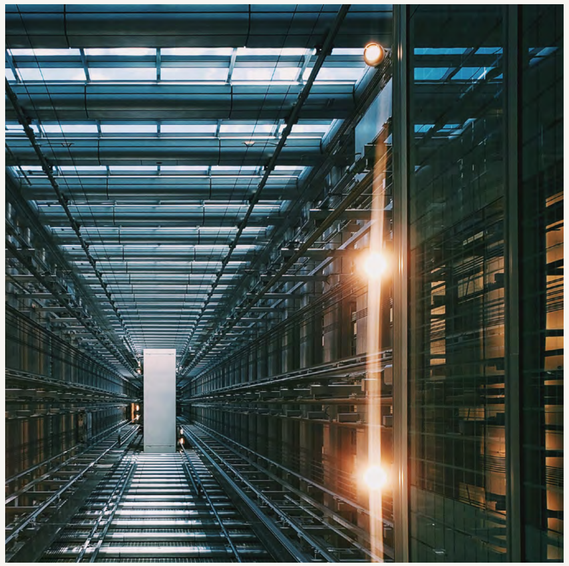
# Strengthening Phenomena

2020-2030

CIRCKLO



# Cloud Computing

Strengthening
2020-2023

**Massive computing power and storage capacity can be accessed cost-effectively and in real-time through the use of cloud computing. The market and use of cloud computing services are anticipated to grow thanks to the business opportunities they create. Cloud computing will play an essential role in the emergence of smart cities, future of work, autonomous vehicles, as well as in bringing the use of Big Data and the Internet of Things to the industrial settings.**

## Background

Cloud computing refers to virtual computing resources, software, platform or infrastructure delivered over the Internet, as a service. As there is no capital tied to servers or maintenance, cloud services can provide flexibility and resilience in developing and running applications and storing data.

The most significant impact of cloud computing to businesses is access to the latest low-cost technologies. It helps with storing, processing and analysing masses of data – fundamental to the usage of Big Data and developments associated with IoT, Industry 4.0, AI, and machine learning.

In 2019, many larger corporations formed partnerships aimed at creating new cloud computing-related concepts. Volkswagen teamed up with Microsoft for connected vehicle services, IBM with Bank of America for financial services-specific cloud computing, and Microsoft with Oracle to strengthen their positions with the competition.

In cloud computing, cybersecurity-related issues will persist in the years to come, but actions are continuously taken to mitigate the problems. In 2018, Siemens initiated The Charter of Trust, a partnership to improve cybersecurity across global supply chains.

## Impacts

The applications that create value by using cloud computing set the pace for the future. Pay-as-you-go access to cloud services can boost the innovation capabilities of start-ups and small businesses. Furthermore, when access to massive computing power through the cloud becomes a reality, scientific breakthroughs could be easier to achieve.

The data transfer policies of some countries may limit local access to the international cloud computing market. For this reason, cloud computing might not spread quickly everywhere, but it may be mainly found in societies with more comprehensive laws.

Cloud computing will also affect the energy sector. By 2030, Nature estimates the total Information and communication technologies (ICT) energy demand will be between 8 and 21% of all electricity consumed.

# Open Source

## Strengthening 2024-2028

**The open-source model that offers developers open and free access to source code of a programme is becoming a standard in the industry. According to Forrester, Gartner and other analyst firms, 80-90% of all the software developers are already using OSS (open source software). This number is expected to rise as most companies and developers understand how OSS can help to offer faster time-to-market with lower cost and better customer experience.**

### Background

Around 30 years ago, companies creating disruptive software solutions patented them, and also imposed restrictions on their usage, only offering their creations through licensing arrangements. Such licensed software not only had limitations on the usage and other operational shortcomings, but it was also costly. Cut to today's world and you find a wide range of companies thriving in the same space, utilising a common software framework, only differentiated by some additional or innovative features that give each company its competitive advantage. OSS has brought a new revolution into the world. The free and open availability of source code allows the developers to modify the codes and create a new, advanced or an altogether unique application that best suits their requirements.

Adoption of OSS has aligned with the growth of the sharing economy which is mainly based on the concept of collaborative consumption. Companies have shifted their focus from being exceedingly protective of their codes to openly sharing them in a quest to create more advanced and innovative offerings that will better serve their customers. This tectonic shift in approach has driven giants like Tesla, Apple and Facebook to share their open-source software and architecture and support the development of solutions that could disrupt the traditional ways of business and operations.

There is an increase in the number of start-ups entering the market to capitalise on the opportunities that open source architecture offers, while major corporations are also penetrating the segment through partnerships and M&As. Microsoft bought GitHub for $7.5 billion, while IBM acquired Red Hat for $34 billion. In 2018, acquisition deals in the OSS sector reached $55 billion.

### Impacts

Recent reports by Forrester, Gartner and other analyst companies indicated that 80-90% of all the software developers are already using OSS. In the future, this number is expected to rise closer to 100%. This is due to most companies and developers understanding the advantages of OSS, and to the world increasingly adopting disruptive technologies like cloud systems, IoT and artificial intelligence (AI).

As the world becomes more connected through digital technologies, the threats to security systems are growing. A 2018 Synopsys OSSRA report, which audited over 1,100 codebases, found that 77% of IoT codebases entailed open source components with an average of 677 vulnerabilities per application. This could spell disaster if such vulnerabilities are not fixed and end up in the final product. Security concerns and the implementation of more stringent data protection and privacy regulations impact, and will likely continue impacting, the OSS segment. If the security issues are not addressed robustly enough, this will affect the use of open-source code. Security concerns will drive further development of automated tools like Diffblue Secure for the identification of and fixing security vulnerabilities.

The open-source approach is further expanding to cover areas like machine learning (ML) and artificial intelligence, with new open-source ML and AI learning libraries/ frameworks like TensorFlow now available in the market. Availability of open-source AI and ML programmes will expand the applications of the technologies to newer fields and functions through the creation of innovative AI/ML-based solutions.


# AI Machine Learning

Strengthening
2024-2028

**Machine learning is an important branch in Artificial Intelligence computing. It uses complex algorithms to analyse large data sets to produce probabilities and likeness between variables. Services like Apple Siri and IBM Watson are based on machine learning.**

## Background

Everyone is familiar with machine learning from Google's search engine or Amazon. The results that combine user profile metadata with search criteria may sometimes seem trivial, yet the math and computer science used to achieve those results are quite demanding.

Machine learning predicts outcomes based on past occurrences, pattern recognition and statistics. It applies and develops further mathematical methods used in statistics.

Complexity of the math and software code of machine learning requires considerable resources from the developer. Thus it is not surprising that large companies offer machine learning expertise as a service, such as Amazon Machine Learning, Microsoft Azure and Google Prediction.

Machine learning may also be done in real-time. The Google Car project is a good example: incoming data is analysed on the fly (or rather on the drive). A rapidly growing field is using machine learning for bots that act as APIs (application programming interfaces). Using Natural Language Processing, these bots analyse speech, texts or tags. Here the data set is large over time, and results improve respectively.

## Impacts

In the future, machine learning will evolve and move towards deep learning algorithms. Compared with algorithms where their designer fully controls what it does, machine learning will add a dimension where the software learns in the process and may fine tune its code. In other words, variation in a data set may also cause a change in the algorithm that works on it.

Machine learning benefits primarily large companies or entities such as nation states which possess large data sets and have the resources to analyse them. If machine learning code will be released as open source, it raises questions about privacy when data that exists in the public domain can be easily cross referenced.

# From Products to Relationships

## Strengthening 2020-2023

**Social media and omnipresence possibilities have transformed customers' relationship to brands. Companies will need to be able to offer holistic customer experiences rather than mere products if they wish to survive in the fast and competitive markets of the future. Customers will increasingly demand more individualistic attention and service. Therefore, creating an ecosystem that engages customers and manages customer relationships will be at the core of business activities.**

### Background

Consumers' relationship with brands is evolving. Social media and omnichannel presence possibilities give companies a more human-like character and allow them to be more present in customers' lives. Digitalisation and emerging technologies present novel ways to connect with customers and create value that goes beyond merely offering products and services. Accordingly, brands' ability to form emotional connections with their customers is becoming more important.

As customers' relationships with companies begin to resemble their relationships with people, their expectations also change. In today's competitive marketplace, customers are increasingly drawn to value-driven companies that have a strong vision and purpose. In addition, they expect personalised service and convenience in every touchpoint across the entire customer journey. Companies that offer these holistic, personalised experiences can form long-lasting, value-driven relationships with their customers.

Moreover, in the age of conscious consumerism, advertisements are no longer as effective as they once were. Forming relationships with existing customers increases brand loyalty and reputation, which then attracts new customers through positive reviews and word-of-mouth marketing. For example, corporate responses to COVID-19 illustrate how marketing is becoming more relationship-oriented. To support their customers during this extraordinary time, many companies stopped brand promotion activities and instead focused on communicating empathy.

### Impacts

The increasing importance of meaningful relationships will have a transformative impact across all industries in business-to-customer markets. Companies will need to invest resources to remain constantly engaged with their consumers across multiple channels and offer fast, convenient and personalised services. Data will be a central component of forming relationships and curating individualised experiences.

Marketing, consumer insights and brand strategy departments will play key roles in creating strong and consistent brand images, managing brand relationships, and finding innovative ways to connect with customers. Customer reward programs, conversational marketing, experience and atmosphere design will also rise in importance. In the future, brands that offer convenience and emotional value will continue to have a competitive advantage. Companies will increasingly position themselves as social agents and empower customers through purpose-driven marketing.


# Internet of Things (IoT)

Strengthening
2024-2028

**The internet of things (IoT) refers to devices which communicate with one another and people via the internet. The possibilities of IoT are considered immense. The development of IoT itself, alongside increasing processing power, software, sensors and data storage, is considered as one of the central drivers of the fourth industrial revolution.**

## Background

In the vision of the IoT developers, each built square meter will have at least one data collecting and transmitting sensor. The sensors do not necessarily need to be attached to the grid, as they can get their energy directly from their environment: for example, from movements of air or pressure fluctuations. This vision will not necessarily be realised through the 5G. For this reason, high expectations are placed, on the 6G technology, as well as on the Narrowband-IoT technology.

According to the forecast of International Data Corporation, by 2025 there will be 41.6 billion connected devices which will generate 79.4 zettabytes of data. The same estimates suggest that $ 1,2 trillion will be spent globally on IoT by 2022. The IoT market is especially expanded in the 2020s by preemptive maintenance, self-optimising production and automated warehouse management. After this, we will witness IoT's growth in consumer markets also. In the long term, rapidly developing communication networks, nano and material technologies, brain research, medical and biotechnologies, as well as the advances in the AI, open whole new dimensions to the possible uses of the IoT.

## Impacts

IoT will lead to systemic change that will require new mindsets and a higher agility within organizations. In business terms, both value creation and value capture will be different. For example, not only current but also emergent customer needs must be addressed in real time and in a proactive way.

Going forward, it might no longer be enough to develop, make and sell standalone products that become obsolete with time. People and businesses expect product refreshes through over-the-air updates, with minimal disruption and hassle. This will continue the push for organizations to pursue a recurring revenue model instead of (or in addition to) point transactions.

The increasing capabilities of smart, connected products are expanding and reshaping industry boundaries. This interconnectedness will demand that companies understand and manage their industry and business processes on a high-level. It might become increasingly important to zoom out and understand other players' businesses and priorities in the marketspace to find and exploit complementary partnerships.

# Blockchain

Strengthening
2023-2028

**Blockchain, the technology behind the cryptocurrency Bitcoin, is a system of recording information in a way that makes changing or hacking the data extremely difficult. It is one form of Distributed Ledger Technology (DLT) where records of transactions are stored in public digital ledgers distributed across the network. Blockchain technology is not confined to the cryptocurrency world, and it can bring about a technological revolution as big as the Internet.**

## Background

Blockchain is a shared ledger, a database that is distributed on a vast number of computers. Information on a ledger is processed and distributed in blocks, encrypted by a hash algorithm, and then chained sequentially. Whenever a transaction is added or changed, the update is processed simultaneously in all the ledgers across the entire network. This makes the system almost unbreakable, as hackers need to tamper all the blocks in the chain at once to be able to alter the data.

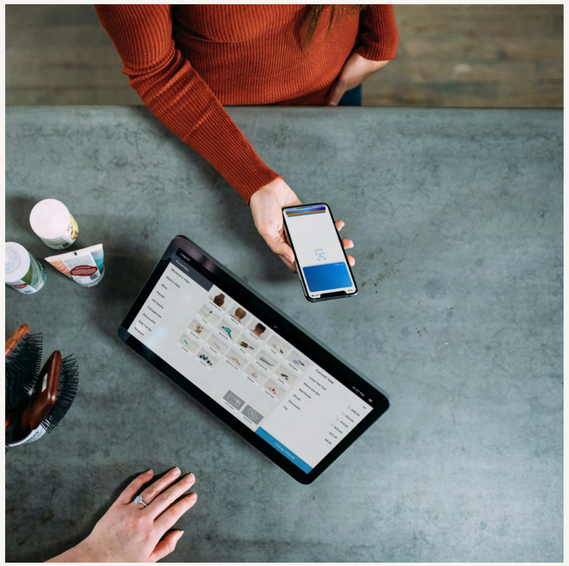
The first generation of blockchain started with Bitcoin, and it had been synonymous with cryptocurrencies. However, many saw boundless possibilities and potential applications of this revolutionary technology outside the cryptocurrency world. Blockchain could be used in any sector where high transparency and robust security are required in transactions.

The second generation blockchain was brought about by Ethereum, a cryptocurrency produced by Vitalik Buterin. Ethereum is not only a cryptocurrency but also a tool to build decentralised blockchain applications. A feature known as “smart contract” enables the blockchain to be used for exchanging anything of value directly without any middlemen. While the previous generation blockchain exchanged only cryptocurrency tokens, smart contracts now allow other assets and information to be exchanged. This opens the possibility for various applications in business transactions that are not limited to the financial sector. Many big corporations such as Microsoft are adopting this technology to cut down costs and save time.

## Impacts

Internet visionary Don Tapscott considers the blockchain to have equal potential, as a technology, to that of the birth of the World Wide Web in the 1990s. It may alter the hierarchy of information and, in particular, enable new kinds of organisations to reliably manage and transfer funds or other assets on the Internet.

Investment and research into blockchain are still gathering pace, and potential applications of this technology seem far-reaching. Researchers are exploring possible uses in healthcare, insurance, supply chains, voting, and many more industries. For example, the major supermarket chain Walmart already utilises blockchain to manage its supply chain and to enhance the traceability of food. Sony has also developed a copyright management system based on blockchain, which is free from data tampering. Such use cases are expected to expand further.



# Big Data

Strengthening
2020-2023

**Each new day more data is collected and the tools for data management and utilisation become more sophisticated and effective. The role of big data in knowledge creation and analysis is constantly growing, which suggests significant disruptive impacts to all venues of human life in the future.**

## Background

Big data is a wide and evolving concept which can be simplified to mean the transformation of massive amounts of unstructured data into an easily understandable and presentable form. Therefore, the core of the phenomenon is in the management, analysis and dissemination of data.

The big data revolution is driven by technological developments such as supercomputers, cloud-computing and mobile communication. We are constantly moving towards more efficient and better real-time, anticipatory and intelligent data analysis. This also means we have to pay increased attention to the threats the development poses on, for example, privacy, safety and equality.

Big data has been named by several experts as the next revolutionary power to change the ways people work, live and think. However, big data will affect the operations of organisations even more drastically, as the effects are boosted by advancements in assisting technologies, new work models and the Internet of everything.

## Impacts

Big data has already changed the ways organisations operate. In ten years, its significance as a valuable source of information is generally recognised. Big data will be a remarkable competitive advantage for early adopters and the big players who have the resources to invest in the increasingly powerful and intelligent business analytics solutions. Data will be a more important source of revenue for all kinds of companies as the data market grows hand in hand with the development of better algorithms for its utilisation.


# Platform Economy

Strengthening
2020-2023

**Platform economy mainly refers to service innovations built on external online ecosystems and made publicly available to consumers. These platform-based services are easily scalable and, therefore, endlessly replicable, creating huge growth potential for companies that succeed in their marketing efforts.**

## Background

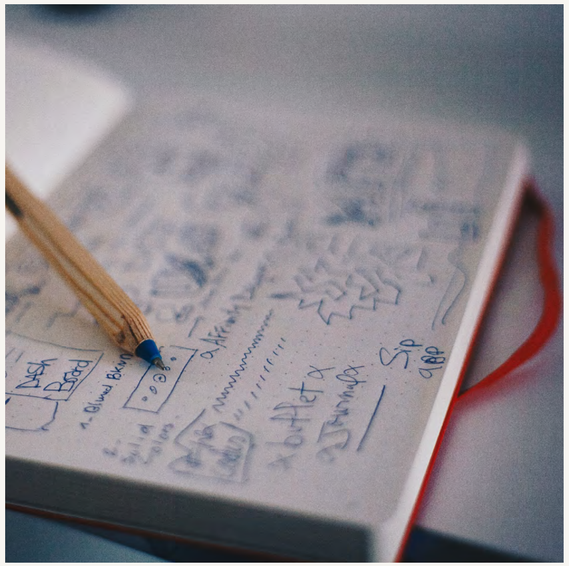
Some platforms operate on advertisement revenue, others link consumers to one another and turns them into producers. The platform provides stakeholders with necessary reliability and it usually handles money transactions.

Many countries have doubts regarding the platform economy. Because operations on platforms often form a global marketplace, controlling them is difficult. For example, Airbnb has been banned in cities such as New York and Berlin to protect local hospitality businesses. Uber, on the other hand, tends to bypass all education and license demands and is therefore considered illegal in Finland.

The platform economy (or platformisation) is closely linked to a variety of new kinds of businesses, such as social media (Facebook, LinkedIn, WhatsApp, Instagram), sales and auction sites (Alibaba, Amazon, eBay, Angie's List), finance and insurance sector (Revolut), recruitment services (Workday, Elance-oDesk, Freelancer, WorkFusion), urban transport (Uber, Lyft, Sidecar), mobile payment (Mahala, Square), cleantech (Sungevity, SolarCity, EnerNOC) and a growing number of other fields.

## Impacts

The platform economy may radically reduce the number of middle-men between producers and consumers in retail as well as in the service sector. The platforms are now driving globalisation. It is well possible that the near future brings along businesses that act as platforms for platforms, i.e. ensure a functioning operational environment for platform companies in countries and regions that have taken a negative view on a certain kind of platform business.



# Concept Economy

Strengthening
2020-2023

**New business and product concepts reach a significant market value way before they have generated enough profits to justify their estimated worth. A superior business concept enables even small actors to take over seemingly very competitive markets dominated by large businesses. Concept economy can act as a catalyst to transform innovative ideas into disruptive and successful businesses.**

## Background

Radio, TV, Internet, social media and mobile communication devices have all played their roles in making the world seem increasingly fast and hasty. The cycles of product and service development have quickened and results have to be visible sooner than ever. First come, first served: good ideas and concepts have become the core of economic success.

The worth of concepts can grow at unprecedented rates. One example is the previous Instagram deal: Facebook bought the 2-year-old employer of 13 that ran a social media concept focusing on photos for a whooping 1 billion USD. The shift from naught to a billion broke all records. The example clearly shows the opportunities of good concepts.

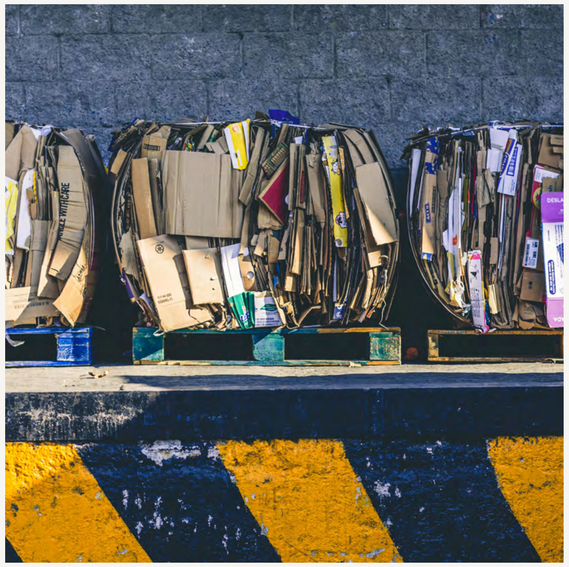
A similar requirement for haste has started to come into effect also in the public sector. As the operational environment is increasingly changing, flexibility, rapid development work and agile decision-making have become more and more important.

Moreover, transparent sharing of ideas and concepts is now more common than before. Many have stated that ideas without actualisation have no value. But then again, one could put it the other way round; even the best realisation falls short if the idea is no good.

## Impacts

The concept economy, together with the creative economy, catalyse the creation of start-ups and increase the capital these can raise. Companies built on sound concepts can be more directly built to be sold, not necessarily to create clear profits. However, concepts are difficult to copyright or otherwise secure, and thus the concept economy forces businesses to aim for publicity and growth as quickly as possible.

If organisations lack the ability to react to change and identify threats, even well-established corporates could be replaced by those who lead expansion by game-changing and strategic insights. Thus, organisations which encourage openness to learn, novel ideas and diverse opinions are likely to seize the opportunity and transform their businesses into a success.



# Circular Economy

Strengthening
2024-2028

**Circular economy is a rising production model aiming to reduce waste and pollution by following the principles of sustainable development in the design of material flows. The efficient use and recycling of all raw materials benefit both the environment and the economy. A shift to a circular system also benefits human beings directly by allowing us to sustain our lifestyles, creating new job opportunities and improving our health through reduced air pollution.**

## Background

Circular economy refers to a model of production in which minimum amount of waste and pollution are created. Its focus is on the sustainable design of technical and biological material flows. The design of a technical cycle aims to re-use and extract maximum value from all products, components and raw materials. A biological cycle, on the other hand, is created following the idea that minimum amount of pollution enters the biosphere.

The economic value of this model is achieved through smart processes and energy savings, new technologies and materials, and efficient recycling and re-use. The concrete benefit for the environment stems from reduced greenhouse gas emissions and the preservation of existing ecosystems.

Sustainable development is fostered by many nations and concrete application models are crucial to its success. Circular economy is already a flagship initiative of the EU, and many other economies are developing similar strategies. This new model is also driven by several multinational companies, causing an increased environmental awareness of their customers. It is estimated that the global economy could benefit over US$1 trillion annually and create 100, 000 jobs by 2025 if companies shift to circular supply chains.

Climate change and resource scarcity are global concerns that are driving the demand for new and efficient approaches to renew our consumption and production. The growing world population and the industrialisation of developing economies are accelerating the demand for and implementation of sustainable systems.

## Impacts

Governments will develop concrete measures and offer economic incentives for companies providing greener products and supporting recycling schemes. Companies will increasingly adopt circular business models as more concrete examples exist, and cost benefits become clear. A shift from mass production to a circular model will also require a cultural shift away from today's capitalist modes of consumption. Public awareness will be fostered by teaching circular values in all levels of education, as well as by increasing customer and citizen campaigns.

Given that developing countries are the centres of production, global co-operation and investment will be crucial for the successful implementation of circular production and consumption models within developing economies. However, since the majority of the existing solutions are developed within the Western context, new approaches that address the particular challenges of emerging markets, such as the uneven access to resources, will be needed.

CIRCKLO