Module 1: Introduction to Tech Features

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Video 1: The Fourth Industrial Revolution

Emerging technologies have given rise to the Fourth Industrial Revolution. It entails the blurring of boundaries between the physical, digital, and biological worlds. It's expected to bring change at a speed, scale and force that's unknown to us. From artificial intelligence to the internet of everything, from quantum computing to bio synthetics, from Fintech to cryptocurrency, every aspect of life and business is changing, moving the world exponentially forward. Thus, the fourth industrial revolution will eventually permeate all economic and social spheres. While there are similarities between the different industrial revolutions in terms of their transformative impact on industries, it's worthwhile to point out some key differences:

The industrial revolutions of the past were heavily driven by the West. Think about the UK's industrializations, or the system of mass production that was pioneered in the early 20th century by the Ford Motor Company in the US. In contrast, the fourth industrial revolution is driven not just by the US, but a new economic heavyweight: China.

Europe, so far, is lagging behind. This implies major economic shifts. According to a 2017 PwC report, AI will contribute to 26 percent of GDP growth in China, but only 14.5 percent in the USA. Just imagine if these gains can be secured. In Europe, however, AI is expected to contribute only between 9.9 and 11.5 percent. But the implications aren't only macro-economic in nature. For businesses, it implies the need for practical considerations. How should businesses keep a competitive advantage by leveraging AI and other deeptech innovation?

How should businesses engage with the startup ecosystems in China, the US and across the globe? These questions are becoming increasingly important.

The former revolutions heavily depended on physical and capital-intensive assets. Advanced AI techniques, quantum computing and brain computer interfaces will likely remain expensive for a while. However, it's those types of cognitive technologies that move the value creation from hardware to software. They also move the value creation from physical labour to data insights, augmenting human cognition. This is why we also call it the "cognitive" revolution.

This has strategic considerations for companies. To secure a competitive advantage, which areas should I focus on to develop my own AI capabilities? Given limited resources, which areas can I rely on third party providers?

To understand how important this consideration is, we don't need to look any further than to the automobile industry. Estimates have shown that by 2030, the profit share of traditional suppliers, OEM vehicle sales and aftermarket could be cut by more than half to 41%. This is due to the shift of value creation from mechanics and engineering to algorithms and data processing. However, the ongoing industrial revolution is becoming truly cognitive, at the point where AI and other technologies, such as Brain-Computer Interfaces collide. It's already happening, and it's happening at greater speed than previous industrializations.

Video 2: Introduction

With social and economic discontinuities shaping the present and future, navigating through the midst of technology trends offers opportunities, as well as challenges and risks. Therefore, leveraging, anticipating, and managing the opportunities is indeed important. But it's also critical to mitigate associated risks, and that requires an in-depth understanding of the technologies on the horizon. It also requires building skills necessary that can help assess disruptions and futures.

Against this backdrop, here are the learning objectives for this course. We are going to not only assess key disruptive technology trends, but also apply foresight tools and frameworks for conceiving and assessing tech-driven futures. In addition, we are going to leverage disruptive tech insights to drive innovation strategies, and create a technology portfolio to gain competitive advantages in your industry. Finally, we will learn how to build resilience in your organization amidst technology disruption.

Ladies and Gentlemen, we stand at a watershed moment in the uncertain future of not just the economy, but also humanity. Many potent technologies are developing at breathtaking speed. I am therefore looking forward to taking you through our course which will touch on the most important ones.

My name is Olaf Groth, and I will be your instructor for this course. I am a professional faculty member at UC Berkeley Haas School of Business, and a professor at Hult International School. Next to my academic roles, I am also the Founder and CEO of Cambrian Futures and Cambrian Design, a strategy and product design lab at the interface of deep tech, business, and the global economy. I am also a member of the Global Expert Network at the World Economic Forum. I'm a co-author of "Solomon's Code: Humanity in a World of Thinking Machines".

Throughout this course, I will make use of 25 years of experience as a global strategic executive and adviser. I've worked for multinational corporations including Boeing, Qualcomm, Vodafone and Q Cells. I've also worked for foundations in countries such as Germany, the USA and Kenya, with and for governments of the USA, UAE and Caribbean, as well as startups and private equity firms.

I live with two beautiful daughters and my wife. I work globally from a home base in the San Francisco Bay Area, the heart of the Silicon Valley, and also retain a base near Kiel, Germany. I regularly travel to many parts of Asia, Africa and the Middle East, as well to teach, consult and gain new perspectives on the technology economy of tomorrow.

Video 3: Course Overview

Here is an overview for the course.

We'll start off by laying the groundwork for this course in Module 1. We will begin by demystifying how technologies emerge, and take a closer look at Gardner's Hype Cycle. Then, we'll use another framework, the S-Curve, to assess and understand how efforts in time and money relate to the increasing performance of technologies. We will then do a high-level fly over of the different technology domains that will be the core of this course. Before we'll close this module, we will dive into the FLP IT framework that can help us assess future-oriented tech scenarios.

The next module will be dedicated to AI and Data. We will unpack what AI is all about, what's hype and what's real, relevant trends and actors in the space, and implications and strategic considerations of AI and big data for your businesses.

In Module 3, we will move to compute power, the backbone of the future of digital. Compute power heavily defines and empowers the capabilities of other technologies, such as artificial intelligence. In particular, we will look at two emerging new chip designs, neuromorphic computing and quantum computing.

From there, we will go on to explore the Internet of Everything followed by Robotics and Automation, two domains that are not necessarily separate technology domains per se, but are the applications of AI, data, sensor and connectivity in a physical environment.

Module 6 then will lead us more firmly into an area we call the "cognitive revolution". While the first, second and third industrial revolutions were built physical assets in the form of the steam engine or manufacturing hubs, the cognitive revolution is starting to integrate machines and humans. With virtual and augmented reality technologies integrating the virtual and analogue worlds, brain-computer interfaces are implanting new realities into our heads, and even letting us create new realities without cognitive strengths.

In Module 7, we will go into a technology domain that started in the finance industry, and is now disrupting many more: AI, blockchain and quantum computing. These technologies will change how we transact, secure and record in new ways.

In the last module, we will dive into strategic portfolio theory, which will lay the groundwork for the final capstone project. You might know portfolio theory from corporate finance. It refers to a

mathematical framework for assembling or assessing a portfolio of assets such that the expected return is maximized for a given level of risk. A similar approach can also be applied to a company's technology innovation strategy. Since technologies emerge very dynamically, they imply equally dynamic challenges for the companies' management. When do you replace old technologies with new innovation? Which new technologies should you experiment with or invest in, taking into account the strategic objectives of the company? The risk here is that if a company doesn't replace old types of technologies, or invest in the right technology areas on time, it could lose its competitive advantage in an existing market, or miss the opportunity to create a whole new market.

Needless to say, there are lots of interesting issues and questions that we will tackle. I am looking forward to being on this journey together with you!

Video 4: Gardner's Hype Cycle (Part A)

As an executive, you are constantly expected to have a point of view of new technologies and trends to keep your business a competitive edge in your industry. But with new technologies emerging daily at different levels of maturity, how do you assess them? And how do you decide which ones are a serious threat and when?

There is one infamous case. Steve Balmer, CEO at the time at Microsoft, missed the dawn of data business models. He grossly overestimated the hype and underestimated the trough of disillusionment regarding the technology underpinning the iPhone.

Balmer is not alone. Also, Ken Olsen of DEC had no lack of industry smarts, quite the opposite. He had as much information about the PC as anybody in the world. In fact, he had so much knowledge that he felt he could make this claim here with complete certainty. However, back at that time, people had little understanding of the different stages of technology development as well as their trajectories.

Not all technologies make it through the trough. Google Glas is a perfect example of hype, withdrawal into niches and then dying out, before being revived again. Although it never met the promises when launched, it was supposed to be the future: lightweight AR glasses that could take photographs and give directions from the bridge of your nose. Despite the general public's perception of the device being creepy and expensive, it didn't disappear. In 2019, an enterprise version was launched to cater niches, helping workers in a variety of industries, from logistics to manufacturing to field services, to do their jobs more efficiently through hands-free access to the information and tools. Emerging dominant innovators in the space are adopting and spreading the technology, fusing it with VR and AR.

The Gartner hype cycle provides insight into how disruptive technologies emerge. It teaches us how to get a perspective on the maturities of technologies in order to cut through the "hype". It's been adopted by organizations worldwide to make a decision on technology strategies and investments.

Gartner's Hype cycle essentially describes a 5-step pattern that almost all new technologies follow. It's an expression of their overall performance, state of ongoing trials and experimentation, their adoption in the marketplace among users.

A new technology trigger, such as AI, quantum computing, AR/VR, or blockchain, introduces new possibilities that capture the imagination and cause a rapid increase in expectations. People would say "AI is a breakthrough!"

The fervor quickly increases to a climax of exaggerated expectations. The "hype" is deafening and dramatically shoots beyond the reality of what is possible. People would say "AI will change everything!"

The reality, however, soon sets in, as people realize that the promises of this "hype" are not being fulfilled. Expectations fall like a rock and the market slides into a valley of disillusionment. People would say "AI is actually not so magical after all."

But technology often has foundational value that others can build upon. Hence it's constantly improving as people are beginning to find real applications. This is the tendency of the Enlightenment: expectations are rising again, but less strongly, in line with what is achievable. People would say "AI is indeed useful in these cases."

Finally, expectations of technology are absorbed into everyday life, with well-established best practices settling at the productivity plateau. People would say "AI is an ordinary fact of life. Here is how we use it".

Video 5: Gardner's Hype Cycle (Part B)

Understanding the emergence of technology through Gardner's Hype Cycle can help us answer a few important questions. First, what level of effort should we invest in technologies at the stage of innovation triggers? This is the stage where it makes the most sense to work with the broader ecosystem, such as through Corporate Venture Capital or other forms of collaborative innovation partnership. Those instruments will help you keep a finger on the pulse of a brand-new technology area, exploring and building competitive capacities in those spaces. They will also remind us to not lose the focus on other types of technologies that offer a better and more immediate RoI.

Second, should we start or continue to invest in technologies at the stage of inflated expectations? If you come in at the peak of inflated expectations, it will be very costly to evaluate the product, and to work through the problems in the technology or product. You are going to be paying with time and money all the way down through the valley of disillusionment, until you come up the other side of the slope of enlightenment.

Most of the technologies we'll be looking at are still in the early stages of development. Yet, in order to keep a competitive edge in your industries, it is important not to fall victim to ill-understood hypes or valley of disillusionment.

AI is one of over 90 technology domains for which Gartner annually develops Hype Cycles. It's composed of a bunch of technologies and approaches to make machines intelligent. Hence, one of the first tasks to understand where AI currently stands in the Hype Cycle is to break AI down into the different technologies and components that combined can be referred to as AI. While a lot of AI-driven applications are proliferating across industries, many more advanced AI technologies are still at the early beginnings of their development stages.

Let's take a look at some of the technologies and how they have evolved over time.

In Gartner's Hype Cycle 2010, technologies such as Brain-Computer Interface and Augmented Reality are already on their way to the peak of inflated expectations, while Artificial Intelligence or its subsets Machine or Deep Learning are not receiving any mention yet. This shows that there are no predefined time periods for each of the stages. Neither does it mean that technology ever gets across the peak of inflated expectations or trough of disillusionment. Though, in the case of AI, while not being mentioned with the terms we use today, it still sits implicitly at the heart of a number of technologies mentioned here, such as autonomous driving.

In Gartner's Hype Cycle 2011 and forward, we see cloud computing at the peak of inflated expectations. Looking into the future, it's hard to imagine how we could have ever worked without the cloud. It's a core technology Gardner foresaw in time, which today has clearly reached the plateau of productivity.

Fast forward to Gartner's Hype Cycle 2015. Despite having been around the block for a while, cryptocurrencies has found its way into the Gartner hype cycle. Also, the subject of AI is becoming more pronounced, largely thanks to increasing public attention following some milestone events such as the victory of AlphaGo, the first computer Go program to beat a human professional Go player without handicap. 2015 was also the year that cloud computing went mainstream. For example, the game giant Zynga abandoned its own data centers and returned to the Amazon cloud, while Amazon and Microsoft posted big cloud computing earnings. Cloud computing started to become the default option for everything from storage to computing, to apps and analytics.

Video 6: What is an S-Curve?

Gartner's Hype Cycle has shown us how technologies normally move through different stages. The speed in which those technologies move through those stages, depends on how fast innovation occurs and technology improves, as well as how quickly it finds its market fit. That in turn depends on the level of effort invested in terms of money, time and identification of pain and gain points for customers.

The S-Curve is a more company-focused way to understand inception-commercialization-maturation phases. It helps explain the success of some companies as compared to others. Google, Amazon or Tesla, for example, have significantly invested in new technologies early on. They are now reaping the benefits as they have managed to establish first-mover advantages and market-leading positions. Companies that don't put this effort forth invariably find themselves pushed beyond maturity into obsolescence. Let's unpack this more.

The S-Curve is a curve that shows how technologies can grow and emerge in multiple waves. Research shows that both the rate of a technology's improvement, as well as its rate of diffusion to the market, typically follows an S-shaped curve. It's another framework that helps us assess adoption and maturation dynamics.
When an innovation is introduced, oftentimes only a low level of effort is dedicated because the innovation is poorly understood. This, on the other hand, usually yields only small improvements.

Firms may be reluctant to adopt new technology, because performance improvement is initially slow and costly, also because they may have significant investment in incumbent technology.

On the other hand, as the understanding about the potential of the innovation increases, investment increases and the performance also improves.

However, this also means that some technologies don't always reach their full adoption potential. They may be displaced by new, discontinuous technology. Examples include the switch from carbon copying to photocopying, or from vinyl records to compact discs, or that first automobiles were initially much slower than horse-drawn carriages.

Video 7: Three Phases of S-Curve (Part A)

Let's take a closer look at the different stages using the example of electric vehicles. Let's start with the Fluid Phase.

Electric vehicles were first invented in the middle of the 19th century. However, it took many experiments before the technology was ready for the market. Initially, the electric motors were inferior in range and efficiency to the combustion engine, which was being experimented with in parallel. While Tesla began to emerge in 2006 and has become the dominant innovator in the space today in 2020, various companies have been contributing to the shaping of the fluid phase. Just think of the first mass-produced hybrid model, Toyota's Prius, launched in 1997. Or GM's Volt, the first plug-in hybrid, launched in 2010. Or BMW's i3, or Nissan's LEAF, an all-electric car with zero exhaust emissions, launched in December 2010. Despite these developments, however, global sales of all-electric cars and vans amounted to only 1 million units between 2010 and 2016. While the number of sales rose, it remained low compared to the total amount of cars sold in the same year. For example, global sales of all-electric vehicles was 2.1 million in 2019, but the total amount of cars sold in the same year was 77.5 million.

This is because these early versions of hybrid and electric vehicles were often expensive, as the technology was relatively new and was only produced in small series. Customers were mainly people in narrow segments who cared about the environment, or were looking for a futuristic status symbol and willing to pay a premium or accept heavy compromises.

Above all, however, their performance was limited due to low investment relative to the combustion engine to respond to low demand, a catch 22 and a key feature of the fluid phase. We see this in the example of Tesla. Tesla introduced the Model S in 2010, which had a standard range of only 160 miles at a steep price of around USD 60,000. Thanks to investments by the U.S. Department of Energy, battery costs were then reduced by 50 percent in just four years through 2013.

Against this backdrop, the Transitional Phase began with the introduction of Model 3, Tesla's mass market vehicle, announced in 2019. The standard range of this model rose to 250 miles at a price of USD 35,000. So the increased efforts led to an increase in performance, which in turn led to a greater adoption of electric vehicles: Tesla sold 19,000 cars in 2014, a figure that rose to over 190,000 by 2019.

Video 8: Three Phases of S-Curve (Part B)

After the Fluid Phase comes the Transition Phase, where the market settles on a dominant design, diffusion and standards. In the electric vehicle industry example, think about the developments towards standardized charging systems for electric vehicles or the ongoing

search for standardized regulation of autonomous vehicles, which are now converging on electric vehicles.

Those standards help level the playing field and enable innovation, which means that more and more competitors are encouraged to come into play. For actors to win in this environment, it's critical to build alliances with some sort of defensive moat around their standards. The goal is to minimize the ability of others to succeed with competing standards, and build the capacities to scale their own innovation quickly. Against this background, we often see consortia form compete and, in many instances, also fail to launch.

As of 2020, we are still in the late fluid phase, but we see the beginning of such consortia forming in Europe, the US and Japan. We see Ford and Volkswagen working together, Toyota working with Suzuki, Mazda collaborating with Subaru. BMW is working with Jaguar Land Rover and Daimler sold a 50% stake in its Smart brand to Geely earlier this year, with the companies planning to make the marque EV-only.

The third phase is the Specific Phase, where the products mature, price-based competition often sets in, and competitor or producer numbers start to consolidate.

At this stage, investments in the technology are usually starting to get discontinued, or go through a rebalancing of resources as companies are looking to create scale economies and generate efficiencies. Volume markets get addressed, and they become saturated as the products mature. Experimentation and breakthrough innovation takes a proverbial back seat, and the S-curve starts to flatten out. Usually, so do margins, as the fat-and-rich "wild west" period of the many competitors gives way to greater market concentration and a focus on being the biggest.

While electric vehicles are still a ways away from this point, think about another example: What additional functionalities should have been added to the pocket calculators around 2000, when mobile phones started to fulfill all basic functions of a pocket calculator?

Therefore, Innovators need to have a steady pipeline of Fluid Phase projects and a smaller number of transition phase activities to always be ready to overlay another S-curve when the previous one matures.

Video 9: Impact of S-Curve on Business Strategy

What does all of this mean for a company's tech strategy? During the Fluid Phase, a new technology is introduced to a market and not well understood by the potential users yet. This means, at this stage, companies are well advised to leave their R&D focus open. Innovation needs to evolve through trials and errors. This is an uncomfortable period for many managers, because it's not efficient and ROI is more uncertain than ever.

This unspecified focus is necessary, because of technical uncertainty, flexible processes and inefficiencies I mentioned. It's a period in which we figure out what sticks and makes money. Hence, there are some external and internal challenges to be aware of during the fluid phase. Being aware of the challenges will help companies move more successfully through this stage. External challenges include an uncertain market response to a new innovation, long and complex sales processes, and the lack of an ecosystem. Internal challenges include undefined values, unclear business strategies, no definition of a "minimum winning game" for this new

technology, as well as unproven business models. Defining a MWG is critical at this point. Innovation executives need to prove that the technology can find its market with a first adopter, or set of adopters who can validate it and pay for it. Once that happens, CFOs or VCs will be more willing to provide follow-on funding.

Thus, first adopters are critical. According to Rogers and his seminal theory of “Diffusion of innovations", in a market there are 5 different adopter groups: (I) the innovators, (II) the early adopters, (III) the early majority, (IV) the late majority and the (V) laggards. Each group requires their own communication channels in order to drive adoption. The innovators belong to the curious and risk-embracing type of people who like to share innovations with their communities. They are technology enthusiasts. The early adopters, also known as the visionaries, learn quickly about innovations and are willing to try them out. The late majority focuses on proven technologies before they adopt them. They insist on good references, and are not easily influenced unless they see a good reason for it. The laggards are very sceptical towards new innovations, and would rather not change anything to adopt a new technology. For them, the risks often outweigh the promise. It requires a lot of data points as proof to help them overcome their concerns for the business and their own careers.

In conclusion, during the fluid phase, businesses must stay very alert and aware of the evolution of technological innovations. They need to understand how best to respond to early signals to calibrate on both the market needs and communications.

Next, in the Transitional Phase, a business takes the key learnings from the fluid phase, and adjusts the innovation to be more tailored to the market. This means R&D efforts need to adapt and become more focused. The product is gaining in specific features. By this time, there might be already new firms bringing similar technologies to the market. This also implies that competition becomes around pricing rather than innovation.

The performance of the business increases due to the better understanding of the market situation. In conclusion, this is the phase in which growth is happening!

The Specific Phase is the phase where performance is stagnating over time. There’s little or no more growth in the adoption of a technology. The product is well known and its design becomes standardized. This is usually when we see a focus on maintaining market share through sustaining innovation, and a much more granular weighing of features and functionality against price.

Some of the internal and external challenges in the transitional and specific phase include retaining the right leadership in the business, because the talent that was attracted to earlier phases may leave. The technology in question needs not only an appropriate management for the Specific Phase to maintain margins, but also new impulses to renew the business and maintain growth momentum. The specific phase also requires keeping a close eye on competitors and suppliers. Competitors might stop innovating, and suppliers might incorporate your innovations in their own components to achieve cost reductions.

Usually, we catch the next growth curve by starting another S-Curve where the older one starts to flatten out. After understanding the different phases of the S-Curve, it’s time to ask ourselves relevant questions for our business. What could come after the S-Curve? Is there another pattern to follow for introducing technologies sustainably?

Video 10: Fly Over Tech Domains: AI, Data Science & Compute Power

This a high-level fly over the different technology domains that are rapidly transforming our lives and society as a whole. There's so much we can learn about each technology, but let's first get an overview and understand what they are all about.

When we think of AI, we often think about science fiction movies like the Matrix, Terminator or Star Wars. Science fiction movies are most often reflecting human-like intelligence, or even an intelligence superior to humans. As such, humans end up in an inferior and terrifying position where they have never imagined themselves before.

Let's unpack this. AI is an umbrella discipline that covers everything related to making machines smarter. For example, AI can allow machines to identify defects in textile, at a speed and accuracy that the human eye cannot detect or predict. AI can do things from predicting how many patients a hospital will need to serve in a time period, to allowing self-driving cars to travel from San Francisco to Seattle. Because machines can digest more data than a human could ever do, machines are outperforming humans already in some of these tasks.

But leveraging its potential is still a herculean task. The development, adoption and scaling of AI and data require businesses to rethink their products and business models. It also requires businesses to redesign their organizations in order to secure the availability and accessibility of high-quality data, computing power, talent strategy, research and innovation partnerships, ethics policies and governance systems.

We are going to dive deeper into AI and data science by addressing key questions for our business such as "What are the advantages and limitations of AI?" "How do these affect our business models?" as well as "How to negotiate with global digital platforms?"

Digital technologies require computing power, either on-site, through the cloud or both. Which options a company chooses depends on the strategic importance attributed to the technologies and data, and level of protection that is desired.

Put simply: If we speed up computing, we enhance AI. This will allow us to solve a whole new horizon of optimization problems, and enable solutions that are too complex for our current state of processors, such as traffic management in IOE, cognitive neuroscience in AR/BCI.

While performance of semiconductors such as memory chips or processors has significantly increased over time, prices have dropped, making some semiconductors as cheap as a grain of rice. Yet, "Moore's Law", which meant that chip performance doubles every two years, is believed to have hit its limits. New chips therefore become of increasing importance, such as AI specific chips called ASICs, or entirely new designs and approaches like neuromorphic chips and quantum computing's Q-bit technology.

The impact of quantum computing will likely be the most significant on society and on businesses. For example, quantum computing has an impact on cyber- and national security, since quantum powered code will likely be able to break all existing security systems. As countries get smarter in using quantum computing, government leaders should be aware of this risk, and protect their information to prepare themselves for the quantum world. As Satya Nadella, the current CEO of Microsoft, once said, "The battle over quantum computing is "an

arms race" as important as AI or virtual and augmented reality, though it has "gone largely unnoticed."

Understanding compute power can help answer questions like "How can compute power create value in your products or services?" "How can we enable secure access to new compute powers?

Video 11: Fly Over Tech Domains: Internet of Everything, Robotics & Automation

With the drop in prices of semiconductors and increasing connectivity through the proliferation of 4 and now 5G, we are seeing an increasing amount of things and devices connected to the internet. By 2025, the number of devices to be connected to the internet is projected at 75.44 billion worldwide, a fivefold increase in ten years, and ten times the amount of people living on our planet.

The number is set to grow further. A review of the Internet address book in 2012, commonly referred to as IP addresses, allows for 340 trillion trillion trillion devices to be connected. That's 340 with 66 zeros. Consider the immense complexity of all those IP addresses talking to each other and deriving value from that. A potential treasure trove of insights, but also noise.

That's the Internet of Everything, or IoE, connecting people with people, people with machines, machines with machines, machines to data, data to meaning and value to action. IoE is the broader concept behind The Internet of Things, or IoT, which is limiting itself to only connecting physical objects with each other. In doing so, IoE allows for optimizing the relationships between people, communities and organizations, by designing the needs of each individual group in the overall system.

As such, it improves asset utilization, employee productivity, supply chains and logistics, customer experience and innovation and time to market if we get it right. Relationships between the three categories of "Everythings" become visible. We can optimize them by designing what the different parts need most in the overall "nervous system of society." It will likely also open up entirely new top-line opportunities through new types of products and services addressing this. As trends in computing power increase the performance on the edge, so does the processing of data on the device.

First things first: Robotic, automation and AI are not the same. Many robots or automation processes are not intelligent. Think about the many industrial robots that conduct repetitive tasks, which usually don't require intelligence. Not all automation requires robots, which are mechanical and require engineering. Automation can also mean the automation of cognitive processes solely through software without a mechanical element. Think about book-keeping software that automates the accounting of receipts.

Another way to look at it is by distinguishing hard and software robots. Software robots can be installed on a device such as on a PC or a physical server. They can take the form of a website interaction bot, data management bot, or IT services bot. Hardware robots are a piece of machinery used for implementing automated power. Hardware robots are used for example in construction businesses.

While robots especially in the manufacturing industry are globally on the rise, their negative impact on the labor market has been largely debunked. The impact of automation and robots on

the labour market remains debated. The horror scenarios of major job losses were false as we start to understand that robots and automation replace individual tasks rather than complete jobs. In any case, the consequences robots can have on the business, on society and on the environment are tremendous.

Here are some questions you can ask yourself: What kind of robots might be suitable for my business? How will robots affect my business economically and socially?

Video 12: Fly Over Tech Domains: VR/AR, BCI/BMI, Fintech & Blockchain

Let's fly over to VR/AR, which refers to Virtual Reality or Augmented Reality. Both terms seem quite similar but are different when taking a closer look at them. Whereas VR is a presentation of a complete virtual world through glasses and controllers, in AR, virtual elements are added to the reality through a phone, TV or a computer.

VR enables utilization of computer technology in order to develop a simulated environment. In contrast, AR lays computer-generated representations over an existing reality that enhances the interaction ability of this system for the human. AR can have a significant impact on the healthcare sector by modelling organs and saving lives in the way that medical concepts can be broken into 3D forms. VR and AR can not only influence education, healthcare, fashion, and food and beverages sectors, but also transform the tourism and retail industries.

While VR and AR might make it sometimes hard to distinguish between different realities, those technologies are non-invasive. By contrast, BCI and BMI can be both invasive and noninvasive. BCI/BMI stands for Brain-Computer Interface or Brain-Machine Interface. It allows for communication between the brain and the computer by reading brain waves and stimulating neural activity. It's a two way street. It can help paralyzed people to walk again and communicate without speaking or immersing themselves in a new generation of computer games. Brain and computer must learn how to cooperate and work with each other.

Making BCI work is no longer a question of basic research. Those riddles are being solved. BrainQ, an Israeli startup, already combines machine learning with neuroscience, developing an AI-powered electromagnetic field therapy aimed at reducing disability following stroke and other neuro disorders. The startup Kernel is building affordable helmets that can see and record brain activity, enabling scientists to analyze neurons as they fire and reveal more about how the mind works.

VR/AR have a much higher potential to drive some of your businesses in the future, as does BCI/BMI. We will explore how to bring more virtuality into your business, and how to become innovative leaders in this domain.

Digital technologies are disrupting the way we save, pay, borrow, lend or govern money. From seamingless consumer experience, extensive financial inclusion to total automation of portfolio management, everything is transforming in the financial industry.

And let’s make no mistake, those FinTechs are not filling just niches anymore. The Economist magazine reported in October 2020 that the sector is coming of age. The looming IPO of Ant Group, measured by cash raised, will probably be the biggest initial public offering in history, beating Saudi Aramco’s in 2019.

The underlying technology infrastructure, next to AI, is increasingly Distributed Ledger Technology or blockchain as it is commonly referred to. Decentralized Finance, or DeFi, refers to decentralized financial instruments that offer loans, derivatives and interest for example. But they don't rely on banks or traditional currencies and use blockchain and crypto instead, accounting for the largest share of Venture Capital in the FinTech space.

Despite continuing volatility, cybersecurity risks and legal uncertainty, crypto currencies have boasted continuous YoY market cap growth since 2014, with a value adjustment after the hype in 2017. An increasing number of industry experts see macro-economic trends driving crypto assets further.

It's important to explore colliding trends and cross connections, actors and implications of Financial Technology, in order to answer questions such as: "How can we leverage FinTech innovations?" "How can we identify business cases and better embrace coins, utility or security tokens?"

Video 13: FLP IT Model: Forces and Logic

Seeing opportunities and remaining resilient is crucial during uncertain times. The coronavirus pandemic that started in 2019 had a drastic impact on the worldwide economy. Many sectors are badly affected, whereas some others continue to thrive. No matter to which sector the business belongs, it's important to see the pandemic as a new opportunity and practice resilience during change and uncertainty.

The FLP IT Model helps to flip your view, realize opportunities, and practice resilience for businesses facing disruption including technology disruption. It helps us create technology futures, see opportunities, and craft moves that give us competitive advantage.

It does so by looking at 5 essentials steps that jointly comprise FLP IT: (I) Forces, (II) Logic, (III) Phenomena, (IV) Impact and (V) Triage. We will go through each of the 5 steps and share what they involve.

There are several different uncertainties and forces that can develop in a pandemic. Uncertainties include the range of tech trends and forces colliding with non-tech forces, such as the time until a vaccine is found, the impact of lockdown on the economy, the mortality rate of the virus, the degree of solidarity in the countries. Anticipating different uncertainties and forces allows us to foresee and validate different opportunities.

To position your business robustly under change and uncertainty, it's important to assess the forces and create potential future scenarios. When you assess forces, you can pick any you think are suitable, but they need to fulfill one important criteria: Namely the one of high impact and high uncertainty. You can then position this force in a matrix constructed of two other uncertainties, such as, for instance, the impact of stimulus & rescue packages by government and adaptive capacity of societal institutions.

It is important to understand that not every uncertainty or force needs to be a technology force to be disruptive. Rather, we need to combine tech forces with non-tech forces to understand how the fabric of the future will be woven. So, don't forget to consider a broad range of STEEPLEM forces, which stands for Social, Technological, Economic, Environmental, Political,

Legal, Ethical, Military. This is because tech and non-tech forces collide in real life and create threats and opportunities.

Video 14: FLP IT Model: Four Potential Future Scenarios

Depending on where to position the forces within the matrix, it can provide you with four potential future scenarios. Let me walk you through each of them. What are the four potential future scenarios under a pandemic?

In Medieval Mess, there's a perpetual toggling of restraint and relief, as virus waves keep coming. This is a world in which economies experience a wide variety of cycles with on-and off-months. There's a massive disruption of business models that rely on physical contact and absence of broad consumer spending power. Inequality grows as global capital elites pull away from the rest of their populations and localism prevails. Widespread unemployment and poverty rises. A generation of disenfranchised individuals ensues.

The second scenario is called Technographics Triumph, where Asia loses soft-power, but gains hard-power and steps into the global leadership vacuum. This is a world in which a handful of countries manage to suppress the virus and stimulate the economy at different speeds, but speed is everything. Those that have tight rule enforcement and burden-sharing are faster. Their programs generally hit the right spots. China's domestic market fills the vacuum created by US and EU recessions and unemployment.

Frugal Feudalism is the third scenario, where the economic set point is stuck at a low level. This is a world in which governments manage to collaborate to suppress the virus to low levels and bail out corporations, but the misallocation of resources leads to depressed purchasing power, continued high unemployment, which in some regions becomes chronic. Social dynamics suffer and modern tribalism re-emerges. Political-economic oligarchies solidify power. We see a sustained focus on frugal solutions developed by entrepreneurs with Universal Basic Income business models.

The last scenario is Renaissance Reloaded, where adaptive innovation leads to new higher levels of growth. The world puts the crises behind itself as one of history's most costly learning laboratories, gaining significant anti-fragility. New innovation in adaptive technologies, shorter cycles of production and experimental approaches, combined with immunity and vaccines as well as demand empowerment, lead to a new wave of creativity and productivity. A new wave of techno-optimism surges, as people are confident that technologies can meet them where they are at, rather than the other way around.

The goal of this exercise is not to predict which scenario will ultimately play out. Mapping out different scenarios is important to understand the extremes and anticipate where we might position ourselves in the future.

Video 15: FLP IT Model: Phenomena, Impact, and Triage

Now let's see what patterns and phenomena emerge from the scenarios. That's the P. During pandemics, like COVID-19, many changes in our society and economy happen. For example, there's less dependency on international trade, and a stronger focus on local economies, increased work from home, increased automation and digital transformation, and increased national production for the survival of future crises leading to potential deglobalization.

Let's look at the I for Impact. Diagnosing the socio-economic system and creating different scenarios can have a positive impact on the value chain. With disruption, systems are under stress. According to renowned author Nassim Taleb, "If they are healthy, they will learn and heal. If they are flawed and fragile, they will break." Look for breakage points, and look for opportunities where our technologies can help the system learn and become more antifragile.

Identify who has the power in value chains, and how to intervene at which levels by initiating innovative ideas. When revenue stops flowing, who is particularly vulnerable to that? Who has thin margins, who lacks cash reserves, and who is well positioned with a lot of leverage downstream and upstream in the chain? This will determine who's up and who's down, which will have a fairly direct impact on their margins and sustainability. The value chain might morph or consolidate as a result.

Having understood the different scenarios and the impact of phenomena, you need to review what this all means for your business. What have you learned? How can you best position yourself to continue to thrive in uncertain times with significant pressures? These are questions to ask at this stage. In most cases, this will require that you triage your portfolio of projects and businesses, especially those that are technology-driven or require more technology adjustment. That is the T. Old projects need to be divested of or shut down to avoid liabilities. That should set free resources for new parts of your portfolio to be created or emphasized. Disruption should always lead to throughtful, agile changes in portfolios, projects and business models. Disruption without such adjustments is merely chaos and pain.

In summary, the FLP IT model helps you flip your focus from what could be threatened, to the opportunities that could be realized and to practice resilience for your business. The FLP IT model stands for 5 essential steps to take: (I) Forces, (II) Logic, (III) Phenomena, (IV) Impact and (V) Triage. It's important to identify and assess different forces, especially those with high uncertainty and high impact. It's also critical to analyze how they play out in future market scenarios. Consider the different phenomena and the impact of those phenomena on your industry and your business. Reflect on that and recompose your business or project portfolio accordingly. Most importantly, stay innovative and harvest the future opportunities.