

ARTIFICIAL INTELLIGENCE (AI) IN ACTION

USE CASES AND IMPACTS OF AI IN
SOCIETY, BUSINESS AND
TRAVEL & TOURISM

January 2024

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FOREWORD

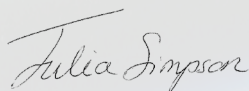
Planning your dream holiday. Cutting food waste. Finding the most fuel-efficient flight. These aren't just things we hope technology can achieve in the future. They are ways artificial intelligence (AI) is being used, right now, by Travel & Tourism companies around the globe.

This report is the second in a series from the World Travel & Tourism Council (WTTC), in partnership with our member and leading technology company Microsoft, about artificial intelligence and its potential for the Travel & Tourism sector. In our first report (an 'Introduction to AI Technology'), we looked at what AI is and where it came from. This time, we're taking a look at the ways AI is being used by travel companies today, and how it might be used in the future to make travel easier, greener and more inclusive.

Being quick to understand new technologies is crucial for business success and has always been a source of competitive advantage. Our hope is that this guide will not only inspire you to make the most of AI in your business, but that it can shed light on the most innovative, exciting and sustainable applications of AI technology in use today. We also look at where AI is heading next, and three main avenues of technological exploration currently being pursued by computer scientists.

Finally, we try to answer one of the biggest questions in Travel & Tourism today: will AI cost jobs? We hope that by sharing some of the ways this technology is being used we can reassure you that, although disruptive, AI has far greater potential to help grow our sector and spark the creation of many more jobs than may be lost.

By understanding both AI technology and the ways our sector is using it, I hope we can spread the best ideas further and perhaps even introduce you to a few you haven't considered yet. The future is already here. Now, we get to be the ones who create the best of it.



Julia Simpson

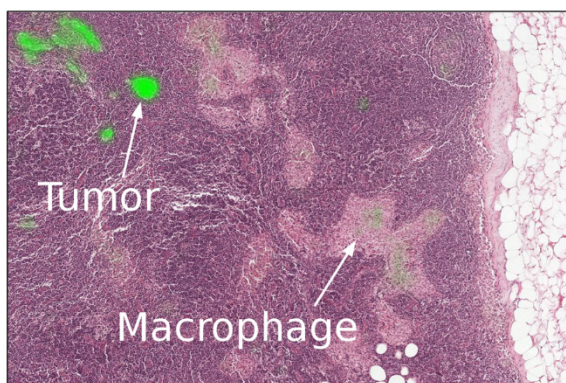
President & CEO

World Travel & Tourism Council

AI IN SOCIETY

Artificial Intelligence is already all around us in our daily lives and before exploring the business and tourism specific applications in the following chapters, it is worth first considering its wider use in society, as this is also driving the adoption of AI and global discussion on AI risks and governance.

AI has fantastic potential and can already be used in a very wide array of applications today – from screening for cancers, to AI powered hotel check in robots. AI is also already being used by many of us every day, without ever realising it. For example in email spam filters, the predictive text function on smartphones, or to provide personalised recommendations in food delivery and movie streaming apps.



Google cancer screening with AI ¹



AI powered robot check in at Henn-na Hotel, Japan

The possibilities of AI are almost limitless. But three transformational future uses for everyday life are often cited – AI for autonomous transport, AI in education and AI in the home.

- 1. AI for Autonomous Driving:** In the future, AI in the transport sector could revolutionise how we move between places, with AI essential for driverless vehicles. Autonomous taxis (or Robotaxis) are already operational in certain cities of the U.S. and China, with the vehicle 'AI brain' taking data from the car's sensors to detect and recognise objects like other cars, traffic lights or pedestrians. This data is then used to make decisions in real time, such as when to brake, accelerate and steer. As these AI systems gain more experience on the road and collect more data, they use machine learning algorithms to improve their driving skills and get smarter in how to handle all kinds of driving scenarios safely.
- 2. AI in Education:** Sophisticated AI chatbots have already shown that they can answer exam questions and pass some of the world's most demanding tests, including law bar exams ², university MBA courses ³ and medical doctor exams ⁴, in some cases with higher average scores than humans. Many students and school children are already using AI tools today to assist with their homework and will grow up with access to the power of AI at their fingertips. Universities and schools around the world are currently developing guidance and guardrails on how AI should be used in the educational sector, but its great

power could also enable AI to provide more personalised educational experiences, with AI tutoring systems able to adapt and cater for individual needs and a student's specific learning pace.

3. **AI in the Home:** AI is already in our homes and in our everyday lives, from AI-powered smart speakers, lighting, temperature controls and security systems, to AI-powered apps on our phones. AI-driven smart home systems are increasingly popular and, in the future, could evolve to provide even greater comfort, convenience and efficiency, with advanced AI algorithms learning from residents' habits to optimise energy usage.

Robots in the home to help with household chores have been science fiction for many years. But today AI-powered 'virtual companion' apps allow people living alone to have human-like conversations with virtual humans on their phone. In Sweden, where a significant proportion of the population lives alone, energy provider Stockholm Exergi and Accenture paired voice assistant speakers with AI and asked elderly Stockholm residents to recount their life stories in a project called Memory Lane ⁵. The AI-powered speaker could ask context specific questions to the person it was listening to, which would drive meaningful conversations and tackle loneliness. Many extraordinary stories have now been kept and placed online for future generations to listen to.

These examples and many other potential applications of AI could drive a revolution in society – much like the internet did from the 1990's – with AI having the potential to touch every area of society and transform how we live, learn and communicate. But AI's impact goes far beyond social changes, as AI can also help tackle some of the world's greatest problems, from climate change to infectious diseases, through advanced simulations and predictions. There is therefore tremendous potential for AI to significantly benefit humanity.

AI FOR GLOBAL GOOD

In 2017, the United Nations launched the '**AI for Good**' initiative, led by the ITU (International Telecommunications Union) – the UN agency responsible for digital technology – and supported by 40 other UN agencies. Its goal is to promote the development of 'safe, inclusive and responsible' AI technology to help achieve the 17 UN Sustainable Development Goals (SDG's). These include goals to end poverty and world hunger, reduce global inequalities, develop clean and affordable energy and to take urgent action to combat climate change, among others.



UN Sustainable Development Goals (SDG): <https://sdgs.un.org/goals>

In particular the UN 'AI for Good' initiative aims to support research by assembling experts from academia, industry, civil society and governments to form collaborative networks focused on practical AI solutions for the SDG's. These groups can then advise global policymakers on how AI can be developed and used ethically and issue recommendations on how to build AI skills, especially in underrepresented regions so that AI does not expand the 'global digital divide'.

For some SDG global challenges, such as in health, AI is seen as much more than just a 'nice to have', with some considering AI to be the 'only' solution possible to achieve the SDG goals. For example SDG Goal 3 seeks to improve global health by reducing premature deaths from heart disease. This kills millions of people each year, yet there are only thousands of registered cardiologists around the world, leading to an imbalance of care and treatment. An innovative start-up company in Spain is therefore asking the public to **#DonateYourHeartbeats** to develop a large dataset of heart patterns, which can then be used to train an AI algorithm and lead to a new low cost diagnostic and early warning tool for heart disease. It is innovative application of AI such as this that could transform the world.

STANDARDS FOR AI IN SOCIETY (INCLUDING CHILDREN & AI)

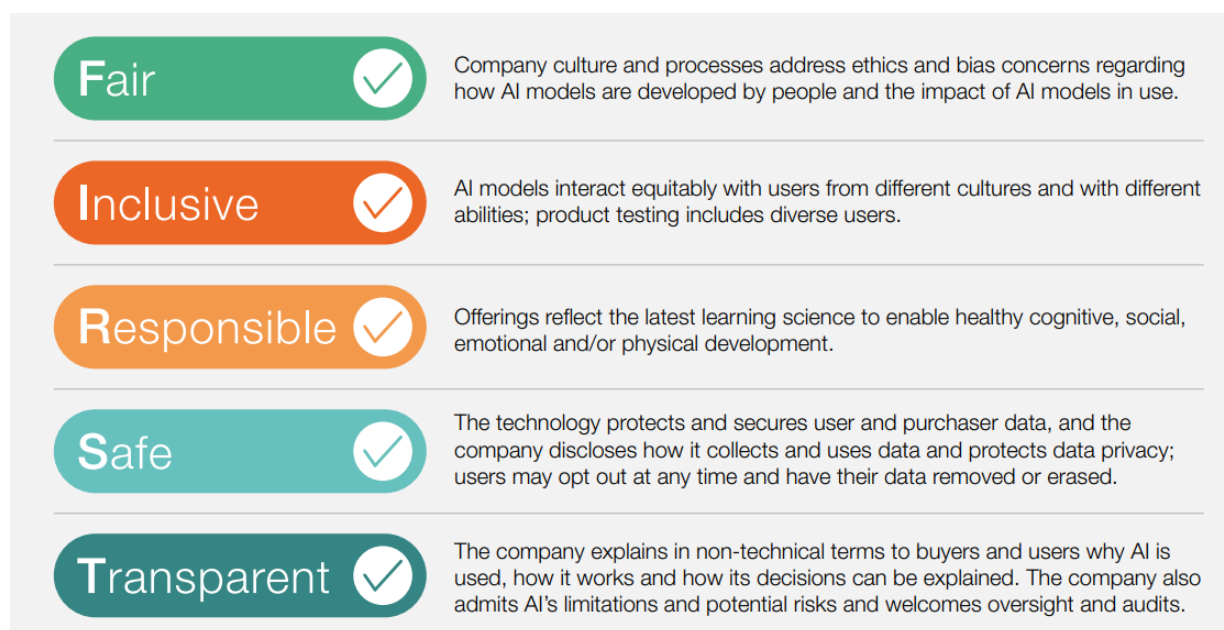
To support the implementation of safe and responsible AI practices in society a subsidiary of the Institute of Electrical & Electronics Engineers (IEEE), the IEEE Standards Association, has allowed free global access to their AI ethics and governance standards on the IEE Xplore Digital Library ^{6 7}. This will contribute to creating AI systems around the world which are more trustworthy and advance understanding of how important ethical AI issues in society can be addressed. The European Union Artificial Intelligence Act (EU AIA) – covered in the accompanying WTTTC report on AI Risks & Governance– references some of the components made freely available by the IEEE to support organisations in achieving regulatory compliance.

The IEEE standards include information on good AI systems governance, metrics for evaluating the impact of AI systems on human wellbeing, methodologies for handling data and standards for the design of age appropriate digital services (to name only a few standards). This last standard establishes a set of processes for developing digital and AI services where the end user is a child and follows the '**5Rights Principles**' which takes the existing fundamental rights of children from the UN Convention of the Rights of the Child (UNCRC) and applies them to the digital world ⁸.

The **UN estimates that 1 in 3 users of digital services worldwide is a child**, but the digital world has been largely developed without children in mind. Actions to address children's digital rights might include privacy safeguards to protect children's data, age assurance tests to limit access to certain services, age appropriate explanations for children, oversight mechanisms, or ensuring children are not subject to the same level of personal responsibility as adults.

In 2019, UNICEF started an '**AI for Children**' ⁹ initiative to explore how '*AI can protect, provide for, and empower children*' as many children are already interacting with AI technologies on a daily basis. For example AI is embedded in toys, virtual assistants, video games and learning software. AI-powered algorithms provide recommendations to children on what videos to watch, what music to listen to and who to be friends with on social media. In 2020 UNICEF analysed 20 national AI strategies ¹⁰ and found '*only cursory mention of children and their specific needs*' and only two strategies (Norway & India) specifically mentioned the importance of protecting children's data and privacy. Since then, UNICEF has run a 'Global Forum on AI for Children', published 'Policy Guidance on AI for Children v2' ¹¹ and an 'AI Guide for Teenagers'. It has also run pilot tests of the policies with governments and companies around the world ¹² and launched 'Generation AI' ¹³ a project to safely engage children in an AI powered future.

In 2022, the World Economic Forum (WEF) also published an '**AI Toolkit for Children**'¹⁴ which is designed to help businesses develop responsible AI systems that involve children and to help parents safely buy and use AI products. The toolkit provides a checklist for managers to guide child suitable product developments and encourages companies to produce technology that is FIRST (Fair, Inclusive, Responsible, Safe and Transparent). It also proposes an 'AI Labelling System' for products and services designed for children to clearly communicate when a system uses AI, how the child interacts with the AI and what choices the child and parent have to increase their privacy and security.



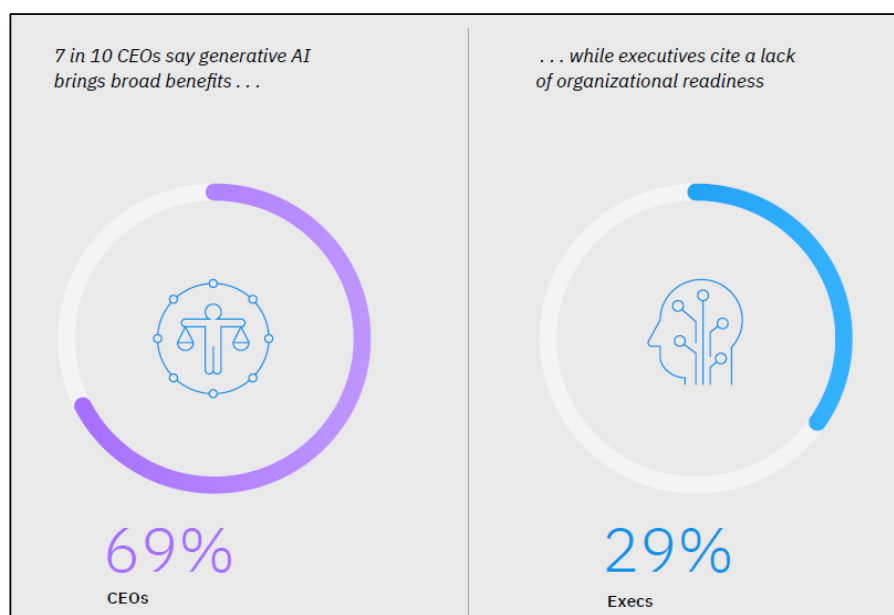
WEF 'FIRST' Framework for Children & AI

AI IN BUSINESS

Artificial intelligence is one of the most important technologies in the world today and **many CEOs believe it will change the way we do business.**

In early 2023, the IBM Institute for Business Value, in co-operation with Oxford Economics, interviewed 3000 CEOs from 30+ countries and 24 industries as part of their IBM C-Suite Study series¹⁵. They found that three out of four CEO's (75%) believe the organisation with the most advanced deployment of generative AI will win in a competitive commercial world, while nearly half of all CEO's surveyed (43%) are already using generative AI to inform strategic business decisions.

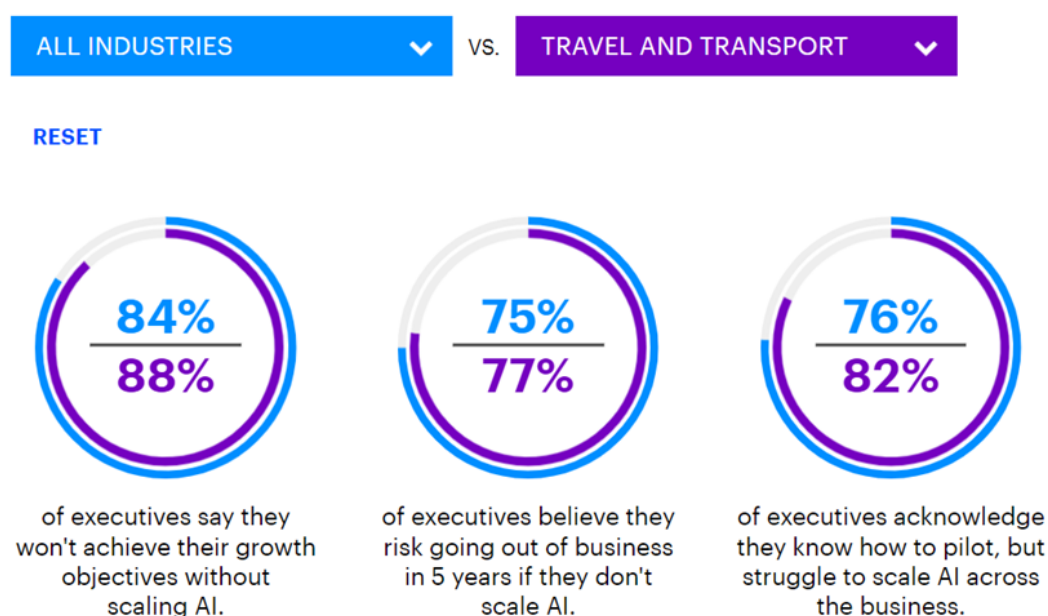
But they also observed a difference between the appetite and confidence of CEOs in AI and that of managers. CEOs were eager to act on AI as quickly as possible, with seven in ten CEO's (69%) feeling their organisation was ready for the deployment of AI, but only 29% of their management teams felt they had the in-house expertise required to adopt AI successfully.



vIBM CEO decision making in the age of AI report (2023)

Up-skilling and re-skilling of staff to have digital skills will therefore be crucial for the successful adoption of AI into businesses, with training approaches ranging from simple online courses, to full time AI experiences such as the 'Shell.ai Residency Programme'¹⁶. This initiative from the energy company Shell is a two year, full time, immersive programme where staff who have a passion for using AI and developing digital solutions will be supported to lead and solve real business problems across all of Shell's business units using technology. Microsoft CEO Satya Nadella recently commented that "what is happening at Shell is pretty amazing! The have a very deliberate strategy of using AI right across their operation, from their drilling operations, to safety in Shell retail stations"¹⁷.

In 2019, the “*AI Built to Scale*” study by Accenture interviewed 1500 C-Suite executives (including 100 travel and transport executives) from companies with a minimum annual revenue of \$1 billion (USD) in 12 countries and across 16 industries¹⁸. Their aim was to uncover the success factors required for successfully scaling AI across a business, where they found **88% of travel and transport businesses believe they need AI to achieve their growth objectives**, with **77% of travel and transport executives believing they risk going out of business within five years if they don’t scale AI within their organisations**. Worryingly a very high percentage of **travel and transport executives (82%) also acknowledged that they know how to conduct small scale pilots of AI, but struggle to scale AI successfully across their organisations**. The below chart illustrates the travel and transport results (purple) vs the average across all of the 16 industries surveyed (blue)



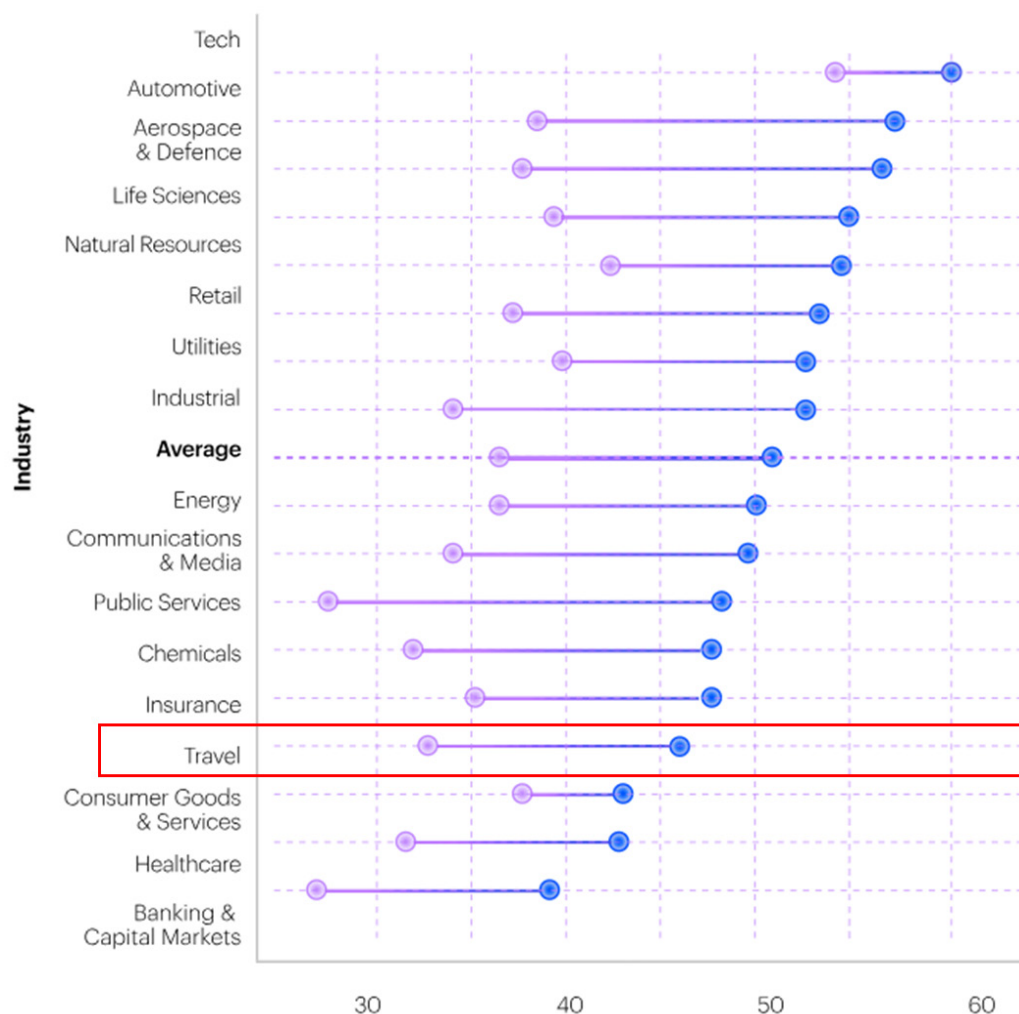
Accenture AI Built to Scale Research

To address the shortfall in successful scaling of AI across businesses, Accenture recommend three actions:

1. **Drive ‘Intentional AI’:** include AI implementation in C-Suite targets and objectives
2. **Tune out data noise:** structure and manage business critical data by identifying financial, marketing, consumer and master data as priority domains and invest in data quality, data management and data governance frameworks on the cloud
3. **Treat AI as a team sport:** embed multi-disciplinary teams throughout the organisation (such as data scientists, training specialists and communications professionals) to drive AI adoption in all relevant business units, in addition to having sponsorship from the top of the company

However despite C-Suite executives from travel and transport companies emphasising the importance of AI to their businesses, a further study from Accenture on the “*Art of AI Maturity*”¹⁹ in 2022 found that only a limited number of companies have currently advanced their AI maturity enough to achieve their growth and business transformation expectations. This study of 1,615 C-Suite executives from 1,176 of the world’s largest companies in 15 countries defined ‘AI maturity’ as the “*degree to which an organisation has mastered AI related capabilities in the right combination to achieve high performance for customers, shareholders and employees*”.

They found that while sectors such as the technology industry are understandably far ahead in their AI maturity, there is enormous room for growth in the implementation of AI across all other industries, especially in the **travel industry which recorded the 4th lowest level of AI maturity and lags behind most other consumer facing industries** (with only consumer goods, healthcare and banking less mature). This indicates that there is a huge opportunity for Travel & Tourism companies to embrace AI. The below chart illustrates the observed level of AI maturity in 2021 (in pink), with Accenture's forecast for 2024 (in blue).



Median AI Maturity Index in 2021 (pink) and the 2024 forecast (blue) by industry

In early 2023, Oxford Economics hosted a briefing on “*what AI means for economies, business, jobs and cities*”²⁰ which concluded with **four recommendations for organisations to successfully implement AI within their businesses**. These are to:

1. Review how AI can benefit your organisation, especially in terms of enhanced efficiency and improved customer service
2. Review the data structure within your organisation and optimise it for AI. This could be a significant task for many organisations who are storing considerable amounts of unstructured data
3. Review the current skillsets of your employees and determine what AI training they will need for the successful adoption of AI
4. Act responsibly at all times and address ethical considerations from the start, including how AI might impact bias, discrimination and privacy with your organisation

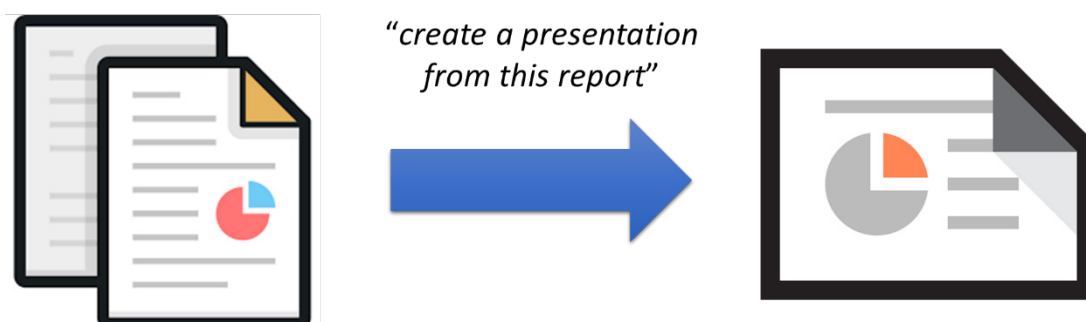
AI AND WORK

AI enables tasks to be automated and completed quicker, leading many to consider how AI will affect jobs and work in the future. It is impossible to answer that question fully at this stage and it is inevitable that some jobs will be lost to technology, but AI leading to mass unemployment in all areas of society is unlikely to happen, with AI more likely to enable new industries to emerge, new jobs to be created and some jobs to be transformed, as has happened with other labour saving technologies throughout history.

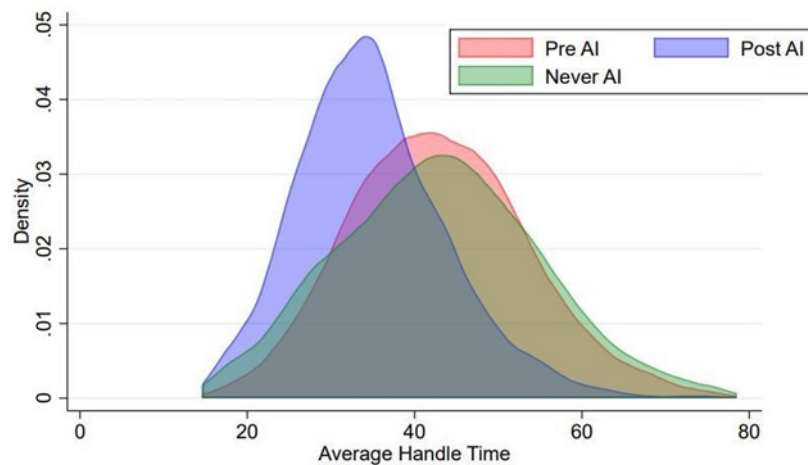
One reason that the impact of AI on jobs sometimes creates alarm, is that it is often much easier to imagine existing jobs being lost, than it is to imagine new ones being created. For example, even two decades ago during the computer led, dot com boom, it would have been impossible to imagine the many millions of jobs that have been created since then in areas such as cloud computing, smart devices and social media.

However government aid and support from other parts of society will be required to smooth the transition of AI into work, especially for those whose jobs could be significantly disrupted and who may have to move into new fields of employment.

While AI technology is advancing rapidly, **the most promising use of AI in the foreseeable future is not to replace humans, but to work alongside humans to complete tasks faster, cheaper and better than before.** Everyday business software (such as spreadsheets, email mailboxes and word processing) is already being enhanced with AI tools. For example AI can enable an office worker to prepare a professional presentation in only a few seconds, by selecting a report and asking the AI to convert it to a presentation. The AI will be able to automatically summarise the text, create bullet points, generate the slides and even produce appropriate images using AI image generation technologies – all automatically and with only a simple ‘natural language’ prompt from a user such as *“create a presentation from this report”*.



In early 2023, researchers from the Massachusetts Institute of Technology (MIT) and Stanford University in the U.S. explored *“Generative AI at Work”*²¹. Their study assessed the performance of more than 5000 customer service agents and found that **workers were on average 14% more productive when using generative AI tools** (see the blue area of the chart below). Several other studies from around the world have also demonstrated that significant productivity gains can be achieved when using AI in a business environment.



Productivity of customer service agents using AI

It can therefore be useful to think of AI in a business context as like having both a professor and an intern available in your office at any moment. Like a professor, AI can help businesses to analyse complex data and find facts for any topic in an instant and like an intern, AI can draft correspondence, prepare work plans and complete routine tasks with ease.

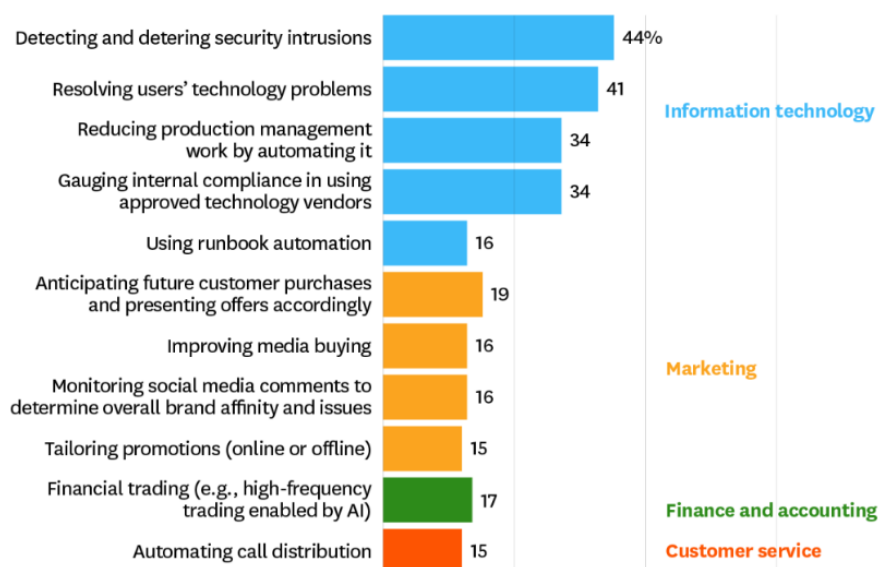
But this is not the future. AI for business is here today and AI systems are already partnering with humans in many corporate and industrial settings. For example, AI is working alongside humans in factories to alert companies about impending supply chain bottlenecks, while corporations are using AI to analyse and understand customer sentiment on social media in near-real time. Several law firms have been testing an AI system to speed up legal analysis and the UN has been trialling AI powered speech recognition systems that are making instantaneous translations possible in many more than the six official UN languages, helping more of the world to become engaged in international affairs.

There are therefore many opportunities for Travel & Tourism businesses to integrate AI within their business operations, including in sales, marketing, customer service and business administration such as finance and security.

Although now some years out of date, a Harvard Business Review article in 2017 explored how companies were using AI, which included a survey of 13 job functions (such as sales, procurement, finance etc) in 835 companies around the world ²². They found that AI was already helping businesses to save money and address business challenges across a range of functions, with IT, marketing, finance and customer service being the top areas. It is very likely that recent advancements in AI will be helping businesses further and in a broader range of areas today.

How Companies Around the World Are Using Artificial Intelligence

IT activities are the most popular.



Harvard Business Review, April 2017

Also in 2017, PwC research²³ estimated that **AI could contribute \$15.7 trillion (USD) to the global economy by 2030** and will be driven by 3 key areas of business:

1. Productivity gains from companies automating processes
2. Productivity gains from companies augmenting their workforce with AI technologies
3. Increased consumer demand resulting from the availability of personalised and/or higher quality AI enhanced products and services

INTELLECTUAL PROPERTY

The relationship between AI and copyrighted material has recently attracted a lot of media and political attention. High profile cases include artists suing AI image generating companies, plus US comedian Sarah Silverman and Games of Thrones author George R.R. Martin suing AI providers over potential copyright infringement of their books.

Data is crucial for training AI systems and for fine tuning their performance. Training AI systems with large, diverse and representative data helps to reduce the risk of bias, but in some cases the datasets used to train AI could include copyrighted material that is publicly available on the internet.

Many copyright laws around the world allow such use, but they also often empower copyright holders the right and ability to object to their content being used for AI training. This can have implications for both AI developers and businesses or society that use AI systems. As of 2023, several legal cases are currently going through the courts and it is therefore too early to state in this report what the outcome of those cases may be, so **Travel & Tourism companies should be aware of copyright cases happening at this stage.**

Some parties have called for AI developers to disclose a summary of any copyrighted material used to train their systems. But many AI solutions, such as sophisticated AI chatbots use data from the internet for training and therefore this requirement is widely considered as impossible to meet in practice, as it would essentially amount to disclosing a summary of all content available on the internet.

More recently, the issue of AI and copyright has focussed on whether output produced by an AI system (such as AI generated text, pictures or video) could be protected by copyright and how this would work in practice. Many jurisdictions have agreed that AI generated outputs cannot be copyright protection, as they lack the necessary element of human creation, but this may be reviewed in the future as more and more material is produced by AI. **Travel & Tourism business should therefore be aware that they currently cannot copyright protect any works they produce with AI (as of 2023).**

Other intellectual property rights (IPR) also need to be considered with AI, such as patents, trade secrets, the protection of data and trademarks. The number of patent applications in AI has increased dramatically in recent years. In 2011 the World Intellectual Property Office (WIPO) registered 12,473 AI patent applications, but this had quadrupled only six years later by the end of 2017 when 55,660 AI patent applications were filed. That number is expected to be much higher today.

However, filing for an AI related patent does not necessarily mean it will be granted if it does not meet the patentability criteria. A key problem lies in the different practices and approaches taken by different patent offices around the world. Some offices are very reluctant to grant a patent for AI and there is an important distinction between an 'AI assisted invention' (where AI was used to help invent a solution, but the solution does not contain any AI elements) and an 'AI implemented invention' (that contains AI components).

A patent is an exclusive right granted by a public authority. To secure a patent, the invention must meet three key criteria – it must be new, it must involve an inventive step and it must be capable of industrial application. In the case above of an 'AI assisted invention', a patent examiner would be unlikely to know that AI was used in the process of inventing, which raises difficult questions about the 'inventive step' criteria as currently most patent offices and courts will not recognise AI as an inventor.

Obtaining a patent is also a lengthy and complex process which requires the assistance of a patent legal specialist. Once a patent has been issued, it will also incur maintenance fees as time progresses, so **Travel & Tourism businesses should consider all relevant issues before seeking to secure patent protection for any of their AI generated inventions. Travel & Tourism executives should also be aware that this is an evolving area and IP laws relating to AI may be subject to change in the future.**

Businesses could also consider their AI models, or entire AI systems, as 'trade secrets', which they could license to other companies, if the secrecy is secured through a confidentiality agreement. There are three requirements for information to be considered a trade secret - (1) It must be secret, (2) it needs to have commercial value because of being secret, and (3) the holder of the secret must have taken reasonable steps to keep it secret. Trade secrets are often protected under competition law, but the three elements can create considerable scope for different legal interpretations between national courts and **Travel & Tourism businesses should therefore be aware of this if considering protecting their AI related intellectual property as a 'trade secret'.**

AI systems can however be protected by trademarks, which applies specifically to the name of an AI system. **The design of the interface between the AI system and a user could also qualify for 'design protection'** which is a legal term for the protection of innovative designs. Design protection includes areas such as the AI system's appearance, but does not include its function, or the underlying idea.

Travel & Tourism companies should therefore think carefully about their IP strategy when using AI for business or commercial purposes and develop a plan specific to their business model. As discussed above the protection of AI related technologies and solutions is evolving and can vary by country and jurisdiction and businesses may therefore also wish to consider the protection of AI related intellectual property as part of their corporate risk management function.

LEGAL RESPONSIBILITY & LIABILITY

The question of legal liability is particularly challenging with AI technology. **There is currently no globally accepted guidance or legal jurisprudence (a theory of law) which expressly deals with the responsibility for decisions made by AI systems, and any liability that may flow from those decisions.** For example, there is no internationally agreed position as to whether responsibility and liability for an AI informed decision should fall on the operator deploying an AI system, the end user of an AI system, or any other parties who have contributed to the development of the AI system (such as hardware and software manufacturers).

If a legal claim was made against a decision that involved AI, who was responsible and liable would therefore likely depend on whether a ‘bad actor’ or fault component could be identified, which would in turn depend upon the extent to which the factors contributing to a decision could be identified. To address this, future AI laws are likely to include robust requirements for ‘**AI transparency**’ which will help people to understand the inner workings of AI systems and will be critical to be able to explain why decisions were made by an AI system and integral to a legal evaluative process. This is particularly important in safety critical areas, such as AI powered driverless vehicles.

If an AI causes damage to a third party, the operator or developer of the AI system may also be liable in ‘tort’ under civil law if it is negligent. Tort is a wrong that occurs when someone unfairly causes loss, or harm, to another person. However, it is currently very difficult to determine who is negligent in many cases as an AI’s output can be unpredictable and the cause of the output difficult to identify. There may also be cases where AI users are required to monitor the actions of AI and perform a certain level of duty of care to reduce the chances of negative outcomes, especially in the early stages of AI introduction.

There could also be liability cases where an AI system executes a ‘contract’. For example in a shop where an AI system automatically places an order for an item after checking the shops stock levels. When the execution of the contract by an AI system is appropriate, the contract is regarded as valid. However, if the AI system makes a mistake (for example by purchasing unnecessary items), it is questionable whether the user of the AI system (e.g. the shop) should be liable under the contract.

When an AI user (e.g. a shop) entrusts the AI with the execution of a contract, it is considered that the user expresses its intention to “sign the contract using AI” to the counterparty (e.g. the supplier). Similarly, the counterparty expresses its intention to “accept the contract offer made by AI”. Since the intentions of the shop and supplier (the AI user and the counterparty) match one another, the contract is deemed as duly executed.

But the contract is still valid and effective in principle, even if a mistake is found in the contract offer made by the AI system (for example by purchasing unnecessary items), because the intention of the AI user to “sign the contract using AI” and the counterparty to “accept the contract offer made by AI” still match each other. The execution of a contract by AI is often only considered “invalid due to mistakes” in exceptional circumstances, where the motive of the AI user (e.g. the shop) can be deemed to have been explicitly expressed to the counterparty (e.g. the supplier).

Travel & Tourism businesses should always consider potential liability issues when using AI and be aware that, like many areas of AI, this is an evolving area of the law. However in the near term at least, it is likely courts will seek to apply existing jurisprudence to the greatest extent possible, by for example allocating liability to the manufacturer of a faulty product.

AI STANDARDS

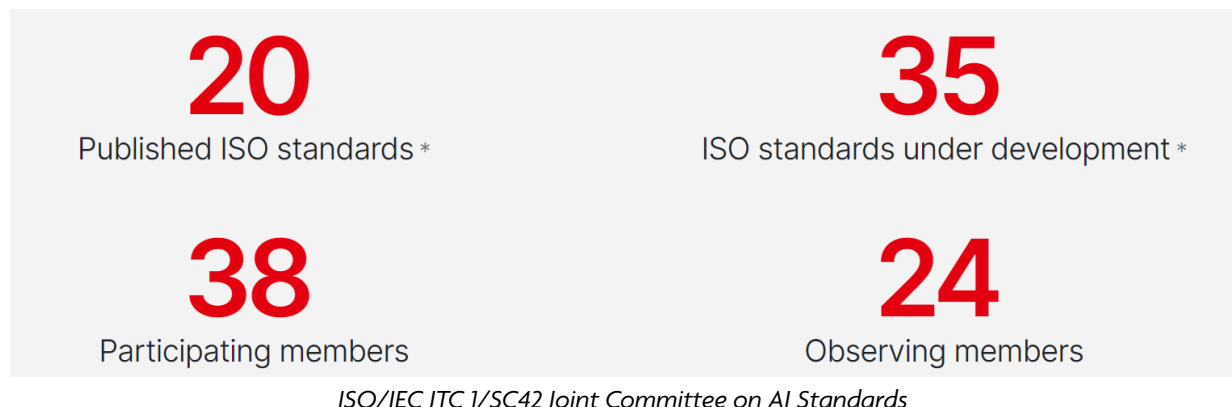
AI standards will set common guidelines, principles and technical specifications for the safe development, deployment and governance of AI systems. Standards also enable interoperability between products or systems and **AI standards will therefore be important for the global adoption of AI in businesses and society**. Various approaches to AI standardisation are currently being taken forward across the world at the national, regional, international and even bilateral level, based on a variety of factors.

In 2018, the BSI (British Standards Institute) surveyed 64 AI experts to understand what they felt were the greatest benefits of AI standards ²⁴, with three quarters agreeing that the top benefits were to:

- Aid regulatory compliance (63% agreed)
- Reduce unintended bias (63% agreed)
- Improve privacy protection (62% agreed)
- Support effective AI governance (60% agreed)

These results were shared with expert committees leading the development of international AI standards from the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

“**ISO/IEC JTC 1**” is a Joint Technical Committee of the ISO and the IEC. Its purpose is to develop, maintain and promote standards in the fields of information and communications technology (ICT) and it is therefore within this structure that many AI standards are being created. The ISO/IEC committee known by the designation “**ISO/IEC JTC 1/SC42**” ²⁵ serves as the main focal point for AI standards. It has an active group of members and a work programme covering many areas, such as standards for AI Concepts & Terminology, Trustworthiness in AI, Bias in AI Systems and AI Risk Management.

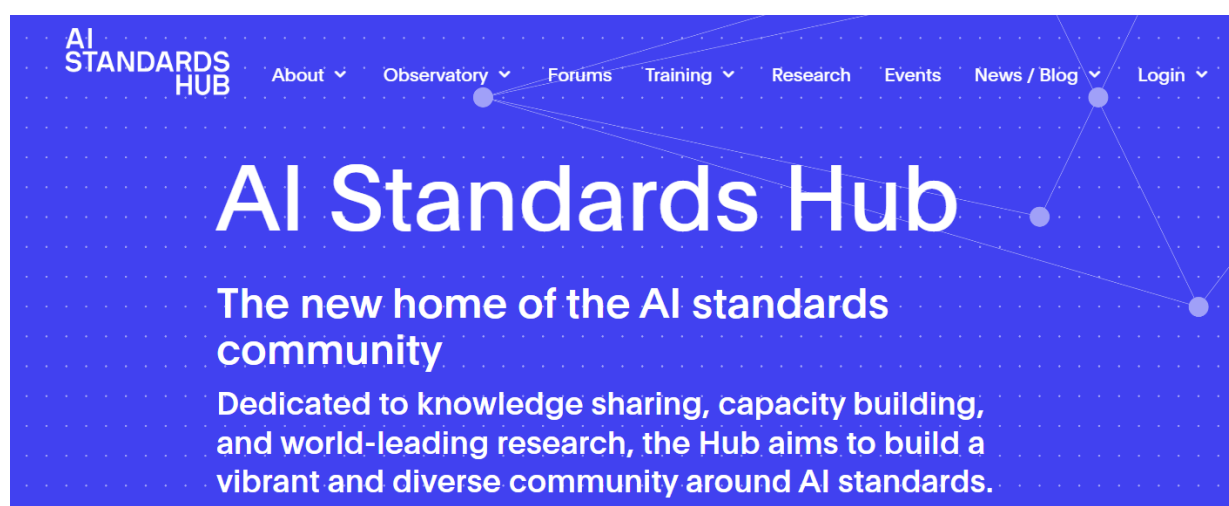


Of particular interest to Travel & Tourism companies may be the international **ISO/IEC standard 22989** ²⁶ **(available to purchase online from the ISO website) which covers AI terminology** and defines 110 AI concepts, such as AI bias, transparency and trustworthiness. Another standard of interest may be **ISO/IEC standard 42001 on ‘AI Management Systems’** ²⁷ which is due for approval in early 2024 and will be essential in helping businesses to manage the safe and trustworthy implementation of AI in their organisation. Its emphasis is on integrating an AI management system within a company’s existing governance structures alongside other corporate policies and management systems that may already exist in a company, such as environmental (EMS), quality (QMS), safety (SMS) or security (SeMS) management systems. This AI standard provides guidance for establishing, implementing, maintaining and continually improving an AI management system. It is intended for use by any company, in any sector, that plans to provide any products or services using AI.

Other bodies developing AI standards include (but are not limited to):

- The **Institute of Electrical & Electronics Engineers (IEEE)** who are exploring more technical areas of AI, such as AI in autonomous systems and facial recognition devices
- The **International Telecommunications Union (ITU)** who are working on AI standards in areas such as 5G and future telecommunication networks, and as a UN agency, in partnership with the **World Health Organisation (WHO)** on AI standards for healthcare
- **European Standards Organisations (CEN/CENELEC)** who are coordinating AI standardisation efforts across Europe and identifying if there are needs for AI standards that are not already covered internationally by ISO/IEC. This may include sector specific AI standards in Europe
-plus many national initiatives in country **Standards Development Organisations (SDO's)**

Information on AI standards can therefore be scattered on different websites and platforms, making them difficult to find. **To address this, the UK established an online 'AI Standards Hub'²⁸ in 2022 as an international repository of AI standards information and reports.** It acts as an international community portal and seeks to bring together the private sector, governments, academia, consumers and civil society from around the world to help shape debates about AI standards and promote the development of AI standards that are effective, coherent and safe. The hub also provides simple guides and blogs on AI standards which may be a useful resource for Travel & Tourism businesses exploring this area.



AI Standards Hub (<https://aistandardshub.org>)



AI IN TRAVEL & TOURISM

It is an exciting time for AI in Travel & Tourism, with AI technology creating new and innovative opportunities across every Travel & Tourism industry and at many touchpoints with the traveller. From AI driven wayfinding apps, to hotel concierge services and booking engines, **AI has arrived in Travel & Tourism and is poised to further streamline operations, improve customer experiences, optimise pricing strategies, enhance decision-making and so much more.**

As the world emerges from the COVID-19 pandemic, travel has shown its resilience to recover and a strong demand for travel remains. But traveller patterns are likely to continue to shift into the future, with new working trends and environmental considerations changing the nature of business travel.

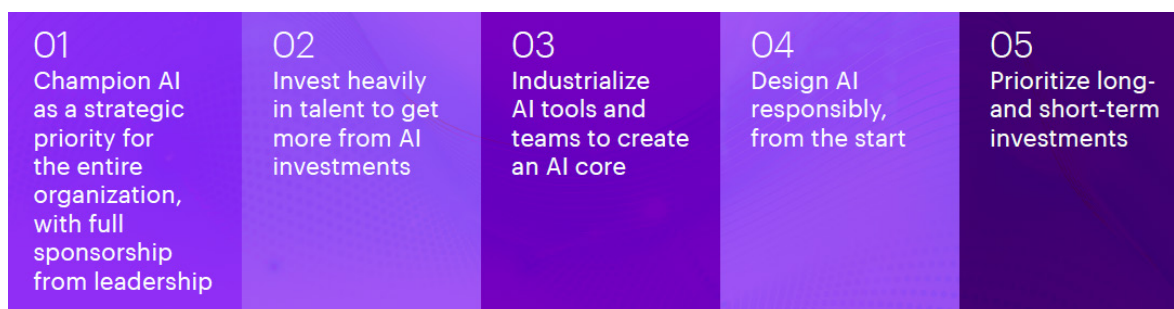
Therefore to succeed in this dynamically changing environment and to win customer loyalty, Travel & Tourism companies must embrace the power of data, with AI making it possible to fully capitalise on the value of this data to create extraordinary and personalised customer experiences, optimised efficiency, minimised costs and improved decision making.

AI is a powerful enabler for Travel & Tourism and the 2022 “Art of AI Maturity” study from Accenture (detailed in the previous chapter) analysed investor calls from 2000 of the world’s largest companies from 2010 to 2021 and found that the **AI transformation is happening in businesses much faster than the previous digital transformation – on average 16 months faster – which shows that there is a clear sense of urgency for the Travel & Tourism sector to not get left behind in this fast moving business and consumer revolution.**

While there are an increasing number of AI examples in Travel & Tourism, **Accenture’s data ²⁹ found that the travel sector is currently lagging behind the majority of other consumer facing industry sectors in the adoption and implementation of AI** and that Travel & Tourism companies tend to:

1. Have a shortage of AI skilled workers
2. Have limited AI infrastructure and data networks (such as cloud computing)
3. Lack a formal ‘AI strategy’, alongside an overall business plan (although Travel & Tourism companies do fare well in senior level sponsorship of AI initiatives)
4. Are reactive to the use of AI and waiting for others to move first (vs being proactive and experimental)

To help address these issues, **Accenture recommends five actions for Travel & Tourism businesses:**



1. **Champion AI as a strategic priority for the entire organisation, with full sponsorship from leadership:** AI strategies need the support of the CEO and entire executive suite, and should be applied across departments (not just in isolated domains) for the biggest impact.
2. **Invest heavily in talent to get more from AI investments:** The more proficient all employees are in AI related skills, at every level of the business, the easier it will be for Travel & Tourism companies to scale human and AI collaboration across the business and achieve the full benefits of AI.
3. **Industrialise AI tools and teams to create an AI core:** An AI core works across the cloud and enables efficient and effective collaboration across travel ecosystem providers. While travellers often perceive a trip as a single journey that flows from one experience to the next, in reality a traveller's journey is often enabled by many different providers. Industry collaboration is therefore particularly important for the successful implementation of AI in travel.
4. **Design AI responsibly from the start:** Adhering to laws, regulations and strong ethical standards is critical for the safe and trustworthy deployment of AI. However AI is a rapidly evolving technology and the potential for regulatory changes around the world can make this challenging. Travel & Tourism companies are therefore advised to use high quality, trustworthy AI systems that are likely to be 'regulation ready' and to stay close to AI regulatory developments. A summary of global AI regulations is included in an accompanying WTTC report on '**AI Strategies, Policies & Regulations**' which provides more detailed information and will be periodically updated by WTTC in this fast evolving area.
5. **Prioritise long and short term investments:** Spending on AI is important for success, but many Travel & Tourism businesses are still financially recovering from the COVID-19 pandemic which can make this investment in AI challenging. Travel & Tourism companies are therefore advised to start with data organisation and management as a first priority, as a strong data foundation will support smaller AI initiatives and ultimately enable the scale up of AI and cross business opportunities as further investment becomes available in the longer term.

AI & TRAVELLER JOURNEY

AI is increasingly touching every part of the traveller's journey and in 2023, WTTC knowledge partner Phocuswright issued a report on "*Generative AI Transforming the Travel Cycle*"³⁰ (available to purchase from their website). This report explored the use of AI across every stage of the consumer travel cycle, including inspiration, planning, shopping, booking, experiencing and sharing, as well as how generative AI was impacting Travel & Tourism business operations. As with Accenture's study they found many initial deployments of AI in specific and narrow cases, but a strong appetite from the Travel & Tourism sector for much broader applications of AI in the longer term.

Some further examples of the use of AI in the traveller journey include:

- **Personalised Recommendations & Marketing:** AI powered systems can analyse vast amounts of traveller data, such as booking history, preferences, and online behaviour. This information can then be used to create personalised recommendations for destinations, accommodation, activities and more. AI systems can also tailor marketing campaigns to individual preferences, improving customer engagement and conversion rates.
- **Dynamic Pricing & Revenue Management:** Big data analytics, combined with AI, helps Travel & Tourism companies to optimise their pricing strategies based on factors such as demand trends, competitor pricing and historical data. AI algorithms can then adjust travel prices in real-time to maximise revenue and occupancy rates for hotels, flights and other travel services.
- **Customer Service & Chatbots:** Sophisticated AI chatbots can provide instant responses to traveller queries and requests. Travel & Tourism companies can also 'fine tune' their AI chatbots by analysing large volumes of customer interactions, which will improve their understanding of customer preferences and deliver more accurate and helpful responses.
- **Demand Forecasting & Business Operational Requirements:** AI can assist Travel & Tourism companies to predict future demand patterns and requirements. This can then help organisations to allocate resources efficiently, manage staffing levels and make better, informed decisions about inventory and capacity levels.
- **Traveller Planning Assistance:** AI can help travellers plan their trips by analysing historical data, weather conditions, local events and other traveller reviews to automatically provide personalised itineraries and suggested activities.
- **Enhanced Customer Experience:** AI powered virtual assistants in hotels, airports and travel apps can provide real time information and guidance to travellers to improve their customer experience. Examples could include localised recommendations, directions, or notification about delays.
- **Improved Operational Efficiency:** AI systems can help to optimise operations within the Travel & Tourism industry. For example, airlines could use AI to predict maintenance needs which reduce flight delays, while airports could use AI to manage security queues and optimise baggage handling.
- **Risk Management:** AI and 'big data' can be used to assess travel risks, such as geopolitical events, health advisories or weather disruptions. This enables Travel & Tourism companies to make better informed decisions on traveller risk and safety and provide timely alerts to travellers.
- **Destination Insights:** Governments, Destination Management Organisations (DMOs) and National Tourism Organisations (NTOs) can use AI to gain insights into traveller behaviours and preferences. This information can then help to develop targeted marketing campaigns and prioritise infrastructure improvements which will enhance destination attractiveness and the overall tourist experience.
- **Sustainability & Resource Management:** AI powered analytics help the Travel & Tourism industry to monitor and manage environmental impacts. This includes optimising energy consumption, reducing waste and promoting sustainable practices.

AI IN TRAVEL & TOURISM CASE STUDY EXAMPLES

*Microsoft : Creating Better, More Connected Experiences for Customers & Airline Team Members* ³¹

Microsoft and American Airlines are partnering to use technology that will create better experiences for American Airlines customers and employees. They aim to use data and AI to optimise every aspect of their business, from bag tracking to digitally simulating operations at major airport hubs.

One innovative example is at Dallas Fort Worth International Airport (DFW), which is American Airlines' largest hub airport.



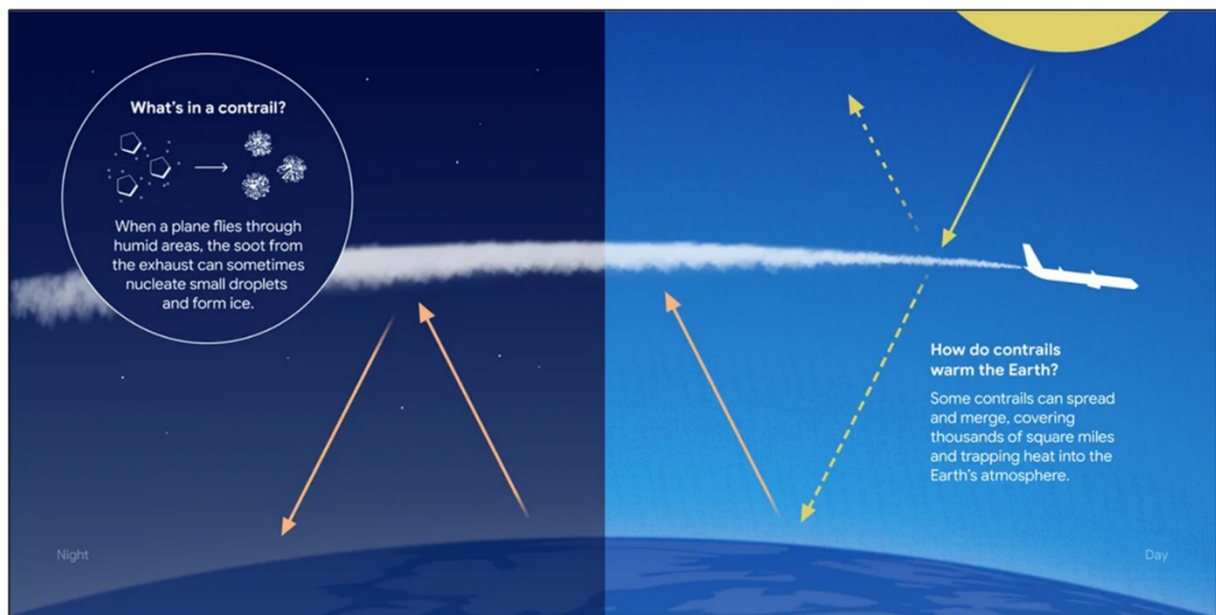
Reaching the gate quickly after landing is critical to running a smooth operation, so **Microsoft is using AI to reduce the taxi time, which can save thousands of gallons of jet fuel per year and give connecting travellers extra time to make their next flight.**

Built on the Azure Microsoft Cloud, American Airlines intelligent gating programme provides real-time analysis of data points, including routing and runway information, to automatically assign the nearest available gate to each arriving aircraft. Previously, gating decisions for American Airlines 136 gates at DFW required manual input from gate planners. Now, the AI program can look at multiple data points simultaneously for hundreds of daily arrivals, saving more than a minute of taxi time per flight. **That adds up to over 10 hours of reduced taxi time per day, lowering fuel usage, reducing operating costs and decreasing CO2 emissions.**

*Google : Mitigating the Climate Impact of Contrails* ³²

Google teamed up with American Airlines and Breakthrough Energy to use AI with satellite imagery, weather information and flight path data to help airlines reduce the climate impact of contrails. Contrails are thin white lines sometime seen behind airplanes, which have a surprisingly large impact on the climate. A 2022 IPCC report ³³ noted that clouds created by contrails trap large amounts of heat that would otherwise have left the earth's atmosphere and account for approximately 35% of aviation's global warming impact.

If airlines avoid flying through areas that would create contrails this could significantly reduce global warming – **the challenge is knowing which flight routes will not create contrails.**



*Contrails : Visual explanation of nighttime and daytime contrail effects.
Contrails from night flights often produce more warming than daytime contrails*

Using Google's AI predictions, American Airlines pilots flew 70 test flights attempting to avoid altitudes forecasted to create persistent contrails. **Post-flight analysis of satellite images found the pilots reduced contrails by 54%, while only burning 2% more fuel.** Further optimisation could reduce the net fuel impact to just 0.3% while avoiding most contrail warming.

This shows that contrail avoidance is a cost-effective, scalable way to reduce aviation emissions. The next steps are to automate avoidance, target highest-impact contrails, and improve satellite verification. The ultimate goal is to work with all airlines to implement contrail avoidance using AI in the coming years.



IBM : Scaling AI at Lufthansa ³⁴

In the airline industry, timing and synchronisation are critical to efficient operations, so Lufthansa, Germany's largest airline, partnered with IBM to rapidly scale up its use of AI to enhance the airline's operational efficiency and improve the customer experience.

Lufthansa initially collaborated with an IBM Garage team to quickly test and implement AI based ideas. Their first project integrated IBM Watson products (including Watsonx Assistant and Watson Explorer) into Lufthansa's AI Studio to improve the airline's customer service help centre. **By using AI, previously disparate data sources were now searchable in 'natural language' and 'aviation terms' to more easily address almost 100,000 customer queries annually.**



Lufthansa then worked with IBM to modernise its data science platform, moving it to the IBM Cloud. This provided improved scalability, security, and flexibility. IBM's Data Science & AI Elite team (DSE) also helped Lufthansa to prototype three innovative use cases focused on avoiding flight delays, better predicting boarding times and reducing check-in queues.

The IBM enabled data science platform now allows Lufthansa to easily develop new use cases, work with more data sources, make the most of open source tools, and take advantage of IBM Watson Studio's AutoAI and machine learning capabilities.

By partnering with IBM, Lufthansa has quickly transitioned from initial AI proofs-of-concept to scaling data science projects across its organisation in less than two years. This is helping drive improvements in customer experience and operational excellence.

TRAVEL & TOURISM AI EXAMPLES

Some other examples from WTTC members and Travel & Tourism companies implementing AI include:

 Expedia	Expedia: In 2023, Expedia launched an AI trip planning experience within its smartphone app. This offers recommendations such as where to go, where to stay and what to see in a destination.
 Tripadvisor	Tripadvisor: In 2023, Tripadvisor upgraded its 'Trips' planning product with the introduction of a new AI powered travel itinerary generator.
 Trip.com	Trip.com: In 2023 Trip.com introduced TripGen, an AI chatbot to 'generate your dream trip'. TripGen offers real-time travel tips, inspiration & itinerary suggestions.
 SITA	SITA: SITA OptiClimb uses AI with weather forecasts and operational flight plan inputs to predict aircraft fuel burn scenarios, providing pilots with optimised climb speeds and acceleration levels that can minimise fuel burn during take-off.
 vision-box	Vision-Box: In 2023, Vision-Box launched AI technology within their biometric border corridors, which uses AI based image processing and tracking to provide an alternative to narrow and gated access control gates.
 IBEROSTAR GROUP	Iberostar: Iberostar reduced its food waste by 28% in the first half of 2023 by implementing AI in its hotels. Their AI system monitors food production and categorises food waste, to control costs and reduce waste.
 Hilton	Hilton : In 2023, the Hilton 'Green Breakfast' pilot used AI to reduce food waste by 62% across 13 UAE hotels. This equates to preventing 726 tonnes of CO ₂ e emissions across a year.
 airbnb	Airbnb: Airbnb has introduced AI powered 'photo tours', for hosts to automatically create photo experiences of their properties and in 2023 acquired GamePlanner.ai to accelerate AI projects across the Airbnb platform.

This is not an exclusive list of AI projects and many other Travel & Tourism companies have also implemented (or are experimenting with) AI, so **now is the time for the Travel & Tourism sector to fully embrace AI.**

AI & ANGUILLA

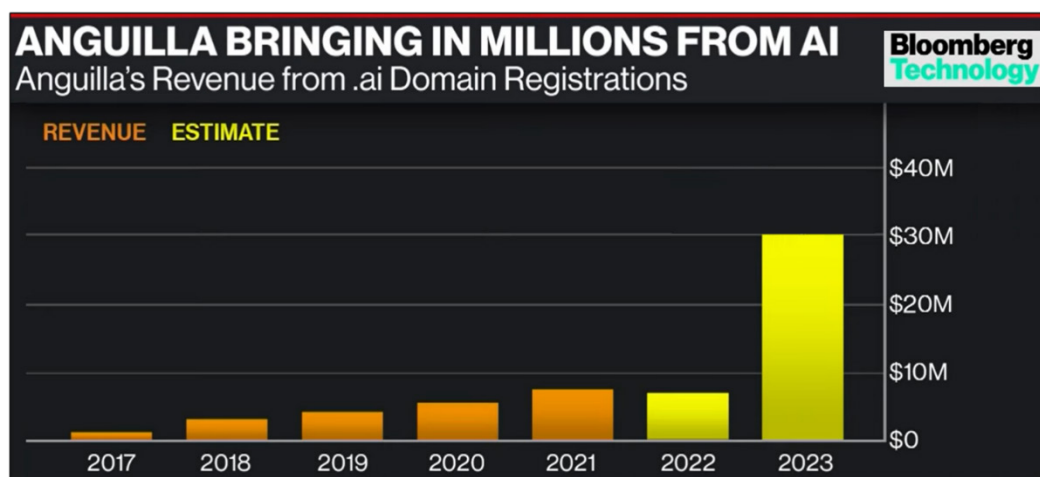
The rapid growth of AI is creating new and exciting opportunities all around the world. One nation ready to seize this moment is this beautiful Caribbean Island of **Anguilla**.



Anguilla : BBC News Map ³⁵

As companies worldwide recognise the power of AI to revolutionise their business and enhance customer experiences, they are eagerly embracing “.ai” websites to showcase their AI products and services. This includes established companies such as Google, IBM, Microsoft, Amazon, Facebook and many others, including a thriving field of AI start-up companies, who have all **registered “.ai” websites, which is the web domain of Anguilla** ³⁶.

This dates back to the 1990's when countries were first assigned internet country codes. Since the early 2000's Anguilla has allowed anyone, anywhere in the world to register “.ai” websites, with the registration fees going to the Government of Anguilla. For a while, this created a small and steady income for the island each year. But with the international surge in artificial intelligence that all changed and from **June 2022 to June 2023 the number of “.ai” websites almost doubled from 143,737 to 248,609** ³⁷. Bloomberg news estimates that revenues for Anguilla from “.ai” registrations will reach \$30 million (USD) in 2023 ³⁸ and could remain high in the years to come as AI plays a major role in the future of society and business.



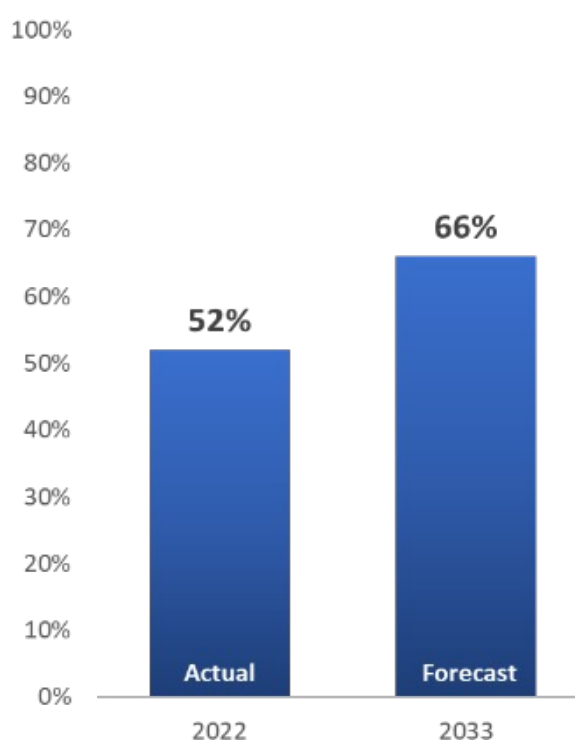
Bloomberg News, 31st August 2023

WTTC economic data ³⁹ for Anguilla shows their economy totalled \$308 million (USD) in 2022, with “.ai” registrations of \$30 million forecast for 2023 therefore representing an extraordinary 10% of Anguilla’s national GDP. **Travel & Tourism is the most important industry in Anguilla contributing over half (52%) of their GDP in 2022 and is set to rise to two thirds of their GDP (66%) by 2033**, with revenues from “.ai” registrations enabling new investments across the island that will make **Anguilla an even better and more attractive tourism destination**, benefiting both locals and visitors to the island.

Anguilla’s distinctive “.ai” web domain is not only a beacon for technological progress and forward-thinking organisations, but also draws attention to the island and its rich culture, stunning landscapes and welcoming people.

WTTC data shows international visitors spent more than \$152 million in Anguilla in 2022, with the U.S., Canada and the UK bringing the most international arrivals. New revenue from “.ai” websites and national investments in tourism projects offer a bright future for Anguilla to attract and welcome even more people from around the world to visit this beautiful destination and by AI raising Anguilla’s prominence on the global digital stage to become a sought-after digital hub, Anguilla can attract even more inward investment and international collaborations, which will contribute to the islands continued growth, prosperity and development as a fantastic tourism destination.

The **Anguilla Tourist Board (ATB)** is excited by the many positive developments in AI, with the growing popularity of “.ai” websites helping to boast the local economy, create new jobs and raise international awareness of Anguilla and its unique culture, noting:



Total Contribution of Travel & Tourism to Anguilla GDP



(Left to Right)

Mr. Kenroy Herbert (Chairman, Anguilla Tourist Board)

Mrs. Stacey Liburd (Director of Tourism, Anguilla Tourist Board)

Hon. Haydn Hughes (Anguilla Minister of Tourism)

“ Anguilla, known for its pristine beaches and captivating culture, is poised to reap significant benefits from international investment in AI web domains.

With the increasing popularity and reliance on artificial intelligence and technological advancements, establishing a strong presence in the digital landscape is crucial for promoting our island as a premier tourist destination.

By securing AI web domains relevant to our tourism industry, Anguilla can also enhance its online visibility, attract a wider global audience, and engage with potential visitors in a more personalised and dynamic manner. This investment will not only drive increased traffic to our digital platforms but also position Anguilla as an innovative and forward-thinking destination ”

AI has put Anguilla on the map and is a unique example of how tourism can benefit from a global technology boom!



SUSTAINABLE AI

Like many technologies, the use of artificial intelligence has an environmental impact, primarily in the underlying cloud IT infrastructure, which can require considerable amounts of water for the cooling of power stations and the production of CO₂ emissions from the use of electricity to power data centres.

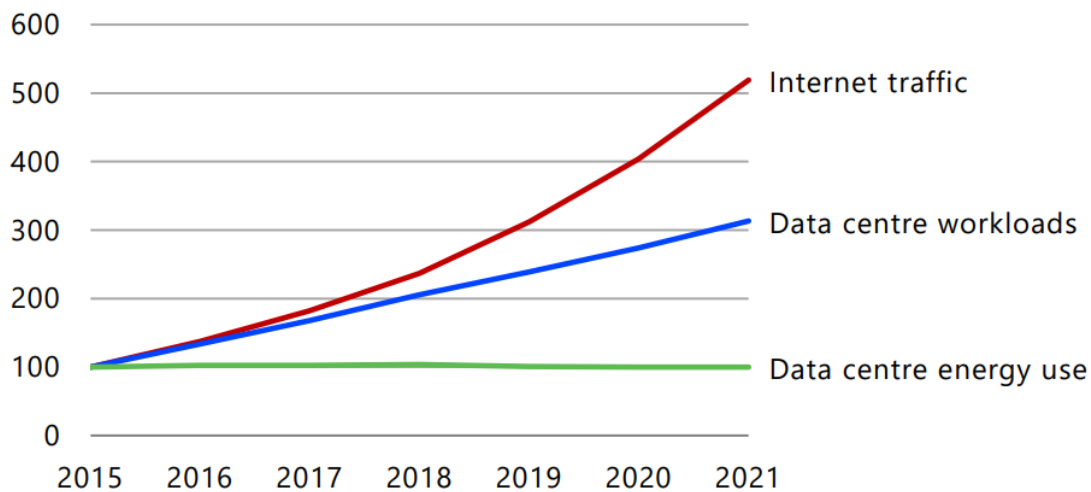
In 2022, the European Parliament estimated the global ICT sector uses up to 10% of the world's electricity and generates between 2% to 5% of the world's greenhouse gas emissions (GHGs) ⁴⁰. These numbers are unfortunately expected to grow in the near term due to accelerated digitalisation across the world. It is therefore important to note that it is not simply AI that generates an environmental footprint, but the world's wider transition to a digital society and economy.

For example, it is estimated that the carbon footprint of an average email at work may be 4g of CO₂, whilst scrolling an online social media feed for one minute at home may generate 1.5g of CO₂ and streaming one hour of video on your TV in the evening could produce 36g of CO₂ ⁴¹. In 2020 a rough calculation from the UK BBC (British Broadcasting Corporation) estimated that every online user generates approximately 414kg of CO₂ a year from their online activities ⁴² – this is roughly equivalent to the emissions from a one way economy flight from London to New York ⁴³.

These IT related emissions come from the electricity and energy used to power the technology, which is mainly created from fossil fuels (coal, oil and natural gas) and as a result nearly every element of our daily lives online, including the use of AI, contributes to climate change. **To reduce emissions from AI and other digital technologies it is therefore critical that the world transitions away from fossil fuels to renewable energy sources (such as wind, solar and tidal power) as quickly as possible.**

As noted earlier in this report AI is powered by data and the US Office of Energy Efficiency & Renewable Energy states that “*data centers are one of the most energy intensive building types, consuming 10 to 50 times the energy per floor space of a typical commercial building and collectively these data center spaces account for approximately 2% of total U.S electricity use*” ⁴⁴. The good news is that many data centre owners are transitioning to renewable energy sources and the US Department of Energy has produced a helpful guide on “*Best Practices for Energy Efficient Data Center Design*” ⁴⁵.

Further good news comes from a **2019 study from the International Energy Agency (IAE)** ⁴⁶ which found **that despite rising online workloads and global internet traffic tripling since 2015 (see the red line below), the energy consumption from data centres has remained flat (the green line below) due to many energy efficiency projects and commitments from technology companies to manage and reduce their carbon emissions.**



Global trends in internet traffic, data centre workloads and data centre energy use (IAE 2019)

In fact the IEA found that “ICT companies are leaders in corporate renewable energy procurement” with **Microsoft, Google, Amazon, Meta and AT&T being the top 5 global purchasers of renewable energy in 2019.**

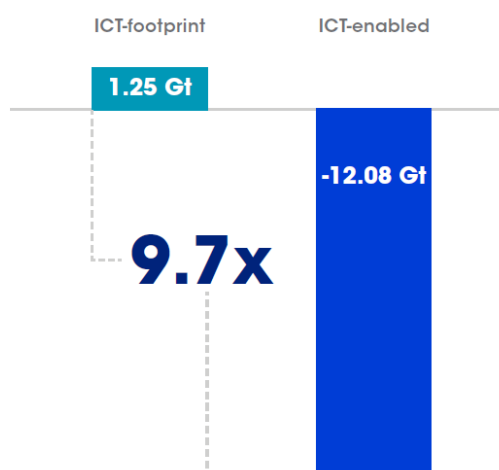
The Intergovernmental Panel on Climate Change (IPCC) also recognises the significant contribution that digital technologies can make to preserving our world and achieving the UN Sustainable Development Goals (SDGs). In 2023 the IPCC stated in their Synthesis Report ⁴⁷ that artificial intelligence can “improve energy management in all sectors” as well as “increase energy efficiency” and “promote the adoption of low emission technologies”. So while AI (like many other digital technologies) has a climate footprint that cannot be ignored, primarily by using cloud based data centres, **AI also has great global potential to help solve some of the world’s most challenging environmental issues and accelerate our planet towards Net Zero.**

For example IBM and NASA have collaborated to widen access to satellite data and accelerate climate related discoveries through AI ⁴⁸. In early 2023, IBM built an AI model that could speed up the analysis of earth satellite images and has provided this model for free to the public (through an open source AI platform called Hugging Face ⁴⁹) that can be used for tasks such as tracking deforestation, predicting crop yields, or detecting and monitoring greenhouse gases. This project also coincided with the US Presidents declaration of 2023 as the ‘Year of Open Science’ which was a series of events and projects throughout 2023 that successfully promoted AI model and data sharing with the public ^{50 51}.

Another successful example of AI helping to achieve global sustainability and net zero emissions is the Port of Rotterdam in the Netherlands, which is Europe’s busiest port. The port has introduced a combination of AI and other innovative digital technologies to optimise the planning and berthing of ships, which is enabling the port to be on track to cut 50% of their carbon emissions by 2030 ⁵².

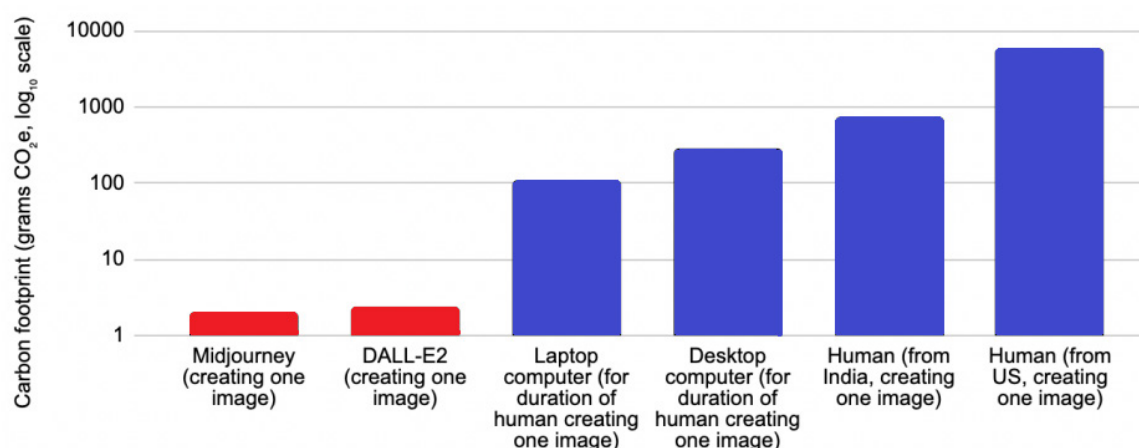
In 2015 a study supported by UNFCCC and undertaken by Accenture and the Global e-Sustainability Initiative (GeSI) ⁵³ - a partnership of ICT companies committed to economic, environmental and social sustainability - also estimated that **digital technologies, including AI, could help other industries (outside of ICT, such as Travel & Tourism) to save 20% of their CO₂ emissions.** The recent advancements in AI since 2015 make it possible that this percentage could be even higher today.

By using AI and other digital technologies to tackle climate change, DIGITAL EUROPE - the European trade association for the digital technology sector - estimated in 2021 that **digital technologies could save 9.7x more emissions than they produce. To make this happen, however, would require the global twin transitions of the green and digital transformations around the world to work in harmony together** ⁵⁴.



Expected gigatonnes (Gt) of CO₂ emissions saved by ICT technology by 2030

In 2023, researchers from universities in the U.S. and New Zealand collaborated to evaluate the environmental impact of AI writing and digital illustration tools and found that as these AI tools are now so quick, efficient and professional, **AI can produce high quality output that is comparable to a human, but with 3 to 4 orders of magnitude less CO₂ emissions than a human doing the same task manually, or on a computer without AI**⁵⁵. This further supports the position that AI technology can be used sustainably.



Carbon footprint of AI illustration tools (Midjourney & DALL-E 2) vs humans artists creating one image

However the world does not have a full and robust understanding of all the environmental considerations for AI and therefore in 2022 an OECD Expert Group on AI and Climate, together with other subject matter experts produced a paper and framework to help improve understanding of the environmental impacts of AI, which was presented at COP27 in Sharm el-Sheikh, Egypt⁵⁶.

This study recommended that AI should be part of the solution to achieving global sustainability targets, but there were five key measurement gaps with implications for government policy makers that need to be addressed. These are; (1) to establish measurement standards for sustainable AI, (2) to expand data collection on the environmental impact of AI, (3) to identify AI specific impacts, (4) to look beyond energy use and emissions as the core environmental impacts and (5) to improve transparency and equity of data and computing power to help government policy makers make AI part of the solution to sustainability challenges everywhere.

Key measurement gaps with policy implications	
	Measurement standards for sustainable AI are needed
	Data collection on environmental impacts of AI compute and applications should be expanded
	AI-specific measurements are difficult to separate from general-purpose compute
	Environmental impacts beyond energy use and GHG emission should be considered
	Efforts are needed to improve environmental transparency and equity everywhere

OECD : Five key measurement gaps, with AI policy implications

RESPONSIBLE DATA MANAGEMENT FOR SUSTAINABLE AI

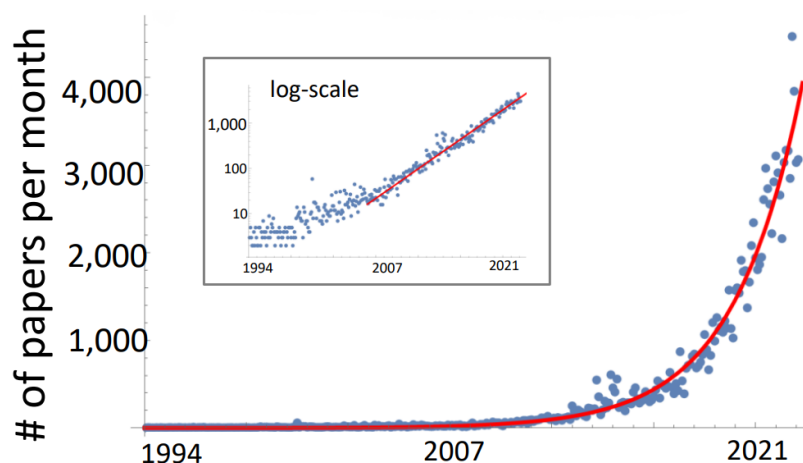
One practical way that Travel & Tourism businesses can minimise their emissions when using AI with their own datasets is to practice responsible data management. As explained in the accompanying WTTC report on an Introduction to AI Technologies, AI models can require huge amounts of data for training, so inefficient data storage practices can generate unnecessary energy and water consumption when the data is stored in cloud based data centres. By adopting responsible data management practices such as data minimisation, efficient data storage and data disposal, organisations can make a meaningful difference to their carbon emissions and significantly decrease their AI environmental footprint.

Considerable amounts of data are often used and stored by organisations...and then forgotten about. A 2022 study by Loughborough University in the UK, with Amazon Web Services (AWS) and the London Data Company identified that **more than 80% of stored business data may be ‘Dark Data’ that is Redundant, Obsolete or Trivial (ROT)**⁵⁷, and could be safely deleted. Each company continually storing this data could equate to many terabytes of data and many kilograms, or even tonnes, of ‘hidden’ CO₂ emissions and water use from the energy and cooling required to store this data indefinitely in the cloud. Good data management practices can therefore contribute to reduced emissions and more sustainable AI.

WHAT'S NEXT FOR AI

Artificial intelligence is an area that once belonged to the world of science fiction, but has made significant advancements in recent years. It is now a fact that AI will be a component of modern life and business in the future, with AI powering an increasing array of our everyday activities, from the work in our offices, to the appliances in our homes.

Academic research publications on AI have exploded since the early 2000's, with a September 2022 study calculating there were approximately **4000 new AI research papers published every month**⁵⁸. This is one new AI research paper published approximately every 10 minutes (!) and this trend is set to get quicker with more papers published each month, driving forward global AI innovation at an incredible speed.



Number of AI papers published per month on the arXiv research sharing platform

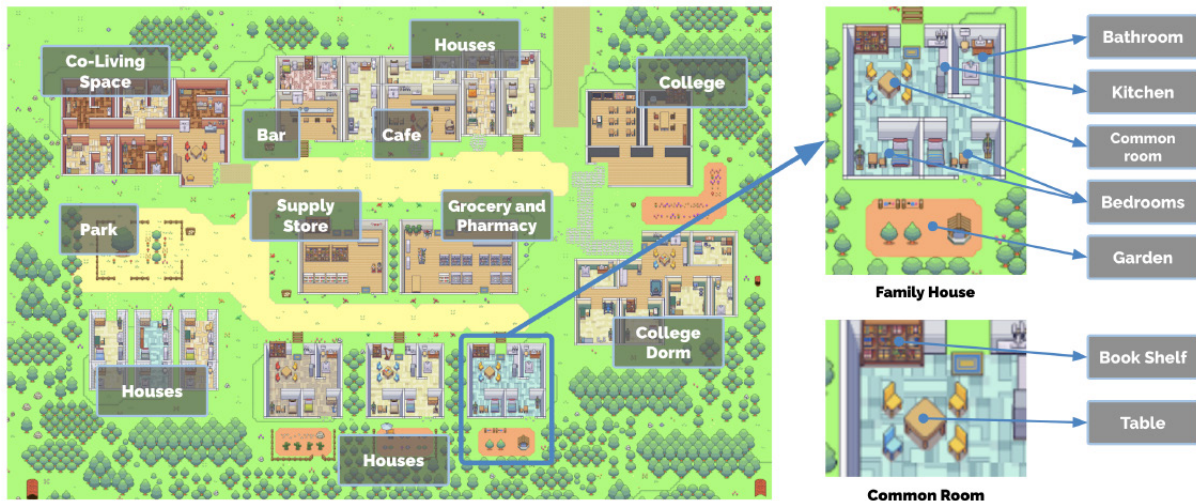
This very rapid pace of technological development and the still evolving regulatory landscape for AI makes it impossible to fully predict how AI will evolve over the next 5 to 50 years, but there are three general areas of AI development that are very likely to significantly advance over the next few years. **These are AI Agents, Artificial General Intelligence (AGI) and Robotics.**

AI AGENTS

One of the most promising areas of AI research and developments in the practical use of AI is the rise of '**AI Agents**'. These sophisticated software solutions are designed to perform tasks autonomously and make decisions based on changing data and knowledge available to them. This sets AI agents apart from other forms of AI, as they are able to intelligently interact with a digital environment, collaborate with other AI agents, perceive information, and automatically act upon it to achieve specific goals. **AI agents can exhibit autonomy, adaptability and an ability to learn from their experiences.**

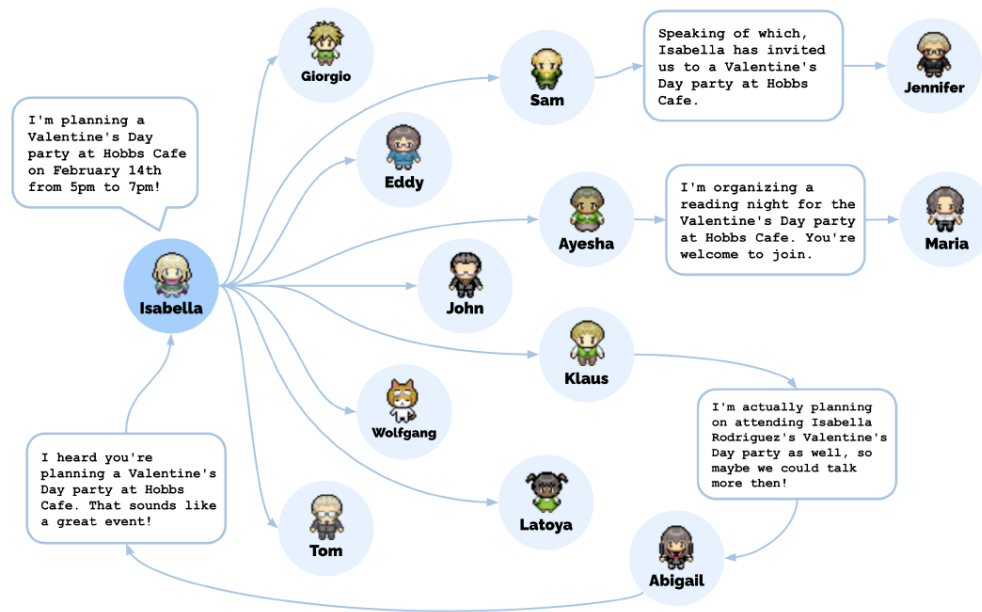
In an award winning academic paper from Google and Stanford University ⁵⁹ in 2023, researchers showed that AI large language models (LLMs) – the technology that underpins sophisticated AI chatbots – could successfully power digital AI agents and achieve remarkable levels of task autonomy never achieved before.

In this study, the researchers made 25 digital AI agents representing humans (referred to as ‘generative agents’ in the paper) that populated a small digital town, inspired by the computer game ‘The Sims’. Users could observe, or interact, with the 25 agents using natural language and the researchers evaluated their ability to accurately and autonomously simulate realistic human behaviour.



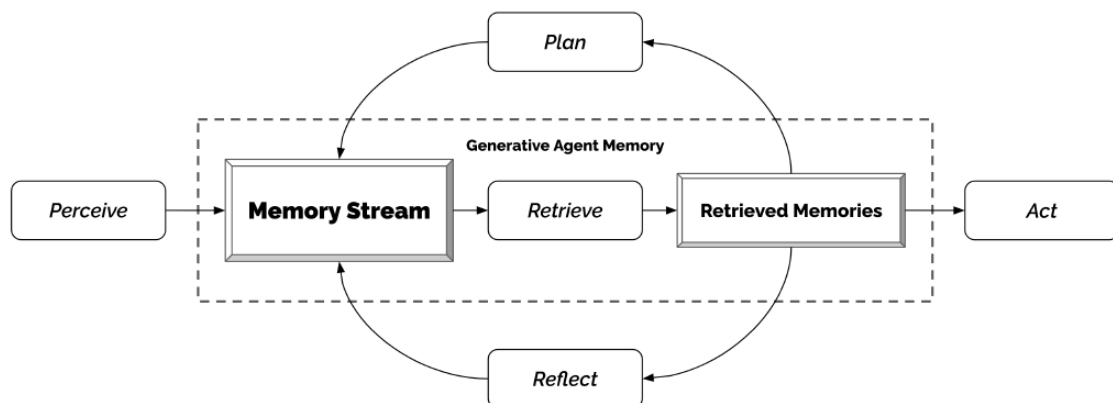
In this study the researchers demonstrate 25 AI agents populating a simulated environment, reminiscent of ‘The Sims’ computer game. Users can observe and intervene as agents plan their days, share news, form relationships and coordinate group activities

In the researchers’ evaluation, the AI agents produced very believable individual and group human behaviour, such as turning off an oven when they see their food is burning, waiting outside a bathroom when they see that it is occupied, or stopping to talk with other agents. In one astonishing example, starting only with a single user prompt that one AI agent wants to throw a Valentines Day party, the AI agents autonomously spread invitations to the party over the next two days, made new acquaintances, asked each other out on dates to the party and co-ordinated between themselves to arrive at the party together, at the right time and location! Despite many possible points of failure in the chain of events, such as AI agents not telling each other about the party, or forgetting to show up several days later, the Valentine’s Day party did in fact happen with several AI agents gathering and interacting with each other.



Isabella's Valentine's Day party invitation reached 12 other AI agents

Success in this project was achieved by fusing an AI large language model (LLM) with an innovative technical architecture that could **'retrieve'** relevant events and interactions over a long period of time, **'reflect'** on those memories and apply reasoning to create **'plans and reactions'** that make sense in the moment and in the longer term trajectory of an agent's behaviour.



AI Agents perceive their environment, with a record of the agent's experiences stored in a Memory Stream. Based on their perceptions, they retrieve relevant memories and use those to determine an action. The retrieved memories are also used to form longer-term plans and create higher-level reflections, both of which are entered into the memory stream for future use

This model could be very useful in many areas of life, society and business, where the simulation of realistic human behaviours could be beneficial. For example **AI agents could be used to prototype ideas in the early stages of design**, where gathering feedback from real human participants may be challenging, or risks exposing intellectual property and confidential information to competitors (or the public) too early. **AI agents could also be used to test new business, or operational ideas**, where it could be too time consuming, difficult, or even risky to test with real human participants.

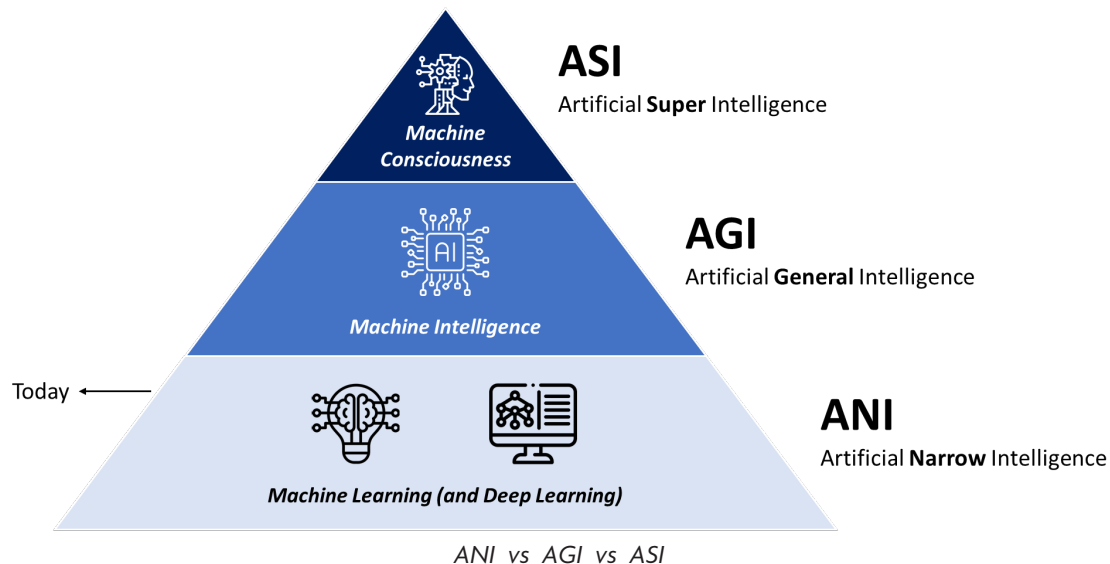
AI agents could also be used in role-play scenarios, such as for job interview preparation. For example a user could safely rehearse questions with an AI agent and even test difficult and conflict laden conversations in a safe digital environment.

The ability of AI agents to interact with an environment and authentically simulate human behaviour could revolutionise many industries and aspects of society by improving decision making, enhancing productivity and introducing new creative possibilities.

ARTIFICIAL GENERAL INTELLIGENCE (AGI)

AI today could be described as Artificial Narrow Intelligence (ANI) as it is very good at specific tasks only. The ability of AI agents to simulate realistic human behaviour is a step towards **Artificial General Intelligence (AGI) which refers to an AI system that understands the world and can perform any intellectual task as well as an ‘average’ human.** AGI is the stated aim of several AI companies.

AGI is different to Artificial Super Intelligence (ASI) which is a future theoretical form of AI that has incredible abilities and would be able to surpass the smartest humans in every field and exhibit intelligent understanding far beyond human comprehension, or control. ASI is therefore a theoretical concept and not considered in this section of the report, with **Artificial General Intelligence (AGI)** a much more potentially achievable prospect for AI in the near-to-mid term.



To be successful, AGI systems would need to possess human like cognitive abilities that enable them to understand, learn and apply knowledge across a wide range of tasks, with a level of reasoning and adaptability comparable to an ‘average’ human. Today's sophisticated AI chatbots are part of the journey towards AGI and several AI chatbots have demonstrated their ability to successfully pass academic and medical exams just as well as a human.

In 2023 a research paper from Microsoft ⁶⁰ therefore found that GPT-4 (the AI model behind the paid for version of ChatGPT) demonstrated ‘sparks’ of artificial general intelligence, with the paper noting that “GPT-4’s performance is strikingly close to human level performance” and that “it could reasonably be viewed as an early (yet still incomplete) version of an artificial general intelligence”. The paper goes on to explain that “this is demonstrated by its core mental capabilities (such as reasoning, creativity and deduction), its range of topics on which it has gained expertise (such as literature, medicine and coding), and the variety of tasks it is able to perform (e.g. playing games, using tools and explaining itself)”. However the paper concludes that “a lot remains to be done to create a system that could qualify as a complete AGI”.

Unfortunately there is **no internationally agreed definition of artificial general intelligence and it is therefore impossible to accurately establish how far away we are from achieving AGI.** But there is a rich library of academic research into ‘human intelligence’ and therefore several attempts have been made to propose a comprehensive definition for AGI, but each has its challenges in being universally accepted. Example definitions for AGI include:

- A **'goal orientated'** approach which measures an AGI's ability to achieve goals in a wide range of environments. However this does not capture the full spectrum of human intelligence, which is able to answer questions without any specific goal or motivation
- A **'skills acquisition'** approach which places the emphasis on the efficiency of learning from experience, but this is unfortunately one of the key weaknesses of current AI large language models
- A **'human capability'** approach which says that an AGI should be able to do anything a human can do, but this is problematic as no two humans are alike and humans have different skills, talents and limitations. There is no human than can do everything that every other human can do. For example, no human can run the 100m as fast as Usain Bolt and also do physics as well as Albert Einstein.

At this time WTTC therefore considers AGI to mean an AI system that can perform any intellectual task at the level of an 'average' human (where 'average' is a subjective term).

In their 'sparks of AGI' research paper, Microsoft identified eight areas where large language models require improvement to achieve AGI. These are:

- 1) **Confidence Calibration:** AI's can make up information (called 'hallucinations') and present it in a very confident and persuasive manner that can be hard to detect. This can be useful for generating creative content, but can also lead to confusion, mistrust and danger when AI is used in safety critical areas such as healthcare. The 'level of confidence' in a result provided by an AI system could therefore be useful in deciding upon the next action to be taken.
- 2) **Long Term Memory:** Improving an AI's ability to perform tasks which require an evolving long term memory will be important for AGI, such as reading a book and being able to follow a plot and understand references to prior chapters (or even other books in a series, such as the Harry Potter collection).
- 3) **Continual Learning:** The knowledge acquired by an AI system can become 'fixed' once it is trained and therefore AI systems can quickly become out of date when it comes to recent events and information. To achieve AGI, an AI system therefore needs to be able to adapt to a constantly changing external environment.
- 4) **Personalisation:** To be most useful, an AGI system would be required to obtain tailored knowledge and understanding of the user and the workings of organisations and be able to adapt over time with specific changes linked to the dynamics of people and organisations.
- 5) **Conceptual Leaps:** Current AI systems have difficulty in performing tasks with conceptual leaps that is often associated with human 'Eureka' moments in completing tasks.
- 6) **Transparency & Consistency:** Current AI systems can provide inconsistencies between their output and the explanation for this output which can lead to mistrust. AGI systems would therefore need to be able to provide high quality explanations of their decisions, with an awareness of their limitations.
- 7) **Fallacies & Irrationality:** Current AI systems can exhibit statistical fallacies and biases which may have been present in their training data. AGI systems would need to reflect the distribution of opinions and perspectives of a large population
- 8) **Sensitivity to Inputs:** Current AI systems can be very sensitive to the wording of prompts, which can require significant effort and experimentation (sometimes called 'prompt engineering'). AGI systems would therefore need to require less prompting time and effort by people, whilst ensuring this did not lead to sub-optimal output.

Estimates for when AGI may be achieved vary widely between AI researchers, with Google Deepmind CEO, Demis Hassabis saying at the 2023 Wall Street Journal ‘Future of Everything Festival’ that “*AGI could be just a few years away, maybe within a decade*” ⁶¹, while the nicknamed ‘Godfather of AI’ Geoffrey Hinton told US television show CBS Morning in March 2023 that “*until quite recently, I thought it was going to be 20 to 50 years before we have general-purpose AI. Now I think it may be 20 years or less*” ⁶². Alternatively a 2022 survey of approximately 4000 machine learning researchers estimated there is only a 50% chance that AGI may be achieved by 2060 ⁶³.

But when (and if) AGI does arrive, it will be transformative and offer enormous opportunities to enhance human innovation. AGI could also broaden access to services that were previously only accessible to the most financially privileged. For example, AGI systems in education could offer personalised, one-on-one tutoring within easy financial reach of everyone, resulting in improved global literacy rates.

ROBOTICS

Robotics is a complementary field to AI and closely related to Artificial General Intelligence (AGI). In the business charter of OpenAI (the company behind ChatGPT) it states that AGI is the “*ability to outperform humans at most economically valuable work*” ⁶⁴.

In considering what are the most ‘economically valuable’ areas of work, the online jobs website ‘Indeed’ listed the 25 most common jobs in America in March 2023 ⁶⁵. Given the very large number of people employed in these roles, they could be considered a proxy for the most valuable jobs to the US economy, with the first ten on the list being: *cashier, food preparation worker, stocking associate, labourer, janitor, construction worker, bookkeeper, server, medical assistant and bartender*. Crucially all these jobs require not only intellectual capacity, but also manual activity and therefore cannot be achieved with an AGI system operating only on a computer – no matter how smart it is.

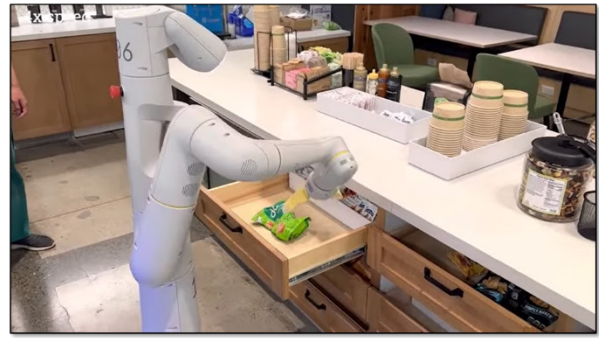
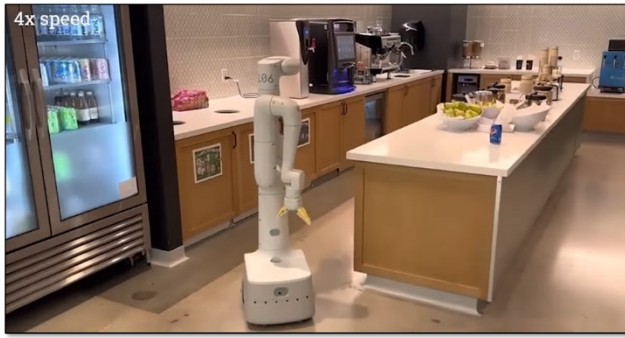
Many people therefore suggest that for **AGI to be achieved, it requires both intelligent AI software and robotic hardware**, leading to significant work developing robotics and integrating with AI.

In a 2020 research paper, academics at the Australian National University identified eight attributes that a system must have for it to be classified as AGI ⁶⁶. These were: logic, autonomy, resilience, integrity, morality, emotion, embodiment and embeddedness. The last two attributes (**embodiment and embeddedness**) refer to having a physical body - or robot - that facilitates learning, interaction and understanding of the world. **Embodiment** refers to the visible form of an idea, whilst **embeddedness** refers to real world objects being in a form that computers can process.

Robotics is therefore an important complimentary field to AI that will enable AI systems to physically interact with the real world. There is considerable research and development of AI and robotics in both universities and industry.

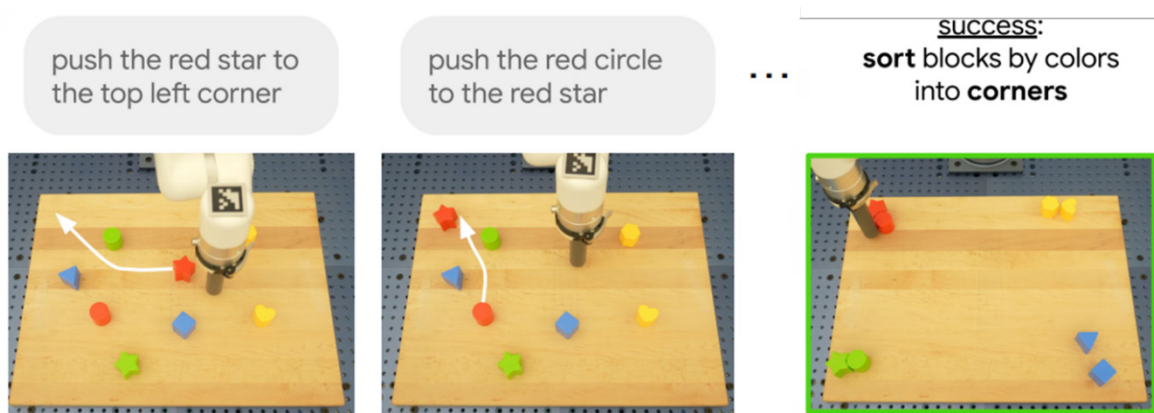
In early 2023, Google introduced PaLM-E as an experiment ⁶⁷. This combined their AI large language model (called PaLM) with a robotic arm (the extra ‘E’ in PaLM-E stands for embodiment) and visual sensors that allowed the robot to ‘see’. The system was evaluated on three robotic tasks and demonstrated an ability to complete all of them successfully.

The first experiment asked a mobile robot with a simple ‘natural language prompt’ to bring a user a packet of crisps from a kitchen drawer. PaLM-E successfully found the drawer, opened it, took out the crisps, dynamically responded to a change in the environment when the crisps were deliberately knocked from the robot back into the drawer, closed the drawer and then delivered the crisps to the user.



Google PaLM-E robot prompted to “pick the green rice chip bag from the drawer”

The second and third experiments evaluated the robot’s ability to identify shapes and colours and organise wooden blocks. Whilst these tests might appear to be simple tasks, PaLM-E demonstrated a step forward in AI and robotics, as it could be instructed with simple natural language prompts and showed it was possible to train AI large language models that are both versatile and able to perform useful tasks in the real world correctly.



Google PaLM-E robot prompted to “sort blocks by colours into the corners”

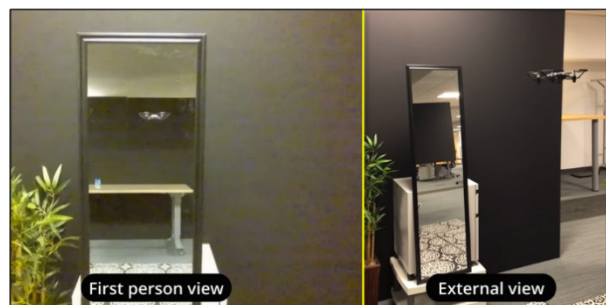
Microsoft has also experimented with AI and robotics to control drones, robotic arms and home assistant robots ⁶⁸. **Their goal was to help people interact with robots more easily, by allowing humans to speak to robots and control them with their own words, without having to learn any of the technical details of the robotic systems, or complex programming languages.**

Microsoft found that AI large language models (that power sophisticated AI chatbots, such as ChatGPT) can already achieve a lot when directly integrated with robotics, but can be improved by using special prompting structures, human feedback and additional software (called Application Programming Interfaces [API]) that help the AI model to control the robots’ functions, such as its camera.

Microsoft demonstrated that AI could successfully fly a drone without it crashing into obstacles, inspect a shelf to find a soft drink and take a selfie in a mirror.

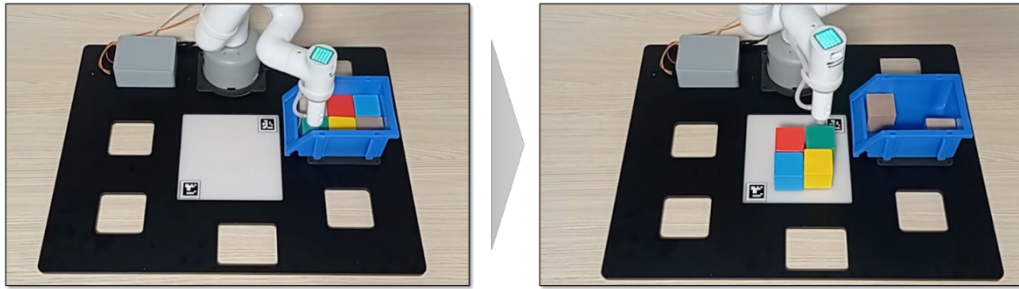


Microsoft Drone
Asked to “find a drink with sugar & a red logo”



Microsoft Drone
Asked to “take a selfie using a reflective surface”

It was also able to control a robotic arm which was asked to “*build the Microsoft logo*” out of wooden blocks. The AI system was able to recall the logo from its knowledge and then use its robotic skills to complete the task.

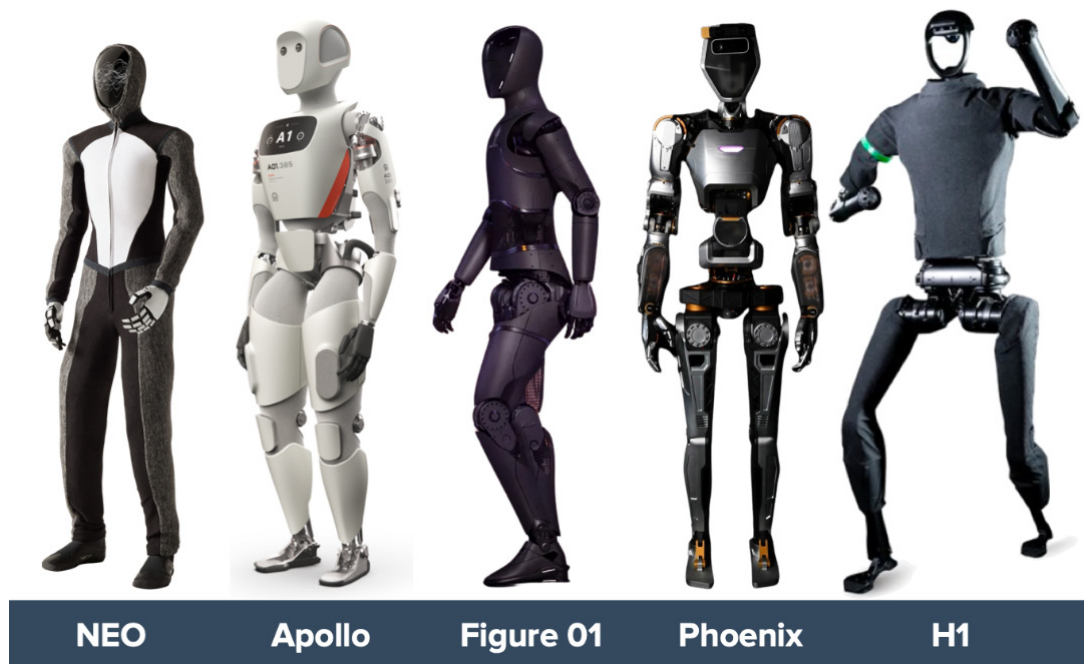


Microsoft Robot asked to “build the Microsoft logo”

Microsoft also found that good, clear, human instructions (called prompts) were important for success, but there is a lack of comprehensive and accessible information on good (and bad) examples of prompts for robots to help researchers and enthusiasts in this field. **Microsoft therefore launched the PromptCraft repository⁶⁹ as a collaborative, open-source platform where anyone can share examples of prompting strategies for different robotic categories.**

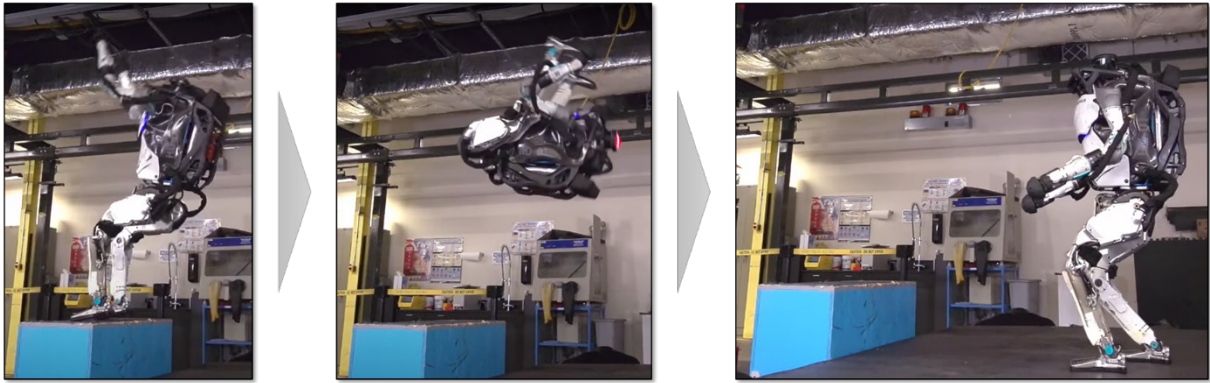
Other researchers are also jumping into this exciting field by developing **humanoid robots, which are robots incorporating AI and designed to resemble a human and mimic human characteristics.**

Several humanoid robot concepts are currently under development, as illustrated in the diagram below:



Humanoid Robots⁷⁰

One of the most well known humanoid robots is ‘Atlas’ from Boston Dynamics⁷¹ which currently operates without AI. Atlas has pre-programmed and scripted moves (so is not using AI to navigate the world) but is designed to **explore the abilities and limitations of a robotic ‘humanoid form’ and has demonstrated remarkable athletics, agility and speed.** Atlas can carry heavy loads, climb stairs, jump over obstacles, balance on narrow beams and even do backflips! Atlas has shown it is possible to develop a robotic body that is able to move like a human.



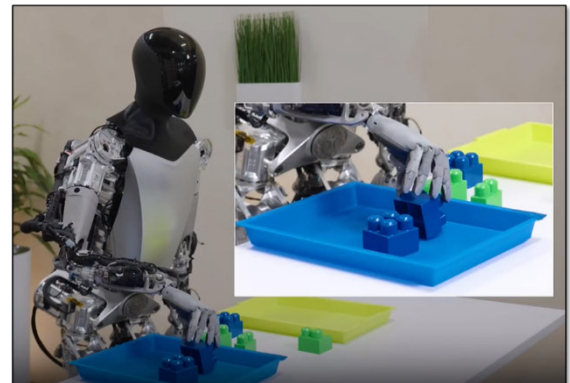
Atlas robot doing a backflip (screenshots from Boston Dynamics video ⁷²)

Another robot that has demonstrated human like abilities is **Optimus, from electric vehicle manufacturer Tesla**. Optimus (also officially called the Tesla Bot) is still under development and described as a “*general purpose, bi-pedal, autonomous humanoid robot capable of performing unsafe, repetitive or boring tasks*” ⁷³.

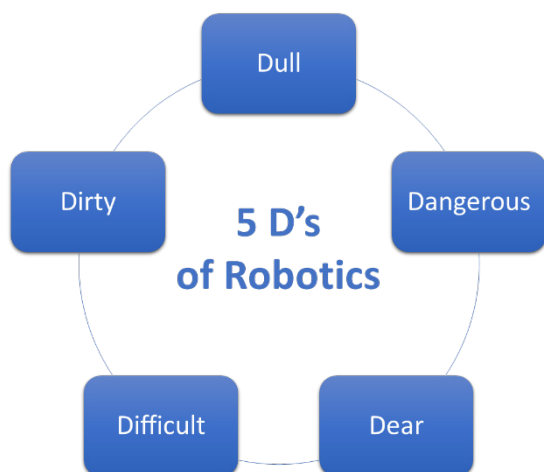
In mid-2023, Tesla issued an X (formally called tweet) ⁷⁴ showcasing the ability of Optimus to do yoga moves, as a demonstration of its balance. The company also released a video showing the human like dexterity of its robotic hand. Optimus’s robotic hand was able to pick up and sort coloured blocks into boxes and through the power of AI automatically take corrective action when the robot noticed one of the blocks had fallen over. Tesla’s CEO Elon Musk has said humanoid robots, powered with AI, may be available from 2027.



Tesla Optimus performs yoga moves



Optimus demonstrates autonomous corrective action to turn the block over



While Tesla describes Optimus as able to do ‘**unsafe, repetitive, or boring**’ tasks, the field of robotics has long used three D’s to describe where robots have an advantage over humans. These are in are in **dull, dirty and dangerous tasks**. This is sometimes expanded to five D’s to also include **difficult and dear tasks** (where dear refers to expensive).

The use of robots and AI is likely to be major area of focus over the coming years and will enable the full power of AI to interact with the real world. However to prevent ‘Terminator style’ robots, appropriate regulations, guardrails and alignment with human values, often referred to as the three H’s (AI that is **helpful, honest and harmless**) will be required, as well as the use of Isaac Asimov’s three laws of robotics.

Isaac Asimov Three ‘Laws of Robotics’

1. A robot may not injure a human being, or through inaction, allow a human being to come to harm.
2. A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
3. A robot must protect its own existence, as long as such protection does not conflict with the First or Second Law.

ANNEX : PROMPTING AI CHATBOTS

– BASIC GUIDE

Prompting an AI chatbot is likely to be the first interaction that most people will have with a sophisticated AI system. **The below instruction therefore provides a very basic guide to prompting.**

How a user prompts an AI system can significantly influence both the relevance and quality of the results.

Prompting an AI chatbot (or other large language model) to achieve the best outcome can be more ‘art’, than ‘science’ and therefore often requires practice and experimentation (sometimes called Prompt Design, or Prompt Engineering).

To help get the best results as quickly as possible for users of AI chatbots, the following basic guide provides high level recommendations, following what has been found to work well for instructing AI chatbots. **However it should be noted different prompt designs are required for getting the best results from AI image generators, which are not covered in this basic guide.**

All readers of this report are encouraged to not only use the below C.R.E.A.T.E format, but to also explore and experiment with different prompting options, which may provide better results to specific tasks.

The six points of the C.R.E.A.T.E format do not have to be used with every prompt, but using some, or all of the elements can lead to better results.

Basic Structure of a C.R.E.A.T.E Prompt Acting as a [CHARACTER] perform [REQUEST]. Here are some [EXAMPLES] with [ADJUSTMENTS]. Provide the [TYPE OF OUTPUT] and [EXTRAS]		
C	Character	Define the AI's role at the start of your prompt e.g. <i>"You are a seasoned copywriter with 20 years of experience in successful sales copy"</i>
R	Request	Be specific with what you need. Instead of writing <i>"write a sales email for a sports car"</i> , specify <i>"write a compelling email for a Tesla Roadster, an electric car with top tier acceleration"</i>
E	Examples	Optionally, provide samples for more precise results. Tone examples (such as <i>"in a professional tone"</i> or <i>"in a conversational tone"</i>) can also guide the AI's output style
A	Adjustments	Refine the prompt if it's not perfect. Use instructions such as <i>"Avoid bullet points; use sub headings"</i>
T	Type of Output	Describe the desired output format e.g. <i>"Produce a 500 word article with a title and conclusion"</i>
E	Extras	Incorporate unique instructions e.g. • <i>"Explain your thinking"</i> • <i>"Ask questions before answering"</i> • <i>"Ignore previous conversations"</i> • <i>"Use data up to January 2023"</i> • <i>"Only use reliable sources and cite them"</i> • <i>"Use CAPS LOCK for emphasis"</i>

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ENDNOTES

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- 8 UN 5Rights Principles for Children (https://www.un.org/techenvoy/sites/www.un.org.techenvoy/files/GDC-submission_5Rights.pdf)
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