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CONNECTED SECRETS

THE BLUEPRINT FOR MASSIVELY IMPROVING YOUR BUSINESS AND SAVING MONEY WITH THE INTERNET OF THINGS

SIMON ROWELL

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The blueprint for massively improving your business and boosting revenues using connected IoT & 5G technology, otherwise known as the Internet of Things.

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Published November 2021

ISBN-13 - **979-8763807363**

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Preface

Everything written with respect to the Internet of Things (IoT) seems to be by and for techie types. When I was trying to find books specifically targeted at business owners, senior executives, and entrepreneurs, I couldn't find any written in a simple non-technical way. Everything was from an engineer's or IT consultant's perspective, not a business decision maker's perspective.

Indeed, it could be argued that one of the reasons this technology isn't as widespread as it should be is that the benefits and opportunities haven't been communicated in a simple, user-friendly way. Most IoT companies are founded by technologists and engineers, and talent in these specialisms doesn't always translate to the best marketing or communication with decision makers. Other IoT suppliers are big telco firms that sell hundreds of different types of connectivity products and solutions to different sorts of customers, without a key focus on connected IoT.

I'm not a technical person by any measure. I would probably call myself a problem solver, and I've worked with numerous companies and executives on how to strategically improve and grow the value of their business. The decision makers I meet might have heard of connected technology, smart technology, the Internet of Things, and machine-to-machine, but many are completely clueless as to what these could mean for them on a day-to-day basis.

Most critically, they don't know how it will make their business or organisation stronger and more valuable. They are not always sure how to communicate the benefits of connected IoT to shareholders and other stakeholders, so they often end up putting it on the back burner and delay doing anything. Unfortunately, this is something that stops many companies around the world embarking on digital transformation. In this book, to avoid

confusion, I'm going to refer to all the terms I've just mentioned as **connected IoT** technology.

I want this book to be different. It is truly focused on connected IoT, and how it can benefit companies and organisations in various sectors. I've tried to create a generalist and user-friendly book that tells you in practical terms how connected IoT can improve your business dramatically, and with only some very simple steps. This book is for the decision makers: CEOs, CFOs, COOs, senior executives, small business owners, entrepreneurs and consultants. An engineer will probably find this book way too simplistic - but that is exactly why I am writing it!

My first encounter with connected IoT close-up when I was working for a large European telco business. I quickly understood the opportunities this technology would produce for many organisations if they implemented it, but was frustrated by limited progress. I come from a family of telecommunications and IT people. After the Second World War, my grandfather was an engineer at the General Post Office (GPO), a forerunner to the BT Group, one of the UK's leading telecommunications companies.

During the war, my grandmother was a telephone exchange operator for the GPO: her job was to connect people to different phone lines by physically unplugging and plugging in phone lines at the telephone exchange. It's crazy to think now this was how people used to be connected to each other in order to make a phone call!

My father trained as an engineer and ended up running a large telecom and IT market research business selling demand and usage data, plus insights into how companies could use technology to make their businesses more valuable. Organisations would use this data and insights to understand what technology trends were happening and where they should look to be investing in future. It was a great way to understand where things were

heading and what innovations were out there that could be used within their own business. He then went on to help tech companies buy and sell other tech companies when things were exploding around the DotCom boom in the late 1990s.

I on the other hand did not train as an engineer, as my ancestors did, but have worked in the technology, telecommunications, and data sectors for most of my career. When I was working at the European telco, I spent much of my time trying to convince senior executives that we should be investing in new innovations like connected IoT and to take advantage of the opportunities that these technologies provided. Unfortunately, I wasn't able to convince many people at the time. I kept going on about how we should be looking at cutting edge innovations and pioneering start-ups. Sadly, I just got the sense that everyone was more interested in maintaining the status quo and not to do anything that would rock the boat. It was a real shame and probably made me quite unpopular. I felt like a fly buzzing on a desk – a fly everyone wanted to squat!

I saw that connected IoT was all about the valuable data that it produced, not the hardware sensors and connectivity networks being used. The data produced could be used to make critical decisions within organisations about how to improve the management of physical assets. Before I worked for the telco I had been in the data and information sectors and saw the value of data for companies and investors in having quick real-time information on what was going on. Those executives and investors could then make very quick decisions – decisions that would have a dramatic impact on the success or failure of their business or investments going forward. Imagine a Reuters or Bloomberg trading platform if you will.

In 2014-15, 'digital transformation' was one of those buzzwords that every company was talking about. But not many were doing anything about

it, and the same situation can be seen today in many areas. The telco business I worked in provided fibre network infrastructure, voice networking, data centres, and managed IT services, but internal decision-making was slow, and I couldn't convince the board to move into the exciting areas of machine learning and the Internet of Things. Deeply frustrated, I found myself in a situation where I had to either move on or go out on my own and do something for myself.

Previously I had worked in a startup and loved every day of it. I always wanted to replicate that experience somewhere else. With a very young family to look after, somehow the opportunity to join another start-up never materialised, but the burning desire to build another business was just too strong. It was time to get back to what I really wanted to do.

There were probably countless companies and organisations like the business I worked for: they didn't really understand how to apply new technologies and digital transformation to their business. Effectively you don't know what you don't know. If you were an engineer, you clearly understood, but translating that into senior stakeholder commitment was a tough gig. This was a massive opportunity – I could go into those businesses and show them how various technologies and strategies could increase their sales revenue growth, and also their profitability. I had worked with entrepreneurs before; I could show others how they could increase the valuation of their companies by using these new technologies and strategies effectively.

So I became a consultant – not one working for a large corporate management consultancy, but an independent, seat-of-your-pants consultant that actually had to go out and find my own customers if I wanted to pay the bills. It was hard – I had the knowledge of what companies could do and how they could improve, but not the credibility of having worked for a large

management consultancy such as McKinsey or Bain. I was an ex-data and telco guy that had to build some independent credibility. Slowly but surely, I started to get business. I became busy and was making good money on my own.

At the back of my mind, I also realised that it would be very hard to scale a business like this: I was a one-man band. I was thinking about this when the Covid pandemic hit. Literally overnight, my whole independent consulting business just dried up. It stopped dead in its tracks. Companies were just not interested in hiring independent consultants when they were trying to find ways to survive government-imposed lockdowns. They were working out how employees could work from home; any scope for strategic improvements was forgotten about.

When the pandemic hit, I knew this was going to be a long-term thing. I lay awake at night, thinking about what I was going to do, and how on earth I was going to provide for my family. It was at this low point that fate stepped in, and I was introduced to Leo.

Leo had been working in IoT and machine learning technologies for over a decade, and he had a number of ideas about how to develop advanced IoT solutions for companies around the world. He had already started a business called Findaa Technology, but with a 100% engineering background, he was struggling to find ways to grow and build it. This is quite typical in the connected IoT space - many companies are formed by fantastic developers and technical gurus, but they struggle to develop it in a way that translates to business solutions for new customers.

You could say the rest is history. Leo and I got together, and we have been building Findaa Technology ever since. We've had the support of various investors who have seen how we can really change the way businesses and organisations work. This book is a guide for both large and

small businesses to learn how they can use connected IoT and smart technology to really improve and become more productive.

Companies often struggle to see how digital transformation helps them tangibly and quickly, so that is the objective of this book. It doesn't matter if you're a small mom-and-pop shop in a quiet town, or a global corporate – in many ways, the problems a business faces can be very similar. What brings them together is that they are involved in trading or managing physical goods and items, and these processes can be made more efficient using connected IoT technology. This book will guide you, in a simple way, on how to be a success with these technologies. Let's go!

Introduction

There is an innovation problem at the heart of many organisations. That may sound controversial, but when I talk to prospects, I sometimes hear, 'Why bother to change?' and 'I don't really get the value anyway.' They don't seem to be thinking long term, just day to day. I see a 'If it's not broken, why fix it?' attitude.

But I'm here to suggest to you that it matters because some competitor will think it matters. They will innovate and eat your breakfast, lunch, and dinner in one go, and they'll do it by integrating new technologies and thinking of new ways to work and manage their business.

The world is littered with companies that have gone out of business because they just didn't care about innovation or competing well enough with their peers. Think of companies like Blockbuster, outmanoeuvred by Netflix, or Amazon, who have had a direct impact on nearly every single retail brand globally. Unfortunately, technology innovation is an unstoppable evolution that can move through a market with speed, impacting your business in ways you cannot imagine. Innovation is great for customers. They see, for example, better ease of use, quicker delivery times, and reduced prices. It is so much better to be ahead of the curve when it comes to technology and innovate, rather than to sit back with a 'wait and see' attitude.

So what's the big deal about the Internet of Things? I mean we're really just talking about a whole bunch of sensors that are attached to objects, that then send information via various connectivity networks back to the cloud, which is then displayed on a data analytics dashboard. Connected IoT is really that simple, but to many senior executives and business owners it may all sound like jargon. The important thing that's often overlooked by IoT

companies is in explaining the value to customers as clearly as possible. This to me has always been the problem with connected IoT. I mean, does Apple start talking about all the chips and firmware drivers in an iPhone to attract customers? No, of course they don't! They talk about the beautiful photos, the ability to watch your favourite TV show on a crystal clear screen, and the fact that all you could possibly require in life is on a small device in your pocket.

Let's start to describe connected IoT in the way Apple would. By having sensors attached to physical objects and sending information back, you are able to make some pretty key decisions, decisions that can have a large impact. For example, if you have real-time automated information on where all your assets and equipment are, then you would be able find things much quicker. If you could monitor the temperature of food stuffs, then you would know if they were about to go off and be wasted. If you could locate and monitor the temperature of Covid vaccines, then you would be able to distribute them much quicker to communities across the globe. If you knew where all your retail stock was, you could send them to your customers much quicker. If everything in your warehouse was recorded automatically via IoT sensors, then you wouldn't need to employ armies of warehousing staff to manage and monitor stored items.

You can begin to see that connected IoT has a direct impact on revenue, cost control, and customer service. It also has a major impact on efficiency and productivity. According to Cisco and DHL, it's predicted that the inefficiency cost facing global supply chains amounts to a staggering $1.9 trillion. Finally, it has numerous environmental benefits by reducing wastage and making sure things are organised in the most economic manner possible.

Barcoding will only provide you with passive historical information, because once something is scanned it is often moved shortly after and the

location is then lost. It's also based on costly manual processes to collect the information. Furthermore, the 2D barcode reader market size is reported to be worth around $7 billion in 2021 according to Grand View Research, so it's a large market using limited passive technology.

'The benefits of a thinking supply chain will be enormous'

- International Data Corporation (IDC)

This is also about serving your customers much better. Getting stuff from A to B quickly and fulfilling orders in the best possible way. Accenture reports that '70% of industry professionals believe better supply chains mean better customer service', but that doesn't mean those same professionals are going to change things too quickly to improve their supply chains. GEODIS have reported that '57% of companies believe better supply chain management provides a competitive edge'. Executives often know they need to do something and its good PR, but taking quick decisive action is another thing. Don't get me wrong, I believe some organisations will move forward, but will their competitors move forward quicker?

Which sectors benefit from connected IoT technology? Well, the honest answer is any sector that produces or manages physical goods can benefit. This includes healthcare, pharmaceuticals, any manufacturing business producing goods, electronics and consumer goods, chemicals, oil and gas, mining, building infrastructure, food and beverage, cold chain, transportation & cargo, and more. Not just commercial, either; the public sector, too, the armed forces, utilities, public works and so on.

Within these sectors it's typically the supply chain and logistics

teams that manage these areas and will probably fall under the responsibility of a senior leader like COO, CFO, or CEO, depending on the size of the organisation. However, it's often the CFO that sees real intrinsic value in implementing something like this. They can see the financial benefits more easily, how using this technology can translate into cost savings, revenue growth, and better performance.

One of the biggest opportunities is in the healthcare sector. Very large and complex in many countries, it is often plagued by inefficiency and waste. As the Lord Carter Report highlighted with respect to the UK's National Health Service (NHS) in 2015, 'Most NHS Trusts don't know what they buy, how much they buy, and what they pay for goods'. This is why the NHS loses or wastes over £8 billion a year overordering items, losing items, or by theft. The problem is even worse in the US; their healthcare network is said to waste up to $750 billion a year because of the same problems.

I think it's really important to state that this isn't just about global business or the state; it's also about every small business that handles physical goods. You can benefit in the same way as a large brand is using connected IoT. Costs are scalable: if you only need to monitor and track a smaller number of items then you will require fewer sensors and trackers. You only pay for what you need, which makes implementing this solution very cost effective. The SaaS data platform dashboards presenting the data is similarly only paid for on a per person usage basis, so, again, it doesn't matter how small your business is.

Some people think this connected IoT technology is all about talking fridges and washing machines. On the consumer side, there are clearly benefits to be had from using this type of technology in households, for example, putting sensors on pipes to see if they are leaking, or a fridge telling you when food needs to be restocked. In this book, we are talking about

connected IoT business to business solutions such as asset tracking and monitoring. We are talking about how this technology can be applied to businesses of any size to make them more efficient, productive, improve their financial performance, and help with sustainability.

'83% of organizations that have introduced IoT technology have improved their efficiency as a result'

- Impact 2020

Remember that connected IoT technology is all about using data from sensors to make decisions, data that can help you manage and run your business more effectively. Whether its implementing Enterprise Resource Planning (ERP) systems which became available twenty years ago, or PC computers used in business forty years ago, it has always been seen as a major leap of faith to implement those unproven technologies at the start before they get adopted. But over years the benefits are demonstrated. Then you look back and ask why you didn't implement them sooner! I guess this is just human behaviour at the end of the day.

In short, this book is highlighting why companies, organisations, and entrepreneurs need to take connected IoT technology seriously, and that its quite simple to implement. We are now going to delve much deeper into specific IoT solutions such as asset tracking and monitoring. We will also look in detail at the specific areas of a business that can be improved by using this technology. We will look at a number of case studies from companies that have used connected IoT very successfully and solved some major problems as a result. Finally, and most importantly, we will explore how you

can embark on implementing this right away and start on a journey of digital transformation and improvement.

So who is this book for?

This book was written for a wide variety of businesses, organisations, and individuals:

- **Large Business** – If you're running or managing a department within a large company that produces or manages physical products then this book will be highly relevant for you. This is especially so if you have leadership who just don't get digital transformation. It explains connected IoT in very simple terms so that any senior leader will get the benefits quickly.
- **Public Sector** – If you're part of a public sector organisation such as a hospital or any other Government entity that requires advanced asset tracking and monitoring, then this will be hugely beneficial for you. There's much to be gained by using connected IoT in the public sector from urban and waste management to the armed forces.
- **Small & Medium Size Business** – If you're managing or running a small or medium sized business then this book will be especially beneficial as you may not have technology advisors that larger organisations will have. You may not have a large internal technology and digital transformation team and therefore will need to rely on external specialists to evolve.
- **Business Owners** – For business owners who may be running regional or local businesses you can have a cost effective and efficient way to organise and monitor your assets and items, for example, if you are running a retail store. If you are dealing with physical products, then this book will help you.

- **Entrepreneurs** – You might be an entrepreneur looking to get in to new IoT technologies either as a user of the technology or as a supplier in your own right. You might be investigating or researching for a business plan. If so, this book should give you everything to get started on this topic.
- **Consultants** – In this case you might be a business or individual advising other businesses how they can benefit from connected IoT as part of a wider technology solution. You might be helping to implement a larger system, such as an ERP system, and this book will show you how this can be made much better.

Section One

Changing Times

Times are changing. When something is *perceived* as being new, it might seem a bit like uncovering treasure, like the world that you thought you knew was, in fact, slightly different. So let's begin.

Chapter One: The Secret Formula

Physical products can feel a bit boring when all we see and hear about seems to only be about technology, online products, and social media networks. You buy stuff online, you communicate online, you socialise online. Over the past two years, you have met colleagues online, even did all your work at home, online. It's all about Google, Amazon, Zoom, Facebook, MS Teams, Twitter, YouTube, Instagram, TikTok, Snapchat etc. No one talks about a boring old engine manufacturer with the same excitement, or so it would appear. Physical products are just, well, physical products: a chair is a chair, a table is a table, oil is oil, and a house is a house.

The digital world is perceived as being sexy and cool. You can get much more information out of a digital product, more interaction. Physical products don't give you that instant information gratification the way digital products do. Digital products are seen as the future of innovation. This is sometimes the case if you are trying to raise money for a start-up: it's not often you will see a venture capitalist invest in a hardware type business because they often don't get the same high valuations as a digital business.

There are exceptions; my hero Elon Musk has done a pretty good job building some amazing physical products with Tesla and SpaceX. But that isn't really what I'm talking about. I'm talking about day-to-day stuff: household products that are manufactured and shipped around the world all the time.

But what if you were to give a physical product some of the same characteristics as a digital product? What if you could create thinking physical assets, or physical goods that can interact and communicate with people and systems?

You would get some of the same benefits as digital world products: instant communication, automated activities, suggested improvements, condition advice, and better controls. Connected IoT is creating the opportunity for assets, physical products and goods, to think and communicate using advanced technologies. We are in a world now where physical products can talk to you: they provide you with information, they provide you with data that you can use to make critical decisions, to create more efficiency and lower costs. Physical goods can tell you if it is too hot or too cold, if it's not working in the right way, if it has been knocked over and is broken, or it's in the wrong place. Think of the opportunities when those physical goods and products are instantly verifiable on your screen, when you know exactly where they are and the condition they're in, to see in an instant where things could be made better and more efficient. It is potentially transformative. The technology to do this, however, has been around for years.

Of course, in the world of quantum physics, scientists have long been telling us that everything is connected and that everything is one. Quantum physics is the study of matter and energy at its most fundamental level, basically how everything in the universe works. It describes how the nature of particles that make up physical matter, and the forces with which they interact. This book is not about quantum physics, and I am no scientist, but there is a common theme here: some might say there are a few similarities to connected IoT.

According to the *New Scientist*, quantum physics predicts very strange things about how matter works, things that are completely at odds with how things seem to work in the real world. The quantum particles that make up physical matter seem to be able to affect each other even at a great distance. Yes, the particles that make up one physical asset may be able to

speak to the particles that make up another physical asset a long way from it, and science doesn't understand how or why this is able to happen. Apparently, this is to do with something called quantum entanglement, or to use Einstein's phrase 'spooky action at a distance', and it certainly is spooky, especially if you start reading up on paradoxes such as Schrödinger's Cat.

Science and, in particular, quantum physics is, and will continue, to make huge leaps forward in understanding particles and molecules. The research coming out of this area is hugely interesting to me. However, until scientists can reach their conclusions with definite and proven scientific discoveries that can be replicated in real life, we live in a world where physical assets have to use other means to communicate and speak to each other, means such as connected IoT.

Turning our attention from the future and to the past, let us take a step back to how things used to be and, in many respects, still are. Since the 1950s, barcodes have been used to track and monitor physical assets and goods. Back then, it was a very smart way of tracking things: all you had to do was stick a label on something, get a scanner, and track it by clicking a button. But barcodes don't tell you much more than what the product is, and where it was located at the time of a scan.

Today, many organisations and businesses either use barcodes – or nothing at all – to track assets. So technology invented in the 1950s is still being used in many businesses to track their goods – in an era where we have electric cars, and send people into space, where we have people living on a space station which operates 24/7, 365 days a year. We have algorithms, powered by artificial intelligence (AI), making automated decisions in a whole variety of sectors, determining the best course of action for a huge number of scenarios. But in the physical world we still mostly using barcodes to track assets. Crazy!

If not barcodes, then companies might use QR codes: you scan an item and this then links it to a website or an online database. This at least does something a little more innovative. QR codes go some way further than barcodes, but they are still outdated passive processes that involve an individual walking around from item to item, scanning assets or products. This can prove very costly to small businesses; they have to employ individuals to go round all items scanning them for stock taking purposes. If you take larger warehousing companies or larger organisations with big storage centres, then the costs can mount up exponentially.

Furthermore, older technologies like barcodes cannot monitor the condition of items and goods. When using barcodes, you still need people to go round and check the temperature and condition of the item, and whether it's still working okay. It's a manual process. We are used to automation in the digital world: things just happen, instantly, and decisions can be made on websites and apps without you even knowing. The physical product world can seem so outdated by comparison.

When we first tried to raise funding at Findaa Technology, some investors didn't like us because we had some hardware elements i.e. our sensors. However, we're mainly about data, advanced software, algorithms and cloud-based servers, but because some elements involved hardware, such as electronic trackers and sensors (which provide the valuable data), some investors were turned off. Some investors preferred to invest in pure digital and software companies where everything was already automated, online, and in the cloud. They didn't want any physical aspects to an investment. I'm not saying that this was the case with all investors, just some who seemed to value purely digital businesses much more highly. There is sometimes this perception in the investment market that something hot can only mean digital!

Of course, if we go back twenty-five years, before the dotcom companies started to emerge, most companies were physical based. Having an online business was rare. But we have got so used to living in the digital world and forgotten that the vast majority of things that companies produce – and that people actually need – are physical. You could probably live without Twitter, but may struggle to live without a washing machine, especially as we are so used to time saving, efficient products, that do the work for us. I think what we're beginning to recognise and see more widely, is a hybrid digital world, where something can be both digital and physical at the same time. Indeed, we are soon going to talk about something called 'digital twins' later on.

Fundamentally we are talking about data and information. Once you have data, it can be analysed and monitored online, remotely, in real time. In Yuval Noah Harari's *Homo Deus*, he talks about the fact that everything is data, from the biomechanical processes in your brain to the DNA in your body, and to the algorithms in robots. Data is constantly being sent from one place to another. The data contains packets of information that can determine your thoughts and your health.

We now have the technology to enable physical products and assets to become data products. Your fridge can now talk to your dog's collar (if you happened to want it to), and a beer keg can talk to a bar owner. A pipe can tell you if its leaking. This might sound weird to some, but think how valuable this data could be. Unfortunately, the application of this technology has proven slow, with a lack of basic understanding of the opportunity.

Smart connected technology involving the Internet of Things has been in the domain of engineers and developers for years, but I want to show that this can be brought to the mainstream, to non-technology people, where the real and daily applications of connected IoT can be demonstrated. Some

people are nervous of digital transformation, but company boards and entrepreneurs need to understand that it’s relatively simple to implement connected IoT technology, and the benefits can be huge. Digital transformation might sound mysterious, a secret known only to a select few engineering types, but it really isn’t like that.

Chapter Two: Current State of the World

It’s important to say a little bit about why connected IoT technology has become more important in recent years. The global Covid-19 pandemic accelerated digital transformation everywhere: many companies had no choice but to send staff off to work remotely. The pandemic has shifted the global economy to being more technology-driven, while at the same time has hindered economies producing certain goods.

I’ve had a home office set-up for many years, so working from home was nothing new, but for many people this was an entirely new experience. Companies that didn’t have any work-from-home policy had to find new technologies and processes in order to serve their employees in remote locations and in their homes. Indeed, nearly two years on from the start of the pandemic many employees haven’t returned; their staff are still working from home and will probably continue to do so in some shape or form going forward.

The pandemic meant that many factories had to abruptly stop producing goods. Manufacturing production was massively delayed by new remote working conditions, or staff were off sick or self-isolating with Covid. Even if manufacturing production lines were mostly automated, it still needed controlling and monitoring by staff - staff who were now not in the factory. It wasn’t just manufacturing plants that were experiencing problems with the global supply of goods, there were also transportation and shipping challenges.

Logistics staff and transportation drivers were not able to work because they were off, or the company just stopped operating because of the pandemic. In some countries like the UK, many foreign workers decided to

isolate in their home countries and never returned to the UK. The culmination of this meant supply chains began to grind to a halt. This caused, and is continuing to cause, massive problems globally. In the autumn of 2021, some eighteen months since the onset of the pandemic, companies like McDonalds, Ikea, Halfords, and many others have reported huge supply chain problems according to the *Guardian*.

Nothing sums this up more so than the fuel crisis in the UK in October 2021. I remember one Saturday morning when I was dropping my son off somewhere at 8:30 in the morning. There was heavy traffic everywhere, at a time when most sensible people were having a weekend lie in. This was highly unusual for a journey that should have been swift, clearly something was up but had no idea what. I quickly realised the source of the traffic were cars queuing for fuel at petrol stations. The cars were backed up along the street causing blockages to people who just wanted to get from A to B and had no intention of getting fuel.

After listening to the news, we were told that because there was a major shortage of truck drivers around the UK, because of the problems mentioned above, fuel was unable to be delivered to petrol stations across the country. The UK had plenty of fuel just no one to deliver it. The problem accentuated itself because instead of people just filling up their vehicles as per normal, they were now doing so more regularly to squeeze every last drop into their tanks. Indeed, some were bringing jerry cans with them so they could fill up reserves of fuel.

The above problem wasn’t just confined to the UK either; other European countries were experiencing similar problems. Movement of labour and global trade are the norm between countries, therefore any disruption to supply chains and the production of goods can have a major impact on the global economy. If you think back to February and March 2020, you know

how operations shut down very quickly as governments tried to fight the Covid-19 outbreak with archaic lockdowns: there were no vaccines then, so we had only this blunt instrument of lockdown. In many cases companies and organisations didn't have contingency plans. The last pandemic was in 1918; a pandemic was probably the last thing anyone was thinking of. There was a very real sense of panic as organisations tried to figure out what needed to be done to maintain control and production.

Here in the UK it was a very strange time, as I'm sure it was for other countries. You knew a wave of infection was coming, and you saw that other countries were dealing with it by shutting down. But you didn't really know what a lockdown would actually feel like. In February 2020, my daughter's school had a ski trip to Italy. When they returned, many in her year started falling ill. No one called it Covid at the time, because no one really knew what Covid was - people were still talking about it as a flu-like virus. But it was clear that those who got sick were suffering from something that wasn't quite a normal flu.

My daughter got sick too and before long, her illness had spread around our household. I remember very clearly one Monday morning in March feeling very strange and not really knowing why. I was lucky that I only had a fairly mild infection of *whatever it was*, but my wife and son suffered quite badly from the 'bug'. I only mention this because it was the same week that the UK government started to close pubs and bars, and I was due to go to birthday drinks that evening. I remember calling my friend saying I didn't feel great, probably only hay fever, but it would probably be best if I didn't join them that night! At the time there were limited testing facilities for Covid in the UK, so we couldn't be sure what it was. It was only later, in April, that we were able to source an antibody test which confirmed that our household had indeed caught Covid a month earlier and before the

lockdown had even started.

When things shut down in spring 2020, it seemed like the world had stopped. Walking out onto the street was like entering some warped post-apocalyptic world. No cars on the road nor any people walking around, and it was clear that most were adhering strictly to lockdown. At the same time everything closed, demand for online goods and products went through the roof. Indeed, Amazon's net profits for 2020 soared 83% on revenues of $386 billion that increased by over $100 billion during the year! If ever there was a market segment to be in, ecommerce companies were definitely it!

Not being able to go out shopping or leave their homes, people were scanning websites buying up lots of stuff remotely. I remember trying to panic-buy a rowing machine and a treadmill because I thought I wouldn't be able to go out and do any exercise! When I logged on, I found that delivery times were now up to three months long. In the middle of an early heatwave, I was also trying to buy a paddling pool for the garden but, again, delivery times were months long. We obviously weren't the only family trying to buy as much as we could online: everything had to be bought online if it couldn't be found in the supermarkets, which were allowed to remain open to sell food and drink.

Many products and goods sold on Amazon are produced in China and other countries around the world, so a supply chain problem was compounded by the fact that these goods were either not being produced, or not being shipped to the UK because of logistical delays. It seemed like trade had just dried up. I can't think of any other period in time that was similar to this, and which we are still feeling the effects of today. I mean I'm part of a lucky generation that hasn't lived through a major wartime period, unlike my grandmother who had to sleep in the London Underground when London was bombed during World War Two. Clearly, 9/11 was a shocking event, and the

effects of it went on for many years, but the Covid pandemic was a very different kind of trauma: the scale of the impact on people's lives was huge with, sadly, many lives lost, and families left devastated.

In the early 1990s, the late Andy Grove, CEO of Intel, used 'strategic inflection point' to describe 'a point in time where the continuation of the status quo would lead to certain failure'. He could have easily been talking about this period of time. Companies ceased operating in the way they had done for many years, and in some cases just went out of business. Many had to move to a new operating model that would work in the new Covid era, an era that we are still in today regardless of the vaccine based recovery.

Goods were left in the wrong warehouses around the world; container ships were stuck in ports, unable to return to their home nations, so they couldn't pick up any new cargo for shipping to new locations. So, even if goods and products were still being manufactured, they couldn't actually be shipped to the end customer. Many companies didn't know where their products and goods were; if they did, they may not have been positioned close enough to end customers for quick delivery.

To make matters worse, some of these goods were highly perishable or sensitive items, meaning that they could only be stored in certain conditions, for a set period of time. For example, cold chain companies supplying fresh food need to store their products in temperature-controlled environments. Chemicals shipped from one country to another require careful monitoring. When normally individuals would go round checking perishable or dangerous cargo on a regular basis to assess their condition, this wasn't always possible due to the lack of staff, some of whom were isolating at home.

The pandemic was just one scenario to cause problems. The UK's Brexit also compounded problematic global trade patterns because of new

shipping restrictions and various diversions in place. Like the pandemic, Brexit also motivated many European nationals to migrate back to their homeland, meaning there were even fewer staff in the UK to fulfil vital functions. The following year, in March 2021, a 220,000 tonne ship called the *Ever Given* got stuck in the Suez Canal blocking 400 vessels that needed to pass through. To give you some perspective, around 12% of global trade passes through this 120 mile stretch of the canal, the shortest sea link between Asia and Europe.

Trade is of such critical importance globally that any blockage or slowing of the trade can have major implications and ramifications for different countries. The Covid pandemic also showed us how many countries rely on international trade routes to receive goods, rather than produce things domestically. Subsequently, we have seen the rise of various forms of economic nationalisation: a necessity when a country has to rely on their own production resources to satisfy domestic demand.

Having said that, we have also witnessed episodes where trade becomes a political weapon to inflict economic damage on other countries, owing to political differences between nations. Recent trade disputes between China and the United States are a good example. What began in July 2018 under then-president Trump eventually led to tariffs on some $550bn Chinese goods and $185bn US goods. Mounting friction makes it difficult for companies to send and receive goods around the world, to know where their assets are and what condition they’re in.

From raw material supplies sent to factories, to manufactured goods being shipped to customer destinations, this friction is present in every part of the supply chain. This disruption has had a major time and therefore negative cost impact for organisations, bringing in to doubt the financial viability of many companies. Some of the effects of this has been masked by

Government funding, but much of this funding is time limited and eventually due to expire.

It’s not just about global trade and supply chain disruption; problems can also occur due to manufacturing and retail processes that have become very popular in recent years. Just in Time (JIT), a production and delivery system first developed in Japan in the 1960s and 70s, can be critical for manufacturing goods like cars, and for supplying supermarkets. It greatly simplifies logistics: components and goods are delivered at exactly the right time. A good example would be in the food supply chain, where food produce is delivered to supermarkets at exactly the right time those items are needed, without the need to store items on site. Deliveries tend to be very regular and driven by point-of-sale data. They don’t have to be stored or warehoused, saving the company both space and cost. In normal times and in a world of slick logistics, it all works great. But problems start to occur when things don’t go to plan.

The same JIT processes that lead to efficiency gains can also inversely cause major disruption and problems in times of difficulty within a country. We all remember the empty shelves and lack of toilet rolls in spring 2020 when demand strongly outstripped supply! In addition, you have other situations like a deep freeze and power outage in Texas that disrupted some petrochemical plants, creating shortages of key plastics and resins for various industries.

For these reasons, McKinsey came up with the concept of Just in Case (JIC) delivery, where companies prepare for events that are outside of their control, and goods and assets need to be stored locally to the production or the retail environment. They recognise that companies can no longer rely on JIT delivery, because global supply chain issues are becoming much more common, and the impact can be felt more acutely. The McKinsey Global

Institute (MGI) has highlighted that over the course of a decade the average company can expect to lose nearly half of one year's profits from supply chain disruptions. As a result, they have said global trade patterns may shift significantly over the next five years, and by as much as 15-25%, due to regular disruption. Further research found that 180 products with a value of $134 billion in 2018 are exported exclusively by a single country, so any shocks in those countries can lead to huge bottlenecks unless alternatives can be found quickly.

With the possibility, likelihood – even certainty – of further huge shocks to the global supply chain infrastructure, companies will need to look at alternative ways of managing their global and national supply chains. This is where technology plays a major part in mitigating these problems. Having an overall picture of where all your goods, assets and items are anywhere within a country, or globally, will go a long way to understanding where your potential risks, pinch points and problems might arise. It also highlights the opportunities that exist.

Having real time visibility over your assets and products anywhere in the world, just makes good business sense. There are other reasons: better security, so you know when products move outside of set geofenced areas, and therefore warned of potential problems i.e. theft. Language problems in supply chains can also lead to misunderstandings of where goods are or should be. Knowing exactly what and where your items are in greatly reduces the time to manufacture or deliver goods to customers. It's all about creating more efficiency and therefore productivity, whilst maintaining complete visibility over your assets. Ultimately, this saves money – which is what we are going to look at next.

Section Two

Why Connected IoT?

We've highlighted the sort of problems that exist today and will exist tomorrow. Here, we're going to explore how companies and organisations can address some of these issues and delve much deeper into the benefits they can enjoy by using connected IoT technologies. The next few chapters will show how, by collecting and using data, there are huge advantages to be gained.

Chapter Three: Better Cost Control

If you were to ask any chief financial officer (CFO) or finance director that deals in physical goods, ‘What keeps you awake at night?’, you would get some interesting answers. A common one is ‘cashflow’ and another is ‘too much working capital tied up in inventory and accounts receivable’. So what exactly does that mean? CFOs really like cash, and when cash is tied up in actual physical goods or items that haven’t been sold yet, or are in warehousing, they begin to worry. Companies will use Enterprise Resource Planning (ERP) systems to help to mitigate these issues, but ERP systems are only as good as the data they receive, and if that data is out-of-date, or is collected via passive manual processes – think barcodes or QR codes – then the CFO will not get an accurate picture of what the current inventory situation is.

Poor data can have a major impact on financial performance and financial reporting. The balance sheet states a company’s assets and liabilities, but if a company’s assets are reported incorrectly, that can have a detrimental effect on reporting to investors and shareholders. Better to have up-to-date real-time information on how many physical assets and products you have and where they are located – in a warehouse, on the road, or somewhere in your supply chain. By tagging your assets and products with an electronic logging device (ELD) you can receive instant information on where an asset is, what it is and, importantly, if its ready for sale or sold. Once its sold, you have the cash (and the CFO can have a long and dreamy night’s sleep).

As well as cash in the bank, the CFO is looking at the costs related to manufacturing goods, and the money used to purchase new assets and

equipment. Some organisations lose very expensive assets on near-daily basis. For example, hospitals often have equipment that goes missing or are unable to be located for various reasons. Furthermore, hospitals often have drugs that go out of date due to inefficient stock tracking. We have heard stories of nurses leaving medical equipment in their private cabinets, and then when they leave for another job it's just forgotten about. Instead of tracking all equipment, its often much easier for the hospital just to order a new item or piece of equipment. This is obviously hugely inefficient: the same behaviours might bankrupt a commercial entity, where cost control is tighter. Unfortunately, cost control is a problem that plagues many public sector services.

I'm going to talk about healthcare in a lot more detail in a later chapter, but needless to say it's a sector that suffers from a huge amount of wastage and losses. The vast majority of hospitals use outdated asset management technologies such as barcodes, which are reliant on manual processes to track equipment within various buildings. The problem is that when someone goes around the hospital to confirm where all the medical equipment is stored, recording the location by hand or by scanner, that equipment is moved shortly afterwards, so the item is lost as far as the barcode tracking data is concerned. This is a big problem for all healthcare systems from Europe to the Middle East, from Asia to the US.

We have been contacted by organisations around the world saying that they have the same problem and that they need a solution that keeps their records and data up-to-date automatically. Using tags in combination with data platforms, you know exactly what you've got and where it is, and costs can be cut dramatically.

It's not just inventory costs which causes huge headaches for CFOs. We also know they worry about revenue generation and hitting sales targets.

Sales locations need the right levels of stock positioned there in order to fulfil demand in the first place. If you don't have the inventory positioned in the right place, then you can't sell, or delivery will be slow: when you do sell items, then there will be a delay before those orders can be fulfilled. Think about recent major supply chain issues with delays in retail locations everywhere due to 'unavailable stock', from milkshakes at McDonalds to Nando's chicken!

If a retail business has products stocked in various locations based on delayed SKU stock data, then they might not be able to control their supply chains as quickly as a business who has all of their inventory monitored in real time. They won't be able to fulfil demand quickly because they wouldn't know where their existing stock is in real time. Not being able to fulfil new orders quickly and on demand can have an impact on revenue. If you are using connected technology such as IoT trackers attached to your inventory, you will be able to move or divert things very quickly and know exactly where they are every step of the way.

Real-time data analytics can have a large impact on knowing where your goods are, saving on logistics costs, and helping to increase revenues. This is something that every business of any size, should be using and embedding into their existing processes and systems. The global leader in being able to fulfil demand quickly is *again* Amazon: the time from order to delivery can be less than 24 hours, sometimes counted in hours. They have real-time data constantly feeding into decision-making algorithms and processes within their business, creating major efficiencies which saves them costs.

What about a beverage manufacturer? They need to know where demand for their drinks is coming from. Where should a processing plant send the beer kegs? Imagine a screen, otherwise known as a dashboard,

where with the click of a button, you could shift the delivery of assets and goods very quickly. If you saw long-term demand trends changing, you could position items for sale in different locations to make order fulfilment faster. This can be done right now, and easily, with existing technologies and software, using a competent supplier of connected IoT solutions (or a really great one, like Findaa Technology!).

Connected IoT assets also enable you to reduce the amount of spend on over-ordering stock or inventory, and help prevent over-ordering situations. They make sure that you utilise your existing assets in the most efficient way possible and highlight anything that isn't really used that you don't have to reorder again. They stop the loss and the theft of stock by tracking items with location beacons attached, so asset losses become minimal.

With better inventory management and better supply chain control, you have more efficiency within the business. With better efficiency comes lower costs, less wastage, more sustainability, and increased sales. These are all good reasons to keep a CFO happy whatever type of business you are running. At Findaa, the head of finance is often one of the decision makers we speak to in order to get agreement with a new deployment, and they see the benefits very quickly.

Chapter Four: Greater Efficiency

In this chapter, I really want to talk about how the use of connected devices makes life a lot simpler. This is one of the great benefits of using connected IoT technology and trackers combined with an information platform, where you can see on one page where everything is, and how your business can be made more efficient.

We know that connected IoT technology can help organisations manage their costs better. Let's see how this actually happens. What are the tangible things that you can do to drive higher productivity and better operational performance? This is often the remit of the operations director or chief operating officer (COO), and the people working in operations, supply chains, logistics, and asset management.

Control Towers

I want you to imagine a control tower at an airport where you have windows overlooking all the runways and passenger terminals. You can see every plane that's on the ground and in the air, around the airport, at any point in time, you basically have 360° visibility of everything going on outside. You have a complete picture of what's moving within the airport estate, and in the air above. Not only that, but you are also able to see what's going on further afield from your screens, where planes are flying and at what height, speed of travel, and if there's anything else nearby. You can control the different routes the planes are flying in, tell them to change track and adjust their position if needed, and to avoid a problem or get to a destination in more efficient way on a better flight path.

Airports couldn't run without air traffic control, and planes wouldn't

be able to land and take off around the world without a system like this. Imagine if you could apply a similar system to your supply chains and logistics, anywhere you wanted. It would provide for a very efficient way of assessing where all your goods and assets are at any one point in time. In addition, you will be able to see the condition of each asset if required in terms of the temperature of the product, the humidity, whether it has been vibrating, or undergone some sort of shock like having been dropped.

This means that you can see where all your goods are whether they're on a ship travelling overseas, whether they're on a plane being transported to another country, or on a truck or train nationally. You can tell if a product has arrived at its destination – a customer or client – or if things have been held up at a port somewhere, or not actually left the company depot and still in your warehouse. This system isn't reliant on someone manually going round clicking on each barcode SKU to check if it's meant to be in the right place, it just happens automatically in real time. You are effectively taking away a number of processes within the supply chain out and don't need to go around checking every item every hour or every day to work out whether something is in the right place. You will know, from looking at your dashboard.

Efficiency

Any company that produces or manages physical items will rely on independent third parties to help fulfil transport services. So, who are these third parties? Logistics companies, freight forwarders, shipping firms, outsourced supply chain providers, otherwise known as 3PL (third party logistics). What if you did not have to rely on them to check whether your goods have been successfully shipped, and if they're in the location they're supposed to be? No one company can handle everything themselves, so we

need third parties. But that doesn't mean you have to give up control over the information you're receiving.

You will often depend on them to provide you with the right information instantly, so that you can make the most efficient transport decisions possible. Unfortunately, it doesn't always happen this way. Sometimes, you may not get all the data you need from a third party, or the data provided is incorrect. Freight forwarders specialise in the arrangement of cargo on behalf of those shipping goods. They can also compound delays, especially when admin issues arise, such as lost emails. You may have language barriers and other communication issues between yourselves and those third parties: we know situations where companies speak to third parties all over the world and language can be a major issue with miscommunication, providing further confusion when decisions must be made quickly.

A control tower dashboard would give you that very quick overview of where all your stock is at any one point in time, the condition they're in, and the volume of inventory you've got on the road or in a local distribution centre. This could be down to the pallet, the individual item, or the containerload. This is how it was meant to be when the processes were originally created all those years ago, saving you time and money in a practical, highly tangible way.

Wouldn't it be much better to have the data direct to you, in real time, without having to rely on anyone else or a third party? I'm not saying you cut out the middleman completely, because you still need people to organise freight forwarding and so on, but it will certainly reduce the amount of friction you have in the supply chain and logistics processes.

Now you may be thinking that you already have a similar system in place because you use an ERP system which can highlight the inventory

you've got and where it is. But I would dig deeper. Find out what is being used to track and trace the goods, and how much it is currently costing. Are you relying on outdated historical passive data from barcodes? Do you have real-time condition data, and how quickly do you receive the data? What assurance do you have that the data is correct? How is the data displayed? Can you analyse it effectively? And, finally, do you have a complete overall picture of all your assets?

In our experience, most large businesses have historical data going into some sort of ERP system that is, essentially, static – based on what happened in the past, not the current situation right now. Unfortunately, this doesn't always cut it. We know that as soon as something is scanned by a barcode scanner, for example, it's often moved and therefore its current location is lost. We are going to talk about ERP systems more, but for now, the only message I would leave you with is that you need something effective to work in conjunction with an ERP system.

The food supply chain is currently very wasteful. In the US alone, 30-40% of all food in the supply chain is lost every year because it's spoiled or not delivered on time. This represents massive wastage that could be utilised elsewhere in the world if the system worked more efficiently. If you take all the fruit and vegetables produced, 40-50% is lost or wasted each year, according to the Centre for Nutrition Studies. The annual loss and waste is some 1.3 billion tons of consumable food, equating to $1 trillion in value globally every year. I think you would agree this is a shocking statistic on any level. If ever there was a need for more supply chain efficiency, it is here.

I'm not saying that every problem could be solved at once by utilising connected IoT technology, but it could certainly make a huge dent in that wastage – just by having a system in place that can tag groups of items together to monitor their location and condition in one place, and then report

data back to a central dashboard.

Let’s take healthcare as another example. A typical hospital has thousands of expensive medical devices and equipment on the premises. Unfortunately, these devices cannot always be found quickly. Imagine a nurse needing to find a ventilator very quickly – they know that it was last seen in Ward 3, but when they go there, it’s not there anymore. A track-and-trace system would have automatically recorded where it was in real time. You could go to a dashboard or an app on your phone and it would tell you exactly where the nearest one was in an instant and whether it’s available. Not only does this have an impact on finding things quickly, but it is also improving patient outcomes.

We are talking about making organisational operations more effective and efficient whenever there are physical assets that need managing. It doesn’t matter if it’s medical devices, food and beverage, oil & gas, or white goods – it can be applied anywhere that physical assets need to be managed or maintained.

It should be noted again that this isn’t just about tracking vehicles and transport, but tracking individual items, pallets, and containers. This is a critical difference. Vehicle tracking is already commonplace. The difference is to do with specific item tracking and monitoring, for example, a beer bottle or a vaccine. For manufacturing you may want to track individual items in the production line, to make sure everything is present and correct when needed to manufacture something efficiently.

In my view we are seeing the start of the untangling in the connection between tracking transportation vehicles and the tracking of individual items. I appreciate that many do not quite see or understand this yet. I often have conversations with, for example, commodities traders, where I say, ‘You can track your traded assets from the mine to the warehouse,’ and they reply, ‘We

do this already,' because they monitor the ships. This isn't first-to-last mile tracking and monitoring. If something is to go astray or get damaged, it's unlikely to be on a cargo ship or air freight. First mile to last mile is really important for a variety of assets including those goods that could spoil such as in cold chain logistics.

Data Analytics

Once you know the location, condition, time, supply chain routes and maps, you can start to analyse these and come up with the most efficient scenarios, and plan on the basis that you can optimise where things are going. This can then be integrated with other data points such as point-of-sale demand data, location sales data, forecast sales demand, plus storage and inventory levels in various locations. You could even include information on the weather if delays tend to occur in certain weather conditions.

The data platform should be able to analyse exactly what this all means in terms of where assets should be located, and plan for where they should be sent. You can take this a step further with scenario planning, where you pre-determine what would happen in certain scenarios and how you would react to that. For example, if a port suddenly closed and your goods had to be sent to another location, you would already have that mapped out, and contingencies in place using your 'control tower' dashboard. These decisions are made in real time because the data you receive is in real time, not based on historical situations or historical data from third parties.

The integration of various data points on your whole supply chain and logistics will give you very valuable insights as to how you should run your business operations. Granular information can be combined with other internal data which then provides those hugely valuable insights. Take construction. If you could combine construction materials and building

equipment with tracking tags, in combination with building information systems, combined with architectural and project plan data, you could pretty much automate the supply and logistics for constructing a building. Things would be delivered on time and in the right place according to the set project schedule. When the project was finished and the building standing, the site would communicate that it was all okay and that no maintenance was required in any areas. Combine it with robots and the building could be built without builders!

Chapter Five: Improved Customer Service

Having started my career in sales I've always had customer service in focus when looking at solutions for businesses. When growing any business, you have to provide your customers with value, and they have to see the benefits of using your products or services. It's not always about price, but about the perception of value your product or service will provide compared to your competitors. It is also about innovating your customer service so that you are ahead of your competition.

Amazon, for example, are not always the cheapest option. You can often find a lot of products cheaper if you go direct to the supplier or go to other online providers. I was recently looking for a new camera to produce some video content, the same camera was at least £100 cheaper by using a different online provider. But would it arrive in good time? And if there was a problem, would it be resolved quickly? What you get with Amazon is good delivery assurance – your products are probably going to arrive on time and in the right condition. You also know that if there is a problem, it will be rectified quickly, and any refunds will be returned without hassle.

This cannot be said with other online retailers where you may be left waiting for longer periods of time to receive your products. What really makes Amazon stand out is the fact that their customer service is pretty amazing, and order fulfilment processes have now been optimised to such an extent that you can order something at 5pm on Monday and have it next-day. This is easy and demonstrates great customer service. During the UK's first lockdown, I bought clothes from a large global clothing retailer; when they arrived, they didn't fit, so I returned them. It took two months, *two months*, to get a refund. Great customer service is not guaranteed.

Amazon have created the best organised postal service in the world by implementing great technology. They understood right at the beginning that the use of technology and processes would help create a positive customer service experience. Furthermore, because they are an online retailer, they needed great systems because they didn't have a physical retail store environment to smile and blow you away with a physical brand presence.

A big part of Amazon's success has been in their warehousing planning and strategy, which has ensured that all their products are accessible and in the right place for their customers anywhere in the world. Amazon often place warehouses close to big cities and areas with large populations, and these are well stocked with most items that people require. They use connected IoT technology to make sure they can locate items very quickly and can be accessed by robots automatically when orders come in. They use predetermined supply chain delivery routes that have been optimised by other companies like Fedex and UPS so they know they're the best. Finally, they constantly innovate with various technologies. For example, they are now looking at drone technology to deliver goods to customers where possible in certain locations. Who knows if this will actually catch on, the point is that Amazon are constantly innovating and that goes some way to explaining why they are consistently one of the five most valuable companies in the world. Not bad for what began as an online bookstore!

You don't need to build the next Amazon digital ecosystem, but you can deploy many of the same technologies in your own business to generate similar customer service benefits. If customers order from you and they know that their orders are going to be fulfilled, they are likely to be loyal, and buy from you again and again. Repeat business should be a key aim for your business: we know that 80% of business will often come from 20% of the customer base according to Pareto's law.

Customer service is important in healthcare, too. A member of my family was visiting a private hospital, looking to have a heart monitor fitted. Every time she went to have it fitted, the nurse came out and said they couldn't find it. We have already talked about the detrimental effect this sort of thing can have on patients. But would anyone want to go back to that private hospital and use their services again? My relative hasn't gone back to that hospital since and prefers to use other medical centres. She also told everyone about her bad experiences, which meant the hospital is now perceived by her friends as not a great place to go if you have a health condition. They may have then told their friends and so on. For a private hospital – but could be any business - that's not great news.

By using asset tracking technology, these problems would probably never have arisen. When I say asset tracking technology, I'm talking about using connected IoT trackers that could have been placed on the medical device and therefore have it tracked in real time. The nurse could therefore have found it very quickly when my relative arrived at the hospital. They would have had a real time log of the location and condition of the medical device, without spending time trying to find it with a patient waiting to be seen. It wasted the nurse's time, and it wasted the patient's time, and indeed all other patients afterwards who were delayed in being seen.

Another company we spoke to wanted to provide their customers more information on their sustainability credentials, which is a good example of customer service innovation. They wanted their customers to know key things like where the product was manufactured, where the raw ingredients came from, how much transportation (CO2 miles) were required to manufacturer the product. Our technology could assist with producing this data for their customers, in an automated way, using a combination of connected IoT and QR codes. It's an exciting area of work for us.

Connected IoT technology should be seen as a customer satisfaction multiplier, in that you use the technology to help serve your customers better and more efficiently. Of course, how many organisations do you think actually do this, today? The answer is very few. Why do I think this is? Well, there is sometimes a general lack of knowledge in the market about connected IoT and how smart devices can bring benefits to a business or an organisation. In many cases these products are not marketed very well, and they tend to be overly technology-based, when decision-makers in businesses and organisations want short cost benefit user cases. If they don't understand how something is going to benefit them quickly they move on. Connected IoT technology just isn't seen in the same light yet as, say an ERP system, or CRM software. When I talk to some businesses, they don't believe what this technology can actually do for them. In some cases, they think its unrealistic and that it's not possible.

Connected IoT technology should also be used in organisations and businesses as a way of improving operations. It means they are used to assist and help fulfil the objectives of a business. This encompasses driving more revenues, increasing productivity, and providing excellent customer service. It also means you're able to plan your business and resources much better. Entrepreneurs should be employing this right from the start of their business journey, especially when dealing in physical assets.

Later we're going to talk about how you can implement connected IoT technology within your organisation or business very simply. It's not complicated – just a simple way to improve your delivery and ordering fulfilment processes and improve customer service.

Chapter Six: Sustainability Benefits

I now want to turn your attention to sustainability and the environmental benefits that can be achieved by using connected IoT technology. Yes, connected IoT can also help you to save the planet! By optimising what you have and managing your assets more efficiently, you are reducing wastage and wasted effort in your organisation. If you are not losing as many items, then there is no need for you to replace these things, which may duplicate what you already have if the lost items turn up. You are extending the lifecycle of a product which means less items need to be produced. This may be bad for capitalism, but it's good for the environment.

The technology can be applied to logistics to improve sustainability. In logistics there is something called 'dynamic routing' which is changing and amending delivery routes as required based on circumstances. This often drives efficiency and improves productivity. But it also means less mistakes and wasted journeys which means less CO2 burned, alongside lower energy use costs. Again, it's all about optimisation.

In the healthcare sector, pharmaceuticals go out of date and have to be discarded. We've spoken to hospitals where they throw out drugs and vaccines all the time because they haven't been able to use them in time, and these things have very strict expiry dates. You cannot give patients drugs which are past their use-by date, or take any risks when some drugs have to be kept in strictly controlled environments. Our Covid vaccines need to be kept at very low temperature-controlled levels in order to be effective, and if they go outside of these temperature parameters, they have to be discarded.

In Chapter Four, I highlighted wastage in the food and beverage sector and cold chain, which is keeping fresh produce in strictly controlled

environmental conditions. Much of this loss occurs before it has even reached the end consumer. It is not just the food that is wasted; it's the energy and resources used to produce that food in the first place. Indeed, agriculture accounts for the largest human use of water.

'The food currently lost or wasted in Latin America could feed 300 million people'

– FAO 2013

Connected IoT technology helps to reduce energy consumption. A recent report by Record Evolution stated that by using smart IoT technology globally, the energy sector could save more than 2 billion metric tons of carbon dioxide global emissions per annum. This would represent a saving of around 6% of all global emissions every year. Using connected IoT technology in the shipping industry and creating efficiencies in maritime cargo transportation, is said to reduce fuel consumption by up to 15%.

Environmental issues and ESG (Environmental, Social, and Governance) reporting is now at the top of most company boards' agendas. This was not always the case. About 15 years ago, I joined a start-up that had a fantastic idea of reporting on ESG factors in companies. This was completely innovative at a time when historical reporting on a company's environmental impact was usually via an analyst's report. Investors looked at these reports to see whether a company was doing well or performing badly with respect to environmental impact and ESG factors. The report would effectively be the opinion of the analyst and editor, based on whatever data that they could get at the time.

The start-up turned this on its head. We collected data on hundreds of indicators and data points including water use, energy use, CO2 impact, social issues (like number of staff sick days), and corporate governance issues like board structure and male/female senior exec balance ratios. No one else was doing this at the time – all you could get was a written opinion on a company or investment, when hedge funds and other investors wanted pure data they had to do it themselves which was time consuming. They wanted to come up with their own conclusions that may lead to buying or selling signals in different companies. Our company found a niche in providing this ESG data, and it was very popular.

In the past five years, ESG factors have become very high profile for many organisations. It often sits at the top of CEOs' and board agendas. This is great news because today there is so much more transparency than there was fifteen years ago, and companies and organisations can be held to account for their environmental impact and the sustainability factors they employ internally. It's critical for organisations and businesses to report positive ESG factors and data to their investors, so that they can prove they are working and acting in a sustainable way. Sometimes this is regarded as greenwashing. But now this has to be backed up by tangible actions, not just words, and legislatures continue to look at this area closely.

This is where connected IoT technology can play an important role today. With data, companies can operate more efficiently and reduce the amount of energy they use because they are more streamlined. Any organisation or business that is managing physical assets of any kind, using connected IoT technology and the data generated from it, can improve their ESG ratings and perception with their investors, customers, and employees. The data is transparent and can demonstrate streamlined logistics and operations, thus reducing their carbon footprint. Key stakeholders can see

trends and opportunities to make further improvements.

It should be a no-brainer for anyone transporting, manufacturing, or using physical goods to employ connected IoT technology and the data that it provides to reduce its impact on the environment. Every CEO is looking for ways to improve sustainability in their business. If I was a COO or supply chain director tasked with improving sustainable performance in my area, one of the first things I would do is integrate this type of technology into my operations. To me, this is a quick win, but you'd be surprised how many businesses, entrepreneurs, and organisations overlook it.

Conversely, consumers and households have adopted technology keenly. They see that they can save money by having smart sensors, or other smart building technology that will turn off lights automatically, monitor their energy use, or cut off water supplies if there are leaks. Imagine if every company employed the same attitude to tackle sustainability issues. Living in London it still shocks me to see office buildings with lights blazing late into the night.

It is true that connected IoT technology also uses resources. For example, the data that is produced by sensors is normally then sent to the cloud, and most cloud technology is based on storing data in huge data centres that consume a lot of energy. Data centres need to be kept cool and this requires power for the air-conditioning units. It should also be noted that the sensors themselves often require battery power in order to operate, and used batteries need to be disposed of.

I would argue that there are two things to counter these issues. Firstly, data centres are becoming much more efficient in using energy, and the technology that is used to store the data is also becoming more efficient, so over time the environmental impact is going to reduce. Secondly, we are seeing huge improvements in the capacity and storage of batteries.

Additionally, most IoT sensor batteries are rechargeable, so that they can simply be restored by using a simple USB charger. Not much can be improved without using some energy and resources; we are talking about taking positive steps to improve sustainability.

Ultimately, I believe the environmental benefits of using connected IoT technology far outweigh any negative issues associated with it, especially because it is improving all the time. It is also a very generic argument that could be used against anything that is technology based and produces data, from the media to television to the Internet, including things like YouTube, Facebook, Instagram, WhatsApp, TikTok and basically every single digital asset we already have and use in our lives daily. The only complete solution to this will be when we achieve such things as quantum computing, or nuclear fusion energy, and by creating much more efficiency with batteries and semiconductors.

Chapter Seven: Preventative Maintenance

Preventative maintenance is another key benefit of connected IoT technology. Traditionally, preventative maintenance meant scheduled maintenance – the maintenance of a piece of equipment was scheduled to take place within certain time frames throughout the year, for example, every 6-12 months. An example would be when you get your boiler serviced once a year, the engineer will come around on a certain day, take your boiler apart, check everything and make sure it's working correctly, and if not, fix or replace it. Another example would be when you book your car in for its annual service, when it will be checked and again replace any parts that are faulty or need fixing.

The problem with scheduled maintenance is that it doesn't assess the current condition of a piece of equipment throughout the year. For example, if it starts to go wrong by overheating or by vibrating too much, it will only be discovered and rectified at the scheduled maintenance time, or if the piece of equipment has stopped working altogether and an engineer has to be called out. With aircraft, scheduled maintenance happens very regularly, and things are checked often as you can imagine.

Connected IoT technology sensors can be applied to various parts of a larger item or machinery, whether that be an aircraft, car, boiler, or even a complex piece of manufacturing equipment. The sensors will be able to tell if the piece of equipment is overheating beyond set manufacturer's parameters, and therefore not operating correctly or how it should be. It will also be able to tell you if the moving parts within a piece of equipment are vibrating outside of set parameters and need checking by an engineer. If a piece of equipment overheats or vibrates outside of its fixed parameters, this is likely

to signal a problem, one which may prove costly in future if not spotted. A dependence on scheduled maintenance, and not taking into account the current condition of equipment, could mean taking unnecessary risks, and may prove an inefficient and costly way to maintain equipment.

There are other sensors that can be used such as gas sensors, humidity or fluid sensors, light sensors, sound sensors, and shock sensors. Basically, if something needs monitoring, IoT sensors can do it! There are two major benefits of this. Firstly, it can protect you from service downtime which could have an impact on other aspects of a production line in manufacturing, for example. Secondly, it will reduce the potentially substantial costs of equipment breakage and subsequent damage to other parts of the item.

Automatic remote condition monitoring is an ideal way to monitor production lines, manufacturing facilities, and items being used – such as an aircraft – to minimise the costs associated with equipment failure and breakage. In manufacturing plants, if one piece of equipment was to fail then it could have a knock-on effect on all the other pieces of equipment, or indeed shut down the entire production line.

Monitoring can be done remotely if need be, without having to be on-site or in the vicinity of the equipment or item being used. This can also reduce the costs of manual checks that might take place daily or weekly. You have the added security of being alerted as soon as a problem arises, and you can respond to it there and then.

This awareness can be a matter of life or death in healthcare. In a hospital, medical devices are used to care for patients and in some scenarios to keep them alive – if this type of equipment fails then the result could be catastrophic. I'll take you back to the example of a lost heart monitor – imagine if (once found!) it had failed or provided the wrong data when

assessing a patient because it was not maintained properly.

Being able to monitor equipment remotely provides huge benefits not only from a cost perspective but also service, and potentially in a life or death context. When you combine predictive maintenance with software-defined networking (SDN) and remote access, you have the ability, in some scenarios, to fix things remotely when you know there's a problem. You are able to conduct responsive maintenance, remotely.

We're talking about data that is sent from connected IoT sensors to the cloud, then presented on a dashboard displaying location, condition, and any maintenance issues that might be occurring at that moment in time. Think of the benefits that this can provide if you are monitoring remote assets in the field such as wind turbines, unmanned lighthouses, oil rigs, unmanned radar stations and so on. The applications are unlimited as to where you deploy sensors to manage things, automatically and remotely, and without any manual intervention locally.

'Only 11% of machine failures follow an age-degradation pattern. A whopping 89% occur at random'

– **IBM Research Report**

Furthermore, if you combine this with AI you can start getting automated decision-making in response to the preventative maintenance data. AI can determine the risk factors involved and the level of assistance that will be required to fix the equipment. These algorithms can determine the level of risk and from this decide autonomously to send out engineers to fix remote assets in the field, without any manual intervention or decision-making. It

sounds like science fiction, but the technology exists to do this right now, especially when we look at digital twins.

Digital Twins

It sounds fascinating doesn't it, but what exactly is a digital twin? Basically, a digital twin is a digital representation of a physical object, process, or service. It is a digital replica, a digital copy, you are creating of something physical. Not only that, but you are also modelling what the physical object actually does day to day in the digital world, so that its movements and processes are replicated digitally. It makes me think of the online virtual world *Second Life* by American tech company Linden Lab, whereby people could join as residents and create virtual representations of themselves (avatars). More recently we have the metaverse being created by Meta – Facebook to you and me.

Digital twins replicate physical objects – they exist in a digital world and can be manipulated in that world rather than directly with the physical counterpart. So what is the benefit of all this? Well, if the digital twin is replicating exactly what a physical item does, including its movements and conditions, as well as the environment it's in, then you are able to collect vast amounts of data in order to predict how that physical asset will perform in future. You can create simulations and plan various scenarios digitally, without any direct impact on the live physical product.

When you integrate digital twins with connected IoT and AI, things start to get very interesting. You're able to model real life scenarios in the digital world, based on real data, and can therefore plan your strategies based on this, ultimately preventing costly failures of physical objects and creating greater efficiencies. You are modelling how things could work, or how things might be, without any real impact on the day to day physical presence of your

assets. It’s a safe environment to test and plan in.

When it comes to predictive maintenance, everything would have been planned by the digital twin. So if something does go wrong, you are able to fix it very quickly because the scenarios have already been planned and rectified in previous digital simulations. This saves the time and cost of maintaining physical assets and rectifying problems in the quickest way possible. You can also make improvements in the digital world without impacting your business-as-usual physical processes, until they are proven to be successful.

If combined with AI, simulations of the digital twin are being run continuously to predict the future. As data from sensors on the physical object around condition and location is received by the AI algorithm, alongside other external data sources like the weather or traffic, the algorithm can make automated decisions based on what it thinks will be the best outcome for that physical replica. Don’t worry! This isn’t the 1980s movie *War Games,* where a computer took control of NORAD (North American Aerospace Defense Command) and started to conduct a nuclear war simulation to see who would win a nuclear war with Russia (the answer was no one). It’s much cleverer than that.

Technology is moving into the realms of science fiction, but the benefits will hugely outweigh the negatives with increased security protocols put in place around this immense power. Indeed, cyber security will have to advance at the same speed in order to counter any data breaches, malicious attacks, or other potential security incidents. With digital twins, you could improve efficiency hugely across many sectors, and you will see costs drop in all areas of supply chains, logistics, manufacturing, and transportation. Let’s look closer at some of these areas to learn more about the benefits they may see from utilising connected IoT.

Section Three

Who Will Benefit?

The application of this technology is wide and varied, and really deserves a sector-by-sector introduction, which is what we'll do now. I wanted to make sure that this book was all about the potential real-life scenarios, and you will see that they are extensive.

Chapter Eight: Supply Chains & Logistics

Supply chains, logistics, shipping, transportation, storage, warehousing, and port infrastructure are all areas where there is much to gain by using connected IoT technology. Let's take each one in turn.

Supply chains really sit at the top of this pyramid because it controls and manages the flow of goods and services between businesses and locations, including the movement and storage of raw materials, work in progress (WIP) inventory, and finished goods. Supply chain basically manages end-to-end order fulfilment, from the point of origin to the point of consumption, through a multitude of interconnected networks, channels, and routes.

If any part of the supply chain breaks down, that can affect an entire business. For example, if you're building a car, you will need a number of microchips to manage the car's intelligent systems. If the silicon chips cannot be manufactured because the raw materials to make them have not been shipped to the silicon chip manufacturer at the right time, then this can affect the manufacturing of the car itself. It's a problem that has been highlighted numerous times during the Covid pandemic and certainly in the last few months of 2021. It is also a problem likely to continue for the foreseeable future with Tesla starting to use re-conditioned chips, according to TechMarketView. This has all led to long delays in many companies' supply chains and production facilities, meaning goods just can't be produced in time for consumer demand.

In laymen's terms, it's getting all the raw materials together to build a product, manufacture it, and then ship it to your end customer or wherever it needs to go. In that process, there are several other stages involved such as

warehousing, storage, and logistics. Supply chain management (SCM) can involve multiple technologies and software to help in this process. There are third parties that will manage parts of this process, often logistic companies focused on assisting with SCM, and some household names include DHL, FedEx, and UPS.

When supply can't meet demand, if often leads to price increases because people are willing to pay more for limited goods out there in the market. When prices are rising, this can drive up inflation – and high inflation is a danger to any economy. When inflation takes hold, one of the ways economies can control this is with interest rates. Higher interest rates drive up the cost of borrowing money, with an obviously significant impact on anyone with a large amount of debt, such as a mortgage on a property. It is hoped that a higher cost of debt will drive down demand and therefore supply and demand become more balanced. So you can see that supply chain management is really important! It's critical to ensure that every part of the supply chain works efficiently and effectively.

Logistics

Connected IoT technology can assist in numerous areas in the supply chain, because sensors can be used in multiple areas including manufacturing, logistics, and warehousing. Before we look at manufacturing, we are going focus on logistics and warehousing. Logistics is really all about the flow of things between the point of origin and the point of consumption – the delivery of Amazon packages to someone's doorstep would be a good example. The concept of logistics has been around for centuries, and has its origins in the military, where it encompasses the discipline of planning and carrying out the movement, supply, and maintenance of a country's military forces. It's how soldiers get their equipment and food.

We've all seen UPS, FedEx, and DHL trucks on the road, or planes in the air, transporting goods around the world very quickly and efficiently. These are logistics services, companies employing tens of thousands of people and implementing advanced technologies to make the process as seamless as possible. A large part of this will include connected IoT technology such as telematics, which tracks vehicles so that their location can be monitored.

Telematics uses a combination of technologies, including a GPS receiver that receives data from a GSM/GPRS sender installed in each vehicle. Now acronyms like GPS, GSM, and GPRS may not mean much, but all you have to know is that there is a sending device (like a TV remote control) and a receiving device (the TV!). The sending device just keeps saying 'I'm here, okay, I'm now here, but now I'm here' you get the point. The receiving device listens for this and says, 'Okay, great I can see you, and now I can see you've moved, and you moved again'. In this highly simplified way trucks, vans, ships and a multitude of other transportation vehicles can be tracked at every stage of the transportation process. It means that if you're shipping a parcel from A to B you can pretty much see that the van that it's meant to be on is at a certain place.

Importantly, you have to remember that with telematics you are just tracking the vehicle, not the goods or any of the items in it. So although you can see that a truck has driven from A to B, or that the ship has sailed from one port to another, or that a plane has taken off from one airport and landed at another, you often cannot see the end-to-end journey from point of origin to point to delivery just by using telematics. Nor can you monitor the items in terms of their condition, for example, temperature or humidity.

A big advantage of today's connected IoT technology is that you can track an item end to end, at an item, pallet, or container level, so that you can

see that item has left its point of origin and arrived at its point of destination, regardless of the vehicles or transportation methods used. These technologies are sometimes banded together under something called Real-Time Location Systems (RTLS) and used to automatically identify and track the location of objects or items in real time, usually within a contained area. At Findaa Technology, we've developed solutions that can do this at a global level, in real time and automatically.

What this means is that you could track and monitor an item on a shelf in a storage warehouse in London that is then transported to a shelf in a storage warehouse in Singapore, automatically, in real time, without any manual intervention. Pretty cool, huh? This is logistics on steroids! Remember the key value here is not the electronic sensors used to track these items, but the data that they produce and send back to the cloud and your control tower dashboard, which you can then use to make quick decisions. For example, rerouting cargo to different transport lanes if blockages or problems occur, is something that is termed 'dynamic routing'. Dynamic routing drives efficiency and can therefore bring sustainability benefits.

Smart Ports

One of the areas where delays tend to occur is in shipping ports where cargo containers are being unloaded and loaded up onto ships in quick succession. If there is a problem in any one of these areas – a cargo container cannot be unloaded because a crane isn't available, or a truck driver has not arrived on time to collect that container, then the whole system of unloading and loading can be delayed substantially. Not to mention the knock-on delays if ships cannot leave or dock at the scheduled time, causing further congestion.

As such, we have seen the rise of smart ports, which is the

application of smart connected IoT technology to shipping port infrastructure to make the loading and unloading processes as seamless and frictionless as possible. This would include employing autonomous trucks that operate independently within the port, moving containers around, and autonomous cranes that would unload and load automatically based on the click of a button or a pre-programmed plan. Ericsson reported that smart ports can save up to 20% in costs every year by optimising port processes. They have also reported that connected IoT technology increases productivity within the port by up to 25%.

The new technologies can apply data analytics to operations within a port, so that it can provide recommendations to improve the movement of cargo and traffic more efficiently, automatically and in real time, and this helps to avoid any bottlenecks that might occur. They can also ‘game’ various scenarios so that there are plans for any problems that might arise. However, like many things related to connected IoT technology, the uptake in ports has been minimal especially in smaller ports, and many companies still rely on old processes and systems, despite the cost savings and productivity benefits to be had.

Ports have to be fairly secure environments because they are hubs for transporting valuable cargo around the world, and they employ ‘smart security’ mechanisms to make sure that things are locked up properly. As part of this they may employ a ‘smart gate’ type system where access control at various terminals is done via biometric verification, CCTV surveillance, and data analytics simultaneously. If any part of this triangle of senses and data thinks there is something wrong, the gate will stay shut. Smart locks are a good innovation in connected IoT and used in both the business and consumer sectors.

Warehouses

It was in warehousing where Findaa Technology's original purpose and mission came about. We realised that in most warehouses, stored items had barcodes slapped on the side and were then stacked on shelves in boxes. A warehouse worker would then go round with a scanner and record that item 123 is stored in warehouse position 567 at 5:00pm, and that will then be the shown in the warehouse asset system. Of course, any subsequent movement will then be unrecorded until someone again goes round and scans the new position of item 123, in its new position at the new time.

The time that elapses between various scans is what can cause many problems in warehouse operations, and why things cannot always be monitored efficiently. Warehouse items can go missing or are stolen – and there's no record of this, because once an item is recorded by the barcode scanner it has no data after that and no further updates as to its current position. The condition of the item is also unknown, which can be a problem if storing perishable or volatile items.

Some warehouses will use radio frequency identification (RFID) technology. The way RFID works is that you place a tag onto an item and every time it passes a certain point in a building it is recorded as having passed that area. An example of this would be keyless entry to a room, when you wave a card in front of the sensor to unlock and open the door, as with a hotel bedroom. If a box was picked up from the shelf in the warehouse and moved through a doorway it would be recorded as having moved through that doorway. Unless there is another RFID receiver afterwards there will be no record of what happened to that box after it moved through that doorway. RFID is a passive technology only recording a current location when passing a receiver and cannot monitor conditions. We will talk about RFID tags in a bit more detail later on.

Ultimately the problem with warehouses is that items cannot be tracked end to end, automatically, and in real-time. Processes are still based on old processes which are slow, expensive, and prone to mistakes. You cannot have ‘control tower’ dashboard functionality with barcodes or RFID. Furthermore, and using the example of an item in a box on a shelf in a warehouse in London that needs to be tracked in real-time to a warehouse shelf in Singapore, this cannot be done with barcode and RFID technologies. More firepower is needed!

Any business or organisation can apply this technology quite seriously and you don’t need to be an international global business to do it successfully. It might be that warehousing companies don’t really care or think there is much of a need to put this technology into warehouses, but I would challenge them to think how much of a premium they could charge if they can guarantee extra security for customers’ items stored in their warehouses, and how they would stand out in comparison to the rest of the market. Providing this level of assurance to customers is a sign of great customer service and truly caring about their market.

The supply chain is a highly complex and important part of any company dealing with physical assets or servicing companies with physical assets, and applying the right supply chain management technology is critical for success. There are already a multitude of technologies and software used in supply chain management including ERP systems and robotics, but connected IoT technology can take them to the next level in terms of efficiency, productivity, cost savings, control and insight, not to mention improved sustainability, end to end. The data that connected IoT technology can generate can feed directly into existing systems and provide data to larger enterprise-wide systems.

Chapter Nine: Manufacturing & Energy

The manufacturing and energy sectors are huge areas for connected IoT, and where there's a real drive to make things more efficient and streamlined.

Manufacturing

IoT sensing and location data trackers can be applied extensively to manufacturing facilities. A typical manufacturing plant has to operate in a coordinated way if it is to produce items successfully at the end of the production line, and any improvement in this efficiency will greatly assist in producing items much more quickly and cost-effectively.

Manufacturing is undergoing what has been termed the Fourth Industrial Revolution or Industry 4.0. Another buzzword, I know, but there it is! Connected IoT technology is at the heart of this 'new' revolution. It basically involves adding sensors to everything in the manufacturing plant, so there is data being collected from every part of the production line. In some cases, it's not sensors that are used, its 'smart cameras' with embedded AI technology and software to highlight things that are abnormal or outside of set parameters. This allows a very complex production line with lots of data being received into central systems, to show how productive and efficient the production line is. It can also lead to better forecasting accuracy with respect to the throughput of products and goods to meet demand levels.

It's not just monitoring the production line itself but also the raw material inputs and product outputs. A product can be made up of hundreds or thousands of parts that all need to be in the right place at the right time. Any delay or misplaced item can slow the whole production line down

ultimately impacting financial performance.

Let’s use Airbus SE as an example. To assemble an airplane takes millions of components, each put together at exactly the right time in the right place, in order for the next job to start. Any delay to this process will have a knock-on effect and could end up shutting down the whole production line. To put together a jetliner, you need to have tens of thousands of individual assembly steps taking place at different times, and any mistake will have huge consequences.

To counter this, Airbus came up with its ‘factory of the future’, an initiative which involves streamlining all its operations, and bolstering production capacity. To do this, Airbus implemented a whole variety of integrated sensors to be placed on tools and machines on the shop floor, and they also provide workers with wearable technology designed to reduce errors within the workplace. Over time, Airbus found that they were making huge improvements in their production line. In some areas, IoT technology led to an increase of 500% in productivity and eliminated nearly all errors.

We know other aircraft manufacturers employing similar techniques and processes. Boeing are quoted as saying that they want to be the most valuable information provider in aviation because of the amount of data they are producing within their production facilities. The American multinational also embeds IoT sensors in the planes themselves, so that data on the condition of the aircraft is reported much more quickly, and before any problems might arise. They also use the technology to make sure the cabin environment set up is optimised for passengers.

The ‘factory of the future’ concept isn’t unique to Airbus or Boeing, and we know many other organisations doing or planning something similar. It enables companies to explore how things can be improved with connected IoT technology without impacting current production lines. Often

manufacturers need smaller tags that are used within their indoor production facilities and require a high level of location and condition efficiency. To do this requires good technical expertise combined with connectivity solutions such as Bluetooth, 5G and AI. At Findaa we can enable this with our advanced IoT and 5G technology capabilities, driving up efficiencies for manufacturing companies.

The whole area of predictive maintenance in manufacturing is fascinating too. Being able to assess whether something is broken, or needs maintaining, cuts out a lot of the manual processes by checking and ultimately giving pointers to problems before they arise. This creates even more efficiencies, because you're not waiting until something is broken to fix it – you get a warning that there is a problem somewhere on the production line that needs addressing, whether it's something that's overheating, vibrating too much, or has been dropped on the floor and needs assessing. Sensors can be used to get predictive maintenance indicators before problems become costly.

Again, this is a scalable solution, so you don't have to be a global business like Airbus or Boeing in order to benefit from these type of technologies and solutions. Many smaller manufacturers can use them, and the technology just scales with your business. You still benefit from the same data platform and dashboard providing you with all the information in order to make much better decisions. So, entrepreneurs and small businesses take note!

In addition to monitoring assets within manufacturing facilities you can monitor the workforce as well. There are often health and safety considerations for workers, especially if they operate in dangerous facilities. Being able to locate individuals remotely and warn them if they are about to enter particularly hazardous situations by geofencing zones. There are also

productivity improvements that can be made by understanding how workers operate and using that data for optimising processes and improving workforce training. Of course there might be privacy issues around this that we will address later on.

Oil, Gas and Chemicals

The US Energy Information Administration (EIA) predicts that the world's energy consumption will increase by 50% between 2018 and 2050. You can imagine what this will mean for carbon emissions without new ways to achieve more sustainable power generation. At the heart of this, is the application of technology to make improvements in energy production. In many respects, IoT in the energy and chemical sectors is all about using sensors to understand the condition of items, rather than the location of products. You can understand why condition information is sometimes more important than location information when it comes to monitoring highly volatile products.

Having said that, there are major benefits from automatically monitoring the location of trucks containing oil and gas that need to be filled and emptied in certain locations at certain times. There are also benefits to be had in predictive maintenance and in monitoring pipelines and storage facilities that need to be strictly temperature controlled or stored in certain conditions. Real-time alerts can play a major role in spotting problems before they arise, problems which could be hugely disruptive when we are talking about volatile materials with the potential to cause huge damage if the worst were to happen.

Commodities

Mining shares many aspects with oil, gas and chemicals.

Furthermore, if you're mining high value goods such as precious metals, stones, or rare earth products then there are major security concerns surrounding their location and storage, especially when they are newly mined. With connected IoT you can geofence items so that if you were to tag the gold itself, or other precious assets, you could be warned if those items went outside of set location parameters. With this technology you have assurance that these valuable items are where they're meant to be, and are protected in transit, so that if they did become lost, or went off track, then alerts are raised very quickly.

Sensor technology, and that includes gas sensors, can also be used within the mines to protect miners and other workers operating in highly dangerous situations underground, or surrounded by volatile objects and environments. These sensors have the ability to detect a multitude of things, for example where workers are located and if they have fallen over and need to be contacted.

Coal, like other energy products and commodities, is traded on exchanges in the capital markets. Often, futures and options traders have to buy and sell products based on contracts whereby they agree to take delivery of certain items if the contract runs its course. In these scenarios they need assurance that products like coal are being transported and stored in the right places and are secure. Traders need to have visibility of their goods and IoT provides exactly this.

Like other sectors, commodity traders rely on telematics and shipping data to know where their products are, but, as we've touched on before, you are only monitoring the transport vehicle not the goods themselves. Sometimes there can be problems with communication if traders aren't informed of up to minute location changes or if shipments are missed for whatever reason. In future, I'm expecting a much wider utilisation of

connected IoT technology in commodity trading, and control tower dashboards used to show where commodities are instantly, and that are protected with geofencing capabilities.

Chapter Ten: Healthcare

Connected IoT in healthcare is probably one of my favourite areas: a sector where major improvements can be made, and one of our most in demand areas for Findaa. In many state-run organisations, or semi state-run organisations, there is a huge amount of inefficiency to tackle. Much of this became more visible when the pandemic, a major global emergency, took hold and the world was suddenly on an emergency healthcare footing. As hospitals were overrun with Covid-19 patients it became clear that many healthcare systems were not fit for purpose and old-fashioned systems and processes were making things worse in many situations.

Here in the UK, where thousands of patients were being admitted to emergency facilities every week, hospitals were becoming a very dangerous place to be, because the possibility of contracting Covid whilst in hospital was so much higher. Staff were unable to handle all the patients at once and it kind of became a triage situation where the worst-suffering patients had to be handled first. A major part of the reasoning for the UK's successive lockdowns was to preserve overstretched medical resources, a situation replicated in many other countries.

Efficiency

When the pandemic hit the UK in early 2020, the British Medical Journal (BMJ) reported that the country had trouble quantifying how many ventilators it had and where they were located, because of a lack of national asset tracking register. You could not say that the UK had 10,000 ventilators, and that they were situated in these hospitals, in these regions, and if patients required them in larger numbers in another part of the country they could be

transferred quickly. The asset tracking data just wasn't there.

It wasn't just ventilators that were needed, it was other types of medical equipment from syringe drivers to ECG machines, to patient care systems, to operating theatre items. Many health authorities didn't know what they had or where their medical equipment was, and this is still the case in many hospitals. Again, for most healthcare providers it's a case of sticking a barcode on a piece of equipment and sending someone round every day to scan where it is and log it. In some cases, it's not even a barcode, it's logging the location of the medical device on a piece of paper. Its then moved when an emergency arises, or when the medical device is needed in another part of the hospital. The equipment is effectively lost, and it will only be found when, or if, it is scanned again at some point.

Some hospitals might use RFID tags, but its passive historical data collected: you're not recording any current location information after a medical device has passed a receiver on the wall. Another big problem with UK hospitals is that the Internet and Wi-Fi is very bad. It can be hard to get a good signal to utilise some advanced asset tracking technologies that are reliant on Wi-Fi. One of the great things about Findaa is that we don't use any Internet connectivity – we bring our own network to the party so that there is no dependence on third-party IT departments to enable the connectivity to our IoT electronic devices. However, connectivity in hospitals varies around the world, for example, in Dubai UAE, hospitals have a very good Wi-Fi signals throughout.

We see hospitals as a major opportunity to improve asset tracking and monitoring in a way that not only has a major impact on cost savings, but also in huge productivity and efficiency gains of medical staff who need to serve patients rather than be looking for equipment – which, according to the Nursing Times, can take up to 10% of the nurses shift time. In a 12-hour

shift, this is over one hour spent trying to find medical equipment in the hospital. This has a direct impact on patient care and also potentially patient outcomes. This is ultimately much more important than just knowing the condition and location of assets. Hospitals are still learning about connected IoT technology and I hope that this book will provide pointers for decision-makers in both state and private hospitals.

Hospitals can be chaotic environments

Cost Control

We highlighted in Chapter 3 that hospitals are one of the places where there is huge – and avoidable – financial wastage. There is a lot of overordering when it is much easier to just buy something new instead of trying to find what you've got. There is a significant lack of inventory control and accountability. In the UK we have the National Health Service (NHS), which is state funded to the tune of over £200 billion per year. Now, in my view, state-funded organisations aren't run in the most efficient way, but private facilities still have the same issues that plague public healthcare, although they have a little bit more control over the cost structure (being

privately funded, they have to report to shareholders).

I have been told stories of nurses who cannot find equipment so they go onto the website and just order another item, and then a few days later the old equipment will turn up. They now have an additional medical device, which will probably not be used, and will just sit there gathering dust, and likely be outdated by the time there's any need to use it. So much better to track and monitor these devices in real time.

It's often the case that a small investment in connected IoT technology will pay for itself in less than one year in most hospitals. We work with lots of hospitals, but it is a slow process in getting these new systems implemented. Understandably, the pandemic has made things slower to get things done in healthcare generally, but still there are major admin hurdles and strict processes to go through to get equipment and technology installed. Because we don't use Wi-Fi, this actually helps us tremendously in that we're not reliant on hospital IT departments to help install our solutions. When our solution is deployed in hospitals, we are told time and again that it so much better than RFID tags and barcodes, and a great return on investment for the hospital. It's this sort of feedback that gives us a real buzz!

Patient Tracking

Over the past few years, we have seen an increase in the demand for patient tracking in healthcare settings. Patient tracking means that staff and nurses know the location of a patient at all times, and can also monitor them in case of falls or injuries. Hospitals are big, complex environments encompassing a number of buildings and it's easy for patients to get up and wander around, if they're able to, without being noticed. It's not like an office building where you have a temporary pass that says who you are and who you're meeting – you might be in a gown or visiting for day care and it's

really hard for security staff to know who is meant to be there and who is not. In the UK, you can usually just walk into most hospitals without anyone asking who you are, or what you're doing there.

Patient tracking can use RFID and connected IoT technologies to monitor a patient's passage through a hospital when they pass certain receiver points, such as a doorway, or just locate automatically and in real time. Imagine a system that basically tells you the location and high-level condition of every patient in the hospital, where they are and where they need to be next – for example if they have to go for an X-ray or return back to their bed. A porter will often help some patients move around the hospital, but there is a disconnect in the information flow between where they are, what they're doing and their current condition: it's still based on manual non streamlined processes. There is also huge opportunity for error.

You've got situations where you have parents with kids, and those kids have to go off with others to be treated. Additionally, new babies may have to be separated from their mother when they are born, and in some rare cases the wrong baby is placed with the wrong mother. Electronic tagging would greatly reduce the risk of this ever happening.

It's not just the tracking of individuals, but the flow of information, that is critical. I know this from personal experience. When my father was in and out of hospital for cancer treatment, he would often see many consultants and doctors, all of which had a separate piece of information that they wanted to communicate or record, and things slipped through the net. During a typical inpatient's stay, they are handed off twenty-four times on average, according to The Future of Healthcare 2022 Hospital Vision Study, and each hand-off could mean faltering communication and a delay in treatment.

Of course, there are privacy considerations to be thought out when it comes to tracking individuals in a hospital. Some patients may not want to be

tracked and the hospital will need to protect that data. But to have a seamless flow in terms of location and information will, I believe, be a hugely beneficial thing. Furthermore, it creates a secure environment due to everyone having a tracking ID when they enter the building. Again, according to the same Future of Healthcare study, the use of location technology to track patients through the hospital is set to grow from 58% to 96% over the coming years.

Drugs and Vaccines

Drugs often go out of date, or they need to be kept in temperature-controlled environments so they don't spoil before they are able to be used. The case is even worse for vaccines which require very strict conditions both in transportation and once they have reached their destination. Covid vaccines, in particular, have to be kept at very specific temperatures – the Pfizer vaccine, for example, needs to be kept at temperatures down to -70 ℃ .

It is not just at the point of care that problems arise for pharmaceuticals, but also at the point of production. According to CloudLeaf's State of Supply Chain Visibility Report, during the manufacture of drugs there is 30% product damage or spoilage, 25% have temperature excursions, 24% have unexpected delays, 21% are lost or misplaced inventory, and 20% have compliance issues. You can see the opportunity if these companies were to deploy smart connected technology, like trackers to assess whether drugs were going outside of certain temperature parameters, and location sensors to find them quickly.

In mid-December 2020, before any Covid vaccine was rolled out, we were in conversation with the UK's Vaccine Taskforce, who are responsible for the distribution of the Covid vaccines throughout the country. They could

hopefully see that we had a pretty good solution to track and maintain these vaccines. Fortunately for the country, but maybe a little unfortunately for us, they decided to distribute and get vaccines around the country using the logistical divisions of the British Armed Forces to manage the whole process. Of course, we would have loved to have been involved, but actually the Covid vaccine rollout was a great success for the country, and the UK achieved one of the best vaccination rates in the world. Maybe one day we will play a part in the global rollout of many other types of vaccines in countries where there isn't major logistical infrastructure in place, and therefore technology will play a crucial role. This will likely be ongoing process when it comes to not just Covid-19 vaccine logistics, but also for other diseases and infection controls.

I guess the message to any pharmaceutical company out there is that if you are not using connected IoT technology to track and maintain the condition of your pharmaceutical products, whether they be drugs or vaccines, then you are missing a major trick. The cost savings are potentially huge, because your waste and spoilage will be so much less. You can also assure customers of the quality of your products in hospitals and other healthcare centres around the world, and on the high street in pharmacies.

Remote Patient Care

A major growth area in the past few years, and certainly since the pandemic started, has been in remote patient care. So, what is it? Remote patient care is where you administer medical services and manage patients outside of the hospital and in the community. For example, instead of having a patient come to the hospital and be treated at the hospital, you treat them at their home instead – often a much more comfortable environment for the patient. During the pandemic, hospitals wanted to keep as many people as

possible out of hospital, and remote patient care grew so that only the most needy patients were admitted to hospitals, with the rest treated in their home.

When people are treated in their home, you need to have medical equipment and devices out of hospital and on the road. Syringe drivers and other pieces of equipment are needed by nurses in the community so they can treat their patients just as well as if they were in hospital. Some of this equipment can be worth several thousands of pounds and may have to be kept in patients' homes for a period of time, to be used by the patient when the nurse isn't there. This comes with its own risks – there is no one there to monitor the equipment, and it could get lost or even stolen.

As such there is a distinct need for asset tracking and monitoring in remote patient care. Connected IoT plays a part in keeping this equipment secure and monitored, and therefore plays a huge role in remote patient care outside of hospitals. This trend will only continue over the coming years, and indeed in the UK it is now one of the objectives of NHS England to accelerate remote patient care going forward.

We are seeing fantastic innovations when it comes to new procedures and equipment for patients with a variety of conditions. There are companies out there who can provide smart cameras in tablet form, that a patient can swallow, and the camera will take pictures and record the condition of the patient's body and stomach internally. The patient just has to swallow the camera and it will record images from inside the body. This can be used in situations where someone has to have an endoscopy to investigate issues within the intestines. Currently this procedure is done by sticking a camera connected to a pipe down someone's throat and then pushing into the stomach, a very uncomfortable procedure and difficult to undergo.

With this new smart camera capsule technology, it is possible to undergo these procedures in your own home, rather than go to a hospital.

What used to be a very uncomfortable and frightening procedure can now be done non-invasively, in relaxed surroundings, in your own home. Other equipment is needed to work with the camera, such as recording devices and equipment to capture the images. As you can imagine, this equipment is very expensive, the sort of thing that needs tracking and monitoring if it is to be used much more extensively in communities outside of hospitals.

At Findaa, we work with organisations to solve the problem of tracking and monitoring of these very expensive pieces of equipment. We can tag the box that the camera and recorder comes in so we can see whether the equipment is in the person's home and or not. This protects the equipment from getting stolen or being moved to the wrong location and provides added security and safety benefits for patients using it.

Emergency Care

In emergency care, medical equipment is carried around by paramedics and emergency staff to use with ambulances and helicopters to provide medical assistance very quickly. We know from speaking to emergency care providers that paramedics can leave equipment at a site they have attended in response to an emergency call. This also happens when HEMS (Helicopter Emergency Medical Service) rescues or treats people in remote locations such as mountain ranges and national parks. When you're working in these situations it's often very loud and confusing with helicopter rotors still moving, and people who are scared and need treatment very quickly.

In these situations, it's very easy to imagine equipment being left behind or dropped accidentally, and then very difficult for a helicopter or ambulance to go back to pick it up, especially if they've been called out to other emergencies. In many cases, they don't even know they have left the

equipment behind somewhere until a check at the end of the day, and it is hard to know exactly where that equipment has been left. Again, connected IoT technology has a role to play here in that it can check automatically if equipment has gone back onto the ambulance or helicopter. If not there is a tracking beacon on it so that emergency care staff will know where and when equipment is left behind, and can then go back and get it later.

Connected Healthcare

Healthcare is a major growth area of for connected IoT technology, and it's a big part of our business. Hospitals have had to adapt very quickly to deal with the extra burden of the pandemic, alongside any other problems they might have had before the pandemic began. It is my prediction that there will be much larger focus on healthcare in future from an investment, technology, and innovation perspective. This is especially so because we have aging populations in many parts of the world where people are going to suffer from chronic conditions and need substantial care in their old age.

Medical innovation is driving changes around the world, but it has to be done in conjunction with improved cyber security. Today you can monitor your heart rate and fitness from your watch and this data is sent back to central data repositories. But sensors are improving and in future you will be able to monitor a multitude of human health conditions from your watch, which might then be accessible to doctors around the world. The benefits are tremendous in that if you are travelling, doctors will know very quickly about your medical history. But with this the risk of data loss increases.

Healthcare in the UK is very process driven, with multiple levels of decision-making and a lot of time involved in implementing new technology into healthcare providers and hospitals. When looking to get new innovation embedded, it can sometimes feel like trying to change the direction of an oil

tanker! However, the way technology is changing, and the fact that it's having such a positive impact on patient outcomes, it can only be a matter of time before more and more connected technologies will be embedded into healthcare. Indeed, connected IoT spending growth in healthcare is now out-performing every other sector. According to Help Net Security in 2020, the growth rate in IoT spending in the healthcare industry represents a compound growth rate of 14.5% per annum, which is larger than all other sectors currently. Even larger than 'smart home' spending, which grew at 14.4% in 2020. Long may we continue to see the growth of connected IoT in healthcare!

Chapter Eleven: Retail & Cold Chain

In this chapter we're going to look at some of the other areas where connected IoT can be used extensively including retail, cold chain, food and beverage, and luxury. In some cases, they share similarities with supply chains and logistics, in that these sectors will also have supply chains and use logistics companies to transport the goods and items.

Retail

To be completely clear. Retail is changing dramatically, and it has seen huge change because of the pandemic. Sadly, you only have to walk through an average town in the UK to see the number of shops that have closed, boarded up and empty. It's a combination of the fact that people haven't been able to go out shopping, but also to do with the long-term trend of online shopping. For me it's sad to see these shops closed and boarded up, but positively there will likely be a renewal of town and city centres with other uses for those properties. For example - private accommodation, entertainment spaces, restaurants, and bars. Cities and towns will hopefully become lived-in and lively places again, instead of just areas to shop or to commute to, and this can be a good thing. Indeed already post pandemic, I see life seeping back in to towns and cities nicely.

I can also see a renewal of physical shopping in future, too, as people want to physically look at items before they purchase them (probably online), or, in the case of clothing, be able to try them on. During the pandemic, it sometimes felt that online retailers were just trying to hold onto cash as long as possible, they could make refunds for returned goods much quicker if they wanted to, but maybe chose not to. However, that didn't stop people

shopping online, indeed Amazon's monthly visitors increased from 2 billion to 2.7 billion since the beginning of the pandemic, according to Statista.

Many brands have started turning to IoT in retail which is expected to grow to $94.4 billion in 2025.

- Digiteum

Connected IoT can be used to drive new experiences and opportunities in retail. For example, if you walked past a store you had previously visited or purchased stuff from before, the window display might dynamically advertise products specifically that might interest you. It can do this because of the proximity chips in your phone triggering the personalised advertising in the store window. It reminds me very much of the movie *Minority Report* with Tom Cruise where you had people enter stores and an avatar would welcome them by their first name, telling them about their buying history and what they may be interested in purchasing this time round. With connected IoT, these opportunities are now becoming reality.

Furthermore, as consumers become more interested in the sustainability aspects of a product and how it was produced, the ability to share this information dynamically will become more of a reality. QR codes on products can be used to access web pages that explain how and where those products were made. But with data from connected IoT you will be able get much more granular information including total CO2 miles travelled to deliver the product, the direct sources of the raw materials needed to produce the product, the condition of those items throughout the whole supply chain etc. Consumers now want to be fully informed and know that what they buy

meets with their individual values.

So how can connected IoT help retail:

1. **Personalised Communications**
   Retailers become aware that you're visiting stores every so often and embedded sensors can recommend certain things to buy within the store, based on communicating with your smart phone. For example, Starbucks uses IoT beacons that can send notifications to your phone about new promotions and products in the store.

2. **Optimise Product Usage**
   Some connected products such as electronics have sensors that communicate directly to manufacturers, so that if changes need to be made to that product remotely, they can be. We have already seen software updates for many things and that are widely used today, but this is the ability to automatically resolve problems remotely without an engineer's visit.

3. **Monitor and Predict Store Waiting Times**
   By using smart cameras and other sensors you can tell how many visitors there are in the store at any one time and therefore decide whether you visit at that moment. It can also be used to tell you the most efficient times to visit a store. Very useful, especially if elderly and other shoppers want to visit at quieter times.

4. **Update Customer on Delivery Status**
   By tracking and monitoring items you're able to communicate directly to

the customer, to tell them the status of where their orders are, and when they will be delivered. This involves tracking the item by automation, not by scanning, which is how it's currently done by many delivery service providers.

5. **Increase Store Management Efficiency**
   By embedding sensors into items or packages you can tell if there has been any shrinkage within the store, meaning if goods have gone missing or stolen. Items can be geofenced so that if they go outside a certain area, or set location parameters, then alerts are sent to security staff in order to highlight where the product leakage is.

6. **Location Tracking**
   Location tracking has a number of uses from monitoring when a product is sent out for delivery to a customer, to tracking incoming supply from manufacturers and distributors around the world, so you have accurate data points on when items will be available to sell.

7. **Inventory Management**
   Tracking inventory with smart tags can tell you if your product is in stock and how many items there are. Using smart tags you will not be reliant on barcodes or QR codes, and therefore your inventory management becomes automated and more efficient.

8. **Smart Shelves**
   Smart shelves can do a number of things. Firstly, seeing that a shelf is empty and needs restocking, it will send a message to staff to restock. Secondly, shelves with products that can speak direct to consumers via

smart phones. For example, it can ping a smart phone if an item on a digital shopping list and needed by a customer, is passing by that shelf.

9. Predictive Equipment Maintenance

In retail, predictive maintenance packages could be sold with the product. So if a dishwasher becomes broken it could speak to its manufacturer, tell them there's a problem occurring and that a part needs replacing. Then with this information, an AI algorithm could automatically arrange for an engineer to visit.

10. Supply Chain Optimisation

We've spoken a lot about supply chain optimisation, and how by embedding senses throughout the supply chain you can increase the speed of delivery and optimise routes when shipping. In retail, physical items are sent and delivered regularly, by optimising this it will help companies sell more of their products.

At a time when so much of the world moved to using digital channels, it is now good to see retail stores start to embed innovative technologies in order to survive in this new environment. By embedding connected IoT technology, retail stores are able to digitise many items by giving them a digital identity with data and information. Therefore you begin to create a perfect retail world where you can go and touch and feel the product you want to buy, but also benefit from all the things you get online such as customer reviews and detailed product information. Your smart phone then gives you the choice as to which channel you want to purchase the item on, online or in store.

Cold Chain

Cold chain is a low temperature-controlled supply chain. Example products would be food, pharmaceuticals, chemicals, and anything else that needs transporting from A to B in an environmentally controlled manner. Today warehouse staff, transportation staff, and others will often monitor the temperature and record that data into a spreadsheet or on to a clipboard. It's a manual process, and its reliability is based on people inputting the data correctly.

The biggest problem with manual cold chain monitoring is that temperature logging is prone to errors. This is because workers are often busy, which can result in inaccurate or missed temperature condition records. This can have a major impact on the quality of foodstuffs and in some cases be dangerous – if certain things go outside of temperature parameters, they can melt, be spoiled, or make someone ill. Not to mention the reputational damage that is caused by selling a product that has gone off or is spoiled.

By using connected IoT you're able to achieve several benefits in cold chain monitoring. Most importantly, temperature logging is automated and therefore you don't have to worry about checking temperature gauges or thermometers manually. It's all done automatically in real time, with data sent to the cloud and shown digitally giving you the information you need. The possibility of human error is much reduced.

Ultimately you are simplifying cold chain processes which reduces complexity. If you're a large business with fleets of trucks and transporting many temperature-controlled items, this can mean more efficiency and positive cost savings. If you monitor the temperature of tens of thousands of items in hundreds of trucks, ships, and planes, across large distances, using manual processes, then you will know it's a highly complex and costly activity. Connected IoT can do all of this automatically in real time, keeping

costs down compared to the alternative.

It's very easy to combine real-time location tracking with temperature monitoring, and having those sensors embedded into a small tag makes it simple to monitor the location and condition of items. It’s a much cheaper way to keep an eye on your cold chain assets, and to make sure that they maintain their value by supplying them to customers in the best condition possible. So whether you ship ice cream, frozen foods, seafood, fresh produce, and beverages, then you should be using connected IoT!

Luxury Items

Luxury items include things like fine wine, fine art, jewellery, precious goods, artefacts, and designer clothing. Luxury items, being expensive, have extra security implications around them. They are items that people want and are often prepared to do anything to get them, and sometimes take risks to do that. It may be that these products are made into replicas, counterfeit goods, and authenticity becomes an issue – people need to be sure they are not buying fake goods. The data surrounding these products can be used to authenticate them and to keep them secure.

Let’s take the global wine industry as an example. It has a market value of US$304 billion of which approximately 5% is fine wine, and that would represent about $15 billion. A study conducted by a French newspaper *Sud Ouest* found that approximately 20% of the fine Bordeaux and Burgundy wine market was fake, if extrapolated out to the global fine wine market it would represent about $3 billion of fraudulent wine around the world. The fake wine market gained notoriety in the 2016 documentary *Sour Grapes*. Counterfeit wine is most likely sold at auction houses rather than wine merchants and therefore even harder to authenticate when buying in auction conditions.

Connected IoT has a role to play in helping to authenticate fine wine and other luxury goods. Not only can you collect historical data points on location and condition over time, and therefore track and trace the history of an item, but you can also apply other data points and technologies as well, such as blockchain – something we're going to talk a little bit more about later. Unfortunately, these technologies weren't used when the famous wine counterfeiter Rudy Kurniawan was arrested in 2012 for having faked millions of dollars' worth of fine wine over several years.

Fine art is often transported between private homes and museums on loan and has to be tracked and monitored so that pieces of art can be authenticated. In the movie *The Thomas Crown Affair*, a famous painting is stolen in New York and taken to a private home before being returned: IoT trackers would have made this much more difficult for the fictional art thief! Furthermore, sensors mean paintings can be monitored for humidity levels, a factor in paintings deteriorating over time.

According to the OECD, 3.3% of all world trade is in fake goods and counterfeit products. With global trade valued at over $19 trillion in 2019, it represents about $627 billion in traded counterfeit products. With all the luxury brands out there, knowing what's real and what's not can be very difficult as counterfeiting gets more advanced. Providing authenticity for products can be very important and people will often pay more to know what they are buying is the real deal.

If you were to combine connected IoT with blockchain you would have a bulletproof way of authenticating many physical items. Being able to see its history, location, and condition over time, you have very high levels of confidence that the item you are buying is what it says it is. If connected IoT could make an impact on the global counterfeiting market, it would solve one of the biggest problems for global luxury brands, and enable them to charge a

premium for the guarantee that something is authentic.

The tracking and monitoring of luxury goods may be seen as the preserve of the rich, but they are often the riskiest assets to monitor and track due to their value. They are also items that tend to travel quite extensively, whether it be transporting a painting or jewellery, there are major risks associated with that. There is also sometimes a little paranoia when it comes to security staff – can they be completely trusted to look after precious items? Having a non-human independent technology-based tracker provides you with direct information as to location and condition, and circumnavigates any friction caused by using third-party security staff.

Chapter Twelve: Insurance & Asset Financing

Insurance and financing are not areas you might associate with connected IoT: they are service economy sectors that do not make anything tangible, but rather mitigate risk and provide funding opportunities for organisations. However there are good examples as to how connected IoT could be used in these sectors.

Insurance

When you think of insurance, you probably think car insurance, house insurance, or protection against losing any of your assets. But connected IoT has brought opportunities such as being able to build new innovative insurance products, open new distribution channels, and enable more prediction and prevention of potential client losses. The number of connected devices is set to reach more than 50 billion by 2025, and all of these will be able to provide detailed information as to how they are performing and if they need any costly maintenance. This includes people who may have wearable devices and monitors to assess their health and determine how fit and healthy they are. They provide volumes of data that can be used by insurance companies to assess individual risk levels, meaning more tailored insurance policies.

One of the most common examples of connected IoT in insurance is with car insurance and the use of telematics. Telematics provides the opportunity to assess a car's journey. Is it being driven too fast? Are there erratic driving movements? Is there too much quick breaking from the driver? Has it needed more maintenance compared to other cars? A car insurance company will take all this information and assess your risk profile as a driver.

Indeed, insurance companies will often give you a discount if you use telematics in your car because they are able to assess your risk profile much more clearly against everyone else in the market. You can see how insurance companies can use this as a strategic way to tailor insurance premiums to individuals, so that they are charged exactly the right amount for their individual risk level. If they are deemed to be a safe driver, they will receive a better premium compared to someone who is deemed to be a higher risk driver.

'A model of 'repair and replace' to "predict and prevent" will fundamentally change the relationship between insurers and their customers' ***- Chubb Insurance***

According to the Traffic Injury Research Foundation in 2019, more than 90% of road crashes are the result of human error or condition. Even more worrying is that drivers under the age of 25 cause 85% of all serious injuries on the road. This goes some way towards explaining why insurance premiums for young drivers are so high compared to older drivers. So instead of tarring everyone with the same brush, by using telematics you can really delve deep into the granular data of each driver, to see how they compare against each other and really tailor the insurance premium for that individual – this can only be a good thing for both the insurance company and the customer.

Other insurance segments could benefit from the same granular detail to tailor insurance premiums for other insurance products. What if you were

able to get the same granular detail for cargo shipments? Or on the transportation of fine art and luxury goods, or for the protection of household items? By having sensors attached to insured assets, the insurance company will be able to assess how those items are being handled and protected by the asset owner, therefore able to charge a premium based on the risk level of the insured customer.

The areas of insurance underwriting that protect these types of goods are Marine, Specie, Property, Casualty and Commercial lines insurance, but from a connected IoT perspective they have not undergone the same *digital transformation* as the car or health insurance markets. Underwriting insurance tends to work in silos whereby individual insurance areas work independently on their own products, without much integration or communication with other market areas. We found this out the hard way when we were trying to get various insurance markets to understand how this technology can be applied for them, in the same way that telematics greatly assists car insurance. Sometimes we were met with a lack of understanding of how this technology could be used, and *again* it was a case of executives not really understanding how this digital transformation could improve their business.

However, I'm confident this is changing. All areas of insurance will eventually understand the clear benefits that connected IoT technology can bring to them. A highly innovative company, Dacadoo, helps insurance companies provide health insurance based on a customer's health score, made up of several health data points. If you have a higher health score, then you might have a lower health insurance premium. Conversely, if you had a lower health score and were deemed as less healthy, then you might have a higher health insurance premium. It's a great example of a forward-thinking innovative business transforming health insurance!

You can apply the same principles to other areas of insurance. If you provide insurance for logistics or warehousing companies, you could insure them with a lower premium if they have quality asset tracking and monitoring capabilities. You can quote manufacturers a lower premium if they are tracking the items in the factory with connected IoT technology because they might have reduced loss risks. You could calculate lower insurance premiums for food production facilities and cold chain companies that track and monitor temperatures foodstuffs better, meaning less wastage and fewer potential claims on insurance. If insurers know you are managing your assets in a very efficient manner and have better oversight of your supply chains and distribution, actively trying to minimise any potential loss or damage, then you will be a lower risk and potentially charged a lower premium.

This is a great benefit for customers who want tailored insurance policies and better premiums. Insurance companies also benefit from being able to innovate and create new types of insurance products. Product innovation enables insurance companies to differentiate themselves and make themselves stand out more clearly within their markets. It should also attract more demand as people see the potential of being charged lower insurance premiums for the same level of protection.

To enable this product and market differentiation, insurance companies will probably need to partner with external third-party companies, like Findaa Technology who can help build these solutions. Connected IoT will be a big part of the insurance industry in future, and not just in relation to car or health insurance.

Asset Financing

I began the chapter by noting that the benefits of connected IoT

technology may not be so obvious in financing. With asset financing and leasing, money is lent to individuals and companies that want to buy assets and equipment for their business and other areas. It means that they don't need to have the capital saved in order to expand their business.

Like with insurance, connected IoT can lead to more personalisation of financial services products by being able to assess lending risk levels better, and then tailor the product to the customer. IoT is really about sensors generating data, which is then analysed and turned into insights for better decision-making. So, if sensor data can help determine whether a financial services company should lend money to a customer, then there is a market and product innovation opportunity.

An asset finance company can use connected IoT to help them better understand the level of risk in lending to a business who wants to acquire an asset and monitor how that asset is maintained once purchased. The reason this is important is because the asset financing company will often have a claim on the asset if the company defaults and doesn't keep up payments, in the same way that a mortgage company has the right to repossess your home if you don't keep up with mortgage repayments.

Clearly the asset finance company wants there to be the maximum possible value in the asset, and so it's in their interest to make sure it is well maintained and kept in a good condition while being used by the customer. The data they get from the tracking devices enables them to make sure those assets are kept in the best condition possible and warned if there is a problem. If financed assets and equipment have tags, the finance house could charge a lower lending premium as a result.

I think there could be great use for this type of finance product for industrial and manufacturing equipment, and for consumer assets. For example, your mortgage costs might decrease if you install things like

sensors on your water pipes and use smart locks. Both the financial services company and the customer can benefit by utilising connected IoT as part of the terms and conditions of a loan agreement. In fact, if I were an asset financing company, I would insist on customers using this technology to help lower the risk level of the loan, and to protect the assets if the worst happened.

Of course, professional services organisations can still use connected IoT for employee productivity and health and safety improvements. By knowing how staff work, processes can be made more efficient. This will likely have to be done anonymously without individual names associated with the sensors due to privacy regulations. There are some positive user cases in this area and we are going to look at some examples later on.

The world of connected IoT can impact many different sectors in a positive way and therefore should be central to any digital transformation that organisations have planned. The next chapter will look at some other sectors that will greatly benefit from using this technology.

Chapter Thirteen: Construction & Other Sectors

There are multiple sectors that can benefit from connected IoT technology and that is a great thing. In this chapter we're going to look at some other areas including construction, facilities management, public sector, and livestock. They all have pressing needs for solutions to numerous problems, and which could benefit from worker and asset, tracking and monitoring.

Construction & Facilities Management

The adoption of connected IoT technology in the construction sector has been quite slow. This again is largely due to the lack of understanding of what the technology can do and how it can benefit construction. However, with the increased use of building management systems (BMS) to monitor a building, the adoption of connected IoT technology will also increase as well, especially as there are many benefits to be had.

These benefits include the monitoring of building materials within the supply chain of construction projects, remote waste management monitoring, making construction workers safer on site especially when working in dangerous situations, and finally, in managing the infrastructure of a building in terms of the sensors that can monitor leaks, gases, heat, and so on.

Increasing population density and urbanisation means an increase in need for accommodation and facilities. The Covid pandemic may have delayed this when there was some migration out of cities, but the long term trend is for more, not less urbanisation. According to the Construction Product Association (CPA) the construction output will increase by 12.9% in

2021 – with more growth forecast for 2022, albeit at a lower level due to supply chain delays globally.

Connected IoT could be used to track equipment and materials through the supply chain to make sure they are delivered at exactly the right time to site. In construction, if any element is delayed then it can have huge cost implications for the construction project. What if project managers could see potential delays on a viewable data dashboard, and then look for alternative suppliers quickly? This could have positive implications for the overall cost of a construction project, and lead to huge efficiencies for the sector.

In addition, construction workers often work in dangerous situations – for example building underground basements or working at height with high-rise buildings. Then there are crane drivers, delivery drivers, plus others involved in the logistics of a construction project, who may be at increased risk of injury. The ability to track all individuals on site in their various functions, will give project managers a very quick and detailed overview of where all workers are and if anyone is in any potential danger. It also provides the ability to move people around quickly and efficiently depending on what activities need completing. A construction project can be a bit like a choreographed show, where the order of events needs to happen seamlessly for it to be successful.

Health and safety continues to be a high profile issue in construction and with connected IoT you could geofence areas so that workers are warned before entering certain zones. If a non-qualified construction worker is in a dangerous zone they shouldn’t be in, then a warning can be given to both them and the health & safety manager. Furthermore you could sense for things such as worker falling over or being hit by something.

Construction materials often cost a lot of money and there are large

security implications of having these materials lying around on site and unprotected when not being used or stored. Tracking and monitoring these materials so that they are geofenced in certain locations when not in use, will create further cost savings by reducing theft. According to the Chartered Institute of Building, in a recent survey, 21% of construction firms reported thefts on sites every week. Losses from theft in construction can amount to over £800 million per annum in the UK alone.

Placing trackers on valuable materials also enables project managers to locate materials in the right location on a construction site. This helps to maximise the use of space available and position them where they can be accessed quickly. Finally, you're able to monitor items that are volatile such as certain chemicals or other sensitive products that need to be used for a project. This involves having sensors to monitor heat and gas to make sure that these are kept in stable conditions.

Once a building is constructed and occupied, connected IoT can be used to help monitor the building environment, also known as facilities management. For example, being able to know if fire extinguishers are in the correct position and have enough fire containment liquid in them. Also if the Heat, Air Ventilation, and Cooling (HVAC) systems are working correctly and not overheating or vibrating too much to suggest a maintenance issue. All these things can now be monitored remotely within a building and before problems arise.

Infrastructure

This leads nicely on to large infrastructure projects and utilities like building power stations or water treatment facilities, these projects are mainly controlled by central and local governments. There are clear user cases here for connected IoT technology in monitoring various elements within the site,

for example water facilities will need to be checked for leakages and the condition of the water itself, before it is released. In waste management, having sensors that are able to inform managers of problems would help mitigate any problems quickly.

Power stations have their own unique set of issues to deal with. Often, there is large, complex machinery working that needs monitoring, and high temperatures in various parts of the power plant that need to be strictly controlled. Here it's a case of providing sensors to monitor all areas of the plant to make sure things don't overheat, that complex machinery is not vibrating outside of set parameters, and everything is generally running smoothly. If not maintenance teams are informed and called upon to respond.

Heavy industry and infrastructure companies also have significant worker health and safety concerns. Indeed, many conversations we have with prospects in this area is related to improving worker safety with connected IoT. According to the Health and Safety Executive (HSE), 693,000 people sustain an injury at work every year leading to an annual cost of over £16.2 billion. A staggering amount borne by employers! Understandably, this is often at the top of agendas in organisations where there's an increased risk of accidents.

But with technology you can monitor workers in dangerous facilities to minimise accidents and so staff can be located very quickly if the worst was to happen. When the Fukushima nuclear power station accident happened in Japan in 2011, and the Chernobyl nuclear power station accident happened in Ukraine in 1986, the location of staff was a major difficulty. Many workers could just not be accounted for. Today, if you embed sensors into a workers security pass or hard hat, you can quickly locate and warn individuals of impending issues. Connected IoT has a large protective role to play in improving worker health and safety.

Smart Cities

There has been much enthusiasm about smart cities over the years, and for good reason. So what is a smart city? A smart city is an urban environment that uses advanced technology to improve energy distribution, streamline rubbish collection, reduce traffic congestion, and improve air quality. This has major environmental benefits in areas that often have a lot of pollution and a high population density. It's applying connected IoT technology to solve problems in creative ways. A simple example would be connected traffic lights that receive data from sensors and then adjust their lights and timing to respond to real time traffic. By doing this it can help to reduce road congestion.

There are even applications for wastage management whereby sensors placed in bins automatically inform wastage companies that bins need to be emptied or replaced in certain locations. Use of skips in towns can use the same technology so that the skip company will automatically know when the skip needs to be emptied and where it's located. You're using technology to automate many of the repetitive and manual processes that take place in a city.

For public transportation you can tell which trains are busy and which are not, or even which seats in which carriages are occupied. You can see when a train or a bus is about to arrive and can plan much more effectively via apps, cutting down the time waiting for public transport. Then there are smart streetlamps that will only operate when environments are busy, thereby reducing energy use; sensors in parking spaces telling you if they're free, reducing time hunting for a parking space. Talking lampposts can even give you advice and tell you where to go!

This is all really important, because 54% of people worldwide

already live in cities according to the United Nations, and this is expected to reach 66% by 2050. It means increased urbanisation will add another 2.5 billion people to cities over the next thirty years. Only the use of technology will help address this increased influx, as more and more people migrate to urban conurbations and make more demands on already stressed infrastructure.

Armed Forces

The world of defence is changing quite dramatically due to the implementation of advanced technologies and connected IoT is playing a major role in this. You can know where all your assets are on the battlefield without any human intervention or communication. Combined with the fact that you can now autonomously control weapons in the field means you're effectively turning theatres of war into computer games. If you add in tactical combat robots like DOGO which was designed by General Robotics and comes armed with a Glock 9mm pistol, you see that reality is beginning to mimic science fiction movies such as *The Terminator* and *RoboCop*.

So let's take a deeper look as to how connected IoT is being used for military purposes. Firstly, you can survey battlefields very clearly in terms of the assets deployed and the terrain that they're covering. You're able to position all friendly and non-friendly assets to plan and strategize as to the best course of action in the field. From here, you can coordinate logistics and supply chains which will have their own sensors and monitors on board to track location and timings of delivery. There will be a data dashboard with everything mapped out, for greater awareness as to where everything is deployed from both sides. You will have an overall picture of where things should be moved to as the battle unfolds.

Secondly, with sensors you will be able to monitor your soldiers'

location and health. These sensors will transmit data back to central command where individuals can be monitored in terms of health and any injuries that might have occurred, and decisions made as to where soldiers should be deployed or positioned. It will also be able to tell soldiers to take certain medications or supplements to boost energy levels or prevent health deteriorating based on current conditions.

Thirdly, you will be able to monitor inventory more effectively, and determine how much you've got in the way of supplies and items required for battle. These may be stored remotely, or in theatre, and you will be able to control the distribution of assets and inventory more efficiently based on needs and requirements. This will effectively measure when supplies might run out, and control the movement of military personnel into the right locations.

Finally, and perhaps most importantly, you can run simulations based on all the data you're receiving from the battlefield and supply chains, and then determine the best course of attack and defence. You will be able to plan for various scenarios based on your assets, food, location, time, health conditions, and the location of your targets. You will not want this data exposed and, as such, strict security protocols would need to be in place. We will talk about data security in more detail in a later chapter.

Animals and Livestock

Moving to a somewhat more genteel user case we are now going to look at racehorses! Racehorses can be worth tens of millions of dollars. Protecting and monitoring equine assets can be a very important role for any horse-trading business or livery. Even lower value horses are still easily worth thousands of dollars, and therefore could also benefit from this wonderful technology.

The issue here is that horses like to roam. They like to be free, out in the fields, but this can lead to problems in terms of controlling where horses are. Horses can jump fences and hedges, and get through gates quite easily, they could even escape from a livery or be the subject of a theft, which is not uncommon. It can be a major problem with any horse-trading business if owners and buyers do not have visibility of security and the protection processes in place to keep their assets safe and secure.

An asset that can be worth tens of millions of dollars is worth protecting very closely, especially for situations where they could be kidnapped for ransom. One of the most famous examples of this was when a thoroughbred racehorse called Shergar was kidnapped from a stud in County Kildare Ireland in 1983. Shergar was owned by the Aga Khan, an Imam and businessman. The horse had been sent to Britain four years earlier for training and raced in numerous sweep stakes including the Epsom Derby and the Irish sweeps Derby. A ransom of £2 million was demanded and if not paid the horse would disappear. The ransom was not paid and, sadly, the horse was never seen again.

The opportunity for horse theft or loss is still as great today, if not greater, because of the immense value of some of these racehorses. Clearly, connected IoT technology did not exist in the 1980s, but if it had done, the situation may have been very different. The horse would have been tracked and potentially found very quickly.

We have worked on technology that can be embedded into horse collars so the animal can be tracked at any point in a stud environment, whether in the stable, training ground or out in the field, and an alarm will be raised if the horse travels outside of a set zone. Tracking things like racehorses both indoors and outside is fairly complex due to the changing indoor and outside environments. There will mean less reliance on manual

checks to see where the horses are at any one time. Some of these training grounds are huge and they are often taken between racetracks and various indoor facilities, so having a tracking device is hugely beneficial.

We can also assess a horse's condition – its temperature, whether it is moving too quickly, or has sustained a shock at any point. This is very similar to patient tracking in a hospital where they may wear a wearable device that monitors the condition of the individual in addition to their location. A dashboard can be used to track the location of a racehorse at any time day or night 365 days a year, without the need for people to go and check on them all the time.

Livestock and farm animals do not have the same high value as a racehorse and therefore it may not be something that is desirable or economical to do in a farm environment. The same cannot be said for pets! Pets, like your dog, will have intangible value and owners are often prepared to spend a small fortune on making sure that their dog is secure and protected. Unfortunately, during the pandemic lockdown the number of dogs stolen went up dramatically due to increased demand for them. More people were looking for excuses to go out and exercise, getting a dog seemed like the perfect thing to do.

Having a simple tracking and monitoring device placed on the dog, like its collar, means it can be tracked at any point in time as long as the tag is not removed. There are ways of making this discrete so that any potential dog thief will not know that the dog is tagged with an asset tracking device. These simple outdoor pet trackers are becoming much more common, and you can purchase them fairly easily and cheaply. The key thing is to also have a data platform or app so you can visualise the location of the animal at any time

Chapter Fourteen: The Consumer Market

This book is predominately for B2B users, but it would be remiss of me not to say a little about the consumer market, which in future will be a huge user of connected IoT technology. We've already touched upon smart home technology. Go into any home store and you will see this technology available to buy off-the-shelf. But the concept of a truly connected home, with a lot of automation and the data visualisation of personal asset locations and conditions has not yet been realised.

What is the visualisation of assets? I want you to imagine an app or data platform that will give you an overview of all the expensive assets in your home, where they're located, and any information on their condition that might be relevant. On the screen you will see an internal map of your home with different floor levels. From this you will then be able to see a visualised depiction of where your passport is, your jewellery location, watches, and all other valuable or sentimental items that you might have in your home. You will know in an instant where every physical item that means something to you is, so you now have a complete inventory of physical assets. Not just in the home either: you will be able to track, trace, and monitor items that you may have stored in a warehouse, or whilst you're travelling.

Can you imagine the value this will bring when it comes to moving home, when you have to pack up all your things and ship them to another location? No more losing items in transit. When I was in my twenties, I was lucky enough to be posted to Sydney, Australia, with my job. Still relatively young, I didn't own many things, so it was pretty easy to ship everything overseas. The one thing that I did own of any value was a set of golf clubs

that I wanted to bring with me. When my shipment arrived in Sydney my golf clubs were there, but *not* the golf clubs that I had shipped – meaning I had the same golf bag but not the same clubs. They'd been replaced by *cheaper* golf clubs. On the shipping docket, it said golf clubs 'shipped and received', but they were not my golf clubs!

I had no comeback on this, unfortunately, and it was many years before I could afford a better set. What it showed is that things get shipped around the world based on information recorded by human input, not by technology that can track, trace, and verify. If electronic tags were available then I could have either tagged each golf club or boxed them up and just tagged the box. I would have been able to see where they were, anywhere in the world, in real time. So a consumable inventory of assets is valuable for a number of scenarios, not just moving overseas, but also in moving down the road – or in just having a personal inventory.

Did you know that airlines lose or mishandle around 25 million bags a year according to a BBC report? This declined significantly during the pandemic, because there weren't many planes in the air and fewer bags being handled, but it's still a continuing problem in the airline industry. My advice would be not to rely on the airline to guarantee the safety of your luggage, better to track your luggage yourself using electronic tags, in the same way you label your luggage today. If your luggage does go missing you can show the airline that it's in Madrid, not Malta. It's unlikely airlines will pay for this type of service and if they do, they will probably rely on passive RFID tags which won't really help you. Better to look after your luggage with active asset trackers.

The vision is that you can see an itemised inventory of all your valuable assets, including their location and condition, in real time, and automatically. This has major security benefits when it comes to theft and

misplacement. If your home is burgled, and the police or insurance company ask what has been stolen, you will have a log of what you had, what's gone missing, and where it now is. It's like having a mini tracker on all your assets, not just your car. Everything is tracked and monitored so if something is stolen, police have a very good idea as to who, what, when and how it happened. With electronic trackers, you can do the detective work for them!

The global household insurance market is worth about $225 billion and, according to Allied Market Research, projected to rise to $395 billion by 2027. That's a lot of consumer insurance for household assets. Now imagine that if the items of value were tagged, tracked and traced? The insurance risk will decrease dramatically, with increased asset monitoring reducing pay-outs. You can see that this is so much better than a burglar alarm that rings a bell when someone breaks in. Better to deter before the break-in, the same way car theft decreases when trackers are fitted.

Now a word of caution. If you're going to implement connected IoT in the home, do your homework! Some providers will insist that you use their own private networks to tag, track, and trace – for example, you will have to use a specific type of smartphone for it to work. Now this is all well and good if everyone uses the same type of smartphone and it's nearby to the item your tracking. If not, you will likely have problems in terms of accuracy and data lag. In addition, you will need a decent data analytics platform to see your list of assets, and not just a map with a dot in an approximate location. The market is just starting to get interested in consumer connected IoT, but my prediction is that it will become huge.

As I end this section, I hope you've got a much better idea of the possibilities for connected IoT, how it can be applied, and its huge benefits in various sectors and industries. From supply chains to healthcare, to insurance and financial services, connected IoT provides major benefits in terms of

efficiency, optimisation, and cost savings for those who decide to invest in these technologies.

I’m sure there are many possibilities I haven’t mentioned, where connected IoT technology would make a big difference. Just know that if you own, manage or produce any physical assets of some value, and want to track and monitor them to benefit from things mentioned above, then you will be able to use this technology in the majority of cases. If you would like to discuss your own user cases, objectives, or your business in more detail, then we at Findaa would be very happy to help. You will be surprised what we get asked to track, monitor, and trace!

Section Four

How Connected IoT Works

Here we start to go into a lot more detail as to how these technologies work, and why you would use certain devices as opposed to others. It's what many IoT books concern themselves about, and usually written in a style suited to people with deep technology experience. But this section is written for general users and decision-makers, at a more basic level, so everyone can understand what this technology is and why it can be applied so effectively as described. The thing to remember is that whatever technology used, they are there to generate data and insights, which is the real value of using connected IoT technology.

Chapter Fifteen: Sensors & Connectivity

Connected IoT is so important for any organisation producing or managing physical items or assets, but how does it actually work? In reality, we're talking about a whole bunch of electronics, algorithms, cloud computing, data dashboards, and connectivity networks, to assist the whole IoT ecosystem. So, let's start with the basics.

According to the IT Online Learning article on the History of IoT, the concept of connected devices dates to 1832, when the first electromagnetic telegraph was designed. It was personal direct communication between two machines through the transfer of electronic signals. This was the original telegraph that was used to transmit both communication and information via different mechanisms. Before this, we are in the realms of pigeon carriers! My first job was at the global news agency Reuters, a company which dated back to the eighteenth century, and had pigeons to transfer news and information from city to city.

To quote from the Reuters.com public website 'In April 1850, Julius Reuter started a news and stock price information service using carrier pigeons between Brussels and Aachen, Germany using 45 trained birds. There was a telegraph gap of 76 miles between Brussels and Aachen. The birds were sent each day by rail to Brussels, and they flew back to Aachen with the information. Their flight only took two hours, much quicker than by rail and it worked well. This continued until the telegraph gap was closed in the first quarter of 1851.' This was only 171 years ago! My, how things have changed since then…

Barcodes

Fast forward to 1948, when the first barcode was invented by two Drexel University students named Norman Woodland and Bernard Silver. They were interested in tackling the problem of supermarket stock controls, which needed better inventory management and customer check outs. The barcode reader was a machine the size of a refrigerator, with printout data on the teletype machine or magnetic tape. All the North American railroads adopted barcodes and it became the standard way to track items. Barcode scanning technology, albeit with much smaller, handheld scanners, is still the mainstay in the food sectors, supermarkets, and also throughout healthcare and hospitals in particular. However, times are changing.

The benefit of using barcodes is that they're cheap – but they offer little more value than pen and paper in many situations. You scan an item, record what and where it *currently* is and that's it. Of course, scanners have improved, but with still very limited functionality, and with this more expense is incurred. You need to hire stock control people to do the scanning which can be costly, and you only know where items *were*, not where they are now. There is also no way to monitor the current condition just by using barcodes. When you talk about asset tracking, barcodes are still the 'technology' that most people think about unfortunately.

RFID (Radio Frequency Identification)

The history of RFID goes back to the Second World War, when the British invented radar. A Scottish physicist, Sir Robert Alexander Watson-Watt, invented a system to warn of incoming German planes and bombers. However, the radar could not identify which planes were German and which were British, and it was only when the British saw that the Germans travelled in a certain pattern, and made certain moves, that they could learn to identify which planes were German. This became the first crude passive RFID, in that

the British could now identify German aircraft because of the reflective identity it made.

The British then learned that if they placed a transmitter on all British planes that actively sent out an identification signal, they could identify these planes as friendly. This was, effectively, the world's first active RFID i.e., a signal was actively sent from the planes to a receiver on the ground. Reflection versus transmission of signals, a key differentiator in the evolution of asset tracking.

But according to Mark Roberti, who founded the RFID Journal and is an authority on everything RFID, it wasn't until 1973 that an American, Mario Cardullo, claimed to have received a patent for an active RFID tag with a rewritable memory, and this is the RFID tag that we know today. Other American entrepreneurs like Charles Watson were also inventing locks on doors that could be opened using a receiver and passive RFID tag. The US Government was looking for solutions to track nuclear materials using trackers – this ended up with transponders on transportation trucks with readers attached to the gates of secure military facilities.

In many respects RFID is still used in a similar way today although the applications are more varied. RFID is beneficial to any application where an item must pass a certain point or gate. For example, on a production line where an item has to go from one stage to another and there needs to be a notification that it has reached the new stage. Using RFID in some manufacturing production lines has benefits. But there's also a number of key limitations.

The range of RFID is typically less than 3 meters, so the tag on the item and the receiver need to be in close proximity to each other. As such, you need to deploy many more readers or receivers into an environment to be able to see where the tagged items are, and that can ramp up costs quite

considerably. RFID is also one-way communication, meaning that data is sent from the RFID tag to the receiver and not the other way round. It also transmits just one piece of information, the location of that tag, so you cannot get other data points such as temperature, humidity, light, sound and shock.

As such the application of RFID is limited, and it's not really classed as connected IoT. Indeed, RFID was created before the Internet was even invented. In my view, RFID is a kind of 'barcode plus' solution in that you're placing a receiver near an RFID tag to sense its location rather than physically scanning it with a handheld scanner. You still have to be in close proximity to the scanner/receiver in order to recognise the RFID tag. The fixed RFID receiver can be placed by a doorway or near a gate where items have to pass through. Like barcode data, RFID location data is historical, meaning that once the RFID tag passes the doorway or has been scanned, you lose track of it until it passes by another receiver or is scanned again.

RFID is not automated real-time asset tracking, and can only provide two data points, historical location and time. If you wanted to provide further data points then you would need to use another solution such as NFC (Near Field Communication). This provides more information to receivers but has a much more limited range. The NFC chip, which could be embedded into your smart phone or elsewhere, needs to be very close to the receiver for it to work. In fact, the maximum range is around 10cm. NFC is used for things like payment with credit cards or to use with e-tickets when travelling. Again, it's not a connected IoT-type solution, but it does provide detailed information: when you place the NFC chip close to a receiver it is sending data about your banking information or ticketing information, and therefore has a slightly wider scope.

Bluetooth

Bluetooth is a wireless technology that allows data transmission between two devices. You see it widely used on moveable devices such as smart phones, laptops, cars, or other electronic equipment that needs to communicate. But its uses go far beyond that and can be applied very effectively in environments that require detailed asset tracking and monitoring systems in place. For example, Bluetooth can be used in most of the user cases highlighted earlier in the book because it can effectively transmit data over longer ranges compared to RFID. The maximum effective range of Bluetooth is around 100m – large enough for most buildings – and this range can be increased by placing more receivers within a building.

Bluetooth can provide various data points such as location, time, temperature, humidity and any other type of sensor you might require. It has good accuracy, which drives down power consumption in the Bluetooth tag. And it uses low power signals, especially when it's using the Bluetooth Low Energy (BLE) standard. This makes it ideal to use a small battery that doesn't need recharging for long periods, and therefore can be attached to an asset for a longer time period, sending signals to a receiver. It will work very well in a warehouse-type environment, manufacturing plant, office building, or hospital, where it can be attached to an item and send data to receivers dotted around the building.

Due to having better functionality, Bluetooth is a key technology to many aspects of connected IoT and one of the solutions that we use at Findaa and deploy with our clients. Most Bluetooth solutions are currently using Bluetooth 4.2 version or lower. However, there is a newer version called Bluetooth 5 or even Bluetooth 5.1, which provides some major upgrades from previous versions. For example, Bluetooth 5 allows you to transmit data up to 200m, double the current version, and allows much faster data transfer speeds, which means more accuracy and more data throughput in a quicker

timeframe. This provides for a better data solution for most indoor environments, and therefore we try to use this as much as possible with clients. The downside is that Bluetooth 5 is more expensive than previous versions and therefore needs to be taken into account when designing a solution.

Bluetooth technology continues to get better and evolve, as such by the time you read this book, we may be at Bluetooth 6 or beyond! This is the same for all technology, the benefit with connected IoT is that upgrade paths can be quite simple affairs and often done remotely without the user even knowing. Especially so when we talk about the benefits of 5G later on.

GPS

Now let's turn our attention to outdoor tracking, and central to this is GPS, or global positioning system. GPS has existed for many years and is one of the key technologies used with things like telematics in the transportation sectors. Fleet managers will often use GPS in their vehicles to provide a real-time view of current and past locations, to improve operations and increase efficiencies. GPS uses a worldwide radio navigation satellite system, that communicates with GPS satellites via a transmitter on the connected IoT tag which is placed on the item. GPS is also used in your smartphone to give you your current location and to plan routes with apps like Google Maps or Waze.

GPS has several benefits and is therefore embedded in many of the devices that we build at Findaa for external asset tracking and geofencing. It provides outside asset visual location data on a dashboard and therefore of great importance to supply chain management and logistics. However, GPS is only one-way location communication from the satellites to the GPS tracker. The satellites together are able to triangulate the position of the GPS tracker.

It cannot provide any other data points apart from location and time, which are obviously central to asset tracking of goods and items. If you want to have two-way communication that can report other data points, then you will need to combine GPS with other wizardry for this to happen.

With GPS, the benefits are well noted. You can improve efficiency by mapping out better routes and understanding where everything is at a moment in time. This optimises your whole supply chain and logistics capability dramatically and leads to cost savings down the road. GPS tags become even more powerful when you combine them with other technologies and connectivity networks. Kind of like baking an IoT cake with various electronic and software ingredients!

Cellular 1G,2G,3G,4G

Cellular is a wireless radio wave communication network that is distributed over land in cell formations, with each cell served by at least one transceiver base station. Each neighbouring cell tends to have a different frequency so that there's limited interference between them. The G numbers represent (G)enerations of mobile network standards used and are important in connected IoT. The aim of wireless communication is to provide the same high quality and reliability you get with wired communication such as a landline phone or fixed data line.

It all started in the late 1970s with 1G, which basically means the first generation of mobile communication standards. 1G was used in the first mobile phones developed and used in the 1980s. These phones tended to be very big, with very poor battery life, and used limited analog technology meaning low quality calls. I remember the day my dad brought one home from work and thought it was a thing of magic!

2G connectivity introduced digital communications which meant the

speed of data transfer increased. It was a major network upgrade to go from 1G to 2G. 2G provided a secure and reliable communication channel and introduced the concept of GSM (Global System for Mobile Communications) which enabled small data services such as SMS and MMS i.e., text messaging! You don't really need to get bogged down in the detail here, but it's important to note that 2G introduced the ability to send two-way data communication.

2G was enhanced considerably when GPRS (General Packet Radio Service) was introduced. Packet-switched networks allowed radio resources to only be used when users were sending or receiving data, not at any other time. This led to much more efficiency meaning more two-way data could be sent across the network. 2G combined with GPRS enabled data speeds to increase, which meant you could effectively transfer up to date condition data such as temperature, vibration, shock, and so on. As such, 2G is still an effective IoT solution because of the benefits it brings and the low cost of deployment. When you combine GPS with 2G GPRS, you get a very effective low-cost outdoor asset tracking and monitoring solution that we can still use today.

3G or the third generation standard of wireless technology introduced the capability for web browsing, email, video downloading, picture sharing and other smart phone technology that we see today, albeit at slow data transfer speeds. 3G enabled multimedia and streaming capabilities and was therefore essential for kicking off a whole new world of smartphones. 4G provided all the same benefits as 3G, but at much higher speeds and higher network performance. 4G was then combined with LTE (Long Term Evolution), effectively an upgrade to 4G, so we could start streaming content in high definition (HD) without any buffering or delays. We can use 3G or 4G in connected IoT, but often find that 2G is suffice for most limited data

transfer situations. The exception to this is with backhaul data transfer – don't worry we will get on to this!

5G

Things change considerably when we start talking about 5G and the implications of this new standard. It is the successor to 4G networks and deployment started in 2019. Like all the other generation networks, it uses radio waves through a local antenna in the mobile phone to communicate with the internet and mobile network. The big advantage of 5G is that it gives you much greater bandwidth and higher download speeds, as much as 10 GB/s. That's enough for a high-definition movie download per second! This is way better than most fixed line and Wi-Fi internet speeds and therefore provides for excellent upload and download speeds.

Due to the increased speed and low latency (minimal time lag and delay), the number of user cases for 5G increases dramatically, for example with remote robotic surgery. If you can imagine a surgeon performing a remote procedure many hundreds of miles away from the patient via robotics, you need to have connectivity that's bulletproof and robust enough to move with precision when required. It needs to be as effective as if the surgeon was actually in the operating theatre with the patient. This requires very accurate technology and connectivity to work in complete sync with the surgeon over vast distances. The 5G network will enable this type of application, and therefore has profound implications for how some work can now be conducted going forward.

5G can be applied to heavy industrial and manufacturing plants where, again, robotics can be controlled remotely to manufacture products and work in dangerous situations. The ability to control this from long distances and in hugely accurate ways, will mean that personnel can be kept

at a distance from where the actual work is taking place, but still able to control and change things as required – quickly. 5G gives you that control over distance and therefore can be used in multiple scenarios. Currently, 5G is expensive and the deployment has been slowed by the pandemic, however, eventually it will be rolled out widely and costs should come down. Furthermore, when 5G is combined with AI and robotics you have the capability to transform many processes currently performed by manual labour. I'm not saying this is a good or a bad thing – just that this is the reality of technology opportunities ahead of us.

There are only a limited number of companies with extensive experience of working with 5G technologies at the moment, and we are lucky that our company Findaa is one of them. Indeed based on client feedback, I would go as far to say that we are right at the cutting edge of 5G capabilities when it comes to seamless indoor/outdoor asset tracking and monitoring. However, we do find that cost can sometimes be a consideration for customers if they don't really need all the high speed and low latency benefits.

LPWAN

LPWAN stands for Low Power Wide Area Networks, and they provide long-range communication gateways, built to support large-scale IoT networks that sprawl out over vast industrial or commercial complexes. This is often termed 'backhaul'. They act as a good conduit for collecting all the IoT sensor data from numerous devices in a building or area, and then sending those blocks of data *back* to the cloud or central network. So, if you can imagine that in a wide area you have several tracking devices that send data to a receiver, the receiver then sends that data to the LPWAN gateway, which then sends all that data to the cloud.

LPWANs come in many varieties including NB–IoT, LTE-M, LoRa, and Sigfox. At Findaa, we tend to use LoRa because we like the performance and integration with our hardware and software, but we are not wedded to that specific gateway and will use whatever we think will provide the best outcomes for our clients. That's our philosophy: we will use whatever technologies help provide the best solution for clients. Technology is changing all the time, too, and that includes connected IoT technology.

A good example of this is 5G networks which can now be used to provide wireless backhaul capabilities. Indeed, according to the GSMA (GSM Association) 83% of total backhaul traffic will be over 5G networks by 2027. This represents a 'wireless backhaul evolution' according to them, and therefore needs to be taken seriously when deploying a connected IoT solution.

Wi-Fi

Finally, I want to talk a little bit about Wi-Fi, which I'm sure everyone uses and recognises for what it is. Wi-Fi is used in homes and businesses for general internet use for laptops, smart phones and other devices. Indeed it's fair to say that kids probably wouldn't be able to exist today without Wi-Fi coverage. But Wi-Fi has some major limitations when it comes to connected IoT in terms of its coverage, scalability, and power consumption. We therefore don't consider it to be a serious solution for any IoT deployment. We have worked on client sites where the Wi-Fi is very poor, notably in hospitals throughout the UK, and therefore any reliance on using Wi-Fi as the backbone for any deployment comes with huge risk. Even when coverage is good, there are still issues around how much you can scale it, the power needed to make it work effectively, and security vulnerabilities compared with a closed network. However, like any other technology, if Wi-

Fi were to develop, especially when it comes to later generations like Wi-Fi 6, then we will look at them as potential contenders for integrating into connected IoT solutions. But today Wi-Fi is a big no-no for us.

Bringing It All Together

So, these are all the main hardware and connectivity technologies that we use to build connected IoT solutions for our clients who require both location and sensor data. Of course, there are other things to consider when it comes to hardware connectivity. These include the type of chips we use to sense things such as temperature humidity, light, and gas, and importantly the type of batteries used to provide maximum longevity to power data transfer. Indeed, it's fair to say that chip and battery technology is a book topic in itself, and one that requires special knowledge and skills. In addition, how the electronic tags are built will also have a major impact on how they can be used to solve customer problems. For example, what size do they need to be? How waterproof, how chemical proof, how heat resistant, how shock proof? Can they be used near metals? What firmware you use to make it all work together. And how do you actually attach them to something without falling off! This is all our 'secret sauce' so to speak.

Our electronic tags have the ability to track and monitor items from a storage warehouse in London to a storage warehouse in Singapore automatically, seamlessly, in real time, every step of the way. This is a hugely powerful solution for companies that want good security parameters set up and excellent tracking and monitoring capabilities around the world. We can apply all the elements outlined above to create the ideal solution for our clients, whether they be integrating elements of 2G or 5G, Bluetooth, GPS, or something else. Combined with our bespoke receivers, we are able to create some very complex IoT solutions if that is what's required. The main

objective for every solution we deploy is to solve our customers key problems, create efficiencies for them, and hopefully reduce costs.

In addition to the hardware and connectivity systems, we must remember that this is all about data – the electronic tags are just there to provide the data that can enable better decision-making. So the other main consideration has to be how software is used and combined with the hardware, to make it a truly effective solution.

Chapter Sixteen: Software & Security

It’s funny, when I talk to people about connected IoT they often think of it as purely about electronics and computer chips. The hardware that is deployed is just one side of the equation. Hardware is nothing without software. In fact, some would argue (but I would disagree) that hardware is the easy part, effectively a commodity that any experienced hardware engineer can buy and put together in a certain combination to form an IoT solution. This is especially the case for wider RTLS, or real time location systems.

Software, on the other hand, is more nuanced. It requires more planning and scoping as to how you’re going to collect, analyse, and distribute all the data you receive from your IoT sensors and tags. There can be various types of software involved in building a complete connected IoT solution. These include the firmware that controls the hardware, the cloud computing that receives the data from the tags, the rules engine that determines how the data is presented and what the data actually means, and the front-end dashboard that displays the information clearly so that decisions can be made.

With software introduced, the IoT hardware product effectively becomes a SaaS (software as a service) data platform. This is so much beyond hardware and sensors, and it does surprise me how many people still don’t understand this. Indeed, the software is probably the most important part and once you’ve put these elements together you can effectively receive data from any in-house or third-party IoT tag. Even with our clients who want to use an API or application programming interface – basically something that enables clients to just receive the data that we collect rather

than having to use our dashboard to look at the information – you still need all the backend software to make sure everything works in the right way. I'm not going to go into lots of detail on the various software elements needed to build a complete connected IoT solution as it would turn this chapter into something a bit too techy! But we will touch upon some exciting and key elements.

Data Platform

The data platform is the beating heart of a connected IoT solution. It's where all the data is sent to, organised, and then displayed on a dashboard. Basically, the data platform takes over once data is sent to the cloud by the sensors. So what is the cloud? Officially cloud computing is the on-demand availability of stored data and computing power without any direct active management. It's where the location and sensor data is stored, organised, analysed, and then sent for presenting on a frontend user dashboard. It can be complex and expensive to build this key part of the IoT solution, but without it, everything else is meaningless.

You can use third party cloud solution providers to store the data, and this often provides added benefits such as industrial grade security and known developer protocols. But you still need highly experienced developers to convert this stored data into a working SaaS (software as a service) data platform that can be used simply by users. Some IoT providers only provide the sensor part, but customers turn to companies like Findaa because we have a very good data platform and can therefore provide the whole connected IoT solution for them.

Security

Security is one of the most important considerations when it comes to

IoT, and the interconnectedness of items being tracked and monitored, the connectivity networks involved, and any linkages to your internal systems. If you're not careful IoT can provide a backdoor to your own systems, which could be disastrous for your data security and IP. Once you connect a physical item to the Internet, it could open up a number of vulnerabilities and so it needs proper security protocols to stop any intrusion.

IoT security involves layers of protection, techniques, strategies, and tools that can be used to protect the whole network. The fact that connected IoT is connected is the very reason why you have to be especially careful when it comes to security. There are cybercrime players out there who would benefit from collecting and selling your internal data and, unfortunately, there are many examples of this. We have all heard of examples when car locks have been hacked with wireless keys. In some cases, this can happen in a matter of seconds.

The way to mitigate cyber security issues and vulnerabilities when building connected IoT solutions is to embed in security right from the start. This is in terms of both the hardware and the software that you use, alongside specific processes that you agree with the client. You want to make sure that these are kept up-to-date with the latest operating systems and protections. Another way to do this is the use of digital certificates that provide encryption and decryption from the data transferred between different devices and systems.

From a network point of view, you can deploy a number of security measures including anti-malware, firewalls, and intrusion detection systems that will block unauthorised IP addresses. You need to make sure that any unknown third party is unable to deploy into your own networks and therefore have enough layers of protection to prevent this. This is especially the case when it comes to APIs where your linking one network to another

and therefore are not self-contained any more, for example sending data into a client's internal systems. In 2018, T-Mobile had a massive data breach due to a poor API connection that was compromised; this ended up with the company exposing the personal data of more than 2 million customers.

Security protocols are getting better all the time, but so is the sophistication of cyber attackers. It's definitely our recommendation that companies and organisations employ their own independent data security people or get advice from specialist data security firms in order to protect themselves in the best way possible, whilst still being able to fulfil their objectives and reap the benefits of connected IoT. Data breaches can happen to anyone at any time through any means, so it's critical to be responsible and have oversight of all your potential vulnerabilities.

Blockchain

Blockchain is a shared digital ledger that facilitates the process of recording transactions and information with a timestamp that proves the transaction data existed. That's a formal definition! It's also a software that can be used in conjunction with connected IoT. Many things can be tracked and traded on a blockchain network, which helps to reduce risks and cut costs for all involved. So, how does it work? Think of blockchain as a type of database that stores information in *blocks* that are then chained together with each other. Once the data has filled a block, it is then chained to the previous block, and so on it goes.

What makes blockchain so useful is that it enables you to create a data chain in chronological order, and which has huge value when it comes to being a ledger for transactions. Each block contains all the data of the previous block, so that if one block is corrupted all the data is still available. Blockchain is often associated with crypto currency and specifically Bitcoin,

but blockchain is not a crypto currency in itself, it's an independent database that can be used for numerous things and just so happens to be the backbone for Bitcoin. For crypto currencies, blockchain is used in a decentralised way so that no single person or group has control; all retain control collectively.

Any data entered into blockchain is immutable, meaning that the data entered is irreversible and cannot be changed. This means that any data records are permanently recorded, and in some situations can be viewed by anyone. What blockchain enables is an irreversible timeline of data implemented in a decentralised way, where each block of data has an exact timestamp associated with it. Blockchain is decentralised and transparent, meaning that if a piece of data is entered incorrectly it can be cross referenced with all the other data in the blockchain to check if correct.

Now if you start to combine blockchain with connected IoT there are some major benefits to be had. Firstly, once location and condition data from IoT trackers and devices is entered into the blockchain it is effectively permanently fixed and cannot be disputed. You can track and trace the location and condition of an item effectively without any challenge or argument that it was not what it said it was. You cannot say that something was not in a certain place when it was, or that it was in certain condition when it wasn't. The blockchain data held is recorded and fact!

Blockchain adds another layer of transparency and security to all the user cases mentioned earlier in this book. So, if you want to a guarantee to someone that an item was in a certain place at a certain time, or in a certain condition at a certain time, then blockchain is the way to do it. This could have implications for high value goods that are meant to be delivered in certain conditions or timeframes, because it leaves no room for dispute. Blockchain provides guarantees and builds trust for the data received from connected IoT and I expect will come to play a major part in the IoT story

over the coming years.

Artificial Intelligence

Artificial intelligence (AI) can be used in several ways to boost the effectiveness of connected IoT, so what exactly is AI? AI refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. Scary stuff, right? We've all heard stories about how AI is going to take over the world and will start to out-perform humans in the not-too-distant future. There are justifiable concerns around this. If machines could outthink people, then we have effectively lost control of our environment and our lives to a certain extent. However, if we can harness AI to our benefit whilst remaining in control, then the benefits are exponential.

When it comes to AI and IoT, there are major advantages, for example, artificial intelligence can be used to make automated decisions about supply chains and logistics so that if there was a delay in one area it could automatically decide on switching to a different logistics or shipping channel. It could also be used to think about various scenarios and game those situations to determine what the best course of action and most efficient routes might be. It could tell you the best way to set up a production line in a factory that will lead to higher levels of efficiency and cost savings. When you apply artificial intelligence to data analytics you can get great insights into how to optimise your business or organisation even further.

AI can also be used to boost the effectiveness of IoT equipment, tags and receivers. For example, if you need to find a location more accurately when you have several tags and receivers in a building, AI can be applied using mathematical probability models to gain a much higher level of accuracy as to where an item is. So, if an item has been moving in a certain

area and has done so for most of the time, then in combination with the asset tracking location devices and receivers, AI can state with a very high level of accuracy that the items are where the data says they are.

By using both AI and blockchain in combination with connected IoT, you can see how these technologies can become so much more powerful and valuable for clients. The ability to authenticate anything and have a detailed history of where and how the item has been managed will provide a highly accurate digital log for a physical item. It could mean that by having this you are able to charge more for something, which will then open up many new business models for companies.

Enterprise Resource Planning (ERP)

ERP is a business process management software that manages and integrate a company's financials, supply chain, operations, commerce, reporting, manufacturing, and human resource activities. It's like an all-encompassing piece of software that manages all the internal data of an organisation in one integrated system. So it can get quite complex! In the past, ERP systems were seen as very expensive, complicated software that sometimes actually impeded getting things done. Instead of having a good financial system, a good supply chain system, and a good human resource system, the ERP tried to be everything to everyone and then sometimes couldn't be anything to anyone.

There are some spectacular examples of ERP systems that have failed organisations. MillerCoors, the global beer and beverage business, hired HCL Technologies in 2014 to roll out a unified SAP implementation to serve the entire company. By 2017, the project had so many problems that MillerCoors sued HCL for $100m, claiming HCL had inadequately staffed the project and failed to live up to its promises. Lidl, the German supermarket

chain, tried to implement an SAP system to transition away from their current in-house inventory software, but the project got too complex, and after spending nearly €500m, Lidl decided to scrap the project.

Don’t get me wrong, ERP systems have their place. But to be considered an all-encompassing system that can control almost everything in every department, of every business? It’s probably too wide of the mark, with the complexity and cost involved. This is especially the case if you are talking about ERPs in small and medium-sized businesses. Yet if successfully integrated with third-party software and systems that are excellent at what they do individually, and then helping to produce combined data analytics from all these individual systems, they can come up with powerful insights that can lead to greater operational efficiency.

At Findaa, we can integrate with an organisation’s ERP system if required, and therefore become another data point within the central ERP system. We do this with the use of our API, which enables us to connect to third-party systems easily. We are the experts at asset tracking and monitoring data, and so we can integrate with larger internal systems that monitor things like sales orders and manufacturing operations. We sometimes get told that companies don’t need asset tracking and monitoring systems, because they have and ERP that does that, but in the vast majority of cases they are using manual processes to track items, not an automated system like ours, which can then integrate with their ERP.

Chapter Seventeen – Data Analytics

When we talk about the use of advanced hardware and software technology to track and monitor assets, we are ultimately talking about getting better data for our day-to-day operations. It's the data that enables us to make better decisions and plan for different scenarios. From this you can improve your business, save costs, and improve your sales revenue. This increases the value of your business, which is the ultimate aim for most business owners and shareholders. In addition, there are wider benefits like the ability to employ people and pay salaries, and pay businesses taxes that should *hopefully* benefit all in society.

To make the most of data, many companies will use key performance indicators (KPIs). These KPIs can measure things such as demand forecasting, inventory management, reducing excess and obsolete inventory, transportation efficiency, and warehouse management. By assessing these KPIs, your business will be able to reveal any shortcomings or problems that may be arising and show you the strengths and areas where operations can be improved. It's important to manage these correctly because it's very easy to feel overwhelmed by the volume of data and indicators that you can receive. So, how do you choose your KPIs?

There are some rules that you should probably follow when choosing your KPIs. Number one is that it's important to only select the important KPIs and not a whole mass of general ones, which can be too much. Secondly, it's good to combine external KPIs with internal KPIs to get an overall and balanced, holistic view, and it's important that these indicators are aligned with your overall business strategy and objectives. Finally, each KPI should have a clear metric that can then be compared with historical data

to get an indication of performance trends. People have often said that KPIs need to be SMART in that they are Specific, Measurable, Attainable, Relevant, and Time Based. So, let's look at some examples:

1. **Utility Rate** – This statistic can show you when your items are being used and for how long. Our tags can see when items are being used by its either its movement profile or other parameters set by the client. Utility rate will show a hospital if some equipment is being used more than others or used at all. It's a great KPI to understand if you should be purchasing more or less of something in the future.

2. **Efficiency rate** – The efficiency rate again can be used from the data sent from tags, and shows you how efficient a supply chain, logistic channel, or manufacturing process is. Basically how efficient or quickly it takes something to go from A to B, instead of using an alternative route.

3. **Gross Inventory** – This will show you the cost of merchandise, materials, items, and products purchased by your business to sell end products to your customers. It's a great KPI, which will quickly show you the value of all inventories your business currently has, and one where having improved asset tracking and monitoring can provide for a much more accurate picture. Gross inventory = stock-keeping unit (SKU) quantity x standard cost of SKU (expressed as a%).

4. **Fill Rate** – This KPI will quickly show you the percentage of customer demand that is met by immediate stock availability, so it excludes backorders, stockouts, or lost goods. This gives you a good idea of

stock available and ready to be used to fulfil orders, and it also shows if inventory is placed efficiently for distribution. Fill rate = number of stock orders shipped with 24hrs / number of stock orders within 24hrs x 100 (expressed as a %).

5. **Order To Delivery Lead Time** – This shows the average lead times achieved from the date the customer placed the order to the time the order was delivered. The indicator shows you how efficiently your supply chain and logistics are organised to fulfil customer demand. The higher the lead time, the greater potential negative effects on customer satisfaction. Order to delivery lead time = actual delivery date – purchase order creation date (expressed in days).

6. **Inventory Accuracy** – This is a great KPI that shows you if your items are in the right locations and in the right quantities, compared to your total number of items or products. Having a higher accuracy means better efficiency and lower costs, or in the case of a hospital, could be a matter of life and death. Inventory accuracy = number of items in the wrong location i.e., they need to be moved to a correct location / total number of items x 100 (expressed as a %).

7. **Warehouse Cost Performance** – This KPI shows you the average cost per item or unit shipped and therefore how cost-efficient your warehouse is. Many warehouses still employ manual processes which can elevate costs considerably. Warehouse cost performance = total cost of warehouse operations / total units shipped (expressed as costed number).

8. **Warehouse Order Picking** – If your warehousing operations predominately uses manual labour to organise items, this indicator will show you how efficiently warehouse operations are running. Obviously the longer the time it takes to organise things in your warehouse has cost and customer service implications. Warehouse order picking = orders picked and packed / total warehouse labour hours (expressed as orders per labour hour).

There are many more supply chain, manufacturing, operational, and logistics KPIs that can be used, and it really depends on the type of business or organisation you are running as to which ones you will choose. The above gives you examples of some important KPIs that should see improvements in by using connected IoT technology, when combined with data analytics. It's critical that you compare KPIs on a timescale so that you can begin to formulate trends and whether things are improving things or not. *What gets measured gets done* as they say.

It's really important that you are honest with yourself and choose the right metrics, not just the ones that will make your company or organisation look good. Even look at the ones that provide data that show things are not going well, because it will provide you with a chance to improve and make adjustments in your business. You will be able to work out new strategies to improve internal processes, supply chains, operations, and logistics so that efficiencies can be made, and costs reduced.

By tracking these metrics on a daily, weekly, monthly, or quarterly basis you will get specific trends as to how things are looking and where areas need attention. As part of regular reporting, they also provide important metrics to show senior management and investors as to how efficient your business is, and the impact on financial performance.

Environmental Key Performance Indicators

It's not just about efficiency and financial performance when assessing KPIs, but also the huge environmental benefits that can result. Having previously worked in an environmental data business where we analysed the environmental impact that companies made in terms of their carbon footprint and energy use, it's important that we look at how environmental KPIs can be positively affected by using connected IoT technology. It's important that all companies and organisations start to look at this, especially with new and ambitious climate change targets to reduce emissions over the next few years and decades.

On 20th April 2021, the UK government announced it had set the world's most ambitious climate change targets, to reduce emissions by 78% by 2035 compared to 1990 levels. This will involve huge effort from all areas of society. It may include future legislation that limits the emissions a business produces or will involve increased environmental impact reporting.

This is all good for business and public perceptions. Notice how many companies report positive environmental statistics - they know that this is perceived as positive by their customers and the wider public, attracting positive publicity for them. Therefore, company boards and senior managers are getting their individual departments to start looking very seriously at the environmental impact of various activities, including supply chains, internal operations, and logistics. So, what are some relevant environmental KPIs we can look at?

1. **Supply Chain Miles** – This indicator will show how many miles are travelled to produce a product, and how many miles to fulfil an order. It gives you a good idea of what sort of distance is travelled to produce and deliver all goods and therefore how much fuel, energy, and CO2

will be used to fulfil this. Less miles travelled per sale means less CO2, so the more efficient your supply chain, the lower the environmental impact. Supply chain miles = raw material order location miles + miles travelled between manufacturing plants (if any) + miles travelled to warehouses + customer delivery miles / sales (expressed as a number).

2. **Product Loss Spoiled** – How many of your items are lost or spoiled throughout your supply chain and logistics? Are there leakages in your supply chain and internal operations, which are causing items to go missing or to go off? If so, these are replaced or produced again, leading to increased energy use and cost. Having asset tracking and monitoring in place can minimise this considerably. Product loss spoiled = the total cost of items that are lost or spoiled in your supply chain (expressed as a number).

3. **Freight Transport CO2 Emissions**– Not all supply chain miles are the same and some can generate higher CO2 emissions. It's important that this as optimised both in terms of distance travelled and source of transport. The more efficient, the lower the CO2 emissions. Again, asset tracking and monitoring will help to minimise this. Freight transport CO2 emissions = average CO2 produced in kg per mile/km travelled by your fleet or outsourced transport (expressed in kg).

If you use outsourced logistics or transportation companies then you should still be able to calculate these KPIs by asking for information from your supplier. Environmental impact is of such importance now that logistics suppliers should be able to provide this or at least be able to find it. Like all KPIs, they should be reported over time so that trends can be seen. You should also use KPIs in conjunction with all the internal and external data so

that a larger holistic picture is visible.

Section Five

Who's Doing It?

One of the questions I get asked a lot is 'What other companies are making use of the Internet of Things, and how they are applying this to improve their business?' They sometimes say, 'If my competitors aren't doing it, then why should I?' Or if other similar companies don't do it, then they shouldn't have to either. This is the same argument that is used against any type of transformation or change. So, here I'm going to talk about some of the global leaders deploying connected IoT, and how they are applying it to their organisations to make smarter decisions and achieve better financial performance.

Chapter Eighteen: Success Stories

Below are some case studies of companies and organisations using connected IoT, and the positive impact it's made. It's true that the most forward thinking and innovative companies tend to be medium or large in size, but that's not because they have more money to spend on it. It's often because they have people in the organisation looking at these technologies and how they can be applied, and therefore more open to different forms of digital transformation. Ultimately, any business or organisation that manages produces or transports physical items can use connected IoT to improve their efficiencies and drive down costs. Like anything, there is an initial investment, but the payback time can be very quick. Let's look at some examples.

Nike

Nike is one of the most recognised global brands in sportswear and sponsorship, some may argue that they are the most recognised influential brand in clothing. Yet to sell hundreds of millions of shoes and other products globally every year they need a highly complex supply chain.

Nike outsources most of its manufacturing to third-party independent suppliers, which can be hugely complex, but can ultimately mean significant cost savings. In 2019, Nike's footwear components were supplied by 112 different factories in 12 countries according to Clean Chain. It means that Nike is not overly reliant on any one supplier, so that if a problem occurs somewhere, it doesn't impact the whole supply chain for their customers. The problem with this approach is that it's highly diverse, and components are in different facilities and factories at any one time, which means many things

need to be brought together and shipped to make this a success. Nike had difficulty keeping inventory under control due to issues with the tracking of their goods. Since then, Nike has continued to invest in new technology and update their supply chain management systems and processes.

In 2019 Supply Chain Dive reported that Nike was implementing asset tracking in nearly all its non-licensed apparel and footwear “hundreds of millions of items”, according to Nike CEO Mark Parker. Nike want to embrace a faster, more agile and responsive supply chain, cutting lead times in half. Nike executives have said that increased visibility is a key part of the improved speed.

This gave Nike the ability to see which stores have the inventory to fill various orders, and which ones didn’t, helping to optimise their order fulfilment processes. Harvard Business School even questioned whether Nike was becoming the next big tech giant according to an article on HBS Digital Initiative. In fact, Apple’s Tim Cook became an independent board member at Nike in 2005 and lead independent director since 2016 following founder Phil Knight stepping down as Chairman. Nike has developed Apple mobile applications that work seamlessly in conjunction with iPhones, with built-in accelerometers and sensors to determine various fitness metrics.

Embedding sensors in Nike footwear and other apparel was a logical step in the creation of smart clothing and shoes. This data can be sent to the cloud, recording things like running inefficiencies and potential health problems, that can be monitored remotely by the user, or anonymously by Nike to improve their products. It reminds me of another company called Salted Venture from Japan who developed a golf shoe called IOFIT Smart Shoe, that could analyse and correct the wearers golf swing. They have thus claimed the place of world’s first smart golf shoe. My word, I wish this was available when I was learning to play golf!

But it’s not just about embedding sensors in shoes and apparel, but also IoT use in stores. Nike uses connected IoT within their stores, so that they can detect inventory throughput and communicate with Nike customers with beacon technology. Nike has said that by doing this they are able to enhance their use of stores, create efficiencies, and ultimately increase sales, not to mention much better customer engagement.

You can see how this holistic use of connected IoT technology, both embedded in their products and connected within their stores, gives a clearer picture of product use, and how it can be used to improve user experience and increase sales. Nike has clearly taken digital transformation and connected IoT seriously, and they are beginning to reap the benefits of their investment. They have been and continue to be a leading innovator in this area, I would imagine other brands and retailers replicating their success in the coming years.

John Deere

One of the largest tractor and agricultural equipment manufacturers globally, with over 175 years’ experience, you might not assume that John Deere would be at the cutting edge of smart technology – we are talking about mechanical machinery used on farms to gather crops and for other agricultural uses. But John Deere began equipping all their products with sensors to let users know if oil pressure was too high, or hydraulic pressure too low, or if the machine was running out of fuel. They began to fit their products with digital dashboards to provide an overview of the condition of the vehicle, and to alert the user if anything didn’t look right.

This began an evolution at John Deere, where they realised there were many benefits in having their machinery connected to smart IoT technology. It would mean better performance and the ability to remote

monitor equipment. A good example of how this is used is in their combine harvester equipment. For those who don't know what a combine harvester does, (and to be fair I didn't), it effectively harvests all the grain from fields, separates the head from the stalk, then splits the different parts of various kernels of grain. It is a complex piece of equipment, and very expensive!

John Deere realised that if you applied smart technology to a combine harvester, you could record how many grain kernels came from a single patch of land and compare that to the number of kernels from a different patch of land. This is because connected IoT technology in the equipment includes location and weight sensors; they could tell what was being harvested and how good one patch of land was compared to another. From this data, John Deere created something called the 'smart planting scheme', where the analysis would show the optimum way to plant and harvest a patch of land. Once a tractor hooks up a tiller, effectively a plough, it can start to work the soil to plant seeds.

Now because there's data from previous harvests, the smart planting scheme will know if different plots of land produce high or low yields of grain, and so the tractor will know, when planting the seeds, if a certain patch of land requires more fertiliser compared to another patch of land. If it thinks it does, it will apply more fertiliser and nitrogen to that patch to help generate more growing potential. The inverse of this is that if the tractor believes it is planting in a high yield area, it will reduce the amount of fertiliser and nitrogen required for that patch of land. Connected IoT technology helps create a smart planting system to increase the probability of gaining high yields throughout the farm.

Farming is a very tough business with sometimes small profit margins, that can be wiped out by a bad weather season, so having any technology that increases your chances of success, provides opportunities for

generating greater returns from the land. With tailored planting, harvesting, and fertilising on different patches of land, it gives farmers the ability to maximise produce outputs, and increase productivity and profits on their farm.

Different crops don't all produce the same returns – some crops will generate more profits than others, depending on commodity prices and market demand. So the John Deere smart planting system is also linked up to real time commodity price data, and can therefore determine the most efficient use of seeds on the various patches of land to maximise profits from that land.

This is clever stuff! Not only does this smart planting system determine the optimum use of land for certain crops, it will also be able to report moisture levels in the soil. Sensors are planted across the land monitoring water in the soil. So like the ability to tailor the fertiliser spread, it will also tell the farmer if more water is required in some locations compared to others. This data can then also be linked to weather forecasts so that calculations can be made even more accurate. As such, irrigation also becomes an automated process based on connected IoT sensors in the ground.

John Deere, once an old farming machinery business, has now effectively transformed into a smart farming data business rather than a mechanical equipment company. When these technologies are then applied to autonomous vehicles such as self-driving tractors and robotic combine harvesters, you are beginning to create a fully automated farming system. Robotic tractors plant the best seeds for the type of land and market demand, irrigate based on the moisture and weather conditions, and then harvest automatically with self-driving combine harvesters. This is a great example of digital transformation in farming and how industries are being completely disrupted by connected IoT technology. Farming is a tough business, and

these force multipliers can help farmers and the food production supply chain.

Bega Cheese

You may not have heard of Bega Cheese, but they are one of the largest cheese manufacturers in Australia, with nearly 16% of the country's retail cheese market. They also own the iconic brand Vegemite, which any self-respecting Australian will tell you is recognised everywhere. They are also a large exporter, with over a third of revenues from exporting to over 40 countries. Bega Cheese wanted to increase the efficiency of their supply chain because they knew it would have a positive and direct impact on their business.

Efficiency is a big deal when it comes to foodstuffs. Milk, for example, must be shipped fresh from farm to factory and then turned into cheese and other dairy products before it is again shipped out domestically and overseas. This makes sure the products get to the consumer in the best condition possible, ready to be eaten or drank. The whole dairy supply chain needs to be extremely fast and efficient. Before connected IoT technology, this was a manual process, and it depended on farmers making sure the quality of the milk was good. Also, if there was more supply, Bega Cheese had to rush to get tankers to the farms quickly, to collect the milk and get it to the factory in the shortest possible time.

The first thing Bega Cheese did was apply sensors to storage vats on farms, so they could measure how full the vats were. If the volume of milk is reaching the vat's capacity, the sensor automatically informs the farmer that the milk needs collecting. The vats can be monitored for temperature, or how many times it's been cleaned and when, helping to keep vats free from dangerous bacteria. On the move, trucks are tracked in real time to make sure

that the milk is taken along the most efficient routes, avoiding farms where there's not enough milk to be collected. Factories are then informed when the milk arrives, so all scheduling for production is optimised as far as possible.

External data points are also used to improve decision-making. The weather is monitored for humidity and temperature, because when conditions are right, the cows will produce more milk. This data is then analysed by an algorithm which can predict supply levels based on all of the various data points. Milk production supply levels and transportation scheduling capacity therefore becomes an automated decision-making process based on real-time data. Trends can then be identified – for example if things happened in certain conditions at certain times of year, they're possibly more likely to occur at similar times and conditions in other years. Forecasting becomes much more accurate.

Bega Cheese have completely optimised their inbound supply chain operations, saving time and money for the business. Bega now want to focus on their outbound supply chains – from the factory to the customer – to make sure cheese is being shipped in exactly the right condition either nationally or internationally. Bega Cheese want to know the location and condition of the cheese anywhere in the world, whether they're in a container ship or on a truck being transported to retail operation, and to make sure that correct temperatures are maintained throughout the whole supply chain network.

Bega Cheese achieved just-in-time milk production and delivery, so that standards are the highest possible, and storage is kept to the minimum necessary to keep the milk flowing. Connected IoT has a major role to play in dairies and cold chain, to achieve just-in-time targets. However, moving to a more just-in-case scenario in future might mean having a system that also freezes fresh produce and enables these goods to be stored for a time, before being shipped or consumed. This would help significantly when supply chain

disruption occurs. Of course, connected IoT sensors can play a role in linking to demand data and logistics availability, so that dairy products can be sent for freezing automatically, and stored at the correct temperature until required.

Cardinal Health

Cardinal Health is a distributor of pharmaceuticals, and a manufacturer and distributor of medical, healthcare and laboratory products. They are a large business, serving 90% of US hospitals, over 29,000 US pharmacies, and 3.4 million home healthcare patients. It's also complex, delivering critical life-saving products in a time-controlled manner, including personal protective equipment (PPE).

As the pressure of the pandemic started to heighten, Cardinal Health realised they needed a more technology driven approach to their supply chain and how they delivered products to healthcare providers and workers. They developed a bespoke system to track and trace temperature sensitive medical products for use in all their transportation networks throughout the US. Also using this distribution network to assist the federal government and make sure the right products were delivered to the most-in-need locations during the pandemic.

In 2019, Cardinal Health conducted a study into health supply chains and found that 42% of US medical professionals believed that time spent working on supply chains took them away from patient care. They also reported that 43% of frontline patient care providers believed manual supply chain tasks had a negative impact on patient care. These problems have only been exacerbated by the pandemic and the impact it's had on thousands of healthcare providers around the world. After these findings, Cardinal Health started to implement further track and trace capabilities in their medical

equipment and pharmaceutical deliveries.

Healthcare is an important sector for Findaa. We know lots of applications of connected IoT within different healthcare environments, with big opportunities for hospitals to improve their frontline patient care and increase operational efficiency.

DHL

DHL are probably one of the largest users of connected IoT technology in the world. As one of the main global providers of packaged delivery and express mail, they have huge impetus to use advanced technology wherever possible to increase efficiency. DHL, part of the German logistics company Deutsche Post, deliver over 1.5 billion parcels every year. A company like this must be efficient because margins are often tight. Connected IoT technology has been a great way to build differentiated solutions for their customers.

They achieved this by firstly creating smart shipments, where sensors are embedded into packaged goods that cross various borders and time zones. The sensors can track location, temperature, shock, acceleration, light, and any damage monitoring, thus minimising risks. These sensors are now integral to many of the DHL's supply chains, so that they can analyse the data produced daily for further improvements and optimisation.

Secondly, having invested in connected technology to track their fleet of vehicles and planes, they realised they needed much more granular data and started to use sensors to track roller cages which carry items and goods. The sensors tracked to see that the roller cage didn't find its way out of the DHL network, helping to prevent shrinkage and losses. They also provided for a digital twin of the physical assets, so that items had a digital identity which could be monitored and analysed in the cloud. This allowed

DHL to interact and analyse the digital counterparts of physical objects and processes, just as they would with the physical objects and processes.

From these digital twins, they can create virtual 3-D models for all their warehousing, inventory, and operational facilities, including the size, quantity, location, and demand characteristics for every item that they manage. This has given management full visibility of all global operations. These technologies proved very powerful during the early stages of the pandemic when most employees were having to work away from DHL offices. The technology allowed workers to have complete visibility and control of global operations whilst being based at home.

For example, they could plan for different scenarios and optimise everything by modelling the digital twin data they had. This included warehouse space utilisation optimisation, the simulation of movement of items, and of DHL personnel and equipment. Every element had a digital code attached so it could be replicated in cyberspace and thus planned and controlled remotely. My personal view is that this is the future of tracking and monitoring physical objects with some value or importance. Controversially to some, it might also include tracking workers in future where there would be positive health and safety benefits, and dare I say it, productivity benefits to be had.

DHL also created digital twins to manage the maintenance and servicing of goods or vehicles. For example, if an item or vehicle is faulty, the digital twin will be able to show exactly what parts are needed to make it serviceable again. You will see from the data log of the item that the digital twin has spare parts in certain locations and can be sent to a DHL facility quickly. So, if one of the many thousands of DHL vehicles – which includes trucks, cars, planes, forklifts and so on – becomes faulty, it can be repaired quickly and efficiently using data from its digital twin.

Finally, DHL also uses connected IoT sensors for their facilities and property estate. They are using sensors to monitor heat and light within the facilities and monitor the spatial areas within buildings. To reduce energy, smart sensors optimise their heating ventilation and air-conditioning. This has led to an energy cost savings of over 40%. DHL have been one of the true pioneers when it comes to connected IoT, but there's no reason their progress can't be replicated in any other organisation. They are an organisation that will continue to innovate.

West Hertfordshire NHS

The National Health Service (NHS) in the UK is a large public health organisation with over 1 million employees and a budget of over £200 billion per annum. The NHS itself is divided into regional bodies which are responsible for a specific area and the hospitals located within that region. West Hertfordshire NHS is a regional NHS body made up of several hospitals, one of which is Watford General Hospital. Watford General, like most hospitals, tracked and monitored medical devices in their buildings using barcodes and scanners. But this proved quite inefficient because of reasons outlined earlier.

As mentioned, frontline hospital staff can spend up to 10% of their shift time trying to find equipment, and this is a problem for most hospitals, not just in the UK but globally. Problems were heightened during the pandemic when equipment was needed quickly in various wards, but often took time to find and locate, which could potentially have an impact on patient outcomes. For example, ventilators, syringe drivers, beds and patient monitoring equipment were all needed on a regular basis. If you can imagine a hospital environment where there are many people often moving around quite quickly, transferring patients to different buildings and rooms across the

hospital estate, and porters trying to move equipment around, it's quite a complex environment!

Watford Hospital decided to look for other potential solutions, to create a better system that would help them gain efficiencies and mean less lost items. They decided that a way forward was to pilot a solution whereby medical equipment was automatically tracked on the hospital estate, both in buildings and potentially around them, as well.

This solution required several connected IoT sensors and receivers to find equipment in a hospital building quickly, regardless of the floor or room it was in. Watford General went about putting receivers in strategic points around the hospital and placing tags on medical equipment. All the data was then sent to the cloud and then mapped on to a dashboard, highlighting where everything was on a floor map. A nurse or medical device manager could view the dashboard and quickly find a piece of equipment, then send someone to get it, knowing exactly where it was. It helps prevent loss of items, improves efficiency, and impacts patient care positively by having medical devices found quickly.

With less asset loss there is less need to replace items and therefore a reduction in annual costs. Furthermore, medical equipment can be placed in strategic locations, which would optimise the speed of access to them further, potentially improving patient care. Without doubt, if you're a hospital or healthcare provider managing medical equipment or medical staff, then connected IoT asset tracking and monitoring solutions should be central to your efficiency and productivity strategies going forward.

Bank Of America

A financial services business like Bank of America (BofA) might seem an unlikely beneficiary of connected IoT, but they are using it in a

slightly different but fascinating way. According to AI Of The Tiger – a blog focused on showing where IoT projects are gaining traction - Bank of America really wanted to see why certain teams were more successful compared to others, and how they could use connected IoT to see what worked and what didn't.

The bank placed sensors in employees' ID cards and collected real-time data on areas such as the tone of their voice, speaking speed, volume, physical movements, and the posture when communicating with other colleagues. The goal was to see how the bank could boost efficiency by uncovering when and how productivity reached peak levels within the workforce. The sensors in the ID cards had the ability to look at all these factors which could then be organised by BofA HR management internally. We are talking about connected IoT employee productivity monitoring.

It should be made clear that BofA were not recording any conversation between employees, so it was adhering to all the regulatory issues around this, and any meta data stored was not associated with the employee's name or employee ID, everything was anonymised. The sensors were particularly useful in understanding the level of *emotion* in a conversation, with a record of the pitch and speed of the voice at any given time. They were also monitoring whether the listener faces the speaker, if the speaker dominates the conversation, or if the speakers mirror each other and are therefore on equal terms. They used this data to map out socialising patterns and then connect them to the actual productivity of the employees.

This may all sound controversial, but the findings were revelatory. When the devices were tested by 90 call centre employees at BofA branches, they found that when employees took breaks together, they used the time to solve workplace issues. By adjusting workplace routines so that all employees took breaks together at the same time, the company saw that it

could raise overall productivity by 10%. A win-win for BofA – employees could take their breaks together and an opportunity to socialise and discuss work matters, and the bank raised employee productivity by 10%, with a direct impact on employee ROI.

Whether we like it or not, employee productivity tracking is something that is becoming more popular. As an employee working for an organisation on an employer's premises and adhering to an employment work contract, you have little control over this if your employer decides to implement it. This is of course subject to localised country human resource and privacy legislation. We are talking about adding connected IoT sensors to an employee's ID card – or other items such as a hard hat in a manual labour workplace – to monitor the things that might help to make productivity improvements, and where there are distinct benefits to be had. If you can organise your workforce more efficiently, then your employee ROI could improve substantially.

Your Case Study Here!

Now, you maybe not be Bank of America or Nike, DHL, or any of the other organisations we've looked at as case studies, but the same benefits can be achieved for your organisation in many cases. If you're looking to maximise productivity, operational efficiency, optimisation, and cost savings, alongside the environmental and sustainability benefits, then connected IoT solutions can be hugely beneficial for you. As demonstrated with Bank of America, it might be a financial services or professional services business, not just those dealing in physical goods.

When looking at all the various case studies and wider examples, a 10% improvement in efficiency seems achievable, maybe even commonplace. Think about this for a second. If you improved your business

by 10% whether it be cost savings or revenue improvement, what would that do for the value of your business or organisation?

Chapter Nineteen: Getting In To IoT

I hope this book has given you some interesting ideas as to how connected IoT can change your business or organisation. This technology can change so many inefficient processes and optimise so many different things, that can ultimately lead to cost savings and increased valuations - if that's your objective. What makes this such a great combination of technologies is that you're able to combine connected IoT with artificial intelligence, 5G, blockchain, cloud computing, data analytics, and many other advanced developments in the world of technology innovation. Remember these technologies are used as ingredients to create transformational improvements for you, but on their own they are just ingredients.

If you're an entrepreneur, it's a great business to get into. You are working at the cutting edge of technology. Not only are you helping many businesses with positive benefits, but also helping the environment by making things more efficient and therefore less energy hungry. Or if you want to work in this area for someone else then you need to find a business that you can work and learn in at the same time. Nothing beats experience when it comes to deploying these solutions.

The Internet of Things has a similar business model to that of a classic telco. With a telecommunications company you lay fibre, or in the old days, copper wire, and then earn income from that infrastructure by way of monthly or annual subscription revenue. This can be similar to how connected IoT infrastructure works - you provide sensors and electronic devices to clients and earn monthly subscription revenue from the data you provide. So, it can lead to stable predictable revenues, which is what every entrepreneur (and investor) dreams about.

You might be thinking ‘How do I get started? Where do I go?’ Especially if you’re not an engineer or with any sort of technical background. That should not be a reason to avoid getting into connected IoT. You can team up with engineers and technical experts – indeed, these often make the best type of businesses because you have someone with all the technical and engineering expertise, and someone with the business development experience to build the business. It’s very rare for a business to be successful otherwise. Bill Gates needed Steve Ballmer at Microsoft, Steve Jobs needed Steve Wozniak at Apple, Bill Hewlett needed Dave Packard at Hewlett Packard, and on it goes.

There are many places you can find business co-workers and partners, including online business forums, meet up groups, networking events, and through your own private network. Make people aware that you’re looking to build a connected IoT business, and you may be surprised by the introductions you get.

Chapter Twenty: Findaa Technology

Findaa Technology is a connected IoT and 5G solution business providing a data platform and IoT sensors to organisations and companies globally. We help them to achieve those productivity gains and improvements in efficiency, to lower costs, increase the ROI, and improve sustainability. Whether it be in manufacturing, heavy industry, buildings & construction management, supply chains, logistics, healthcare, public sector, private sector, or even professional services, we can usually provide a solution to match requirements.

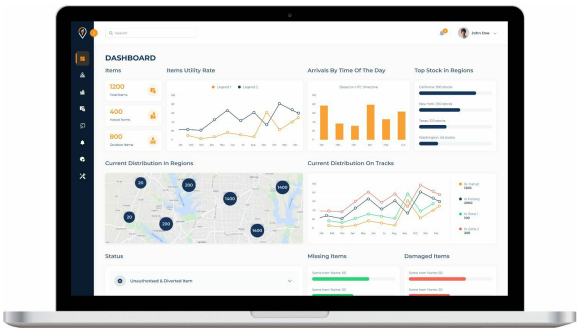
The way we work is to begin with an initial consultation, where we dig deep into your specific objectives and requirements. We then go away and come up with a workable solution that fits those objectives and budget. Whether its tracking and monitoring items around the world in various supply chain channels or being able to find specific items within a certain place in a building, or a combination of both. If you need to track and monitor assets from a room in a building in one country, to a room in another building in another country, we can help. We have been asked to provide some very specific solutions for certain situations and have the capability to do this in-house.

Findaa is sector agnostic, meaning it doesn't really matter what sector you're in for us to be able to work with you. The only caveat would be that we tend to focus on organisations that work with physical goods and items. Having said that, professional services can also benefit from connected IoT technology, as we saw in the Bank of America case study, and have the capability to build those type of employee tracking solutions if required. Indeed, the most expensive asset to monitor and track would be a human

asset. We find that although each organisation has their own requirements, there are common themes between all customers in terms of what they want to achieve, and how they're able to achieve it.

We have a range of technology solutions that we can deploy with our customers, and I'll briefly go through these below.

The Data Platform



Findaa has built its own data platform for our customers to track and monitor all their assets through one central portal. There are many things you can do on the platform to get data on your items, products, assets, or even workers. You can find out where all your items are inside or outside seamlessly, then track each item's history, so you have an audit trail of where everything was and at what time. You can track the condition of the item, so you understand its temperature range, humidity, vibration and shock, and other factors, over specific time frames, and see this visually all on one screen.

You can see what's missing or been damaged, where that occurred and at what time, whilst also seeing what happened just beforehand to get a greater understanding of conditions and situations. You can apply external

analytics to this such as weather conditions, and other external data points as required. You can link Findaa sourced data to your own internal ERP systems, to get a holistic view of multiple data points at once. Our platform is continually evolving and therefore it will likely include a whole variety of new functions by the time you read this and think about deploying a solution.

The Sensors

Findaa has a variety of electronic devices and tags that can be used to monitor and track items depending on where they're required and how they are to be used. These include the following:

1. **UbiTrac 5G**

UbiTrac is an indoor-and-outdoor seamless tracker and sensor which can be used in conjunction with 5G connectivity. It provides real-time location data alongside information regarding temperature, humidity, vibration, shock and more. You simply attach it to the item, box, or pallet, and the data is sent to the cloud which is then shown on your Findaa dashboard.

2. **BeaconTag**

BeaconTag is our real-time beacon tracker. It’s predominantly used for tracking items inside buildings and in combination with our receiver devices. Again, we can provide specific sensors within these tags so that items can be monitored for condition purposes and other things. It is a very small tag so can easily be fitted to smaller items if needed.

3. **BeaconBridge 5G**

BeaconBridge is our indoor receiver. It’s packed full of advanced technology and software to make sure that items can be found quickly and in specific places within a building, even with complex indoor footprints and thick walls. BeaconBridge is what we use in hospitals and in warehouses to make finding items easy. We simply attach to walls in strategic locations and can also enable it with 5G connectivity if required for greater speed and low latency.

4. **OutTag**

OutTag is used for outside location and condition monitoring. If you want to track and monitor items outside, this is the product that we deploy. You do not need any receivers with this product as all the sensors and technology are packed into this small tag that speaks directly to our cloud server, no matter where in the world you are. If you're trying to monitor your external supply chains and logistic routes, then this is the product you will likely deploy. For example, if you're trying to ship and monitor vaccines around the world then this is the tag you'll need.

We're developing more and more electronic devices all the time so again by the time you read this we would've added to this quite considerably.

The Cloud

The Findaa cloud server brings our solutions all together under one roof. It is here that we adhere to strict cyber security protocols that enable us to collect, manage, and distribute the data from our electronic devices to the Findaa data platform. We use industry standard cloud computing methodologies that are tried and tested in multiple blue-chip environments every day, globally. Our cloud server enables clients to use the data on our data platform or sent directly to your own servers if preferred.

Findaa uses a range of connectivity networks, and we tend to tailor it depending on specific customer requirements and cost. For example, we wouldn't use 5G unless a customer specifically needed low latency and very

high-speed bandwidths, although we do believe it will become the standard over the next few years. For every client comes a tailored recommended solution. Ultimately, we are guided by providing the best solution and service possible for the client problem that needs to be solved.

We're very conscious that not all our clients, and especially smaller businesses, can afford the top IoT specifications so we are mindful in our proposals to provide cost-effective solutions. We normally commence our engagement by suggesting a customer starts with a trial or pilot, where they can see the value to be gained from deploying us. Very quickly this often scales to a full engagement, as the benefits are quickly realised. If you would like a FREE consultation to see how we can help you then email me, Simon Rowell, at simonr@findaatech.com

Conclusion

Technology is changing the world whether we like it or not. You can either adapt and be a part of this evolution or become a victim of it. I wrote this book because I could see that many senior executives, management, small business owners couldn't really understand if any of this innovative technology could bring them tangible benefits. They don't know what they don't know. Of course, technology minded people and engineers have understood this for years, but translating it into real tangible benefits that can be achieved by different organisations, is another story.

You don't have to employ an army of expensive management consultants, or IT transformation experts to tell you the benefits of deploying a connected IoT solution. You can read this book and then contact us! We've covered everything from how this type of solution evolved, why it's important, who it's useful for, and the real tangible benefits that can be achieved. I wanted to communicate it in the most straightforward way, so that everyone could grasp the opportunity, not just a global multinational corporation who may already have departments of people looking at this. Everyone should have the same opportunity and knowledge to make the right decisions, and then take their business or organisation forward; it shouldn't be determined by how rich your business is. Having said that I know plenty of large multinational corporations and organisations that are doing nothing in the connected IoT space, and they should be.

The Covid pandemic has changed the way many people think about work, society, and the environment. Aside from the appalling number of deaths that has occurred during the past few years, time spent in lockdown has enabled people to think more deeply about the digitisation of their

organisations. Some companies will decide not to go back to physical locations and continue in remote working structures, others will work in a hybrid working environment, and others will have everyone return to the office or factory if they haven't already. Either way the use of technology in many areas of society and work increased dramatically during the pandemic and will continue for years to come.

The impact of the pandemic on how businesses and organisations are managed will be profound. Many things have been set in motion that will change, if not today then certainly in the years ahead. Some companies will get more competitive, and others will unfortunately go out of business. Some public sector organisations that don't embrace these advanced technologies will cost more to manage in future and become less productive, having a detrimental impact on taxpayers and countries indebted economies.

But don't just take my word for it. Open up any news or research website and see what's going on in the world today. Be aware of what's happening, and how technology is embraced by companies to improve themselves. Think about the impact of all this on your own organisation or business and how you can potentially mitigate it. The most important thing is to take some action. The pandemic accelerated change, but this change was happening anyway. The past is littered with companies that didn't evolve or change and are sadly no longer with us. Think about Kodak, Blockbuster, Tower Records, Polaroid, Radio Shack, Compaq Computers, Minolta, Netscape and on it goes. For each of those large companies there are thousands of smaller companies that went out of business for the same reason. A lack of innovation.

My parting words to you will be to say to embrace the future! Embrace new technologies that will help you get more productive, more efficient, save costs, and improve your sustainability. Commit to making a

decision about this, and then take some action. At least you can then say you thought about it and have your reasons for deciding one way or another. The worst possible thing is not to do anything, and pretend innovation is not happening, *it is*. Whether you decide to use Findaa or some other company, I would love to hear your story and why.

I know this is sometimes said in other books, but you chose to read this book for a reason. You have an interest or have thought about connected IoT and digital transformation before. If you would like case studies on how these types of solutions can help your specific sector or business, then we would be happy to help. Likewise, if you wanted to find out more about the technologies involved and what might be good for your needs, then again, we would be happy to help.

Embrace the future!