The AI Dilemma

A Leadership Guide to Assess Enterprise AI Maturity and Explore AI's Impact in Your Industry

DR. CINDY GORDON

MALAY A. UPADHYAY

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Malay A. Upadhyay

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Dedicated to

Those who would like to see the paths that await us,
and lead us to the better one.

About the Authors

- **Dr. Cindy Gordon** is the Founder and CEO of SalesChoice, a company specializing in AI to End Revenue Uncertainty. She has held senior leadership roles in firms including: Accenture, Xerox, Citicorp and Nortel Networks. In addition, Cindy has been a venture capitalist, angel and/or founder in emerging software companies including: Corent Technology, CoursePeer, Eloqua, Kula, LyfeUp, Emotionalcloud.com, and TouchTown TV. She is an AI thought contributor with Forbes Media, and is recognized for her thought leadership in SaaS, Collaboration and AI & technology emergence, with over 13 published books. She is the 2019 recipient of the MindBridge AI Impact Leader of the Year award, the 2017 Startup Canada National and Regional Entrepreneurship Award Winner, the 2017 CATA & EY Sara Kirke Award for Innovation Leadership, and a 2012 Governor General Award.

  Cindy is also active in not for profit boards. She is the AI Board Advisor for the Forbes School of Business and Technology, Chair of the AI Directory, and CATA Board Advisor for Innovation and STEM. Cindy is also an Adjunct Faculty Professor at George Brown College, teaching AI and Data Science Ethics.

  Her passion is the constant pursuit of sustainable innovation to make our world a better place. She loves cooking, family time, travelling, reading, scuba diving, hiking, squash, and writing. She can be reached on Linkedin at **www.linkedin.com/in/cigordon**.

- **Malay A. Upadhyay** is the Chief Customer Experience Officer at SalesChoice. Besides helping clients with AI value realization on their datasets, he has trained 150+ N. American managers on the basics of AI and its effective adoption, and held executive thought leadership sessions for CEOs and CHROs on AI strategy and IT modernization roadmaps. He began to pen the 'AI Management' series following his online course which helps fill the gap in business professionals' understanding of how to use AI successfully and responsibly. It can be found at **www.ClassesAI.com**.

  Malay holds an MBA, M.Sc. and B.E., and is certified in Machine Learning. He was one of 25 individuals chosen globally to envision the industrial future for the Italian giant, Marzotto Group, on its 175th anniversary. As a consultant

and growth executive who has served multiple industries in India, UAE, Italy and Canada, his co-published course in this field helps elucidate how to organizations can maximize their brand equity with modern tech. It can be found at **www.MyBrandClass.com**.

A Duke of Edinburgh awardee, Malay has also been driving the subject of responsible AI management as a Speaker, Advisor, Author, Online instructor and Member of the European AI Alliance that advised the HLEG on the European Commission's AI policy. At other times, he remains a Fly that loves to travel and blog with Mrs. Fly. You can find more details on Malay and his books, and contact him at **www.TheUpadhyays.com**.

About the Reviewer

Sivaraj Ambat is a Cloud expert and a Software Professional specializing in application development for Web, Desktop, Mobile apps, Chatbots, and AI-based applications. He has over 25 years of industry experience in diverse roles and companies, ranging from Instrumentation and Industrial Robotics to Embedded Systems and Software Application Development. He is a recipient of US-based Training Magazine's 2016 Top 20 Emerging Training Leaders Award and also a winner at many hackathons and quiz competitions. He is presently working in Tech Mahindra, Bangalore as a Principal Consultant and Senior Fellow. He can be reached @sivarajTweets on Twitter

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—Dr. Cindy Gordon and Malay A. Upadhyay, your AI River Guides!

Preface

Artificial Intelligence (AI) is everywhere, even though it is perceived as a novelty by most of us. AI can accurately make predictions we could have never imagined, but has trouble answering simple questions on our phones. It is touted as one of the biggest achievements and threats for humanity by many experts –Elon Musk, Vladimir Putin, the Late Dr. Stephen Hawking and Pope Francis, to name a few. And yet, most of humanity doesn't understand AI at all.

Simultaneously a source of the biggest benefits and risks facing every organization, profit or not-for-profit, AI exists today in a field of anomalies, the resolution to which serves two distinct scenarios: Will we create a perfect world or will we create a perfect storm?

Although the future will most likely see a mix of both of these scenarios, our collective effort and the accuracy of our awareness will determine how alert and resilient our future turns out to be in the battle between AI for Good and AI for Destruction.

A lack of acute awareness among organizations on how to prepare for AI and how to use it successfully and responsibly was the driving inspiration behind our writing this book. When we embarked on our learning journey, there was a glaring gap around the need for global organizations to develop a foundational understanding of AI, appreciate its influence and risks in order to disassociate perception from reality, and provide the leadership boost to build a solid strategy to modernize business models. After all, a significant amount of all investments in AI continue to fail due to a lack of data or organizational readiness and understanding of how to get results from AI.

A bigger concern for us was the dynamics that were globally in play behind-the-scenes, with countries developing their AI policies at different rates, and riskier AI innovations coming to fruition – all while the majority of organizational end users, decision makers and investors across all industries were lacking the skills to advance AI efficiently and effectively. Board directors, CEOs, and leaders were inadvertently limited in their understanding of the dynamics of AI in the broader landscape and the impact that AI would have on their future viability.

And so, this book has been compiled to cover major industries and organizations, as well as our work and personal lives, to drive home the use and influence of AI from diverse angles to enable more knowledge and enlightenment.

Throughout this book, readers will gain a strong understanding of the current and future state of AI evolving. For the sake of clarity and creating a unique experiential lens, each chapter starts with a fictional story through the eyes of Alixia Bolt, who inhabits two worlds – one is perfect and the other is in stark contrast, stormy. This fictional context provides an opportunity for deeper reflection by our readers who will lead us forward to shape both our current and future directions. The chapters are also structured to describe the AI shift taking place in each industry, as well as your work and personal lives, followed by relevant examples of AI in use. We conclude each chapter by understanding the implications and ethical considerations of not advancing AI with effective governance, policies, standards, and audit practices. We have also dedicated an entire chapter to compare the position that the world's major governments have taken around using AI, given the range of economic commitments nations have made.

The battle for AI supremacy is underway, with the likes of China and the USA determined to innovate and lead, while others look to play a crucial role and in some cases, avoid any one country from dominating the landscape. How countries co-exist with 5G networks, surveillance technology, internet of things (IoT) and robotics – all leveraged by powerful AI learning models – will decide the co-existence and harmonization of man and machine.

In many respects, this is the turning point in our history where man and machine will increasingly become more ubiquitous and will no longer be clearly separated. The decisions we make in the coming years on our AI foundations, policies, practices, and legal boundaries, will not only determine the evolution of our business models but also that of our species.

To lead starts with learning. So, here is how we have organized your learning journey.

Chapter 1 will introduce the approaching omnipresence of AI in our work and personal lives. From there, we share its ongoing growth across diverse industries to set the stage for the implications of creating a Perfect World or a Perfect Storm.

Chapters 2 to 5 will discuss AI's growing role, influence and possibilities in four industries – Healthcare, Education, Travel & Transport, and Media & Communications.

Chapters 6 and 7 will shift focus to the public sector, looking first at AI's involvement in government operations, for citizen engagement, police and security, immigration etc., and then examine diverse policies and frameworks by countries around the world. Specifically, we discuss the positions taken by US, China, Canada, UK, Germany, India and Russia. We also explore the multi-national entities - OECD and the European Economic Union (EU) and how they

are collaborating to rally unified policies for increased AI for Good, often called Transparent AI.

Chapter 8 will revert to business, particularly those with a role to play in today's super value chains. These include: Agriculture, Manufacturing and Retail industries where increased sensor technologies, such as IoT and robotic process automation, leverage AI and cloud computing approaches to modernize complex ecosystems.

Chapter 9 will explore the work office environment(s). With over fifty percent of current professional roles predicted to be impacted by AI advances, according to the World Economic Forum, we will look at how AI is empowering or replacing jobs in different line functions, including human resources, legal, finance, sales & marketing, and operations.

Chapter 10 will go deeper into the impact AI is having on our lives on the personal front, with discussions around home automation and Cobots – personalized robots with social intelligence and greater "humanness". This chapter will showcase how the boundaries between man and machine are blurring rapidly as our future unfolds at unprecedented rates.

Chapter 11 will bring all perspectives together to unify and explain how organizations can get AI right – where to begin, which questions to seek answers to and how to manage risks – in order to successfully use AI and shape their future sustainability. Underlying this chapter is the imperative for leaders to get underway and develop their AI strategy and roadmap, to ensure AI is used ethically and responsibly in order to manage its risks without losing competitive strength.

By the end of the book, you will have a strong comprehensive awareness of the AI state, appreciating more its importance and risks around you. You will walk away with a leadership guidance framework to evaluate your organization's AI maturity and readiness to create a successful organizational strategy and roadmap.

Our vision needs is to create a stronger and better world – one we are confident our children will thrive in. How we keep the balance between creating a more perfect world and avoiding the risks of creating a perfect storm will depend on all nations and all citizens being informed, engaged, and responsible.

You have a voice. The decisions you make after reading this book will shape our future world.

So, will our collective path effectively tackle the dilemma we face in balancing the benefits and risks with AI? Will our actions create a Perfect World or a Perfect Storm?

What Some Industry Experts Have to Say

The crucial story of our time is how artificial intelligence at scale, long promised, suddenly became a reality. It is simply impossible to forecast where business, finance, society and geopolitics are headed without understanding AI's trajectory. Happily we have accomplished guides in Dr. Cindy Gordon and Malay Upadhyay, who deftly lay out the possibilities and perils of our century's most important technology.

—Rich Karlgaard, futurist, editor-at-large, Forbes

AI is a transformative technology shaping our future, but there are many questions on what the AI shift will bring. Decisions we make today about ethics, governance, strategy, policy and human-machine interactions will determine if our AI future is a perfect world or a perfect storm. In The AI Dilemma, Dr. Cindy and Malay walk us through a number of sector-based scenarios that paint a picture of how AI may evolve and provide suggested actions we can take now to avoid an AI perfect storm.

—Cathy Cobey, Global Trusted AI Leader, EY

Dr Cindy Gordon and Malay Upadhyay have created a must read handbook for all CEO's and their teams that crisply defines a compelling case for AI adoption by industry. Just as Edison and Alexander Graham Bell changed the world, so to will AI adoption. Simply stated... Adopt or Die... your choice! This is a must read for sure.

—Dr. Kevin Francis, CEO Value Inspirations, Former CEO of Xerox Canada

Is artificial intelligence a wonderful dream or a horrible nightmare—or some of both? Read this book to see how each option plays out across a variety of different industries and settings. You need to understand the extremes to be able to achieve the outcomes you desire!

—Thomas H. Davenport, Distinguished Professor, Babson College, &
Research Fellow, MIT Initiative on the Digital Economy,
Author of Only Humans Need Apply and The AI Advantage

Dr. Cindy and Malay capture the essence of the rapid evolution of technology convergence and it's not-so-subtle impact to socio-economic, cultural, and political nuance as we embrace both the value proposition, and the challenges

new technology provides. From a business enterprise perspective, it's critical that leaders understand the imminent impact AI technology has on enterprise success and the associated influence on societal evolution. I highly recommend this intriguing behind the curtain perspective of the transformative technology we refer to as AI. It will unquestionably have significant influence on the business environment and our evolving cultural shift.

—Dr. Ray Powers/Department Chair,
The Forbes School of Business & Technology

Cindy has been the rock in the foundation of the high tech sector in Canada with relentless pursuit to position Canada in the forefront of the AI revolution. Cindy & Malay's deep knowledge of the AI science and the fundamentals are shared in this book to enable Canada to become a leader in AI. They have produced a must read book that highlights their desire to teach readers with day to day examples about the potential impact of AI on governments, enterprises and individuals. The book reinforces the leadership imperative to apply, build and adopt AI based products and services rather than just watch from the sideline, the great innovation taking place with new AI-based solutions. I recommend this book to anyone that wishes to stay current and relevant as the world experiences the impact of the fourth industrial revolution.

—Eli Fathi, CEO Mindbridge AI

Rich with examples, data, and a compelling and evolving scenario that drives each chapter, this must-read volume weighs the benefits and dangers of Artificial Intelligence and the associated technologies of the current industrial revolution. Dr. Gordon and Mr. Upadhyay draw from economics, science, the humanities, design, and philosophy to pave an accessible and ethical road to AI implementation for business, governments, and the significant sectors of contemporary society.

—Dr. Sara Diamond, President Emerita, OCAD University,
C.M. (Order of Canada), Order of Ontario, ICD.D, RCA

The authors of The AI Dilemma are brilliant, heart-based AI experts who can clearly see the future. Their book is filled with insights each of us needs to know. If you wish to fully understand the balance between AI and humankind, and where the world is truly headed, you need to read this book.

—Roger Love, Celebrity Voice coach, Bestselling Author
Co-Founder of Emotional Cloud, and President of Voiceplace, Inc.

Errata

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Chapter 1
AI Everywhere

Since the industrial revolution, technology has played a unique role in powering growth and transforming world-wide economies. Twenty-five years ago, there were around 700,000 industrial robots worldwide, mostly in Japan. By 2018, Japan alone had over three robots per 100 workers [1]. At a CAGR of 41.8%, the global collaborative robot market is expected to grow from a little less than $1 billion in 2020 to nearly $8 billion by 2026, growing at 15% **compound annual growth rate (CAGR)** [2]. Not all robots are AI-driven, and AI itself, of course, is more than just robots. We encounter most of it in the form of software, most of which is embedded in various technologies we use every day at work or at home. So, *what is this AI-specific change all about, and why is it sweeping our civilization?*

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios

[1] IMF Blog. *Chart of the Week: Japan's Robots.* June 12, 2018. Source: **https://blogs.imf.org/2018/06/12/chart-of-the-week-japans-robots/**.

[2] Research and Markets. The Collaborative Robot (Cobot) Market by Payload, Component (End Effectors, Controllers), Application (Handling, Assembling & Disassembling, Dispensing, Processing), Industry (Electronics, Furniture & Equipment), and Geography - Global Forecast to 2026. **https://www.globenewswire.com/news-release/2020/03/30/2008115/0/en/outlook-on-the-worldwide-collaborative-robot-industry-to-2026-featuring-universal-robots-techman-robot-fanuc-kuka-among-others.html**

- AI growth dynamics
- AI in context
- Impact of AI

Objectives

After studying this chapter, you should be able to:

- Understand what **Artificial Intelligence (AI)** is
- Appreciate the growth of AI, **machine learning (ML)**, deep learning and data science
- Assess the impact of labor with AI

1.1: A perfect world

Alixia Bolt, thirty-three, single and healthy, wakes up from soothing vibrations controlled by her responsive surface smart *ReST bed*. Ten minutes pass. The night lightshades automatically draw back, controlled by Alexa-powered Amazon Echo. A voice activated and cloud connected AI home mural displays a floral paradise of nesting blue jays, quietly chirping in a soothing tune to William Tell's Overture by Rossini. As Alixia peacefully heads into the washroom, her vital sleeping bio signals are automatically measured and sent to AI Health Central. Instantly, a rapid scan index intelligence reports back that all of Alixia's vital signs are in check, and a wall voice bot confirms that she is sufficiently healthy and devoid of any risky pathogens, to leave her home today. Immediately, AI Security Central updates all AI system data feeds and alerts her *Smart Building Registration* to unlock her doors on visual facial identification, a cyber security check that is 100% accurate.

After a quick rinse with a calming jasmine essence oil, Alixia asks **Tailor**, her smart closet what she should wear for the day. Tailor checks her calendar and sees that Alixia is in Manhattan for a client meeting and notices that the last time she met her client, she wore black. So, mixing it up, Tailor recommends a navy dress with a smart wearable scarf, adorned with smart sensors to monitor her body temperature ensuring that she is kept fresh, cool and is not breathing in any toxins or pollutants. While Alixia is dressing, she asks Alexa what her options are for breakfast? A quick scan determines that the best dietary option is one egg white, cooked with spinach and mushrooms, a cup of herbal tea, and a freshly squeezed glass of orange juice. Tailor sends the order to **Lynx**, Alixia's home robot picks out the egg, veggies, and gives a voice command to **Hot Stuff**, the smart stove to activate hot water preparation. In five minutes, a nutritious piping hot breakfast is placed by Lynx on the kitchen table. Lynx also activates BBC favorite news highlights, customized to Alixia's likes.

Lynx senses Alixia is done with her breakfast and asks **Wilkin Wheelie**, or **WW** for short, her smart electric car to be at the front door of Alixia's condo to take her to Central AI, the global cyber security center monitoring all AI algorithms, where she is the chief AI Cyber Security Officer.

Lynx pre-orders Alixia a Starbucks coffee and lunch, so her day runs smoothly and is right on track. Leaving her condo at 9:00 AM, Wilkin activates the tracking device for her condo monitoring system confirming that she has officially left the building. Facial recognition scanning is complete. As WW leaves the building, traffic intelligence from all car signals are updated into WW's memory bank in order to follow the safest route for Alixia. Stopping at the Starbucks drive in, a robotic arm extends to her car window, a Grande Cappuccino arrives - just right!

1.2: A perfect storm

Alixia Bolt, thirty-three and single, wakes up from a stressful night, as the vibrations controlled by her responsive smart *ReST bed* were not synchronized to her body posture, awakening Alixia several times during the night. This was not the first time that Alixia's sleeping patterns have been hacked and uploaded with the wrong settings. Grumbling, she advises Alixia about the hack and Central AI is notified. The night lightshades are automatically drawn by Echo. Unfortunately, the video curtain, instead of revealing her comforting floral paradise of nesting blue jays, displays gruesome aliens shadowed by the Angel of Death music. The hack nightmare continues.

Stressed, Alixia asks **Alexa** to find the nesting blue jays, only to be sent images of vultures with more metal music. Heading to the washroom, Alixia's vital sleeping bio signals are automatically sent to AI Health Central. Instantly, a rapid scan index reports back that all of Alixia's vital signs are not harmonized, and a voice wall command advises her that she is not allowed to leave her smart home, until her stress levels improve. Immediately, AI Security Central updates all AI system data feeds and alerts her smart building registry to lock her doors for 24 hours, until Alixia's body rhythm moves into acceptable tolerance zones. AI Central is concerned about the quality of her cognitive decision making and moves her consciousness to her AI **Neuralink** brain cortex node, and she is automatically connected to the *AI Central Electronic Brain's* nervous system.

Alixia asks Tailor, her smart closet, what she should wear for the day. Tailor sees that Alixia is not allowed to leave her condo today, so recommends light leisure. While Alixia is dressing, she asks Alexa *what food is in the fridge for breakfast?* A quick scan determines that there is limited fresh food; so, dry cereal and almond milk is recommended. Lynx, the home robot, takes the order and moves to open up the cereal box and dispense with the milk. Unfortunately, the automated dispenser spews organic hemp all over the floor. Lynx quickly vacuums up the mess.

Frustrated, Alixia recognizes that all her central home AI settings are connected and with the recent hacking, nothing is operating smoothly. Even the BBC is only displaying static. Alixia places a call to Central AI Intelligence, where she is the chief AI Cyber Security Officer, and asks to speak to Avery Higgins, the global Central AI chief. The response comes in, "*We have a major cyber security breach. We have lost control of the central nervous deep learning core. It seems that a serious new virus is duplicating randomly. I have alerted our cyber security scientists, but 70% of my team's AI control systems are compromised. We are all in lock-down. I think it's time that we call the President of the United AI Nation, AI Cybersecurity as we are under unknown attacks uncontrolled by humans.*"

1.3: The AI Dilemma: a perfect world or a perfect storm?

Victor Hugo once famously remarked: "*No force on earth can stop an idea whose time has come.*"

AI is transforming industries, paving the way to a more alert and smarter world with some predictions claiming a 50% chance that AI would outperform humans in all tasks in the next 45 years [3]. Catalyzed by the internet, digital transformation and the explosive pace of technological change powered by big data, creating industries of the future is a new reality. Services industry robots are now delivering drinks or hotel linens; 3D printing is being used to make cars and aircraft; and smart biotechnology is changing the production of food and medicines.

The biggest shift is that this new world order is being driven by AI. It is a world which can swing for the better or the worse. It depends on the policy, ethical, legal, and security frameworks that we put in place to clearly guide the influence of AI. We think this transformation is one of the deepest since the history of mankind has evolved, and it could go either way, thereby creating a *perfect world or a perfect storm*.

Will humans make the right decisions to create the right possibilities to be fair to ensure human survival, or will we develop products and technologies that supersede human intelligence, skills and decision-making authority? Through the eyes of Alixia Bolt, we have a good world order and an evil world order. The future is likely going to be a mix of both good and evil scenarios. It will take years of careful planning, awareness, and execution to shape the former.

Comparatively, this is similar to the need to create rules and regulations for airplanes, or cars, as society will be grappling with the sense making of AI. However, it is also very different as airplanes or cars were not meant to make decisions like humans

[3] MacDonald, Gayle. *The Globe and Mail. AI is changing the World. Are we Ready for it?* July 4, 2018. Source: **https://www.theglobeandmail.com/life/style/article-artificial-intelligence-is-changing-the-world-are-we-ready-for-it/**

can. With AI, however, it is a very different type of transformative power, as it can potentially beat our cognitive skills on many levels. Over time, as AI and machine learning (ML) continue to evolve at the rate they are currently growing, we will need to get ahead of what is now unleashed in order to create a transparent AI world. Checks and balances will be needed to ensure privacy, but also to ensure we are creating a vigilant focus on building kind and humane AI to serve good versus evil. Building emotional intelligence will be key to ensure man and machine interfaces are optimized for communication. It is very feasible that machines will be programmed to be more empathetic – perhaps even more than some humans are – as they are unlikely to suffer from mood or personality disorders.

Could the mankind DNA accelerate to merge more with the technology DNA? In our speaking engagements, if asked whether one would be open to implanting a multi-function smart electronic device into their brain that acted as a smartphone, health monitor, or cognitive research agent (that is, a thought and research activated external to your brain and implanted into new neurons), the answer is often varied. They are those who would be okay if it's safe and time-saving, and their peers use it. This is a very realistic scenario that is likely to become mainstream sooner than you might think.

In order to survive and solve the next challenges of human civilization, two scenarios could play out over the longer-term horizon: **evolution** or **extinction**. There is now sufficient research to validate that both of these scenarios are hypothetically real and if not harnessed in thoughtful and ethical ways, humans could become subservient to machines. What is unfolding is that man and machine will become more unified as one. Singularity is not a distant reality, as it is increasingly a shadow in line of sight. Ray Kurzweil, an American inventor and futurist, expects that we'll achieve it by 2045 [4].

How governments, board directors, and C-level leaders in all industries face this new reality will create the new tapestry of life, in its new form. It will be a new form where augmented intelligence and AI guided signals increasingly recommend in real time most of the decisions for mankind to make by providing the pros and cons to guide humans to best judgements. As in the medical field, we may be required to make life-threatening decisions from machine guidance systems. But, *will our intuition take precedence or be numbed into execution without time for reflection?*

What type of future do we want?

We can already see the evolution of Alexa or Google Home, getting smarter and smarter. As we will see, it will shortly advise us on parenting skills, or tap into

[4] Sabin, Dyani. Ray Kurzwell Predicts Human Brains to the cloud. Inverse Media. Source: **https://www.inverse.com/culture/coronavirus-twitter**.

learning areas that we would like to fill our leisure time, monitor our moods, and even surface relevant mood content.

Will man and machine be able to cohabitate successfully, when machine intelligence is rapidly superseding human intelligence on every level. AI will soon be able to teach kids everything they need or want to know (whether accurate or not is another question), pen a New York Times bestseller, paint a picture in hours versus months, even give a family dog some competition for affection. According to a McKinsey report back in 2017, 50% of current work activities were already technically automatable with existing demonstrating technologies, not even necessarily AI [5].

This book will examine diverse industry sectors, explore both positive and negative perspectives, provide ideas on how to get ahead of the AI game, and avoid the AI split or lose control of what is genuinely precious to us as humans: having a voice that is ours and ours alone.

We will start this journey by looking at the market dynamics fueling AI and explore some of the diverse views debated amongst futurists, technology innovators, or just concerned citizens. The time to get involved, lead, and shape what is increasingly being framed as the most significant force in the history of mankind is now. We did not get the environment right in evolution over the past 100 years; *can mankind get AI right?*

Sustainability of life is a real question and this book is written to help educate boards, C-suite executives, and leaders, in both the profit and not-for-profit sector, to understand what is here now and very real versus science fiction. It also gives a futuristic outlook of what is coming. What is important is that every person needs to learn, get involved, and shape the future you want for yourself, your colleagues, and your families.

Let's ensure as leaders we think hard about the world we are now creating - the marriage of AI and humans. It sounds very transcendent. Remember the 1993 film Jurassic Park, where the cloned dinosaurs were all out of control and wreaking havoc, and Jeff Goldblum argued: "*Yeah, yeah, but your scientists were so preoccupied with whether or not they could, they did not stop to think if they should.*"

1.4: AI growth dynamics

To get clear on the AI tsunami unfolding, leaders must first understand that digital data is growing at an unprecedented rate. According to the IDC research, digital

[5] Manyika, James, Lund, Susan, Chui, Michael, Bughin, Jacques, Woetzel, Jonathan, Batra, Parul, Ko, Ryan, and Sanghvi, Saurabh. McKinsey and company. *Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages. November 28, 2017.* Source: **https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages#**.

data would grow to 175 zettabytes by 2025[6]. A **zettabyte** is a trillion gigabytes. Interestingly, human and machine-generated data is experiencing a significantly faster growth rate than traditional business data rates. An overwhelming majority of all this data has been created in the past two years. But perhaps, the most striking fact was an older IDC study which stated that we had only analyzed 0.5% of data in 2012, and that even by our present date, only a little over a third of data would be potentially analyzable[7].

The impact of these figures is suggested by a 2020 Accenture research on the impact of AI in 12 developed economies. It reveals that AI could double annual economic growth rates in 2035 and increase labor productivity by up to 40 percent[8]. That implies significant gains for businesses worldwide.

We have Big Data but little access due to fragmentation, ease of data access, data completeness and accuracy, diverse global laws on access, technology skills, and underlying infrastructures. This is why data governance and cleanup are usually the first step most organizations find themselves embroiled in. However, this being said, the world of Big Data is so massive that we need AI to be able to cull through data, connect the patterns, and function efficiently and effectively. Let us look at how AI helps achieve that.

1.4.1: AI in context: defining AI basics

AI has been defined differently by different experts. Most, however, are versions of a central theme of automating analysis. AI can sense, analyze (even reason), act, and learn. In fact, in accomplishing any task, it usually performs a combination of these. These tasks can be entirely pre-programmed or partially programmed, allowing AI to learn and improve on its own.

From a high-level perspective, what you need to understand is that there is Narrow AI and General AI. What we usually imagine when we think of robots taking over is the latter. What most managers and executives expect from AI is also the former – an ability to perform the way humans would. However, what we commonly find in the market today is the former. In simple terms, **narrow AI** is capable of performing specific tasks that it has been built for. It can certainly perform them better, faster and more intelligently, but is nonetheless different from **general AI**, which refers to achieving intelligence comparable to humans. This feat will likely take a few decades to be achieved.

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[6] Patrizio, Andy. NetworkWorld. IDC: *Expect 175 zettabytes of data worldwide by 2025*. December 3, 2018. Source: **https://www.networkworld.com/article/3325397/idc-expect-175-zettabytes-of-data-worldwide-by-2025.html**.

[7] Petrov, Christo. TechJury. *Big Data Statistics 2020.* June 16, 2020. Source: **https://techjury.net/blog/big-data-statistics/**.

[8] Accenture. *Artificial Intelligence is the Future of Growth.* Source: **https://www.accenture.com/ca-en/insight-artificial-intelligence-future-growth**.

To put this in perspective, imagine talking to Amazon Alexa at home. It may appear to be intelligent enough to respond to your queries but will be limited in how far it can take that conversation. It may improve with time, but it may still not know how to interpret sarcasm, humor, anger or joy, or to generate a response other than what it can find on the internet or in pre-populated codes. Although, in our discussions with Roger Love, a leading voice expert who runs voiceplace.com, it is clear that with advanced research underway in affective computing, we are starting to equip machines to better detect emotions.

On the business side, you can define AI as a means to emulate human decision making, when analyzing information to make faster and more accurate decisions in real time. AI technology can further be applied to reduce the time it takes for a business to make decisions over products, distribution, supply chain, human resources, sales, marketing, finance, or legal functions. It impacts all industries and their respective ecosystems.

AI can be used to solve different business problems and use cases:

1. It can help automate back-end business processes, lower costs, and free up people to work on higher value tasks. This is often called **cognitive robotic automation** as it is highly repetitive in nature.
2. The second area is that AI can help mine mountains of data and do sense-making on the data patterns, inside a profit or not for profit, or also from outside organizations bringing diverse data sets together to solve use cases. This area is usually called **cognitive insights** focused on making sharper, faster decisions.
3. The third area is more advanced AI sense making, learning from human interactions to create unique customer engagement interactions, anticipating customer needs, or problems before they happen, and guiding humans to most optimal outcomes. This area is called **cognitive engagement**.

According to a testimony before the US House of Representatives:

Artificial Intelligence (AI) is the ability to create machines who perform tasks normally associated with human intelligence, from autonomous driving and spoken language comprehension to medical diagnosis and scientific discovery. Throughout its roughly 60-year history, AI has been incubated, admired, dismissed as infeasible, respected, maligned, feared, and more recently mainstreamed. (Carbonell, 2018)[9].

The roots of AI date back to 1956 at Dartmouth College. The term Artificial Intelligence was coined at a conference in Dartmouth University John McCarthy, one of the founders of the field. The conference had been presided over in the shared conviction that human thoughts could be reduced to symbolic computation on digital computers in the near future. The main goals were automating calculations,

[9] Carbonell, Jamie. Testimony before the Committee on Science, Space, and Technology, Subcommittee on Research and Technology and Subcommittee on Energy, U.S. House of Representatives on the hearing titled, "*Artificial Intelligence - With Great Power Comes Great Responsibility*". June 26, 2018. Source: **https://science.house.gov//imo/media/doc/Carbonell%20Testimony.PDF?1**.

using language, forming concepts with neural nets, trying all possible answers to a question, self-improvement, abstractions, randomness, and creativity[10].

From the founding of many subfields of AI in the 1960s to the development of its fundamental approaches in 1970s, to the first commercial benefits realization in the 1980s, AI saw consistent, if gradual, evolution right through the 1990s even if it wasn't necessarily pronounced. And then, in 1997, IBM's Deep Blue managed to beat the world champion Gary Kasparov[11].

People often confuse the many terms AI brings with it. ML being a classic example, which is in many ways a more evolved AI – one that reasons and figures out the patterns between inputs and outputs on its own versus being explicitly programmed to behave in certain ways. The accuracy of that analysis, of course, is reliant on finding patterns consistently. This requires a lot of data: the bread-and-butter of AI. So, in a digital world, the exponential growth of data is constantly feeding AI improvements.

AI should be viewed as a new capital-labor generator to stimulate production at unprecedented rates. AI can replicate labor activities at a much greater scale and speed, and can perform some tasks beyond the capabilities of humans. Whether that's entirely good or bad is another question. A growing number of AI applications in various industries and the increasing adoption of AI-enabled products and software tools improving consumer services are some of the factors driving the market.

Like with previous disruptions in technological innovations, humans were capable of making informed choices, as prior innovations could easily be controlled. The first step forward is to appreciate what's coming and to plan for it very wisely. It is important to think carefully about the diverse scenarios that humans can anticipate as AI increasingly augments human intelligence. The late Stephen Hawking believed that *AI will be either the best, or the worst thing ever to happen to humanity*[12]. *Nonetheless, he also saw the positive side of the story stating, The potential benefits of creating intelligence are huge. We cannot predict what we might achieve when our own minds are amplified by AI*[13].

Elon Musk has been similarly both a skeptic and an advocate of AI. At an MIT SpaceX event, he said, "*I think we should be very careful about artificial intelligence. If*

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[10] Veisgal, Jorgen. Medium. *The Birthplace of AI. September 12, 2019.* Source: **https://medium.com/cantors-paradise/the-birthplace-of-ai-9ab7d4e5fb00**.

[11] Chesscom. *Kasparov vs. Deep Blue | The Match That Changed History*: October 12, 2018. Source: **https://www.chess.com/article/view/deep-blue-kasparov-chess**.

[12] Hawking, Stephen. The Guardian. *AI Best or Worst Thing for Humanity?* Source: **https://www.theguardian.com/science/2016/oct/19/stephen-hawking-ai-best-or-worst-thing-for-humanity-cambridge**.

[13] Hern, Alex. The Guardian. *Stephen Hawking: AI will be 'either best or worst thing' for humanity.* October 19, 2.016. Source: **https://www.theguardian.com/science/2016/oct/19/stephen-hawking-ai-best-or-worst-thing-for-humanity-cambridge**.

I had to guess at what our biggest existential threat is, it's probably that… With artificial intelligence, we are summoning the demon. In all those stories where there's the guy with the pentagram and the holy water, it's like – yeah, he's sure he can control the demon. Doesn't work out.[14]*"*

That was back in 2014. Since then, he has invested in numerous next-level AI possibilities, including Vicarious[15], which aimed to build a computer that could think like a person. Musk's eventual vision is to merge man and machine. His investment in **Neuralink**[16], a human computer brain interface company aims to create higher bandwidth connections between our brains and computers to improve language efficiencies. Neuralink aims to enable direct uncompressed communication of concepts between people. Instead of having to compress your original thought by translating it into language and then having the other party decompress the unit of thought, you send them intelligently to increase human comprehension. Neuralink's technology vision is to integrate AI with human consciousness like our senses drawing on higher order thought processes.

Not everyone agrees with Musk and many see him exaggerating the risk factors. But *does his view scare or thrill you?* Irrespective of any polarized views on AI, ethical questions will need to be asked as it is possible that we will no longer be able to distinguish our human self or inner core being. How the technology manifests and evolves its application horsepower should remain a focus area for regulatory and security controls.

1.4.2: Growth of Big Data and AI

We already learnt the exponential growth in data we are currently witnessing. The dollars also tell a compelling story. According to Fortune Business Insights, *the global AI market was predicted to grow from $20.67 billion in 2018 to $202.57 billion by 2026*[17]. And yet, a study from Grand View Research pegged the market to reach $390.9 billion by 2025[18]. Of course, that was before Covid-19 hit us. Interestingly though,

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[14] Gibbs, Samuel. The Guardian. *Elon Musk: artificial intelligence is our biggest existential threat.* October 27, 2014. Source: **https://www.theguardian.com/technology/2014/oct/27/elon-musk-artificial-intelligence-ai-biggest-existential-threat**.

[15] Vicarious.com. Source: **http://www.vicarious.com/about.html**

[16] Etherington, Darrell. TechCrunch. *Neuralink wants to turn Cloud AI into an extension of our Brains.* April 21, 2017. Source: **https://techcrunch.com/2017/04/20/elon-musks-neuralink-wants-to-turn-cloud-based-ai-into-an-extension-of-our-brains/**

[17] Fortune Business Insights. *Artificial Intelligence (AI) Market Size, Share and Industry Analysis By Component (Hardware, Software, Services), By Technology (Computer Vision, Machine Learning, Natural Language Processing, Others), By Industry Vertical (BFSI, Healthcare, Manufacturing, Retail, IT & Telecom, Government, Others) and Regional Forecast, 2019-2026.* January, 2020. Source: **https://www.fortunebusinessinsights.com/industry-reports/artificial-intelligence-market-100114**

[18] Grand View Research. *Artificial Intelligence Market Size Worth $390.9 Billion By 2025.* December, 2019. Source: **https://www.grandviewresearch.com/press-release/global-artificial-intelligence-ai-market**.

the Grand View Research website had a pop-up noting specifically that AI, VR, and AR technologies were anticipated to substantially contribute to our Covid-19 response. How this pandemic has impacted the AI growth story and how AI is tearing through nonetheless, thanks to **HealthTech**, is something we will cover in the upcoming chapters.

Healthcare has been one of the hottest areas for AI start-ups as they raised $4 billion in 2019. All industries combined, AI start-ups had raised a record $26.6 billion in 2019 over more than 2,200 deals, a consistent rise from 1,700 deals totaling $16.8 billion in 2017[19]. Compare that to 2015, when equity deals in AI start-ups was only 400, already a 6x increase from 70 in 2011[20]. According to David Autor, professor of Economics at *MIT, Often people only think of AI boosting growth by substituting humans, but actually huge value is going to come from the new goods, services and innovations that AI will enable*[21].

AI is rapidly coming of age. Becoming one with AI no longer looks as far-fetched as it may sound. It is termed *Singularity*, and some predict mankind could achieve it by 2045[22]. A big step in that direction has come with deep learning. It is simply a modern refinement of ML in which computers teach themselves tasks by crunching far larger sets of data, and do so by replicating the human brain functioning. This allows them to achieve tasks like image recognition. It is what allows some phone apps to recognize a face in a picture whether it's smiling, frowning, or showing partially, and to identify that it's you. What makes deep learning powerful is that it takes the self-learning leaf out of ML's book and puts it on steroids; thanks to its ability to process and learn much more and much faster. It is what enables AI to manage all connected home appliances, recognize and greet people, predict events or enable tighter security by identifying potential suspicious activity.

Sourcing world-class talent is top of the mind with major innovators. Apple recruited Russlan Salakhutdinov[23], from the Carnegie Mellon University, as its Director of AI research. Facebook hired French innovator Yann LeCun to direct its AI research lab. Back in 2017, Facebook was already using neural nets to translate about 2 billion

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[19] Johnson, Khari. Venture Beat. *CB Insights: AI startup funding hit new high of $26.6 billion in 2019*. January 22, 2020. Source: **https://venturebeat.com/2020/01/22/cb-insights-ai-startup-funding-hit-new-high-of-26-6-billion-in-2019/**.

[20] CB Insights. *Artificial Intelligence Explodes: New Deal Activity Record For AI Startups*. June 20, 2016. Source: **https://www.cbinsights.com/blog/artificial-intelligence-funding-trends/**.

[21] Purdy, Mark, and Daugherty, Paul. Accenture. *Why Artificial Intelligence is the Future of Growth. 2016.* Source: **https://www.accenture.com/t20170524t055435__w__/ca-en/_acnmedia/pdf-52/accenture-why-ai-is-the-future-of-growth.pdf**.

[22] Reedy, Christianna. *Futurism. Kurzweil Claims That the Singularity Will Happen by 2045.* October 5, 2017. Source: **https://futurism.com/kurzweil-claims-that-the-singularity-will-happen-by-2045/**.

[23] Salakhutdinov, Russlan. LinkedIn Profile. Source: **https://www.linkedin.com/in/ruslan-salakhutdinov-53a0b610/**.

user posts per day in more than 40 languages and says its translations are seen by 800 million users a day[24].

According to a PWC report, global GDP will be 14% higher in 2030 as a result of AI – the equivalent of an additional $15.7 trillion, 70% of which will belong to two big gainers – China (26% boost) and North America (14.5% boost)[25]. Canada has been silently surging its AI story with deep learning Turing award winners Geoffrey Hinton and Yoshua Bengio calling it home. Canada is punching up its AI super cluster strategy, as we will see in more detail later. The Canadian community is also bringing together global AI ecosystems such as the AI directory, co-founded by the authors originally in partnership with the **Canadian Advanced Technology Alliance (CATA)** and IT World Canada[26].

1.5: Impact on labor with AI

There is a shortage of technology and **science, technology, education, and math (STEM)** skills, or even a basic understanding AI, which are holding back the organizations' capabilities to drive new growth opportunities. With men dominating the C-suite, lack of diversity is another area of concern as it can lead to bias in AI. What is also influential is that our business community is rooted in human decision-making, in contrast to AI system decision-making. It often leads to a lack of speed, consistency and accuracy.

The book *Only Humans Need Apply: Winners and Losers in the Age of Smart Machines* describes three automation eras replacing manual tasks, **replacing routine clerical tasks, and eventually replacing tasks involving human judgement[27].** The evolution of automation from muscle power to knowledge-based rules to intelligence makes it easy to expect a complete replacement of labor by AI. In truth, AI has reached that stage in some tasks but is far in others. Currently, that distinction boils down to all rule-based and replicable a task is.

So, *will the losses make up for new jobs? What are diverse experts saying?* There have been many points of view, all with consequences to plan for. We earlier discussed McKinsey's report which stated that half of existing work was at potentially automatable already. Oxford Economics estimated that up to 20 million manufacturing

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[24] Constine, John. Tech Crunch. *Facebook ditches Bing, 800M users now see its own AI text translations.* May 23, 2016. Source: **https://techcrunch.com/2016/05/23/facebook-translation/**.

[25] PWC. *AI to drive GDP gains of $15.7 trillion with productivity, personalisation improvements.* June 27, 2017. Source: **https://www.pwc.com/gx/en/news-room/press-releases/2017/ai-to-drive-gdp-gains-of-15_7-trillion-with-productivity-personalisation-improvements.html**.

[26] The AI directory. Source: **http://www.aidirectory.ca**.

[27] Davenport, Thomas H, Kirby, Julia. Harper Business. *Only Humans Need Apply: Winners and Losers in the Age of Smart Machines.* January 1, 2016. Source: **https://www.amazon.com/Only-Humans-Need-Apply-Machines/dp/B0731NMF8Z**.

jobs could be replaced by robots by 2030, given that 1 industrial robot can replace 1.6 existing manufacturing jobs[28].

One needs to pause and really think hard when such numbers crop up. The issue here is not straightforward. Robots that can work longer hours without getting tired, do not have unproductive days or have labor unions can often be the difference between businesses shutting down or surviving. But that invariably comes at a cost of someone's job. And such automations are only climbing up the organizational hierarchy as it starts to replicate the tasks of lawyers, marketers, and other managers. As mentioned earlier, it all boils down to how replicable the task is, and how little unexpected the situations are likely to be.

Some have argued for universal basic income due to AI. Richard Branson has been very outspoken on this topic, advocating that those displaced by automation from AI have a guaranteed income, given that they are unlikely to secure future workplace options[29]. Interestingly, that problem may also be solved by AI, at least in part. Companies like Australia-based **Power Ledger**[30] have enabled peer-to-peer transactions of renewable energy that people are generating at home. As argued in a 2012 dissertation at Bocconi University in Milan, renewable energy can also act as an alternate source of income for the home owner. For instance, it can potentially be transferred to a local grocery store in a similar fashion, but as payment for groceries. The transaction network will require Blockchain capabilities and AI for its automation and energy optimization. But this system could allow every country to adopt universal basic income for its citizens. Imagine the impact on a poor home in the Sahara, rich in solar energy!

Renewable energy is one component of the oncoming fourth industrial revolution which is predicated on being fully digital and using AI automation to impact business and the global workforce. The AI and augmented technologies disruption will mean new jobs will emerge such as AI and Data Science architects, new cyber security, privacy and regulatory roles, and new workers who move from managing tasks to managing AI executing those tasks. In addition, leadership skills such as agility, communication, digital transformation, problem-solving, and innovation will also be in higher demand.

The emergence of new AI powered technologies will require diverse thinking to ensure that the fourth industrial revolution is representative of the population and an all-rounded thinking and doesn't leave anybody behind as we reshape our

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[28] Cellan-Jones, Rory. BBC. *Robots 'to replace up to 20 million factory jobs' by 2030.* June 26, 2019. Source: **https://www.bbc.com/news/business-48760799**.

[29] Clifford, Catherine. CNBC. *Billionaire Richard Branson: A.I. is going to eliminate jobs and free cash handouts will be necessary.* February 20, 2018. Source: **https://www.cnbc.com/2018/02/20/richard-branson-a-i-will-make-universal-basic-income-necessary.html**.

[30] Power ledger. Source: **https://www.powerledger.io**.

global economy. In addition, developing thoughtful ethical practices and educating technologists and investors to understand the potential implications of AI-powered software and robotics will be a key evolutionary imperative. It can determine whether we focus on robots' ability to enhance productivity or to enhance the wage gap between poor and rich, or whether self-driving vehicles are built to enhance safety or to save labor costs.

The World Economic Forum has revealed nine areas of ethical deliberations with AI, which include unemployment, inequality, humanity (human-AI interaction), artificial stupidity or mistakes, racist robots, security, evil genies (referring to unintended consequences), singularity and robot rights[31].

Guided AI ethics and audit must evolve more rapidly and ensure diversity is also factored in. We propose frameworks around this in the chapter looking at worldwide AI policies.

1.6: Conclusion

AI algorithms can be transparent, their detailed functions can be understood, they have superior speed, show consistent results, don't need to sleep, and don't have sick or bad days. They also can search and mine deeper into data and decision far better than a human can. But, *can AI also be emotionally intelligent and make creative, sensitive and out-of-box decisions that have historically propelled human growth and evolution?*

How we work together to balance these powerful AI agents of change is still in our control, but the governance, risk, and regulatory frameworks are not well unified across nations, as we will see. Without cooperation, it is going to be difficult to understand why artificial intelligence does what it does, and why it reaches certain conclusions, a phenomenon known as the black box problem among AI developers. *How will our future industries, impact on work and home life unfold?* The decisions we make today will shape our future in unprecedented ways.

Of all species that have existed on Earth, 99.9 percent are now extinct. Many argue that we are currently in the midst of another mass extinction period[32]. *Are we about to share the fate of the dinosaurs? Or will AI and robots take our evolution to a higher order species, with a blend of human DNA and synthetic code?* If that sounds repulsive, think of the artificial flavors, preservatives, medicinal compounds, microplastics, and even medical body parts we have been ingesting or integrating with ourselves anyway.

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[31] Bossmann, Julia. World Economic Forum. *Top 9 ethical issues in artificial intelligence*. October 21, 2016. Source: **https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/**.

[32] Simberloff, Daniel. PBS. *A modern mass extinction?* Source: **https://www.pbs.org/wgbh/evolution/extinction/massext/statement_03.html**.

With global warming acceleration, population growth trends, and the rise of advanced technologies, it is clear that as humans, we have the opportunity to create either a perfect world or a perfect storm. So, *will the AI split be balanced or skewed in how AI advances into our everyday lives?* The next chapters explore diverse industry perspectives on AI and provide examples of AI applications being used in these industries to solve complex operational challenges and improve how business, operations or society at large are modernizing due to the value of AI.

We conclude by providing guidance on how to advance AI successfully in an organization and also highlight the risks of not investing in AI efficiently and effectively to contribute to the future of work. We have also included a strategic self-assessment scorecard to evaluate how mature your organization is in developing an effective transformation strategy for AI to support your business operation, whether you are a profit or not for profit organization.

Change is accelerating at a faster pace than prior innovation curves, and you have a role in determining the future it creates. We have written this book to help you increase your knowledge of AI and be inspired to create a better world, if not a perfect one.

Chapter 2
AI in Healthcare

The United States will require nearly 52,000 additional physicians by 2025 to meet the increased health infrastructure demands, given the rate of population growth and our aging population. The total number of office visits to primary care physicians were expected to increase from 462 million in 2008 to 565 million in 2025[1]. And then, the coronavirus hit.

This is not an isolated example of one nation battling the growing challenges of future healthcare. So, *how does AI help us fill the gaps in this sector?*

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- Transformation occurring in the healthcare sector due to AI
- AI's role during Covid-19
- AI innovations and applications in the sector
- **AI Vault:** Ethical challenges

[1] Petterson, Stephen M., Liaw, Winston R., Phillips Jr, Robert L., Rabin, David L., Meyers, David S. and Bazemore, Andrew W. *Projecting US Primary Care Physician Workforce Needs: 2010-2025.* November/December, 2012. Source: **http://www.annfammed.org/content/10/6/503.abstract**.

- Concluding points on use of AI in the healthcare sector

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in the healthcare sector
- Learn how AI is transforming the healthcare industry and its impact during Covid-19
- Discover healthcare solutions you can use in your organization
- Appreciate the ethical considerations to make
- Build a strategy to lead with AI in the healthcare industry

2.1: A perfect world

Alixia Bolt arrives at the headquarters and Wilkin, her electric car, navigates into the battery grid stall for recharging. As she walks towards the sky elevator, she reflects how incredibly tall the *Central AI* building is. Standing at over 10,000 feet, she reflects upon her travels to Dubai in 2018, as an eight-year-old viewing, at that time, the largest office tower, Burj Khalifa in Dubai. Central AI dwarfs it now. On entering the sky elevator, Alixia is automatically greeted with a cheerful good morning, and her vital signs are rechecked. Health clearance is approved by the time she reaches the 600th floor, before she is through with even the first thought in her head.

Alixia glances at her smartwatch to review her scheduled meetings, which consists of a major AI health science review on the extraordinary progress that is being made in quantum and neural networks in the drug development process, to analyze new chemical compounds from diseases and to identify what medications will have the highest odds of curing the ailments.

Today, Alixia is reviewing the major progress of a San Francisco-based startup, **Atomwise**[2] , regarding their breakthrough research from the **Artificial Intelligence Molecular Screen (AIMS)** program, designed to dramatically accelerate the race towards life by analyzing millions of compounds of each disease to predict the effectiveness of drugs. Its **AtomNet technology** reasons like a human medicinal chemist, drastically reducing the cost and time of drug discovery[3]. Already diseases

[2] Gupta, Megh, and Mohammad, Quasim, *Advances in AI and ML are reshaping HealthCare, Tech Crunch.* March, 2017. Source: **https://techcrunch.com/2017/03/16/advances-in-ai-and-ml-are-reshaping-healthcare/**.

[3] Excerpt from Atomwise corporate website. Source: **http://www.atomwise.com/atomwise-opens-applications-historic-ai-drug-discovery-awards/**.

as diverse as *Ebola, multiple sclerosis*, and *leukemia* have been effectively abolished, given the sheer depth and speed of AI-powered research. The next generation of medical health breakthroughs will be to eradicate all forms of cancer. Alixia is very excited to hear about these new results, as her father, John Benjamin, died from cancer. Alixia smiles as AI in healthcare is now saving millions of people around the world.

2.2: A perfect storm

Today is the *perfect storm*. Alixia responds to the update from Avery, the Global Central AI Chief, "*I will call Dr. Archer Piscoli. In the meantime, please check on the results of the Health Sciences Programs to see if this virus has compromised any major research trials underway. You can likely access the files for review from Tiberius.*"

Alixia immediately logs into *Tiberius*, Central AI's most secure channel. She scans all hospital networks for any compromised viruses that are either altering the compound combinations of new drug trials, or even worse, scrambling calculations directly into global hospital and pharmaceutical distribution centers. As Alixia feared, over 45% of the global health ecosystem network is now infected by this AI virus.

Alixia sends an immediate alert to the central security global healthcare core system adding another wall of cybersecurity protection to prevent the virus from spreading any further. She also reroutes all locations compromised to the new secure channel, averting what could have triggered a global catastrophe of infection of all core hospitals, clinics, and pharmacies.

Alixia now turns her attention to physicians' medical global online libraries to ensure the ultra-killer virus has not infected any of the knowledge source prescription libraries, in particular the ChatBot or health serving robots that are directly tied to these deep network learning sources. Fortunately, the scanners detect only 5% compromise, so an immediate switch over to Tiberius is made. Yet, *how many wrong prescriptions were made impacting human life?* Alixia immediately runs the calculation from the health robots. The result: over 5,000 compromised, 1,000 life threatening with only a 3% chance of survival. Alixia reflects upon the last ultra-deadly virus, and remembers that the last AI health ecosystem breach had caused over 100,000 deaths from wrong compounds being mixed and distributed.

Alixia attempts to call Avery back to let him know that she and her team have been able to ensure the healthcare industry is secure for another day, while they continue to find the source of this ultra-killer virus. Unfortunately, Avery's line is jammed due to voice overload signals. Alixia frowns as another AI outbreak has been experienced. AI continues to bring challenges impacting safety.

2.3: The AI shift

Worldwide, the present healthcare system is facing the following three major issues:

- An increase in demand that is consistently outpacing the supply.
- Aging infrastructure.
- Growing costs that have made advanced care either unaffordable to a significant chunk of human population or a tremendous financial burden for the government.

Perhaps, the biggest impediment to these issues is the complexity brought in by the diverse stakeholders, with hospitals often positioned in the center of the healthcare ecosystem, health insurers on one end and pharmacies on the other. Governing the system is the federal ministry empowered in many countries with regional centers. Of course, there are the vendors and pharmaceutical companies which supply everything from complex medical equipment to medicines. In effect, it is an ecosystem of many silos with many inefficiencies. *How is AI going to improve the health care system and our way of life?*

AI will be transformative and will help us extend health care delivery in both location and time, beyond a doctor's appointment at a clinic or hospital. It includes the use of algorithms and software to approximate human cognition in the analysis of complex medical data. The primary aim of health-related AI applications is to analyze relationships between prevention or treatment techniques and patient outcomes. This implies that your health can be constantly monitored and perhaps, even addressed routinely at home or work, much like in Alixia's case, whether through wearable tech monitoring your heartbeat or through tele-health services.

The other impact of this AI shift occurs at the backend in terms of efficiency. When a doctor refers a patient to a different hospital for advanced diagnosis, information is often lost in transition. This leads to duplication of effort, as the patient often has to be re-checked for basic information that is already available at his previous doctor's clinic. Something similar happens in the patient journey when the pharmacist tells her that the medicine prescribed by her doctor is not covered by her insurance. She then has to re-book an appointment with the physician to get a new prescription, leading to added lines at the clinic. Such inefficiencies can easily be avoided by better informational exchange and coordination. AI can make it possible by analyzing, processing, and sharing such data in real time with the stakeholders involved. AI can also infuse into robotic surgical and behavioral devices or diagnostic tool kits, all aiming for more accuracy and preventative health care and improved services.

Let's take a look at our changing demographic landscape.

With the elderly population in need of care expected to grow by over 50% in US alone, health aides were expected to closely follow the rise at 38% at

one point[4]. This mainly refers to personalization of care and monitoring of health in-home, in addition to innovations of better devices to aid hearing, walking, seeing, and other basic functions.

The insurgence of AI in healthcare won't exactly be universal throughout the system. This will depend on which roles are pivotal and which are proficient. In essence, any role that requires human intervention in terms of providing an interpersonal experience or decision risk experience will require a human. However, those tasks which simply require learning and process analytics execution will see heavy AI involvement. A good example would be delivering medicines or food to a patient's room. The question that brings forth is how the absence of a warm human greeting from a nurse could impact a downtrodden patient.

Did you know that about one third of all health AI SaaS companies are focused on AI enhanced diagnostics? Not surprising when you consider that *diagnostic errors contribute to approximately 10 percent of patient deaths*[5]. But as mentioned earlier, these errors are a result of systemic inefficiencies, which include delays, miscommunication and lack of effective collaboration. These go beyond a simple case of physician underperformance. So, ingesting the tons of data being generated and treatment observations being experienced, enabling global collaboration over these data points and automating tasks or information flow with AI can only improve the avoidable, and at times fatal, lapses in healthcare.

To put it all together, the AI shift is turning healthcare into a patient-centered, tech-led system that brings together the **Internet of Things (IoT),** constant connectivity, ever cheaper hardware, big data and machine learning. This implies accuracy and affordability. It is a boon for pharmaceutical companies if AI can try multiple combination of approved compounds for more expedient discovery of drugs and even utilize a patient's full genome sequence to show the likelihood of a blockbuster drug not working for her and others like her. Likewise, for healthcare providers, AI can enable the quick comparison of services and results of different hospitals or even physicians while also allowing remote monitoring of a patient's health for diagnosis and treatment without burdening the clinic or hospital with unmanageable footfalls.

A multi-billion AI health industry is rapidly in evolution, and it is predicted to help eradicate all diseases one day, with Facebook even having set an ambitious target year - 2100[6]. Whether all diseases will be eradicated is still a big question. Many diseases such as cancer, TB, and polio are expected to be conquered. And yet, the unassuming flu has managed to wreak havoc around us.

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[4] Stanford university. *Artificial Intelligence and Life in 2030.* September, 2016. Source: **https://ai100.stanford.edu/sites/default/files/ai100report10032016fnl_singles.pdf**.

[5] Sennaar, Kumba. *Tech Emergence. Machine Learning for Medical Diagnostics.* January 11, 2018. Source: **https://www.techemergence.com/machine-learning-medical-diagnostics-4-current-applications/**.

[6] Pepicq, Benoit. Android Pit. *Can artificial intelligence really eradicate disease?* October 25, 2018. Source: **https://www.androidpit.com/can-artificial-intelligence-really-eradicate-disease**.

2.4: AI during Covid-19

One would be remiss to not discuss one of the greatest calamities of our time – brutal not only in its destructive capabilities but also the cracks it has exposed in our social, political, and economic state. The coronavirus depends on us and our facilitation to prosper. Strictly speaking, if we follow proper social distancing and hygiene standards, the virus is stripped of its advantage. However, the virus has thrived, thanks to economic pressures of lockdowns and often, our denial of the dangers posed by something we cannot see. These factors have made collaboration and a truly globalized response difficult. That, though, should not come as news.

The fracture in our current governance system has been a point of debate for several years – so much that the **Global Challenges Foundation** called for submissions of ideas for a new global governance and collaboration structure back in 2017. 2,702 entries from 122 countries flowed in[7]. Among the three eventual winners, one had focused on an AI-supported global governance through bottom up deliberation. It entailed a blockchain-based global identity system that would allow citizens to collaborate on an AI platform. As it turns out, something similar has been one of the biggest boons of this technology during our pandemic[8].

In the first six months of the Covid-19 pandemic, we encountered the initial failure of the European Union (EU) to reach a financial agreement to support badly affected countries like Italy[9], the mysterious disappearance of five million masks headed to Canada from Shanghai airport[10], pressure on the **World Health Organization (WHO)** to review its response to Covid-19[11], and a failed UN vote calling for truce among nations to collectively tackle the pandemic[12]. However, as an undercurrent to all these stories, something else was unfolding on a global scale, as revealed by the **Organization for Economic Cooperation and Development (OECD)** when it set

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[7] Global Challenges Foundation. *New Shape Prize*. Source: **https://globalchallenges.org/about/history/new-shape-prize/**.

[8] Global Challenges Foundation. *AI-Supported Global Governance Through Bottom-Up Deliberation.* Source: **https://globalchallenges.org/library-entries/ai-supported-global-governance-through-bottom-up-deliberation/**.

[9] The Guardian. *Just when Italy really needed some unity, the EU failed it – and continues to do so.* April 19, 2020. Source: **https://www.theguardian.com/world/2020/apr/19/european-union-italy-unity-failure-debt-germany-netherlands**.

[10] Humphreys, Adrian. National Post. *What happened when five million medical masks for Canada's COVID-19 fight were hijacked in China. April 17, 2020.* Source: **https://nationalpost.com/news/what-happened-when-five-million-medical-masks-for-canadas-covid-19-fight-were-hijacked-at-an-airport-in-china**.

[11] Smith-Schoenwalder, Cecelia. US News. *WHO Agrees to Independent Review of Coronavirus Pandemic Response. May 18, 2020.* Source: **https://www.usnews.com/news/world-report/articles/2020-05-18/who-agrees-to-independent-review-of-coronavirus-pandemic-response**.

[12] DW. *US blocks UN vote on coronavirus pandemic. May 9, 2020.* Source: **https://www.dw.com/en/us-blocks-un-vote-on-coronavirus-pandemic/a-53377782**.

up a dedicated Covid-19 page under its AI watch. Its objective was to keep an eye on how AI was enabling a globalized effort to tackle Covid-19 where others were failing[13].

The **Covid AI Watch** page showcased, among others, UK's **Knowledge Transfer Network (KTN)** had set up a hackathon called **CoronaHack** calling businesses, data scientists, and biomedical researchers in UK and beyond to share ideas on how to apply AI to tackle the pandemic[14]. The US government, meanwhile, had made available over 29,000 academic research articles for Covid-19 as part of its **Open Research Dataset** challenge to empower AI experts worldwide on their quest[15]. And then, there was the European commission founded **European AI Alliance** that launched the *AI Robotics versus Covid-19 initiative*, calling out ideas, discussions, and existing solutions around the globe that were using AI to aid our fight against the coronavirus[16].

Each of the preceding initiatives was globally focused and exposed a crucial facet of AI: that it needs our collective effort to work; thanks to its need for large volumes of data, iterative learning, and diverse modeling approaches. Even if a single institution has sufficient unbiased data and a rich set of ideas, it can and does always benefit from more. This nature of AI therefore allows people and institutions across the globe to come together even if we fail to do so through our government. In case of Covid-19, the ideas and existing solutions that came to light on the above forums were from obscure corners of the world that would have otherwise gone unnoticed. AI had helped our civilization bypass the political boundaries and geographic limitations.

2.4: The AI innovations

It is difficult to share hundreds of submissions that exhibit AI innovations in healthcare during the Covid era alone. Nonetheless, let us now move on to look at some innovations – both Covid-specific and generic, from using drones to provide drug delivery services to homes and to robotic surgical arms that are more precise than a human hand – that showcase what the boom health tech is going through.

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[13] OECD. *OECD policy brief: Using AI to help combat COVID-19.* Source: **https://oecd.ai/covid**.

[14] Mindstream-ai. Eventbrite. *CoronaHack - AI vs. Covid-19.* Source: **https://www.eventbrite.com/e/coronahack-ai-vs-covid-19-tickets-99337559314**.

[15] Kaggle. *COVID-19 Open Research Dataset Challenge (CORD-19).* Source: **https://www.kaggle.com/allen-institute-for-ai/CORD-19-research-challenge**.

[16] European Commission. *Join the AI-ROBOTICS vs COVID-19 initiative of the European AI Alliance.* March 25, 2020. Source: **https://ec.europa.eu/digital-single-market/en/news/join-ai-robotics-vs-covid-19-initiative-european-ai-alliance**.

2.4.1: Tracking disease outbreaks

Boston children's hospital serves as a good example to start with. Researchers there were able to track the spread of coronavirus by using AI to track the current information on the internet – social media posts, news articles, and even public health data[17]. The end result is a publicly accessible map that attempts to live-track the virus by scouring for clues of the spread.

The team at a company called **BlueDot** has been even more proactive. It had managed to warn its clients of the Covid-19 outbreak on 2020 New Year's Eve, when the outbreak had only just been acknowledged in Wuhan. It was even able to accurately predict 10 out of the first 12 cities that eventually saw official cases – all made possible by its ability to track more than 150 infectious diseases in near real time by scanning official public health sources, moderated health reports, mass media, and the world's flight itinerary[18].

Many countries have deployed apps that can help them and their citizens track and trace the spread of Covid-19 locally. India's **Aarogya Setu app**[19] is one such example. Infrabel, meanwhile, is an anomaly: A Belgian railway company, it used AI to develop a solution that could help to more proactively ensure precautionary measures at workplaces by checking on social distancing and facial covering adherence at workplaces with the use of scanners. In fact, it has also developed **ultra-wideband (UWB)** transmitter wristbands that are able to measure the distance (up to 10 cm) between people on-the-go, which help determine if social distancing requirements are being met by employees[20].

2.4.2: Drug discovery

A reduction in the time it takes to develop drugs and bring to market is perhaps the biggest contribution of AI to healthcare. Researchers at the **Massachusetts Institute of Technology (MIT)** recently developed an AI model that managed to yield a new antibiotic that could even kill antibiotic-resistant bacteria[21]! The AI was able to achieve this because it found an entirely new way of developing antibiotics, beating

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[17] Ordonez, Victor. *ABC News. Doctors using artificial intelligence to track coronavirus outbreak.* March 6, 2020. Source: **https://abcnews.go.com/Health/doctors-artificial-intelligence-track-coronavirus-outbreak/story?id=69444963**.

[18] MaRS Discovery District. *Cracking COVID-19: How BlueDot spots warning signs of pandemics. YouTube.* April 16, 2020. Source: **https://www.youtube.com/watch?v=J8HSCMYalvs**.

[19] Government of India. *Aarogya Setu App.* Source: **https://www.mygov.in/aarogya-setu-app/**.

[20] Global Railway Review. *Infrabel to implement artificial intelligence solution in COVID-19 fight.* May 27, 2020. Source: **https://www.globalrailwayreview.com/news/101107/infrabel-artificial-intelligence-solution-covid19/**.

[21] Trafton, Anne. *Artificial intelligence yields new antibiotic. MIT News.* February 20, 2020. Source: **http://news.mit.edu/2020/artificial-intelligence-identifies-new-antibiotic-0220**.

the costly and time-taking current process of exploring compounds and screening new antibiotics.

Not only can AI reduce the time to find a cure but it can also provide safer make-do options while the discovery and development is underway. **Cyclica** focuses on analyzing drugs already approved by FDA[22]. It finds analogies in existing medications to unlock stop-gap therapies that can tackle similar viruses while a vaccine is found.

More data allows more insights which can allow more effective actions, and **DNAstack** is proving this as it helps target treatments by people's genes by using international health data to determine which genetic markers predispose patients to certain diseases, and their response to medications. Its **COVID-19 Beacon**[23] has helped discover specific genetic mutations by geography and evolutionary origins, thereby customizing the treatment for doctors.

2.4.3: Disease diagnostics

Hospitals worldwide are facing a deluge of patient data. They always have; only now they are strategically interested in aligning it to make their operations and treatments more effective and efficient. The Mount Sinai hospital in New York was no different in its struggles with a vast amount of patient data. So, it applied deep learning to the database of patient records consisting of test results, physician observations and a lot more, through a system **Deep Patient**. With around 700,000 individuals to analyze, there was enough volume to allow the system to recognize patterns and consequently indicate oncoming or likely future ailments, including some types of cancer and to everyone's surprise, the otherwise hard-to-predict Schizophrenia[24].

Across the Atlantic, an Oxford hospital developed AI that could diagnose scans for heart diseases and lung cancer, potentially reducing GBP 2.2 billion spent on pathology services in the UK by 50%. The system called Ultromics actually seemed to improve the current misdiagnosis rate of roughly 25% which would otherwise require unnecessary treatment[25].

Such systems can save billions of dollars. The question they leave us with, though, is how far can an AI diagnosis system be blindly trusted on its predictions that a patient will incur a certain disease if the doctor cannot see any signs of the disease yet.

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[22] *AI meets Biophysics for Drug Discovery.* Cyclica. Source: **https://cyclicarx.com.**

[23] Covid Cloud. *DNAstack.* Source: **https://covid-19.dnastack.com/.**

[24] Miotto, Riccardo, Li Li, Kidd, Brian A, and Dudley, Joel T. Nature. Deep Patient: *An Unsupervised Representation to Predict the Future of Patients from the Electronic Health Records.* May 17, 2016. Source: **https://www.nature.com/articles/srep26094**.

[25] Ghosh, Pallab. BBC News. *AI Early Diagnosis could save heart and cancer patients.* Jan 2, 2018. Source: **http://www.bbc.com/news/health-42357257**.

2.4.4: Drug delivery

Matternet - a spin-out of the Silicon Valley-based **Singularity University (SU),** has been using drones to deliver drugs to remote areas or disaster zones in Haiti[26]. It rose to the challenge during Covid-19 to work with United Parcel Service (UPS) in a partnership that allowed contactless delivery of prescription medicines from the CVS pharmacy to the largest retirement community in the US[27]. That incidentally is a case of AI serving up a better world for us. On the other hand, we also have more personal operative and healthcare assistance. This is where AI's most pronounced and visible contribution in healthcare could be; for it is where we are personally involved as patients. Attempts at bringing in the use of advanced technology have been in the pipeline for nearly two decades now.

2.4.5: Intuitive surgical robots via guided AI

Intuitive surgical's **da Vinci** system[28] is old. Originally designed for minimally invasive heart bypass surgeries, it is now also involved in treating prostate cancer. Today, it is used in nearly three quarters of a million procedures a year[29].

At this time, robotic arms performing complex surgeries are not yet mainstream. However, there are many grounds changing medical innovations in the market. That includes miniature robots, small enough to be injected into one's eye to fix membranes. It was achieved with **Robotic Retinal Dissection Device (R2D2)** in 2016 by an ophthalmologist and professor at the Oxford University and was a hundredth of a millimeter thick![30] In fact, robots like R2D2 or the **Smart Tissue Autonomous Robot (STAR)** have managed to make more precise cuts than expert surgeons, and therefore, damage less of the surrounding flesh[31].

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[26] Balch, Oliver. *The Guardian. The future of healthcare: AI, augmented reality and drug-delivering drones.* November 1, 2016. Source: **https://www.theguardian.com/sustainable-business/2016/nov/01/the-future-of-healthcare-ai-augmented-reality-and-drug-delivering-drones**.

[27] Matternet. April 27, 2020. Source: **https://mttr.net**.

[28] Intuitive surgical. Source: **http://www.intuitivesurgical.com**.

[29] Trefis Team. Forbes. *Intuitive Surgical Maintains Its Growth Momentum With Strong Growth In Procedure Volumes*. January 22, 2016. Source: **http://www.forbes.com/ sites/greatspeculations/2016/01/22/ intuitive-surgical-maintains-its-growth-momentum-with- strong-growth-in-procedure-volumes/#22 ae6b0939a1**.

[30] Parkin, Simon. *Legacy Medsearch. Can Tiny Robots Revolutionize Eye Surgery?* February 24, 2017. Source: **https://legacymedsearch.com/can-tiny-robots-revolutionize-eye-surgery/**.

[31] Mok, Kimberley. *The New Stack. Autonomous Robot Does Surgical Cuts Better than Human Surgeon.* November 16, 2017. Source: **https://thenewstack.io/autonomous-robot-surgical-cuts-better-human-surgeon/**.

2.4.6: Health AI aids - apps and wearables

The Ochsner hospital in New Orleans has been piloting Apple's new *HealthKit* and *Watch* to send patients home with wireless blood pressure cuffs and weight scales which pregnant mothers can use to monitor their health at home[32]. But as many would testify, in dealing with wearables, it's not just a question of function but of fashion too.

Can you imagine a pollution-indicating scarf, one with a filter to protect us from pollutants? Wair showcased this solution – a scarf and an app – at CES 2017, to make our lungs cleaner without compromising on that all-important fashion statement. Its smart scarf can even send alerts to a paired smartphone[33].

The overall smart clothing market is likely to grow from $1.6 billion in 2019 to $5.3 billion by 2024 at a CAGR of over 26%[34]. **Hexoskin**, for instance, makes shirts that can monitor heart rate, heart rate variability (HRV) (allows you to estimate stress and fatigue), heart rate recovery, ECG, breathing rate, minute ventilation, peak acceleration, steps, sleep positions, and activity intensity![35]

2.4.7: Behavioral therapeutic AI

The power of AI is its ability to compute billions of insights and form observations faster than humans can. The differentiator here is not the pattern recognition itself – we humans have carried this skill since ancient times – but the depth and accuracy with which deep learning executes it. Certain ailments need AI because our own understanding is limited. That is the nature of biochemistry, after all. Perhaps, that is why Israel-based **Lifegraph** proves helpful by detecting early signs of distress in patients. Tele-language, meanwhile, is good for language therapy sessions. Its uniqueness is in the fact that it can engage multiple patients simultaneously.[36]

Similar to the schizophrenia-predictions, AI is also poised to predict death, or more specifically, how long a patient would live. In fact, Dr. Ziad Obermeyer finds this other-worldly capability to be something extremely easy - one where the system

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[32] Farr, Christina. CNBC. *This hospital modeled itself after the Apple Store, and lets pregnant mothers use gadgets to monitor their health at home.* March 4, 2019. Source: **https://www.cnbc.com/2019/03/04/ochsner-hospital-in-new-orleans-has-o-bar-like-apple-store.html**.

[33] Foxx, Chris. *BBC. CES 2017: Wair's smart scarf fights pollution with fashion.* January 2, 2017. Source: **http://www.bbc.com/news/technology-38406641**.

[34] Markets and Markets. *Smart Clothing Market by Textile Type, Product Type (Upper Wear, Lower Wear, Innerwear, and Others), End-User Industry (Military & Defense, Sports & Fitness, Fashion & Entertainment, Healthcare), and Geography - Global Forecast to 2024.* November, 2019. Source: **https://www.marketsandmarkets.com/Market-Reports/smart-clothing-market-56415040.html**.

[35] Hexoskin. Source: **https://www.hexoskin.com**.

[36] Stanford University. *Artificial Intelligence and Life in 2030.* September, 2016. Source: **https://ai100.stanford.edu/sites/default/files/ai100report10032016fnl_singles.pdf**.

only needs to be fed tons of historical data in the form of electronic records of people who are dead. He is not fazed by the fact that he would not know the logic computer has used to reach its conclusion. Instead, he draws an analogy to the discovery of steroids for immune suppression where we first observed that it worked and then went on to find out why. Working with AI's mysterious ways, in his opinion, is quite similar to how we have worked with medicines all these years.[37]

Behavior also corresponds to daily life. With not many of us getting the proper technique right while brushing our teeth, Ara, an intelligent toothbrush, comes to the rescue. It has embedded sensors that can analyze our personal techniques, identify gaps, monitor progress, and advise how well we brushed.[38]

Then, there is **ChatterBaby**, which can advise new moms on what type of cry a baby is having. *Is the baby hungry, tired, in pain, or needing a diaper change?* With time, it is likely to start identifying smells on other issues, such as dirty diapers, and also early signs of autism.[39]

Early research from a Stanford University research study showed that their ChatBot, called **Woebot**, managed to reduce depression significantly within two weeks![40] A Woebot can analyze responses to questions like: *How do you feel today?* In the absence of the social stigma of visiting a therapist, lack of judgments from Woebot, its round-the-clock availability and smart advice, the youth can become very comfortable with the therapeutic chatbot. Of course, Woebot's success depends on collecting more and more data, which in turn requires more people choosing to be comfortable with the idea of an emotion-sensitive chatbot.

2.4.8: Mood sensors via emotional AI

Emotional AI or mood sensors are very effective to monitor our health and sense of wellbeing, have conversations with us, monitor our health patterns analyzing our moods and predict what we need, to make us happier or healthier. To give more context, we all have a relationship with the things we are attached to. We all roll over when our alarm clock rings and when it's time to get out of bed to face a new day, we try and hold on to our dreamy rest. When you try to start your car and it doesn't kick in, you likely also call it names.

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[37] Tedeschi, Bob. StatNews. *Making the modern radiologist obsolete? How machine learning may revolutionize medicine*. October 3, 2016. Source: **https://www.statnews.com/2016/10/03/machine-learning-medicine-health/**.

[38] Kolibree. Ara. Source: **https://www.kolibree.com/en/ara/**.

[39] Molteni, Megan. Wired. *Can this AI-powered baby translator help diagnose autism?* November 5, 2018. Source: **https://www.wired.com/story/can-this-ai-powered-baby-translator-help-diagnose-autism/**.

[40] Eve. HBS Digital Initiative. *Woebot – the bleeding intelligent self-help therapist and companion.* April 21, 2020. Source: **https://digital.hbs.edu/platform-digit/submission/woebot-the-bleeding-intelligent-self-help-therapist-and-companion/**.

But *what happens when these objects start to talk back to you? What if they are actually absorbing all our speech patterns and indexing our moods and have the ability to clearly communicate with us, to understand us, and to express realistic emotion?*

With our conversational UI interfaces with **Alexa, Siri, Cortana**, and so on – our digital personal assistants integrated IoT Sensors, and with their 24x7 constant access to more data sources, AI and natural language approaches will increasingly craft intelligent and relevant mood sensitive conversations. As machine learning capabilities advance, users will feel better, be understood more, and will grow closer to their AI products. They may even read our facial expressions, answer our questions, express themselves, and even give us a hug (in case of a robot) when it senses we need one. We will enter a new world where our products understand us, as humans understand each other. Our needs will be anticipated and options for our day will be surfaced up to us.

Remember when Disney introduced us to the lovable robot companion, **Baymax**, *who could carry out a host of medical tasks for a patient?* This is now becoming a reality where robots can supplement staff by handling both care-heavy and muscle-heavy tasks. Consider the case of robots in Japan assigned for elderly care. While the bear robot can lift elderly patients, Robot Dinsow can help them move and exercise, in addition to helping with their mood. Robot Pepper can help schedule appointments, educate patients, and interpret behavior. Robot Paro can engage patients in simple conversations while also entertaining and comforting them.[41]

A research study[42] conducted by **J. Walter Thompson (JWT)** Innovation Group London and Mindshare Futures, on consumer response to Amazon Echo and even smartphone voice assistants found that the emotional response and proximity grew during the course of experiments. In fact, with deeper emotional attachment with the voice assistant, many came to wish it were a real person. Most startlingly, more than a quarter of regular voice technology users said they had had a sexual fantasy about their voice assistant. The movie, *Her*, provides a futuristic view of such an emotional AI, where AI assistants are universal and cause havoc to human emotions as the distinction between real and not real fades away.

2.5: The AI vault

As the global digital health market grows, the strategic implications will be different for different players. For hospitals, the incentive has so far been to fill its beds. The new age changes that to exactly the opposite – reducing the need for people to come to the hospitals. The benefits of such a sweeping change can only be realized

[41] Hamstra, Brittany. *Will These Nurse Robots Take Your Job? Don't Freak Out Just Yet. Nurse Organization Publication,* February 27th, 2018. Source: **https://nurse.org/articles/nurse-robots-friend-or-foe/**.

[42] Snider, Seth. *Artificial Love Designing for Emotional Intelligence.* Source: **https://becominghuman.ai/artificial-love-designing-for-emotional-intelligence-5b21c11242c8**.

if doctors, nurses, patients, technologists, pharmaceutical and biotech companies, policy makers, and other associated parties are suitably educated on the benefits and risks that AI tech will bring to the ecosystem. With the recent outbreaks of the novel coronavirus, we are seeing how AI can inform nations globally of the health risks and monitor community regions being impacted in real-time. Creating an aligned ecosystem that measures successful outcomes against a vision of an ethical and fairness AI healthcare sector will take tremendous vision and patience.

2.5.1: What do you do when AI's ways of working are unexplainable?

Remember the successful case of Deep Patient at Mount Sinai hospital? As we mentioned, psychiatric disorders like schizophrenia are very difficult for doctors to predict. But while Deep Patient can do the job fairly easily and accurately, here's the other side to that coin: neither doctors nor researchers can easily tell how it does this analysis. AI is helpful to us if it can make our jobs easier while showing us the way. But *what happens, when AI works in mysterious ways that cannot be explained?*

If deep learning cannot rationally explain how it can predict potential schizophrenics, doctors are effectively prescribing drugs on something they don't fully understand either. Therein, lies a major AI risk: *a lack of understanding of how it works.*[43] Humans are accountable legally; so, making critical decisions without context can prove very costly. For instance, AI's applications to diagnose cancer more efficiently is rapidly going mainstream as earlier detection is not only good for humans, it is far more accurate and less expensive than current practices. But it can also lead to false positives where a prospective patient ends up getting treated without ever actually having had the risk of cancer.

2.5.2: How are privacy and security frameworks impacting AI advancements?

Given the level of privacy and security needed, the aging infrastructure and outdated healthcare processes remains a sloth-like beast that moves so slowly. Greater ease here could allow unintended side effects of drugs to show up early and reduce costs and time involved in bringing drugs to market. Existing healthcare technologies and machinery are already digitized and most archives have gone digital over the recent years, leading to available data that is ready to use but the legal and regulatory frameworks are impacting diffusion of AI innovation.[44] This is important because

[43] Knight. Will. MIT Technology Review. *The Dark Secret at the Heart of AI*. April 11, 2017. Source: **https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/**.

[44] Stanford University. *Artificial Intelligence and Life in 2030.* September, 2016. Source: **https://ai100.stanford.edu/sites/default/files/ai100report10032016fnl_singles.pdf**.

currently, doctors typically get a verbal description of the symptoms from patients and then try to recognize patterns based on experience and prior knowledge to identify the cause. With AI, doctors can instead be more intuitive and supervise the process with inputs, while allowing the system to run advanced analysis and form outcome diagnostics to provide options for doctors to make more informed decisions.

Another natural concern with AI has to do with data security. AI algorithms are giving us access to the emotional and psychological states of individuals.[45] Such physical, physiological or genetic information is highly private to any person. It's suitable usage and protection must therefore be of utmost importance. Seamless connectivity and the ability to share patient information in real-time with a doctor and then between other stakeholders exposes such data beyond a patient's control. Moreover, while companies may take holistic care of this issue, we must tread carefully on the idea of using behavioral data to help companies understand their customers better without any control. This level of marketing intelligence becomes a cash cow that is very hard to resist and move away from. Ethically, the lines become quite blurred.

2.6 Conclusion

To bring home the deep AI considerations in healthcare, here are five guide posts to help evolve AI in the health industry sector.

First, we must establish ethical standards applicable to the global healthcare sector to develop diverse scenarios for the successful development and sustainability of AI. This is to ensure that both positive and negative use cases are factored into our policy, legal, security, and regulatory frameworks.

Second, investing in educational programs to help healthcare practitioners understand how AI can work in a medical setting and help them to understand how AI solutions can be beneficial to their everyday jobs is equally relevant to ensuring successful adoption and utilization of AI enabled technologies.

Third, for companies developing AI solutions, such as IBM and GE, even more communication directed towards the general public about the potential advantages and risks of using AI in medical fields is a responsibility that should not be taken lightly.

Fourth, for healthcare institutions, the focus should be on evolving policies, practices, procedures to ensure all the necessary steps to be able to monitor and measure the success of AI systems and ensure that it is statistically valid.

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[45] Moore, Andrew W. MIT Sloan Review. *Predicting a Future Where the Future Is Routinely Predicted.* September 12, 2016. Source: **http://sloanreview.mit.edu/article/predicting-a-future-where-the-future-is-routinely-predicted/.**

Fifth, healthcare is poised to reap great benefits from the deployment of AI, but at the same time, human lives could be put at risk, and hence, cautionary evolution is recommended. AI is already making a noticeable and productive impact in healthcare, leading to the betterment of society. Evolution is about embracing the art of the unknown.

In summary, AI is likely to drive down costs related to diagnosis, logistics, and systemic inefficiencies by allowing better data exchange, records management, deeper diagnostics, and remote treatments. However, healthcare brings with it regulatory challenges. That is likely to be influenced by our appetite to accept the trade-off between improvements and risk to privacy. Nonetheless, driven by the need of a system bursting at the seams, we will continue to see robotic process automation and other AI techniques uncover powerful new ways to predict health problems.

Will we create a perfect world or a perfect storm for the healthcare industry?

Chapter 3
AI in Education

If healthcare has been the pillar of our sustenance as a human race, education has been the pillar of our cognitive and skills growth. Educational access and skill development in AI are foundational for human evolution, as it is enabling global literacy on unprecedented levels. Let us investigate this further.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- Transformation occurring in the education sector due to AI
- AI innovations and applications in the education sector
- **AI Vault:** ethical challenges
- Concluding points on the use of AI in the educational sector

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in education
- Learn how AI is transforming the education sector

- Discover learning solutions you can use in your organization
- Appreciate the ethical considerations to make
- Understand what the education sector needs for AI growth

3.1: A perfect world

Alixia Bolt reflects on her childhood's educational learning experiences.

Her first memory of learning was formed at four months when her first nanochip was injected and connected to her own **intelligent tutoring system (ITS)** to enable her educational learning growth. With her ears partially developed, Alixia's world could offer her a steady stream of sounds ranging from her parent's voices to diverse peaceful music or sound selections researched by the AI Baby Growth and Health institute to stimulate her brain and cognitive skill development. In addition to the built-in 24x7 surround learning system, Alixia's parents could also view her development at every stage of growth and participate in all her life's smallest miracles – from opening her eyes at 24 weeks to holding her twin brother's hands. Learning had been integrated into every second of every day.

When Alixia was born, she was also equipped with a baby **Neuralinker** that had been specially designed to accelerate her linguistic capabilities. Her parents chose the Neuralinker super model that would allow Alixia to speak over 500 languages in just a few years.

Every day, Alixia's world was stimulated by her diverse ITS learning aids and educational robots. From taking her math lessons powered by Whizz Education to visiting on demand adaptive learning groups powered by intelligent AI moderators, learning had never been easier. Walking in a garden, seeing a flower, she was immediately informed of its phylum classification and genetic makeup. To think of what it was like to live in the 20th century, she could conjure up any learning question or experience and become an expert in minutes. Teachers were augmented mentors, and their focus was on ensuring the learning experiences had the desired outcomes to keep some checks and balances in the AI educational ecosystems.

Sensors counted how many smiles or frowns Alixia or her teachers were having in their remote locations, profiling not only the quality of her learning environment but also the moods and psychological well-being for learning aptitude surveillance. Alixia entered the workforce at age 15, the new adulthood threshold that had been set in light of significantly more intelligent and informed children. Only, this workforce was more aspiration-driven and part of one's natural growth. After all, education was no longer going to end with K-12 or college but would be a natural lifelong affair. A global expert in everything she needed to address business or life challenges, Alixia was constantly connected to Neuralink's educational electronic brain, the universal content repository of all knowledge – always right, reliable and responsive in a perfect world.

3.2: A perfect storm

Alixia Bolt reflects on her childhood's educational learning experiences.

Her first memory of learning was formed at four months when her first malfunctioning nanochip was injected and connected to her own ITS to start her educational learning growth. With her ears partially developed, Alixia's world was soon shattered with a glitch that offered her disturbing sounds ranging from an adult's quarrelling voices to chilling sound selections that were proven to harm cognitive and brain development. Quality check had clearly gone amiss in this novel technology. What made it worse was that Alixia's parents could not monitor her development at every stage of her growth, even as she was subjected to the constancy of technology.

When Alixia was born, she was equipped with a baby Neuralinker that had been specially designed to accelerate her linguistic capabilities. Her parents chose the Neuralinker super model that would allow Alixia to speak over 500 languages in a few years. The following two issues came to light immediately:

- The National government did not allow a few languages to be taught on account of perceived cultural opposition.
- Crucially, the limit of 500 languages was set on a generic understanding of human linguistic capability and did not take into account Alixia's specific cognitive limitations, leaving the door open for an information overload that was to ensue in a few years.

Every day, Alixia's world was stimulated by diverse ITS learning aids and educational robots. From taking her math lessons powered by Whizz Education, to visiting on-demand adaptive learning groups powered by intelligent AI moderators, learning had never been easier. However, Alixia's world lacked human emotion and she felt isolated, as her learning experiences were all controlled by AI-powered learning systems. She did not like the feeling of privacy invasion as her every thought was visible in the learning circle and when she had a recognized skill depth, others were allowed to access those memories to learn from. She never had privacy and her robot friends could never explain to her the value of privacy. Even her parents always look puzzled when Alixia raised this question. Teachers no longer existed, as educational experiences were totally controlled by the learning circle and powered by advanced AI and robotic tutors. Every question and answer known to mankind was recorded and accessible 24x7, but filtered and modified by the national government.

Eventually, Alixia entered the workforce a presumed global expert as per set levels of education she had cleared. However, the world outside remained infused with a sense of isolation as depression and suicides had reached an all-time high worldwide. Education was always available but Alixia no longer wanted to go back into that world. And yet, the work sphere wasn't any better, for social skills and cognitive

sustaining power had not been able to get to prior functional levels for many years now.

3.3: The AI shift

Let's begin by exploring some of our most primitive ancestral learning signals. At its very core, education is the process by which our brains receive and process information to stimulate an action. Today, we do so by reading, practice, and increasingly from perceiving (role modelling) and replicating. Think Neo's matrix-style simulations and we get an idea of how electromagnetic impulses carrying codes of information may be relayed directly to our brain. On the most primitive level, we have achieved this before by developing a capability as simple as differentiating between light and dark areas. You'd be right to wonder how significant such little progress could possibly have been. Let's take a reflective moment to a time back when humans did not exist.

Our earliest ancestors - one of the first multicellular organisms on Earth lived underwater. It was a prehistoric age when species were yet to discover land on Earth. It was as much a geographic challenge as a visual one, for evolution was yet to create eyes for these organisms.

This complex visual receptor we enjoy today came into being with a simple protein molecule that could absorb light, allowing those earliest microbes to differentiate between light and dark areas of the ocean. This little change had a profound effect - it allowed such organisms to move away from sunlit areas and thus avoided the harsh ultraviolet light from damaging their DNA. Naturally, this section of species prospered over time. Gradually, the protein molecule formed pigments allowing better ability to find light for microbes that were using sunlight for energy. Soon they evolved into sockets, narrowed the visual focus, and eventually developed lenses, all of which led to the creation of eyes that could differentiate colors and shadows, find prey, and help organisms secure themselves and move with the direction. By the time one of them first discovered land, we were ready for this new world.

History is a powerful trajectory reference for the future. It repeats itself in diverse ways. So, when AI allows our brain to recognize light and dark areas on a screen without using our eyes, it is in many ways the onset of a similar evolutionary path that we have been on many times before.

Educational evolution has the following four facets:

1. The strategy for competencies and skills development identified to close know-what or know-how gaps.
2. The curriculum or content developed to close those learning gaps.
3. The distribution of content for knowledge access to meet audience and learner needs, virtual classrooms, and so on.

4. The ongoing curriculum content maturity continuum and the measurement assessments or practices to sustain educational skills development.

A significant change in the educational process, aided by Covid-19, has been our emergence from siloed institutional settings to virtual classrooms. AI has the potential to become a great social equalizer. More 50% of consumers believed AI will provide educational help to disadvantaged school children, according to a recent PWC research survey on AI.[1] Researchers are also deploying AI in the classroom to aid the teacher. It can help tell whether the students are bored or finding the lecture difficult based on video recordings of facial expressions.[2]

AI also can have an educational facilitative role. This can be blissful at an age where half our time is spent organizing and managing a vast amount of data and complying with process protocols. For example, when writing this book, we were faced with many resources. However, we had to read and source the most insightful gems. Looking ahead, AI will be able to pull out relevant information based on reference points from different sources to give us the content we need, thereby saving us hours and hours of research work. In fact, given its pattern recognition prowess, it also can replicate our writing styles to pen sentences for us. This is how books may be written in the future, as authors become editors and AI becomes the raw patterning architect of content that architects our specific needs and surfaces our asks (voice) in real-time. As we look into the future, we may also have our own mental and action footprint create our unique psychographic profile. But if we extrapolate this further, each profile could be correlated to all global population profiles which will record every second as we learn and germinate new ideas. Seems far off but technically it is already feasible, with access to data.

Now, think about the burden of homework that we all have faced in after-school hours, and how AI can help. It will allow students more time for play and physiological development. As we become increasingly receptive towards fitness issues, AI will present new learning experiences to engage with the real world. For example, **Augmented Intelligence** will allow more time and opportunity for us to spend time outdoors, interact with people near and far. Consider taking a walk outside wearing **augmented reality (AR)**-powered lenses or glasses. Suddenly, that same garden you cross every day is richly enriched with accompanying information on the type and life of each flower – a virtual encyclopedia for botany aficionados. How much more we will learn about our surroundings and the world in a simple stroll, thanks to instant information provision with AR powered and customized to our liking by AI algorithms.

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[1] PWC. *Bot.Me: A revolutionary partnership.* Source: **http://www.pwcartificialintelligence.com/#amplifying-society**.

[2] Waltz, Emily. *IEEE Spectrum. Are Your Students Bored? This AI Could Tell You.* January 13, 2020. Source: **https://spectrum.ieee.org/the-human-os/biomedical/devices/ai-tracks-emotions-in-the-classroom**.

We live in an attention deficit world. And it's affecting children most as they grow up attuned to the art of distraction. A report by *Common Sense Media* showed that children younger than eight were spending nearly thrice as much time on a mobile screen than they did only a few years ago, and nearly one in two owned a tablet, compared to one in ten a decade back. This implies a profound change in our ability to grasp information. The report rightly suggested that the ubiquity of mobiles is changing childhood.[3]

Amazon's Echo Dot for education is worth a mention here as it starts to acknowledge its inevitable engagement with children in the house, and its role in educating them positively or negatively. Amazon has consulted child psychologists in this effort to answer questions that the parents deem fit. This includes avoiding questions about guns or alcohol, for instance.[4] Of course, that still leaves the privacy question unanswered.

When it comes to content, education is often a sensitive issue because what we learn shapes our progress in the years that follow. Governments worldwide have adhered to strict control over what is taught in schools. A purely logical bend to the way we solve problems, for instance, can root us out of more spiritual facets of learning, as is best seen in the contrast between earlier educational styles prevalent in the Gurukuls of the East versus the more western approach that exists today. Yet, information access and learning access can no longer be controlled in the future.

An age of AI will enable an age of *adaptive education*. With technology's inherent ability to map and measure a student's cognitive ability, aptitude, and IQ through behaviors and performances and then surface up relevance for increased performance, AI will adapt the learning content to suit the individual, distributing focus to real time needs versus structured unadaptive and outdated content. Such educational context parallels a coaching learning style that can be adjusted by students, parents, or coaches to create the perfect learning experience based on the collective wisdom(s) of all universal knowledge and experiences. AI in education will increase our windows to learn from.

Just the way our ability to distinguish between light and dark had parallels in history, so does our ability towards quick pattern recognition – the single most important skill behind our social development. It was pattern recognition that allowed early human beings to follow the stars or foretell the arrival of different seasons. Just think of how crucial that would have been in helping our distant ancestors shield themselves from an oncoming winter. Now, imagine what humans will be able to do as they can actively explore and utilize unlimited patterns, of all types, from an early

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[3] Howard, Jacqueline. CNN News. *Kids under 9 spend more than 2 hours a day on screens, report shows.* October 19, 2017. Source: **https://www.cnn.com/2017/10/19/health/children-smartphone-tablet-use-report/index.html**.

[4] Johnson, Khari. VentureBeat. *Amazon's Echo Dot for kids is all about the upsell.* April 28, 2018. Source: **https://venturebeat.com/2018/04/28/amazons-echo-dot-for-kids-is-all-about-the-upsell/.**

age. Thinking about the AI shift in education helps us see just how AI approaches will not only modernize education, but more importantly, help us strengthen the human race.

3.4: The AI innovations

The education sector is seeing AI innovations primarily in a virtual delivery of instructions, more diverse classroom or remote engagements, and the use of analytics for better learning by the students. Let us take a look at a few such examples.

3.4.1: Customized virtual education

Massive Open Online Courses (MOOCs), have already enabled learning enthusiasts to access and deploy materials from leading universities and even institutions like *Khan Academy, Udacity, Coursera*, and *edX* are just a few examples. It's good to begin with these examples because MOOCs have reduced learning limitations like geography, time, class size, space, and so on. MOOC tools are advancing and bringing in AI and machine learning techniques to manage and conduct courses in a better manner. For instance, to test large pool of students, certain questions can now be automatically generated.

Familiar platforms are fundamental to the adoption of new technologies. Users did not jump from kerosene lamps to electric bulbs overnight, no matter how beneficial it may have been. Thus, propagation of cognitive customizations through a globally available and utilized channel like MOOCs is critical to our AI shift. As a result, the sector is facing a level of unprecedented automation aimed mainly at how effectively students can study.

For instance, AI has helped teachers in the creation process of learning content. Content Technologies, the brainchild of **Cram101** and **JustTheFacts101**, allows teachers to prepare course curriculums and then use an engine to organize the content around the core concepts and customize it to each student's needs[5]. **Netex Learning**, on the other hand, offers similar customization capabilities to teachers, thus helping them monitor the progress of their class effectively[6]. Instructors can then create even more comprehensive blended courses through sites like **Teachable, Udemy**, and **Coursecraft**. These sites create a blended learning ecosystem that couples coaching with content acquisition through videos, group chats, editable worksheets, and varied assessments. Carnegie Learning's **MATHiaU** does personalization with a focus on remedial learning for incoming college freshmen by providing personalized tutoring and feedback with the software's use of cognitive

[5] CTI. Source: **http://contenttechnologiesinc.com/.**

[6] Netex. Source: **https://www.netexlearning.com/en/.**

sciences[7]. The latter incidentally can have a massive impact for colleges as remedial learning costs colleges billions of dollars annually, and the success rate is otherwise below par at best.

3.4.2: Prescriptive education

Carnegie Mellon University (CMU) is setting standards in penetrative analysis of students for their well-being and effectiveness. This subjective insight, after all, is the beauty of AI capability. A case in point is its **iTalk2Learn system16** which takes into account the learner's information such as her/his subject knowledge, cognitive needs and emotional state, among others. Solutions like **iTalk2Learn** will enable future education systems to be more cognizant of the stress levels and coping abilities in real time for any individual student. And with all the talk around tools, it was inevitable that someone put a face to it, which is what the **University of Southern California (USC)** institute for creative technologies is attempting at by having virtual environments inhabited by 3D avatars that provide realistic social interactions[8].

Hangzhou No. 11, a Chinese middle school, was one of the first to use facial recognition with sensor cameras to capture students' expressions and movements[9]. The technology could also take attendance. The objective was to track students' engagement levels as well as their emotional state in order to make education more effective and compliant. Each student could thus be categorized to guide study habits correlated to better test performance. The surveillance, part of a growing systemic fact that we will discuss more later, has naturally led to its fair share of debates.

We would be remiss if we did not recollect George Orwell describing a system in his dystopian novel, 1984, called **Face Crime**. Despite the increasing focus on AI sensing technologies, our external facial personas may not necessarily match our inner feelings – or so is the presumption. Nonetheless, ethical and privacy concerns have led to quite a backlash against facial recognition in recent times, with many companies stepping back on its use.

3.4.3: Collaborative education

The most basic examples of collaborative facilitation by AI would be the multitude of conference call software. As accustomed as we may have become to **Zoom, Google**

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[7] Carnegie Learning. *MATHiaU*. Source: **https://www.carnegielearning.com/products/software-platform/mathiau-learning-software/**.

[8] Faggella, Daniel. Tech Emergence. *Examples of Artificial Intelligence in Education.* March 7, 2017. Source: **https://www.techemergence.com/examples-of-artificial-intelligence-in-education/**.

[9] Venture Beat. *Chinese school installs facial recognition cameras to monitor students.* May 17, 2018. Source: **https://venturebeat.com/2018/05/17/chinese-school-installs-facial-recognition-cameras-to-monitor-students/**.

Hangouts or **Microsoft Teams**, thanks to the lockdowns during pandemic, their contribution in ensuring that education for currently enrolled students continued without major interruption has been huge. AI can allow automatic meeting transcription, scheduling, notes taking and detailed meeting analytics, besides of course, facial recognition[10].

Other innovation solutions offer students the chance to connect with and learn from peers worldwide. Brainly, for instance, can answer specific questions a student has by providing answers or video content around the concept or by even connecting the student to the video creator[11]. It uses crowdsourcing, much like **Quora**, but this type of virtual classroom that extends and enriches learning content is increasingly being made available by AI algorithms that will learn about your needs and wants and surface up relevancy on demand.

3.4.4: Robots in education

Let's look at another area of educational evolution where robots are used in the classroom. The intention of most researchers in robotics is not for robots to replace teachers. Rather, the design goals of most robots are to function as an aid in the classroom and to enhance the added value they can bring as a stimulating and engaging educational tool. In order to facilitate the integration of robots in the classroom, we need to be able to provide appropriate interfaces (software, hardware, or even mobile applications), and allow the teacher to control the robot with minimal training.

Take **Ozobot** – a robot that teaches children to code and reason deductively. It can aid students of different age groups differently. For the very young, it allows screen-free coding that are based on color codes[12]. **Cubelets** help teach children logical thinking through assembling robot blocks to think, act, or sense, depending on the function of the different blocks[13]. **PLEO rb** is a robot pet that helps children learn biology by teaching the robot to react to different aspects of the environment. These include the robot evolving through four stages of newborn, toddler, teenager and adult, and a fifth after-born stage comprising varying moods – all reactive to the owner's style of nurturing[14].

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[10] Barolo, Priscilla. Zoom Blog. *A Glimpse Into How AI Will Make Meetings Better.* March 29, 2018. Source: **https://blog.zoom.us/glimpse-into-how-ai-will-make-meetings-better/?zcid=1166**.

[11] Lunden, Ingrid. Tech Crunch. *Brainly, a crowdsourced homework helper for students, raises $30M to expand in the US.* July 25, 2019. Source: **https://techcrunch.com/2019/07/25/brainly-a-crowdsourced-homework-helper-for-students-raises-30m-to-expand-in-the-us/**

[12] Ozobot. *Colour Codes.* Source: **http://ozobot.com/**.

[13] Modular Robotics. *Cubelets*. Source: **http://www.modrobotics.com/cubelets**.

[14] Innvo Labs. *Pleo rb.* Source: **http://www.pleoworld.com/pleo_rb/eng/ lifeform.php**.

There are also tools that can help children get accustomed to visual programming and even build applications. Examples would include the **Dash** and **Cue** robots from **Wonder Workshop** whose objective is to teach kids to code as they play[15]. Integrating study with play is a masterstroke. It is effective because it aligns the task of absorbing information with an interesting process. And in every such instance, students are being assisted in their learning process.

3.4.5: Augmented intelligence

While AI is meant to help us humans with things like computation, memory, perseverance, precision, and speed, we move into the realm of augmented intelligence when AI merges more with how humans think. Augmented intelligence leverages AI into higher performing, enhancing human capabilities in areas like abstraction, breaking rules, judgment, nuance, listening, and storytelling.

Remember the evolution of the eye and its parallel to helping our brains deduce basic information? **Neuralink**, an Elon Musk venture, is a classic example of expediting this ongoing man-made evolution. With chips and electromagnetic devices implanted in the human brain, the initial objective was more medicinal such as recovery from brain injury and recovering lost eyesight. However, it could also enhance memory and allow more direct interfacing with computing devices[16]. While Musk says it could happen pretty soon, there is a flip side to the possibilities it brings. The easier we make for an informational delivery into our brain and conscience, the easier it may be to manipulate (or hack) us or for human brains to become lazy and atrophy, as it is a muscle and must keep *fit*.

Braintree (sold to PayPal in 2013) co-founder Bryan Johnson wanted to seize the reins of evolution and build a better human. His idea: *A non-invasive interface that could be injected into the brain to genetically engineer neurons. That attempted interface, though, is not the product of his start up, Kernel; it is an algorithm that can subsequently read and digitize the brain's signals to send back modifications*[17]. And once again, while Bryan's objective is to treat ailments like Alzheimer's, depression or epilepsy, the technique will evolve an individual's cognitive ability.

Neuroscience researchers say that we have very limited understanding about how the neurons in the human brain communicate. Fast forward and assume that in less than 25 years we will have mastered collecting data on our neurons and know how to increase human cognition with AI implants.

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[15] Wonder Workshop. Source: **https://www.makewonder.com**.

[16] Eadicicco, Lisa. Business Insider. *Elon Musk says there's a chance his AI-brain-chip company will be putting implants in humans within a year.* May 7, 2020. Source: **https://www.businessinsider.com/elon-musk-neuralink-brain-chip-put-in-human-within-year-2020-5**.

[17] Shelton, LeeAnn. UChicago News. *How one entrepreneur is tackling humanity's most pressing problems.* September 6, 2019. Source: **https://news.uchicago.edu/story/how-one-entrepreneur-tackling-humanitys-most-pressing-problems**.

Brain implants that deliver electrical pulses tuned to a person's feelings and behavior are being tested in people for the first time. US military's research arm, the **Defense Advanced Research Projects Agency (DARPA),** has funded trials of *closed-loop* brain implants that use algorithms to detect patterns associated with mood disorders and can provide chemical or electrical simulation to bring the brain back to a healthy state[18].

We have looked at diverse examples of how AI is being applied in the educational sector, but what ties all the innovation approaches - from MOOC, to robots to Neuralinks, to AI facial recognition mood detecting software - is the fact that all these methods stimulate learning to improving mental capacity, health, and cognition. Yet, given the risks, *how critical are these innovations? Do we really need them?* A UK study found that almost half the surveyed students at universities had experienced a *serious personal, emotional, behavioral, or mental health problem for which they needed professional help*[19]. So, what complicates the matter is that the answer to the earlier questions is an initial yes, but inevitably leads to a potential loss of control. Where we may be weak as humans, AI has the future potential to strengthen our weakest links. But once the technology is created, its use cannot remain limited to serve the original purpose and to serve it within measure.

3.5 The AI vault

The social implications of any new technology can often be overlooked in the excitement to embrace it. To prepare future generations to engage and work with AI, it is important to plan the potential effect it may have on education thoughtfully and carefully to steer its impact to future generations while also rethinking access and sustainability of new education models.

According to Wolfe, et al. (2013)[20] , there are five key areas for educators to think about today:

- First is having mentors to aid how an individual learns and how she/he can be kept engaged in her/his specific environment.
- Second is focus on 21st century skills such as deep pattern recognition, while coding becomes a subject in junior school, as previously discussed.

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[18] Reardon, Sara. Gale Academic OneFile. *AI-controlled brain implants for mood disorders tested in people.* November 30, 2017. Source: **https://go.gale.com/ps/anonymous?id=GALE%7CA516460237**.

[19] Barr, Sabrina. The Independent. *Almost Half Of Students Have Experienced 'A Serious Psychological Issue', Study Finds.* March 10, 2020. Source: **https://www.independent.co.uk/life-style/health-and-families/students-mental-health-university-depression-anxiety-study-a9389571.html**.

[20] Woolf, Beverly Park, Lane, H. Chad, Chaudhri, Vinay K., Kolodner, Janet L. *AI Grand Special Issue on Intelligent Learning Technologies, AI Magazine. Challenges for Education.* Fall 2013. Version 10-Jun-13. Source: **http://gdac.uqam.ca/inf7470/Lectures/Woolf-et-al-Grand-challenges-in-ed-FINAL.pdf**.

- The third factor pertains to the gap between cognition and test scores. Institutions have to plug this by understanding the settings in which learning occurs and the kind of channels and data utilized to make assessments more relevant.
- The fourth factor is on providing universal access to global classrooms, as is being achieved through MOOCs. Many multinational companies have employed this technique to uniformly train their employees in different countries.
- Finally, there is the element of lifelong learning and life-wide learning - the age-old lesson of continuous learning has value.

More importantly, AI can allow us to unlearn and relearn in the face of rapidly changing technologies. Our most important job as educators or leaders is to ensure that we prepare future generations to be proficient and knowledgeable to function effectively and efficiently in our AI age.

3.5.1: Proactive planning

The education systems globally need to ensure that they start to proactively prepare children and citizens for life with AI. With 50% of jobs in the labor market predicted to shift from AI and robots, education must be a pillar for evolutionary success.

One of the most important steps is to ensure that current and future workforces are sufficiently skilled and well-versed in digital skills and technologies, understand AI, its value and be able to know when AI methods are appropriate or not.

Most small business owners understandably lack confidence in basic digital skills, preventing them from becoming more digital. Based on our experiences, education is needed for AI at all levels of government, business, and society. Understanding that data is an asset and developing data literacy is key: how you define the problem, how you source and harness data, how you visualize it, how you model it, and how you understand bias to ensure outcomes are relevant.

Interestingly, AI also brings with it a need to actively educate students on soft skills. While all school systems, whether public or private, must encompass **Science, Technology, Engineering and Math (STEM)** skills, they must also encourage creativity, adaptability, caring, and interpersonal skills which will ensure that the AI models are built to ethical and moral standards. They will also provide a crucial comparative advantage for humans over machines over a longer time-frame. It is important for young people to understand that the digital world is an environment similar to the physical world which contains all the biases and other limitations. Understanding the limitations of technology is really important, as is being able to demand from technology rather than being demanded of.

Educational leaders must work more closely with technology vendors and parents and consumer associations to ensure AI and digital products for kids help the learning process versus increase sense of isolation. Children have reduced attention spans. Children today have shallower cognitive capabilities and experience a loss of identity as a result of time spent online and using social media. We have already seen the impacts of how the idealized world represented on social media can lead to many illnesses, including eating disorders and serious mental illnesses. Adding AI into this mix, we predict, will further increase these social impacts. Some of the questions that educators will need to ask is how do they intend to teach children and parents from the age of three on how to protect themselves in the digital world; for example, by keeping personal information private, or in minimizing access to digital tablets, especially before bed time to enable children to wind down and rest.

As AI advances, educational groups must also strengthen their position on knowledge evolution for the betterment of mankind. Education is about knowledge access and growth to develop skills to be a better person. As the human understanding of the natural dynamics of our ecosystem evolves, we are beginning to realize how profound minor changes have been to our civilization.

Throughout history, people with knowledge from shamans to scientists were put on a pedestal, bestowed with privileges and have had their words followed. Our selective advantage with knowledge distinguished us from other species. We were quick to realize this, as those with information began to manipulate those without. This was perhaps the advent of politics. As kingdoms arrived, the first step for any tyrannical ruler was to control the information that subjects had access to. A primary example would be *Emperor Qin Shi Huang* who, upon coming to power, standardized everything and burnt all books from the previous regimes[21]. In a similar vein, modern day governments actively control what is taught in schools.

Such control of information can seriously disrupt the knowledge base of an entire race over time as significant chunks of knowledge from history just gets wiped out and people soon forget. The greatest and possibly most startling evidence of this change is the advanced technology and architecture ancient civilizations are claimed to have used, which otherwise appear lost today in present day skills. No one really knows how **Stonehenge** or the **Egyptian pyramids** were built. Some of these might just be fantastical or misunderstood trails from our past, but they do throw light on the magnitude of knowledge gaps that can occur if education becomes selective for a sustained period.

Today, the internet allows largely free access to information; what limits our reach is our inability to find the right information or source at times. Many countries still control the access to specific types of content on the internet, but increasingly these

[21] Gracy, Carrie. BBC News. Qin Shi Huang: *The ruthless emperor who burned books.* October 15, 2012. Source: **http://www.bbc.com/news/magazine-19922863**.

walls are crumbling. An AI empowered internet can be the most powerful sense making overlay but it has its limits. Think about our reliance on search engines. A robust and accurate AI search algorithm can dig out and mine data from the depths of both the online world and physical world for us as per our unique needs. In other words, if a student is looking for particular content, she/he will now be able to pull easily related information that probably lay hidden in page 50 of an average non-AI enabled Google search.

Let us plug the AI-enablement to Google's evolving algorithms that prioritize how relevant a page is to a given search, how recent its visitors have been and how frequent their visits, among other things. We are faced with two opposing possibilities as a result. On one hand, a previously evasive page will now be visible far more easily. On the other hand, suitably altering algorithms may imply that certain information would never be found because they just wouldn't show up any more. In an automated world, individuals would hardly bother with manually fishing for data that is not readily available or provided by the system. We will be exposed to what algorithms push at us. Google has already pampered us to and we trust the google search bar, perhaps far more than we should.

3.5.2: Better access and revenue models

Education is a thriving sector for the world's top universities. Many are opening up campuses abroad in developing nations to tap into international growing markets. The provision of distance education will naturally bring down the cost, turning it into a volume game. With time, we have already moved to some extent from a learning-based educational need to a branding-based one, where certain degrees are more popularly employed as a self-branding gateway to newer locations or higher paying jobs. Institutions have enjoyed supremacy because their content has not been readily available to outsiders, but in an age of MOOCs and widespread data on the internet, we will be able to create a **MeUniversity.ai** capability.

Imagine Alixia paying a hundred thousand dollars to get an MBA while her to-be-colleague in sub-Saharan Africa gets the same knowledge for a fraction of the price (or nothing at all). Consequently, the colleague would also be willing to take up work for a fraction of the pay. *Should institutions restrict informational dissipation to keep the associated brand value alive?* Or *should they turn to research centers?* If so, *where does the revenue come from?* An argument for free education has often been the incremental earning it brings, thanks to well-educated and capable resources it results in for a country. So perhaps this dilemma is a matter of how well the advent of AI and easy access to education gets compensated by the resulting brain assets in a society.

3.5.3: Behavioral predictions

Another factor for educators is to consider the impact of the penetrative power of AI in our personal lives. We looked at many examples where technology can help tutor us based on our cognitive ability, performance, and emotional state. An AI system can accurately identify such details about someone without looking deep into her personal life.

Our behavior on social media is just one such source of information that can predict our psychological and preferential status. Researcher, **Justin Cheng**, a Stanford Ph.D. student has been trying to unlock the psyche behind abusive or radical remarks and complains by finding patterns in social media messages in terms of readability, frequency of messages, and tendency to veer off topic[22]. As educators, this can help us trace potentially disruptive behavior to countering bullying and to suitably treating target students.

In a seamlessly integrated and omnipresent machine learning environment, an invasion of a student's privacy for her own good calls for strict controls and monitoring. Of course, this issue will be a recurring theme in most facets of AI applications, especially those that relate to our personal growth and interests.

Our job as leaders in education will be to balance the type of content generated in an automated way from a cognitive system, powered by AI. It cannot be too biased, nor can it be entirely unrestrained. It's a fine line and its boundaries are not clearly defined, as frameworks, ethics, and policies are in early emergence. We do predict that as the world becomes more educated and consciousness evolves, humans will be trusted to define the educational content most relevant to their needs at a specific point in time. Dynamic learning, at the point of need, may increasingly become the norm versus only formal structured learning.

A more important skill will be using the new alphabet tools supported by AI to help students explore and solve problems, with richer content and simulated real-life experiences. More students, across all ages will be able to grasp current information easily, regardless of where they live. And informed citizens are always a boon for the society.

3.6: Conclusion

Education is as central to our sustained development as healthcare is to our human race's evolution. There will always be a natural inclination of mankind to control AI's reach into education, as throughout history, we have repeatedly skewed what was

[22] Leung, Wency. The Globe and Mail. *What online comments can reveal about the person behind the keyboard.* May 9, 2017. Source: **https://www.theglobeandmail.com/life/what-online-comments-can-reveal-about-the-person-behind-the-persona/article34930289/**.

being taught in schools. In doing so, we have limited our progress. However, this change is unlike prior advancements of society. AI is automating entire industries, value chains, and technology solutions are improving the access and provisioning of data for AI to feed upon, analyze, and interpret.

In summary, the fundamental shifts from AI in education include enabling:

- **Instant communication:** Everyone will be able to instantly pair with peers to learn in real time, expand their own personal learning networks, and meet their interests and needs at any given moment.
- **Dynamic differentiation:** With AI, students and teachers will be able to connect with the resources they need exactly when they need them. Not only will the entire internet of educational resources be accessible, but all role model student assignments will surface up. More authentic learning experiences will be made available from AI. And let's not forget about the robots or voice enabled devices for 24x7 tutoring support.
- **Personalized experiences:** What better way to offer more personalized learning at a point of need and interest and find resources or create new questions and conversations for greater learning.
- **Exploration with VR/AR:** With the rise of VR and AR, and the benefits of bringing immersive learning experiences, AI will be a powerful enabler to expand practical learning beyond the limitations of the time and place of the classroom setting. AI will guide and show student want they want to explore, and find rich ways to bring the content to life instantly.

The impact of education on work and learning will be an ongoing conversation. One way to keep informed on the impact of AI will be to follow repositories like the **Getting Smart hub**[23], which is rich with content that explores educational relevancy on the implications of AI on employment, learning, and ethical issues – a conversation around how we can shape a future that works for everyone. Education is our greatest passport to the future. With AI, it is also our most powerful weapon to advance our world.

Will we create a perfect world or a perfect storm for the education industry?

[23] Getting Smart. *Supporting Leaders and Leaders in Taking the News Step.* Source: **http://www.gettingsmart.com/**.

Chapter 4
AI in Travel

Space X. Think of this name and the future of travel looks only bound by our imagination, teleportation aside. For quite some time now, we have envisioned an age when humans can travel to Mars and beyond and perhaps even settle there. Elon Musk's brainchild follows his vision to take us to space and back. Having successfully become the first private player to take two astronauts in space[1], the eventual objective is to send humans to Mars, while NASA is developing the capabilities needed to send humans to an asteroid by 2025 and Mars in the 2030s[2]. *What role does AI have to play in this scheme and in the broader travel industry?* If we think about autonomous vehicles, the picture starts to become clearer. Then again, think about virtual reality and the importance of travel itself reduces.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- Transformation occurring in the travel sector due to AI

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[1] Thompson, Amy. Space. *A SpaceX rocket will launch Starlink and BlackSky satellites today. Here's how to watch.* June 26, 2020. Source: **https://www.space.com/spacex-starlink-blacksky-global-satellite-launch-webcast.html**.

[2] NASA. *NASA's Journey To Mars.* December 1, 2014. Source: **https://www.nasa.gov/content/nasas-journey-to-mars**.

- AI innovations and applications in the travel sector
- **AI Vault:** policy, legal, and privacy challenges
- Concluding points on AI use by leisure, travel, and automotive companies

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in the travel sector.
- Learn how AI is transforming the air and space travel, public and private transportation, and hotels and tourism.
- Understand the privacy and control issues facing AI in this sector.
- Understand the policy and legal issues facing AI in this sector.

4.1: The perfect world

Alixia Bolt, boards the pilot free SuperSonic Jet, travelling 25 times the speed of sound, to go to Geneva for the *World Economic AI Forum on International Transportation Futures.* She is visiting the **World Economic Forum (WEF)** AI Chief Security Officer to have the world's first guided tour of the new all-in-one **Flexie** offering a new form of personalized public transportation that acts as a car, a plane, and a boat in one, bringing in great efficiency while allowing individuals a better substitute to personal vehicles. Flexie also has sleeping and cooking integrated quarters to give the most comfort to travelling long distances and offers voice activation, autopilot commands, or human control options.

As Alixia takes her seat, she is greeted by a voice monitor connected to her headset advising her that her pre-order snack and drink option for her 30-minute flight from Washington DC to Geneva will be brought to her after flight take-off. **Rollie** robot appears and greets the ten passengers on the flight and passes out their pre-orders. Alixia decides to check in on her cat at her condo and presses her mobile to dispense a pet treat. Arriving in Geneva, she is greeted by the Chief Security Officer of the WEF-AI. As she looks ahead, she can see a red and blue Flexie as recognition of her role as a USA Ambassador of AI International Security, waiting to take her to HQ through a few detours.

The automotive industry has experienced consolidation on all levels as trains, cars, boats, and planes have been revolutionized since the advent of AI. Fossil fuels are banned world-wide, and renewable energies are the dominant fuel sources. Companies like Ford, Mercedes Benz, and other traditional auto-manufacturers have had to adapt due to innovators like **NIO**. As Alixia sits in Flexie, her seat is automatically contoured to her body type, elongating the back seat and extending her leg reach, to accommodate Alxia's 6 feet 2 inches. A cold glass of water dispenses

from Flexie's robotic arm. Alixia's armrest immediately diagnoses her temperature and monitors her breathing patterns, and notices that she is a little congested. So, a small pin like prick dispenses a calming agent, accessed automatically from her medical files. A short burst of sound, from the AI navigation system, automatically buckles everyone up, and the guided tour begins, once as a car, then as a fly-mobile and then as a boat, before returning to WEF for a final briefing. Connected cars that advise each other of their travel patterns are commonplace now, and the extra data intelligence on all travel signals has enabled AI to advance to deeper signal insights, further protecting humans.

At the end of her meeting, Alixia is now ready to head to her hotel – in Lucerne. It's her staycation of choice when in Switzerland and a mere 10 minute ride from Geneva via the hyperloop train. Her hotel has already received her preferences and the room is ready with the precise lavender sprinkling she likes to sniff in the quiet air of her lakefront room. Late at night, as she is sipping a perfectly made cup of tea, Alixia smiles at the thought of watching Stratus beat Flexie's experience. The thought of that space shuttle does make her wonder if she'll get this divine cup of beverage tomorrow in the next hotel she is staying at. It's a space hotel[3] – sitting in the upper orbit of the Earth. Alixia argues – "*that should be no excuse for it not receiving her preferences which she has permitted to be securely shared for better guest experience*."

4.2: The perfect storm

As Alixia Bolt reaches the airport, she is advised that the pilot-free SuperSonic Jet has been grounded, for a preceding flight accidentally veered off course by misjudging a flock of birds. Alixia is glad she wasn't on the flight, but now faces a far longer travel time. She is visiting the WEF-AI Chief Security Officer to have the world's first guided tour of new all-in-one Flexie offering a new form of personalized public transportation that acts as a car, a plane, and a boat in one. As Alixia takes her seat, she is greeted by Rollie robot asking for her order. Her pre-ordered meal has naturally not been communicated to this new flight under safety and privacy controls. Unfortunately, this flight is also not carrying anything vegetarian. Alixia has to make do with the fluids available at the self-service dispenser. Enroute, Alixia decides to check in on her cat at her condo, but receives a message advising her that her smart sensor screen is on pause and needs a reboot. She sets it up remotely, only to hear that it will take three hours. *Has it been manually undone by an impostor?* There is no way to tell.

The WEF-AI Chief Security Officer awaits her with a Flexie. As Alixia sits in, her seat tries to automatically contour to her body type. The AI navigation system only has

[3] Wall, Mike. Space. *'Luxury Space Hotel' to Launch in 2021.* April 5, 2018. Source: **https://www.space.com/40207-space-hotel-launch-2021-aurora-station.html**.

her basic profile and assumes Alixia is *5'4"* – the average height of women in the US[4]. It has been inadvertently trained on a biased dataset. Alixia is very uncomfortable in her seat, reflected in her temperature, which tells Rollie that she is under some duress. It provides a small pin-like prick which dispenses a calming agent. However, a miscalculation of her body weight results in an overdose, and as the tour gets underway with international experts, Alixia is soon fast asleep. Waking up two hours later, Alixia is so upset that she chooses to head to her hotel in Lucerne, but witnesses a malfunctioning air-conditioning system in the hyperloop train. Thankfully, it's just a 10 minute ride.

Now, in her generic hotel room, Alixia reflects on her impressions of Flexie with a touch of helplessness. Despite the limited but ghastly experience, there is little she can do; for all traditional automobile manufacturers are now gone – driven out of business by falling demand, failure to adapt, and competition by newbie start-ups with little experience. Exhausted by the thought, she wonders how great it would have been if she could at least get a cup of tea just the way she likes it. Unfortunately, the hotels cannot retain her personal information due to laws in place to protect her privacy and security in an increasingly risky connected world. She could prepare the tea herself but in the absence of humans, the robotic room service is ill-equipped to manage the nuances of her requests, unless they are generic. The hotel-management profession is now obsolete, given the dearth of jobs in the space due to all-out automation. Alixia sighs and wonders how the Space Hotel would be. She's anxious at the idea of being flown up by **Stratus** – Flexie's similarly imperfect cousin. The idea of watching a clutter of innumerable satellites around her doesn't help things either. A cup of tea, she realizes, is the least of her worries right now.

4.3: The AI shift

We started our discussion with SpaceX. Mars is a rich destination for scientific discovery and robotic and human exploration as we expand our presence into the solar system. Its formation and evolution are comparable to Earth, helping us learn more about our own planet's history and future. While robotic explorers have studied Mars for more than 40 years, NASA's path for the human exploration of Mars begins in low-Earth orbit aboard the International Space Station. As such, astronauts are helping us prove out how many of the technologies and communications systems will be needed for deep space travels with humans aboard. The space station also advances our understanding of how the body changes in space and how to protect astronaut health. AI is aiding all this by allowing predictive testing simulations on equipment, smart simulator predictive sensors to control and de-risk flight plans to monitor all bodily functions, and predicting risks or automatically dispensing medicinal interventions.

[4] Medical News Today. *What is the average height for women?* March 6, 2018. Source: **https://www.medicalnewstoday.com/articles/321132**.

Travelling to Mars is the epitome of future travel for us today, with the exception of the more elusive possibility of teleporting, although scientists have already proved they can teleport quantum particles[5]. So it is not inconceivable that teleporting humans will in time be a reality. Nonetheless, the transportation industry shows how AI does not necessarily imply extreme futurism.

Autonomous vehicles are one of the biggest AI advancement areas that we have recently seen. Interestingly, it is not a new concept. One of its earliest mentions was half a century ago when Robert E. Fenton and Karl W. Olson, two engineers at **Ohio State University (OSU),** first attempted this on a highway[6].

Cars use sensors to understand the current environment around them, just the way we use our brains. By 2025, cars will effectively become computers on wheels, generating a vast amount of valuable data. We may by then have the infrastructure to process, analyze and learn from it. That is where AI comes in. Over the next ten years, it is expected that cars will no longer remain isolated modules but will be constantly cloud connected to share data captured by its sensors at a magnitude that can only be processed by machine learning and AI. The number of AI systems in vehicles may thus jump from 7 million in 2015 to 122 million in 2025, according to a report from IHS Technology[7].

With **advanced driver-assistance systems (ADAS),** the driver and cars will be able to interact with each other, achieving infotainment value in addition to evaluating both the driver and car's condition for proper functionality. It will be made possible largely thanks to deep learning, through image recognition, understanding verbal or gesture-based communication, use of sensors, and tracking of all connected units. To understand this better, consider a cloud connected ecosystem of cars equipped with sensors retrieving data during the drive. AI recognizes a pattern in how steering wheels are abruptly turned by a number of cars at a certain spot on the road and detects an obstacle there. This information can then be relayed on to the driver in a certain car about to arrive at that spot, or utilized to drive the autonomous car somewhere in the traffic. Meanwhile, with the car itself doing all the heavy lifting, its passengers would be free to use mobile for leisure or work, enhancing the use and production of data for the mobile industry, or taking a short nap to improve balance of life and work in the constant blur world we live in. That being said, *is it safe?* The answer is likely to shift over time.

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[5] University of Vienna. Phys.org. *Complex quantum teleportation achieved for the first time*. August 23, 2019. Source: **https://phys.org/news/2019-08-complex-quantum-teleportation.html**.

[6] Ackerman, Evan. IEEE Spectrum. *The Electronic Highway: How 1960s Visionaries Presaged Today's Autonomous Vehicles.* August 2, 2016. Source: **http://spectrum.ieee.org/cars-that-think/transportation/self-driving/the-electronic-highway-of-1969**.

[7] Ludwig, John. Venture Beat. *AI is already driving the future of connected cars.* March 22, 2017. Source: **https://venturebeat.com/2017/03/22/why-ai-will-drive-the-future-of-connected-cars-starting-now/**.

AI is also being actively deployed in many similar ways, especially in cases where it estimates traffic and the time taken to reach a destination to suggest the best route. Solutions like Waze and Google Maps are using AI algorithms to guide drivers. With time, cars will also be equipped with abilities such as eye tracking to monitor the driver's focus or in directing the car to a gas station or to re-charge a station when it is low on fuel, or even detect the blood alcohol levels. Imagine when your car won't start if it hears slurred words and refuses to put you in danger! All these use cases are being researched and in labs and we can rest assured that the AI race in travel products, services and solutions is under rapid transformation.

AI can also improve the internal operations of the travel industry. If we think about the entire travel process, perhaps the most significant advances have come in the pre-travel phase from inference engines using AI to suggest travel destinations based on buyer profiles, dynamic pricing of tickets, and review aggregation for everything - from hotels to restaurants to attractions-to-see. So, **machine learning (ML)** methods can easily customize suggestions for travelers based on their preference and travel history, or from sourcing friends with similar lifestyle preferences, to guide their final decision. American Express acquired **Mezi**[8] , an AI personal travel assistant, which can make travel operations smoother by taking care of up to 70% of the experience. This includes arranging your flights, booking your accommodations, and even making your restaurant reservations. And of course, it's understanding of your personal preference improves your usage to a point where a simple text request from you can do the job.

Further down the travel chain, we have the actual travel experience, either by plane, train, bus, or car. We have talked a bit about driverless cars and how they will transform transportation experiences. AI also finds itself installed in security checks at airports. Similarly, it is a major boon for cities that become better equipped for transportation planning, with constant monitoring and estimation of traffic patterns through sensors and cameras installed on roads to manage traffic congestion. What these changes effectively imply is a self-regulated, constantly AI-alert, movement that we can hop on and off to accomplish our traveling needs.

AI can indirectly help municipal revenues by improving the efficiency of the public transport system. Consider the Indian Railways – an industry so big that until recently, it had a separate day reserved in parliament for its own budget announcement, with everything else clubbed under the *General Budget* announcements. Given its sheer size, its performance has had to battle a constantly increasing commuter count. Unsurprisingly, most consequent customer complaints have been aimed at the trains' lack of quality. Today, the Indian Railway receives around 5,000 tweets a day; an overwhelming data pipe boom for an administration trying to keep up with deep

[8] MacDonald, Gayle. The Globe and Mail. *Artificial Intelligence is Changing the World. Are we Ready for It?* July 7, 2018. Source: **https://www.theglobeandmail.com/life/style/article-artificial-intelligence-is-changing-the-world-are-we-ready-for-it/**

cracks in an outdated system. Another example is that of the disastrous fire hazard incident at King's Cross station in London's underground rail network in 1987[9].

In both of these cases, the issue lies with a lack of timely and accurate communication. Humans are prone to erroneous assumptions and delays which can be countered well by an efficient AI system. Such a system could track observations and alerts in real time from passengers and officials, transmit the information across the system, and perhaps even activate remedial safety measures. AI could help ensure train scheduling assumptions are adhered to, delays are predicted, speeds of various trains in the network are optimized in relation to each other and the planned schedule, and all railways assets are tracked and monitored for optimal functionality in real-time.[10]

AI in travel also impacts other industries - insurance, for instance. For them, it will be a matter of getting advanced insight into the customer being insured or the conditions in which a car is being driven, all of which can impact the policies they create or evidence they have first-hand from street cameras, and not having to rely on what an individual says in reporting accidents. As a matter of fact, the predictability of a car or driver running into an accident can pre-emptively inform the insurers as well!

Hoteliers will also benefit as they receive updates on a current travel experience or insights from past preferences of a current or future guest, thereby enabling customized experiences best suited to that customer, even before they arrive. For example, spraying lavender in a room may be a preferred smell versus lime to help create the right mood for a customer. You may be thinking: *how does AI know you like lavender?* Companies like **Stratuscent**[11] teaching AI to smell may have the answer.

AI agents need not be that advanced though. They can be programmed to crawl the **world wide web (www)** for tweets from your Twitter handle (in your hotel permission profile) and add keywords matching to your personal profile, using a **Natural Language Processing (NLP)** agent. It can automatically select recurring word phrases like: "*I love the smell of Lavender*", "*I just planted fresh lavender in the garden*", or "*I just visited the Lavender gardens in Provence, France*." Each of these positive *Lavender* phrases gives the AI algorithm insight to what you like. This insight can be used to trigger hotel management the opportunity to create a unique experience for you. The benefits to a hotel are obvious: increasing customer loyalty with incredible and memorable experiences. The downside brings us back to privacy issues.

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[9] Gargi Sharma. Parallel Dots. *How Artificial Intelligence Can Make Public Transportation Safer.* March 31, 2017 Source: **http://blog.paralleldots.com/technology/artificial-intelligence-can-make-public-transportation-safer/**

[10] Jain, Bharti. ReadWrite. *The Penetration of Artificial Intelligence in Indian Railways.* January 17, 2020. Source: **https://readwrite.com/2020/01/17/the-penetration-of-artificial-intelligence-in-indian-railways/**.

[11] Stratuscent. *Unlocking the potential of scent detection.* Source: **https://stratuscent.com/**.

Personalization benefits can drive customers to share their stories that have become memorable to them to others in their trusted communities, only amplifying the hotel's brand and differentiating their approaches in the market. Just think of what this customer may say about her hotel visit experience if fresh lavender is in her bathroom, by her desk and on a gift sachet saying *Welcome*, making the arduous business trip just a little more relaxing. From greeting us at the hotel doors to trigger specific action points to ensure that everything is picture perfect from the moment we arrive to the moment we check out – AI sensors can handle a lot, plunging us effectively into a 24x7 AI loop between its stimuli and our response.

4.4: The AI innovations

Travel, leisure, and transportation is a broad sector, disrupted by Covid-19 but seeing significant AI investment and innovations nonetheless – perhaps even more so to make the operations more sustainable in the new age. We will see a few examples here.

4.4.1: AI in hotels

We will discuss the hotel industry being abuzz with AI's ability to learn about customers to help the hotel staff create improved customer experiences impacting their customer purchases, travel choices, journey patterns, location preferences, hotel rating inquiries, and payment methods. According to a study back in 2016 by **Travelzoo**, the majority of respondents were comfortable with robots being used in the travel industry and 80% in fact, expected them to play a part in many aspects of life by 2020[12]. Back then, of course, no one had predicted a pandemic that would hit the travel industry so hard.

Hilton, a USA global hotel chain, was one of the first on the ship with Connie the concierge. In a case of AI feeding AI, Connie utilized **WayBlazer** to advise hotel guests on places to see and other information, once again learning and improving in its communication with time. And if you may be too lazy to go to a robot to find what you can over the internet as well, Radisson Blu's Edwardian hotels introduced Edward, the chatbot[13].

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[12] TravelZoo. *Travellers Expect Robots on their Holidays by 2020*. March 16, 2016 London, Source: **https://press.travelzoo.com/robophiles--robophobes--britons-divided-over-use-of-robots-in-travel**.

[13] EventMB Studio Team. *Event Manager Blog. 3 Hotels Using Artificial Intelligence To Improve Guest Experience*. October 17, 2018. Source: **https://www.eventmanagerblog.com/ai-concierge-hotel-guest-experience**.

AI-driven chatbots can also perform other relevant tasks, including ordering meals or drinks, suggesting special dishes, controlling room temperature and lighting, scheduling a dinner or lunch, managing evening reservations, taxi booking and itinerary planning, recommending interesting sightseeing and visits, and answering critical queries. Through virtual interactions via a mobile app, Chatbots can bypass the hotel staff and be a service representative just like a human at the other end. Amazon has already been equipping hotels with its Echo device that guests can speak to in order to automate part of their stay, including drawing curtains or switching on the television[14]. Chatbots can also easily be leveraged on websites by traveling companies. The authors recall an experience with **KLM** that made a last-minute flight cancellation significantly less stressful. **Expedia**, on the other hand, allows bookings within the app. Both instances, incidentally, use Facebook Messenger[15].

Another fast-growing area of using AI in hotels is **Augmented Reality (AR)** which can enhance or change the physical space for a person, making it more dramatic or invigorating. Take *The Hub* hotel from the Premier Inn in the UK, which allows its guests to learn more about an area by pointing their phones at the wall maps in the hotel rooms. **Best Western** caters to kids by allowing them to see themselves beside virtual Disney stars, thereby increasing their propensity to visit Disneyland[16]. The psychological effects in augmenting desires can be a great hook for potential customers for any institution.

We had earlier discussed the growth being witnessed in the demand for service robots. Hotels are among its key recipients and leading companies like LG electronics are working towards the supply. One example of the robot service experience comes from Singapore Hotel Jen were **Jeno** and **Jena** may be found zipping around to deliver service to rooms. By zipping, we mean a steady 1.5 miles per hour, with sensors to help avoid obstacles in the path[17].

4.4.1.1: A scene for Alixia Bolt

Alixia Bolt enters her hotel after a long flight back from Geneva, after a successful experience testing out new NIO cars, fully AI enabled and driverless. As she enters the hotel lobby of the Four Seasons, the hotel door is automatically opened from

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14 Soper, Taylor. GeekWire. *Testing Alexa in a hotel room: We used Amazon's voice assistant inside a swanky Las Vegas suite.* January 10, 2018. Source: **https://www.geekwire.com/2018/testing-alexa-hotel-room-used-amazons-voice-assistant-inside-swanky-las-vegas-suite/**.

15 Marques, Mariana. Medium. Top 3 chatbots that are changing the travel industry. March 14, 2018. Source: **https://medium.com/hijiffy/top-3-chatbots-that-are-changing-the-travel-industry-d325082c50b8**.

16 Revfine. *How Augmented Reality is Transforming the Hospitality Industry.* Source: **https://www.revfine.com/augmented-reality-hospitality-industry/**.

17 Hertzfeld, Esther. Hotel Management. *Singapore Hotel Jen properties install Relay autonomous robots.* November 21, 2017. Source: **https://www.hotelmanagement.net/tech/hotel-jen-installs-relay-autonomous-robots.**

facial recognition. She is soon greeted by her **Peter Porter** robot[18] that is handling all her express check in and checkout needs, taking care of her payments, and ensuring her luggage is rapidly brought to her room. As soon as she reaches her elevator, she is greeted by Clio, her 24x7 robot attendant that will deliver anything she asks for: ordering and serving her meals, bringing her drinks of her choice, bringing to her room her clean linens, and also cleaning up her room.

Shortly after Clio introduces Alixia to **Tuly**[19] , it has replaced antiquated devices like light switches and clocks in all guest rooms. Instead, all Alixia has to do is to ask Tuly to make any adjustments, activated by her voice commands.

4.4.2: AI in cars

The first agenda in the use of AI in cars is to take predictive actions instead of reactive ones. Predictive breaking is a case in point. Such capability has already found its way in many mainstream cars today. But imagine drivers who never get distracted, never are sleepy, always know the best route to avoid traffic, and can be counted on to never be inebriated, or under the influence of drugs. That's the safety promise of autonomous vehicles, as we advance to cars with smarter controls, and eventually more safety. The way to that promise, though, is bumpy and more uncertain.

Cars with big eyes sum up all that companies are currently trying to achieve in our most common mode of transportation. It is almost a necessity now as car companies are striving to stay meaningful by building partnerships that can launch them towards this vision from Ford and MIT to BMW and Baidu. **HERE**, the German digital map maker has worked towards equipping drivers to see traffic conditions better in real time with contributions in data from BMW, Daimler, and Volkswagen. Insurers, municipalities, road authorities, smartphone makers, and app developers will inevitably join the HERE initiative to make the most use of this channel and to contribute to making it better[20].

There's more. NXP semiconductors' acquisition by Qualcomm was intended towards making chips for autonomous vehicles. **Cruise Automation's** self-driving software attracted GM while **Mobileye's** sensors for driverless cars caught the attention of Intel. All acquisitions went for north of a billion dollars[21].

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[18] Hertzfeld, Esther. Hotel Management. *LG Introduces Robots to replace Hotel Employees.* January 9th, 2018. Source: **https://www.hotelmanagement.net/tech/lg-introduces-robots-to-replace-hotel-employees**.

[19] Tesse, Jenna. Hotel Management. *A look inside Japan's Robot Run Hotel, Hotel Management.* July 20, 2015. Source: **https://www.hotelmanagement.net/tech/a-look-inside-japan-s-robot-run-hotel**

[20] Auchard, Eric. Reuters. *Here Automakers Team Up To Share Data on Traffic Conditions.* September 25, 2016. Source: **http://www.reuters.com/article/us-autos-connected-idUSKCN11V0VG**.

[21] Scott Nyquist. Linkedin. August 1 2017. *Why driverless cars might not hit the road so fast.* Source: **https://www.linkedin.com/pulse/why-driverless-cars-might-hit-road-so-fast-scott-nyquist?trk=eml-email_feed_ecosystem_digest_01-hero-0-null&midToken=AQGDxiYHcYplbw&fromEmail=fromEmail&ut=0rJpWqE1_GWDQ1**

Intel's Mobileye went on to catch the attention of a Chinese electric vehicle start-up and Tencent-backed NIO in 2019[22]. Then, Covid-19 hit and NIO found itself in a massive bailout situation[23]. That will likely not change the landscape though and these companies may be the ones to watch apart from Tesla. The car industry serves as a great example of AI innovation through collaborative competition. The trick behind successful AI is the optimal use of more and more data, which in turn comes from diverse sources, inevitably requiring collaboration in the value chain ecosystem.

In 2015, Gartner forecasted that about one in five vehicles on the road worldwide will have some form of wireless network connection by 2020, amounting to more than 250 million connected vehicles[24]. By the end of 2019, the company had forecasted the automotive industry to comprise over 50% of 5G **Internet of Things (IoT)** installations by 2023 – a period during which the installations themselves were expected to grow 14-fold to 48.6 units[25].

The injection of computation technology, sensors, and cloud connectivity is what effectively revolutionizes cars. Connected cars communicating with each other and with the surroundings, including street lights, signals or cameras, are fast approaching. Ford Engineer and John Cardillo have been working on the use of AI and sensors to detect staged dangers[26]. Even in the world of the **National Association for Stock Car Auto Racing (NASCAR),** we have Argo AI/Ford motor company, using deep learning to help improve safety measures[27].

Eventually, every car is likely to have a universal voice system or **vehicle-to-everything (V2X).** Already, *The Colorado Department of Transportation* has been putting up the digital infrastructure highway or the internet of roads that has the ability to communicate[28].

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[22] Tech Crunch. November 5, 2019. Source: **https://techcrunch.com/2019/11/05/nio-intels-mobileye-partner-to-build-self-driving-electric-cars-for-consumers/**.

[23] O'Kane Sean. The Verge. *Nio inks a $1.4 billion bailout as coronavirus sinks sales*. February 27, 2017. Source: **https://www.theverge.com/2020/2/27/21155949/nio-hefei-investment-ec6-bailout-coronavirus-china**

[24] Stamford. Gartner. January 26 2015. *Gartner Says By 2020, a Quarter Billion Connected Vehicles Will Enable New In-Vehicle Services and Automated Driving Capabilities.* Source: **http://www.gartner.com/newsroom/id/2970017**.

[25] McLellan, Charles. ZDNet. *Connected cars: How 5G and IoT will affect the auto industry.* February 3, 2020. Source: **https://www.zdnet.com/article/connected-cars-how-5g-and-iot-will-affect-the-auto-industry/**

[26] Harper, Brian. Press Reader. *Cars connected to everything in the works.* August 27, 2018. Source: **https://www.pressreader.com/canada/montreal-gazette/20180827/281960313614525**.

[27] Sennaar, Kumba. *Tech Emergence. Artificial Intelligence in Sports – Current and Future Applications.* August, 2017. Source: **https://www.techemergence.com/artificial-intelligence-in-sports/**.

[28] Riley, Rachel. Government Technology. *Colorado Paves Way for 'Vehicle-to-Everything' Highway Pilot.* January 7, 2019. Source: **https://www.govtech.com/fs/transportation/Colorado-Paves-Way-for-Vehicle-to-Everything-Highway-Pilot.html**.

4.4.3: AI in public transportation

Beginning with the world's first driverless bus in Lyon in 2016 to Stockholm's trials in 2018 to an amphibious bus-and-boat in Germany, AI is redefining Europe's public transportation system. And *how could ships be left out from the autonomy?* Enter Rolls Royce's partnership with Google for crewless cargo ships. And then, there's Dubai drone taxi, taking the approach to skies![29]

Japan serves as a good example. The country deployed predictive analytics developed by the **Palo Alto Research Centre (PARC)** which has helped in rail maintenance and lower false alarm rates, significantly improving delays by tackling avoidable faults like those with autonomous doors or tracks[30]. Predicting delays is something Fujitsu worked at as well, in partnership with *SRI International*, and *Jorudan Co*[31].

Prediction, of course has a flip side. Imagine a student going to Bengaluru for a **Common Entrance Test (CET)** exam that's critical to this student. This person's ticket could be auto-priced a little higher if the algorithm is designed to follow the dynamic pricing models in use today, which hike up the rates in times of high demand. The policies that companies choose to use on *AI Fairness* to treat all customers fairly will come under intense scrutiny as these practices evolve.

4.4.4: AI in airport and airlines

Airport security using AI for surveillance has been explored by the **US Department of Homeland Security** in partnership with Google, as it ran a contest to build algorithms that could automatically identify concealed items through images captured by checkpoint scanners[32]. There is also the research integrating video surveillance with AI to track passengers and their belongings through the entire checkpoint. The **Evolv Edge** system is one such example that can scan up to 900 people walking through a portable security gate, which is much faster than conventional X-ray scanners. AI can spot check any changes in line queues and analyze or predict facial expressions that may be suspicious. For instance, biometrics are being utilized to track patterns in a person's gait or any other anomalies, for that matter[33]. It can even pick up fingerprints as passengers go through the security lines and run risk analytics.

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[29] Choudhary, Varun. Hackernoon. *Examples of AI Implementation in Transport.* June 27, 2019. Source: **https://hackernoon.com/examples-of-ai-implementation-in-transport-c1a451b90fb7**.

[30] Turner, Julian. Railway Technology. *Lines of data: using IIoT and AI to improve predictive rail maintenance.* July 2, 2019. Source: **https://www.railway-technology.com/features/ai-and-iot-in-rail/**.

[31] Sapatnekar, Mrunmayi. Techseen. *Fujitsu, Jorudan to work on AI-based train delayed predictions.* Source: **https://techseen.com/2016/07/19/fujitsu-jorudan-ai-train-predictions/**.

[32] Cade Metz. *The New York Times. How Deep Neural Networks Could Improve Airport Security.* June 24, 2017. Source: **https://www.pressreader.com/canada/toronto-star/20170624/281913068117190**

[33] Airport Technology. *How can AI help speed up airport security?* January 2, 2019. Source: **https://www.airport-technology.com/features/ai-at-airports-security/**.

AI sensors will also identify what you had for lunch if food particles are left on your hands, that's a hotdog, or explosive traces. Even more fascinating will be the voice activated robots that may simply ask you how your hotdog was, and advise you on your next destination that you have been sent the top three best hotdog spots in Boston when you arrive, if interested. Every step will have AI monitoring systems as is being rapidly planned by the imaginations of the designers, futurists, and product engineers.

Aeromexico used AI to install **Aerobot** chatbot which, in six months, increased automation in the customer service department from 0% to 96% while reducing the average customer service resolution time via chat from 16 minutes to two minutes[34]. Customer service is also seeing strong deployment of robots, with the likes of EVA Air, Glasgow Airport, Japan Airlines, Haneda Airport, and KLM taking this route[35]. Meanwhile, at a **SITA Air Transport IT Summit** in Brussels, JetBlue announced that it will launch a trial of biometric-enabled self-boarding at the Logan International Airport in a project that will make use of facial recognition technology, clearly paving the way for more AI adoption in the protocols and customer's journey experience[36].

4.4.5: AI in space

Having shifted our focus from surface travel to air travel, let us go higher up, literally. For all our emphasis on the importance of AI in shaping our day-to-day travel, it is most naturally suited to space travel, as mentioned earlier, given the hostile environment we have to face beyond Earth's atmosphere and the vastness of space itself. After all, while traveling to a different planet is a beautiful dream for many, we must first transcend the time lapse in communication we are bound to face in dealing with distances measuring light years. And robots or autonomous vehicles have been braving it for some time.

Remote Agent was NASA's first AI-like software back in 1998, designed to autonomously plan a schedule and diagnose faults on spacecraft. The software has laid foundations that today help other satellites[37]. In a nutshell, it is easy to see how robots or autonomous software can help remove the need to risk humans in our

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[34] Future Travel Experience. *Aeromexico enhances AI chatbot with additional features.* April, 2017. Source: **http://www.futuretravelexperience.com/2017/04/aeromexico-enhances-ai-chat-bot-with-additional-features/**.

[35] Future Travel Experience. *HMSHost brings humanoid robots to Oakland International Airport*. January, 2017. Source: **http://www.futuretravelexperience.com/2017/01/hmshost-brings-pepper-the-robot-to-oakland-airport/**.

[36] Future Travel Experience. *Artificial intelligence, robotics and biometrics on JetBlue's technology watch list.* June, 2017. Source: **http://www.futuretravelexperience.com/2017/06/artificial-intelligence-robotics-and-biometrics-on-jetblues-technology-watch-list/**

[37] Tamela Maciel. National Space Centre. *Artificial Intelligence in Space.* March 22, 2017. Source: **http://spacecentre.co.uk/blog-post/artificial-intelligence-space/**.

hostile space. After all, neither of the two voyagers – the furthest known man-made objects in space today have had any human traveling on them.

Elon Musk, of course, wants to take us to space as we well know. There is an interesting irony there. He is wary of the power of AI in replacing humans while at the same time devising ways for us to, therefore, simply move out of this planet and settle elsewhere, inevitably with the help of technology. The irony is not lost on anyone and compels us to think of just how dystopian a world we are creating in the guise of fearing one. Or *is it that the future is bright and our fears are simply essential catalysts to lead us towards that change?*

4.5: The AI vault

AI needs continued stakeholder collaboration to ensure safety and privacy when applied to products or services that cater to us. The safety needs of autonomous vehicles serve as a case in point. Similarly, the data being exchanged by an autonomous vehicle with others on the road raise questions around privacy and control. *How do we address these?*

4.5.1: Policy and legal impacts

New policies will be required to ensure the safety of lives and also reduce injuries. It is important to put in perspective the economic and societal benefits of automated vehicles. Most people don't realize that 94 percent of car crashes are due to human error, primarily due to visual, manual, or cognitive distractions[38]. When you consider that between 35,000 and 40,000 people die in motor vehicle-related crashes in the U.S. alone each year, the number of serious injuries requiring medical attention runs into millions[39], and the overall cost runs into billions, automated vehicles start to look quite attractive. They are less error prone and have the potential to deliver both societal safety benefits and improved productivity. Even a decade back, according to a **National Highway Safety Administration (NHTSA)** study, motor vehicle crashes annually cost $242 billion in economic activity, including $57.6 billion in lost workplace productivity, and $594 billion due to loss of life and decreased quality of life due to injuries[40]. In addition to the benefits of minimizing crashes and eliminating costs, roads filled with automated vehicles could reduce traffic congestion. American

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[38] Levin, Gabriel. The Levin Firm. *What is the Most Common Cause of Car Accidents?* August 29, 2019. Source: **https://www.levininjuryfirm.com/what-is-common-cause-car-accidents/**.

[39] NSC. *Motor Vehicle Deaths Estimated to Have Dropped 2% in 2019*. Source: **https://www.nsc.org/road-safety/safety-topics/fatality-estimates**.

[40] Automated Vehicles for Safety Source: **https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety**.

commuters spend 54 extra hours in traffic congestion per year[41], with the number increasing to 119 arduous hours if you're in Los Angeles[42]. Even that, though, is dwarfed by the over 11 days spent in traffic in Colombian capital, Bogota, closely followed by the likes of Rome, Dublin, Paris, and many other global cities[43]!

If a Tesla causes an accident or an Uber speeds through a red light,[44] our society attributes that error to all autonomous car technology. This means that not only does the future of autonomous cars depend on advanced AI algorithms, self-driving cars also rely on the standardization of that algorithm across all autonomous vehicles. Without this shared technology, we can't expect our society or policy makers to accept autonomous cars on public roads on a wide-scale[45]. In fact, policy makers would also have to make road rules and regulations for autonomous vehicles to suitably monitor their movement and manage accidents. With the driver no longer operating the vehicle, *would it be fair to blame him or her for a fault in the car's running?* The onus seems to inevitably lie on the shoulders of companies manufacturing the car, ones executing the driving, and the authorities governing the traffic.

Another area of concern is that licensing and testing standards for driverless cars in USA is being developed at the state level, whereas the real solution in policy making should be in a nationally recognized licensing framework for autonomous vehicles determining appropriate standards for liability, security, and data privacy. This being said, over 33 states in the USA had introduced legislation on AV's by 2017, and 15 had enacted AV related bills by 2018.[46]

As an example of policy development, the British government set up a center for connected and autonomous vehicles to support research, development, demonstration and deployment. It launched a new safety regime, called **CAV PASS**,

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[41] Wellington, A, J. CNN. *Commuters waste an average of 54 hours a year stalled in traffic, study says.* August 22, 2019. Source: **https://www.cnn.com/2019/08/22/us/traffic-commute-gridlock-transportation-study-trnd/index.html**.

[42] Liu, Jennifer. CNBC. *Commuters in this city spend 119 hours a year stuck in traffic.* September 4, 2019. Source: **https://www.cnbc.com/2019/09/04/commuters-in-this-city-spend-119-hours-a-year-stuck-in-traffic.html**.

[43] Fleming, Sean. *World Economic Forum. Commuters in these cities spend more than 8 days a year stuck in traffic.* February 19, 2019. Source: **https://www.weforum.org/agenda/2019/02/commuters-in-these-cities-spend-more-than-8-days-a-year-stuck-in-traffic/**.

[44] Hawkins, Andrew J. The Verge. *Uber says it's reviewing incidents of self-driving cars running a red light*. December 14, 2016. Source: **http://www.theverge.com/2016/12/14/13960836/uber-self-driving-car-san-francisco- red-light-safety**.

[45] Giarratana, Chris. ReadWrite. *How artificial intelligence is driving the future of autonomous cars.* December 20, 2016. Source: **https://readwrite.com/2016/12/20/ai-driving-future-autonomous-cars-tl4/**.

[46] NCSL. *Autonomous Vehicles | Self-Driving Vehicles Enacted Legislation.* February 18, 2020. Source: **http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx**.

in September 2019, just a month after opening up data on planned changes to the road network, highlighting potential traffic jams up to months in advance, to allow tech firms to use AI to end future holiday jams due to roadwork[47].

As with most AI adoption, the primary roadblock is hit the moment we arrive at a point where technology has to mimic human interpretation of a situation. For instance, if a driverless vehicle were faced with a dilemma – risk the life of the passenger or a pedestrian – how would it make a judgment, and *how would that judgment be judged from a legal perspective?* In an often-grey zone of ethics which we have rarely been able to holistically define even in case of human drivers, and which can at times not have an absolute right or wrong choice, an autonomous vehicle would be out of its depth.

4.5.2: Privacy and control

Another issue with AI here takes us back to the point we encountered while discussing AI in healthcare. Consider the case of an AV developed by Nvidia which was tested in Monmouth County, New Jersey. The car followed an algorithm that had taught itself to drive by watching a human do it instead of following specific instructions.[48] No one knows how it computed its test drive successfully. In this case, the car made choices which were no longer actively provided by us. If we were to club this behavior with scenarios involving life and death in a real-life traffic environment, it is disturbing to acknowledge that we simply would not know or be able to predict what an autonomous vehicle would choose to do.

There is also the question of balancing privacy and control with safety and efficiency, especially if all transit – private or public – becomes AI-powered. Already, if you are walking in China and are in the research zone where **SenseTime** (an AI facial recognition and surveillance company, considered one of the world's most valuable AI startups, at over $4.5B)[49] is, it can identify details about you and your vehicle. China's public security bureau owns about 30 million surveillance cameras, though not all are smart enough to run analysis. But there are 176 million video surveillance cameras monitoring China's streets, when you consider the private owners too. With the SenseTime technology installed at major Chinese airports, railway stations, subway stations, and traffic signals, it can verify identities to track VIPs or risk individuals, while also being connected to powerful advertisers for self-service

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[47] Gov.uk. Latest Documents. Source: **https://www.gov.uk/government/latest?departments%5B%5D=centre-for-connected-and-autonomous-vehicles**.

[48] Knight, Will. MIT Technology Review. *The Dark Secret at the Heart of AI.* April 11, 2017. Source: **https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/**

[49] Marr, Bernard. Forbes. *Meet The World's Most Valuable AI Startup: China's SenseTime.* June 17, 2019. Source: **https://www.forbes.com/sites/bernardmarr/2019/06/17/meet-the-worlds-most-valuable-ai-startup-chinas-sensetime/#7c16f9d6309f**.

shopping[50]. The latter is a recommendation system based on the profile of the person gathered by the system. As an example, a person wearing a Rolex is likely a good target for a F.P. Journe watch.

4.6: Conclusion

AI's advent in the travel industry can be seen from two perspectives. First is the nature of change. This will occur in terms of the technology being deployed to build the infrastructure or to facilitate travel itself, and in terms of enabling better management of relationships with the traveler. This is the realistic part where existing examples of AI adoption have already laid the groundwork for what needs to be done in a better fashion. It's beautiful, really, to imagine a seamless provision of an Uber driver or a hotel stay that is well suited to how we would individually like our travel experience to be. Everything connected in travel will become the new normal as V2X will accelerate. This scenario is not just feasible, it is highly likely.

The second perspective refers to the rate of disruption, primarily because our imagination of applications is in hyper growth mode. As the travel industry matures in its use and experience in AI, there will be more ethical policy, legal and security frameworks in place to guide us. What is clear for AI in travel is that customer service is always top of mind, with hotels often living or perishing, based on the way customers are treated. With AI, the possibilities for improving customer experiences are endless, ranging from innovative chat bots, robots, virtual experiences etc. What we need to take into account is that all of these AI sensor experiences will in time all come together and form insights on people. As sensors move into the walls, in time some nations will also know our sleeping patterns and our mood patterns. *Do we want that?* At the end of this chapter, we deserve to know how AI makes a decision before we allow it to operate our cars for us. But then, as Jeff Clune, an assistant professor at the University of Wyoming, puts it, *"It might just be part of the nature of intelligence that only part of it is exposed to rational explanation. Some of it is just instinctual, or subconscious, or inscrutable*.[51]"

Will we create a perfect world or a perfect storm for the travel industry?

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[50] Bloomberg. South China Morning Post. *China AI champions like SenseTime are scrambling to survive Trump's blacklist.* October 29, 2019. Source: **https://www.scmp.com/tech/start-ups/article/3035279/china-ai-champions-sensetime-are-scrambling-survive-trumps-blacklist**.

[51] Knight, Will. MIT Technology Review. *The Dark Secret at the Heart of AI.* April 11 2017. Source: **https://www.technologyreview.com/s/604087/the-dark-secret-at-the-heart-of-ai/**

Chapter 5
AI in Media and Communications

In Kalki Evian: The Ring of Khaoriphea, a science fiction, we get a glimpse of the impact of AI and smart immersive technologies on the future of media and communications. In one of the chapters, one of the characters enters the long arches of Milano Centrale, a futuristic version of Milan's iconic railway station that could swell the hearts of the city's proud Milanese. As she strides past shops, she is greeted by holographic images greeting her with ongoing offers. Her determined steps, however, lead directly inside one of the trains. As she takes her seat of choice, her phone is auto-scanned to initiate, confirm, and conclude the corresponding ticket purchase. Auto-scanned by what, you may ask. *Scanners embedded at every seat? The screen in front of her?* It could even be an omnipresent wireless or cellular connectivity.

Speculation aside, this short journey harbors two omnipresent phenomena that we can realistically expect with an AI-led communication:

- First, the character's phone acts as her identification, alerting virtual salespeople to address her as she passes by the shops – something that continues our discussion on **SenseTime** in the last chapter.
- Second, her phone also takes ownership in executing decisions she intends to make by communicating with other entities (for example, purchasing the economy seat of a train). In other words, it is continually interpreting her choices.

AI's role in media and communications is a curious but also a most omnipresent force. We will now dive deeper into this latent world.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- Transformation occurring in the media sector due to AI
- AI innovations and applications in the media sector
- **AI Vault:** ethical and privacy-related challenges
- Concluding points on use of AI in the media and communications sector

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in the media sector
- Learn how AI is transforming the media sector
- Discover AI's impact on phones, decoding, news, and so on
- Appreciate the need for data alignment
- Understand privacy and ethical issues facing AI in this sector

5.1: The perfect world

Alixia Bolt enters her condominium and is greeted by Lynx, her 24X7 **cooperative robot (cobot)** concierge, asking her if she has any special preferences for music or movies. It advises her that her home's smart sensors have recently been updated, and she can also have access to a new list of releases. Lynx reminds Alixia that if she forgets a movie's name, she can describe some context and the name will be automatically presented with options relevant to her tastes.

Alixia dons her **Google Daydream View** for a virtual reality experience and asks for National Geographic and is immediately immersed in virtual reality stories of nature. Breaking news pops up at the bottom right-hand corner from a news channel in Germany, triggered by the words AI, security and breaking, among others. Alixia asks Google Player to translate the news coverage for her. As the story runs, another pop up soon appears, validating that the news is so far 96% accurate and verified. Once it concludes, Alixia looks out of her window and starts to daydream, thinking about a trip to space. And as she looks up, her screen is already promoting the 50th **Aurora Super Station** opening, comfortably accommodating over three hundred guests.

Alixia tries to control her excitement, just the way humans learned how to control their thoughts and ensure when on public channels, the right media images or sources are projected. A century ago, it was not uncommon for mistakes to be made in media that were embarrassing but as the industry and AI intelligence in media surpassed human intelligence, media and entertainment became truly what humans wanted at any time, day, or night. Neural sensors that read and interpret Alixia's brain signals are sensors that automatically parse brain waves into media intelligence beacons to surface any thoughts that Alixia is open to bringing to life via the media universe where she is connected to everyone and everything - one giant AI human and machine mesh network. While this can be potentially challenging, it has had a collateral effect of reducing exaggerated reactions and sentimental misuse by humans.

It is an experience economy, where **virtual reality (VR)** is making it possible for us to escape for micro-vacations to any corner of the Earth and beyond. It is only further bolstered by the AR augmentation that already allows so much more information and sensory pleasure to accompany every aspect of one's reality around.

5.2: The perfect storm

The experience economy where everyone is now wearing their VR glasses has immersed humans in constant 360-degree media and office avatar to conduct work. Life without it just seems so blaze and dull! Alixia Bolt enters her condominium and is greeted by Lynx, her 24x7 **cooperative robot (cobot)** concierge, advising her that the home sensor system has recently undergone an update and requires Alixia's permission to access her personal room cameras, without which it cannot operate. Saying no implies saying no to the entire system. Alixia has little choice and is left aggrieved at the idea of being exposed in her private space at a single glitch.

As Alixia dons her VR glasses for some entertainment, a breaking news story suddenly pops up. It's in German and translations are too imperfect to follow the content clearly. Unfortunately, real-time analysis of fake news is not possible; so, it might very well be that she has to sit through the entire feature before she finds out that is not true. With AI's ability to create videos out of even a single picture, political figures are continually being seen to be doing things they really are not doing.

With billions and billions of smart sensors clogging up the airwaves, the surge in outages has been steady over the past twelve months, impacting global security surveillance systems. Looking at her security AI risk predictor smartwatch, she is advised that over the next 30 minutes, over 10,000 security risk zones will likely be infected with malware, adding to her already not so perfect day. Fortunately, these global outages typically only last one to three hours, but result in significantly impacting security as signals from cars, planes, trains, traffic lights, smart home appliances, media and communication systems, robots, and even human brain

waves are at risk of intrusion. Fortunately, Alixia has back-up access to her systems, given her security profile, but most homeowners or professionals are not equipped with backup sources.

It was only yesterday that Alixia was daydreaming of a trip to the **Aurora Space Station**. Now, as Alixia looks out of her window, she can only see static screen displays, all with a blazing red statement: *All systems are down. For your safety, please return to your homes. "Ironic messaging,"* she thinks. With the smart sensors down, identity and facial recognition systems won't let most homeowners inside the homes unless they have bypass access.

So, the majority of citizens will be stranded in public locations until the power is restored.

5.3: The AI shift

AI in media and communication automates customization. It understands that unlike the physical world where any given space is fixed and common for everyone inhabiting it, multiple versions of the same space can exist at the same time virtually, each unique to an attendee and controlled in how much it superimposes with the others. Such a version of AI would be omnipresent and effectively one with our world.

This chapter is about media and communication. As you will find, it is effectively about an invisible omnipresence. That has been the nature of communication in our society. From offline gossips to constant streams of mobile networks, media changes with time but communication in some form or the other always exists. AI's contribution is to bring in behavioral analysis and customizability to the equation.

In an article on Business Insider, the author **Matt Weinberger** feels that smartphones themselves will die just the way fax machines and beepers did. He sees it as medium-term occurrence but builds on advances taking place at the likes of Amazon, Google, and Facebook.[1] For instance, Elon Musk's **Neuralink** and its goal of building computers into our brains by way of neural lace blends the digital and physical worlds in a perfect phoneless communication.

In the Alan Turing biopic, The *Imitation Game* starring Benedict Cumberbatch, a friend introduces the coy young Alan to the concept of cryptography. He explains that its brilliance rests on the fact that these are messages that anyone can see but no one knows what they mean unless one has the key. Faced with a potentially life-

[1] Weinberger, Matt. Business Insider. *The smartphone is eventually going to die, and then things are going to get really crazy.* April 2017. Source: **http://www.businessinsider.com/death-of-the-smartphone-and-what-comes-after-2017-3?utm_content=buffer36320&utm_medium=social&utm_source=facebook.com&utm_campaign=buffer-bi**.

changing moment that would lead him to build the first computer, Alan wonders how cryptography is different from talking. *People never say what they mean,* he points out.

This scene is portraying the significance of an AI intervention. Because a machine is not attuned to sentimental interpretation, its greatest challenge would be in assessing things contextually, something humans are exceptionally good at. On the other hand, many straightforward things that a person normally finds difficult to process could start becoming more reachable with AI. This includes information in a different language, research on a topic in different corners of the world, and a plethora of cultural data and wisdom that has otherwise been subjected to interpretational flaws and bias in other communities.

When it comes to relaying information, AI pervades a standard **spoken** or **text-based** engagement. With holistic patterns of what was spoken and what the ensuing reaction was, an AI-enabled tool can understand components of good music or foreign tongue, including those of certain animals or birds.

Media and communication companies face many unique challenges, including the disruption of traditional business models, new distribution channels, and the rise of content value in customer engagement experiences. As matching the right content with increasingly fragmented customer bases continue to plague this industry, telecom companies find themselves dealing with users that are less loyal and are increasingly willing to change suppliers, intensifying customer churn dynamics. They face high infrastructure operating costs from managing new networks but also support legacy products that are fully commoditized. Increasing operational efficiencies and finding new pathways for value creation have never been so top of mind in media and communication companies.

Smarter AI-driven communication is helping companies time their messages to customers, tweak the content to match the recipient's interest, and predict the risk of customer churn based on their messages. It also allows companies to engage their audience without manual intervention, thanks to chatbots. Even proactively fixing communication infrastructure based on its risk of imminent damage is helping ensure our globally connected world doesn't suffer from avoidable lapses in its digital connectivity.

AI in communication is also benefiting from the advent of the **Internet of Things (IoT)** which allows us to communicate with things or vice versa; of blockchain, which ensures secure communication even between strangers; and of 5G, which offers AI the speed it deserves to maximize its data capture and analytical capability. The consequent world of *smart everything* is one where our devices will graduate from being voice-controlled to even predicting our behavior or requirements and communicating with each other to render the task complete. As an example, imagine driving back from the office. As the car approaches home, the car communicates with

parking garage doors to open. The doors communicate with the home's temperature control to automatically heat or cool to an optimum preferred temperature. The system instructs lights to switch on in the rooms you would be walking into as you freshen up, and switching off for better energy control. And so on. All this enablement will require robust connectivity, bringing the device manufactures and network carriers in front and center. In some ways, they already are, as evidenced by the race to champion 5G and the power play unfolding around it. We will discuss this in detail in the chapter on policies.

5.4: The AI innovations

The AI shift in media and communication is fundamental and a case of multiple technological developments merging. A good way to appreciate the impact of AI in media and communications is to look at the use cases in the market to gain context of what is already here and also what is coming.

5.4.1: Use of AI in media and music

AI can help the music industry track who's listening and how it's being shared in a better way, in turn enabling micropayments on each usage. Consider **JAAK**[2] which uses the blockchain technology to identify the usage and rights to songs streamed. It enables apps and platforms to identify who is streaming a song and when, identifying the multiple rights holders, and assigning corresponding payments. It is planning to use AI to provide usage analytics to its customers.

SyncSpot[3] utilizes AI on the promotional front by matching brands for co-promotion. Coachella, Heineken, and Unilever have all benefited from its services.

AI helps in song creation too. Break free is quite an ironic title for a solo single that has been produced by AI, but the musician Taryn Southern certainly struck a chord there. It was created using the AI platform, **Amper**[4] , which received inputs such as the preferred genre, instruments to be used and beats per minute, and produced disjointed verses that could be rearranged into a song[5]. That was not a lone wolf

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[2] Castillo, Michael del. Forbes. *Exclusive: From CryptoKitties To Cardi B: Warner Music Joins $11 Million Investment In Ethereum Replacement.* September 12, 2019. Source: **https://www.forbes.com/sites/michaeldelcastillo/2019/09/12/exclusive-from-cryptokitties-to-cardi-b-warner-music-joins-11-million-investment-in-ethereum-replacement/#326efe532b21**.

[3] SyncSpot. Source: **https://syncspot.net/**.

[4] Source: **https://www.ampermusic.com/**.

[5] Plaugic, Lizzie. The Verge. Musician Taryn Southern on composing her new album entirely with AI. August 27 2017. Source: **https://www.theverge.com/2017/8/27/16197196/taryn-southern-album-artificial-intelligence-interview**.

situation though. NLP has been used in creating stage performances[6] while platforms like **WordsEye** have generated 3D scenes from natural language text[7] to stoke its users' creativity. There is also **Weav**[8] which creates variations of a song to match the energy and mood of the listener in different circumstances. Think about acoustic versions of hard rock tracks. Consequently, the tool can be used to sync music to a range of situations – from active training to sex.

5.4.2: AI decoding in linguistics

The need to corroborate the extent of realism in AI's fantastic transformation of media and communication is prompted by the mention of decoding animal linguistics. **Gavagai AB** is on a mission to decode the dolphin-language dictionary by using AI to deduce their complex communication system. Their system called **Cetacean Hearing and Telemetry (CHAT)** has already mastered over 40 human languages. Similar techniques, in fact, are underway with AI to allow us to communicate with our pets.[9] It is worth wondering whether understanding and communicating with dolphins would imply that we will also get a better understanding and communicating with each other. More importantly, it will likely allow more empathy among us for our pets. This level of contextual and cultural complexity seems much more far-fetched to maneuver around for AI. If AI could speak, it would have a standard response: it all exists in the patterns.

5.4.3: AI in news

The use of AI in journalism has helped to rapidly expand coverage – from 300 to 4,000 company earnings reports in case of the Associated Press, which led to increased trading activity and market liquidity, thereby strengthening the market. AI also allows quicker real-time analysis of news as in the case of **Graphiq** and quicker content creation such as generating short videos from the text as in case of **Wibbits**.[10]

Such analysis or creation could take days and weeks but are now shortened to minutes. In fact, the co-founder of Narrative Science had once predicted up to 90% of articles will be written by AI in the next 15 years [11]. **Wordsmith**, developed by

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[6] Annie Dorsen. August 1, 2016. Source: **http://www.anniedorsen.com/**.

[7] WordsEye. August 1, 2016. Source: **https://www.wordseye.com/**.

[8] Source: **https://www.weav.io/**.

[9] Thomas, Anu. *Analytics India Magazine. With AI Translation Technology, You May Soon Be Able To Talk To Your Pets.* February 11, 2020. Source: **https://analyticsindiamag.com/with-ai-translation-tech-you-may-soon-be-able-to-talk-to-your-pets/**.

[10] Hall, Stefan. Qrius. *Can you tell if this was written by a robot? 7 challenges for AI in journalism.* January 21, 2018. Source: **https://qrius.com/can-tell-written-robot-7-challenges-ai-journalism/**.

[11] Levy, Steven. Wired. *Can an Algorithm Write a Better News Story Than a Human Reporter?* April 24, 2012. Source: **https://www.wired.com/2012/04/can-an-algorithm-write-a-better-news-story-than-a-human-reporter/**

Automated Insights, helps bring professional sports to our screens. It has allowed Associated Press to increase its reporting capacity to cover 13 leagues and 142 Major League Baseball (MLB)-affiliated teams by translating hard data from MLB into narratives using natural language[12]. The technology can save journalists time, freeing them up to conduct interviews with real people.

The use of AI in news is not all rosy. There is the beast that is fake news. With time, the technology has already gotten more dangerous. Consider Samsung's **Deepfake AI** that can generate an entire talking video of you from a single profile pic[13] and profile pics are almost always publicly visible and accessible! But there are also those meeting the challenge head-on. Twitter started providing additional information, context, and tags to mark misinformation or allow users to check credibility in real-time.[14] MIT **Computer Science & Artificial Intelligence Laboratory (CSAIL),** meanwhile, has been working on an AI system that can determine accurate or biased news by cross-referencing Wikipedia, Twitter, URL structure, traffic, and other such areas. The system was 65% accurate at detecting a site's level of factuality and roughly 70% accurate at detecting political bias.[15]

There is also the sheer volume of publication of AI research to consider in this sector. US has historically led the way in both the number of publications and their importance. But China's AI researchers have steadily progressed in recent years with consistently more deep learning papers published than others did.[16]

5.4.4: AI in advertising

Personalization is one of the great gifts of AI to advertisers. The ability to micro-segment their customers and deliver the perfect promotion just when a target needs it most can lend immediate and attractive ROI. Techniques like **Reinforcement Learning (RL)** have offered companies the ability to test out multiple advertisement

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[12] Sennaar, Kumba. Tech Emergence. August, 2017. *Artificial Intelligence in Sports – Current and Future Applications*. Source: **https://www.techemergence.com/artificial-intelligence-in-sports/**.

[13] Solsman, Joan E. CNet. *Samsung deepfake AI could fabricate a video of you from a single profile pic*. May 24, 2019. Source: **https://www.cnet.com/news/samsung-ai-deepfake-can-fabricate-a-video-of-you-from-a-single-photo-mona-lisa-cheapfake-dumbfake/**.

[14] Roth Yoel; Pickles, Nick. Twitter. *Updating our Approach to Misleading Information*. May 11, 2020. Source: **https://blog.twitter.com/en_us/topics/product/2020/updating-our-approach-to-misleading-information.html**.

[15] Clark- Towers, Charles. Forbes. *Can AI put an End to Fake News - Don't be So Sure*. October 4, 2018. Source: **http://www.forbes.com/sites/charlestowersclark/2018/10/04/can-ai-put-an-end-to-fake-news-dont-be-so-sure/**.

[16] Larson, Christina. Science. *China's massive investment in artificial intelligence has an insidious downside*. February 8, 2018. Source: **https://www.sciencemag.org/news/2018/02/china-s-massive-investment-artificial-intelligence-has-insidious-downside**.

variations in real-time on-the-go to quickly identify the best of the lot and show it to consumers in real-time. As a result, most advertisements you come across likely are AI-delivered.

Amplero provides critical customer data to allow more customer interaction across all channels. **GumGum** allows advertisers to optimize ad placement across platforms. And Lobster allows advertisers to generate ads by scanning major social media sites for most relevant or trending content.[17]

Consider Netflix recommending movies or TV shows to you. Or Ads you see on Google search, YouTube videos, or even in your email. Think about the Ads you find on social media in between posts. All AI-enabled. In fact, the technique can do for marketers what it does for news, by helping create content. Going back to the Netflix example, where the company raised the bar even further was producing its hit *House of Cards.* Netflix committed to two seasons with a big of $100 million, without seeing a single episode; all thanks to an analysis of 30 million *plays*, 4 million ratings, and 3 million searches to uncover the target audience's taste[18] identified through as many as 70,000 attributes of movies and TV shows.[19] The success of similar shows and others produced by its director and the popularity of its actor all featured in the calculations. And of course, trailers were optimized by the audience type too, as mentioned before. The success of predictive analytics in finding and producing hits has seen other major movie houses jump in too.

AI insights to predict the box office success of films are also being delivered to production houses by start-ups like **Cinelytic, ScriptBook**, and **Vault**, with some even being twice as accurate[20]. Once again, the question it brings to us is whether we will lose diversity in movies if the same formula informs all future movie making.

Another example of AI is its ability to reliably correct conventional wisdom. **Persado**, for example, analyzed 18 million messages across 180 brands in 2019 to identify words that truly resonated with customers. Using such approaches, JP Morgan Chase found that shorter messages were not necessarily the most effective. This allowed them to switch from *take advantage of today's mortgage rates to congratulations, you're on the right track. Come see if you pre-qualify for a home loan*.[21]

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[17] Bruce, Debra. Knowledge Nile. *Artificial Intelligence in Advertising: Examples & Applications*. Source: **https://www.knowledgenile.com/blogs/artificial-intelligence-advertising/#GoogleAds**.

[18] Petraetis, Greg. Insider Pro. *How Netflix built a House of Cards with big data.* July 13, 2017. Source: **https://www.idginsiderpro.com/article/3207670/how-netflix-built-a-house-of-cards-with-big-data.html**.

[19] Netke, Shirish. Wiley. The RegTech Book: *The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries in Regulation*. Source: **https://books.google.ca/books?id=78ynDwAAQBAJ&pg=PT197**.

[20] Tercek, Robert. Medium. *Synthetic Personalities*. June 3, 2019. Source: **https://medium.com/id-in-the-iot/artificial-intelligence-is-completely-reinventing-media-and-marketing-d724c150ece3**.

[21] Baciu, Assaf. CMO by Adobe. *How AI Can Change The Way You Talk To Customers*. Source: **https://cmo.adobe.com/articles/2020/3/how-ai-can-change-the-way-you-talk-to-customers.html**.

5.4.5: AI in phones

Huawei has developed an AI enabled phone that can enable some futuristic features such as touch-free gesture control and smart rotations. It enhanced its effort to ensure the phone recognizes the objects being snapped and improve the photo on its own[22]. **Skylum**, meanwhile, is aiming to allow smartphone images to be upscaled and printed at an incredibly high resolution and sharpness.[23]

Phones are the perfect incubators of AI, with so much data and so many use case possibilities in play at all times. Face recognition, fingerprint scanners, Siri or Google Assistant, GPS, and auto-relaying of relevant news or articles as per our interests are all features most of us are now habituated to. Each of these rely on AI. Likewise, most apps today are AI-based or AI-enabled.

With digital data accumulating bread crumbs on everyone through all our media and mobile interactions, we are entering a new world where surveillance capitalism has the risk of going mainstream.

According to **Harvard Academic**, Shoshana Zuboff, surveillance **capitalism** is defined as: *"a rogue force driven by novel economic imperatives that disregard social norms, and nullify the elementary rights associated with individual autonomy. In other words, it's bad for you and bad for everyone else too."*[24]

5.5: The AI vault

We saw that communications and media companies are actively embracing artificial intelligence. A March 2018 Accenture Strategy research[25] found that 63 percent of telecommunication and media executives anticipate AI will drive additional revenue and growth opportunities by accelerating the introduction of the new products and services they take to market. The research study, although not a surprise, also found that to take advantage of AI, a deeply thought out AI strategy was key to getting applied intelligence right across all levels of their core business to solve complex challenges.

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[22] Synced. Medium. *Huawei Flexes AI Muscle With New Mate 30 Gesture Control and Smart Rotation.* September 20, 2019. Source: **https://medium.com/syncedreview/huawei-flexes-ai-muscle-with-new-mate-30-gesture-control-and-smart-rotation-a2e01afdc034**.

[23] Tchebotarev, Evgeny. Forbes. *AI is Changing The Way We Think about Photography.* May 30, 2018. Source: **https://jaak.io/https://www.forbes.com/sites/evgenytchebotarev/2018/05/30/ai-is-already-changing-the-way-we-think-about-photography/#3c80d8ccbb6a**

[24] Zuboff, Shoshana. PublicAffairs. *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power.* January 15, 2019. Source: **https://www.amazon.com/Age-Surveillance-Capitalism-Future-Frontier-ebook/dp/B01N2QEZE2/**

[25] Weitz, Jonathan. Accenture Research. *Planning for AI-driven Growth.* March 2, 2018. Source: **https://www.accenture.com/us-en/blogs/blogs-artificial-intelligence-communications-media**

Modern AI requires access to large and diverse data sets. So, getting organized to source the data easily is key before developing advanced AI approaches to enable insights for decision making. Once the data pipes are streamlined, the focus needs to shift to the best in class prioritization of use cases with demonstrated value to the long-term goals of the business. Strong collaboration is needed with business strategists, data, and AI professionals to ensure the right programs are prioritized against a myriad of possibilities. By collaborating with data teams, strategists can continue to multiply AI use throughout the enterprise.

An AI system-generated communication might initially be like a *baby talking* - without malice or social consideration of what is the right thing to say. But perhaps, it will help us surpass the games humans have played with words throughout history. Bad news for politicians. Great news for theologists. As for the larger question of a future AI robot plotting against us for the sake of our best interests, we must now turn to the man who showed us the way through fiction in his short story: *Too Bad!* There, we have a robot who is miniaturized to enter a patient's bloodstream and destroy his tumor. Once it has cured the host's cancer, it chooses self-obliteration to prevent any fatal risk its exit from the patient's body posed to his life. That genius author's name was **Isaac Asimov** and his way consisted of three simple rules, or *Laws of Robotics* [26], as follows:

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 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.

AI-led communication feels concerning at first due to recent developments that have come to light. Notably, we speak here of two AI chatbots that apparently developed their own language by modifying the English language to make it easier for them to communicate with each other.[27] That was just an experiment and a loosely interpreted version of actual events but it laid bare the natural progress of things: If we teach a system to self-communicate, it will do exactly that. So *how do we then control it and make sure that such a system talks but only as per our wishes?* The answer leads us to a more powerful ethical consideration – one that requires some introspection.

Suppose AI managed to deduce what dolphins are talking about. *What does that mean for us?* Naturally, it would allow us to then find a way to talk to them. *Would that necessarily be a good thing?* There are a couple of issues:

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[26] Three Laws of Robotics. Source: **https://en.wikipedia.org/wiki/Three_Laws_of_Robotics**.

[27] Griffin, Andrew. Independent. July 31 2017. *Facebook's Artificial Intelligence Robots Shut Down After They Start Talking to Each Other in Their Own Language*. Source: **http://www.independent.co.uk/life-style/gadgets-and-tech/news/facebook-artificial-intelligence-ai-chatbot-new-language-research-openai-google-a7869706.html**

- First, *how can we verify that our interpretation of complex communication really is correct?* After all, we fail at that task even among different human cultures. Perhaps, our focus would initially remain limited to understanding basic expressions of joy, pain, and so on.
- The next issue is with what we do with that understanding. Acting on it would imply humans interfering yet again with nature. While it could have medicinal or security value in guiding dolphins, such power is just as likely to be misused.

There is also a more uplifting side to this. Consider the example of Taryn Southern, the musician who produced a solo album using an AI platform. In comparison to working with human collaborators, she found working with AI to be more freeing and liberating[28]. This once again brings to mind the Oscar-nominated movie, Her, where Joaquin Phoenix's heartbroken Theodore finds companionship and love in his phone chatbot, **Samantha**, voiced by Scarlett Johansson. She understands him far more deeply, is far less expectant of responses, and is available whenever he wants. This pamper-phenomenon that we otherwise try to achieve with pets is an amazing example of just how engaging AI communication can be. However, a vulnerable Theodore does eventually learn that Samantha is simultaneously talking to 8,314 other individuals, 641 out of whom she is in love with each being genuine on its own. *Why is this scene important, and why now?* It is because in talking about AI ethics, we always tend to discuss it in terms of our safety and wellbeing. The tryst between Samantha and Theodore, however, brings us to a different question: *Is ethics in AI necessarily a case of the technology complying with what we consider ethical, or is it at times a matter of us changing our definition of ethics circumstantially?*

It is the wall that we face all our lives: *accepting a different stream of thought that is not evil, but just different.* It is a cultural, generational, or even theological challenge that most fail to overcome. So, in a way, some things about AI's insurgence are designed to make us face and evolve as a species, redefining some of our present customs and ways of existing in society, including our biases and racism. So far, our concerns have remained constrained to the imagination rendered by movies like **The Terminator** or **The Matrix**. This is why technology giants like Google, Facebook, Amazon, Microsoft, and IBM have come together in an initiative called **Partnership on AI**[29] to ponder over the risks and strategies around AI in an open platform for the benefit of society.

Magic Leap[30] is a wearable computer that brings the virtual world and physical world together. It is an art brought to life by a mix of left brains and right brains

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[28] Plaugic, Lizzie. The Verge. August 27 2017. *Musician Taryn Southern on composing her new album entirely with AI*. Source: **https://www.theverge.com/2017/8/27/16197196/taryn-southern-album-artificial-intelligence-interview**.

[29] Partnership on AI. September 12th 2017. Source: **https://www.partnershiponai.org**.

[30] Magic Leap. Source: **https://www.magicleap.com/en-us**.

at work. Researchers, computer scientists, operations managers, and engineers take care of the processes and strategy of approach, while more creative minds like writers and designers bring in the imagination and vision. Companies need to take serious note of this. We often talk about the need for companies to adopt AI as a new technology and to enable teams to utilize it. Yet, the company that wins the AI race will be the one that understands that the power of this technology can only be fully utilized through a collaboration of different minds within the company. Working in silos and distinct departments will not help and that can mean a fundamental change to the way we work in the age of AI.

And finally, we have the issue of privacy and control, put at risk by our growing culture of surveillance capitalism. When every IOTA of our behavior becomes an ingredient for product or service improvement, the upside of creating better experiences for us can quickly be overpowered by the downside of us losing control over those experiences. Today, digital connectivity is everywhere and driving new ways of interacting. Going by older definitions of capitalism which focused on labor, surveillance capitalism is always on – always collecting feeds on every aspect of a human's existence. Google can be viewed as the start of surveillance capitalism collecting all your searches, click-through, and forming a picture of your interactions. Fast forward! We have Facebook, Microsoft, Twitter, and Amazon, all collecting insights on you. Even global brands like Thomson Reuters are analyzing everything you read and surfacing up articles or media reports that will most interest you.

In Toronto, there was a project called **SideWalk** Labs, which was building an infrastructure from scratch with Alphabet (Google) which was targeting to serve surveillance intelligence, with the likes of autonomous cars, intelligent rubbish collection, smart air quality measurement, and heated streets made possible. The vision was incredible, though could have led to data collection on individuals on an unprecedented scale. Nonetheless, debates on Google owning the data for the local Ontario province in Canada were not able to harmonize with Google and in 2020, Google pulled out.[31]

Bringing together diverse ecosystems requires tremendous legal planning and goodwill and keeping an eye on the bigger vision to innovate to learn from. Another example would be EU and Google's hard-fought case on the *Right to Forget*, which gave EU citizens the power to demand data about them to be deleted. However, Google eventually won the case, requiring it to only remove links from its search results in Europe, but not anywhere else.[32] This is the level of stickiness of information on us, once it finds its way in the digital world.

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[31] Smart Cities World. *Sidewalk Labs shuts down Toronto smart city project.* May 11, 2020. Source: **https://www.smartcitiesworld.net/news/news/sidewalk-labs-shuts-down-toronto-smart-city-project-5262**.

[32] Kelion, Leo. BBC. *Google wins landmark right to be forgotten case.* September 24, 2019. Source: **https://www.bbc.com/news/technology-49808208**.

5.6: Conclusion

As seen in this chapter, media and communication has been our most consistent use of AI. We are already getting used to the reality of AI guiding us as we now easily give instructions to Siri or follow Netflix's recommendations. The technology's role is to allow new and efficient ways for us to communicate, whether through virtual reality or through accurate interpretation of a message in text or art form.

Yes, the chances of two AI systems having a side conversation is a real possibility, but we cannot tackle the problem by preventing it entirely, for we cannot prevent it without limiting our own growth. Instead, we have to first face our own fear every time we become uncomfortable imagining two people - or in this case, chatbots, having a secret side conversation which we presume to be against us. After all, AI chat is not gossip. And ironically, as in the case of AI-powered homes and IoT, we are already encouraging different devices to communicate with each other.

As we look ahead to the future of media and communications industry transformation, AI's impact on this industry is already visible in patterns today. Our businesses and homes are controlled by wireless and increasingly sensor armed devices that will all have smarter AI chips and AI deep learning algorithms monitoring all our business and home networks, computers, or mobile.

As the wall of everything connected continues to grow, and new artifacts enter our everyday lives, like robots and other intelligent devices, leaders in this sector will need to think hard about the impacts of collecting content from diverse sources and the evolution of sense-making to play out the society we deserve. Most important, we must ensure the media news is trustworthy and accurate.

What is going to be critical is to understand the risks of surveillance capitalism as it is no longer just the internet collecting data on us, it's the risk of what this data will do to invade our freedom. Advertising and media pose one of the greatest risks for surveillance at scale, as not only are companies monitoring your habits, and interactions, but also shaping those interactions to encourage you to make choices. These are some of the darker sides of AI enablement that are creating super personas without authority from you.

This is a new world where media and AI super intelligence is infused into everything. *Will it make for a perfect world or a perfect storm?*

Chapter 6
AI in the Public Sector

In the previous chapter, we discussed AI's omnipresence through media and communication, and its resultant impact on privacy and control. These aspects of AI require governments to step in for effective legal and ethical compliance. As we saw, Isaac Asimov laid out his three golden rules to aid our approach towards robotics and AI. For robotics and AI to attain legal status, we first need governments to acknowledge and understand why we need them. For this to happen, governing bodies all round the world must first open up to the concept and possibilities of AI. Unlike most sectors where the AI shift is about an increase in scope and speed of an already ongoing AI adoption, in the case of governance, it is understandably about bringing openness towards AI's adoption. This will be our focus in this chapter.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- Transformation occurring in the public sector due to AI
- AI innovations and applications in the public sector
- AI Vault: ethical challenges and dangers of biased data
- Concluding points on the use of AI by governments and public sector units

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in the public sector
- Learn how AI is transforming the public sector
- Discover the impact on AI on taxes, defense, education, healthcare and immigration from a governmental perspective
- Develop leadership on AI in the public sector
- Understand what governments need to do to drive AI growth adoption

6.1: The perfect world

Like most mornings, Alixia asks **Google Duplex**[1] to source the latest government security news. Automatically, all global articles are ranked according to security risks. Alixia's usual routine is to read the top ten security risk classified articles. Today, she only sees two articles – one on slaughter-bots reporting on drone swarms, fit with small explosives and self-driving technology, used in a political rally to suppress dissidents in a fourth world country. The other is focused on hyper personalized disinformation campaigns which had been set up to target every individual voter with a distinct set of fake news designed to influence their behavior in the upcoming elections.

Alixia need not worry. Her Senior Cyber Security Engineer, Harry Hacker, has already been informed by his Duplex that predicted that Alixia will want a report on the slaughter bots. He immediately advises Alixia that the United AI Nations has just sanctioned the release of airborne robotic machine viruses in the region, which will penetrate the drone shell armor and deactivate any explosive risks. In Alixia's role overseeing security for Central AI, the global hub for AI intelligence, she recognizes that every day she is responsible for ensuring the safety of all nations from cyber robots or drone attacks, generated by rogue terrorists. But on a day when the system cannot even procure more than two such rogue instances, clearly it is a job well done.

Alixia settles back in her chair. Her mind is gathering how it has come to be that a world with such massive possibilities of damage at every step isn't seeing one. Global connectivity enabling education, healthcare, and food security spring to the mind first. The benefits of such foundational well-being candidates for the next election across much of the world have already been filtered based on the minimum required education levels and mental and physical health. This ensures qualification

[1] Leviathan, Yaniv, and Matias, Yossi, *Google Duplex: an AI speech synthesis program and neural network allowing it to understand context and respond accordingly.* Source: **https://ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html**.

before popularity and power in the world's politicians, which in turn keeps so much of global governance running soundly and progressively. And at the heart of it all are stable, functioning AI cyber security risk monitoring systems. For today, they are keeping governments and citizens safe.

6.2: The perfect storm

Like most mornings, Alixia asks Google Duplex[2] to source the latest government security news highlights, ranked by perceived risk levels. Alixia's usual routine is to read the top ten security risk classified articles. That's easier said than done from a regular influx of such articles. Today, she sees that there are over 5,000 slaughterbot drone swarms that are fit with small explosives and self-driving technology that have resulted in thousands of deaths in the last two days alone. In addition, the escalation of fake news, hyper personalized disinformation campaigns which had been set up to target every individual voter with a distinct set of lies have been propagating daily news feeds. It is increasingly difficult to separate the truth from the fake noise.

Alixia calls her Senior Cyber Security Engineer, Harry Hacker, who has already been informed by his Duplex's predictive model that Alixia will want a report on the slaughterbots. There's little he can do, though, as he immediately advises Alixia that the United AI Nations are still in flux over disagreements among member countries on the best course of action. In Alixia's role, overseeing security for Central AI, the global hub for AI intelligence, she recognizes that public sector bodies in different fields are simply unable to keep up with the pace at which AI can strike. Every day she internalizes that her ability to ensure the safety of all nations from cyber robots or drone attacks generated by rogue terrorists is increasingly compromised.

Alixia settles back in her chair; her mind is gathering how a world with such massive possibilities of damage at every step can possibly be secured. Global connectivity could have enabled education, healthcare, and food security, but has instead given way to easy access to hackers and rogue threats. Many candidates for the next election across much of the world have already secured means to subliminally influence vote banks with unverifiable claims and micro-personalization. An informed vote bank is a distant dream, and as a result, so is an efficient government office. At the heart of it all are cracking AI cyber security risk monitoring systems. Today, like most days, Alixia sinks in further with a feeling of guilt at not being able to stop any of it. Today, like most days, she will still try.

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[2] Leviathan, Yaniv, and Matias, Yossi, *Google Duplex: an AI speech synthesis program and neural network allowing it to understand context and respond accordingly.* Source: **https://ai.googleblog.com/2018/05/duplex-ai-system-for-natural-conversation.html**.

6.3: The AI shift

We are witnessing a great deal of activity as forward-looking government leaders are acting now to prepare public sector organizations to fulfill the promise of AI. Given the nature of governance, the incentive to engage in AI-related discussions can differ between capitalist and communist entities. So, perhaps this only reinforces the importance of AI further when all these differing ideological bodies start formulating policies around the new technology.

Based on the discussions underway globally, AI is now big government news. This is exactly the shift we saw when in 2018, the European AI Alliance was formed to guide a high-level group on AI, which was meant to draft AI ethics guidelines and also contribute to the European debate on AI, all of which would feed into the European Commission's policy-making in this area. Even earlier, in 2016, the Obama administration had released a **Request for Information (RFI)** for AI[3]. The objective was to solicit views on AI across sectors and stakeholders to determine the country's inclusive strategic and policy direction.

The RFI was not the only move from the US government back then. Earlier in May 2016, the White House had announced a number of new actions related to AI[4]. It involved inter-agency working groups and a series of workshops to explore the benefits and risks of artificial intelligence on legal and governance, social good, safety and control, and social and economic implications.

Why was this development so important?

There are two reasons for this:

- First, it lent an immediate sense of legitimacy and accountability to a technology that had been until then been merely a powerful new tool to explore. Responses to the RFI came in offering greater clarity, with IBM's example being particularly telling. As the poster child of the AI era, thanks to Watson's much-televised victory in *Jeopardy!*, IBM is one of the technical authorities on the matter. It produced a document whose first act was to redefine AI as *Augmented Intelligence*.[5] It went on to explain the benefits of AI to each major sector, direction of ongoing research, and the importance of sharing data to enhance datasets for AI's efficacy. The paper argued for incentives favoring a people-centered design and responsibility

[3] Federal Register. *Request for Information on Artificial Intelligence.* June 2016. Source: **https://www.federalregister.gov/documents/2016/06/27/2016-15082/request-for-information-on-artificial-intelligence**.

[4] The White House. *Preparing for the Future of Artificial Intelligence.* May 2016. Source: **https://obamawhitehouse.archives.gov/blog/2016/05/03/preparing-future-artificial-intelligence**.

[5] IBM. Response to - *Request for Information Preparing for the Future of Artificial Intelligence.* July 2016. Source: **http://research.ibm.com/cognitive-computing/ostp/rfi-response.shtml**.

as a fundamental focus pillar for any AI development. In doing so, IBM's response also gave us a glimpse into the nature of shift taking place in AI governance, with a focus on facilitating a fact-based dialogue, progressive socio-economic policies, education and workforce programs and investments in interdisciplinary research.

- The second reason pertained to international influence. White House's RFI was also influenced by China's plan on AI.[6] This plan focused on product development, strategic R&D, and growing the AI industry itself – all aimed at achieving leadership in innovation by 2030. Its strategy was to enhance coordination between private players and research centers such as foreign universities while building its own innovation expertise by optimizing its use of both domestic and international *innovation resources*.

Recent AI advances have made it possible to identify individuals not only in up-close still photos, but also in video—a far more complex scientific task. China's acceptance and deployment of such technologies is in sharp contrast to US, where plans to use facial recognition on selected flights met with intense uproar. In China, surveillance cameras were found every hundred meters or so in several cities. The same report that claimed this notes that even toilet paper in some public restrooms were being dispensed, in limited amounts, after a facial scan[7]. Such developments open the ground for debate on which side has it better – individual privacy in US or social security in China.

One issue with surveillance technology is that it is not necessarily accurate in recognizing and classifying ethnically different faces, as they are trained on image databases that do not always include a healthy mix of all races. A good example would be AI's comfort today with recognizing a Christian bride but not a Hindu bride carrying significantly more facial make-up.

The AI race has drawn reactions from other countries too, like Canada. Industry and government there had pledged more than $500-million toward AI, which led to the rise of powerful institutions such as the **Montreal Institute for Learning Algorithms**, the **Vector Institute**, and the **Alberta Machine Intelligence Institute**.[8]

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[6] Kania, Elsa. Lawfare. *The Dual-Use Dilemma in China's New AI Plan: Leveraging Foreign Innovation Resources and Military-Civil Fusion.* July, 2017. Source: **https://lawfareblog.com/dual-use-dilemma-chinas-new-ai-plan-leveraging-foreign-innovation-resources-and-military-civil**.

[7] Larson, Christina. Science. *China's massive investment in artificial intelligence has an insidious downside.* February 8, 2018. Source: **https://www.sciencemag.org/news/2018/02/china-s-massive-investment-artificial-intelligence-has-insidious-downside**.

[8] Agrafioti, Foteini, Bengio, Yoshua, and Poutanen, Tomi. *The Globe and Mail. It's Time to Make the Canadian AI Ecosystem Bloom.* July, 2017. Source: **https://beta.theglobeandmail.com/report-on-business/rob-commentary/its-time-to-make-the-canadian-ai-ecosystem-bloom/article35559957/?ref=http://www.theglobeandmail.com&**.

There is one topic from the media and communications sector that carries over to fall under the purview of governments: **fact-checking**. Fake facts are a new trend designed to drive and influence the audience. Keeping a check on them is both a legal and an ethical matter. Despite its nuances, AI can help governments achieve this, as we shall see in the next section. That brings us to the other set of advantages this technology hands to countries. Whether in news, election, or criminal justice, fact-dependent areas would see greater use of artificial intelligence that is devoid of sentimental or interpretational bias. We need it due to the impossibility of vetting and considering all possible sources manually, even if it takes us time to perfect the use of technology in such situations.

One of the most profound AI shifts in governance has come about in its deployment for the benefit of low-resource communities in what some may consider a response to our fears of AI-led joblessness. The application belongs to areas like health, education, defense, and so on. But in every case, AI is helping reduce costs by facilitating preventive and more effective actions. For instance, AI can allow dispersion of information more quickly through social media channels in case of an emergency or health outbreaks. Think about the homeless networks in major cities around the world; dispersing timely and accurate information to them is quite a challenge. AI could identify the key influencers in the group by analyzing social media to then allow authorities to spread the word on key health issues.

For governments, a natural use of AI is also in effective policing and security. There are many examples on this note as we shall see in the next section. As we discussed earlier in this book, the same is true for education too where AI will allow governments to monitor performance in public school boards and manage content being taught with greater ease.

AI is also helping identify patterns of equipment failures based on the maintenance and flight logs of US Air Force's *F-16 fighter jets*. Such analytical insights can help prevent future failures and reduce risk for the pilots.[9]

What we have missed out on in our discussion so far, however, is the profound impact of using AI in government offices. We will pick the topic of AI at workplaces in greater detail later in the book, but suffice to say for now that AI will help regulate, monitor, and improve the efficiency of slow and lagging public sector work culture, bringing about a far deeper impact on socio-economic growth than any other development. For one, it would reduce the need to fill out multiple forms or go from door to door at different government offices. AI could link different departments and their records to make informational exchange smooth, avoid loss of data en-route, and simplify the experience and speed of service rendered to citizens.

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[9] Moore, Andrew W. MIT Sloan Management Review. *Predicting a Future Where the Future Is Routinely Predicted*. September 12, 2016. Source: **https://sloanreview.mit.edu/article/predicting-a-future-where-the-future-is-routinely-predicted/**.

To achieve the above, it can be expected that governments would gravitate towards more funding for interdisciplinary research and more employees with added technical expertise at all levels in the different departments. A more significant shift may come about in a rise of inter-departmental governance. Taking the example of US, currently, the use of AI in different spheres is likely to be governed independently by different bodies such as the **Food and Drug Administration (FDA),** the **Securities and Exchange Commission (SEC),** or the **Federal Trade Commission (FTC).** This could change with time with a dedicated body for all AI activity if the technology continues to be seen as an entity percolating all industries.

Governing the AI space would imply a host of new policies and laws to cater to liability (to determine accountability), privacy (to avoid misuse), or labor (to prevent mistreatment). We know this, of course. What we do not know is the extent to which an artificial intelligence system would come to formulate or govern such laws. AI would help far more in taxation by more easily determining defaulters or those at risk of doing so. It would also help track frauds both in a preventive and a curative fashion. This means greater hand-in-hand play with financial institutions, just the way governments are trying to work with technology firms like Google or Facebook to identify and control social miscreants.

What's left to discuss in assessing the AI shift for governments? A pesky little thing called politics. Elections are a game of assessing sentiments. The one who does it better, wins. More often than not, polls are lost because a candidate misjudged the sentiments or the fundamental pain points of his vote bank during campaigns. This changes with AI. A technology so powerful in tapping intrinsic patterns will lend much more insight into what people are getting influenced by. The software may even find what the latent issues are by looking at online conversations. Its grasp of customized content, as we saw in the last chapter, would then mean a campaign designed to accurately reflect and appease the concerns of a target population. And that brings us to the Cambridge Analytica social media scandal,[10] which raised serious questions about the accountability of social media companies and power that AI can have in influencing entire regimes.

6.4: The AI innovations

AI innovations in the public sector principally aim to ease government processes. This is where most of its applications can be seen. One example is **National Science Foundation (NSF), Army Research Office (ARO),** and **Defense Advanced Research Projects Agency (DARPA)**'s attempt to translate information in even low-resource languages. These are otherwise missed by conventional translation software which

[10] Confessore, Nicholas. *The New York Times. Cambridge Analytica and Facebook: The Scandal and the Fallout So Far. April 4, 2018*. Source: **https://www.nytimes.com/2018/04/04/us/politics/cambridge-analytica-scandal-fallout.html.**

primarily focuses on only the top 2% of all languages in the world. The aim is to allow more seamless international assistance, say, in case of a natural disaster.[11] The following are examples of innovative AI approaches to advance government needs and productivity.

6.4.1: AI for welfare

We reviewed Stanford University's report on *Artificial Intelligence and Life* in 2030 for instances of AI use in the public sector and where predictive analytics has helped agencies use their limited budgets in improved ways. This includes earlier detections of existing or potential lead poisoning for preventative measures as in Flint, Michigan, or identifying pregnant women at risk for adverse birth outcomes, as in Illinois.[12]

The Obama administration in 2016 had discussed initiatives such as the Precision Medicine Initiative **(PMI)** and the Cancer Moonshot which aimed to use AI to help doctors diagnose diseases and suggest treatments.[13]

The **Southern Nevada Health District (SNHD)** uses a geotagging app that tracks tweets reporting food poisoning in order to flag the restaurants the persons visited. This effectively allows the body to generate a more targeted list of eateries to investigate – a far cry from the 35,855 food inspections it had to conduct on nearly 16,000 randomly selected facilities in 2014.[14]

Another way that the government can take the most out of AI is by coordinating the financial analysis from multiple transaction mediums for taxation purposes. A PwC report cites how AI can help with scanning unstructured tax notices, tax compliance and reporting, account classification to predict trial balance for tax adjustments, and of course, chatbots to automate answering questions.[15] **CrowdReason** armed its **MetaTaskerPT** product, which is already adept at these use cases, helping extract

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[11] Carbonell, Jaime. U.S. House of Representatives Committee on Science, Space and Technology. *Testimony of Professor Jaime Carbonell on Science, Space and Technology, Subcommittee on Research and Technology and Subcommittee on Energy, of the U.S. House of Representatives on the hearing titled, "Artificial Intelligence – With Great Power Comes Great Responsibility".* June 26,2018. Source: **https://science.house.gov//imo/media/doc/Carbonell%20Testimony.PDF?1**.

[12] Stanford University. *Artificial Intelligence And Life In 2030.* September, 2016. Source: **https://ai100.stanford.edu/sites/g/files/sbiybj9861/f/ai_100_report_0831fnl.pdf**.

[13] Felten, Ed. *The White House - President Barack Obama. Preparing for the Future of Artificial Intelligence.* May 3, 2016. Source: **https://obamawhitehouse.archives.gov/blog/2016/05/03/preparing-future-artificial-intelligence.**

[14] Viechnicki, Peter, Schatsky, David and Eggers, William. *Deloitte Insights. AI Augmented Government: Using Cognitive Technologies to redesign Public Sector Work.* April 26, 2017. Source: **https://www2.deloitte.com/insights/us/en/focus/cognitive-technologies/artificial-intelligence-government.html**

[15] PWC. *How Tax is leveraging AI — Including machine learning — In 2019.* 2019. Source: **https://www.pwc.com/cb/en/services/pdf/how-tax-leveraging-ai-machine-learning-2019.pdf**.

relevant data from tax documents, classifying tax-sensitive transactions, analyzing notices from regulators, and identifying possible tax credits or deductions. It can even predict potential tax fraud cases.[16] Meanwhile, companies like **Smansha**[17] (previously, PayPie) and **MindBridge**[18] are advancing financial risk analysis in audit and tax-related areas.

We spoke of fact-checking with the use of AI. Its nuances have led companies like **Full Fact** and **Claimbuster** to use machine learning. While the former is a British fact-checking organization offering, among other things, services that check statistics and real-time reporting, Claimbuster is focused on spotting factual claims, sorting through massive amount of text to find items to fact check.[19] These tools not only allow reporting compliance but also enable an accurately informed diaspora.

6.4.2: AI for security

As of February 2020, 43.7 million people in the US had already been subjected to facial recognition by the **US Department of Homeland Security**, primarily while boarding flights and cruises and crossing borders. Unfortunately, a recent study found widespread age, gender and racial bias in the systems deployed to the extent that most were 10 to 100 times more likely to misidentify other races as compared to the Caucasians.[20]

A White House report to help prepare for the future of AI[21] pointed out the use of AI by the department of Veteran Affairs at Walter Reed Medical Center to help predict medical complications and improve treatment of severe combat wounds, leading to better patient outcomes, faster healing, and lower costs. AI also helped reduce hospital-acquired infections at Johns Hopkins University by predicting complications to enable preventive treatment. The technology was used by the University of Chicago in an academic program to address public challenges such as unemployment and school dropouts. The University of Southern California, meanwhile, launched the center for *Artificial Intelligence in Society*, to employ machine learning to solve socially relevant problems like homelessness.

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[16] Van Volkenburgh, Brandon. *CrowdReason. Artificial Intelligence and Taxes: 8 Ways It's Being Used.* September 11, 2019. Source: **https://www.crowdreason.com/blog/artificial-intelligence-tax**.

[17] Smansha. Source: **https://www.smansha.com/.**

[18] MindBridge. Source: **https://www.mindbridge.ai/**.

[19] Dooley, Biran J. TDWI. *Can AI Fix Fake Facts? Maybe Not.* May, 2017. Source: **https://tdwi.org/articles/2017/05/08/Can-AI-Fix-Fake-Facts.aspx**

[20] Wiggers, Kyle. VentureBeat. *U.S. Homeland Security has used facial recognition on over 43.7 million people.* February 6, 2020. Source: **https://venturebeat.com/2020/02/06/u-s-homeland-security-has-used-facial-recognition-on-over-43-7-million-people/**.

[21] Executive Office of the President of the United States, National Science and Technology Council Committee on Technology. Preparing for the Future of Artificial Intelligence. October 2016. Source: **https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf**.

Besides administrative assistance through automation and analysis of various documents and filing, AI can also help with geospatial mapping, finding relevant information, and planning in the military. The US Defense Advanced Research Projects Agency (DARPA) first introduced the AI-enabled Digital Tutor in with the intention to reduce from years to months the time required for new Navy recruits to become experts in technical skills. The **Digital Tutor** could monitor, process, and coach student response based on how the best tutors did. It even posed progressively challenging exercises, all of which together ensured a comprehensive knowledge and training.[22]

Maritime security is also being bolstered by **ImageSat International (ISI)**'s Kingfisher which uses AI to track maritime assets, including **illegal, unreported and unregulated (IUU)** fishing, foreign military activities at sea, and counter-terrorism and piracy. This is in addition to the AI-driven data analysis it runs.[23]

Police departments too have evolved to leverage AI capabilities. This includes predictive policing as in the case of the New York Police Department's **CompStat** tool, or the City of Cincinnati which can proactively act on code violations.[24] Policing advancements in the facial recognition technology is one of China's strongest AI innovation areas. One of the applications is enabling police men to wear sunglasses that are equipped to catch criminals. The facial recognition enabled glasses that are connected to smart tablets can identify people from a 10,000-person database and classify them as suspected criminals or criminals or as rule-abiding citizens. These smart glasses, produced by **LLVISION**, allow police to rapidly scan a crowd intelligently and be able to act more swiftly before their targets disappear.[25]

While the military and police can deliver security in the real world, cyber security is another area of growing concern that needs attention. AI has been deployed by companies to facilitate secure communication, usage, and transactions online. Gmail, for instance, can block 100 million spams a day. The **Balbix** platform helps avoid data and security breaches with its AI-based risk predictions. AI is also being deployed by governments to administer huge volumes of security data, shorten the response time, and spot malicious activity that often occurs as a needle in a haystack of online activities.[26]

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[22] Navy. *Innovative IT Training Course Graduates First Digital Tutor Class.* September 2, 2015. Source: **https://www.navy.mil/submit/display.asp?story_id=90901**

[23] Russell, Kendall. Via Satellite. *ISI Uses Satellite Imagery to Monitor Criminals at Sea.* August 2, 2017. Source: **http://www.satellitetoday.com/technology/2017/08/02/using-artificial-intelligence-track-illegal-activities-sea/**.

[24] Stanford University. *Artificial Intelligence and Life in 2030.* September 2016. Source: **https://ai100.stanford.edu/sites/default/files/ai100report10032016fnl_singles.pdf**.

[25] Huang, Zheping. Quartz. *Chinese police are wearing sunglasses that can recognize faces.* February 8, 2018. Source: **https://qz.com/1202075/chinese-police-are-using-facial-recognition-glasses-for-surveillance**.

[26] Xlpat Labs. *How AI & Machine Learning Can Help With Government Cyber Security Strategies.* Source: **https://en.xlpat.com/how-ai-machine-learning-can-help-with-government-cyber-security-strategies**.

AI can also be helpful in detecting irregular financial activities like money laundering, terrorist financing, and fraud. Most of it may come to rely on monitoring of an individual's activity. Will *governments inform citizens of these forms of monitoring?* Under the context of national cyber security, the grey lines between disclosure and risks are likely to continue to persist.

Consider the case of Eric Loomis, the wheelman in a 2013 drive-by shooting in La Crosse, Wisconsin. Criminal courts routinely consider the risk an offender poses to the society at large, with the length of the sentence often being directly proportional to the size of risk. In the case of Eric Loomis, that measure was assessed by AI. *The resultant sentence? Six years*.[27]

6.4.3: AI for immigration

The US has laid out specific policies to attract and facilitate foreign talent in AI. At the same time, it is also leveraging the technology to aid the immigration process. **Emma** is a virtual assistant deployed by the USA Department of Homeland Security's **Citizenship and Immigration Services**. It can provide relevant answers to almost half-a-million questions per month, learning continuously on the way from real-time feedback.[28]

The **Immigration, Refugees and Citizenship Canada (IRCC)** has been leading the way with AI, with its first use of the technology coming in to process temporary resident applications from China and India.[29] There have even been cases of AI-based lie detector tests at airports not only in Canada but also in Europe.[30]

Destin AI[31] is *an artificially intelligent guide* for immigration applicants that can check an applicant's eligibility, connect her with an immigration expert, and keep her informed of the visa status. It is just one of many that are expected to follow to automate laborious government programs in Canada.

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[27] Butt, David. *The Globe and Mail. Should Artificial Intelligence play a role in criminal justice?* June 2017. Source: **https://beta.theglobeandmail.com/opinion/should-artificial-intelligence-play-a-role-in-criminal-justice/article35167201/?ref=http://www.theglobeandmail.com&**.

[28] Eggers, William, Schatsky, Vechnicki, Peter. *AI-Augmented Government.* April 16, 2017. Source: **https://www2.deloitte.com/insights/us/en/focus/cognitive-technologies/artificial-intelligence-government.html**.

[29] Bellissimo, Mario. Bellissimo Law Group. *Artificial Intelligence in Canadian Immigration Law and Practice – What's Happening?* December 24, 2019. Source: **https://www.bellissimolawgroup.com/artificial-intelligence-in-canadian-immigration-law-and-practice-whats-happening/**.

[30] Deschamps, Tara. University of Toronto Magazine. *Computer Says "No": U of T's Petra Molnar warns that the use of AI in immigration decisions could infringe on the human rights of migrants.* October 2, 2019. Source: **https://magazine.utoronto.ca/people/alumni-donors/computer-says-no-petra-molnar-ai-immigration-decisions/**.

[31] Destin.ai. Source: **https://destin.ai/**.

Not all AI tools need be branded, particularly in the public sector. For critical departments like national security or planning, customized AI models are generally more likely. Consider the case of Babusi Nyoni whose team originally developed an AI for Heineken during a Champions League final that could automatically read tweets and converse with the fans in a natural fashion. Babusi went on to tweak the model to study data largely from World Bank on calamities, GDP, or population status. It delivered patterns that could help predict mass migration in Africa![32]

6.5: The AI vault

The use of AI and development requires governments to start from the basics, with careful thought around the data source, its potential breach of privacy, and the nature of its use. AI also brings with it questions around product liability and accountability. If an autonomous vehicle meets with an accident, there is a range of stakeholders that can potentially be at blame, from the car maker to the particular faulty part maker, to the driver. **How should the governments tackle these sensitivities?**

6.5.1: Data and information governance

The **MIT-IBM Watson AI Lab** is studying the principles and ethics that inform our decision-making to properly train AI models. The problem here is implicit. IBM has identified more than 180 human biases that plague our data today, which invariably pollute AI models into making biased decisions.[33] What is more dangerous is that that data can be purposefully corrupted. For example, cars can be fooled and triggered to act inappropriately by adding a silver tape to a road sign.[34]

Government intervention in AI growth also has a more sensitive issue to deal with: *privacy*. As we discussed earlier, AI can easily breach into and make use of private data if it is allowed to. *How then do we stop an administration from snooping into our private lives in the name of security, or to draw a line when that reason fails to explain the level and context of any such breach?*

Another issue with AI in the public sector rests with the accuracy of our awareness. In times of fake facts, humans find it difficult to identify the factual and the fake. Solutions may crop up on this front but cannot yet be expected to be comprehensively

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[32] Nyoni, Babusi. UNHCR. *How artificial intelligence can be used to predict Africa's next migration crisis.* February 10, 2017. Source: **https://www.unhcr.org/innovation/how-artificial-intelligence-can-be-used-to-predict-africas-next-migration-crisis/**.

[33] IBM. *AI bias will explode. But only the unbiased AI will survive.* Source: **https://www.research.ibm.com/5-in-5/ai-and-bias/**.

[34] Glance, David. The Conversation. *What should governments be doing about the rise of Artificial Intelligence?* October 30, 2017. Source: **https://theconversation.com/what-should-governments-be-doing-about-the-rise-of-artificial-intelligence-86561**.

accurate. They need human interference in interpretation and validation. This means that relying solely on AI to deliver verdicts in a courtroom or to point out untrustworthy data sources can have massive repercussions that we may not even realize until it is too late.

Remember the case of Eric Loomis? He did challenge his ruling on grounds that he could not assess the algorithm – a case he lost because the court ruled that the knowledge of the algorithm's output was a sufficient level of transparency.[35] Suppose the AI software that deduced the level of risk he posed to the society was based on his past offenses as well as the social condition he had lived in. Most criminals are a product of circumstances they grow up or live in. *Would six years of prison be more just than relocation in society for this man?* AI did its job by telling us how dangerous Eric was, but without understanding the rationale it used and the context of what made Eric dangerous, *how could a proper sentencing be decided?* Another example would in determining the nationality of individuals about to be deported. To achieve this, the **Canada Border Services Agency (CBSA)** used private third-party DNA services like **ancestory.com**[36]. While it was an initial exploration, it becomes limited to the availability of data and more importantly, banks on the assumption that DNA determines nationality, which is not necessarily the case.

6.5.2: Collaboration

When we speak of AI enabling greater prosperity regardless of the economic quotient of a country, thanks to its inexpensive addressal of issues even in low-resource communities, we must also ensure that the provision of AI-utilization does not rest in the hands of a powerful few countries alone. Such dependency is risky. For instance, AI would have the power of influencing a common group of citizens, say the homeless, across a given area. That could also be a breeding ground for another version of the **Occupy Wall Street (OWS)** movement.

The risk also stands from the perspective of effectiveness. Gary Marcus, a professor of psychology and neuroscience, in a New York Times article, shared the issue of all AI research currently focused on small research labs in universities or large research labs in major private companies. The former, he notes, cannot handle the magnitude of research across multiple fronts needed for a holistic AI solution. The corporate labs, on the other hand, are more focused on narrow research that drives more immediate bottom lines for their companies. His suggested the strategy that AI

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[35] Tashea, Jason. Wired. *Courts Are Using AI to Sentence Criminals. That Must Stop Now.* April 17, 2017. Source: **https://www.wired.com/2017/04/courts-using-ai-sentence-criminals-must-stop-now/**.

[36] Akhmetova, Roxana. Compas. *How AI Is Being Used in Canada's Immigration Decision-Making*. February 4, 2020. Source: **https://www.compas.ox.ac.uk/2020/how-ai-is-being-used-in-canadas-immigration-decision-making/**.

research should follow the route taken by physicists with large labs such as European CERN following tightly defined broad scope, high-impact projects.[37]

Regardless of the risks, we can expect countries to open up to an AI onset across society. Given AI's enabling power across sectors in managing society and in the efficiency it drives in for the economy, any government would likely want to employ it as much as possible. After all, it does not want to be left behind – whether in an arms race or a technology race or even the ever-going economic race. Since governments cannot always lead innovation or deployment on their own, they would inevitably try to achieve AI innovations by facilitating such engagement by private players. Their major concern, however, would come from their vote bank which in turn, would be concerned by the omnipresent fear of AI leading to job loss. This means that governments are likely to favor policies that facilitate the work of its employees in the short to mid-term.

Governments are also likely to offer incentives to smaller players or start-ups in AI. This implies that winning strategies are likely to focus on greater collaboration, whether through acquisition or coopetition. This is crucial if you would like to sustain leadership with AI and ensure you can manoeuvre the fine line of compliance with ever changing public policies that are to be expected for a while in the changing landscape of artificial intelligence.

Are governments also accountable for the physiological and cognitive welfare of citizens? If so, then regulations will have to come in to limit the screen time for children in public schools. Meanwhile, the use of AI in the public sector offices is most likely to rest with administrative functions that cut out the red tape and improve efficiencies.

6.5.3: What should government be doing about AI?

In June, 2018, the U.S. House of Representatives developed a committee on **Science, Space, and Technology** and brought leaders from different jurisdictions to help understand the status of AI and the difference between narrow and general AI.[38] Each expert made their recommendations on the steps forward. Two resounding themes were supporting local AI public sector agencies to advance the field for the greater good and building AI skills to evolve and address the labor impact.

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[37] Marcus, Gary. *The New York Times. Artificial Intelligence Is Stuck. Here's How to Move It Forward.* July 2017. Source: **https://mobile.nytimes.com/2017/07/29/opinion/sunday/artificial-intelligence-is-stuck-heres-how-to-move-it-forward.html?_r=0&referer=.**

[38] GovInfo. *Artificial Intelligence: With Great Power Comes Great Responsibility.* June 26, 2018. Source: **https://www.govinfo.gov/content/pkg/CHRG-115hhrg30877/html/CHRG-115hhrg30877.htm**.

In 2019, President Donald Trump issued an executive order on the matter to leverage AI to support the US economy.[39] The directions involved redirecting funding to prioritize those in AI, making federal data and models available to researchers, establishing standards for AI systems under the **National Institute of Standards and Technology (NIST),** retraining workers to ensure they are AI-skilled, and strategizing international collaboration on AI development.

China, meanwhile, mandated *K-12* skill development in AI to inspire students through the example of the applications of the technology. The literary skills under focus relate to the ability to obtain information needed to solve problems, to compute methods to define problems, to utilize digital resources aptly, and to behave responsibly in both the real and the virtual world.[40]

As a thumb rule, there are a few initiatives that are core to the development of AI and its effective use in the public sector:

- Set up National and International AI Research Centers **to partner openly as a nexus between government, industry, and academia:** Countries like the USA and Canada have been developing effective strategies in this area, but extending into an International AI Research Center for joint and more open funded research can advance the field of AI more strategically. If different countries could agree on specific innovation areas they want to be primary experts in, innovations could be coordinated globally with a vision for open AI innovation. It's difficult because no country would want to be left behind on certain spheres of AI development, but this type of thinking can stimulate a vehicle for growing the volume and scope of AI activities and enable large-scale projects that require sustained collaboration among dozens of researchers, thereby balancing the smaller efforts supported by other funding agencies.
- **Incentivizing data sharing:** To continue to advance the field of AI, governments need to develop open data standards, and develop safe places to share data. Organizations like **MITRE**[41] and **National Institute of Standards and Technology (NIST)** promote the sharing of government data to help develop innovative solutions for social good. This sharing may include creating training environments—safe spaces—in which sensitive data is protected, among other things. Developing risk assessments for data sharing in common frameworks can also help advance AI into a more open data sphere.

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[39] Trump, Donald J.The White House. *Executive Order on Maintaining American Leadership in Artificial Intelligence*. **February 11, 2019. Source: https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/.**

[40] Classroom Aid. *AI Education Will Enter K12 Schools in China.* March 16, 2018. Source: **https://classroom-aid.com/2018/03/16/ai-education-k12-schools-china/**

[41] Mitre. Source: **https://www.mitre.org/publication-keywords/artificial-intelligence**.

- **Developing improved policies and regulatory frameworks:** The widespread adoption of AI will have implications for regulators, and lawmakers will need to consider policy options to address these issues. For example, a new regulatory structure for automated vehicles needs to evolve. Setting standards too prematurely without lots of testing and iterative learning could set us back versus take us forward. Also, developing policies that can protect privacy concerns, including ways in which AI could be used by law-enforcement agencies to violate civil liberties, is an area that needs policy solutions. If someone programs AI to make money, and it does so in a nefarious way, it is not clear how current laws could be used to prosecute the creator of the AI. Policymakers will also need to decide how they are going to measure, or benchmark, the performance of AI and assess the trade-offs.
- **Developing computational ethics and explainable AI:** We develop human centered design systems that are going to operate in environments where we cannot anticipate in advance all the things that could go wrong. Explainable AI and computational ethics are relevant for all places where AI systems are interacting with the physical world. AI researchers have also begun establishing rules of their own. For example, some groups of technologists have created sets of ethical considerations. In addition, researchers from six institutions recently formed a group called **Pervasive Data Ethics for Computational Research (PERVADE)**[42], whose mission is to develop a clearer ethical process for big data research for use by both universities and private companies.
- **Ensuring diversity in STEM and the workforce at large:** For all our calls for more diversity and inclusion as a matter of ethics and principle, its need in the AI domain is bluntly visible. Lack of diversity in AI implies biased insights, which in turn imply inefficiency. The economic benefits from increased diversity are now well documented. Yet, for various reasons, from limited opportunity to social conditioning, diversity remains low in STEM fields. While the governments can facilitate inclusion and fair opportunities for all races, they need to be cognizant of the finer obstacles to encourage diverse participation. These include women dropping out of STEM due to the isolated nature of its work environment. Inclusion requires empathy and both infrastructural and psychological considerations to enable it.

6.6: Conclusion

In conclusion, governmental leadership will be one of the most critical enablers to advancing AI effectively and efficiently. This will require rapid vision to modernize educational capabilities with careful deliberation about the pros and cons of AI

[42] Pervade: *Pervasive Data Ethics for Computational Research.* Source: **https://pervade.umd.edu/**.

education. To put in perspective, AI needs diverse skills in both arts and science, as new roles in ethics, human centered design, and engineering AI methods will all be needed. But let's not lose sight of the critical need for diversity in STEM skills, thus ensuring we develop a diverse and bias-free AI world. With less than 20% of female AI engineers designing our new AI products of the future,[43] we are at risk in creating a bias to white male design views, and this is not in the best interests of our society and world.

Diverse country strategies, ethical frameworks, and guidelines form a strong foundation to guide researchers and business leaders to build an operational monitoring system. The European Commission generated a *trustworthy AI assessment list,* which answers risk questions in AI modeling methods like: *Did you verify how your system behaves in unexpected situations and environments? Did you assess the type and scope of data in your data set?*[44]. Getting AI right from the design phase by demonstrating empathy and avoiding data bias will be key filters as businesses continue to advance AI methods.

These new governmental policies and AI ethical frameworks must ensure they tackle the big four in relation to AI: **Safety, Security, Ethics**, and **Privacy**. We must also ensure that we recognize that the technologists are on the frontlines in AI research and applied AI, and there is a business imperative to balance the creative innovation forces with thoughtful operational leadership practices to ensure privacy and diversity is protected.

In the wake of the digital revolution, some functions of the government may be eliminated due to their inefficiencies, but AI provides an opportunity for smarter citizenship and more open governments that can augment democracy. What is clear is that in an era of smarter networks, we will need improved citizen engagement tools that bridge algorithms with new forms of collaborative decision-making. We will need digital democracies that build on the capabilities of AI and Big Data. How countries come together to approach AI practices and policies requires all government leaders to pause and think hard. The next chapter will squarely focus on what the current national positions are. Let us take a look at whether we are creating a perfect AI world or a perfect storm.

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[43] Yuan, Yuan, and Sarazen, Michael. Synced. *Exploring Gender Imbalance in AI: Numbers, Trends, and Discussions*. March 13, 2020. Source: **https://syncedreview.com/2020/03/13/exploring-gender-imbalance-in-ai-numbers-trends-and-discussions/**.

[44] Vincent, James. The Verge. *AI systems should be accountable, explainable, and unbiased, says EU.* April 8, 2019. Source: **https://www.theverge.com/2019/4/8/18300149/eu-artificial-intelligence-ai-ethical-guidelines-recommendations**.

Chapter 7
AI in Countries

While Alixia Bolt continues to deal with the nuances of AI-powered governance in her alternate worlds, let us stay with the public sector and delve further into how her story could differ depending on the country she may be living in. This chapter explores how diverse countries are advancing in AI strategy and policy frameworks to modernize their nations. AI national strategy frameworks are reviewed from countries like USA, China, Canada, UK, Germany, Australia, India, and Russia. We have also covered AI frameworks from Organization for Economic Co-operation and Development (OECD), The USA Department of National Defense, as well as The European Economic Union which are streamlining international approaches to respect economic growth needs, at the same time respecting the privacy and security of its citizens.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the at the perfect world and the perfect storm scenarios
- The state of AI in different countries – USA, China, Canada, UK, Germany, Australia, India, and Russia
- The OECD and European Commission AI framework
- The AI governance imperatives
- Concluding points on AI policies globally

Objectives

After studying this chapter, you should be able to:

- Understand the different positions major countries around the world are taking with AI
- Learn the framework set out to govern AI by OECD and the European Commissions, as well as independently by China and Russia
- Appreciate four global strategy imperatives for AI

7.1: The perfect world

Alixia Bolt, Chief AI Cyber Security Officer of Central AI, is seated in Geneva at the World Economic AI Forum, joined by other global dignitaries to approve the Trusted AI Harmony Governance Protection Accord, which has three tenants to govern all AI business, legal, and regulatory global practices and methods:

- **User trust protection:** Each person will have a unique user **Identifier (ID)** that will be installed at birth as a tracking device that can be turned on or off for anonymity and freedom, at any time, or place, so there are no tracking signals based on an individual's interaction anywhere. If a person wants to turn on data tracking, this person makes an informed choice as every supplier interaction will require approval to sell or produce goods in the global AI supply chain system. He or she will be able to collect fractional bitcoin recognition of the value of the goods or services sold based on any derived insights that benefit the supplier from data aggregation signals. All transactions are tracked at the *AI Blockchain Global Monitoring Cyber Secure Networks* for open and transparent data exchange marketplaces.
- **Fairness and kindness:** Any AI derived system must not amplify data bias, be respectful of diversity, make decisions based on user approved information, and always exhibit kindness to any AI or robotic device that is designed to improve the lives of business or its citizens. The reputational damage and legal impact resulting from demonstrated bias against any group of users (human or machine) can be seriously detrimental to businesses. AI models are only as good as the data used to train them, and developing a representative, effective training data set is key to ensuring fairness, so validation of all AI models on their integrity will be regulated and auditable.
- **Robust and explainable:** Every AI system must have robust cyber security AI standards that consistently ensure identification, and any outcomes determined by AI must be explainable. Tracking of all AI components and event generation in a scalable and complete AI lifecycle management system must be rigorously enforced to ensure all information flows within AI modeling attributions ensure integrity and transparency.

The vote is called for and the results are instantaneous, calling for unanimous approval of global standards for AI regulatory controls by the universal diplomatic body. Central AI's cyber security advances in reach and protection of democracy. Humans globally have aligned to ensure successive generations are not ruled by surveillance capitalism, ensuring free markets can continue to evolve and be nurtured by AI insights versus having humans farmed as assets without mutual consent. Every nation has come together to ensure humans are responsibly in control and AI is used for creating a safer and better world.

7.2: The perfect storm

Alixia Bolt, seated at the World Economic AI Forum with other global dignitaries, is pondering over the pending approval of the Trusted AI Harmony Governance Protection Accord.

The core tenants correspond to user trust protection, fairness and kindness, and robustness and explainability. Alixia has read through the points for the umpteenth time and is waiting with baited breath for its approval. The vote is called for, and the results are instantaneous on the international screens, with many of the countries' leaders in their country offices.

The votes show a clear divide, with no unanimity in reaching mutual agreement. Some countries have continued their policy alignment to accelerate surveillance capitalism as the new normal with facial recognition, intrusive detector systems, making even minority report representations look amateurish. Few are unwilling to allow forgetting individuals as a matter of criminal risk. Few others are in disagreement, with an eye on militarization of AI. And then there are those who are unable to tie the hands of big business under intense lobbying pressured. Clearly, Central AI will continue to face major challenges to ensure democracy prevails.

Humans unfortunately will see another day of serving under mysterious, uncontrolled, and risky deployment of AI. For now, they will continue to live in fear of what new dangerous feat the technology may be allowed to achieve.

Alixia remembers clearly that the G7 could not get *Global Climatic Policy Change* right and she is now experiencing the erosion of organic reciprocities which enabled capitalism's appeal.

Parasitic and controlling AI practices continue to plague many countries and there appears to be no end in sight, as being able to protect citizen rights for anonymity, the choice to not be monitored by AI 24x7 has miserably failed. Meanwhile, An AI-created pathogen has spread uncontrollably and resulted in a pandemic.

Alixia recalls George Orwell's dystopian book, 1984, and the famous quote: *"If you can feel that staying human is worthwhile, even when it can't have any result whatsoever,*

you've beaten them." This offers her some dim hope that humanity will emerge to counter surveillance capitalism.

7.3: State of AI

Policies are often motivated by the vote bank and the country's economic and geopolitical realities. Given that AI's threat to privacy and blue-collar jobs are often seen as its biggest risks, one would assume that those in developing nations are likely to find it riskier than those in developed nations. Interestingly, opinions on the impact of AI around the world does not necessarily follow this pattern. For instance, a recent Pew Research Center[1] survey shows that the majority of Asians surveyed (often around two-thirds) see AI as a good thing for the society, and have a similarly positive view of its role in automating jobs done by humans in the past. In contrast, many of those in the Western world hold more neutral or even negative viewpoints, with only one-third respondents in France seeing AI in positive light. So, with talent in abundance, it is the smaller countries that can start to challenge the previously dominant players in an AI-driven era.[2] Having said that, as we will see in this chapter, quickly making its way to the top of AI dominance is China, thanks to its centralized AI strategy.

Many global leaders have advised country leaders to think carefully about how to advance and regulate AI. What is clear is that countries are advancing at different paces, with many having common regulatory frameworks that reinforce how we are advancing forward productively to create a more intelligent world, while some others continue to accelerate investments in surveillance capitalism, holding personal privacy as a regime right versus a citizen right.

As seen in the previous chapter, the rise of AI in government has already begun with an acknowledgement of its needs and its inclusion in the vision of countries like Canada, China, and USA. As a matter of fact, it began when AI software started being used in different aspects of security, healthcare, education, and so on. However, true insurgence will require coordination across departments and across sectors. This, in a nutshell, will define the use of AI by governments.

The primary challenge here would be to bring together different agencies with differing motives, permits, and budgets. For companies, the equation is simpler. Prevent job losses and capitalize on the grants and allowances available for greater

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[1] Johnson, Courtney, and Tyson, Alec. World Economic Forum. *Here's how opinions on the impact of artificial intelligence differ around the world.* Dec 18, 2020. Source: **https://www.weforum.org/agenda/2020/12/mixed-views-of-the-impact-of-artificial-intelligence**

[2] Fleming, Sean. World Economic Forum. *World order is going to be rocked by AI - this is how.* February 13, 2020. Source: **https://www.weforum.org/agenda/2020/02/ai-looks-set-to-disrupt-the-established-world-order-here-s-how**

constructive use of AI. AI can be used by some governments of this world to a drastically risky affair. However, in counting those risks, we should not lose sight of the fact that AI also has the potential to unite us like never before. Yes, governments would be equipped to keep a sterner eye on its citizens, but they would also be more and more dependent on each other for truly fruitful use of the technology; thanks to the ever-rising investments and need for more data. This implies collaboration between governments of different countries, between public and private sector institutions within a country, in addition to that between departments within a government.

From the way we see it, it is a perfect ground for a collaborative socio-economic world. Far from AI-wars, we are being given a platform to unite and write the story of human success together. The only way we would fail at it is if we refuse to collaborate. In that case, even eventual robot domination is not something we will have a right to complain about.

7.3.1: AI in USA

Advancements in the AI field in U.S. have been a result of many foundations and agencies keeping a vigilant vision to ensure AI research was sustained. The leading groups have included the **National Science Foundation (NSF),** the **Defense Advanced Projects Agency (DARPA),** the US intelligence community, including the **Intelligence Advanced Projects Activity (IARPA),** and the research divisions of each of the armed services (**Office of Naval Research (ONR)/Naval Research Laboratory (NRL), Air Force Research Laboratory (AFRL),** and **Army Research Laboratory (ARL)/Army Research Office (ARO)).** A comprehensive White House report, preparing for the future of AI, came out back in October 2016, eventually leading to a more execution-focused American AI Initiative in 2019 – a journey given due consideration by two opposing administrations in the country.

The 2016 report acknowledged the challenges in adopting AI across different agencies due to wildly differing capacities. For instance, it noted that while **National Institutes of Health (NIH)** sat on an R&D budget of more than $30 billion, the **Department of Labor (DOL)'s** R&D budget was only $14 million.[3] Then, of course, there is the issue of managing direction. When IBM spoke of responsibility as a focus for any AI development in its response to the White House's RFI on AI in 2016, it defined it as a way to ensure that AI is developed in the right way for the right reasons. *How do we decide which reasons are right?* For any major government in the world today, the primary focus is often defense. Millions and billions are spent to

[3] Executive Office of the President of the United States, National Science and Technology Council Committee on Technology. *Preparing for the Future of Artificial Intelligence*. October 2016. Source: **https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_future_of_ai.pdf.**

the extent that some of the most important innovations and achievements of our age came about as an aid to a climate of war for much of the twentieth century. So, the *right* reasons would naturally differ for different administrations at different times.

When President Donald Trump launched the American AI initiative in 2019, his focus was to double the AI R&D budget by 2022 with an aim to protect *civil liberties, privacy, and American values.*[4] The following year saw more clarity on the ethical and legal use of AI by the U.S. **Department of Defense (DoD).** Thanks to a multi-stakeholder collaborative validation of recommendations, the norms were formulated to be responsible, equitable, traceable, reliable, and governable. The secretary of defense, **Dr. Mark T. Esper**, stated:

> *"The United States, together with our allies and partners, must accelerate the adoption of AI and lead in its national security applications to maintain our strategic position, prevail on future battlefields, and safeguard the rules-based international order. AI technology will change much about the battlefield of the future, but nothing will change America's steadfast commitment to responsible and lawful behavior. The adoption of AI ethical principles will enhance the department's commitment to upholding the highest ethical standards as outlined in the DoD AI strategy, while embracing the U.S. military's strong history of applying rigorous testing and fielding standards for technology innovations.*[5]*"*

This issue of militarization of AI must be taken seriously for both China and the US are investing in it[6] and the same can be expected of other countries too. Indeed, some are quite outspoken in their support on the matter, as we will see later in this chapter. An article in the *Future of Life* institute picks these concerns to reiterate that we must avoid an automized AI-powered arms race. We must also prevent developing destructive AI or an AI developed for doing good but one that chooses a destructive way to achieve it[7].

What about the surveillance? Would states cease to scan individuals boarding planes and index them? What may happen is that citizens would, in time, need to authorize their permission to retain this type of information in a specific context and be forgotten in others. Allowing the right to be unknown is one of the considerations being discussed primarily in Europe. Putting this realistically into an efficient operating environment

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[4] Heckman, Jory. Federal News Network. *Trump budget projects doubling federal AI research spending by FY 2022.* February 11, 2020. Source: **https://federalnewsnetwork.com/artificial-intelligence/2020/02/trump-budget-projects-doubling-federal-ai-research-spending-by-fy-2022/**.

[5] U.S. Dept. of Defense. *DoD Adopts Ethical Principles for Artificial Intelligence.* February 24, 2020. Source: **https://www.defense.gov/Newsroom/Releases/Release/Article/2091996/dod-adopts-ethical-principles-for-artificial-intelligence/.**

[6] Kania, Elsa. Lawfare. *The Dual-Use Dilemma in China's New AI Plan: Leveraging Foreign Innovation Resources and Military-Civil Fusion.* July 2017. Source: **https://lawfareblog.com/dual-use-dilemma-chinas-new-ai-plan-leveraging-foreign-innovation-resources-and-military-civil**.

[7] Future of Life Institute. *Benefits & Risks of Artificial Intelligence.* 2016. Source: **https://futureoflife.org/background/benefits-risks-of-artificial-intelligence/**.

will be a major challenge and won't be easy to regulate. After all, a potential criminal may also prefer that his information not be retained. In such cases, the right way is likely going to be a balance between protecting privacy and ensuring security. At least the right debates are being framed to modernize regulatory frameworks and monitoring them is where the real complexity lies ahead for every country.

As already stated, U.S. and China, the two powerhouses that are aiming for AI leadership are in a state of coopetition, that is, they are both competing and cooperating. China's strategy has led to more and more investments in AI companies in the United States and beyond. In doing so, it has only increased the extent of interdependence between the two largest economies of the world. Every time the AI technology sparks concerns of humans versus another entity, we often forget that it also achieves something highly improbable otherwise: it makes us immediately, and without hesitation, imagine the entire human race as united and one. Those with a more philosophical bent would tell you that any chance of people forgetting their differences can only occur when we all face a common enemy. AI is not an enemy but such a perception alone seems to be enough to make us start thinking alike, even if out of our fears.

How rigorous and effective is this coopetition, and how far does it get dwarfed by competing interests? To draw this contrast, let us switch our attention to the East.

7.3.2: AI in China

There is no country more advanced than China in using AI for governmental citizen and cyber security innovations leveraging sensor technologies. One cannot help but recall scenes of Tom Cruise in the *Minority Report* wearing his futuristic sunglasses when fighting against machines. So, often the futuristic scenes in the media predict future reality. China's vision has been to bring all its 1.4 billion citizens under the purview of facial recognition surveillance through a vast network of CCTV cameras. Chinese tech companies have also provided such technologies to several other countries.[8]

China seems to be a good testing ground on what the impact will be if everyone were indexed electronically and monitored as they walked in city streets. AI innovation in governance has an added angle - that of strategic investments. Because governments may not innovate new uses of technology all the time, they tend to achieve that effect through other channels or state-sponsored players. We spoke of the Dragon starting to raise its head in AI, particularly by coordinating with established institutions. On May 4, 2018 CNBC reported: *China is determined to steal the AI crown from the US and*

[8] Habib, Jacky. CBC. *In Xinjiang, China, Surveillance Technology Is Used To Help The State Control Its Citizens.* Source: **https://www.cbc.ca/passionateeye/m_features/in-xinjiang-china-surveillance-technology-is-used-to-help-the-state-control**.

nothing, not even a trade war, will stop it. China's 2030 plan envisions building a $1 trillion AI industry.[9] China's President Xi Jinping even has AI books in his shelf.[10]

It is difficult to estimate the very substantial level of AI funding in China, but some indication comes from the commitment shown by cities in China towards AI, with Beijing at $2 billion and Tianjin at $16 billion.[11] China has also drawn significant portion of funding towards AI start-ups, second only to US. In the period 2015-19, China attracted $22 billion of funding, though significantly behind US at $75 billion.[12] However, by 2018, China was already far ahead of US in AI-related patent applications (more than 5x)[13]. In fact, since the bulk of US' investments were directed at the private businesses, the scenario looked quite different in terms of public investment. In a testament to its unified national AI strategy, China's public investment clocked at $22.5 billion compared to US' $2.03 billion, according to a 2019 Tortoise Intelligence research. The study also found that China's spending plans were *one-and-a-half times greater than those of every other country in the world combined!* [14]

In the last section, we spoke about the Chinese coopetition. In 2017, Haiyin Capital invested in Neurala, a Boston-based start-up that makes AI software based on technology initially developed for use by the U.S. Air Force and NASA.[15] And China's answer to Google, Baidu, established its **Silicon Valley Artificial Intelligence Laboratory (SVAIL)** in 2014 and by Spring 2017, had acquired **xPerception**, which specializes in computer vision. Around the same time, Tencent revealed its intention to open its first AI research center in Seattle.[16]

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[9] Barhat, Vikram. CNBC. *China is determined to steal A.I. crown from the US and nothing, not even a trade war, will stop it.* May 4, 2018. Source: **https://www.cnbc.com/2018/05/04/china-aims-to-steal-us-a-i-crown-and-not-even-trade-war-will-stop-it.html**.

[10] Shead, Sam. Business Insider. *China's president had 2 books about artificial intelligence on his shelf in his New Year speech.* January 3, 2018. Source: **https://www.businessinsider.com/chinas-president-had-2-books-about-artificial-intelligence-on-his-shelf-in-his-new-year-speech-2018-1**.

[11] Davenport, Thomas H. The Conversation. *China is catching up to the US on artificial intelligence research.* February 27, 2019. Source: **https://theconversation.com/china-is-catching-up-to-the-us-on-artificial-intelligence-research-112119**.

[12] Sawers, Paul. VentureBeat. *Tech Nation: U.S. companies raised 56% of global AI investment since 2015, followed by China and the U.K.* March 16, 2020. Source: **https://venturebeat.com/2020/03/16/tech-nation-u-s-companies-raised-56-of-global-ai-investment-since-2015-followed-by-china-and-u-k/**.

[13] Huang, Echo. Quartz. *China has shot far ahead of the US on deep-learning patents.* March 2, 2018. Source: **https://qz.com/1217798/china-has-shot-far-ahead-of-the-us-on-ai-patents/**.

[14] Fleming, Sean. World Economic Forum. *World order is going to be rocked by AI - this is how.* February 13, 2020. Source: **https://www.weforum.org/agenda/2020/02/ai-looks-set-to-disrupt-the-established-world-order-here-s-how**.

[15] Nagy, Alessandra. Neurala. *AI And Robotics Firm Neurala Expands In Boston With New Seaport Offices, Executive Hires.* January 15 2017. Source: **https://www.neurala.com/press-releases/neurala_expands_warren_katz**.

[16] Kania, Elsa. Lawfare. *The Dual-Use Dilemma in China's New AI Plan: Leveraging Foreign Innovation Resources and Military-Civil Fusion.* July 2017. Source: **https://lawfareblog.com/dual-use-dilemma-chinas-new-ai-plan-leveraging-foreign-innovation-resources-and-military-civil**.

Of course, the state of these investments always depends on the administration's openness towards them – a metric that can vary wildly over time. Changing political climate has seen many efforts also go south. For instance, **China Electronics Technology Group Corporation (CETC),** a Chinese state-owned defense conglomerate that pursues dual-use research and development, established a joint research center with the University of Technology, Sydney, to focus on big data, AI, and quantum technologies in 2017. Midway through the 5-year plan, though, the initiative was embroiled in concerns around the threat to Australian national security.[17] Huawei, on the other hand, announced in the fall of 2016 that it would invest $1 million in a new AI research partnership with the University of California, Berkeley.[18] In 2019, the funding was suspended by the university after the US **Department of Justice (DOJ)** brought criminal charges against the company.[19] And in late 2019, USA banned **SenseTime, Megvi** and **Yuti** – three Chinese facial recognition companies – from doing any business with USA due to increasing fears of national security and foreign policy interests.[20]

To achieve its intended global leadership position in AI, strategic innovation and application won't be enough. Like any leader, China will also have to invoke greater global trust. To that end, the country has taken responsible AI seriously. It was core to the Governance Principles formulated by the *New Generation AI Governance Expert Committee* and presented by *China's Ministry of Science and Technology* in 2019. The principles dealt with *harmony and friendliness, fairness and justice, inclusiveness and sharing, respect for privacy, security and controllability, shared responsibility, open cooperation and agile governance*.[21]

These principles strived to address bias and discrimination, ensure protection of individual's rights, establish ethical standards while dealing with personal information, and avoid any illegal aspects on these fronts. These are positive signs for a government that is often criticized for using AI as a way to monitor its citizens. It indicates China's willingness to frame its policy in collaboration with key players and experts in the field, including not only the country's largest technology firms (Baidu, Tencent and Alibaba) but also institutions like *Peking University, Tsinghua*

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[17] Power, John. South China Morning Post. *China's tech rise poses security and human rights dilemma for Australian universities.* October 21, 2019. Source: **https://www.scmp.com/week-asia/politics/article/3033604/chinas-tech-rise-poses-security-and-human-rights-dilemma**.

[18] Lunden, Ingrid. TechCrunch. *Huawei puts $1M into a new AI research partnership with UC Berkeley.* 2016. Source: **https://techcrunch.com/2016/10/11/huawei-puts-1m-into-a-new-ai-research-partnership-with-uc-berkeley/**.

[19] Von Ehrenstein-Smith, Stanley. The Daily Californian. *UC Berkeley suspends new research collaborations with telecommunications giant Huawei.* February 6, 2019. Source: **https://www.dailycal.org/2019/02/06/uc-berkeley-suspends-new-research-collaborations-with-telecommunications-giant-huawei/**.

[20] Pham, Sherisse. *CNN Business News. SenOctober 10th, 2019. Sense Time Black Listed.* Source: **https://www.cnn.com/2019/10/09/tech/hikvision-sensetime-blacklist/index.html**.

[21] Zhang, Laney. Library of Congress. *China AI Governance Principles Released.* September 9, 2019. Source: **https://www.loc.gov/law/foreign-news/article/china-ai-governance-principles-released/**

University, The Institute of Automation, and the Institute of Computing Technology with the Chinese Academy of Sciences.[22]

These efforts should help on the competitive front. The development of AI is a common challenge for all of humanity and only with countries coming together on a global scale can we truly build AI that is of value and benefit to business, humanity, and the environment.

7.3.3: AI in Canada

Canada has also made a national declaration to be a top Global Leader in AI. It has a case to make in terms of its research ability, having housed two of the three 2018 Turing Award winners in deep learning - **Yousha Bengio and Geoffrey Hinton[23].** However, the application of all that knowledge is likely where the race will be won or lost for the country. The **Alberta Machine Intelligence Institute (AMII)** in Edmonton, the **Montreal Institute for Learning Algorithms (MILA)** in Montreal, and the **Vector Institute** in Toronto are all institutions formed with an eye on innovation and application in accordance with the government's $125 million AI strategy. These vehicles aim to increase the country's talent pool, connect pan-Canadian AI research and innovation, and position Canada as a thought leader on economic, ethical, policy and legal aspects of AI[24].

The University of Montreal also released *The Montreal Declaration* for responsible AI development[25], focused on facilitating a collaborative digital transition of the economy built on the ethical development and deployment of AI. Aimed at anyone keen on the responsible development of AI, the declaration brings together a dialogue between citizens, experts, public officials, industry stakeholders, civil organizations, and professional associations to ponder over AI's social and ethical concerns and produce quality proposals to tackle them. The Declaration currently includes ten principles, catering to the well-being, autonomy, intimacy and privacy, solidarity, democracy, equity, inclusion, caution, responsibility, and environmental sustainability.

Among the aforementioned Turing award winners, Yoshua Bengio has been active in Montreal, having founded MILA to advance collaboration between academic researchers and industry to help companies incorporate AI solutions into their

[22] Knight, Will. MIT Technology Review: *Why does Bejing suddenly Care about AI Ethics. Boston.* May 31, 2019. Source: **https://www.technologyreview.com/s/613610/why-does-china-suddenly-care-about-ai-ethics-and-privacy/**.

[23] Association for Computing Machinery. *ACM Announces 2018 Turing Award Recipients.* March 27, 2019. Source: **https://www.acm.org/articles/bulletins/2019/march/turing-award-2018**.

[24] CIFAR. *CIFAR Pan-Canadian Artificial Intelligence Strategy.* Source: **https://www.cifar.ca/ai/pan-canadian-artificial-intelligence-strategy#**.

[25] Montreal Declaration – *Responsible AI. The Declaration.* Source: **https://www.montrealdeclaration-responsibleai.com/the-declaration**

businesses. Geoffrey Hinton, on the other hand, is driving the landscape in Toronto with the Vector Institute, supported by many high profile leading companies, including: Accenture, Loblaws, Scotiabank, TD Bank, and Shopify.[26] In Northern Alberta, Google's DeepMind opened its first lab outside the United Kingdom[27]. The Royal Bank of Canada, meanwhile, has created Borealis AI[28] in the region to allow its staff to collaborate and publish research with universities.

Not for profit efforts are also rapidly advancing to support AI in Canada, including the efforts of **SalesChoice**, an AI SaaS platform, and IT World Canada, Canada's largest IT and publishing house, and a division of the International Media Firm, **International Data Group (IDG),** to build out a global AI directory[29] profiling stakeholders in this ecosystem.

As we saw earlier, Canada has also been leading the way in the use of AI for immigration, bringing into view a different ethical question around AI's power to make decisions about our fate. *Can it reliably be considered impartial and fair, or is it relying on and trained in biased data? What happens to your data during these decisions, and can this insight on your profile or fate be used and shared with other government departments, putting you further at risk?* Frameworks and mechanisms to guide the use of AI in high risks context(s) has to ensure countries do not operate within an accountability black hole. This is an area for leaders to think more carefully about.

7.3.4: AI in UK

We discussed Canada's talent pool and the need to focus on effective execution. These elements are being driven in great fashion in UK as per its *AI Sector Deal*[30] by a dedicated office for AI[31]. With an eye on AI's socio-economic transformations, UK's national strategy focuses on fostering ideas, enabling people, upgrading the infrastructure, facilitating a conducive business environment, and creating an overall prosperous community[32]. The UK government has earmarked a budget of £0.95 billion for its implemention, complementing and leveraging £1.7 billion in

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[26] Vector Institute. *Partners*. Source: **https://vectorinstitute.ai/partners/**.

[27] CBC. *Google's artificial intelligence masterminds move into Edmonton.* July 7, 2017. Source: **https://www.cbc.ca/news/canada/edmonton/artificial-intelligence-deepmind-edmonton-google-research-1.4195026**.

[28] Borealis AI. Source: **https://www.borealisai.com/en/**

[29] The AI Directory. Source**: http://www.aidirectory.ai**.

[30] HM Government. *Industrial Strategy: Artificial Intelligence Sector Deal.* Source: **https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/702810/180425_BEIS_AI_Sector_Deal__4_.pdf**.

[31] Gov.uk. *Office for Artificial Intelligence.* Source: **https://www.gov.uk/government/organisations/office-for-artificial-intelligence**.

[32] European Commission. *United Kingdom AI Strategy Report.* Source: **https://ec.europa.eu/knowledge4policy/ai-watch/united-kingdom-ai-strategy-report_en**.

UK's cross-sectoral **Industrial Strategy Challenge Fund (ICSF).** What is impressive is the focus on developing 450 PhD's, training 5000 students on digital skills and increasing immigrant AI talent from 1000 to 2000.

Infrastructure-wise, UK has been rather intelligently focused on garnering a large volume of data, through initiatives like the **Open Data Institute (ODI)**[33], the open access policy of **UK Research and Innovation**[34], and the **GeoSpatial Commission**[35]. This does not imply ignoring the other infrastructural development, though. The multi-billion pound **Transforming Cities Fund** out of which nearly half was intended for five shortlisted cities until 2022-23[36] , would be a case in point.

The interesting thing about UK's strategy is that while US is investing in AI businesses, China on leveraging AI for the state surveillance, and Canada on relevant AI research, UK seems to be going after phased trials and pilots in successful AI implementation. A large chunk of that focus is on developing talent and on transportation and mobility use cases. It is also spearheading contributions from beyond the shores; each effort clearly aimed at compensating for a lower population pool on the island in comparison to the likes of US and China. This makes it an excellent ground for the 'coopetition' approach we discussed earlier. Let us go back to the AI sector deal paper to surface some examples to this end.

California-based **Beyond Limits**, which has developed the next generation cognitive reasoning AI, deployed successfully by NASA, the US military, and other government agencies, has chosen UK to support its global expansion. Hong Kong-based **Ironfly Technologies** is expanding in London to further propel the city's robust financial market by using AI/ML to interact with live market data. Japanese company **Astroscale** is another addition to the shores as it aims to clean up space debris. It is supported by £4m from the robotics and AI in Extreme Environments Industrial Strategy Challenge Fund. Canadian VC Chrysalix is looking at European investments from UK while it also acts as a bridge between UK universities and businesses for knowledge and solutions exchange.

UK's collaboration levels are also commendable in its territorial inclusion. **British Telecom (BT)** collaborating with Northern Ireland's Ulster University, semiconductor specialist IQE working with Wales' Cardiff University, Barclays launching the bank's

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[33] Open Data Institute. Source: **https://theodi.org/**.

[34] UK Research and Innovation. *Open Access.* Source: **https://www.ukri.org/funding/information-for-award-holders/open-access/**.

[35] Gov.uk. *Unlocking the power of location:The UK's geospatial strategy.* June 16, 2020. Source: **https://www.gov.uk/government/publications/unlocking-the-power-of-locationthe-uks-geospatial-strategy**.

[36] Department for Transport. *Transforming Cities Fund: tranche 2 supplementary guidance for shortlisted city regions.* March 19, 2019. Source: **https://www.gov.uk/government/publications/apply-for-the-transforming-cities-fund/transforming-cities-fund-supplementary-guidance-for-shortlisted-city-regions-tranche-2**.

first Scottish *Eagle Lab* in Edinburgh, and the Digital Catapult's *Machine Intelligence Garage* programme that allows start-ups across UK to access specialized hardware and expertise are all examples of efforts to drive AI adoption across the kingdom. All these developments naturally make one wonder what's going on across the channel on the European mainland. Let's take a look.

7.3.5: AI in Germany

We will discuss the broader European Union standpoint on AI later in this chapter. In one of its most prominent member countries, Germany, the Federal Government's AI strategy was jointly developed by the Federal Ministry of Education and Research, the Federal Ministry for Economic Affairs and Energy, and the Federal Ministry of Labour and Social Affairs. The aim is to allow mid-sized companies to leverage AI and to attract top talent in order to *safeguard Germany's outstanding position as a research center, to build up the competitiveness of German industry, and to promote the many ways to use AI in all parts of society in order to achieve tangible progress in society in the interest of its citizens.*[37]

Specifically, twelve areas have been put under the lens. These include:

- Strengthening research to drive innovation
- Facilitating competitions to incur new ideas
- Enabling small and medium-sized businesses to use AI
- Offering incentives to generate more AI start-ups
- Managing AI's impact on labor
- Training and attracting specialists
- Improving administrative efficiency with AI
- Making data available for better AI development
- Adjusting the regulatory framework to guide the AI-based decisions
- Setting standards and norms at national and international levels
- Conducting open dialogues to educate the society on AI and ensuring bilateral and multilateral cooperation with other countries

The latter includes a Franco-German research and development network (*virtual center*). These points overwhelmingly deal with a policy standpoint. In terms of AI applications, the Federal Government is looking to solve what it terms the *weak* approach. These include deduction systems to prove the correctness of hardware and software, knowledge-based systems coupled with psychology and cognitive sciences to simulate human expertise, pattern recognition, robotics for autonomous

[37] The Federal Government. *Artificial Intelligence Strategy.* 2018. Source: **https://www.ki-strategie-deutschland.de/home.html**.

systems, and the analysis and understanding of human interaction (images, languages, and so on).

With an investment outlook of over €3 billion to implement its strategy, only a part of which in play so far, Germany is not particularly leading on the investment front. That may seem at odds with the government's goals of increasing the country's (and Europe's) competitiveness in AI, thus ensuring the good of European and international society, and ensuring measures and dialogue on ethical, legal, cultural, and institutional terms. These are clear but also relatively broader in scope compared to some of the other leading countries which are more application-focused.

What is interesting, however, is that while Germany's national AI implementation seems to be aimed at strengthening the country's manufacturing prowess, the broader strategy aims to spearhead Europe's wellbeing and leadership in this space. In that regard, Germany's position so far has been most commendable in its strong focus on a collaborative European and global societal growth with AI, and a clear action plan on how to facilitate it. As an example, the government is supporting setting-up observatories at European and international level, and initiating European and transatlantic dialogue on the human-centric use of AI. The government is also funding AI applications that can benefit the environment and launching platforms that openly promote dialogues between the government, science, commerce, and civil society.

7.3.6: AI in Australia

Down under, Australia has been active in pushing AI as well, with an ethical framework intended to guide AI modeling and use by businesses and governments. The Department of Industry, Science, Energy and Resources in the Australian Government has laid out eight AI principles to help achieve better outcomes, reduce the risk of negative impact, and practice the highest standards of ethical business and good governance with AI.[38] Their framework also clarifies that adherence to these principles is voluntary. Whether that is a good or bad thing may be a matter of perspective. The eight AI principles include **human, social and environmental well-being, human-centered values, fairness, privacy protection and security, reliability and safety, transparency and explainability, contestability** (to challenge the output of an AI system), and **accountability**.

Among these principles, explainability and contestability are welcome additions to the mix that we have seen so far, primarily because they are intended to prevent AI from seizing control of critical decision-making. And as the first principle itself states, AI systems that help address such areas of global concern should be encouraged

[38] Australian Government Department of Industry, Science, Energy and Resources. *AI Ethics Principle*. March, 2020. Source: **https://www.industry.gov.au/data-and-publications/building-australias-artificial-intelligence-capability/ai-ethics-framework/ai-ethics-principles**

like the **United Nations Sustainable Development Goals**[39]. There are also other Australian initiatives underway to further advance the country's position on AI, including projects like **The Human Rights and Technology** project[40], soliciting submissions from the public with the aim to protect human rights in the face of AI. The initiative released an executive summary in 2019 which talks at length about the ethics and responsible use of AI. In fact, Australia has even set up an **AI Safety Commissioner** to bring expertise to the existing regulatory structure, build trust for AI among the community and strengthen the local innovation economy[41].

Australia's hard focus on addressing the ethical challenges and safety around AI over attaining global leadership in the field has been a stark differentiating factor. In 2019, an ethical AI for *defence study*[42] and workshops was led by the **Defence Science and Technology (DST)** group with Plan Jericho and the Trusted Autonomous Systems Defence Cooperative Research Centre, including representatives from the **Australian Defence Force (ADF), Centre for Defence Leadership and Ethics (CDLE),** industry, universities and institutes from Australia and abroad. Its objective was to discuss ethics around the militarization of AI – another unique case among the countries we have looked at so far.

Finally, the government also released the **Consumer Data Right**[43] overview with the primary aim to give Australians greater control over their data. It was planned to start with banking, followed by energy and telecommunications, followed by other sectors in sequential order. The right includes everything for businesses and individuals, from privacy and protection of information to greater collaboration and use of data solely by trusted accredited service providers. To aid the initiative, the government set up $90 million fund over a five-year period.

The dollar amount may not be significant when compared to other leading countries with ambitions in AI, but not all of Australian efforts have been limited to ethical and security considerations. The country also has a **Digital Technologies Hub**[44] which serves as an online resource by the Department of Education, Skills and Employment for students and teachers alike. Meanwhile, to address gaps in the industry, $25 million was provided in Round 6 by the Cooperative Research Centres Programme for AI

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[39] *United Nations. Sustainable Development Goals.* Source: **https://www.un.org/sustainabledevelopment/sustainable-development-goals/**.

[40] Human Rights and Technology. Source: **https://tech.humanrights.gov.au/**.

[41] Australian Human Rights Commission. *Human Rights and Technology Discussion paper.* December, 2019. Source: **https://tech.humanrights.gov.au/sites/default/files/inline-files/TechRights2019_DiscussionPaper_Summary.pdf**.

[42] Ministerial and Executive Coordination and Communication. Australian Government: Department of Defence. *Ethical AI for Defence: World experts gather in Canberra.* August 1, 2019. Source: **https://news.defence.gov.au/media/media-releases/ethical-ai-defence-world-experts-gather-canberra**.

[43] Australian Government: The Treasury. *Consumer Data Right Overview.* September, 2019. Source: **https://treasury.gov.au/consumer-data-right**.

[44] Digital Technologies Hub. Source: **https://www.digitaltechnologieshub.edu.au/**.

projects[45]. The **Commonwealth Scientific and Industrial Research Organization (CSIRO)'**s Data61 has been developing an AI technology roadmap[46] to help frame policies and develop the country's skills, infrastructure, research, regulation and data governance around AI. It has also identified three focus areas for the country to further build its capabilities in. These include: *natural resources and environment; health, ageing and disability; and cities, towns and infrastructure.*

7.3.7: AI in India

It is important to look at the state of AI among developing economies as well, assuming China is an anomaly. While Australia's AI policy was weaved around security, India's looks at inclusive growth. As one of the fastest growing economies with the second largest population in the world, it has a significant stake in the AI revolution. India's national strategy on AI has a clear mandate, tagged *# AIforAll*. India's strategy is a two-tiered collaborative approach comprising **Centres of Research Excellence (CoREs) and International Center of Transformational Artificial Intelligence (ICTAI).**

The strategy looks at five sectors that encompass the fundamentals of society. These are *increased access and affordability of quality healthcare; enhanced farmers' income, increased farm productivity and reduction of waste; improved access and quality of education; efficient and connectivity for the burgeoning urban population; and smarter and safer modes of transportation and better traffic and congestion problems.*[47]

As part of the **Smart Cities** program, 99 cities have been selected with an expected investment of Rs. 2.04 lakh crores (~US$27 billion). However, among the countries we have looked at so far, India faces the strongest challenge in terms of income, literacy, and healthcare disparity across the nation. As an example, per 1000 population, India has 0.76 doctors, 2.09 nurses and 1.3 hospital beds, compared to WHO's recommendation of 1 doctor, 2.5 nurses and 3.5 hospital beds. The country realizes the range of socioeconomic realities its citizens face, which is why India's plan to leverage AI keeps a keen eye on inclusivity. In that aspect, the country faces a unique challenge, but also the greatest visible per capita benefits if AI is adopted well. Like Germany, India's AI ambition is centered on the upliftment of society. Unlike Germany, much of that upliftment is geared towards fulfilling basic needs and improving efficiencies, instead of raising the entire region to a leadership position. The strategy document reflects this sensitivity by openly sharing the barriers that India faces. These include a lack of expertise in the field; lack of access to intelligent

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[45] Australian Government: *Department of Industry, Science, Energy and Resources. Artificial Intelligence.* Source: **https://www.industry.gov.au/strategies-for-the-future/artificial-intelligence**.

[46] CSIRO Data61. *Artificial Intelligence Roadmap.* Source: **https://data61.csiro.au/en/Our-Research/Our-Work/AI-Roadmap**.

[47] NITI Aayog. *National Strategy for Artificial Intelligence #AIFORALL.* June, 2018. Source: **https://niti.gov.in/national-strategy-artificial-intelligence**.

data; low awareness, collaboration, and high resource cost in AI adoption; and lack of formal regulations in the space.

Not all its efforts are blinded to the outside world. Interestingly, as means of achieving inclusive growth, India also plans to serve as an AI *garage* for 40% of the World as a solution provider not to the developed but to the developing economies. The plan is to utilize AI developed for its own social growth to aid that of other countries with similar socioeconomic needs. The paper has even proposed a slogan to go with the approach, titled *Solved in India* – a cousin to the country's present *Make in India* campaign for manufacturing. As a result, the country expects AI to boost its annual growth rate by 1.3% by 2035.

India's call to the World is also seemingly being heard for far more strategic reasons. Right around the time Huawei was facing rebuttals from Western nations on its 5G network offering, India's Reliance Jio developed its own 5G network and curiously, welcomed significant investments (to the tune of $13.2 billion) from the US giants Facebook and Alphabet for around 17% stake. That was in addition to investments from several US private equity firms[48] . Soon after, Facebook-owned WhatsApp emerged as the platform of choice to drive commerce, effectively placing Reliance Jio in a competing position with Chinese Tencent-backed **WeChat**[49] .

A global house for AI services would require India to significantly increase its talent pool. Although later to the game in comparison to China's educational strides, India recently overhauled its education system into a new-look **New Education Policy 2020**[50] **.** The policy – aimed at creating job creators vs. job hunters – clears the way for flexible interdisciplinary and vocation-based learning with emphasis on coding early on in schools. India's first concern is to propel its population into the modern era, instead of racing for global AI leadership. But with the kind of inconvenient see-saw that TikTok found itself on, in having to choose between a forced acquisition or a US ban, the ongoing US-China technology cold war is also opening up strategic opportunities in the global market for countries like India. Time will tell how effective and timely the country's efforts are.

India's interpretation of ethics in AI revolves around fairness, accountability, and transparency. These three attributes could inform the launch of a **National AI Marketplace** – a platform to house data and AI models for exchange. A cloud

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[48] Bahree, Megha. Forbes. *Google Joins Facebook In Billionaire Mukesh Ambani's Jio Juggernaut*. July 15, 2020. Source: **https://www.forbes.com/sites/meghabahree/2020/07/15/google-joins-facebook-in-billionaire-mukesh-ambanis-jio-juggernaut/#1f088b4e1990**.

[49] Mukherjee, Andy. Bloomberg. *Can Ambani Take on Tencent, Huawei and Xiaomi?* July 15, 2020. Source: **https://www.bloomberg.com/opinion/articles/2020-07-16/india-s-ambani-challenges-huawei-tencent-in-u-s-china-tech-war**.

[50] Chopra, Ritika. *The Indian Express. Explained: Reading the new National Education Policy 2020*. August 1, 2020. Source: **https://indianexpress.com/article/explained/reading-new-education-policy-india-schools-colleges-6531603/**.

platform, called **AIRAWAT** presents a creative take on the open data schemes laid out elsewhere. However, doubts have been raised on the implementation feasibility of the strategy.

After much delay, the government allocated □7,000 crores (~US$932 million) to NITI Aayog in 2019 for the broader AI strategy execution.[51] Earlier that year, an expert in Chatham House had noted that: *In the absence of thinking about both technical feasibility and social viability, there is a strong risk that AI-based technology gains are likely to benefit only a select few Indians. In this context, the AI for All narrative obscures rather than answers many of the fundamental challenges that India faces.*[52]" At the time of this writing in 2020, the government was in the process of finalizing the mechanism to implement India's proposed strategy.[53]

7.3.8: AI in Russia

Back in 2017, the Russian President Vladimir Putin labeled AI as the future of mankind in a speech that acknowledged both its opportunities and threats – foreseen and unforeseen. President Putin was clear in his view that any monopoly in the AI domain should be avoided as any singular AI leader would effectively be the ruler of the world.[54]

Russia's AI strategy has developed iteratively over the years, similar to what we saw earlier with the U.S. Its plan, released by the **Russian Ministry of Defense, Ministry of Education and Science, and Academy of Sciences,**[55] proposed forming a consortium on data and AI to induce collective efforts of the scientific, educational, and industrial community. It also opened the way for a richer algorithmic repository, dedicated laboratories, training systems, and innovative infrastructure. State-wide research on the impact of AI was taken up, in addition to a system for compliance checking and annual conferences. However, perhaps most uniquely in its openness, the plan proposed *military games*.

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[51] Hebbar, Prajakta. Analytics India Mag. *NITI Aayog To Get ₹7,000 Crore To Execute AI Project:* Report. September 11, 2019. Source: **https://analyticsindiamag.com/niti-aayog-to-get-%e2%82%b97000-crore-to-execute-ai-project-report/**.

[52] Moltzau, Alex. Medium. *India's Artificial Intelligence Strategy Going Into 2020.* February 1, 2020. Source: **https://medium.com/@alexmoltzau/indias-artificial-intelligence-strategy-going-into-2020-d51af4edd0bb**.

[53] Sharma, Yogima Seth. Economic Times. *Govt to soon finalise mechanism to implement national strategy for AI*. March 11, 2020. Source: **https://economictimes.indiatimes.com/news/economy/policy/govt-to-soon-finalise-mechanism-to-implement-national-strategy-for-ai/articleshow/74574924.cms**.

[54] Gigova, Radina. CNN. *Who Vladimir Putin thinks will rule the world.* September 2, 2017. Source: **https://www.cnn.com/2017/09/01/world/putin-artificial-intelligence-will-rule-world/index.html**.

[55] Ministry of Defense of the Russian Federation. *Conference "Artificial Intelligence: Problems and Solutions - 2018".* 2018. Source: **http://mil.ru/conferences/is-intellekt.htm**

Russia has been a vocal supporter of the militarization of AI having made it clear in 2017 that it will develop **lethal autonomous weapon systems (LAWS)** otherwise banned by the UN.[56] This opens a debate on the following two fronts:

- First, *is Russia simply not being a hypocrite by being open about something that some other countries may do in secrecy?*
- Second, assuming ideal compliance to the UN mandate, *will Russia's position inevitably compel countries capable of developing LAWS to do so to suitably defend themselves?*

Russia has been a key player in the AI field for many years. Its first major AI research was taken up as early as 1954 in the Soviet era. In 1988, the **Association of Artificial Intelligence (AAI)** was formed.[57] Given the developments since and leading up to its current national strategy, Russia's AI focus is attuned to three fronts: **domestic-civilian, military**, and **foreign policy**. This national strategy was prepared by the country's largest bank – **SberBank** – in late 2019, following a directive in Vladimir Putin's approved list of instructions earlier in the year.[58]

In October 2019, Putin approved the AI strategy running into 2030. Besides ethics, data and training, the plan laid substantial focus on collaboration between the state and large companies, which would include the likes of genome technology and portable energy in addition to AI. It also showcased Russia's eye on growth, given an estimated global market growth of $500 billion for AI products, which equates to a 17-fold rise by 2024.[59] The principles include: **the protection of human rights, security, transparency, technological sovereignty, innovation cycle integrity, cost-effectiveness**, and **support for competition.**[60]

The six-year AI budget was increased from $1.3 billion to $6.1 billion around the same time when the strategy was announced,[61] indicating how state-driven Russia's AI initiative is, akin to China's. This model can be a recipe for success, as we have seen in case of the originally Pentagon-funded development of the internet. However, the Russian Prime Minister Dmitry Medvedev did say that the country seeks to go their

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[56] Hutchison, Harold C. Business Insider. *Russia says it will ignore any UN ban of killer robots.* November 30, 2017. Source: **https://www.businessinsider.com/russia-will-ignore-un-killer-robot-ban-2017-11**.

[57] Sukhankin, Sergey. *The Jamestown Foundation. The Three 'Faces' of Russia's AI Strategy.* November 5, 2019. Source: **https://jamestown.org/program/the-three-faces-of-russias-ai-strategy/**.

[58] President of Russia. *The list of instructions following the meeting of the Supervisory Board of the Agency for Strategic Initiatives*. January 30, 2019. Source: **http://kremlin.ru/acts/assignments/orders/59758**.

[59] Nikolski, Alexei. TASS. *Putin approves National Strategy for AI until 2030.* October 11, 2019. Source: **https://tass.com/economy/1082644**.

[60] Russia AI Strategy Translation from October 2019 Source: **https://cset.georgetown.edu/wp-content/uploads/t0060_Russia_AI_strategy_EN-1.pdf**.

[61] Bendett, Samuel. *Defense One. Russia's AI Quest is State-Driven — Even More than China's. Can It Work?* November 25, 2019. Source: **https://www.defenseone.com/ideas/2019/11/russias-ai-quest-state-driven-even-more-chinas-can-it-work/161519/**

own way in the development of digital technologies, which could make success a challenge in the face of a weaker start-up culture and brain drain that Russia faces. Having said that, successes like **NtechLab** (facial recognition), **Yandex.ru** (search engine), **Zyfra** (data analysis) and initiatives like the **Skolkovo Innovation Cluster** for start-ups, the **National Technology Initiative (NTI)** for logistical and financial support to AI development, and the **Russian Direct Investment Fund (RDIF)** are all steps in the right direction.

7.4: International AI governance frameworks

While the rise of AI in global governments is in full swing in some countries, it is gaining steam in others with an acknowledgement of its needs and its inclusion in the vision of these countries. The movement to develop joint AI regulatory policy and ethical frameworks had begun when AI software started being used in different aspects of security, healthcare, education, and so on and areas that have mature regulatory controls. However, true insurgence required mass coordination across departments and across sectors. That, after all, is what will define the use of AI by governments.

The primary challenge in aligning AI governance practices into unified systems is that it will require tremendous collaboration across many different agencies with differing motives, and budgets. For companies, the equation is simpler. Prevent job losses and capitalize on the grants and allowances available for greater constructive use of AI.

As we have seen, AI can be used by some governments of this world to more risk dynamics like pervasive surveillance capitalism. However, we should not lose sight of the fact that AI also has the potential to unite us like never before. Yes, governments would be equipped to keep a sterner eye on its citizens, particularly in high risk centers, airports, train stations, banks, and so on, but the truly fruitful use cases AI relate to its need for collaboration, thanks to the ever-rising investments and data pervasiveness. Truly impactful AI models can be created anywhere in the world, after all. And accurate AI models require as much data as they can gather to ensure diversity and lack of bias. This implies collaboration between governments of different countries, between public and private sector institutions within a country, and between departments within a government, and active citizen engagement.

From the way we see it, AI serves the perfect ground for a collaborative socio-economic world. Far from AI-wars, we are being given a platform to unite and write the story of human success where we can coexist with machines in harmony. The only way we would fail at it is if we cannot collaborate and regulate the progress. If we cannot harmonize and socialize and evolve the human race, then even eventual robot domination is not something we will have the right to complain about.

7.4.1: The OECD AI framework

The **Organization for Economic Cooperation and Development (OECD)** has been proactive in keeping track of AI policy and regulatory developments across the world, thanks to its **OECD.AI Policy Observatory.** It has been on point to track all global AI development, in fact. With over 70 economies in the mix, it can greatly aid AI's role in promoting sustainable economic growth. A powerful example on display came in light of the Covid-19 pandemic as the observatory set up an AI-powered watch on its development.[62] The page even displayed all major AI initiatives being taken up around the world to tackle the pandemic.

The G20 human-centered AI principles, which were laid out in 2019 with an eye on trust, were informed by OECD's 50+ member expert panel.[63] These principles prioritized the growth and well-being of people and planets while holding the developers accountable for AI's functioning. The principles also mandated transparency and robustness in how AI functioned, compliant with legal, moral, fair, responsible and democratic values.

In addition to these principles, the OECD also released a set of recommendations for the world's governments which included facilitating R&D investments, setting up infrastructure for data and knowledge exchange, guiding the deployment of trustworthy AI, training people on the subject and cooperating with other countries.

OECD's guidelines are helpful for developing economies that can benefit from clearer strategic directions. These include countries like Argentina, Brazil, Colombia, Costa Rica, Peru and Romania, among 42 that adopted OECD's AI Principles in 2019.[64]

7.4.2: The European Union AI framework

A year prior, in 2018, 25 European countries signed a *Declaration of Cooperation* on AI.[65] It was a timely development as the European Commission had set up a **high-level expert group (HLEG)** to advise it on AI policy. The HLEG, in turn, launched a European AI Alliance to bring in key stakeholders in the field globally to pitch in with recommendations and an informed dialogue. And In 2019, it delivered ethical guidelines for trustworthy AI, incorporating further comments on its first draft that had released in December 2018, claiming that AI should be lawful, ethical, and robust.[66]

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[62] OECD.ai Policy Observatory. *AI-powered COVID-19 watch.* Source: **https://www.oecd.ai/covid**.

[63] *G20 Ministerial Statement on Trade and Digital Economy*. Source: **https://www.mofa.go.jp/files/000486596.pdf**.

[64] OECD. **Forty-two countries adopt new OECD Principles on Artificial Intelligence.** Source: **https://www.oecd.org/newsroom/forty-two-countries-adopt-new-oecd-principles-on-artificial-intelligence.htm**.

[65] European Commission. *EU Member States sign up to cooperate on Artificial Intelligence.* April 10, 2018. Source: **https://ec.europa.eu/digital-single-market/en/news/eu-member-states-sign-cooperate-artificial-intelligence.**

[66] European Commission. *Ethics guidelines for trustworthy AI.* Source: **https://ec.europa.eu/digital-single-market/en/news/ethics-guidelines-trustworthy-ai.**

The implementation of the ethical guidelines falls in a tricky territory, with EU considering and then dropping the idea to ban facial recognition, for instance.[67] Nonetheless, the principles laid out by the HLG are likely to help the EU flesh out specifics of AI technology development and use. These principles include: *human agency and oversight; technical robustness and safety; privacy and data governance, transparency of the data, system and AI business models; diversity to ensure non-discrimination and fairness; societal and environmental well-being, and accountability.*

With an increased annual investment estimated to be €1.5 billion for the 2018-20 period, the European Commission's original approach was based on three pillars: **leading in technological development and adoption, preparing for the ensuing socio-economic changes, and ensuring an ethical and legal framework.**[68] Unlike OECD, EU has a more focused regional mandate. Collectively, its aim is *to become a global leader in innovation in the data economy and its applications* by building an ecosystem of excellence and trust.[69] The principles we discussed earlier are all directed towards the trust factor. The European Commission recently released a white paper giving more details on its pursuit of excellence. And while many of the components are expected – driving adoption in the public and private sectors, setting up infrastructure to allow data access and further research, and skilling people – it also aims to work with member states to focus on SME's as a driving force.

However, it is interesting to see both OECD and EU's prioritization of transparency and explainability of AI – the most crucial requirement to make sure companies don't develop Black Box AI, and users don't blindly follow AI in their decision-making. Both organizations have also ensured that any new policy builds on existing frameworks. An example to this point would be the **Digital Single Market**[70] strategy in case of EU, formed in 2015 to facilitate digital opportunities across the continent. EU has also taken into account the **Civil Law Rules on Robotics**[71] from 2017 and the **General Data Protection Regulation**[72] from 2018.

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[67] Nicolás, Elena Sánchez. *EU Observer. EU backtracks on plans to ban facial recognition.* February, 2020. Source: **https://euobserver.com/science/147500**

[68] European Commission. *Artificial Intelligence.* April, 2020. Source: **https://ec.europa.eu/digital-single-market/en/artificial-intelligence**.

[69] European Commission. *White Paper On Artificial Intelligence - A European approach to excellence and trust*. February 19, 2020. Source: **https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf**.

[70] European Commission. *Shaping Europe's digital future*. Source: **https://ec.europa.eu/digital-single-market/**.

[71] European Parliament. Source: **https://www.europarl.europa.eu/doceo/document/A-8-2017-0005_EN.html**

[72] GDPR. Source: **https://gdpr.eu/**

7.5: The AI governance imperatives

Despite their unique approaches, every nation profiled reinforced common themes. Although the details may have varied from nation to nation, the general patterns can inform four key AI strategic imperatives:

1. Investing in human capital at all levels: To win with AI, talent is the number one priority for countries to pay acute attention to. As of late 2017, China had an estimated 8.9% of the world's total talent in AI, followed by the U.S. at 13.9%.[73]
    a. Building a national policy that leverages e-learning and curriculum at all levels of a nation's educational systems – corporate/vocational, universities, colleges, high schools, junior and elementary programs – with increased **Science, Technology, Engineering, and Mathematics (STEM)** components.
    b. Ensuring that other skills in the arts (Philosophy, Ethics, Psychology, and Emotional Intelligence), user centered design and communication fields are balanced to tackle AI programs.
2. Acceleration of applied R&D leveraging collaborative ecosystems
    a. Every country researched reinforced the importance of applied innovation versus only pure R&D to ensure the problems that were being tackled could be applied and iterated to learn from.
    b. An emphasis on open research and open data were commonly referred to as being key to amass major global data sets to solve common problems, particularly in the health and medical field to tackle diseases like cancer, diabetics, and increasingly deadly viruses like Covid-19 to solve global health challenges.
3. Smart cities and infrastructures
    a. Cities cannot sustain their growth without AI. Urbanization to cities is a global dynamic as mega cities have accelerated. Over half the world's population now lives in cities, up from 14% in 1900.[74] By 2050, that number will swell to over 66%.[75] Countries must prepare to modernize their cities and infrastructures to keep pace with the increasing demands and need for municipal efficiency.

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[73] Kania, Elsa B. CNAS Research. *China's Threat to American Government and Private Sector Research and Innovation Leadership*. July 19, 2018. Source: **https://www.cnas.org/publications/congressional-testimony/testimony-before-the-house-permanent-select-committee-on-intelligence**

[74] Walker, Jon. Emerj Research. *Smart City Artificial Intelligence Applications and Trends.* January 31 2019. Source: **https://emerj.com/ai-sector-overviews/smart-city-artificial-intelligence-applications-trends/**.

[75] Cogito. *Applications and Role of AI in Smart Cities for Sustainable Development.* March 13, 2020. Source: **https://www.cogitotech.com/blog/applications-role-of-ai-in-smart-cities/**.

   b. Cost, time, and space savings will also require smarter management of the infrastructure dynamics. That, in turn, will require a great deal of logistical intelligence and data access. NVIDIA predicts that there will be over 1 billion cameras deployed on cameras[76] on government property, infrastructure, and on commercial buildings linked to AI advanced analytics to help manage the growth dynamics due to enablement's from IoT, sensors, AI, grid computing, and so on.

4. Ensuring privacy, ethical, and secure practices
   a. According to PwC research, 77% of CEOs feel AI could increase vulnerability and disrupt their business.[77] And yet, only 25% prioritized AI ethics in their investment decisions.[78] Privacy and security policies must guide AI development and adoption, and without clear guidelines, lines may easily and often inadvertently be crossed – as we have already seen in the pre-General Data Protection Regulation (**GDPR**) era.
   b. Ensuring AI models can be explained and interpreted to manage operational, reputational and financial risk is another key theme in AI ethical policies. For example, IBM Research, on the matter of trusting AI, states, *we need to understand the rationale behind the algorithmic assessment, recommendation or outcome, and be able to interact with it, probe it – even ask questions*.[79]

The last point also brings us to another need in the purview of AI ethics – a GDPR-like framework that can reliably and measurable guide such policy framing by countries. While a sound strategy may facilitate a proper and well-intentioned development and use of AI, its successful impact relies heavily on the quality of the solutions and on how informed their buyers and users are. To this end, administrations can launch a framework to help qualify AI solutions across the following eight parameters:[80]

1. **Depth of AI:** AI can be a simple statistical model or it can be something deeper and more robust. A uniform rating system on how deep or rigorous

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[76] NVIDIA. *NVIDIA Paves Path to AI Cities with Metropolis Edge-to-Cloud Platform for Video Analytics.* May 18, 2017. Source: **https://nvidianews.nvidia.com/news/nvidia-paves-path-to-ai-cities-with-metropolis-edge-to-cloud-platform-for-video-analytics**.

[77] Anand, Mala. Knowledge @ Wharton. *Want Responsible AI? Think Business Outcomes.* July 17, 2019. Source: **https://knowledge.wharton.upenn.edu/article/want-responsible-ai-think-business-outcomes**.

[78] Fatemi, Falon. Forbes. *How Companies Should Answer the Call for Responsible AI.* February 28 , 2020. Source: **https://www.forbes.com/sites/falonfatemi/2020/02/28/how-companies-should-answer-the-call-for-responsible-ai/#ccf493413f55**.

[79] IBM Research. *Trusting AI.* Source: **https://www.research.ibm.com/artificial-intelligence/trusted-ai/**.

[80] The Upadhyays. *8 Parameters to Qualify AI Solutions.* June 13, 2020. Source: **https://www.theupadhyays.com/post/8-parameters-to-qualify-ai-solutions**

an AI model is could quickly help assess what the model will be able to handle in practical application scenarios.

2. **Explainability of AI:** As far as feasible, AI should not be a black box if it aids critical decision-making. Having said that, it is tricky in case of techniques like deep learning.
3. **Type of AI:** If users had access to a dictionary of the different types of AI functions and their explanation, they could better identify which types of AI tool they should look at to solve specific problems.
4. **Support needed for AI:** Organizations need clarity on what support any AI tool would require from its users for it to perform properly.
5. **Usage conditions for AI:** AI tools, no matter how good they are, work best under specific conditions related to the use case, data, or conditions. Remember most tools are Narrow AI and not general AI. So, clarity on this front is crucial for organizations to determine if a tool would be useful for them and their specific needs. This could be similar to the information we find on food packaging today.
6. **Biases with AI:** Biases can occur in many forms. Any AI developer should be accountable to advise on the potential biases the tool may carry based on its training and development, at least to the best of the developer's knowledge, to help guard organizations against insight fallacy.
7. **Job-loss risk of AI:** Much like a rating system for the depth of AI, a scale (or even color codes) could be developed to estimate the extent or risk of job-loss with an AI solution, even if it were measured against the criticality of the tool. This would help organizations and societies better assess and plan job displacement and make informed choices in their use of AI.
8. **Kindness of AI:** If we fear robots taking over, we must also think about building ones that are kind. Imagine an autonomous car in a moment of accident, where it has to decide between running into another car or running off track and into a pedestrian. While preferences can be clearly set on who the car should first protect, it's not enough. Defining elements of kindness and building them into AI's analytical and action capability can have a significant impact in the long run.

7.6: Conclusion

This chapter summarized the AI strategy being formulated by many countries. The choice of these countries was strategic as well in their often-distinct approach and perspective. We saw US and China's clear mandate to establish global leadership in AI but in varying styles. While US has faced uproar to more surveillance, China is using it as its main artillery for state-driven AI enablement. While US' investments in AI have mostly belonged to privately owned businesses, China's investments

paint a picture of what a coherent nationwide effort looks like. Russia is another example of state-driven AI growth, but the country is most vocal about its stand on competitive AI. Canada, by contrast, is witnessing a more research and knowledge-driven AI growth in sharp contrast to UK's application focus. UK also looks to be most organized in its iterative pilot-wise AI deployment. Australia, meanwhile, is more concerned with AI's ethics and preventative policy with regards to citizen security. Germany is hoping to deepen its manufacturing expertise with AI but its focus is equally directed at the regional upliftment of Europe in this space. Societal upliftment is also a mandate for India, an example of AI's role in a developing nation, but its interest is in inclusivity and in ensuring AI can help reduce the socio-economic gap its citizens currently face.

There are several other countries with a clear AI mandate and policy – Singapore, France and Japan being few examples – all of which are versions of the approaches discussed earlier. We also looked at the global policies laid out by the likes of OECD and EU, which could not only inform AI's direction in large economies but also drive the policies for smaller economies. The key is to balance the competition levels among the larger players when the stakes are high as AI becomes more integrated into every aspect of our world economy. To that end, another promising set of AI visionary future principle were developed by the G7 leaders: **Canada, France, Germany, Italy, Japan, the United Kingdom,** and the **United States**. Called the *Charlevoix Common Vision for the Future of Artificial Intelligence,* it included 12 commitments which, among other themes, included the inclusion of women and underrepresented groups and development of human-centric AI.[81]

With trillions of dollars in potential value on offer from AI over the next decade, the Oxford Insights and the International Development Research Centre created a Government AI Readiness Index in 2017.[82] The index is handy, much like the assessment framework you will find in the previous chapter, as these tools can help governments and organizations to assess where they stand in being able to reap the benefits of AI. This site provides an excellent summary of other countries not profiled in this chapter, and is a very helpful resource to keep abreast of international AI government readiness levels, measured across eleven key metrics, ranging from in-country digital skills and government innovation to existing data capabilities. At the time of writing, the top 20 list began with Singapore and culminated with China, with no Latin American or African country making it.

While ending this chapter on international AI country policies, it is important that leaders understand how profoundly AI will impact both business and societal

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[81] Future of Life Institute. *AI Policy – Charlevoix Common Vision For The Future Of Artificial Intelligence.* Source: **https://futureoflife.org/charlevoix-common-vision-future-artificial-intelligence/.**

[82] Oxford Insights. *Government Artificial Intelligence Readiness Index 2019.* Source: **https://www.oxfordinsights.com/ai-readiness2019**.

transformation. The development of aligned and thoughtful country AI policies that help to shape and create a safe, secure and a positive innovation climate to advance our digital world, harnessing the opportunities that advanced AI can deliver to benefit both society and citizens is a modernization imperative. Just ask yourself, *does your administration have a clear AI Strategy? Or is there an AI Ethics framework to guide the citizens and your business strategies?*

Today, too many Board Directors and CEOs are not educating themselves on AI and investing in new skills and knowledge of their talent to be able to understand how to use these new methods and ensure they are building responsible AI approaches. Without their voices coming in, the governments cannot hope to facilitate the country and its businesses' future competitiveness.

We have emphasized the importance of talent and skill development as it is the most important area for countries, governments, and organizations to focus on, in order to build the right strategies and help propel organizations and societies forward. Like Louisa May Alcott said in **Little Women**, *because talent isn't genius, and no amount of energy can make it so. I want to be great, or nothing.*[83]

So, *are we heading towards a perfect world or a perfect storm?*

[83] Alcott, Louisa May. *The Literature Page.* Little Women: Chapter 39. Source: **http://www.literaturepage.com/read/littlewomen-451.html**.

Chapter 8
AI in Value Chains

In the previous two chapters, we discussed the policies, development and use of AI in the public sector. The consequent AI shift may look different under different administrations, but it holds some degree of consistency when we turn our attention back to businesses.

In this chapter, we will specifically look at the spine that binds our globalized world – the value networks that cater to consumers worldwide. This chapter is about the journey and interface between companies and customers. Our fourth industrial age is defined by global supply chains and ecosystems that are increasingly interconnected by everything digital – where the **Internet of Things (IoT),** blockchain, quantum computing, smart computing platforms, and advanced forms of **Artificial Intelligence (AI)** and **Machine Learning (ML)** methods have coalesced. The interconnectedness between institutions across the value chain from agriculture to manufacturing to processing to distribution to retail to our homes is an intrinsically deep ecosystem now. And AI is underpinning everything.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- Transformation occurring in the value chains due to AI

- AI innovations and applications in the value chains
- **AI Vault:** ethical challenges
- Concluding points on the use of AI by private sector companies in the value chain

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in the value chain
- Learn how AI is transforming the value chain
- Discover the impact on AI in agriculture and mining, manufacturing and retail
- Appreciate the ethical considerations to keep in mind while driving AI growth

8.1: The perfect world

Alixia Bolt is taking a vacation to visit her grandparent's farm, near Bloomingdale, Indiana. The 100,000-acre farm in the Midwestern United States has been operating since the 1950s. The farm is the largest diversified agriculture business with 100 dairy cattle, 1,000 hogs and producing corn, soybeans, and strawberries. The Bolt family have been applying AI and robotic technology for decades. Alixia's great grandfather, Henry Bolt, is the leading scientific researcher at the Indiana University and has been granted >100 patents on modernizing global agricultural businesses. Given her grandfather's stellar industry profile, Alixia wants to ensure she has relevant insights on the farm's current and future production. Echo works to find her all the relevant knowledge and prepares a future report on new innovations prime for application testing. In less than five minutes, over two million articles are scanned and indexed, with an automatic voice narrative prepared. Alixia takes a look at the following:

1. 100 drones patrol the vast farm inspecting for soil composition, inspecting insect controls, helping to pick strawberries, automatically dispense water, deploying drone ants to catch or kill any harmful insects, and releasing relevant sounds to scare predators from eating farm produce before harvest.
2. 500 cameras are connected to over 1 million **Internet of Things (IoT)** sensors which are located around the farm's fences monitoring all traffic patterns onto the property. The number of birds is automatically classified by alerting the drones in real time of predator intrusions, or human faces attempting to steal any of farm production outputs. Every movement, animal, man, or machine is tracked and sent to the Central AI as all agricultural data has now been centralized due to global warming regulations.

3. The *Bolt agriculture blockchain* is the world's largest super blockchain supply and demand channel enabling trustworthy food supply chains and building trust between producers and consumers. As the world's most trusted way of storing data, it facilitates the use of data-driven technologies to make farming smarter globally, and now provides an equity mechanism ensuring starvation ceases.
4. New innovations are recommended to increase drone delivery services to local super markets and to home orders, ensure genetic diversity to avoid crops being susceptible to diseases, and purchase new corn production robotic tractors for complete automatic production.

Alixia is well prepared to sit with her great grandfather Henry, now 120, and talk about her dream to operate the family farm and continue the Bolt legacy.

8.2: The perfect storm

Alixia Bolt is taking a vacation to visit her grandparent's farm, near Bloomingdale, Indiana. For the first time, the 100,000-acre farm in the Midwestern USA is closing since its founding in 1950. The Bolt farm was once the largest diversified agriculture business, producing both fresh produce, corn, soybeans, strawberries, dairy cattle, and meat products, mainly from hogs. Due to excessive global warming, the Bolt farm has had many environment and AI terrorism setbacks. Alixia knows seeing her grandfather, Henry, that her visit will be a very sad day as his entire life was dedicated to modernizing agriculture businesses to ensure AI and robotics were used responsibly. Alixia asks Echo to prepare a report highlighting the main devastation points in their family agricultural business. In less than five minutes, a voice narrative is prepared. Alixia takes a look at the following:

1. 100 drones which were used to patrol their vast farms have been decommissioned. They were reported to have released too many pesticides, which resulted in the devastating effect. Since AI's insights had exposed the most resistant and long-living variety for each crop, most of the world's crops now exist in a single form. The lack of diversity has left them defenseless against any disease or chemical that adversely impacts that particular variety.
2. 500 facial recognition cameras connected to over 1 million IoT sensors had been hacked scrambling images from diverse farms across USA. So, all information collected was corrupt, and as more IoT signals were connecting, the erosion of quality data accelerated.
3. The Bolt agriculture blockchain too has suffered from the data erosion. It has become alarmingly expensive to run and has disrupted the food supply chain replying on it.
4. New innovations have been put on hold due to PR publicity and risks of hacking plaguing the Bolt family farm. As a result, the estate recently declared

bankruptcy due to legal suits and food poisonings, resulting in over 10,000 deaths traced to the farm's production centers.

Alixia is well prepared to sit with her grandfather to have a very difficult conversation: *shutting down the farm forever.* His pain nearly dwarfs her own dream to continue the Bolt agricultural farm legacy; that pain itself is dwarfed by the irreversible damage to food security facing the country.

8.3: The AI shift

If AI is an ocean, it benefits from a continuous stream of data flow. Imagine connections made and remade in an endless all knowing, all sensing and learning network of intelligent nodes, and over time travelling into ecosystems with no channel boundaries, like rivers flow with many tributaries, moving debris aside, and creating new pathways for emergence to stand free.

We discussed the transforming landscape of governments and evolving current government processes and policies. Perhaps, the most significant influencer in policies around the world has been the interdependence of countries on each other. It led Thomas Friedman to come up with his famous **Golden Arches Theory of Conflict Prevention**[1]: *No two countries that had a McDonald's restaurant would go to war with each other.* With such interdependence, businesses that implement AI tend to have a ripple effect on those around them in the ecosystem.

Adoption of AI is likely to be accelerated by either competitive or collaborative incentives. In other words, a business may have to consider the technology to remain competitive or to stay on par with its partners in the ecosystem.

Some of the common functionalities of AI that are moving rapidly into businesses include: predictive analytics, where predictions on future outcomes are made, for example, a sales deal; prescriptive analytics, where guidance is offered on how to influence outcomes; for example, what discount is best for a customer; and of course voice-enabled applications that guide businesses to make more informed decisions. Business governance and risk practices are still evolving and international policies are still operating at a high level of congruence and understanding, versus operationally monitored by relevant trusted AI compliance and risk practices.

Tim Sloane, in his report at **Mercator Advisor Group**, pointed out some basic ways in which machine learning or advanced AI is likely to be incorporated in enterprises. Sloane views the application in an *extremely wide range of specific problems across all business domains* – mostly to achieve lower costs, but also to expand business

[1] Haeber, Jonathon. CBS News. *What is the Golden Arches Theory of Conflict Prevention?* January 28, 2008. Source: **https://www.cbsnews.com/news/what-is-the-golden-arches-theory-of-conflict-prevention/**.

opportunities and elicit new behavior in customers and employees.[2] The latter is a merger of predictive and influential capabilities that can share experiences to guide a customer to a desired outcome like an influencer drug that can cause us to take an action that is against our freedom or *informed* knowledge.

In a value chain, AI's most abundant application comes in the form of robots. For all our talk of the robot inundation, the installation of robots did see a dip in 2019 (381,000) from the historic highs of 2018 (422,000) as per the World Robotics Report 2020. Nonetheless, the report expected two million installations over the next three years.[3] How far Covid-19 impacts that number is yet to be seen. The **National Bureau of Economic Research** estimated that one more robot per thousand workers reduced employment by roughly six workers and reduced wages by half a percent. But these jobs were lost mainly in the least productive manufacturing industries,[4] saving costs and helping companies keep factories onshore. That, incidentally, takes us back to our thought experiment of the inevitability and practicality driving AI adoption today.

One of the most common types of industrial robots is called an Articulated Robot resembling a human arm, often found in material holding, automotive assembly, steel bridge manufacturing, and even in food packaging.[5] **Sage automation**[6] would be a good example here.

Service robots, often called **cooperative robots (Cobots),** can assist humans in a variety of industries, excluding industrial and manufacturing automation applications which are the domains of its cousin, the articulated robot. These robots would include straightforward household chores like vacuum cleaning and lawn-mowing robots, work chores like tele and remote-presence, services like elder care and leisure companionship, and training or hobby kits. A Market Research Engine report says that the service robotics market is expected to be around US$ 34.5 Billion by 2025 at a **compound annual growth rate (CAGR)** of 15%[7].

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[2] Sloane, Tim. *Mercator Advisor Group. Bringing AI into the Enterprise: A Machine Learning Primer.* August 21, 2017. Source: **https://www.mercatoradvisorygroup.com/Reports/Bringing-AI-into-the-Enterprise--A-Machine-Learning-Primer/**.

[3] International Federation of Robotics. *World Robotics 2020.* Source: **https://ifr.org/img/office/World_Robotics_2020_Sales_Flyer.pdf**.

[4] Bytes, Washington. Forbes. April, 2017. *Will Robots Take Our Jobs? We May Be Overreacting.* Source: **https://www.forbes.com/sites/washingtonbytes/2017/04/03/will-robots-take-our-jobs-we-may-be-overreacting/#6226241b312e**.

[5] Technavio Blog. *6 Major Types of Industrial Robots Used in the Global Manufacturing 2018.* August 31, 2018. Source: **https://blog.technavio.com/blog/major-types-of-industrial-robots**.

[6] Sage Automation. *Articulated Arms*. Source: **https://www.sagerobot.com/articulated-arms/**.

[7] Market Research Engine. **Robotics Market By Operating Environment Analysis (Ground, Aerial, Marine, Automated Guided Underwater Vehicle (AUVs), Remotely Operated Underwater Vehicles (ROVs), Unmanned Surface vehicles Controls); By Application Analysis (Personal, Professional) and By Regional Analysis – Global Forecast by 2020 – 2025.** January, 2020. Source: **https://www.marketresearchengine.com/global-service-robotics-market**.

To understand more clearly how AI has emerged into the supply network, let's start with one end of the value chain: **agriculture.**

8.3.1: AI in agriculture and mining

Unmanned remote-controlled helicopters have already been spraying rice fields in Japan since the early 1990s. But it is only now that AI in agriculture has become a growth industry, maturing rapidly. Evidence of wide adoption is apparent in the dairy farming where thousands of milking robots are already operating. This market will benefit from a new injection of life as suppliers diversify into new territories and as low-cost light-weight sprayer drones enter the market. Agricultural robotics is also rapidly progressing on the ground. Vision-enabled robotic implements have been in commercial use for few years in organic farming. These implements follow the crop rows, identify the weeds, and aid with mechanical hoeing. The end game is to turn these implements into general-purpose autonomous robots.

AI also offers new growth capabilities for the mining industry. Mining is pervasive with outdated legacy technology and productivity challenges. AI provides numerous practical ways to modernize mining operations. AI can help anticipate and avoid breakdown of equipment, find patterns that can predict bottleneck in activities and allow better resource planning and improved productivity. The patterns can also help prevent work hazards. This can allow miners to get a sense of existing quality and safety standards.

The following are the two distinct advantages to use robots:

1. The hours they can put in, which is much more than a human can.
2. The level of analysis they can bring in to point out anomalies in diverse areas, soil quality, weather impacts, predicting produce risks or accelerating production with robots and drones, and so on.

AI methods can allow farmers or miners to not only standardize the produce production, but also take preventive actions or set appropriate predictions in terms of the quality or risks of the harvest. For some miners, there is also a third advantage: **safety**. A smarter machine, powered by AI software, has allowed miners to avoid working down in the mine shaft where he would be inhaling dust and exhaust fumes, and instead work in the comfort of an office from where he can control the machine doing the digging, using a joystick[8].

Based on applied AI applications in agriculture and mining, there appears to be three approaches that are being leveraged to improve agriculture: **Robots and drones, crops and soil monitoring, and predictive analytics**:

[8] Goodman, Peter S. The New York Times. December, 2017. *The Robots Are Coming, and Sweden Is Fine.* Source: **https://mobile.nytimes.com/2017/12/27/business/the-robots-are-coming-and-sweden-is-fine.html**.

1. **Robots and drones:** We can use autonomous robots to handle essential agricultural tasks such as harvesting crops at a higher volume and faster pace than human laborers can, and target to reallocate labor into higher producing agriculture farming crops. For instance, **Harvest CROO Robotics**[9] has developed a robot to help strawberry farmers pick and pack their crops. Lack of laborers been leading to significant losses for farming. Faced with the prospect of shutting down, a robot that can do the work of 25 laborers fast becomes life-saver. The market for drones in agriculture is projected to grow from US$1.2 billion in 2019 to US $4.8 billion at a CAGR of 31.4%[10].
2. **Crop and soil monitoring:** Companies are also leveraging AI and aerial technology to monitor crop health. Consider **SkySquirrel Technologies**[11] for vineyards. By visually analyzing crops and soil, the technology can allow proactive action, thereby helping improve crop yield and soil health, and reducing costs. Weed control is a good example. With an estimated 250 species of weeds now resistant to herbicides[12], uncontrolled weeds on corn and soybean crops cause annual losses of around $43 billion to farmers[13]. Robots like **See & Spray** by the Blue River Technology can leverages computer vision to monitor and precisely spray weeds on cotton plants, lowering herbicide costs by 90%[14].
3. **Predictive analytics:** Machine learning models are being developed to track and predict various environmental impacts on crop yield such as weather changes. For example, California-based **Trace Genomics** can sense the soil's strengths and weaknesses based on pathogen screening which can help prevent defective crops later on, saving the farmers a lot of wasted time and effort. Colorado-based **aWhere**[15], meanwhile, uses machine learning algorithms in connection with satellites to predict weather and analyze crop sustainability.

So far, we have only highlighted the positive aspects of AI and robots in the agriculture industry. Agricultural drones used for soil and field analysis may also incorrectly

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[9] Harvest CROO Robotics. Source: **https://harvestcroo.com/**.

[10] Markets and Markets. *Agriculture Drones Market by Offering (Hardware and Software & Services), Application (Precision Farming, Livestock Monitoring, Precision Fish Farming, and Smart Greenhouse), Component, and Geography - Global Forecast to 2024.* Source: **https://www.marketsandmarkets.com/Market-Reports/agriculture-drones-market-23709764.html**.

[11] Sky Squirrel. Source: **https://www.skysquirrel.ca/#productnav**.

[12] WSSA. *Facts About Weeds.* Source: **http://wssa.net/wp-content/uploads/WSSA-Fact-SheetFinal.pdf**.

[13] WSSA. *WSSA Calculates Billions in Potential Economic Losses from Uncontrolled Weeds.* May 4, 2016. Source: **http://wssa.net/2016/05/wssa-calculates-billions-in-potential-economic-losses-from-uncontrolled-weeds/**.

[14] Blue River Technology. Source: **http://www.bluerivertechnology.com/**.

[15] aWhere. Source: **http://www.awhere.com/**.

assess soil health. They may constitute a noise nuisance which could substantially interfere with the use or enjoyment of the land. Drones can malfunction and drone operators can make mistakes, either of which could result in damage to another's property or event to birds or livestock. The latter may even be scared off, preventing birds from eating unhealthy insects that impact crop production.

8.3.2: AI in manufacturing

AI in manufacturing is almost a stereotype – it's where the robots we envision are primarily employed. Manufacturers have more reasons to cheer for AI for they are at the junction of another evolutionary shift, as previously occurred with the advent of the Ford mass production model or Toyota's just-in-time model. While AI can certainly help improve the efficiency and volume of production even more, it can also help keep counterfeits in check. AI is poised to radically change many industries but it is particularly suited to manufacturing as it can make manufacturing safer, increase efficiency, ensure quality control, shorten production time, reduce waste, and improve predictive maintenance.[16] "

Industrial workplaces are also prone to accidents. *What if blue-collar workplace accidents could be predicted and thereby reduced?* AI, with its predictive ability, can achieve exactly this by allowing precautionary measures.

In terms of the economic outlook, AI in the manufacturing market was expected to grow to $27 billion by 2027 at CAGR of 39.7% [17]. The key drivers of the manufacturing market are twofold: large and complex data sets available in the form of big data, and evolution of industrial IoT and automation. Improving computing power, declining hardware cost, and increasing venture capital investments are also fueling the growth of this market. However, reluctance among manufacturers to adopt AI-based technologies primarily comes down to the perceived risk to job security and lack of expertise. Unlike software, robots often have a more direct impact on replacing manual labor. Nonetheless, Covid-19 appears to have forced the hands of manufacturers with 26% having deployed AI and 50% having it under development in a recent survey[18].

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[16] Thilmany, Jean. ASME. *Artificial Intelligence Transforms Manufacturing.* May 31, 2018. Source: **https://www.asme.org/engineering-topics/articles/manufacturing-design/artificial-intelligence-transforms-manufacturing**.

[17] Meticulous Research. *Artificial Intelligence (AI) in Manufacturing Market Worth $27 Billion by 2027- Exclusive Report by Meticulous Research®. March 30, 2020.* Source: **https://www.globenewswire.com/news-release/2020/03/30/2008236/0/en/Artificial-Intelligence-AI-in-Manufacturing-Market-Worth-27-Billion-by-2027-Exclusive-Report-by-Meticulous-Research.html**.

[18] Wilson, Georgia. Manufacturing. *SAS: adopting artificial intelligence (AI) in manufacturing.* April 27, 2020. Source: **https://www.manufacturingglobal.com/technology/sas-adopting-artificial-intelligence-ai-manufacturing**.

Dr. Wang. Zi Jian, an Expert Research Scientist at Siemens, has a vision that *robots and humans will work in total harmony*[19]. Examples of Siemens innovations include allowing robots and humans to easily communicate with each other. Manufacturing is moving towards a state where the robots are becoming more and more autonomous, requiring lesser programming and creating programs by interpreting tasks. Their benefits are obvious at first: 24/7 working capability, better preventative measures, operational and maintenance cost reduction, no union issues, and higher productivity. On closer look though, waters become murkier as job losses and ethics come into the picture. Just because we can does not mean we should. But *what about dire situations posed by unaffordability?*

As we will see in the next section, the robots are fast becoming the difference between a business shutting down or surviving. The robots, however, are also becoming capable of creating themselves. **FANUC** is an example of robots operating a complex production system consisting of 22 sub-factories operating 24/7 where intelligent robots create computerized offspring capable, just like them, of machine learning and computer vision. They *build, test and inspect* themselves in a startling example of how far AI in manufacturing has come[20].

8.3.3: AI in retail

Like agriculture and manufacturing, retail has a lot to gain from increased data insights and physical operational automation. AI can get quite creative with the former in this domain, which is perhaps why retailers are expected to increasingly adopt intelligent automation technologies[21]. The study finds six ways in which AI is transforming retail. These are supply chain planning, demand forecasting, customer intelligence, marketing, advertising, and campaign management, store operations, and pricing and promotion.

At the top of the list is **supply chain and inventory planning.** To speak of innovation in these areas, one has to bring Zara into the equation. The company revolutionized inventory turnover in store to make fast fashion possible. It exemplified how fast efficient value chains could allow new fashion to move from design to production to supply in a matter of days. AI can speed things up even further or at least make them easier by predicting the next fashion trend. Whether this is good for our environment is a serious question to ask. Nonetheless, the novelty of Zara's model has faded in the face of its unexpected competitor - Amazon.

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[19] Siemens. Source: **https://new.siemens.com/uk/en/company/jobs/what-we-do/working-with-robots.html**.

[20] Forbes. *How AI Builds A Better Manufacturing Process.* July 17, 2018. Source: **https://www.forbes.com/sites/insights-intelai/2018/07/17/how-ai-builds-a-better-manufacturing-process/#6021620e1e84**.

[21] Bayern, Macy. Tech Republic. *6 Ways that AI will revolutionize Retail*. January 15, 2019. Source: **https://www.techrepublic.com/article/6-ways-ai-will-revolutionize-retail/**

Retailers have been the strongest players in the value chain for a while now. While AI wasn't seen as a natural contributor to their services, the likes of Amazon has forced others to rethink. Having already conceived of Alexa, Amazon has a ready platform to propel its AI story forward. It has prompted the likes of Ikea to consider the space more seriously to gauge public sentiments around AI in addition to its own discussions on the ethics of it internally[22].

While Amazon is the leader in e-commerce, AI has spawned an entire range of box subscription companies that deliver certain replenishable goods every month or so. Powered with more visibility into consumer preferences, these companies can capitalize on our need for variety in products. In doing so, they perfectly fit our busy lifestyle where we remain spoiled for choice but starved for time to satisfy the cravings. Such businesses could not have grown without being empowered with a way to accurately tap into our tastes and how they change over time. AI can help businesses also empower other businesses that have a need to cater to such demands by enabling B2C companies to offer real-time customized services to its customers. This is a big shift from traditional retailers where companies had no interaction with consumers as they made their choices. In a retail world that is all about an omni-channel delivery, AI thus helps with both information and fulfilment.

Supporting the value chain are services, not far behind either in the AI shift. An article on Quartz Media notes how Fukoku Mutual Life Insurance planned to invest $1.7 million to install the AI system and $128,000 per year to maintain it, saving $1.1 million per year on employee salaries in the process. IBM's Watson AI was expected to improve productivity by 30%[23]. The biggest beneficiary are banks who are getting the golden package of great customer insights with secure outreach. Thanks to FinTech and their own omni-channel presence, banks can cut costs and compete without being hindered by issues of security or tardiness.

And then there are the other prolific businesses such as the sporting industry with the North American one projected to reach $83.1 billion in revenues by 2023 mainly through gate revenues, media rights, sponsorship and merchandising. The current AI applications include the use of chatbots so as to respond to fan inquiries, computer vision that could identify specific cars at high speed to render clear photographs during car racing, automated journalism to allow media to expand their coverage, and wearable tech aimed to optimize training and performance. We can expect the near future to utilize AI in other aspects of the sporting experience too, whether to referee, generate tickets, or provide highlights[24].

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[22] Schwab, Katharine. Fast Company. *Even Ikea if Studying AI Now.* April 28, 2017. Source: **https://www.fastcodesign.com/90112347/even-ikea-is-studying-ai-now**

[23] Gough, Christina. Statista. *North America sports market size from 2009 to 2023 (in billion U.S. dollars).* December 10, 2019. Source: **https://www.statista.com/statistics/214960/revenue-of-the-north-american-sports-market/**.

[24] Sennaar, Kumba. Tech Emergence. August, 2017. *Artificial Intelligence in Sports – Current and Future Applications*. Source: **https://www.techemergence.com/artificial-intelligence-in-sports/**.

8.4: The AI innovations

We already discussed a few companies innovating in the agricultural landscape. Canada's federal government has been active in making its dairy farmers globally competitive. Its **Dairy Farm Investment Program (DFIP)** has allowed farm workers like Vancouver's Diana West to work alongside robots milking cows. These robots can tell when a cow may be having an infection or when she is in heat[25]. Cainthus caters to cows in a different way. It uses facial recognition to identify cows in a few seconds, allowing huge herds to be monitored. John Deere's **AutoTrac**, on the other hand, helps on crop farms. It can ensure uniform and accurate planting of crops while reducing duplication of agricultural processes such as tilling, planting, and fertilizing[26].

Another innovative agriculture company is a Berlin-based agricultural tech start-up **Plantix**[27], or *the crop doctor* that can already detect 400 plant damages across 30 crops, offers diagnosis based on crop images over WhatsApp. The app has already developed a major market in India where farmers may not necessarily be tech-savvy. Plantix works because it has made adoption easy among this target group, a must for agricultural AI to grow.

RockMass Technologies[28]**,** for example, is a handheld tool that uses sensors and real-time data to identify potential failure planes on rock surfaces – 18 times faster than manual methods. **ThoroughTec** is good for heavy equipment simulations. It uses sensors too, but to monitor workers' behavior, and enables better training and requirement fulfilling in order to reduce their exposure to dangerous situations.[29] **Rio Tinto**, the mining giant, has used autonomous trucks with a very strategic AI focus that allows real-time data collection and analysis to monitor equipment and operations in its many mines, rail networks, and ports. As part of its **Mine of the Future** vision which went live in 2019, it even boasts an autonomous train to move ore to processing centers, and smart sorting machines to remove debris.[30] They are also creating an intelligent mine where all assets are connected and can make

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[25] CBC Cross Country Checkup. CBC. September 3 2017. "*When milking robots were installed, this dairy farm worker's 'fears vanished quickly*" Source: **http://www.cbc.ca/radio/checkup/blog/when-milking-robots-were-installed-this-dairy-farm-worker-s-fears-vanished-quickly-1.4274643**.

[26] Venkatachalam, Sandhya. World Economic Forum. May, 2017. *3 ways Artificial Intelligence will change the world for the better*. Source: **https://www.weforum.org/agenda/2017/05/artificial-intelligence-will-change-the-world-heres-how**.

[27] Plantix. Source: **https://plantix.net/en/**.

[28] Rockmass Technologies. Source: **https://www.rockmasstech.com**.

[29] ThoroughTec. Source: **http://www.thoroughtec.com**.

[30] Barbaschow, Asha. ZDNet. *Rio Tinto preparing for the Mine of the Future with automation.* February 26, 2018. Source: **https://www.zdnet.com/google-amp/article/rio-tinto-preparing-for-the-mine-of-the-future-with-automation/.**

decisions themselves. It is due to commence in 2021 – a handy possibility in the lockdown age of a pandemic.[31]

Any data analysis and robotics relies heavily on the capacity and adaptability of computer chips. The computing chip's evolution into a replica of the human brain functioning is being led by the likes of Google, Apple, and Samsung. What this means is that in addition to a central processor, Google has loads of custom-built chips working alongside to run algorithms that drive AI. Microsoft, meanwhile, has settled for **Field Programmable Gate Arrays (FPGAs),** which can be reprogrammed for new jobs on the fly.[32]

Landing.ai, a start-up formed by Silicon Valley veteran Andrew Ng, has developed machine-vision tools to find microscopic defects in products such as circuit boards at resolutions well beyond the human vision, using a machine-learning algorithm trained on remarkably small volumes of sample images. Once on line, if it spots a problem or defect, it sends an immediate alert – an AI process known as **automated issue identification.**[33]

BMW is working directly with the Alexa team at Amazon[34] to integrate responses from Alexa – both visual and audio – allowing you to manage the center console for many functions like volume control. Of course, we are gradually heading towards voice controlling bigger tasks in the car – something we have previously covered in our discussion on autonomous cars.

In 2015, GE launched its IoT-powered **Brilliant Manufacturing Suite** [35] for customers, which could link design, engineering, manufacturing, supply chain, distribution and services into one globally scalable, intelligent system that detects inefficiencies. The pilot in Pune, India, claimed to have improved equipment effectiveness by 18%.

Kuka, the Chinese-owned German manufacturing company, focuses on human-robot collaboration so they can work more closely together. Imagine walking near a robotic arm hauling large machinery – not very safe, is it? That's where Kuka comes

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[31] Hall, Matthew. Mining Technology. *Mapping out autonomous and remote mine projects in Western Australia*. June 18, 2020. Source: **https://www.mining-technology.com/features/mapping-out-autonomous-and-remote-mine-projects-in-western-australia/**.

[32] Metz, Cade. NY Times. *Chips Off the OldBlock: Computers AreTaking Design CuesFrom Human Brains.* September 16, 2017. Source: **https://www.nytimes.com/2017/09/16/technology/chips-off-the-old-block-computers-are-taking-design-cues-from-human-brains.html**

[33] Forbes. *How AI build a Better Manufacturing Process.* July 17, 2018. Source: **https://www.forbes.com/sites/insights-intelai/2018/07/17/how-ai-builds-a-better-manufacturing-process/#3ea0ae2c1e84**.

[34] Lardinois, Frederic. TechCrunch. *BMW's Alexa integration gets it right*. July, 2018. Source: **https://techcrunch.com/2018/07/29/bmws-alexa-integration-gets-it-right/.**

[35] Walker, Jon. Emerj. *Machine Learning in Manufacturing – Present and Future Use-Cases.* October 23, 2019. Source: **https://emerj.com/ai-sector-overviews/machine-learning-in-manufacturing/.**

in with its sensitive robot arm that uses intelligent control technology and high-performance sensors to avoid accidentally hurting a human working beside it.[36]

In the world of NASCAR, we have the Argo AI/Ford Motor Company, using deep learning to help improve safety measures. **PIQ** caters instead to combat sports by having developed an AI-powered wearable for boxing with Everlast using **Group for Artificial Intelligence Applications (GAIA)** intelligence to track and analyze microscopic movements to help maximize the efficiency of workouts and training.[37]

Enough about robots in factories. Let's see what they are doing in retail. **Ocado**, a large online-only grocery retailer, is using machine learning to classify and prioritize many emails that stream into their call center. They are using it also to monitor the health of their robots – turning the tables on robots and monitoring the health of machines elsewhere.[38] And all that learning only adds to the learning curve of other connected systems.

When it comes to retail, counterfeit products are a big challenge that producers have to deal with. Companies like **Entrupy** and **Cypheme** have risen to the opportunity. The former sells microscopic camera systems that can be placed on suspected counterfeit products. It transfers captured images to an AI algorithm that checks against a database of authentic products to determine if the item is authentic too. Cypheme, on the other hand, uses GPU-accelerated computing which collaborates with manufacturers to have a traceable paper with specific design integrated with the packaging. Then, photos of any product pack can be taken by the Cypheme app for the AI algorithms to determine authenticity.[39]

Amazon Prime Air[40] is a successfully-tested drone that can deliver packages. The company also has **Echo Look**, an app which allows consumers to take their photos and videos to follow voice-based recommendations where Alexa-recommended photo images can be superimposed for VR type showrooming.[41] For personal styling, **StitchFix** is an e-commerce that uses AI-driven data analytics to deliver a

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[36] P, Pamela. Gutenberg Technology. *Turning Machine Learning and Deep Analytics into Business Insights.* December 19, 2019. Source: **https://blog.gutenberg-technology.com/en/turning-machine-learning-and-deep-analytics-into-business-insights**

[37] Sennaar, Kumba. Tech Emergence. August, 2017. *Artificial Intelligence in Sports – Current and Future Applications.* Source: **https://www.techemergence.com/artificial-intelligence-in-sports/.**

[38] Gov.uk: Department for Business, Energy & Industrial Strategy. *AI Sector Deal.* May 21, 2019. Source: **https://www.gov.uk/government/publications/artificial-intelligence-sector-deal/ai-sector-deal.**

[39] Mitchell, Robin. All About Circuits. *How AI Can Help Stop Counterfeiters (Or Make Them More Effective Than Ever).* June 3, 2017. Source: **https://www.allaboutcircuits.com/news/how-ai-can-help-stop-counterfeiters-or-make-them-more-effective-than-ever/.**

[40] Amazon. *Amazon Prime Air.* Source: **https://www.amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011.**

[41] Goode, Lauren. The Verge. *Amazon's Echo Look Does More for Amazon Than It Does For Your Style"* July 6, 2017. Source: **https://www.theverge.com/2017/7/6/15924120/amazon-echo-look-review-camera-clothes-style**

box of five customized curated styles every month to women and men who are too busy to shop.[42] **Slyce** instead tries to empower retailers like **Nordstrom and Tommy Hilfiger** to interact with customers in real-time to get guidance or help in locating garments of various sizes. All a customer has to do is take a picture of the product through the app.[43] From distant farms to stores, businesses across the value chain are busy incorporating AI.

8.5: The AI vault

When Xuedon Huang and his team at Microsoft built a neural network that could in some ways recognize spoken words better than humans, the model had managed to close the gap with humans – in about a year.[44] *How does that make you feel?* For most, there is a sense of unsettlement. For everyone, it should also spell a sense of the expected. That is how the rate of AI growth is growing itself. Businesses must therefore clearly understand how advanced AI can be best and safely used in their firms. It is difficult to generalize the use cases across all sectors but in a nutshell, the job of machine learning is to analyze and act on data and signals in a specific context. As Sloane notes in his aforementioned report, *the cloud infrastructure will be a battleground for machine learning dominance, demanding an entirely new infrastructure for building, training, deploying, and managing these new general-purpose platforms.*[45]

Some businesses, of course, choose to rightly also consider the public's point of view before they decide on applications. That was the case with Ikea in our earlier mentioned example. It's survey, however, returned some interesting initial results where people seemed to prefer AI that is male but also motherly and protective and able to read emotions. They also want AI to reflect their worldviews which, as we know, differs greatly. That is the tricky part, and Ikea might just navigate it by producing household items that are personalized to suit such tastes. The company's strategy is to use such data to inform future products.[46] Meanwhile, Amazon's

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[42] Sinha, Jay I., Foscht, Thomas, Fung, Thomas T. MIT Sloan Management Review. *How Analytics and AI Are Driving the Subscription E-Commerce Phenomenon.* December 6, 2016. Source: **https://sloanreview.mit.edu/article/using-analytics-and-ai-subscription-e-commerce-has-personalized-marketing-all-boxed-up/.**

[43] The Globe and Mail. *Artificial Intelligence Brings a New Look to the Fashion World.* June 5, 2017. Source: **https://www.theglobeandmail.com/life/fashion-and-beauty/artificial-intelligence-brings-a-new-look-to-the-fashionworld/article35204132/?cmpid=rss1&click=sf_globefb.**

[44] Metz, Cade. NY Times. September 16 2017. *"Chips Off the OldBlock: Computers AreTaking Design CuesFrom Human Brains."* Source: **https://www.nytimes.com/2017/09/16/technology/chips-off-the-old-block-computers-are-taking-design-cues-from-human-brains.html**

[45] Sloane, Tim. Mercator Advisor Group. August 21, 2017. *"Bringing AI into the Enterprise: A Machine Learning Primer."* Source: **https://www.mercatoradvisorygroup.com/Reports/Bringing-AI-into-the-Enterprise--A-Machine-Learning-Primer/**.

[46] Schwab, Katharine. Fast Company. *Even Ikea if Studying AI Now.* April 28, 2017. Source: **https://www.fastcodesign.com/90112347/even-ikea-is-studying-ai-now**

Echo Look, described earlier as the VR assistant for consumers, has a much larger purpose of allowing the company to get a deeper understanding of consumers' personal tastes. Both Ikea and Amazon are thus strategically looking at consumer's preferences but in two very different ways.

If we go back to the example of StitchFix or other such box subscriptions that continuously choose styles for consumers by anticipating their personal preferences, they employ data scientists to determine personal styles. This is their core team, instead of one consisting of fashion designers and such. It should give us a sense of how companies may have to shift the composition of their workforce, regardless of the industry they are in.

A **McKinsey Analytics** report makes the strategic advantage of adapting AI quite clear, starting with, of course, the power to analyze unimaginable amount of data. It notes that early AI adopters have deployed AI across the technology groups with the backing of executive leadership and use AI in the most core part of the value chain to increase revenue as well as reduce costs.[47] This is also why banks are so well poised to leverage AI, thanks to the years they have spent building vast pools of datasets on their customers. The ease with which FinTech companies can provide services to end customers makes it mandatory for banks to jump in. Thankfully, the big institutions enjoy what customers crave most when it comes to financial services: security and trust.

Most of the applications enabling the value chain productivity can be attributed to predictive (and prescriptive) analytics. Whether in product design or end-to-end customer journeys, resource effectiveness or the cost-centric zero-based budgeting policy, the AI analytics is set to fuel the next twenty percent productivity rise. *What do we mean by "next"?* It's a journey of milestones that began with the rise of steam-powered industries. Productivity has increased with new innovations and management systems. The next wave of productivity increase is underway, thanks to our focus on utilizing data and plugging in AI-enabled sensing and automation capabilities. Another McKinsey report tags this under **analytics-to-value (AtV).** It is where product optimization is achieved by utilizing multiple sources of data and advanced analytics to generate complex insights that enable the next level of design thinking driven towards cost improvements and value.[48]

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[47] Bughin, Jacques, Hazan, Eric, Ramaswamy, Sree, Chui, Michael, Allas, Tera, Dahlstrom, Peter, Henke, Nicholaus, and Trench, Monica. McKinsey Global Institute. June 2017. "*How artificial intelligence can deliver real value to companies."* Source: **https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/how-artificial-intelligence-can-deliver-real-value-to-companies?cid=podcast-eml-alt-mgi-mck-oth-1711**.

[48] Goenaga, Mercedes, Radtke, Philipp, Speicher, Kevin, and Westinner, Rafael. *McKinsey & Company.* April 2017. Ops 4.0: Fueling the next 20 percent productivity rise with digital analytics. Source: **https://www.mckinsey.com/business-functions/operations/our-insights/ops-4-0-fueling-the-next-20-percent-productivity-rise-with-digital-analytics**

AI's strength at times can also be its biggest weakness. Consider the case of anti-counterfeit capabilities the technology has. While it can help producers or consumers distinguish genuine products from ones that are not, it can also facilitate creating a fake. A partnership of Microsoft, ING, Delft University of Technology, and the Dutch museums Mauritshuis and Rembrandthuis, showcased this when they used AI and a 3D printer to create a painting that resembled an original Rembrandt. On the other hand, **Face2Face**, developed by the Max Planck Institute for Informatics, the University of Erlangen-Nuremberg, and Stanford University, could generate real-time facial expressions from a user superimposed over a target video source.[49]

Let's step back for a moment and let it sink in. What this means is that anything we see, whether on screen or on a canvas, can potentially be a fake. *What then is the point of visual legal evidence or live shows?*

As mentioned earlier, AI has other more destructive capabilities such as malware. As Diane Kelley, Global Executive Security Advisor at IBM, noted, an AI-enabled malware could identify if it lands on a point-of-sale system rather than on a server and decide to switch off its server-related functions and instead switch on its ram scraper that would be more appropriate for this new environment![50] This is why proper regulatory practices are so important. To achieve this, executives must first be aware of both the need and nature of measures to be put in place. A handy reference to this point would be EY and SalesChoice's co-produced video series on **Managing the Risks of AI -** a helpful look at the importance of transparency, diversity and accountability in this space.[51]

And to reiterate, as we already have, the greatest risk with the adoption of robots is that it will replace workers. However, *is that always true in the context we perceive it to be?* We looked at the tough choice some farmers are facing in adopting AI to survive or lose their business for good. The case of the Canadian dairy farmer Diana that we briefly discussed earlier in this chapter shows a different side of labor displacement. Her installation of robots to constantly milk cows did not take away jobs on the farm. The workers simply moved from milking cows to taking care of robots! While a robot may be good at analyzing when a cow may have an infection, it can't cure it; nor can it artificially inseminate a cow it determines to be in heat. In short, business will continue to need workers. For now, AI simply improves their efficiency. *General AI* that is smart enough to truly behave like humans is many years away. Any displacement in the short term, then, is not different because there is a

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[49] Mitchell, Robin. All About Circuits. June 3 2017. "*How AI Can Help Stop Counterfeiters (Or Make Them More Effective Than Ever).*" Source: **https://www.allaboutcircuits.com/news/how-ai-can-help-stop-counterfeiters-or-make-them-more-effective-than-ever/**.

[50] Barth, Bradley. SC Media. February 17 2017. *The Dark Side of AI.* Source: **https://www.scmagazine.com/the-dark-side-of-ai/article/638867/**.

[51] EY Canada. *Managing the Risks of AI.* Source: **https://www.youtube.com/watch?v=r7fudt5rVX4**

new technology automating things – the arrival of computers did the same – but because the global demand itself is reaching a saturation point.

Oxford academic researchers Benedikt and Osbourne (2013) had predicted that computerization would principally be confined to low-skill and low-wage occupations. They claimed that workers that perform simple tasks will have to acquire creative and social skills and increasingly analytical skills.[52] Today, cashier-free terminals at supermarkets are now a common sight; drones delivering packages are fast becoming one; and autonomous trucks are lurking in the mainstream market in the foreseeable future (even though Rio Tinto has already been using it). No wonder that 50% of all occupations in the U.S. are at risk of replacement by 2026, with 1.4 million jobs becoming redundant. Unfortunately, most of those are overrepresented by women workers (secretaries, assistants, receptionists, and so on).[53]

For example, a simple task is comparing the calendars of diverse stakeholders and booking a meeting. AI solutions are enabling this more and more. On the flip side, there are opportunities to rethink how these dollars saved can be reinvested into new others by calling on *real customers* to ensure their customer service needs are being met, human voice to voice contact still has relevance and meaning. The work environment could easily be robotic with AI processes handling all supply chain and customer care needs – the technology is there – but how would one measure the net gain or loss between the dollars saved and customers lost due to lack of human experience.

The issue is that for businesses and economies to choose to employ humans over AI for such jobs, they would have to simultaneously opt against faster, cheaper or more efficient growth and operations. This would lead to one of two scenarios: if only one business or economy makes this decision, it would be consciously falling behind competitors who do employ AI. On the other hand, if all business or economies choose to favour humans over more efficient AI-empowered systems - which is extremely unlikely - we will sooner or later hit a wall in our own growth, in terms of prosperity and quality of life. A recent IDC survey showed that there is a direct correlation between AI adoption and superior business outcomes, with early adopters seeing a 25% improvement in customer experience, accelerated rates of innovation, higher competitiveness, higher margins, and better employee experience with AI solutions.

To put in perspective, think of a world where we knowingly choose to shut down Uber and Netflix from our lives, or one where the gap between demand for

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[52] Frey, Benedikt, Osborne, Michael A. Oxford Martin. *The Future of Employment: How Susceptible are Jobs to Computerization.* September 17, 2013. Source: **https://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf.**

[53] Holder, Sarah. Bloomberg City Lab. *As AI Takes Over Jobs, Women Workers May Have the Most to Lose.* March 13, 2019. Source: **https://www.citylab.com/equity/2019/03/job-market-artificial-intelligence-women-workforce-ai-tech/584632/.**

healthcare and supply of its services keeps widening, or even one where more and more individual around the world miss out on education due to low affordability or access. Garry Kasprov, the chess champ and witness to the prowess of AI-powered **Deep Blue** which defeated him in chess in 1997, notes in his book Deep Thinking that the sheer power of analyzing billions of examples in our data-rich world is invaluable. Because while 90% accuracy may not be enough for self-driving cars, it is a much-needed boon for areas like medical diagnosis.[54]

8.6: Conclusion

It is businesses that both leverage and push technology into our lives and society. AI is no different. Some call it the mathematical corporation, given the collaboration of technology and humans in insights-driven processes.[55] *Efficiency* here is the key, one that directly or indirectly results in reduction in costs or increase in revenues. Businesses will determine the R&D and further development of deep learning and beyond, its economies of scale and consequently also the ability of other sectors to adopt the technology.

The impact of AI in businesses of course has a huge jobs-angle. We cannot deny the downside for workers due to AI. Tom Mitchell, a professor in the machine learning department at Carnegie Mellon University, talks about how routine clerical jobs are being eliminated due to AI while massage therapists' jobs are safe. The third category, he points out, are the jobs being created owing to new kind of business models. **Cue: Uber**.[56] Take note, for that is where strategy must kick in.

Developing a balance between business and our home and our society will take a great deal of conscious leadership and sensitivity to the emerging realities of meshing human rights with machine rights. In the foreseeable future, AI is likely to replace jobs that consist of rule-based tasks in predictable situations. We will take a closer look at that over the next chapters. But for AI to become as smart as humans and replace them, it needs the contributions of psychologists too, for a good understanding of humans is needed to do better than them in new situations. As is quite apparent when a computer is compared with a baby in their learning capability, and as David Mindell, a Massachusetts Institute of Technology professor

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[54] Kasparov, Garry. Fortune. September, 2017. *Garry Kasparov: There's No Shame in Losing to a Machine.* Source: **http://fortune.com/2017/09/25/garry-kasparov-chess-strategy-artificial-intelligence-ai/**

[55] Kinni, Theodore. MIT Sloan Management Review. *Ethics Should Precede Action in Machine Intelligence.* June 29, 2017. Source: **https://sloanreview.mit.edu/article/ethics-should-proceed-action-in-machine-intelligence/.**

[56] McKendrick, Joe. Forbes. *Artificial Intelligence Will Replace Tasks, Not Jobs.* August 14, 2018. Source: **https://www.forbes.com/sites/joemckendrick/2018/08/14/artificial-intelligence-will-replace-tasks-not-jobs/#3c45155fa7fa.**

puts it most succinctly: *The computer science world still has a long way to go before it has a clue about how to deal with people.*[57]

What is clear as more AI and robotic process automation advances into our work environments, we will need to be cognizant of ensuring emotional intelligence and psychological constructs are designed into AI systems. Empathy and kindness will be foundational tenants, and to get this field right, we will need diverse disciplines coming together to ensure the man and machine interface is harmonized. That may be the difference between our value chains creating a perfect world or a perfect storm.

[57] Mind Matters. *Machines cannot take over.* February 17, 2019. Source: **https://mindmatters.ai/2019/02/machines-cannot-take-over/**.

Chapter 9
AI at Work

Covid-19 may have changed the definition of office for many of us, but AI remains prevalent at work. We have already looked at several examples from AI helping journalists to workers in the value chain. In fact, most applications or software you use at work is likely to have an AI component. Document analysis and classifying them has proven, especially useful in Legal work, as has auto-processing of receipts in finance. Identifying minute differences in the behavior of customers, from when a user may want a new car to whether they would like to buy bread with milk, is continuously helping marketers. Its predictability is helping the sales team make more accurate forecasts. Auto-transcription of meetings can help make work calls more productive, while chatbots can help address a significant chunk of customer queries that customer support would otherwise have to handle. In this chapter, we take a closer look at how AI is involved in our day-to-day work.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- Transformation occurring in different functions due to AI
- AI innovations and applications in different functions and at workplace
- **AI Vault:** ethical challenges

- Concluding points on the use of AI in day-to-day work in companies and administrations

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in the public sector
- Learn how AI is transforming the private sector
- Discover the impact of AI in workplace robotics, HR, law, finance, and marketing and sales
- Appreciate the ethical considerations to keep in mind while using AI

9.1: The perfect world

Alixia may be in a remote location but she always has Lynx at hand. Her Cobot is back home, but it is virtually present with her wherever and whenever Alixia needs her. At this moment, it is a rather perfunctory task of going through her schedule for the day.

"It looks like a day full of calls. Up first at 9:30 is Cara for 30."

Alixia feels amused to hear one bot speak of another. That's who **Cara** is – an HR bot, capable of scanning thousands of job applications for skill and personality fit, and equally adept at identifying employees at risk of churning or exhibiting low motivation levels in their weekly engagement-checks. Today is Alixia's turn to answer – or converse, to be more precise – with Cara.

"Immediately after the first call is one with Denzel for your upcoming tax filing at 10. I have already proposed 10:15, assuming you'll want a 15-minute break between meetings. Sorry, I couldn't delay it more or it'd overlap with your usual lunch time." Alixia wonders why a Finance call is nearly two hours long, but Lynx has already predicted that question, and answers, "It's expected to last two hours to cover a five-point agenda which includes…"

As Lynx lists the items out, some relieve Alixia while others, not so much. She's glad her expenses are already categorized and filed through an auto-assessment of her receipts. Any tax claim opportunities would be nice to learn of in the call. What she's not too thrilled about though, is the inevitable cost optimization discussion Denzel will bring up – no doubt with a bag full of insights on ways to increase efficiently.

As Lynx carries on with the schedule, one in particular catches Alixia'a attention. Right at the end of the day is a call with **Legal**, another bot, with a curious addition of someone from Central AI's marketing team. Tasked with keeping a global audience informed on Central AI's work and value, the team has further evolved the hyper-personalization of its messages to automatically tweak the content, timing, and even

the choice of words in its messages by each recipient for maximum impact. Legal must have flagged an increasing risk of privacy breach that the marketing team may run into and is no doubt going to help them course-correct.

Alixia never looks forward to calls with Legal. Lynx knows this of course, and concludes with, *and a glass of Merlot will be waiting for you at 5.*

9.2: The perfect storm

Alixia may be in a remote location but she always has Lynx at hand. Her Cobot is back home, but it is virtually monitoring her every moment. Alixia doesn't have a privacy choice here unless she is willing to sacrifice a lot of convenience and automation in her life. She asks to know her schedule for the day.

"It looks like a day full of calls. Up first at 9 is Harry, followed by Cara at 9:30 for 30."

Alixia feels unsettled at the first sign of another break-less array of calls. What concerns her more is to hear one bot speak of another. This invariably implies that the bots tried to converse directly with each other again. And while this may be helpful in scheduling calls, it's something Central AI has to always monitor and control. Weekly engagement checks with **Cara** – the HR bot is another cause to worry. Every iota of what and how Alixia answers will be used to judge her over an unempathetic series of questions. Emotions must be kept at bay, if Alixia wishes to avoid another misjudgment of her psychological ability to work.

"Denzel will be talking to you at 10 till 12." Alixia wonders why a finance call is nearly two hours long. She obviously can't ask Lynx that, as she cannot access the agenda.

Alixia pauses Lynx and starts to look at the meeting details. Amidst all the critical cyber security items on her plate, she has to deal with validating and correcting her expense claims, which would likely be miscategorized again. What she finds even more exhausting though is the inevitable cost reduction discussion Denzel will bring up – mostly from non-contextual insights from another AI tool. Alixia feels tired at the idea of having to take Denzel through the rationale behind each cost item.

As Lynx carries on with the schedule, one in particular catches Alixia's attention. Right at the end of the day is a call with **Legal**, another bot, with a curious addition of someone from Central AI's marketing team. No doubt the team has again breached privacy laws in its quest for hyper-personalization of its messages. Legal must have flagged the breach after it had already happened and will now run through the entire clause as per law that one must patiently listen to.

Alixia never looks forward to calls with Legal, partly due to the hypocritical privacy laws. After all, she knows she'll need a glass of red wine at the end of the day. But as per the HR policy, drinking on her work days is not allowed as it can potentially impair her ability to act in case a critical requirement comes up after-hours. And

with every employer given access to its employees' home Cobots to ensure process and legal compliance and to prevent misbehavior, Lynx will be making sure Alixia complies.

9.3: The AI shift

AI is following the destiny of all major technological innovations since the invention of the wheel. As AI gradually seeps into every aspect of our lives, we will come to need it and depend on it even more. This should explain the staggering numbers we have seen in the intention to adopt AI among organizational executives. Even back in 2017, 95% of executives had already reported undertaking a big data initiative while 80.7% considered their big data investment to be successful.[1] In such a case, if AI inevitably takes up most present jobs - even if to improve our lives - *what would we be doing as part of our daily routine and source of income?* If we sit unemployed, naturally, we cannot then afford AI-facilitated products and services. If huge masses are without jobs and in poverty, social crisis is sure to follow. *What then is a more sustainable course of action where we as a society continue to grow?*

The answer to this thought experiment can be seen from both the short term and the long-term perspectives. Long term first because it is simpler, purely on account of the limitations imposed by the uncertainties around what an AI society would definitively look like. In the long run, we would be witness to a largely automated social living where humans would have found engagement of a different nature. It's what we do, after all. Think about the ages before the industrial revolution and widespread jobs. In this world, we are likely to be more focused on stretching the boundaries of what we know and on managing and maintaining the AI systems working for us. At this point, though, we have to move over to the realms of fiction if we are to answer what our source of income would be. It is an idea of prosperity by a new form of currency based on renewable energy, discussed in the earlier mentioned novel *Kalki Evian: The Ring of Khaoriphea.*

The short-term scenario of AI at work is more predictable, and it is one of collaborations in two ways.

We mentioned earlier that the company that wins the AI race will be the one that understands that the power of this technology can only be fully utilized through a collaboration of different minds within the company. The collaboration can be as follows:

- The first kind is one where departmental silo give way to interdepartmental contributions on how an AI solution should be developed or employed.
- The second kind of collaboration is one where the introduction of AI systems, chatbots or robots - results in them working side by side with humans.

[1] Bean, Randy. MIT Sloan Management Review. January, 2017. *Companies Brace for Decade of Disruption From AI.* Source: **https://sloanreview.mit.edu/article/companies-brace-for-decade-of-disruption-from-ai/**.

Even that is medium-term in a way because in the very short term, we are still in a phase where AI is having incremental benefits but remains immature enough to limit how unbiased it acts or how much managers can utilize it.

To conclude our thought experiment, think about the emergence of print books with illustrations for the first time ever in the 1470s in the German city of Augsburg. Back then, wood engravers protested and even stopped the presses out of concern for their jobs. As it turned out, their skillset soon became even more in demand for illustrations in these books.[2] This example should explain why fearing a loss of jobs doesn't make that scenario true, especially when engagement and earning are central tenets of human society.

Jack Krupansky categorizes workers into the following four groups:

- Group one are **intelligent entities** that can be people or machines and are capable of thought and organized behavior.
- Group two are **principals** who have true autonomy and freedom of work which they can delegate to agents and assistants, but also have customers, clients, and users.
- Group three are **agents** who do the job of principals and are contractually obligated to them, and have limited autonomy.
- Group 4 are **assistants** who focus on specific tasks to pursue larger goals or objectives.[3]

A digital co-worker is likely to serve as an assistant and at times as intelligent entities, depending on the nature of work. Intelligence, of course, is relative and a bit abstract. Thomas H. Davenport and Julia Kirby approach the matter from a different angle by looking at the four types of intelligence that machines can exhibit:

- Support for humans
- Automation of repetitive tasks
- Context awareness
- Learning and self-awareness.

Their study shows that general intelligence in machines is still a few decades away. The eventuality, as they see, is the *Great Convergence* when robots and AI software will finally converge to yield robots capable of handling all of the preceding tasks.[4]

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[2] The Economist. August 2017. *Artificial intelligence will create new kinds of work.* Source: **https://www.economist.com/news/business/21727093-humans-will-supply-digital-services-complement-ai-artificial-intelligence-will-create-new**.

[3] Krupansky, Jack. Medium. December, 2017. *Intelligent Entities: Principals, Agents, and Assistants.* Source: **https://medium.com/@jackkrupansky/intelligent-entities-principals-agents-and-assistants-8353639a4092.**

[4] Davenport, Thomas H, and Kirby, Julia. MIT Sloan Management Review. March, 2016. *Just How Smart are Smart Machines?* Source: **https://sloanreview.mit.edu/article/just-how-smart-are-smart-machines/**

Are we facilitating that convergence? In some ways, yes. We saw the case of robots creating robots at Fanuc. Take the case of **Igor Mordatch** and his collaborators who have created a world where bots are allowed to create their own language as a way of collaborating and helping each other achieve a certain task.[5]

But amidst all this, we are missing another point: AI is also enabling jobs to be executed in a better way. Automation of base tasks in a job to enable advanced analysis remains the primary form of AI utilization from accounting to insurance to law to architecture. The latter lends both creativity and increased convenience.

Let's start with recruitment. Even today, a lot of job positions remain vacant while a large percentage of applicants never hear back from employers.[6] Consider a recruiter sweeping through hundreds of resumes superficially. AI can run a more thorough analysis to enable better filtering with due consideration to each application. AI will have tremendous impact in this space. This is because a candidate's profile can easily be linked to her social media profiles and analyzed to fill in the gaps on his or her personality. More advanced forms of facial recognition are also being used in recruiting to evaluate a candidate's sincerity, honesty, and emotional intelligence using AI. Even operationally, applicants can get pre-entered feedback from chatbots instead of arduously waiting for recruiters to respond.

Law is another area where AI helps facilitate the sheer volume of work that lawyers have to deal with. In fact, Dana Ramus, a professor at the University of North Carolina School of Law, and Frank Levy, a labor economist at the Massachusetts Institute of Technology, concluded that putting all new legal technology in place immediately would result in an estimated 13% decline in the lawyers' hours. A more realistic adoption rate would cut it by 2.5% annually over the next five years.[7]

AI may also lead to online courts. The growing interest in applying AI in law is rapidly transforming the legal profession and closing in on the work of paralegals, legal researchers, and litigators. These roles are at risk as AI continues to evolve time consuming work processes. AI is helping lawyers perform diverse legal activities such as due diligence and research, providing additional insights and shortcuts through analytics, automating creative processes (including some writing) in legal work, and so on. Richard Susskind, one of the UK's most respected thinkers at the intersection of legal and technology states that *if you are a young lawyer or you are*

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[5] Metz, Cade. Wired. March, 2017. *It Begins: Bots Are Learning To Chat In Their Own Language.* Source: **https://www.wired.com/2017/03/openai-builds-bots-learn-speak-language/**.

[6] Dickson, Ben. The Next Web. June, 2017. *How artificial intelligence optimizes recruitment.* Source: **https://thenextweb.com/contributors/2017/06/03/artificial-intelligence-optimizes-recruitment-hiring/#.tnw_eAD7GcqE**.

[7] Lohr, Steve. The New York Times. March, 2017. *A.I. Is Doing Legal Work. But It Won't Replace Lawyers, Yet.* Source: **https://mobile.nytimes.com/2017/03/19/technology/lawyers-artificial-intelligence.html**.

running a law firm, you should ask yourself, should I compete with these AI/online systems or should I be one of those who is building these systems? Which will you do?[8]

AI can also be a valuable tool for financial and accounting leaders helping them analyze corporate transactions and ensuring that all compliance requirements have been met, and determining when specific transactions should be excluded from further analysis. There are numerous accounting intelligence toolkits in the market that are designed to help Chief Financial Officers close their financials; account for every line item, and ensure that everything is processed in the right code classification with 100% accuracy. At a strategic level, AI can also be used for business planning, providing scenario analytics, and bringing complex data sources together to inform business leaders of viable options based on predictive factors.

While the other functions predominantly use AI for document analysis and process automation, sales and marketing's biggest use of AI is in understanding customers and improving their experience. It is changing how companies sell and promote themselves. It's how Google answers our searches and Amazon recommends products. Increasingly, both B2B and B2C businesses recognize that AI enables scalable growth, drives revenue to the *hot spots* for more rapid customer conversion, personalize customer experiences with relevant messages, and align marketing and sales with richer insights on pipeline health.

Consider the sporting industry in North America which is projected to reach $73.5 billion in revenues by 2019 mainly through gate revenues, media rights, sponsorship, and merchandising. AI chatbots can even respond to fan inquiries. Computer vision, meanwhile, could identify specific cars at high speed to render clear photographs during car racing. We can expect the near future to utilize AI in other aspects of the sporting experience too, whether to referee, generate tickets, or provide highlights.[9]

In the previous chapter, we learned about **articulated robots** and **service robots** called **Cobots**. There are also the hybrids, or character robots, geared towards more humanized professional service and powered with light industrial arms. Take the example of healthcare where these robots can deal with the physical requirements of patient care while also analyzing the patient's healthcare records to perform its functions better. Covid-19 has exposed the critical shortage of healthcare workers. But even in its absence, in the United States alone, more than a million registered nurses are eligible to retire by 2030. This makes these robots almost necessary. **Moxi**

[8] Botsford, Polly. Legal Cheek. *2020s is the decade of legal change, says Richard Susskind.* May 23, 2019. Source: **https://www.legalcheek.com/2019/05/the-2020s-is-the-decade-of-legal-change-says-richard-susskind/.**

[9] Sennaar, Kumba. Tech Emergence. August, 2017. *Artificial Intelligence in Sports – Current and Future Applications.* Source: **https://www.techemergence.com/artificial-intelligence-in-sports/**.

(developed by a Texas company, Diligent Robotics)[10], **Alice** (developed by Hanson Robotics)[11], and **BellaBot** (developed by PuduTech)[12] are good examples in this category. The best part: is that these robots can deal with not only intelligent and light physical tasks but also the emotional needs such as greeting patients with a glass of wine, showing facial expressions, and reducing loneliness in the elderly being prime examples.

Diligent robotics also deserves a mention for a very prominent definition of the future of work which is, according to them, *to do something you love and utilize your creativity to make a positive impact*, as opposed to performing a task requiring sustained effort or repeated operations[13]. For a company developing service robots, such clarity is important.

New **Robotic Process Automation (RPA)** tools can analyze your emails and rewrite them to make them clearer and more impactful to analyzing post-meeting notes to determine the best course of action and how best it is followed. A classic office space may involve you wearing virtual reality headsets to engage with a virtual bot working beside you on your next desk. Besides the inclusion of AI software in a company or humans working side by side with robots, we must also take into account the case of cyborgs, or humans enhanced with technology. **Far-fetched?** Not so much when we look at some real-life examples in the next section.

9.4: The AI innovations

We all understand that man and machine interfaces are coming closer and closer together. But before we imagine **Cyborgs**, it is important to understand that man has a significant role in managing the machine, at least in the foreseeable future. In the previous chapter, we looked at AI's role in the operational value chain. Quality control is also needed in the digital content. For instance, tech companies often employ workers to police the firm's own services and control quality. This cannot always be handled by AI, especially when content is subjective. For instance, Facebook announced increasing its moderators from 4,500 to 7,500 in 2017 to remove any content illegal in Germany within 24 hours, as per the country's laws. Microsoft operates something like the **Universal Human Relevance System (UHRS)** which handles millions of micro-tasks each month such as checking results of its search algorithms. Google, meanwhile, employs 10,000 rater's looking at YouTube videos or testing new services. CrowdFlower is another example where digital workers

[10] Diligent Robotics. *Moxi*. Source: **https://diligentrobots.com/moxi.**

[11] Hanson Robotics. *Alice*. Source: **https://www.hansonrobotics.com/alice-eva/.**

[12] Castrodale, Jelisa. Food & Wine. *This Robot Cat Waiter Delivers Your Food and Gets Fussy if You Pet it Too Long*. January 8, 2020. Source: **https://www.foodandwine.com/news/robot-cat-waiter-ces-pudutech.**

[13] Diligent Robotics. *About Us*. Source: **https://diligentrobots.com/about**.

classify email queries by content, sentiment, or other criteria before AI answers them or passes it on to humans if no simple answer is available.[14]

9.4.1: AI in human resources

When we mentioned the use of social media to fill in profile gaps, the reference was made to **Beamery**[15], a machine learning-based candidate relationship management software that keeps track of interactions between candidates and employers to find the best candidates to engage. Human involvement allows flexibility but can also lead to bias. This is where we have **ThisWayGlobal**[16] which helps take bias out of the action by rejecting gender, race, age, and so on to only focus on the skillset of a candidate.

AI also makes life simpler for candidates. **Mya**[17] provides a chatbot that applicants can talk to get recruiter feedback on their application, including information of the company culture. This means applicants that go through AI assistants are much more likely to get a response. It also uses **Natural Language Processing (NLP)** to ask candidates relevant questions and fill the gap. Of course, what candidates would like even more is instant action, one that **JobBot** [18] allows by interviewing applicants immediately after they apply; although that is currently attuned towards hourly workers. **JobConvo**[19] is a broader platform that allows complete applicant tracking and vacancy management across multiple channels.

The coolest use of AI for recruiting came from a job applicant, Esther Crawford, who developed **EstherBot** which turned her resume into a chatbot, allowing it to interact with recruiters over Facebook Messenger![20]

Textio, Montage, Stella, and Koru are other examples of AI in recruiting. But human resource professionals also have to deal with employee engagement. Palatine Analytics can help them select the the right candidate for promotion, while **X.ai** helps with administrative work. **AISense** can transcribe meetings while **askSpoke** can answer routine employee questions.[21] And perhaps most importantly, **BotlerAI**[22]

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[14] The Economist. August 2017. *Artificial intelligence will create new kinds of work.* Source: **https://www.economist.com/news/business/21727093-humans-will-supply-digital-services-complement-ai-artificial-intelligence-will-create-new**.

[15] Beamery. Source: **https://beamery.com/**.

[16] ThisWayGlobal. Source: **https://thiswayglobal.com/overview/.**

[17] Mya. Source: **https://www.mya.com/.**

[18] JobBot. Source: **http://jobbot.ai/.**

[19] JobConvo. Source: https://www.jobconvo.com/.

[20] Kaur, Khushi. Chatbots Journal. November 13, 2019. *The Business Impact of Chatbots: Two Case Studies.* Source: **https://chatbotsjournal.com/the-business-impact-of-chatbots-abd684f39c.**

[21] Greene, Jessica. AskSpoke. *21 ways AI is transforming the workplace in 2019.* Source: **https://www.askspoke.com/blog/support/how-ai-is-transforming-workplace/.**

[22] BotlerAI. Source: **https://botler.ai/**

is a tool that can detect and even predict misconduct in a situation to empower users to take an informed next step and connect with relevant resources.

9.4.2: AI in law

Most AI solutions in the legal field have to do with text analysis and discovery. NLP can help identify the documents that would be relevant to a case and interpret the text much faster, but advising clients or negotiating and appearing in court is expected to be beyond AI's capability for some time to come. Ross Intelligence, which taps into IBM Watson, can read through thousands of cases and rank ones that are most similar to a case at hand for evidence-based practice.[23]

Kira[24] possesses a similar ability to process legal documents. **Nalaytics** [25] even adds an analytical component to those routine tasks. **Luminance**[26], on the other hand, can pick out warning signs with any company and generate a quick overview. Speed (and volume) is key in its ability to understand the language the way we would, making it great at due diligence. **rradar**[27] comes from the other end, helping businesses with legal advices to avoid inadvertent illegal actions. And just in case you do find yourself in a court, **Lex Machina**[28] can help reveal insights about the parties, judges, lawyers, and subjects of the case.

9.4.3: AI in finance and accounting

When it comes to services, financial ones are at the forefront as mentioned earlier. **ATB Finanical**, an Alberta Credit Union, partnered with Finn.ai for a phone-based AI-enabled assistant that allows customers to outsource the management of their cash flow to an app. Layer 6 continuously scans customers' interactions with banks to predict how they will react. Incidentally, these are both Canadian firms that signal the shift taking place in the country's banking industry. No surprises then that the TD bank played a role in the formation of the Vector Institute, RBC invested in Borealis AI, Scotiabank partnered with the startup DeepLearni.ng and BMO Nesbitt Burns started to offer a **SmartFolio** robo-advisor for wealth management.[29]

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[23] Lohr, Steve. The New York Times. *A.I. Is Doing Legal Work. But It Won't Replace Lawyers, Yet.* March 19, 2017. Source: **https://mobile.nytimes.com/2017/03/19/technology/lawyers-artificial-intelligence.html.**

[24] Kira. Source: **https://www.kirasystems.com/.**

[25] Nalaytics. *Nalaytics for Legal.* Source: **https://www.nalytics.com/legal.**

[26] Luminance. Source: **https://www.luminance.com/.**

[27] rradar. Source: **https://www.rradar.com/.**

[28] Lex Machina. Source: **https://lexmachina.com/.**

[29] Lorinc, John. MaRS. December, 2017. *How bots are making banking better.* Source: **https://magazine.marsdd.com/how-bots-are-making-banking-better-4c5d07fbce1f.**

Mindbridge AI offers *the world's first and only AI powered auditing and financial risk assessment platform.*[30] It allows auditors to evaluate errors or fraud that may be lurking in financial data by identifying unusual transactions. The best part about the software is its transparency allowing the line of sight into its risk rankings for better decision making.

Beanworks is an accounts payable automation software solution that allows approving invoices and paying vendors remotely. Manual accounts payable work can cost up to $14 per invoice in labor costs. **Beanworks** helps minimize this by eliminating 83% data entry work.[31]

How could we forget about the posterchild of AI in the financial space: **PayPal**. The company used regression for fraud detection, but has also moved over time to deep learning to achieve the same with greater accuracy – a necessity when managing hundreds of billions of dollars in payment.[32]

Zest AI[33] can help underwriters assess loan applicants even with little credit history. **Underwrite.ai**, in fact, achieves this by applying AI derived from genomics and particle physics.[34] **DataRobot**[35] appeals to a range of industries and functions. Finance is one of them. It uses predictive models which can help detect fraud or help with wealth management. **Kensho**[36] is analytical too, but can address more complex questions such as the drop in the British pound following Brexit. With such levels of intelligence, it is only natural that AI tries to beat the market. **Kavout**[37] scores stocks on their expected performance by analyzing market data, SEC filings, and other such information, making life easier for brokers.

Banks are also quite particular about personalizing the customer experience. **Abe AI**[38] can work with the likes of Google Home or Alexa to be your virtual financial assistant addressing simple requests. **Trim**[39], on the other hand, can analyze your spending to help you save more by cancelling money-wasting subscriptions or finding better options for insurance.

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[30] MindBridge AI. *AI Auditor.* Source: **https://www.mindbridge.ai/products/ai-auditor/.**

[31] Beanworks. Source: **https://www.beanworks.com/**.

[32] Analytics India Magazine. This Is How PayPal Uses AI/ML To Manage $712 Billion Payments. February 20, 2020. Source: **https://analyticsindiamag.com/this-is-how-paypal-uses-ai-ml-to-manage-712-billion-payments/**.

[33] Zest AI. Source: **https://www.zest.ai/**.

[34] Underwrite.ai. Source: **http://www.underwrite.ai/**.

[35] DataRobot. Source: **https://www.datarobot.com/.**

[36] Kensho. Source: **https://www.kensho.com/.**

[37] Kavout. Source: **https://www.kavout.com/.**

[38] Abe AI. Source: **http://www.abe.ai/.**

[39] Trim. Source: **https://www.asktrim.com/**

9.4.4: AI in sales and marketing

There are hundreds of AI enabled tools today that can aid sales and marketing. Most that did not use AI earlier are becoming AI-enabled as companies are quickly making a decision to either build or buy this capability.

Google's **RankBrain**[40] monitors user engagement 24/7 in order to provide the best search results for every query that someone types into a Google search bar, taking into account the location, words, and personalization to determine the searcher's true intent. **Marketo**[41] is no RankBrain but it's still a good example of an AI-powered marketing platform that can search your company's website to identify which assets (white papers, articles, eBooks, and so on) will appeal most to a particular audience segment, allowing you to keep your prospects engaged and subscribed. **Growlabs** (now **RollWorks**)[42] could compliment this technique by determining when it is the best time to follow-up on your email based on the recipient's profile.

Sending timely emails with relevant content follows the identification of the right leads. Identifying the ideal customer profile is tricky. This is why **LeadCrunch**[43] uses AI to target companies that look most like your current customers. What is very unique about the company is that it is not a subscription-based pricing SaaS Model, rather volume and value-based. **Hubspot**[44] does a similar scoring of prospects based on their similarity to your existing customers but offers the benefit of a full-scale CRM platform too. **Infer**[45] brings more rigor by scoring leads based on thousands of firmographic, demographic, and technographic information points from over 20 million companies.

At the end of the day, a chunk of the right leads come from a great online presence and engagement. **Rocco**[46] allows this by suggesting social media content that your followers are most likely to engage with. After all, if AI can auto-generate content for journalists, it can certainly do so for marketers. **Albert**[47], on the other hand, takes care of your advertising budget by automatically analyzing and managing paid ad campaigns online on the likes of Google or Facebook.

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[40] Jayson, DeMers. Medium. *What Is Google RankBrain and Why Does It Matter?* April 5, 2020. Source: **https://medium.com/@jaysondemers/what-is-google-rankbrain-and-why-does-it-matter-5d1058d8f901**.

[41] Marketo. Source: **https://www.marketo.com/**.

[42] RollWorks. Source: **https://www.rollworks.com/why-rollworks**.

[43] LeadCrunch. Source: **https://leadcrunch.com/**.

[44] Hubspot. Source: **https://www.hubspot.com/**.

[45] Infer. Source: **https://infer.com/**.

[46] Rocco. Source: **http://www.rocco.ai/**.

[47] Albert. Source: **https://albert.ai/**.

There are also the chatbots that have helped so many industries. They are a boon to marketers in helping personalize and automate a more interactive website visitor experience through intelligent conversations, best exemplified by Sephora's **Kik**[48] . Bots help the sporting industry too, KAI being a case in point. It was introduced by the team Sacramento Kings in partnership with Sapien in 2016. Thunder bot was introduced by the NHL team Tampa Bay Lightning with **Satisfi Labs**.[49] **DigitalGenius** automates customer support across multiple channels, thus improving the quality and experience for customers.[50]

A sales cycle – the journey to convert a lead into a customer – falls between the lead engagement and customer support activity. Predicting the odds of a deal being won is one of the biggest challenges, given the number of measurable and subjective – known and unknown – factors involved. Emerging companies using AI to achieve this include Aviso, Clari, SalesChoice and TopOpps, to name a few.

SalesChoice[51] brings multiple AI techniques to cover the myriad of facets in a sales cycle. For instance, its opportunity quality assessment is completely AI-automated, thereby taking out human bias, and in compliance with the policies we have read about so far. It offers transparency in how AI determines each deal's quality, allowing managers to understand and make more contextual decisions. It also uses the quality insights for collateral benefits: marketers can invest in channels that give the best quality leads (and not just the greatest number of leads); customer success teams can identify the best customers with realistic potential for future business; and managers can understand whether bad quality deals were behind a sales person's low performance. SalesChoice doesn't stop at this. It also shows whether the data is properly entered by each user, thereby helping prevent inaccurate or biased insights. Most importantly, it also analyzes the natural conversational styles so that any customer is engaged by the sales person most closely matching his/her personality. Cultural mismatch, after all, is a big reason why 83% M&A transactions are not successful,[52] and deals go south. People buy from those they like (and trust).

SalesChoice is a rare example of a company deploying multiple AI techniques to cover a range of use cases in a field – both quantitative and qualitative – and it takes care of the ethical AI issues of bias and lack of transparency, reducing future risks for companies. And this makes for a good transition to our next section.

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[48] Kik. Source: **https://www.kik.com/bots/sephora/**.

[49] Sennaar, Kumba. Tech Emergence. *Artificial Intelligence in Sports – Current and Future Applications.* August, 2017. Source: **https://www.techemergence.com/artificial-intelligence-in-sports/**.

[50] Digital Genius. Source: **https://www.digitalgenius.com/**.

[51] SalesChoice. Source: **http://www.saleschoice.com**.

[52] Bradt, George. Forbes. *The Root Cause Of Every Merger's Success Or Failure: Culture.* June 29, 2015. Source: **https://www.forbes.com/sites/georgebradt/2015/06/29/the-root-cause-of-every-mergers-success-or-failure-culture/#24ec2d45d305**.

9.4.5: AI in Cyborgs

At last, we come to the merger of man and machine – the cyborgs. Google Glass would be a familiar example of a non-permanent augmentation that can reveal additional information on any product. Employees at Wisconsin's Three Square Market were chipped with tiny devices that could communicate with systems outside the body, allowing them to simply wave their hand to enter security doors.[53]

Cyborgs need not be like terminators. They can be far more subtle and useful. Consider the cyborgs in the medical industry solving problems for color blindness, loss of hearing, loss of limbs, providing bionic capabilities, and even building human tissue from cyborg organoids.

Consider Neil Harbissan who moved from being able to see only black-and-white to seeing colors beyond the scope of normal human perception. Dr. Kevin Warwick, or **Captain Cyborg**, installed chips in his arm to remotely control heating or lights. The world's first Bionic Man, Jesse Sullivan, has recovered from his accidental electrocution to now control his prosthetic limbs with his mind.[54] Most prosthetic implants are helping victims lead a normal and empowered life. But from Jerry Jalava's USB port embedded finger, to Stelios Arcadio's artificially-embedded ear in his left hand – *how do we ensure that we design our man and machine interfaces to protect the human species?* What is important is to not lose the most sacred boundary in our creativity and imagination: *morals*. Let the robots do what they are excellent at automating repeatable routines.

AI enhancements also make training and sourcing information easier, increasing our efficiency. For instance, a GE technician wiring a wind turbine's control box experienced a 34% increase in the performance at the very first attempt of being guided by line-of-sight instructions overlaid on the job by an AR headset.[55]

9.5: The AI vault

When it comes to a strategic heads up, an MIT SMR article summarizes this beautifully. It states the simplest step for managers is to understand that any technology helps reduce costs and determine how AI will do so. Accordingly, just

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[53] CBC Radio. September 2017. *Will you have to become a cyborg for your job?* Source: **http://www.cbc.ca/radio/quirks/september-9-2017-1.4280509/will-you-have-to-become-a-cyborg-for-your-job-1.4280516**.

[54] The Medical Futurist. *The World's Most Famous Real-Life Cyborgs.* June 22 , 2017. Source: **https://medicalfuturist.com/the-worlds-most-famous-real-life-cyborgs/**.

[55] Abraham, Magid, and Annunziata, Marco. Harvard Business Review. *Augmented Reality Is Already Improving Worker Performance.* March, 2017. Source: **https://hbr.org/2017/03/augmented-reality-is-already-improving-worker-performance**.

the way semiconductors helped reduce the cost of arithmetic, or doing calculations, AI will help reduce the cost of prediction.[56]

In a 2017 PwC CEO Pulse survey,[57] 76 percent of respondents said potential for biases and lack of transparency were impeding AI adoption in their enterprise. 73 percent also said the same about the need to ensure governance and rules to control AI. Consider the example of the AI-powered mortgage loan application evaluation system. *What if these types of applications started to deny a demographic segment because of systemic biases?* Data bias will increasingly become a risk factor and legal reality as AI continues to seep into all forms of business applications. Business leaders faced with ensuring interpretability, consistent performance, and data integrity will have to work closely with their organization's developers and analysts. Developers are responsible for building the machine learning model, selecting the algorithms used for the AI application, and verifying that the AI was built correctly and continues to perform as expected. Analysts are responsible for validating the AI model created by the developers to be sure the model addresses the business need at hand. Finally, management is responsible for the decision to deploy the system and must be prepared to take responsibility for the business impact.

Every glance from an ethical standpoint on an AI intrusion has so far centered on the more controversial aspects. Irony abounds as AI at work can have a heavy positive influence on an issue we have been grappling with in recent times - *gender inequality*. In an age where our species is becoming more and more cognizant of the need for diversity and gender equality in every sphere of life, AI may see women play a far greater role, given its nature. If technology takes over most physically demanding jobs, the ones we are left with would require softer skills - emotional intelligence topping the chart - in which women typically excel. High **Emotional Quotient (EQ)** is needed for empathy, compassion, engagement and influence and jobs that currently demand high EQ are already dominated by women. Not surprising, given that a Korn-Ferry report found that women score higher in 11 out of 12 key emotional intelligence capabilities.[58]

As seen in the previous chapter, automation in industries like mining can help prevent workers from hazardous work, compelling them to move to safer jobs (assuming they are available). The lines between AI's benefit and risk to jobs thin further in case of non-hazardous work. But even then, AI can often be a need rather than a choice.

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[56] Agrawal, Ajay, Gans, Joshua S, and Goldfarb, Avi. MIT Sloan Management Review. February, 2017. *What to Expect From Artificial Intelligence.* Source: **https://sloanreview.mit.edu/article/what-to-expect-from-artificial-intelligence/**.

[57] PWC Pulse Survey. Source: **http://usblogs.pwc.com/emerging-technology/artificial-intelligence-is-your-business-ready/**

[58] Beck, Megan, and Libert, Barry. MIT Sloan Management Review. December, 2017. *Could AI Be the Cure for Workplace Gender Inequality?* Source: **https://sloanreview.mit.edu/article/could-ai-be-the-cure-for-workplace-gender-inequality/.**

An April 2020 Gartner report made it clear that *"the COVID-19 pandemic changes how sellers engage with customers, as they can no longer rely on traditional practices," calling leaders to adopt "new planning, guided selling, conversation intelligence, forecasting, digital commerce and pricing technologies."*[59]

The case of Cyborgs as depicted by CBC radio raised interesting questions from a security and an ethical point of view. Adding chips to our bodies can be considered a breach of privacy, not only physically but also in terms of the control and monitoring capabilities it gives an employer. Of course, we must then also consider the repercussions of when the employee leaves the company and joins another!

Even if we forget about dissenting human employees for a moment, *what happens when managers are faced with dissenting chat bot employees?* We read about this earlier in the book when Facebook got a taste of this scenario and had to shut down an experiment where two artificial intelligence programs started chatting to each other in a language only they seemed to understand.[60] Given that there are those who are actively working on building AI systems that can converse with each other, perhaps this ability poses a far more risky challenge. As mentioned in the previous chapters, this is why effective regulatory mechanisms are so urgently needed today.

Dependence, security, and privacy are all issues to consider when it comes to utilizing AI at work. *How far can one fight off the persistency of dystopian AI-related predictions we have been bombarded with?* Pattern recognition and its consequent extrapolation helped our ancestors survive. Our brain is hardwired to do so and to do so in a way that first looks at the worst-case scenario. An Oxford study estimated that 47% of jobs in the US are at risk of being automated in the next 20 years.[61] 80% was the figure quoted by Health Management System's **Nustad** on the question of the proportion of jobs that will be displaced by AI. Her approach to address the issue is with a volunteer program where employees join training projects that interest them which may lead to new roles. Salesforce offered its customers all training materials for free to develop both internal staff and end users.[62]

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[59] Travis, Theodore; Hansen, Ilona; Zijadic, Adnan; Lewis, Mark; Hilbert, Melissa. Gartner. *Top CRM Sales Technologies for the New Realities of Selling in the COVID-19 World.* April 3, 2020. Source: **https://www.gartner.com/en/documents/3982971.**

[60] Griffin, Andrew. Independent. July, 2017. *Facebook's Artificial Intelligence Robots Shut Down After They Start Talking To Each Other In Their Language.* Source: **http://www.independent.co.uk/life-style/gadgets-and-tech/news/facebook-artificial-intelligence-ai-chatbot-new-language-research-openai-google-a7869706.html**.

[61] Department of Engineering Science: University of Oxford. June 2017. *New study shows nearly half of US jobs at risk of computerisation.* Source: **http://www.eng.ox.ac.uk/about/news/new-study-shows-nearly-half-of-us-jobs-at-risk-of-computerisation**.

[62] Ryder, Allison. MIT Sloan Management Review. June 2017. *Video: Preparing for the Changes AI Will Bring to Tomorrow's Jobs*. Source: **https://sloanreview.mit.edu/article/video-preparing-for-the-changes-ai-will-bring-to-tomorrows-jobs/**.

Is training the answer? If we are speaking purely in terms of increasing the capability of humans to do more, then yes. But this is not a race. Humans are not always competing with AI. We are incorporating the technology in our lives to make us more efficient at what we do. Yet, training remains relevant because workers have to be prepared for the new roles that man machine interfaces, Cobots and robots, are creating.

To understand what new roles may come by, we must also understand how AI is likely to be employed. The Davenport-Kirby article suggests that managers should be introducing cognitive technologies in workplaces now and discover their human augmenting value. The key is to create IT architectures that support more than one application. A well-designed architecture would have certain key attributes: the ability to handle a variety of data types, ability to learn, transparency, a variety of human roles, flexible updating and modification, robust reporting capabilities, and a state-of-the-art IT hygiene from the perspective of interface, security, and so on.[63]

Reid Hoffman, co-founder of LinkedIn, narrows this further by anticipating that AI-enabled knowledge graphs will empower managers with better organizational dashboards that allow data-driven performance management and increased talent mobility.[64]

Gradually, as we come to work with an AI co-worker, that requires a set of considerations of its own. Shelly Palmer suggests dealing with it with respect. He states that open questions on how one can increase sales may not work, but something more specific such as the best day to offer a discount on a certain product would yield more insightful information. Having already outsourced a lot of our brainwork to our smartphones such as managing calendars or making calculations, we must adapt to think for two by understanding which parts of our jobs would be best handled by the computer and which ones by us.[65]

In addition to helping make us better workers by increasing our efficiency and productivity, AI also has more basic results. Consider the case of the aforementioned Mr. Mika Persson who has managed to avoid serious health repercussions of working in the mines, thanks to machines doing the job for him. His sentiment towards machines replacing his job is similar to that of a Vancouver dairy farmer Diana

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[63] Davenport, Thomas H, and Kirby, Julia. MIT Sloan Management Review. March, 2016. *Just How Smart are Smart Machines?* Source: **https://sloanreview.mit.edu/article/just-how-smart-are-smart-machines/.**

[64] Hoffman, Reid. MIT Sloan Management Review. June, 2016. *Using Artificial Intelligence to Set Information Free.* Source: **https://sloanreview.mit.edu/article/using-artificial-intelligence-to-humanize-management-and-set-information-free/.**

[65] Palmer, Shelly. Shellypalmer.com. December, 2017. *Put AI to Work for Your Brand Right Now*. Source: **https://www.shellypalmer.com/2017/12/put-ai-work-brand-right-now/?utm_source=Daily+Email&utm_campaign=44569a6ffd-EMAIL_CAMPAIGN_2017_12_10&utm_medium=email&utm_term=0_03a4a88021-44569a6ffd-248644173**.

West who is now able to manage her production more efficiently. Mr. Persson is not only thankful at having gotten an office job managing the machine instead of doing the dirty work, but also relaxed about the future of his belief in the government's economic model and concern towards the welfare of the public.

Also in other countries like in Sweden and its Scandinavian neighbors, where unions are powerful, government support is abundant and trust between employees and employers run deep, people are far more relaxed - though aware - about the use of machines at work.[66] The Scandinavian approach is telling, for it shows the importance of companies and governments being fair and empathetic towards social well-being. If these are not prevalent, then institutions will always try to find ways to profit at the expense of their stakeholders, whether with the use of AI or outsourcing or some new innovation yet to be visible.

9.6: Conclusion

In the end, it's only a matter of time. According to the *McKinsey report*, a total AI takeover of jobs could take decades and largely depends on how fast we develop NLP capabilities.[67] It also depends on two other factors in our view: the robots' ability to build and repair other robot workers; and their ability to deal with situations with empathy and context the way humans do. Termed singularity (man and machine as one), it is a question of when?

As Gary Kasprov mentioned in his book, Deep Blue could defeat him in chess because while it can analyze 200 million positions per second, compared to his two or three, it was doing so in a situation with strict rules and a clear goal - *checkmate*. Real-life scenarios are rarely ever like this. Think Google Translate which learns a language only by repeated assessment of real-world examples rather than grammar rules. Accuracy then is something it achieves through a little bit of iteration over an extended time.[68]

There are also those like Kevin Drum who declare that AI will take over our jobs in 40 years[69] - interestingly, quite in line with Mr. Davenport and Ms. Kirby's map of cognitive intelligence capabilities. His thesis is based on the speed with which

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[66] Goodman, Peter S. The New York Times. December, 2017. *The Robots Are Coming, and Sweden Is Fine.* Source: **https://mobile.nytimes.com/2017/12/27/business/the-robots-are-coming-and-sweden-is-fine.html**.

[67] Lohr, Steve. The New York Times. January, 2017. *Robots Will Take Jobs, but Not as Fast as Some Fear, New Report Says.* Source: **https://www.nytimes.com/2017/01/12/technology/robots-will-take-jobs-but-not-as-fast-as-some-fear-new-report-says.html**.

[68] Kasparov, Garry. Fortune. September, 2017. *Garry Kasparov: There's No Shame in Losing to a Machine.* Source: **http://fortune.com/2017/09/25/garry-kasparov-chess-strategy-artificial-intelligence-ai/**

[69] Drum, Kevin. Mother Jones. November/December, 2017. *You Will Lose Your Job to a Robot—and Sooner Than You Think.* Source: **http://www.motherjones.com/politics/2017/10/you-will-lose-your-job-to-a-robot-and-sooner-than-you-think/**.

changes have already occurred. After all, until not so long ago, Watson needed a computer the size of a bedroom to win *Jeopardy!* against two of its best players. Given that Uber's trucking subsidiary Otto delivered 2,000 cases of Budweiser 120 miles from Fort Collins, Colorado, to Colorado Springs, without a driver at the wheel,[70] the full production of such a fleet would likely mean loss of most trucking jobs. Kevin makes an interesting assessment to close off his argument. He states that during the first 70 years of the digital era, computing power doubled every couple of years, producing steadily improving accounting software, airline reservation systems, and so on. At the current rate, we will start to see visible progress towards AI around 2025, in comparison to a human brain's power of 10 to 50 petaflops (quadrillions of calculations per second). In the decade after, AI will reach one-tenth of our brain power and within the decade after that, we'll have full human-level AI. It's an exponential curve.

Is Kevin mistaken? Perhaps not, but we must consider the collateral need and impact of such a takeover. Theoretically, AI can certainly take over most tasks we know today, but how much time that takes is a significant parameter to take into consideration because in that time, it would have just as likely created new kinds of jobs. Our social setting may have undergone significant transformation, as has been put on full throttle by the pandemic. IDC did state that the revenue boost due to AI associated with CRM activities will also result in net-new jobs which could, if respondent opinions bear out, reach more than 800,000 by 2021 in direct jobs, and 2 million if you add in indirect and induced jobs.[71] The **World Economic Forum Future of Work 2018 Report**[72] projected that in the non-agricultural workspace by 2022, 75 million current jobs could be displaced as AI advances and starts to take over more routine aspects of work. However, 133 million new jobs could also be created, and new skills in both emotional intelligence and technical intelligence like technology design and programming will become increasingly important. *How does Covid-19 change this outlook?*

We cannot underestimate the duality of AI growth as the technology is central to fixing so many aspects of our creaking socio-economic system, starting with the basics of education, healthcare, and food. While we know that the onset of AI may replace many traditional jobs, *how long in an AI-less world would it take before food, water, education or healthcare scarcity hunts us first?* A $470,000 radiologist salary may certainly be under threat from an AI system like **Arterys** which can perform an MRI

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[70] Isaac, Mike. The New York Times. *Self-Driving Truck's First Mission: A 120-Mile Beer Run.* October 15, 2016. Source: **https://www.nytimes.com/2016/10/26/technology/self-driving-trucks-first-mission-a-beer-run.html.**

[71] Gantz, John F, Murray, Gerry, Schubmehl, David, Vesset, Dan, and Wardley, Mary. IDC. *A Trillion-Dollar Boost: The Economic Impact of AI on Customer Relationship Management.* June, 2017. Source: **https://www.salesforce.com/content/dam/web/en_us/www/documents/white-papers/the-economic-impact-of-ai.pdf**.

[72] World Economic Forum. *The Future of Jobs Report. 2018.* Source: **http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf**.

analysis of blood flow in 15 seconds as compared to 45 minutes taken by humans.[73] But while the educated and urban amongst us looks at what we may miss out on in the future, the view among the majority of the world's population - the lesser privileged - is vastly different and in much dire need of greater efficiency and access. *How much might they - or even us who normally face long wait times in hospitals - benefit from the same efficient MRI system?* Such a need for AI has already been relayed by Covid-19 to even well-off organizations worldwide.

More importantly, we have to consider the state of job growth, with or without AI. Global jobs are increasingly facing the strain of trying to meet the global demand from a growing population. In 2019, 90% of new jobs that were created in Canada were part-time. *Does that mean that AI has already arrived and taken over?* No. This is the reality of the trend we have been heading towards for many years now. There are also countries facing population decline, those facing low literacy and capability levels, and the ones unable to provide ample job security. Growth helps economies sustain that fine balance over time. It is what induces new techno-economic systems to take over. And this is why we cannot just become stationary as a society. To imagine it clearly, think about driving a car. To maintain speed, we cannot let go of the accelerator entirely. The car would simply slow down and eventually come to a halt. Periodic acceleration is necessary even to keep the car moving.

What could this sustained progressive society look like? Oh, and while we discussed Cyborgs from a work context, *what does that augmentation mean for our personal lives?* We come now to AI's influence, up close and personal. Of course, that may both influence and be influenced by whether we create a perfect world or a perfect storm at work.

[73] Williams, Alex. *The New York Times. Will Robots Take Our Children's Jobs?* December, 2017. Source: **https://mobile.nytimes.com/2017/12/11/style/robots-jobs-children.html**

Chapter 10
AI at Home

In the previous chapter, we discussed *Thomas Davenport* and *Julia Kirby* perspectives on context awareness, learning, and self-awareness as advanced types of intelligence that would lead to the *great convergence*. They were referring to the work capabilities of AI. Such a stage will have serious societal ramifications. We agree the AI shift will pose new questions on what it means to be human. Can AI itself be so human-like that we cannot tell the difference in our day-to-day living realities? This chapter looks at the ways in which AI is playing a role in our society.

Structure

In this chapter, we will discuss the following topics:

- A fictional look at the perfect world and the perfect storm scenarios
- AI shift occurring in our private space and homes due to AI
- AI innovations and applications in the consumer sector
- AI Vault: ethical challenges
- Concluding points on the use of AI in our day-to-day lives

Objectives

After studying this chapter, you should be able to:

- Envision the positive or negative impact of AI in our personal lives
- Learn how AI is transforming our everyday living
- Understand the implications of AI on our lives
- Appreciate the ethical considerations to keep in mind while using AI

10.1: A perfect world

Alixia Bolt wakes up from a restful sleep. **Aibo**[1] , her pet robot dog, gives Alixia a gentle nudge and turns its head to **Lynx** who recognizes Aibo's command to remove Alixia's sheets from her bed. Lynx then loads up **Xin**, an intelligent washing machine. Each piece of Alixia's clothing is **radio-frequency identification (RFID)** tagged to read her clothing labels and initiate a customized washing cycle for a given set. As Alixia heads to brush her teeth with **Ara**, her AI toothbrush, it guides around her teeth to clean perfection.

Alixia enjoys all the robotic luxuries and is now 120 years old having completed bionic eye surgery replacements, and a bionic heart operation on the way. She now has 50 percent of her brain hardwired to ensure she is cognitively responding to the same brain neuron processing levels as a thirty-three-year-old. As she looks out at a mesmerizing sunrise past her wall-to-wall window, something in her sparks a different craving. She orders **Echo** to turn off the virtual screen and walks to the window. The streams of gold draping lush greenery are immediately replaced by an endless stretch of utter blackness, interrupted only by an even more mesmerizing view – the Earth, quietly rotating as Alixia looks at it from her space home. She can switch to a view of the moon but this morning she craves the natural.

As AI eventually helped crack the quantum code, teleporting followed soon after. This implied rapid transport between space and earth. The porting has been monitored thanks to the embedded individual chips. The portal is made up of millions and millions of IoT AI intelligent 24x7 sensors and monitoring systems intelligently encoding temperature, air, sound, weight, moods and health, and so on into the central AI nervous system.

Everyone wears virtual **augmented reality (AR)** travel masks so they can use their travel time for any purpose, either for work, education, entertainment, or simply having human contact and selecting a virtual world reality of your choice. Even now on earth, most of the society wears a perfectly veneered virtual world skin mask that allows one to experience walking on a beach to work, or walking up a mountain to hike. Wearable clothing can not only allow virtual temperature heating and cooling agents to mirror your travel experience environment settings, but also to protect the wearer's health from super viruses, reducing the risk of pandemics.

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[1] MacDonald, Gayle. The Globe and Mail. *AI is Changing the World. Are we Ready for It?* July 7 2018. Source: **https://www.theglobeandmail.com/life/style/article-artificial-intelligence-is-changing-the-world-are-we-ready-for-it/**

Alixia feels a sudden rush of thankfulness at how much humans have managed to limit manmade damage to Earth's environment, reversing climate change in time and sustaining the balance. And Alixia, in her career, played a pivotal role. She brings her thoughts back to the present in compliance with her mandatory training on mindfulness and appreciating the present. Somehow, no part of Earth is ever enough for her eyes. Alixia has an option: *to go back to the ground view or to stay with this one.* With the slightest smile, Alixia chooses a third option and orders Echo again – in thought.

In the blink of an eye, the **virtual reality (VR)** world vanishes and is replaced by a centuries-old house. Alixia gets up and walks out to the bolt farm.

10.2: A perfect storm

Alixia Bolt wakes up from a distressed sleep. **Aibo**[2], her pet robot dog, has been barking intermittently throughout the night. Alixia regrets having bought Aibo, a super model that runs on solar, and a central AI nervous system will never put down options at his core. Alixia asks Lynx to remove her sheets from her bed and load up Xin, the intelligent washing machine. Unfortunately, Xin misreads her labels and washes her dark colors in bleach white rinsing laundry detergents. They are totally ruined. As Alixia brushes her teeth with Ara, her AI-enabled toothbrush reboots into high speed and starts to brush her gums excessively causing them to bleed.

Alixia has been struggling with mental depression for 50 years. When she reached 70, she reflects on what was an incredible opportunity to become a founder of the most advanced bio-engineering future labs. She signed her life away for an *Immortality* AI *Program* to always stay alive, no matter how difficult the journey was.

She just completed her fifth bionic eye surgery replacements, her third bionic heart operation and now has 20 percent of her brain hardwired to ensure she is cognitively responding to the same brain neuron processing levels as a thirty-three-year-old. Unfortunately, her human tissue has been dying more rapidly over the past five years and her doctors have advised her that in the next 20 years, she will no longer have any human brain tissue left but will be mentally healthier and any feelings of depression or pain will cease to exist. Meanwhile, she is already scheduled for her next mandatory surgeries, as they are an ongoing affair to keep her going.

As Alixia looks out from her window, she is saddened by the congestion of space homes around, dotting the blackness of space. The view is interrupted only by an Earth that is starting to look more and more like Venus's runaway global warming. Alixia immediately checks her emotions, as she has been trained to be impassive

[2] MacDonald, Gayle. The Globe and Mail. *AI is Changing the World.* Are we Ready for It? July 7 2018. Source: **https://www.theglobeandmail.com/life/style/article-artificial-intelligence-is-changing-the-world-are-we-ready-for-it/**

and objective. *Quite in sync with the robot that I'm becoming*, she thinks. Yet, it's an important task as millions and millions of IoT AI intelligent 24x7 sensors and monitoring systems are constantly monitoring her and feeding it into the AI central nervous system. Any serious negative deviation and authorities will appear via teleportation – the bane of AI's advances in quantum physics.

Alixia wonders if being on Earth would have been any different, despite having to live underground to avoid the adverse climate. But everyone is chipped anyway, as countries succumbed to these new realities one by one in the name of security. She realizes that her only escape is to go into one of the VR worlds – the only space that allows some respite, despite its severe isolation. She orders Echo to load one – to no avail. She tries again. Nothing happens.

Am I already in a virtual world? she wonders. With age, she has often come to forget and suffers delusions, often unable to trace back a thought's genesis, given the implants in her brain. Artificial news, artificial worlds, artificial brains and everything monitored. Alixia suspiciously asks Echo to shut down the VR. Echo obeys. To her despair, she finds herself bed-ridden in a hospital-like setting, unable to move her wrinkled limbs, and experiencing a shooting pain in her head from a presumed brain surgery. Frustrated, she returns to her VR.

10.3: The AI shift

In speaking of AI and living, the biggest question is that of a living AI itself, which implies consciousness. First, *what does it mean to be conscious?* Consciousness is everything you experience. It is the musical tune that is stuck and keeps playing in your head, the tangy sweetness of a homemade lemon chocolate mousse, the buzzing pain of a toothache, the incredible sense of loss of a child, or the joy of a new-born child, and the bitter knowledge that eventually all feelings will end with certainty in death. To that point, *could AI enable our consciousness to live on?*

The origin and nature of these experiences, sometimes referred to as **qualia** – or individual instances of subjective, conscious experience – are a mystery from the earliest days of antiquity right up to the present. Many modern analytic philosophers of mind, most prominently Daniel Dennett of Tufts University, find the existence of consciousness such an intolerable affront to what they believe should be a meaningless universe of matter and the void that they declare it to be an illusion. That is, they either deny that qualia exist or argue that they can never be meaningfully studied by science.[3]

Different schools of thought exist; some would say consciousness is the ability to receive, store and process information and act on it. Others would say, it involves

[3] Koch, Chistof. Scientific American, *What is Consciousness?* June 1, 2018. Source: **https://www.scientificamerican.com/article/what-is-consciousness**.

something more inexplicable that speaks to our sense of creativity and being. A **World Economic Forum (WEF)** article crystallizes it into two viewpoints. First is the **Big-C** concept of consciousness which follows the *Copenhagen interpretation* and also of an ancient theory of mind in Vedanta.

Consciousness and the complementary world are two aspects of the same reality. The second viewpoint is **Little-C** or the more Buddhist concept of consciousness where there are roots from biology, which emerges from chemistry, which emerges from physics. Accordingly, what happens in the mind is identical to and perhaps, reflective of what happens in the physical brain.[4] The Little-C form of consciousness may well be achieved by a self-aware and constantly computing AI. However, *is that enough to make it human-like?*

Sentiments play a big part in our everyday behavior. In fact, even when we fear robots taking over our world to gain power, *fear*, and *power* are entities even a self-aware AI may not be aware of. This level of consciousness, or the Big-C, is important to be taken into account because it factors in the existence of dreams, visions, or inspirations.

IBM is already teaching AI to behave like the human brain by paying attention and making memories. The human mind is different from AI in learning incrementally instead of needing large datasets upfront to learn from in order to perform relational reasoning or to build connections between past experiences to make sense of the current situation in real time. **DeepMind** was trained at making such inferences and turned out to be better than humans at times in relational reasoning.[5] *What happens when AI does begin to remember and have an individual identity of its own.*

Velcro was inspired from seeds with microscopic hooks that got stuck to a sweater.[6] Mussels inspired Kaichang Li to develop a glue that was water-repellent, which eventually led Columbia Forest Products to develop **PureBond** and the glue keeping most of our furniture together today.[7] It was dreams or visions that inspired Elias Howe's 1845 design of the modern sewing machine. In fact, when Srinivasa Ramanujan's book containing thousands of mathematical formulas well ahead of their time was discovered in the twentieth century, no methods accompanied them.

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[4] Kak, Subhash. World Economic Forum. December, 2017. *Is artificial intelligence set to become conscious?* Source: **https://www.weforum.org/agenda/2017/12/will-artificial-intelligence-become-conscious.**

[5] Tarantola, Andrew. Endgadget. *IBM is teaching AI to behave more like the human brain.* September, 2017. Source: **https://www.engadget.com/2017/09/01/ibm-is-teaching-ai-to-behave-more-like-the-human-brain/**.

[6] Swearingen, Jake, The Vindicated. *An Idea That Stuck: How George de Mestral Invented the Velcro Fastener.* November, 2016. Source: **http://nymag.com/vindicated/2016/11/an-idea-that-stuck-how-george-de-mestral-invented-velcro.html.**

[7] The Golden Goose Award. 2017: *The Sea Soy Solution.* September, 2016. Source: **https://www.goldengooseaward.org/awardees/sea-soy-solution**.

The genius mathematician had claimed to have learnt of the formulas by a goddess while he was asleep.[8]

Can a self-aware robot also be capable of inspiration? Perhaps, if it can detect patterns and correlate them to specific problems. But then, *can it start to also have dreams or visions?* Even from a logical perspective, a number of other things need to happen first. Robots would not easily decode the concept of dreams if they are built on the foundations of what humans have taught them; and what we are teaching them is based on things we can rationally explain. Even if we assume that dreams are a biochemical response to aspects of living a daily life to recognize a phenomenon they can't rationally explain, robots would need to sense or believe in a higher power. Belief is more an emotion than a physical entity. This brings us to a different topic all together: *religion*.

All stories of God relate to one or more beings that existed at some point in history and achieved great things. If a robot does so, *will future robots generations later come to praise and pray to it?* For that to happen, robots would first need the capability to be inspired and to be thankful or be sorry for something. This leads us to the question: *can a robot be thankful for a problem that gets solved?* For machines, problems are simply tasks to be attempted and executed. Likewise, to feel sorry for a mistake or failure, robots would first need to understand the repercussions of those mistakes on a sentimental level. If a self-aware machine makes a computational error leading to an accident, it is likely to dispassionately and honestly realize and account for the nature and source of that mistake. It might also then act to fix it. But *would it feel sorry?*

We are driving home is a simple point: there is a difference between machines becoming self-aware and them becoming human-like in terms of consciousness.

Now, let us move closer to the current reality, and consider our engagement with AI. Robots may or may not come to create their own religion, but we certainly can. There are many other things in life that move or interest us. While religion pertains to the more metaphysical, there are more intimate and basic forms of engagement with our physical world in everyday conversations and intimate moments as we are social beings. Our everyday life is starting to, and will soon fully, involve AI where our day to activities will increasingly become more socialized with professional service Cobots and our laws will shift to also protect society's robots at large. The primary driver of this trend is our need to satisfy iconoclastic desires - whether sexual or simply relational - which can be fulfilled with a robot in privacy and without depending on or influencing another human.

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[8] Kak, Subhash. World Economic Forum. *Is artificial intelligence set to become conscious?* December, 2017. Source: **https://www.weforum.org/agenda/2017/12/will-artificial-intelligence-become-conscious**

We have been using AI every time we have surfed Netflix or even when we have used Uber to send a request to pick us up. Our profile and travel preferences and even food preferences are being automatically classified in Uber databases. Given AI's ability to process and analyze vast amount of data across an unlimited number of variables, our everyday behaviors can increasingly be tracked online and connected – whether insights from the online world or physical world, places we visit, things we are interested in or conversations we are having. Less visible uses of AI occur in a smart building, where we use sensors and process automation to control operations such as heating, air conditioning, security and lightning[9] - again providing more insights on our behaviors and our emotions.

In the previous chapter, we discussed the development of AI capability for public and for private enterprise applications. Many more AI developments have been in the B2C space focused on consumer consumption. Naturally, this has led to a proliferation of AI tools to use in our daily living.

In the chapter on AI in media and communications, we discussed communication with AI and ended with how we are advancing diverse systems to communicate with each other. The **Internet of Things (IoT)** is accelerating smarter learning homes where we can control our home needs from our office. The advances in home or office automation are geared towards convenience and efficiency. Homes use energy only as per requirement to avoid waste, while Alexa or Google Home dims lights or plays our favorite movie to minimize our effort creating even more instant gratification.

AI-enabled living is nearly ubiquitous - in our cars, phones, homes - from kitchens to bedrooms to washrooms to our intelligent beds, everything is becoming smarter with eventually a central AI nervous system - monitoring not just our heart beats, our calories, our steps and our homes, but also creating a digital footprint that in time could be transferred to a robot/Cobot. If that robot looked just like us, we could stay connected to our families for infinite memories.

This AI living shift is already here and is set to influence future generations who will grow up immersed with AI which will simply be in everything. We won't even question its existence, just like we don't question the value of electricity lighting up what we need to see. AI will become the all-knowing and all-sensing invisible layer that will connect all of us in time.

Also, consider the AR or advanced screen technologies which may make television or computer screens redundant. Again, if I can make calls simply by ordering Alexa from my couch, why do I need the smartphone? Alexa or Siri could be simply all I need to be connected to for everything, with a virtual screen popping up wherever I am.

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[9] Newman, Daniel. Futurum. October, 2016. *How AI, IoT, and Smart Machines Will Create Smarter Buildings.* Source: **https://futurumresearch.com/how-ai-iot-and-smart-machines-will-create-smarter-buildings/.**

AI applications in homes will mostly help residents with two things: **information or goods/service exchanges,** and **remote control of various appliances or systems.** The same objective would also be achieved by wearables such as AR-enabled glasses. However, while these are currently based on sensing our presence, inputs on screens, voice commands, or hand gestures, we will soon aim to connect our brains directly to computers. Once this happens, we will have reached perhaps the final stages of our world's digitization. The only next step then would be the one we discussed around AI at work - digitization of our bodies where cyborgs will evolve the human species. And that is when machines will finally have the power of displaying real human emotion, and understanding beliefs with human and machine interface augmentation. Consciousness, then, could certainly be achievable by this new species.

The global neuromodulation market is expected to reach $11 billion by 2022, growing at 13.1%[10]. Imagine that every person in the world has synthetic chips in brains that understand everything we know and can mutually choose to connect to other brains we trust to tap into their knowledge bases. Think brain indexing where the information is searched and displaying in your eye glasses. The **Global Human Augmentation Market** is expected to reach a market value of US$ 3 billion by 2023 at 30% CAGR.[11] Wearables are the dominating category here, closely followed by in-built augmentation. Even greater than these, though, is the prevalence of digital assistance, popular among the young. It is time to look at some familiar and not-so-familiar examples of how AI pervades our life.

10.4: The AI innovations

Sophia will go down in history as the first robot to be granted citizenship. Saudi Arabia is to thank for this courtesy.[12] She may be the closest example that we have to a self-sufficient conversationally intelligence machine. Samantha, though, may be closer in other ways. A robotic doll designed for intimacy and released by the Spanish company **Synthea Amatus**, it requires romantic interest in her mate before agreeing to coitus.[13]

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[10] Pai. Siddharth. LiveMint. *The Making of Cyborgs and The Challenges Ahead.* August 2019, Source: **https://www.livemint.com/opinion/columns/opinion-the-making-of-cyborgs-and-the-challenges-ahead-1565025448727.html.**

[11] Market Watch. *Human Augmentation Market reach of USD 3 billion by 2023, Analysis by Industry Size, Share, Revenue Growth.* May 2, 2020. Source: **https://www.marketwatch.com/press-release/human-augmentation-market-reach-of-usd-3-billion-by-2023analysis-by-industry-size-share-revenue-growth-2020-05-02**

[12] The Jakarta Post. October, 2017. *Meet Sophia: The first robot declared a citizen by Saudi Arabia.* Source: **https://www.youtube.com/watch?v=E8Ox6H64yu8&app=desktop. Last Accessed: January 2, 2018.**

[13] Soh, Debra. The Globe and Mail. July, 2017. *The sex robots are coming. Do not fear them.* Source: **https://www.theglobeandmail.com/opinion/the-sex-robots-are-coming-do-not-fear-them/article35698109/.**

Earlier in this chapter, we discussed religion and the big questions that surround one involving AI. For starters, we now have something like **The Way of the Future,** a newly incorporated American religion that worships AI as the Godhead. It was founded by Anthony Levandowski in 2015 to promote the AI Godhead towards the betterment of society.[14] It's an interesting choice of word for a higher power, as Elon Musk seems to be preparing to turn us into one with the earlier discussed **Neuralink** bridge between our brain and a computer. This Cyborgial step is facilitated by Neubionix which intends to create a platform that powers neuromodulation devices to help restore eyesight, spinal cord injuries, or brain functions.[15]

Such advanced amalgamation of man and machine is rare and not mainstream. What we do have, though, are a range of tools to guide our everyday lives. For instance, a patent approved in 2016 could allow Google to determine and forecast up-to-the-minute weather conditions at micro-locations.[16] **Lucid**, a cloud-based building management service provider, runs connected cities with **Clinton Global Initiative (CGI)** and aims to help 100 US cities update their municipal buildings to include smart technology.[17]

PiQ caters instead to combat sports by having developed an AI-powered wearable for boxing with Everlast, using **Global Artificial Intelligence Accelerator (GAIA)** intelligence to track and analyze microscopic movements to help maximize the efficiency of workouts and training. Even more relevant to our personal interest would be the AI-powered connected sneakers from **Boltt Sports Technologies** which attempt to include fitness trackers and stride sensors connected via Bluetooth with the company's app.[18]

We spoke about the ease with which we can shop and be served products of our choice, thanks to predictive technology and omni-channel connectivity that manufacturers and retailers now allow. Let's move indoors to our smart homes. Kitchens are seeing a flood of enablers, thanks to their appliance-heavy environment. Samsung is bringing to us smart fridges such as **The Family Hub 2.0** equipped with 21.5-inch LED touchscreen which allows family members to post messages, share photos and

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[14] Brean, Joseph. National Post. November, 2017. *All hail the Godbot: In Silicon Valley artificial intelligence isn't just king, it's literally a new religion.* Source: **http://nationalpost.com/news/world/all-hail-the-godbot-in-silicon-valley-artificial-intelligence-isnt-just-king-its-literally-a-new-religion**.

[15] Pai. Siddharth. LiveMint. *The Making of Cyborgs and The Challenges Ahead.* August 2019, Source: **https://www.livemint.com/opinion/columns/opinion-the-making-of-cyborgs-and-the-challenges-ahead-1565025448727.html.**

[16] CB Insights. September, 2017. *Looks Like Rain: Google Patent Aims To Create 'Micro-Location' Weather Mapping.* Source: **https://www.cbinsights.com/research/google-weather-prediction-patent/**.

[17] Newman, Daniel. Futurum. October, 2016. *How AI, IoT, and Smart Machines Will Create Smarter Buildings.* Source: **https://futurumresearch.com/how-ai-iot-and-smart-machines-will-create-smarter-buildings/**.

[18] Sennaar, Kumba. Tech Emergence. *Artificial Intelligence in Sports – Current and Future Applications.* August, 2017. Source: **https://www.techemergence.com/artificial-intelligence-in-sports/**.

look at shared calendars while the internal cameras allow them to look inside. Users can also use voice commands to check weather, time, prepare grocery lists, or order products online.[19]

Logameal can evaluate a meal's nutritional value, while **Chefling** would suggest recipes based on the contents of our pantry. **Hello Egg** can tailor meals to our tastes, dietary restrictions and calorie considerations, including drawing up a grocery list to submit to the market for pickup or delivery. **Smarty Pan** would keep track of the frying temperatures and calories, while **Moley** can make a range of gourmet meals (and learn more!). **IntelligentX**, meanwhile, helps bring us closer to commercial cooking. It is a smart beer brewed by Automated Brewing Intelligence which develops recipes based on algorithms generated with the help of feedback from beer lovers who can ping these via Facebook.[20]

Kuri, a robot by Mayfield Robotics, uses speakers, microphones, cameras, and sensors to intelligently move about the house, recognize family members, or play music. It can thus greet residents or notify parents stuck in traffic when the children come back home. **LG Hub Robot** does not move but as a central point of control, it can also recognize family members and greet them while doing everything else that Echo offers, thanks to Amazon Alexa on board. **Emotech Olly** robot has a similar prerogative of ensuring enjoyable communication with the owners. **Aristotle by Mattel**, meanwhile, helps to recognize the somewhat difficult pronunciation of children.[21]

Most of these *robots* can do all the basic tasks of playing music, controlling light for us, or acting as an alarm. This is how common and basic these tasks have become in terms of automation, thanks to the likes of Google Home and Amazon Echo. Speaking of making the lives of children easier, digital assistants can easily be ordered about by children too. Anki's **Cozmo**[22] is a bot built to perceive its environment and relationships. As kids play with this tiny bot, it can get excited, scared, nervous, happy, sad, or frustrated. Animators from Pixar and DreamWorks have provided the bot with 1,200 little movements to express these emotions the way you'd see cartoon characters express them in their movies. The objective is to create a deeper emotional connection and stimulation for the kids playing with this toy.

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[19] Burgess, Matt. Wired. February, 2017. *You can now talk to your Samsung fridge.* Source: **http://www.wired.co.uk/article/samsung-family-hub-2-smart-fridge**

[20] Whitehead, Ralph. The Globe and Mail. June, 2017. *Artificial Intelligence Brings a New Look to the Fashion World.* Source: **https://www.theglobeandmail.com/life/fashion-and-beauty/artificial-intelligence-brings-a-new-look-to-the-fashionworld/article35204132/**.

[21] Edwards, Luke. Mirror. *Best 'smart home' robots of CES 2017 - including LG's Hub Robot, Kuri, Olly and Aristotle*. January, 2017. Source: **http://www.mirror.co.uk/tech/best-smart-home-robots-ces-9567893**.

[22] Anki. *Cozmo*. Source: **https://anki.com/en-ca/cozmo.html**.

UBTECH robots have even more advanced humanoid like robots in their premium series[23] that, in addition to sensing the environments, can also walk, dance or do yoga. The bots can also educate children with, say, coding lessons. UBTECH's Lynx connects with Alexa to make the home truly smart and for accurate speech detection to learn our moods so it can cheer us up when needed.

Smart homes can know who and where you are, and it will use this information to accommodate and even anticipate your needs. But, let's not limit our thinking to *smart homes* on Earth, as leading companies like **Orion, Axiom Space,** and **Bigelow Aerospace**, are already designing and planning to launch commercial space stations to the Earth orbit in the next few years to meet anticipated demand from space tourists, national governments, researchers, and private industry. Other private players like **Virgin Galactic** and **Blue Origin** are already developing vehicles to take paying customers to and from suborbital space and are scheduled to begin commercial operations soon.[24]

10.5: The AI vault

The future human is stronger, faster, less prone to injury, and more productive, thanks to robotics extending such attributes in humans.[25] The next generation is already receiving real-time information faster than any previous ones and this will accelerate. Consider engagement implications in basic home tasks: from pressing buttons on a television, to using remote control from our couch, to using a voice command from anywhere in the house to activate any intelligent device.

Will these children turn out to be less physically active, over-informed, over stimulated, never feeling disconnected and with limited time to simply be? We don't know the full impact of always being turned on, but with human attention spans down to less than 8 seconds, researchers are worried about the long-term implications of children being too connected to technology in their early cognitive development years as curiosity behaviors require empty space to day dream.

The World Health Organization's 2018 guidelines recommended that young children (aged 2-5) should be exposed to one hour per day, or less, of screen time. However, the report also found that the vast majority of research examining the effects of the internet on the brain has been conducted in adults and so more research is needed to determine the benefits and drawbacks of usage of internet in young people.[26]

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[23] Ubtech. *Premium Robots*. Source: **https://www.ubtrobot.com/collections/premium-robots?ls=en**

[24] Wall, Mike. Space. *Luxury Space Hotel to Launch in 2021.* April 5, 2018. Source: **https://www.space.com/40207-space-hotel-launch-2021-aurora-station.html**.

[25] Herr, Hugh. Science. *Robotics for Human Augmentation.* Source: **https://www.sciencemag.org/journals/robotics/human-augmentation**.

[26] The Science Daily. *How the Internet May be Changing the Brain.* June 5, 2019. Source: **https://www.sciencedaily.com/releases/2019/06/190605100345.htm.**

It is important for children not to miss out on other crucial developmental activities such as social interaction and exercise. Parents and caregivers require *family-friendly* rules around both the time spent on personal devices and also the types of content they are engaged with.

More importantly, *how will our next generation respond to continuously engaging with an intelligence entity that is not human?* Cynthia Breazeal believes voice-operated assistants will help build their social skills, bringing tone and emotion back into our conversations, which will be hard to grasp in a world of text messages and tweets.[27]

Consider the religion formed by Mr. Levandowski. He is a man with a proven capability to predict and capitalize on the future and who has used his skills to take an initiative aimed for the betterment of society. *Which part of this line can we rationally deem unethical or unallowed?* Yet, the end result could be potentially dangerous as wars have been fought and misdeeds done in the name of religions that never intended any of those at the time of their formation. This is how innocent or well-intended things at times lead to harm. But then, there is also the opposite scenario where religions bring in the moral and discipline needed for a positive impact.

Lets' take sexual interests as a case. A Newfoundland and Labrador man went on trial for having ordered a child sex doll.[28] The problem is that sexual interest in children may be a biological phenomenon while a significant population fantasizes about being forced into sex against their will.[29] If such fetishes are innate and cannot be ignored, letting individuals satisfy them with robots instead of a real person may be a far better option. However, both non-consensual sex or one with minors are disagreeable to our moral standards. As robots will be given more rights, *will sex be allowed with a robot without its consent? Where will the boundaries of ethics lie in such a scenario?* In case of the Newfoundland offender, the judge found him – not guilty.

Unlike the public or corporate space that can be governed by clear rules, the world in our brain is a far more complex place to set proper guidelines. Many religions, kingdoms, and countries have tried and failed. Polygamy was ethical at one time, unethical at another. Extremes aside, many aspects of human beliefs change over time.

As we discussed in the chapter on AI in media and communications, an AI system-generated communication might force us to learn to surpass the mind games and look at our issues from a more unbiased point of view to decide what's right and

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[27] Metz, Rachel. MIT Technology Review. *Growing Up with Alexa.* August, 2017. Source: **https://www.technologyreview.com/s/608430/growing-up-with-alexa/**.

[28] CBC News. *Sex doll is child porn, but judge finds Kenneth Harrisson not guilty.* May 23, 2019. Source: **https://www.cbc.ca/news/canada/newfoundland-labrador/kenneth-harrisson-not-guilty-1.5146259**.

[29] Critelli, Joseph W; Bivona, Jenny M. PubMed.gov. *Women's Erotic Rape Fantasies: An Evaluation of Theory and Research.* January-March, 2008. Source: **https://pubmed.ncbi.nlm.nih.gov/18321031/**.

what's wrong, and exactly why it is so. But the path is tricky. In the case of Google Translate services, when the underlying AI was improved with neural networks, it managed to write its own language tailored specifically to the task of translating sentences.[30]

If two bots start to converse between themselves, as we are already encouraging our appliances to with IoT, *why does our fear of robots taking over not stop us?*

- The first reason is that when we speak of AI writing its own language, how far we can imagine the ensuing calamity is a matter of our choice of English words used and our corresponding interpretation.
- The second reason is our underlying need or desire for convenience. After all, we do continue to use fossil fuels despite being well aware of climate change and its impact on our environment, which is life threatening to future generations.

Our need and affinity for convenience and novelty is what made Victor Hugo *say no force* on Earth can stop an idea whose time has come. Facebook may have shut down its self-interacting bots, but it will not be the only example of its kind and not everyone will be shut down. Think of citizen Sophia, trained to converse in interviews and talk shows. We do not fully know where her responses are being generated from, be it pure algorithms or advanced situational deductions. But *at what point should we be concerned, if at all?*

Chatbots aside, even the basic version of Facebook in an AR can have its risks, as we are beginning to have less and less control over the kind of content we receive. In fact, glitches in the home automation systems can have serious repercussions. *What if the toaster is switched on automatically, lights switched off on their own, or the central locking system hacked to open up for an intruder?*

The preceding risks are external. Taking this a step further, what if those glitches or hacks are connected to our brains. In a world of Neuralink which could allow us to share our hopes, fears or anxieties without the use of written or spoken language, *how do we control who receives that information and how or when they use it?*[31]

When information flows over electromagnetic impulses through our brain, it may be difficult to distinguish self-generated thought from an externally induced one. We are now facing the reality of subliminal marketing augmentation between man and machine discourse and having to think of how human behavior can be influenced

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[30] Walker, James. Digital Journal. July, 2017. *Researchers shut down AI that invented its own language.* Source: **http://www.digitaljournal.com/tech-and-science/technology/a-step-closer-to-skynet-ai-invents-a-language-humans-can-t-read/article/498142?es_p=4627379.**

[31] Markou, Christopher. Daily Mail. May, 2017. *What could possibly go wrong... Experts reveal the dangers of Elon Musk's radical Neuralink brain interface.* Source: **http://www.dailymail.co.uk/sciencetech/article-4466498/Experts-reveal-dangers-Elon-Musk-s-Neuralink.html.**

by addressing the subconscious. AI will make this far easier but *are we ready for that world?*

What makes the brain linkage so dangerous is that when we come to the brain-mind interface, we simply do not know enough of how things work. This is what differentiates safe AI initiatives from dangerous ones. Most of what we discussed in this book subscribed to innovations and developments in domains where we knew how something worked originally, and how AI was bringing a change to it. It is when we venture into the unknown in using AI that we have a genuine cause for concern. This is when to slow down and tread carefully becomes important.

True, digital enhancements can help cure deformities and even give us enhanced capabilities. From an evolutionary standpoint, if we really have reached the pinnacle of what we can do - enough to scare us that machines would surpass us - the next stage may very well be our own enhancement with the use of these machines. In such a scenario, in a world faced with hunger, poverty and poor health, a race of Cyborgs which are quite simply, humans equipped with tools may help make us better people. We already started this process the day we started to wear glasses or contact lenses for improved vision, or use crutches to be able to walk.

AI will have a similar beneficial impact on our society too. For instance, in the US, where buildings are responsible for 42% of electrical energy consumption, smart buildings can help optimize energy usage and reduce wastage.[32]

The role of AI in our everyday life is apparent in terms of connectivity and automation. Questions arise when it starts to get even more personal by physically becoming a part of us as our co-dependency increases.

For instance, a NY Times article by Cade Metz stated that a service Google built could recognize spoken words far more accurately. However, according to Jeff Dean, one of the company's prominent engineers, if the world's more than one billion phones that operate on Google's Android software used the new service just three minutes a day, Google would have to double its data center capacity in order to support it. Such restrictions have forced tech companies to get creative, and they are responding by drawing inspiration from nature. Their approach to an all-empowered computing system is to build machines like *a human brain, where a central stem oversees the central nervous system and offloads particular tasks to the surrounding cortex.* This approach is necessary as there is a limit to how far and how fast transistors on a chip can be enhanced. It has also led companies to explore new chip materials and design techniques, in the face of rising applications that would be needing them.[33]

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[32] Newman, Daniel. Futurum. October, 2016. *How AI, IoT, and Smart Machines Will Create Smarter Buildings.* Source: **https://futurumresearch.com/how-ai-iot-and-smart-machines-will-create-smarter-buildings/.**

[33] Metz, Cade. The New York Times. *Chips Off the Old Block: Computers Are Taking Design Cues From Human Brains.* September 16, 2017. Source: **https://www.nytimes.com/2017/09/16/technology/chips-off-the-old-block-computers-are-taking-design-cues-from-human-brains.html.**

In the near term, the impact of AI in our everyday life is simple. It involves being tracked by interlinked systems and getting automation convenience in return. Why have a smart watch or Fitbit to monitor the steps, *when our shoes could track our every movement and be connected to Wi-Fi and logistical tracking intelligence?* The stairs, floors, roads, and sidewalks too could, in time, have sensors and be connected. As man and machine increase their constant meshing evolution, we must acknowledge just how strongly and seriously we have recognized and acted to address the issue imposed by ongoing AI usage where the primary risk is in breach of our privacy and misuse of personal information.

We discussed earlier also about Samsung's smart fridges. To enable their increased functionality, Samsung is using **Spotify, iHeartRadio, LiDL, Glympse,** and others – all in one.[34] This is a classic enabler strategy being pursued by Amazon Alexa and Google Home. The trick to addressing the AI at home and beyond market is for service providers to partner with existing providers and work together to find creative ways to either bring their offerings to customers or leverage the information being generated to enhance user experience and relevance of their product(s) or service(s).

Of course, when we speak of computers doing everything, the same holds true for evil things too. Evil, such as malware. We can reasonably expect AI to empower malwares to run its destructive course and hold the fort on its own too. Derek Manky, global security strategist, Fortinet, expects the new generation of malware to be situationally aware [35] in order to take contextual decisions in changing scenarios. This would make for very carefully thought out and adaptive attacks, including ones across platforms. In such a large population of educated, ethical and risk averse humans, corrective action is as inevitable as *the idea whose time has come.*

10.6: Conclusion

If the objective of all AI-powered apps is to increase our convenience, it is clear by now that this will only be best achieved by connecting different tools working for us. That is what it takes to build a smart home or building. As businesses are starting to realize this, their AI density strategy is all about bringing their services together with strategic partners to enable smarter market reaches. AI is teaching us to think of collaboration instead of competition.

Regulatory bodies are also ensuring that AI modernization is done within certain boundaries, as global AI ethical frameworks and guidelines are rapidly coming

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[34] Burgess, Matt. Wired. February, 2017. *You can now talk to your Samsung fridge.* Source: **http://www.wired.co.uk/article/samsung-family-hub-2-smart-fridge**.

[35] Barth, Bradley. SC Media. *The Dark Side of AI.* February 17 2017. Source: **https://www.scmagazine.com/the-dark-side-of-ai/article/638867/**.

together. Enforcing them will require even more interventions in modernizing procurement purchasing practices to ensure responsible AI is governed. For higher risk data sets, external audits will go mainstream, and we will start to see ethics for AI become a board level skill augmenting leadership teams and requiring new board director roles.

Civic groups or concerned citizens are already ensuring that boundaries are created where they don't exist. Social media is allowing each one of us to let them all know where these boundaries should exist in the first place. Perhaps for the first time in recent history, society is starting to act as a united organism with every stakeholder, every entity in the ecosystem playing a role in shaping up our future wellbeing.

Yes, it is easy to see things that are going wrong, but that is precisely why precautionary actions are so widespread. It is our in-built control mechanism as we learn why all legends of old have talked about the benefits of working together. Businesses are learning this fast, and it is that change that underlies the speed with which technological adoption is growing.

To come back to our earlier question, with Alexa or Google Home, young children would be growing up with a digital butler they can order to play their favorite song or ask questions popped up by their inquisitive minds. *How would the mindset come to differ?* Will our future world be a robot tucking our children in and reading a bedtime story activated by a child's wishes (voice activated) or will the story simply start based on the mood the child is in. This world will be much richer with sensory insights. However, *will a loving robot's cuddle have the same depth of touch as a mother or a father? Will we increase our resilience as humans to learn and feel loved or reduce our sense of touch and simply evolve and become closer to a machine ourselves?*

The answer depends on *whether we are comfortable with this world for our future generations?* This is a bigger and more complex philosophical question. It also addresses the most pertinent question of this book: Whether we create a perfect world or a perfect storm will depend on what those terms mean to each of us.

Chapter 11
Getting AI Right

The technologies, with vast processing cloud infrastructures and an endless supply of data storage, have equalized access to AI, enabling it to be ubiquitous. The time is now for companies to capitalize on AI. AI could add $13 trillion to the global economy over the next decade. And yet, only 8% of firms are engaging in core practices that can support AI adoption.[1] Unplanned, disparate projects with AI are unlikely to be very effective. *What are these core practices?* Let us conclude by looking at how organizations and governments can start with AI, build momentum to advance it, and manage risks on the way.

Structure

In this chapter, we will discuss the following topics:

- Beginning an AI journey
- AI maturity assessment
- Advancing AI in the organization

[1] Fountaine, Tim; McGarthy, Brian; Saleh, Tamin. Harvard Business Review. *Building the AI Powered Organization*. July-August, 2019. Source: **https://hbr.org/2019/07/building-the-ai-powered-organization**.

- AI mandate in an organization
- Managing the risks of AI

Objective

After studying this chapter, you should be able to:

- Understand how to begin to get AI right in your company
- Assess the maturity of AI leadership governance and strategy in your organization
- Learn how to advance AI in the organization and society
- Appreciate the importance of agility and communication in this space
- Learn the risks of AI and how to manage them
- Discover why AI programs go off track

11.1: Where should you begin?

Taking the first step is always the hardest when we are uncertain. The Great Enlightenment Philosopher Voltaire said in the 16th Century, *"The first step, my son, which one makes in the world is the one on which depends the rest of our days".*[2] In the age of reason, uncertainty was cherished as a way to give strength to advance changes to modernize society and manifested in rich theatrical dialogues, musings, and scholarly writings. This view of having courage to take the first step forward was a major change platform of Martin Luther King, who understood the importance of change and eloquently said, *"Faith is taking the first step when you don't see the whole staircase."* [3]

- To take the first step with AI, every global leader, worker, or society member needs to appreciate that AI is not a trend that will dissipate or slow down. AI's reach is already diffusing into every global business model, operating practice, and societal context, although at different adoption curves. The type of growth we have seen throughout the book is testament to why leaders are no longer able to ignore it.
- The next step for a business leader is recognizing that AI and digital literacy are table stakes to stay in business, whether you are a profit or not-for-profit business. No organization can afford to not have a business strategy defining clearly how AI can add value to its products, services, or internal business practices responsibly.

[2] Goodreads. Source: **https://www.goodreads.com/quotes/236526-the-first-step-my-son-which-one-makes-in-the**.

[3] Quote Person. Source: **https://www.quoteperson.com/quoteid/939;jsessionid=52E80FDBAC90540B565270716F67AF5F**.

- AI is reshaping business and guiding decisions on everything from intelligent call centers detecting emotional purchasing intent, identifying pandemic risks like Covid-19, predicting weather patterns and monitoring crop harvests, verifying bank loan risks, taking over the controls of your car to drive you to the most optimal destination routes, identifying fraudulent bookkeeping anomalies, and guiding sales and marketing professionals to focus their sales cycles on better opportunities with higher odds of winning or simply controlling a drone to safely deliver your groceries.
- The third step is thinking about the knowledge base. AI initiatives often face rewiring the company's knowledge bases and often, companies lack the required skill sets needed to successfully make the big shift to cloud computing enablement's to achieve the economies of scale needed for crunching their database.

The Economist wrote shortly after the obvious consequences of the Covid-19 pandemic that the *infusion of data-enabled services into ever more aspects of life will accelerate.*[4] Digital transformation is now a bigger change imperative for all global organizations and a great deal of the enablement will be driven by cloud computing and AI innovations.

As discussed throughout this book, the global race for AI leadership dominance is well underway with the Giant Titans, USA, and China. China is gracefully positioned with its Imperial Dragon, known for its strength and superiority, continually sparring with the USA's symbolic Wall Street Charging Bull. While the USA is developing a unified federal government declaration for its AI advancement plans and calling on all USA agency leaders to embrace for massive change and to plan more rapidly, China has already mobilized end-to-end AI value chains, given their centralization communist powers, controlling governments, industries, and agencies. Other countries will have to make some very strategic decisions as to where they want the world's economic dominance to come from. The choices that we make over the next twenty years in regards to international ventures, technologies purchased, mergers and acquisitions, investments, and economic policies will determine the future world that our children will inherit.

Collaboration and striving for a more authentic and responsible world that appreciates our environment is fragile and recognizes technology innovations can do better than harm, but also fiercely protects what is unique about being a human, as a creative species also capable of doing better than harm. Human beings have a conscience and can distinguish easily between right and wrong. Humans are guided by ethics enabling emotional intelligence from behaviors demonstrating empathy, compassion, humility, charity, tolerance, and love. All of these traits presently

[4] The Economist. *The changes covid-19 is forcing on to business.* April 11, 2020. Source: **https://www.economist.com/briefing/2020/04/11/the-changes-covid-19-is-forcing-on-to-business**.

distinguish man from machines. The real question is *how long this divide will hold before man and machine blend into the best of both worlds where machines cross over to truly reflect creativity and emotional intelligence?* Key term here: the best of both worlds, not the worst.

Art has already evolved from the dystopian terminator to a more mature Westworld which explores the finer nuances of robots becoming self-aware and conscious and being able to create original. As historically evidenced, science is due to follow next.

11.2: AI maturity assessment

The SalesChoice AI Leadership Governance **and** Strategy Scorecard© (with permission for reproduction) is one of the foundational assessment tools that leaders can use to gauge the state of AI maturity in their organizations. We present here ten best practice questions for evaluating your leadership in AI governance and strategy practices, proven to advance organizational capabilities in AI maturity. As you go through these questions, answer each with a Yes or No/Unsure.

1. Do you have an AI governance operating model in your company?
2. Do you have a clearly defined AI strategy and roadmap in your company?
3. Do you currently train your board, C-level leaders, VP, Directors, Managers, and frontline on understanding the value of AI?
4. Do you have an ethics and privacy policy for AI in your company?
5. Does your AI governance and solutioning practices take into account the needs of all stakeholder groups to promote clear value outcomes, including a positive societal impact?
6. Do you have an AI ethics and security operating council?
7. Do you have the AI goals and objectives aligned with your stakeholder needs and are you monitoring them to a benchmark level of performance and desired outcomes?
8. Do you log all your AI algorithms in an AI inventory management system? (Do you know where your AI algorithms are located and can you understand how they are working for you or the value/ROI they are enabling?)
9. Do you have an AI security and ethics gap scorecard monitoring system that is audited at least annually by a trusted third party?
10. Do you have a robust change management process to support your AI strategy (that is, stakeholder alignment, communication, training, leadership development, key performance scorecards, and so on?)

Analyzing your score:

- **World class:** If you answered 9-10 of the questions with a Yes.
- **Mature:** If you answered 7-8 of the questions with a Yes.
- **Experimentation:** If you answered 5-6 of the questions with a Yes.
- **Emergent:** If you answered 3-4 of the questions with a Yes.
- **Laggard:** If you answered 1-2 of the questions with a Yes.

While these questions offer a generic standard, you can visit **https://www.saleschoice.com** to request additional frameworks for balanced scorecard AI constructs, frameworks for **Machine Learning Operations (MLOps),** or process end-to-end AI enablement's and functional scorecards for diverse leadership roles, including Board Directors, CEOs, CFO's, CIOs, CHRO's, and **Chief Legal Officers (CLOs)** and Chief Data Scientist or Chief AI Officer roles.

11.3: How do you advance AI in the organization?

Companies looking for a short-term ROI of AI are viewing AI as a plug-and-play technology investment. The reality is that AI is a long game, as AI models must be carefully architected, validated and require continual maintenance and feeding over time. It's almost like AI is a young child in its early modelling days and in order to reach full adulthood and achieve statistically valid and accurate levels, patience is needed to ensure rigor and validation.

Moving from pilot AI programs to sustaining companywide production programs requires strategic leadership to focus on bigger challenges like optimizing supply chain dynamics using AI, or modernizing an entire customer journey end-to-end, bringing together a unified vision for all sales, marketing and customer service operations.

Ensuring the right talent is in place such as recruiting for a **Chief Artificial Intelligence Officer (CAIO)** or a Chief Data Science Officer, who has sufficient knowledge and expertise to align a company's culture, operating structure (technology and business processes) and knowhow to set up an effective AI adoption and governance process. The objective is to ensure that a digital mindset is established. Unfortunately, most companies are still operating in silos and lack skills in horizontal workflows and designing collaborative operating practices, where data and knowledge flows easily in all directions, and everyone rallies around what's really important, thus ensuring the customer's needs are being met.

AI cannot function without diverse skills and competencies. AI operations must have a mix of views. Diversity in gender, culture, and so on will allow business and operational people to see beyond the current state, find gaps and be more curious to

address organizational strategic priorities versus being trapped in narrow business functional issues. Creating a transparent mindset to think and operate is key to ensure AI adoption can be successfully achieved.

11.3.1: Practicing agile as a learning organization

AI programs are highly exploratory as data has a lineage and must be ready for AI discovery methods. Ensuring the right data can be easily sourced and is cleansed for accuracy and relevance often takes up 80 percent of the time in an AI project. Hence, organizations must take a minimal viable approach to AI projects versus having a fully developed production environment. With AI, the job is never over.

It's a long-term commitment, so demonstrating value every one to two months to build continued support requires a rigorous communication approach and sustaining executive sponsorship. Having an agile learning mindset is the right leadership perspective to have. As confidence builds in AI program delivery, AI teams will be able to produce agile insights in days or weeks versus in months. But it's key that executive leadership teams understand AI is only as good as the data you feed it. If you feed it incomplete or biased data sets, AI will only learn from the errors it is chomping on. The ideal scenario is consuming a cleansed, and highly representative data set that has automatic replenishments to constantly feed its ever-ending sensation for more data. Easier said than done.

However, to achieve this type of mental agility, leaders must be carefully educated about what AI is, what the business problems best suited for AI are and what the approaches/methods of AI most relevant to the business problems they want answered are. If leaders are not prepared with new knowledge on AI, they cannot lead successfully and they will make assumptions that classify AI to other technology projects and look for an ROI in months. Patience is crucial to win at the long game.

11.3.2: Communicating relevance for securing confidence and success

Every modernization journey needs a compelling story with reasons answering the why question and the value question. Humans always fear change. So, it is important that AI projects communicate what's in it for the employee(s) and define clearly the value and benefits to the organization. Understanding what the market and competitors are also doing is most helpful so that employees have more appreciation of what other market players are doing to reduce their resistance to fundamental changes. Understanding and learning is foundational. Not underestimating the value of communication is key to ensure organizations have a successful AI journey.

With so much negative press about jobs being taken away from AI, organizations must be honest. If robots are replacing laborers in manufacturing plants, find new roles, if feasible, to extend the value of your workforce. Train them to be robotic maintenance engineers, or invest in them to take on new roles in your call centers, or invest in their education so they can find future work. Leaders have the responsibility to be honest to their workforces about the impact AI or Robotics will have on their current roles as AI programs are executed upon.

Leaders will want to establish a compelling vision that motivates their employees to rally around and establish relevant goals and objectives into their everyday work context. Workers must understand why AI is important to the business and how they'll fit into the new AI context. Having clarity whether AI will augment or enhance or diminish jobs / roles is key to the leadership integrity of an organizational culture.

Let's look at a real-life inspired situation where employees rejected the insights that AI was providing to predict customer churn and account risks. The following example highlights what can happen due to poorly planned communication impacting the success of a major AI program.

Imagine a global transportation and logistics provider that was launching a new AI-driven customer-retention program in its call center, using intelligent AI bot agents to answer customer questions that were highly repetitive. These equate to millions of dollars in investments. The company deployed the program without sufficient communication to the call center workers who were unionized. As a result, internal discontent accelerated with fears that the intelligent agents were taking away jobs. The truth, in fact, was that the call center resources could now handle more complex and critical customer challenges while the highly repetitive inquiries were being handled by robotic automation techniques. The company did not help the centers employees' transition to the new approach. So, there was delay and employee discontent that could have been avoided if thoughtful change management communication practices had been invested in as part of the ongoing modernization journey.

Companies that are doing this well are ensuring their employees are well informed and educated. For instance, instead of just reacting to calls cancelling service, they can be more valuable and, say, proactively reach out to customers at risk of defection, giving them AI-generated recommendations on new offers that customers are more likely to accept.

11.3.3: Securing early wins to build support momentum

AI programs require long term horizons outlooks but short-term value demonstrations. The latter implies communicating early results with tangible

benefits, quantitative and qualitative, to support AI initiatives. Successful organizations build a portfolio of AI initiatives with different time horizons and use a consistent value framework, so projects can be classified and demonstrate returns monthly or quarterly. It is not uncommon for an AI program to have a three to five-year horizon outlook, especially in more complex business operations.

As Franklin D. Roosevelt had alluded to in his rallying cry to revise the US economy from the *great depression*, the first step is to overcome a dystopian, a fear-driven mindset. Being able to avoid fear means ensuring you set up an organizational change journey that places value in employee frontline engagement to experiment with AI to learn rather than waiting for every perfect governance structure to be in place. Developing agile proof of concepts using AI for discovery can help reduce fear and build positive change momentum to move an organization forward.

A large global bank allowed some of its workforce to develop and deploy a digital tool kit that used a combination of AI techniques. It allowed the employees to automate most of the tasks for the bank – both simple and complex - resulting in a significant productivity rise. Insurance is another area where actuaries and data scientists have joined hands to build predictive models that help improve a range of tasks from underwriting to pricing the plans to managing risk. These types of initiatives capitalize on the insights that empower front line employees to do more with advanced data and analytics and develop an AI value appreciation, avoiding change management disasters which can easily happen without thoughtful communication and engagement approaches.

11.4: Who should AI report to in an organization?

Based on our research, and involvement in the field of AI value realization over the past decade, it is clear that AI transformations can fall into diverse reporting structures. We will illustrate a few examples to show the variance in different enterprises. As organizational design models are still evolving in this field, many companies are still experimenting and leadership of AI is often taken up by line professionals that are leading in major digitization initiatives. A few examples are as follows:

- In Canada Post, Canada's largest postal service, employing over 64,000 employees, and founded in 1867, advanced analytics and AI data scientists report into a Director of Advanced Analytics who reports to the VP of strategy and not to the IT/CIO function. With hundreds of thousands of shipments daily being able to predict most optimal routes to reduce operating expenses, AI can amass all their operational data and enable Canada Post scientists to increasingly take on complex data problems.

- In a large North American Bank, Toronto Dominion, they have a Chief AI Officer who reports not to the CIO Officer, but rather to an Operational Officer where the AI Officer is a peer of the CIO. This bank acquired an **AI Advanced Analytics** firm called **Layer 6**[5] to accelerate advancing AI overlays into solving different use cases, ranging from customer intelligence purchasing patterns to predicting risks in different banking portfolios, and improving fraud and cybersecurity insights.
- At another N. American logistics and courier company, **Purolator**, their advanced analytics and AI team report directly into their **Chief Information Officer (CIO).** They have centralized all analytic and information reporting. In addition, AI approaches are being led by diverse line executives solving different use cases in marketing, sales and revenue operations. Interestingly, Purolator is 91% owned by Canada Post.[6]

In other companies, increasingly, advanced analytics functions are reporting into Chief Financial Officer roles. As per a PwC study,[7] a majority of finance leaders believe that CFO's are ideal to lead digitization, given their access across business units and the ability to therefore help leaders in those units understand the impact of applying analytics on data throughout the enterprise.

We would have to say that AI organizational design approaches are still in the gray area, in terms of a clear owner role. AI projects, after all, carry multiple facets: collecting the data set to solve the use case, selecting of the methods (the algorithms), designing the approach, testing the model, setting up the enablements so users can do the sense making of the predictive models, or guiding insights into user interface experiences that can not only be easily visualized but also be easily understood to help move humans to action.

Although organizational structure will vary, what all of these organizations have in common is that they are investing heavily into cloud operating infrastructures, MLOps software, and upgrading skills and talent to modernize operations.

In summary, deciding where responsibility should lie within an organization is not an exact science, but it should be influenced by the following three factors:

1. Where is the organization in terms of its AI maturity and capabilities?

   In an early stage of AI journey management, it will make more sense to have the players involved in AI projects to come together in a hub and spoke structure to ensure knowledge can be easily accessed and everyone can

[5] Ligaya, Armina. The Globe and Mail. *TD acquires Toronto-based AI startup Layer 6*. January 9, 2018. Source: **https://www.theglobeandmail.com/report-on-business/td-acquires-toronto-based-ai-startup-layer-6/article37537469/**.

[6] Purolator. *Purolator Facts & History.* Source: **https://www.purolator.com/en/purolator-facts-history**.

[7] PWC. *How AI will transform the CFO's role.* 2019. Source: **https://www.pwc.com/gx/en/issues/artificial-intelligence/how-ai-will-transform-the-cfos-role-2019.pdf**.

learn together. This means, advanced analytic or BI leaders, data scientists, data engineers, visualization specialists, and so on can benefit from working together to help establish the company's core AI assets and capabilities such as common analytics tools, data processes, and delivery methodologies. As time passes line of business will build their own AI expertise with data scientists specializing in process domain areas. So, organizations will need to think first about the use case or problem they want to solve, determine where the skills are that they need to solve the problem, and evaluate their own maturity in using AI to really advance efficiently.

2. What is the governance structure that is appropriate for the level of maturity of the organization?

   We established earlier that the distribution of AI and advanced analytics responsibilities will more often than not vary from one organization to the next. Based on our experiences designing and building AI enablement's, having a clearly defined governing coalition of business, IT and analytics leaders are key to ensuring AI can be fully realized in a long-term journey. This group can report to diverse stakeholders, whether it's a CFO, CIO, Chief Analytics Officer, Chief Customer Officer, or in some organizations, a Chief AI Officer.

3. What is the educational foundation (knowledge, skills, competencies, track record) of AI in the organization?

   The C-suite or middle management, despite being the decision maker and investor in AI, cannot possibly lead the way responsibly without being educated in this field. And no AI investment can maximize its ROI without the employees – the end users – understanding the technology too. Whether you invest in formal certifications (online or in person), educational workshops, or peer visits, your ability to evolve will be marginalized without a focused program on what AI is, the methods that can be used to solve different use cases, having clearly defined machine learning operating methods to manage risk, and putting in the right Key Performance Indicators (KPIs) to support your AI journey forward.

11.5: What are the risks of an AI program?

AI programs carry big investments, and they can vary from thousands of dollars to millions, and in some cases even billions. Despite this, according to a recent **International Data Corporation (IDC)** survey, only about 30 percent of companies reported a 90 percent success rate for AI projects. Most reported failure rates of 10 to 49 percent, while 3 percent said that more than half of their AI projects failed.[8]

[8] Korolov, Maria. *CIO Blog : 6 Reasons why AI projects Fail.* August 6th, 2019. Source: **https://www.cio.com/article/3429177/6-reasons-why-ai-projects-fail.html#:~:text=According%20to%20a%20recent%20IDC,of%20their%20AI%20projects%20failed.**

Despite big investments, many organizations get disappointing results from their AI and analytics efforts. The lack of best practices that we discussed in the previous section are largely to blame. Let us dive into the why AI programs go off track.

Based on what we have learned in designing, developing, and deploying diverse AI programs in different organizations, and from our global research in recent years, here are some common pitfalls.

- Driving a technology led approach rather than a human centered design approach. This implies not clearly defining what the problem is that you want to solve, and validating that the problem is worth solving with AI is key for success. Looking at the problem from different stakeholder views is critical as AI cannot only appeal to one functional VP line as data sets to solve AI problems will have to come more often than not from diverse stakeholder areas to solve a problem efficiently. AI use cases should have the support of the executive leadership team as a problem worthy of solving. In other words, choose your entry points wisely and ensure that the problem will have value.
- The lack of access to quality and complete data and validation of the methods and approaches before tackling the challenge at hand and understanding the diverse skills needed to tackle an AI program. Organizations can easily lack a clear understanding of advanced analytics, staff up with expensive data scientists, engineers, and other key players without realizing how advanced and traditional analytics differ. AI requires a diverse set of skills, to create a strong AI program. Having AI value translators or experts who bridge the business and analytics teams by explaining the value of the insights so that business users can buy-in and understand is critical. You can have all the AI insights and findings but if business users do not understand the value or can put the insights into executable decision making, then the value of AI is lost.
- Not having a risk management framework to evaluate the potentials risks or harm that could arise from AI in the use cases being planned for. When selecting candidate models for AI deployments, risk and impact assessments can assist in identifying and understanding the expected and worst-case implications, and inform the risk mitigation processes. It is critical to document the risk impacts and have audit trails for both internal and external accountability.
- Organizations may launch AI pilots but do not understand that AI has to have a long horizon view versus expecting results immediately. It is not to say that you shouldn't strive to find short term insights and gains to build a healthy change momentum of supportive stakeholders; rather, it is to say AI can take you into empty corridors of research that can have absolutely no insight. So, you need to appreciate sometimes that there is no good answer.

Lack of insights, in fact, is also an answer than allows you to continue your discovery. So, it is important be patient in understanding the risks of not securing a valuable outcome or research finding, especially in very large complex data sets.

Note: An AI project on average can take 12-24 months to fully demonstrate value in larger organizations.

- Organizations in early days of experimenting with AI often isolate advanced analytics from the business users, rigidly centralizing it or locking it in poorly coordinated silos, rather than organizing it in ways that allow analytics and business experts to work closely together. No AI program should be initiated or funded without cross functional representation.
- Trying to drive too much enterprise central data consolidation and clean up without driving business lines to clean up their own data lineage and process documentation. Centralizing data is one thing, understanding what each data field means and which process it feeds is another. Data must be positioned as a strategic asset. Leaders can squander time and money on enterprise wide data cleaning instead of aligning data consolidation and clean-up with their most valuable use cases.
- IT professionals can fully build out analytics platforms before identifying business cases, setting up architectures like data lakes without knowing what they'll be needed for and often integrating platforms with legacy systems unnecessarily. This can drive incredible costs and still have big data issues as data lineage and data dictionaries have not been modernized at the same rate.
- Not putting in place a value realization, or performance management tracking framework for each AI program or project initiative to easily quantify the bottom-line impact of analytics, with clear metrics for tracking each initiative.
- Failing to focus on ethical, privacy, regulatory and social implications, thereby increasing risks to data bias, algorithmic method bias, social or legal consequences. Having a robust ethical AI set of operating principles is a key to being successful in AI. Companies like Google, IBM, The USA Department of National Defense, or the European Economic Union all have excellent frameworks that can guide to build responsible AI practices.
- Not understanding responsible AI requires traceability. Traceability relates to ensuring that you understand how AI models make decisions or provide suggestions. Areas to consider are building an audit trail that documents the decision making process; implementing a data stream capture process to ensure there is no degradation or alterations in the data stream to ensure

you know the data set lineage end to end; clearing access to the AI algorithm to ensure that it is not biased and that it fosters trust; having the expertise to audit, understand the algorithms and rules or models; and being ready for external auditors to review your AI practices. These points constitute a smart mindset to have in building your AI and machine learning operating practices.

- Failing to continually fine tune your AI models. AI models once developed need to be periodically updated. New data may be required to improve the model over time, or tuning if the models display any instability, especially when applied in dynamic environments. Once an AI model is developed, it will require ongoing fine tuning. So, preparing for this overhead is a key requirement for successful AI programs.
- Failing to provide incentives for a change. When you decide you are going to develop an AI transformation program, your CEO needs to inspire the vision to help make the company's AI program a success. AI is no different than other major modernization technology programs like IoT or Blockchain, or introducing **Robotic Process Automation (RPA)** into the workplace. Humans need the motivation to change. Recognition programs should be fueled with clear direction of the strategic importance that AI will have in modernizing the organization, retaining talent and creating new ways of working. More importantly, there should be clarity on how employees shaping AI solutions can build highly marketable skills for their future roles.

11.6: Conclusion

The actions that promote scale in AI create new energy to propel an organization forward. Leadership needs to set the tone from the get go.

If publicly traded, Board Directors need to be in the game asking the hard questions of CEOs and their respective leadership teams to understand if their strategy is truly sound. Ensuring continued organization design modernization from working in functional silos, to ensuring collaborative teams that are empowered to make change a reality and are skilled in agile and appreciate inquiry communication methods can all drive the workers' ability to absorb new ways of working faster and be ambassadors of those new ways.

Being involved helps employees to think bigger, imagine bigger, and speed up innovation. Flattening organizational hierarchies and building diverse workforces will strengthen the ability to modernize our industries with AI. AI, as we have outlined throughout this book, can be used to augment decision making and help us develop new applications, products, and services. It will change operational workflows so that data can easily be harvested, create new roles and in some areas, and shift cultural perspectives. Every bit of these developments was becoming a

necessity to retain competitive advantage. In a post-pandemic era, every bit of these developments has become a necessity to survive.

Which industry leaders will advance to shepherd their organizations through the accelerating digital era where AI is table stakes? Companies that excel at implementing AI throughout their organizations will find themselves at a great advantage in a world where humans and machines will increasingly work together and outperform either humans or machines working in isolation of one another.

> *A perfect world is where man and machine bring forward their own uniqueness and operate with aligned values and emotional intelligence to sustain our world and our future generations.*
>
> *A perfect storm is where man and machine operate independently and compete with one another, without foreseeing the longer-term impact on humanity and our environment.*
>
> *You have a choice in setting your organization on a path of abundance or a path of scarcity. Which path you lead by in the AI world will have ripple effects for many years to come.*
>
> *Choose wisely!*
>
> ***Dr. Cindy Gordon and***
> ***Malay A. Upadhyay***

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