginiadignum/the-art-of-ai-accountability-responsibility-transparency-48666ec92ea5

- Reliability
- Liability
- Social impact
- Value assessment of impact
- The SMART goals[36] – Specific, Measurable, Attainable & Achievable, Realistic, Time-based & Trackable

**STEP 3: Development of Outcomes, Tools & Techniques**

Primary objective: assess each alternative against the attributes selected, from best to worst, by using a Multi Attribute Decision Making technique.
Secondary objective: highlight multi-attribute value in endeavors to maximize the benefits and minimize collateral damage

In order to assess the alternatives from best to worst, we performed a Multi Attribute Decision Making (MADM) method on the 12 alternatives listed earlier and ranked the attributes selected from most (1) to least (5) important. The MADM and ranking rely on the research referred in this paper.

| Ordinal ranking | | Possible mark from best to worst | | | |
|---|---|---|---|---|---|
| 1 | Safety | High | Medium | Low | |
| 2 | Reliability | High | Medium | Low | |
| 3 | Liability | Explicit & Unambiguous | Complex Ambiguous | None | |
| 4 | Social Impact | Beneficial | Neutral | Unknown | Disruptive |
| 5 | Value assessment | Best choice | Acceptable | Unacceptable | |
| 6 | Realistic | High | Medium | Low | |
| 7 | Attainable & Achievable | High | Medium | Low | |
| 8 | Measurable | High | Medium | Low | |
| 9 | Specific | High | Medium | Low | |
| 10 | Time-based & Trackable | High | Medium | Low | |

*Figure 6: Ranking of the attributes used to assess the 12 alternatives*[37]

[36] Haughey, D. (n.d.). SMART Goals. Retrieved from https://www.projectsmart.co.uk/smart-goals.php

[37] By author

We then performed the MADM as follows:

| Attribute\Alternative | Alt. 1 | Alt. 2 | Alt. 3 | Alt. 4 | Alt. 5 | Alt. 6 |
|---|---|---|---|---|---|---|
| Safety | Low | High | High | High | Medium | Low |
| Reliability | Low | High | Medium | Medium | Medium | Low |
| Liability | None | Explicit & Unambiguous | Complex Ambiguous | Complex Ambiguous | Explicit & Unambiguous | Complex Ambiguous |
| Social Impact | Unknown | Beneficial | Neutral | Neutral | Neutral | Neutral |
| Value Assessment | Unacceptable | Acceptable | Acceptable | Acceptable | Acceptable | Unacceptable |
| Realistic | Low | High | Medium | Low | High | Low |
| Attainable & Achievable | High | High | Medium | Low | High | Low |
| Measurable | Medium | High | Medium | Medium | High | Medium |
| Specific | Medium | High | Low | Low | High | Medium |
| Time-based & Trackable | High | High | Medium | Medium | High | Low |

*Figure 7: MADM of the first 6 alternatives*[38]

| Attribute\Alternative | Alt. 7 | Alt. 8 | Alt. 9 | Alt. 10 | Alt. 11 | Alt. 12 |
|---|---|---|---|---|---|---|
| Safety | Low | Medium | High | Medium | High | High |
| Reliability | Low | Medium | Medium | High | High | High |
| Liability | None | Complex Ambiguous | Complex Ambiguous | Explicit & Unambiguous | Explicit & Unambiguous | Explicit & Unambiguous |
| Social Impact | Disruptive | Unknown | Disruptive | Neutral | Beneficial | Beneficial |
| Value Assessment | Unacceptable | Acceptable | Acceptable | Acceptable | Acceptable | Best choice |
| Realistic | Low | High | High | High | High | High |
| Attainable & Achievable | Low | High | High | High | Medium | Medium |
| Measurable | High | High | High | High | High | High |
| Specific | High | High | High | High | High | High |
| Time-based & Trackable | Low | High | High | High | High | High |

*Figure 8: MADM of the last 6 alternatives*[39]

The MADM analysis provides us with a general overview of the efficiency of each alternative, with Alternatives #1, #6 and #7 designated as worst and Alternatives #2, #11 and #12 as best.

**STEP 4: Selection of the criteria**

Primary objective: select criteria to accept or reject the alternative solutions

[38] By author

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Secondary objective: identify the desirable alternatives

The identification of multi-attribute value of AI management highlights the following criteria:

| Best choice | Minimum acceptable | Unacceptable / Worst choice |
|---|---|---|
| Recognizing the qualities and inconveniences so as to build great beneficial leading projects, transparency in decision making, core ethical values, responsibility for mistakes/damages, mitigating social/global dislocation | Human-centered, responsibility, transparency, accountability, security, clean data, safeguards/reverse procedures, front rank contain | Illegal, immoral, irresponsible, irrational, ill-informed, incompetent, unaccountable, uncertain, unpredictable, uncontrollable, criminal, unlawful, felonious, lawless, harmful, unfair, biased, unethical, social dislocation implications, threat to security, uncertain, corrupt or erroneous data, unregulated mutation, accurate, unambiguous, explicit about uncertainty, infamous, breaches with human rights, discriminating |

*Figure 9: Criteria for identification of multi-attribute value of AI management*[40]

**STEP 5: Analysis and comparison of the alternatives**

Objective: Analyze & compare alternatives
Method: Additive weighting technique

We used a data analysis model as the additive weighting method to rank the solutions from best to worst and weighed each attribute mark following this grid:

| Color | | | | |
|---|---|---|---|---|
| Attribute weight | 0 | 0.25 | 0.5 | 1 |

*Figure 10: Weight grid*[41]

The ranking of the attributes from (1) to (5) enabled us to weight each attribute differently, as follows:

| Attribute | Normalization | | | |
|---|---|---|---|---|
| | Relative Rank | Normalization weight (A) | | |
| Safety | 1 | 10/55 | = | 0.182 |

[40] By author

[41] By author

| | | | | |
|---|---|---|---|---|
| Reliability | 2 | 9/55 | = | 0.164 |
| Liability | 3 | 8/55 | = | 0.145 |
| Social Impact | 4 | 7/55 | = | 0.127 |
| Value Assessment | 5 | 6/55 | = | 0.109 |
| Realistic | 6 | 5/55 | = | 0.091 |
| Attainable & Achievable | 7 | 4/55 | = | 0.073 |
| Measurable | 8 | 3/55 | = | 0.055 |
| Specific | 9 | 2/55 | = | 0.036 |
| Time-based and Trackable | 10 | 1/55 | = | 0.018 |
| Total | 55 | SUM | = | 1 |

*Figure 11: Relative weighting of each attribute according to his rank*[42]

The data analysis model pointed out the best alternatives:

| Attribute | Alt1 (B) | | Alt2 (C) | | Alt3 (D) | | Alt4 (E) | |
|---|---|---|---|---|---|---|---|---|
| | (B) | (A)*(B) | (C) | (A)*(C) | (D) | (A)*(D) | (E) | (A)*(E) |
| Safety | 0 | 0 | 1 | 0.182 | 1 | 0.182 | 1 | 0.182 |
| Reliability | 0 | 0 | 1 | 0.164 | 0.5 | 0.082 | 0.5 | 0.082 |
| Liability | 0 | 0 | 1 | 0.145 | 0.5 | 0.073 | 0.5 | 0.073 |
| Social Impact | 0.25 | 0.032 | 1 | 0.127 | 0.5 | 0.064 | 0.5 | 0.064 |
| Value Assessment | 0 | 0 | 0.5 | 0.055 | 0.5 | 0.055 | 0.5 | 0.055 |
| Realistic | 0 | 0 | 1 | 0.091 | 0.5 | 0.046 | 0 | 0 |
| Attainable and Achievable | 1 | 0.073 | 1 | 0.073 | 0.5 | 0.037 | 0 | 0 |
| Measurable | 0.5 | 0.028 | 1 | 0.055 | 0.5 | 0.028 | 0.5 | 0.028 |
| Specific | 0.5 | 0.018 | 1 | 0.036 | 0 | 0 | 0 | 0 |
| Time-based and Trackable | 1 | 0.018 | 1 | 0.018 | 0.5 | 0.009 | 0.5 | 0.009 |
| Total | SUM | 0.169 | SUM | 0.945 | SUM | 0.576 | SUM | 0.493 |

*Figure 12: Assessment and ranking of the alternatives (1-4)*[43]

[42] By author

[43] By author

| Attribute | Alt5 (F) | | Alt6 (G) | | Alt7 (H) | | Alt8 (I) | |
|---|---|---|---|---|---|---|---|---|
| | (F) | (A)*(F) | (G) | (A)*(G) | (H) | (A)*(H) | (I) | (A)*(I) |
| Safety | 0.5 | 0.091 | 0 | 0 | 0 | 0 | 0.5 | 0.091 |
| Reliability | 0.5 | 0.082 | 0 | 0 | 0 | 0 | 0.5 | 0.082 |
| Liability | 1 | 0.145 | 0.5 | 0.073 | 0 | 0 | 0.5 | 0.073 |
| Social Impact | 0.5 | 0.064 | 0.5 | 0.064 | 0 | 0 | 0.25 | 0.032 |
| Value Assessment | 0.5 | 0.055 | 0 | 0 | 0 | 0 | 0.5 | 0.055 |
| Realistic | 1 | 0.091 | 0 | 0 | 0 | 0 | 1 | 0.091 |
| Attainable and Achievable | 1 | 0.073 | 0 | 0 | 0 | 0 | 1 | 0.073 |
| Measurable | 1 | 0.055 | 0.5 | 0.028 | 1 | 0.055 | 1 | 0.055 |
| Specific | 1 | 0.036 | 0.5 | 0.018 | 1 | 0.036 | 1 | 0.036 |
| Time-based and Trackable | 1 | 0.018 | 0 | 0 | 0 | 0 | 1 | 0.018 |
| Total | SUM | 0.710 | SUM | 0.183 | SUM | 0.091 | SUM | 0.606 |

*Figure 13: Assessment and ranking of the alternatives (5-8)*[44]

| Attribute | Alt9 (J) | | Alt10 (K) | | Alt11 (L) | | Alt12 (M) | |
|---|---|---|---|---|---|---|---|---|
| | (J) | (A)*(J) | (K) | (A)*(K) | (L) | (A)*(L) | (M) | (A)*(M) |
| Safety | 1 | 0.182 | 0.5 | 0.091 | 1 | 0.182 | 1 | 0.182 |
| Reliability | 0.5 | 0.082 | 1 | 0.164 | 1 | 0.164 | 1 | 0.164 |
| Liability | 0.5 | 0.073 | 1 | 0.145 | 1 | 0.145 | 1 | 0.145 |
| Social Impact | 0 | 0 | 0.5 | 0.064 | 1 | 0.127 | 1 | 0.127 |
| Value Assessment | 0.5 | 0.055 | 0.5 | 0.055 | 0.5 | 0.055 | 1 | 0.109 |
| Realistic | 1 | 0.091 | 1 | 0.091 | 1 | 0.091 | 1 | 0.091 |
| Attainable and Achievable | 1 | 0.073 | 1 | 0.073 | 0.5 | 0.037 | 0.5 | 0.037 |
| Measurable | 1 | 0.055 | 1 | 0.055 | 1 | 0.055 | 1 | 0.055 |
| Specific | 1 | 0.036 | 1 | 0.036 | 1 | 0.036 | 1 | 0.036 |
| Time-based and Trackable | 1 | 0.018 | 1 | 0.018 | 1 | 0.018 | 1 | 0.018 |
| Total | SUM | 0.665 | SUM | 0.792 | SUM | 0.910 | SUM | 0.964 |

*Figure 14: Assessment and ranking of the alternatives (9-12)*[45]

[44] By author

[45] By author

The comparative of alternatives calls for the critical importance of addressing effectively issues of:

- Responsibility
- Liability
- Core values
- Mitigating dislocation

**STEP 6: Selection of the preferred alternative**

Objective: Select the preferred alternative
Method: Bar-graph ranking from most satisficing down

This analysis highlighted:

- Alternative #12 - Establish Governance of AI & safety agreement compliance in AI – as the best possible alternative, closely followed by Alternatives #2 and #11
- Alternatives #7 and #1 –Relinquishment and Do nothing – as the worst alternatives.

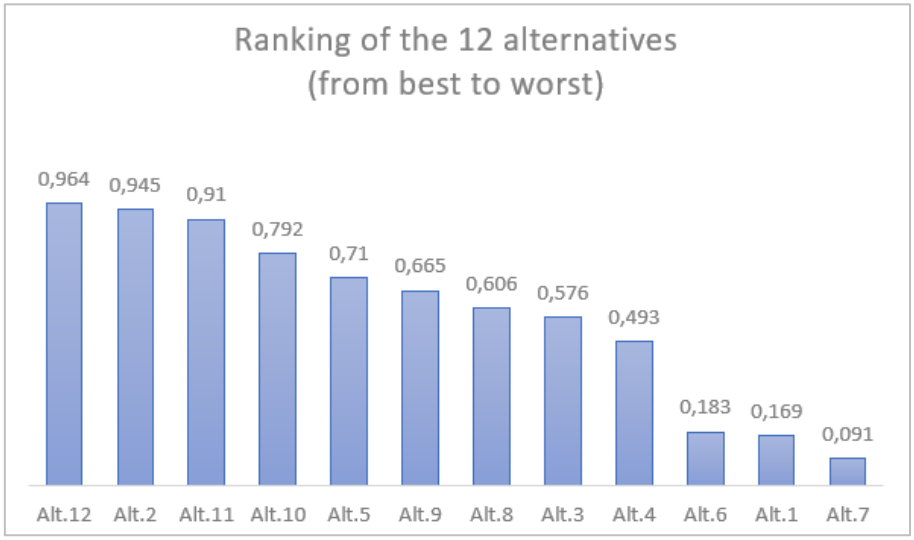


*Figure 15: Ranking of the 12 alternatives, from best to worst*[46]

As evidenced, there are a number of rational alternatives for the gaps in contract management of AI risk. However, one of the most important to bridge is the existing gap between all stakeholders of AI undertakings, notably developers, businesses, government institutions and end-users.

[46] By author

For AI to achieve its full potentialities, it will require to[47]:

- Build a predictable and transparent framework for the complex core issues of accountability, transparency and liability
- Maximize collaboration and mitigate clear potential conflicts between personal and collective concerns
- Deconstruct the risk of social dislocation

**STEP 7: Performance monitoring and post-evaluation of the results**

Given the intrinsic dynamics of AI risk environment, methods to build robust AI contract management are multiple & resourceful. Accordingly, it is recommended to[48]:

- Review all feasible alternatives on a regular basis
- Read and analyze any appearing trends and gaps
- Work at a continual process of checking, reviewing, and monitoring
- Ensure the signals are read
- Act on the signals.

**CONCLUSION**

With obvious links to recent realities of risks that have affected AI asset management - notably self-driving car crash case, military killer robots, new emerging discriminating & disruptive AI technologies and subsequent potential breaches in fundamental Human Rights - the analysis of best alternatives to deal with risk assesses the key features of:

- Understanding effectively the gaps in the risk assessment and management context of AI
- Filling these gaps from lessons learned provided by past and current cases
- Building collaborative adaptability while targeting current & future research of further potential gaps

[47] HOUSE OF LORDS. (2017). *AI in the UK: ready, willing and able?* Retrieved from https://publications.parliament.uk/pa/ld201719/ldselect/ldai/100/100.pdf

[48] Wagner, D., & Furst, K. (2018, September 17). *Risk Management – Artificial Intelligence and Risk Management*. Retrieved from http://www.rmmagazine.com/2018/09/17/artificial-intelligence-and-risk-management/

"Risk managers have a critical role to play in ensuring that management is aware of the potential threats while proposing solutions for how those threats may be neutralized."[49]

Given the fast-paced dynamics of AI, we can never conclusively resolve the issue of unpredictability. However, for the sake of the great beneficial leading projects to come, we support recommendations for clear unambiguous response to:

- Transparency in decision making
- Core ethical values
- Responsibility for mistakes
- Mitigating social/global dislocation

"*Everything we love about civilization is a product of intelligence, so amplifying our human intelligence with artificial intelligence has the potential of helping civilization flourish like never before – as long as we manage to keep the technology beneficial.*"[50]

**Max Tegmark**, President of the Future of Life Institute

[49] Wagner, D., & Furst, K. (2018, September 17). *Risk Management – Artificial Intelligence and Risk Management*. Retrieved from http://www.rmmagazine.com/2018/09/17/artificial-intelligence-and-risk-management/

[50] *Benefits & Risks of Artificial Intelligence*. (n.d.). Retrieved from https://futureoflife.org/background/benefits-risks-of-artificial-intelligence/?cn-reloaded=1&cn-reloaded=1.

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## About the Author

**Paul Grignon**

Lille, France

Paul Grignon is a Centrale Lille Engineering final year currently on a Double MSc in Data Science and Global Project and Programme Management & Business Development at SKEMA Business School under the direct supervision of Dr Paul D Giammalvo, Senior Technical Advisor, PT Mitrata Citragraha and Professor Paul Gardiner, Program Director & DBA Scientific Director.

With his solid Data Science major and continuous interest for the latest technologies and developments, he has built up robust technical knowledge and proficiency in computation methods & tools and techniques, notably machine learning, goal driven design, modelling, statistics & probabilities and data analysis. Meanwhile his passion for challenging AI projects & programmes and diverse hands-on experiences alongside dedicated R&D experts have been valuable opportunities to collaborate closely with scientific community, business leaders and management on complex Machine Learning and deep Learning projects, further sharpening his keen sense of collaborative work and commitment to long-term, responsible data science projects.

His international background and current PMI/CAPM/PMP®, APMG/PRINCE2 competency development course combined to his fast learning-by-doing and multi-tasking capabilities testify to his multi-dimensional appreciation of high-performance Data Decision Science and his positive attitude towards the strategic challenges of complex projects and programs. His ambition is to collaborate on ambitious projects that meet the challenges at every stage in the process.

Paul speaks fluent English, Spanish and French and basic Japanese.

Paul can be contacted at p.grignon33@gmail.com