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1. Introduction



Welcome to Digital Transformation!

Digital transformation is everywhere at the moment. It can be found in companies, governments, and at countless conferences. As the hype around digital transformation continues to persist, the confusion also increases.

In this course, you will receive an introduction to digital transformation. We will explain the key terms, concepts, and technologies in simple and understandable terms. No previous knowledge of the topic is required. You will develop an understanding of what digital transformation is and how you and your company can benefit from it.

The concept behind digital transformation is how to use technology to remake a process so that it becomes more efficient or effective. It's not just about changing an existing service into a digital version but improving it. Digital Transformation refers to an **overall transformation** of organizational activities aimed at leveraging opportunities created by digital technologies and data. This requires companies to profoundly transform their business models.

Some of the technologies used in digital transformation projects are IoT, blockchain, big data, cloud computing, AI, and machine learning. Digital transformation is more than just adding technology—part of the transformation includes changing how employees think. If the corporate culture doesn't support change, then it will be difficult for a company to instill new business processes and reach digital enlightenment. The shift to a digitally transformed business often means breaking down silos and relating differently to customers.

Digital transformation poses many challenges, but it also creates an abundance of new opportunities for your job and your company. Becoming a digital enterprise requires far more profound changes than merely investing in the latest technologies. It calls for change in:

- **Digital Business Models:** Companies need to fundamentally change the way they identify, develop, and launch a new business
- **Digital Operating Models:** Companies need to follow a lean approach to both core and support functions
- **Digital Talent and Skills:** Companies need to attract, retain, and develop the right talent
- **Digital Traction Metrics:** Companies need to adopt newer digital traction metrics as traditional KPIs are no longer effective in a digital business

Digital transformation calls for reexamining the entire way of doing business and exploring new frontiers of value. The transformation through the adoption of digital technology has changed the entire landscape of client engagement, commerce, marketing, and more across industries. The reasons for this change are:

Reasons for change in a digital world



- **Acceleration:** The pace of digital change is rising exponentially, making it very difficult to maintain a position of industry leadership and requiring an acceleration of new digital solutions brought to market.
- **Digital Competition:** The increasing pressure of digital competition has forced the long-established businesses to reexamine their models on the lines of new “born digital” start-ups.

- **Customer Expectations:** Customers expect a good experience across all touchpoints. It is important to ensure that their interactions are seamless and exceptional.
- **Digital Adoption:** Digital adoption of Big data, automation, and IoT has made it necessary for companies to transform completely.

This course will explore the exciting world of digital transformation by presenting key technological changes and discussing how businesses need to adapt in order to succeed in today's competitive business world.

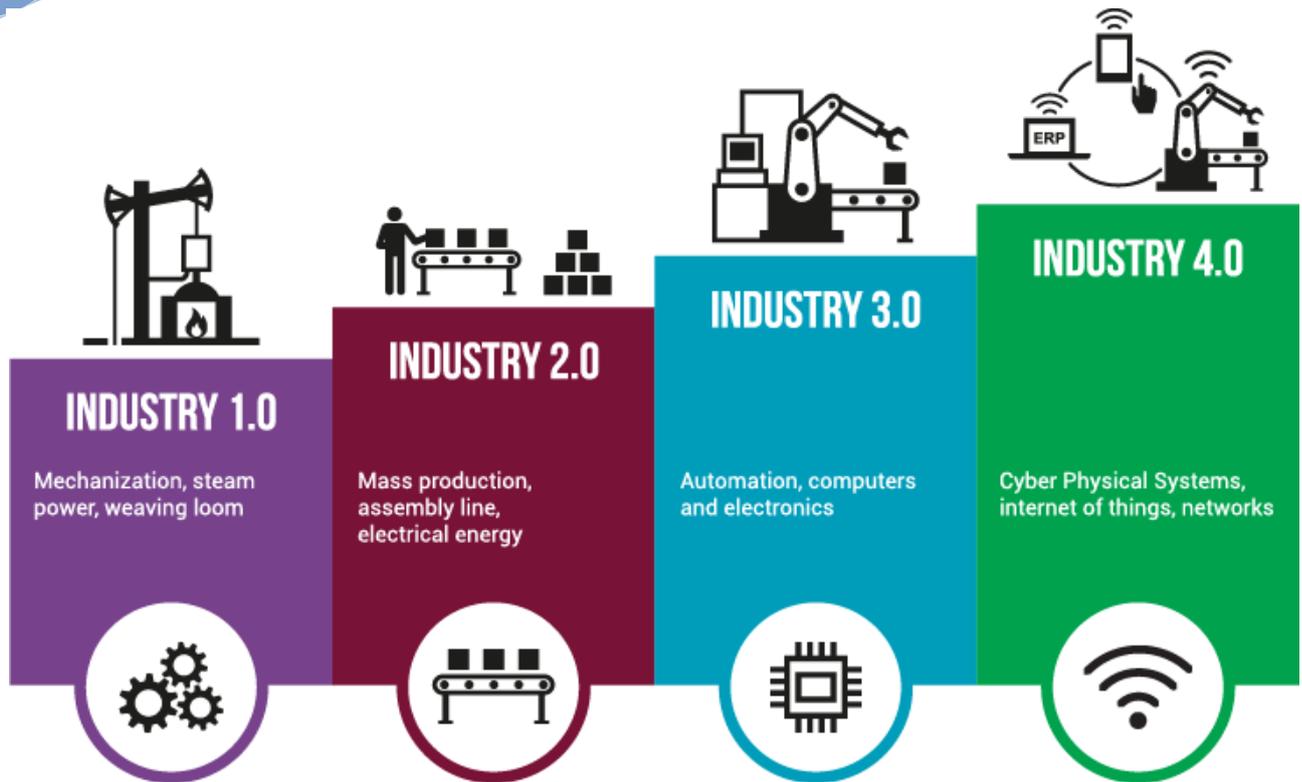
2. The Fourth Industrial Revolution

The Fourth Industrial Revolution is a way of describing the blurring of boundaries between the physical, digital, and biological worlds. It's a fusion of advances in artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, big data & cloud services, quantum computing, blockchain and other technologies.

It's the collective force behind many products and services that are fast becoming indispensable to modern life. Think GPS systems that suggest the fastest route to a destination, voice-activated virtual assistants such as Apple's Siri, personalized Netflix recommendations, and Facebook's ability to recognize your face and tag you in a friend's photo.

While the Fourth Industrial Revolution (sometimes called **Industry 4.0**) is set to change society like never before, it builds on foundations laid by the first three industrial revolutions:

- The advent of the steam engine in the 18th century led to the **first industrial revolution**, allowing production to be mechanized for the first time, and driving social change as people became increasingly urbanized.
- In the **second industrial revolution**, electricity and other scientific advancements led to mass production.
- A **third industrial revolution**, beginning in the 1950s, saw the emergence of computers and digital technology. This led to the increasing automation of manufacturing and the disruption of industries including banking, energy, and communications.



While previous revolutions were characterized by technological developments that enabled better production processes and information sharing, the Fourth Industrial Revolution is distinguishable by its development of “cyber–physical systems”. In cyber–physical systems, technology interacts with both people and machines in new ways. This interaction changes the capabilities of people and machines, and augments technology into people’s lives and bodies.

Nowhere is the upheaval of the Fourth Industrial Revolution more likely to be felt than the workplace. As with previous industrial revolutions, the Fourth Industrial Revolution will profoundly affect people’s lives as AI and increased automation see many types of jobs disappear. At the same time, entirely new categories of jobs are emerging.

As the Fourth Industrial Revolution reshapes the future of work, businesses must prepare their people for the new world that lies ahead. This often means an increased focus on continual learning, building more on-ramps to new types of jobs, and a commitment to diversity.

All previous industrial revolutions have had both **positive and negative impacts** on different stakeholders. Nations have become wealthier, and technologies have helped pull entire societies out of poverty, but the

inability to fairly distribute the resulting benefits or anticipate externalities has resulted in global challenges. By recognizing the risks, whether cybersecurity threats, misinformation on a massive scale through digital media, potential unemployment, or increasing social and income inequality, we can take the steps to align common human values with our technological progress and ensure that the Fourth Industrial Revolution benefits human beings first and foremost.

3. Innovative Technologies



From Big Data to Blockchain – the last two decades have been major years in tech. As cutting-edge technologies reach the market and are integrated, business strategies may evolve as well. In this chapter we want to highlight the most innovative technological developments of the last years:

Big Data & Cloud Services



Today, two mainstream technologies are the center of concern in IT – Big Data and Cloud Computing. Fundamentally different, big data is about dealing with the massive scale of data whereas cloud computing is about infrastructure. However, many businesses are targeting to combine the two techniques.

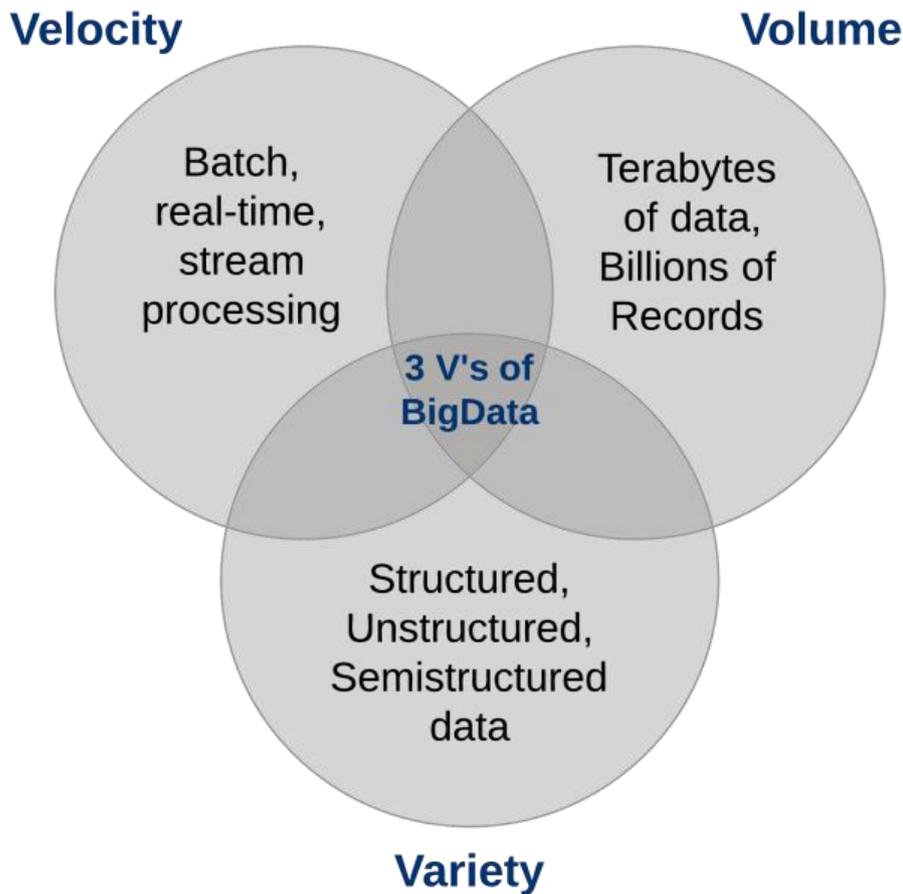
What is Big Data?

Big Data is a term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day

basis. Big data can be analyzed for insights that lead to better decisions and strategic business moves.

The concept gained momentum in the early 2000s when industry analyst Doug Laney articulated the now-mainstream definition of big data as the three Vs:

- **Volume:** The amount of data matters. With big data, you'll have to process high volumes of low-density, unstructured data. This can be data of unknown value, such as clickstreams on a webpage or a mobile app, or sensor-enabled equipment.
- **Velocity:** Velocity is the fast rate at which data is received and (perhaps) acted on. Normally, the highest velocity of data streams directly into memory versus being written to disk. Some internet-enabled smart products operate in real-time and will require real-time evaluation.
- **Variety:** Variety refers to the many types of data that are available. Traditional data types were structured and fit neatly in a relational database. With the rise of big data, data comes in new unstructured or semistructured data types, such as text, audio, and video.



The importance of big data doesn't revolve around how much data you have, but what you do with it. You can take data from any source and analyze it to find answers that enable cost reductions, time reductions, new product development and optimized offerings, and smart decision making.

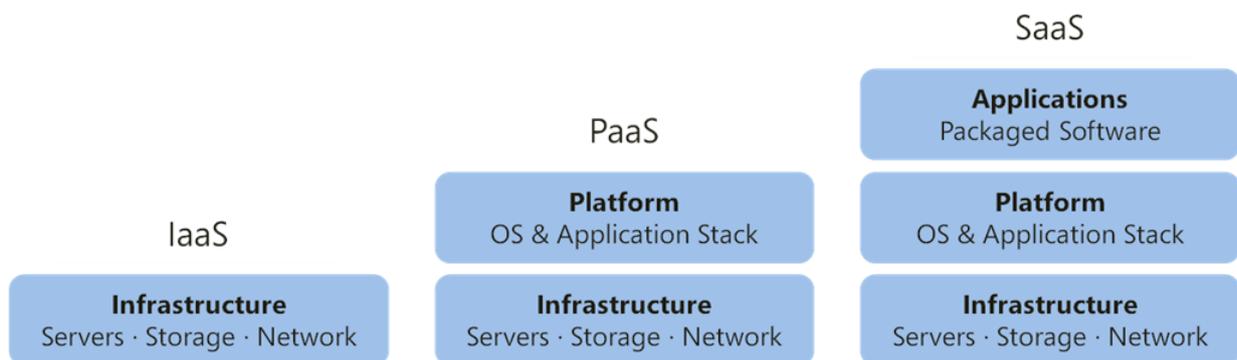
What is Cloud Computing?

Cloud Computing is an on-demand delivery of database, compute power, storage, applications, and other IT resources through cloud services platform over the internet on a pay-as-you-go basis. It is called cloud computing because the information that is to be accessed is found in "the cloud" and it does not require a user to be in a particular region to get access to it.

Cloud computing services cover a vast range of options now: Pretty much any service that doesn't require you to be physically close to the computer hardware that you are using can now be delivered via the

cloud. Cloud computing has three main types that are commonly referred to:

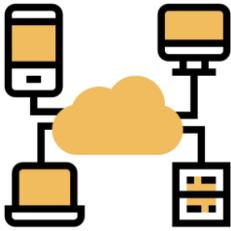
- **Infrastructure as a Service (IaaS)** provides virtualized resources over the network. IaaS provides underlying operating systems, networking, security and servers for developing applications, services for deploying databases, development tools, etc.
- **Platform as a Service (PaaS)** provides an on-demand environment for testing, developing, managing, and delivering software applications. PaaS supports the whole web application lifecycle: building, testing, deploying, managing, and updating.
- **Software as a Service (SaaS)** is a method of delivering software applications. With SaaS, Cloud Service providers host and manage the software applications and underlying infrastructure with a service agreement.



The exact benefits will vary according to the type of cloud service being used but, fundamentally, using cloud services means companies not having to buy or maintain their own computing infrastructure. No more buying servers, updating applications or operating systems, or decommissioning and disposing of hardware or software when it is out of date, as it is all taken care of by the supplier.

Using cloud services means companies can move faster on projects and test out concepts without lengthy procurement and big upfront costs because firms only pay for the resources they consume. This concept of business agility is often mentioned by cloud advocates as a key benefit. The ability to spin up new services without the time and effort associated with traditional IT procurement should mean that is easier to get going with new applications faster.

Internet of Things



One of the biggest tech trends to emerge in recent years is the **Internet of Things (IoT)**. Simply put, the Internet of Things is the idea that all technological devices can be connected to the internet and to each other in an attempt to create the perfect marriage between the physical and digital worlds.

How will this impact you?

It depends on your industry. For example, for those who work in marketing, advertising, media or business management, IOT could provide a wealth of information on how consumers engage with products by tracking their interactions with digital devices. In turn, this data could be used to optimize marketing campaigns and user experiences.

Many technological devices are now being built with WiFi connectivity, meaning they can be connected to the Internet—and to each other. IoT enables devices, home appliances, cars and much more to be connected to and exchange data over the Internet.

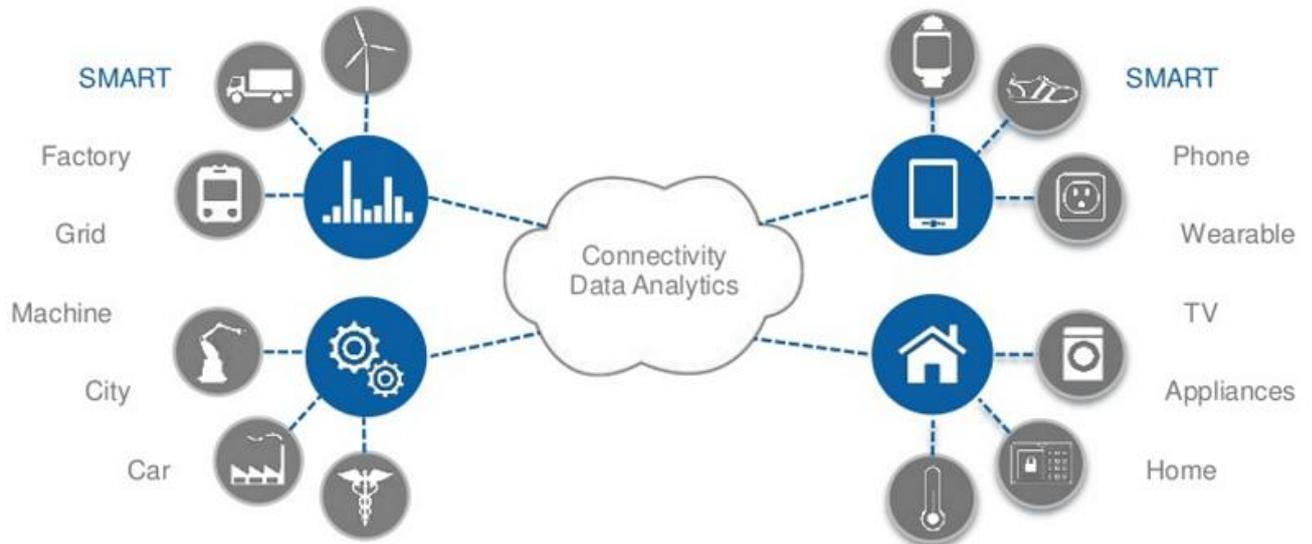
What are the benefits?

As consumers, we're already using and benefiting from IoT: We can lock our doors remotely if we forget to when we leave for work and preheat our ovens on our way home from work, all while tracking our fitness.

But businesses also have much to gain now and in the near future. The IoT can enable better safety, efficiency, and decision making for businesses as data is collected and analyzed. It can enable predictive maintenance, speed up medical care, improve customer service, and offer benefits we haven't even imagined yet.

INDUSTRIAL Internet of Things

CONSUMER Internet of Things



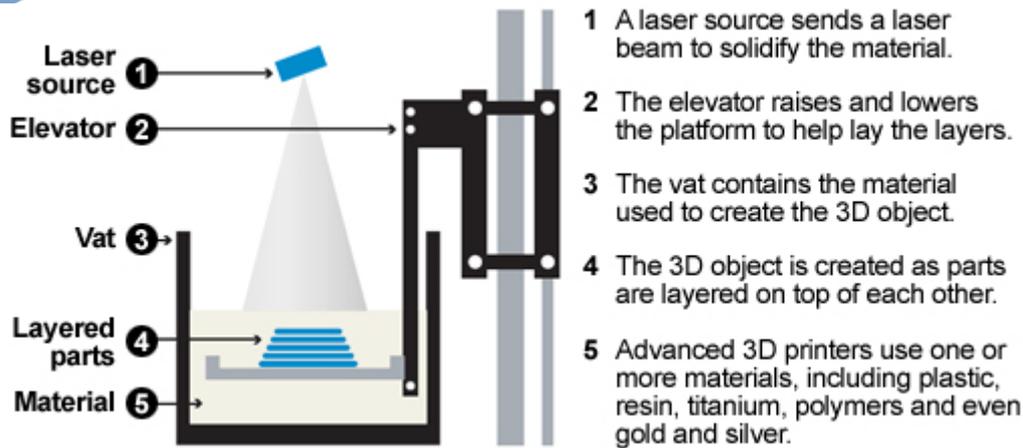
For someone interested in a career in IoT, that means easy entry into the field if you're motivated, with a range of options for getting started. Skills needed include IoT security, cloud computing knowledge, data analytics, automation, understanding of embedded systems, device knowledge, to name only a few. After all, it's the Internet of Things, and those things are many and varied, meaning the skills needed are as well.

Additive Manufacturing



Additive manufacturing (AM), also known as 3D printing, is a transformative approach to industrial production that enables the creation of lighter, stronger parts and systems. It is yet another technological advancement made possible by the transition from analog to digital processes.

3D printers work similar to regular ink printers. But instead of ink, 3D printers deposit the desired material in successive layers to create a physical object from a digital file.



In recent decades, communications, imaging, architecture, and engineering have all undergone their own digital revolutions. Now, AM can bring digital flexibility and efficiency to manufacturing operations.

Conventional manufacturing techniques are capable of producing a great range of shapes and designs but additive manufacturing takes production to the next level.

One of the greatest benefits of this more modern technology is the **greater range of shapes** which can be produced. Designs that can't be manufactured in one entire piece with traditional means can easily be achieved. For example, shapes with a scooped out or hollow center can be produced as a single piece, without the need to weld or attach individual components together. This has the advantage of being **stronger**; no weak spots which can be compromised or stressed.

The additive manufacturing process is **very quick** too, rather than needing an endless round of meetings from engineers in order to be able to tweak designs. With the assistance of the CAD software, making any changes takes simply the click of the mouse. Rapid prototyping, in particular, is very quick, with full models produced quite literally overnight in some cases. This provides companies with far more flexibility and also has the result of slashing costs too.

In the past, the limitations of production have all too often influenced design, ruling out ideas because they weren't practically achievable. The introduction of this technology and its development means the process has been spun on its head, with **the design now driving the production**.

Cyber Security



Cyber Security consists of technologies, processes, and controls designed to protect systems, networks, programs, devices and data from cyber-attacks. Effective cybersecurity reduces the risk of cyber-attacks and protects against the unauthorized exploitation of systems, networks, and technologies.

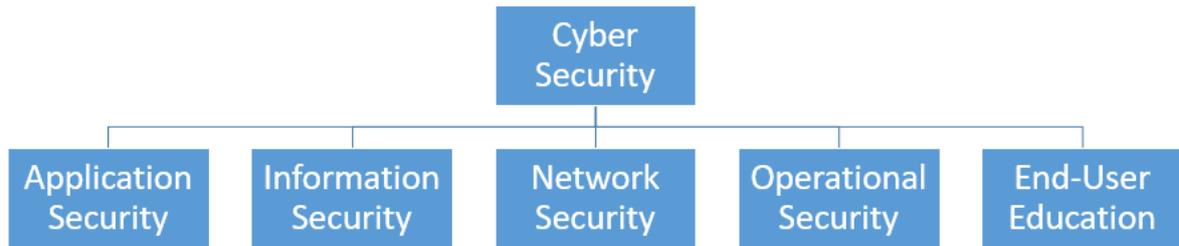
Cyber attacks can cause significant disruption and damage to even the most resilient organization. Impacted organizations stand to lose assets, reputation and business, and face fines and remediation costs.

Most people link cybersecurity only to technological threads and solutions. But robust cybersecurity involves implementing controls based on three pillars: people, processes, and technology. These **Three Pillars of Cyber Security** help organizations protect themselves from both organized and opportunistic attacks, as well as common internal threats, such as a user falling for a phishing scam or mistakenly sending an email to an unintended recipient.

- **People:** Every employee needs to be aware of their role in preventing cyber threats.
- **Processes:** Documented processes should clearly define roles and responsibilities.
- **Technology:** Technical controls are just as essential to mitigate cyber risks.

Fields of Cyber Security

The term Cyber Security applies in a variety of contexts, from business to mobile computing, and can be divided into a few common categories:



- Application security focuses on keeping software and devices free of threats. A compromised application could provide access to the data it is designed to protect.
- Information security protects the integrity and privacy of data, both in storage and in transit.
- Network security is the practice of securing a computer network from intruders, whether targeted attackers or opportunistic malware.
- Operational security includes the processes and decisions for handling and protecting data.
- End-user education addresses people: Human error remains the leading cause of data breaches and organizations need to educate employees on security topics.

Cyber Attacks and Cyber Security Threats

Common methods attackers use to control computers or networks include viruses, worms, spyware, Trojans, and ransomware. Viruses and worms can self-replicate and damage files or systems without the user's knowledge, while spyware and Trojans are often used for surreptitious data collection. Ransomware waits for an opportunity to encrypt all the user's information and demands payment to return access to the user. Malicious code often spreads via an unsolicited email attachment or a legitimate-looking download that actually carries a malware payload.

Social engineering is the process of psychologically manipulating people into performing actions or giving away information. Phishing attacks are the most common form of social engineering. Phishing attacks usually come in the form of a deceptive email that tricks the user into giving away personal information. Not always easy to distinguish from genuine messages, these scams can inflict enormous damage on organizations.

Two more advanced threads are DDoS and MITM:

- A Distributed Denial-of-Service (DDoS) attack attempts to disrupt normal web traffic and take a site offline by flooding a system or server with more requests than it can handle.
- A Man-In-The-Middle (MITM) attack occurs when a hacker inserts themselves between a visitor's device and a server. MITM attacks often happen when a user logs on to an insecure Wi-Fi network. The user will then unknowingly pass information through the attacker.

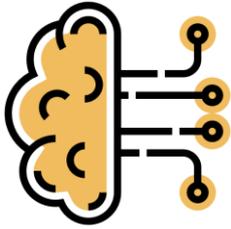
Finally, using outdated (unpatched) software opens up opportunities for criminal hackers to take advantage of vulnerabilities to bring entire systems down. A *zero-day attack* can occur when a vulnerability is made public before a patch or solution has been rolled out by the developer.

Follow these four steps for cyber safety:

- **Only trust https-URLs!** Only use trusted sites when providing your personal information. A good rule of thumb is to check the URL. If the site includes “https://,” then it’s a secure site. If the URL includes “http://,” — note the missing “s” — avoid entering sensitive information like your credit card data.
- **Don’t open unknown attachments/links!** Don’t open email attachments or click links in emails from unknown sources. One of the most common ways people are attacked is through emails disguised as being sent by someone you trust.
- **Keep your devices updated!** Always keep your devices updated. Software updates contain important patches to fix security issues. Cyberattackers thrive on outdated devices because they don’t have the most current security software.
- **Regularly back up your files!** Back up your files regularly to prevent cybersecurity attacks. If you need to wipe your device clean due to a cyberattack, it will help to have your files stored in a safe, separate place.

The most effective strategy to mitigating and minimizing the effects of a cyber attack is to build a solid foundation upon which to grow your cybersecurity technology stack. A solid cybersecurity foundation will identify these gaps and propose the appropriate action to take to mitigate the risk of an attack, enabling you to build a robust cybersecurity strategy.

Artificial Intelligence



Artificial Intelligence (AI) has already received a lot of buzz in recent years, but it continues to be a trend to watch because its effects on how we live, work and play are only in the early stages. In addition, other branches of AI have developed, including Machine Learning.

AI refers to computers systems built to mimic human intelligence and perform tasks such as recognition of images, speech or patterns, and decision making. AI can do these tasks faster and more accurately than humans.

AI has been around since 1956 and is already widely used. In fact, many people use AI services in one form or another every day, including navigation apps, streaming services, smartphone personal assistants, ride-sharing apps, home personal assistants, and smart home devices. In addition to consumer use, AI is used to schedule trains, assess business risk, predict maintenance, and improve energy efficiency, among many other money-saving tasks.

As we move forward and technology progresses and evolves, our definition of AI changes. But regardless of the mechanisms, the level of AI can be broken down into three main categories:

- **Weak AI** – also called Narrow AI – is able to handle just one particular task. Examples include an email spam filtering tool or a recommended playlist from Spotify. Weak AI is the only form of Artificial Intelligence that humanity has achieved so far.
- **Strong AI** – also called General AI – could handle various tasks. It is comparatively as intelligent as the human brain. Unlike weak AI, it can learn and improve itself.
- **Super AI** is a term referring to the time when the capability of computers will surpass humans. Super AI can think about abstractions which are impossible for humans to understand.

AI is one part of what we refer to broadly as **automation** – the technology by which a process or procedure is performed with minimal human assistance. Automation is a hot topic because of potential job loss. It will eliminate millions of jobs, but it is creating jobs as well, especially in the field of AI. Jobs will be created in development, programming and testing, to name a few.

What is Machine Learning?

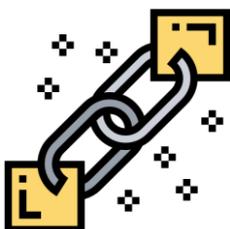
Machine Learning is a subset of AI. With Machine Learning, computers are programmed to learn to do something they are not programmed to do: They literally learn by discovering patterns and insights from data. For example, social media platforms use machine learning to get a better understanding of how you're connected with those in your social network. They do this by analyzing your likes, shares, and comments and then prioritizing content from your closest connections, serving you that content first.

What is Deep Learning?

Deep Learning is a specialized form of machine learning that teaches computers to do what comes naturally to humans: learn by example. Deep learning is a key technology behind driverless cars, enabling them to recognize a stop sign or to distinguish a pedestrian from a lamppost. In deep learning, a computer model learns to perform classification tasks directly from images, text, or sound. Deep learning models can achieve state-of-the-art accuracy, sometimes exceeding human-level performance. Models are trained by using a large set of labeled data and neural network architectures that contain many layers.

Artificial Intelligence – including Machine Learning and Deep Learning – is rapidly being deployed in all industries, creating a huge demand for skilled professionals.

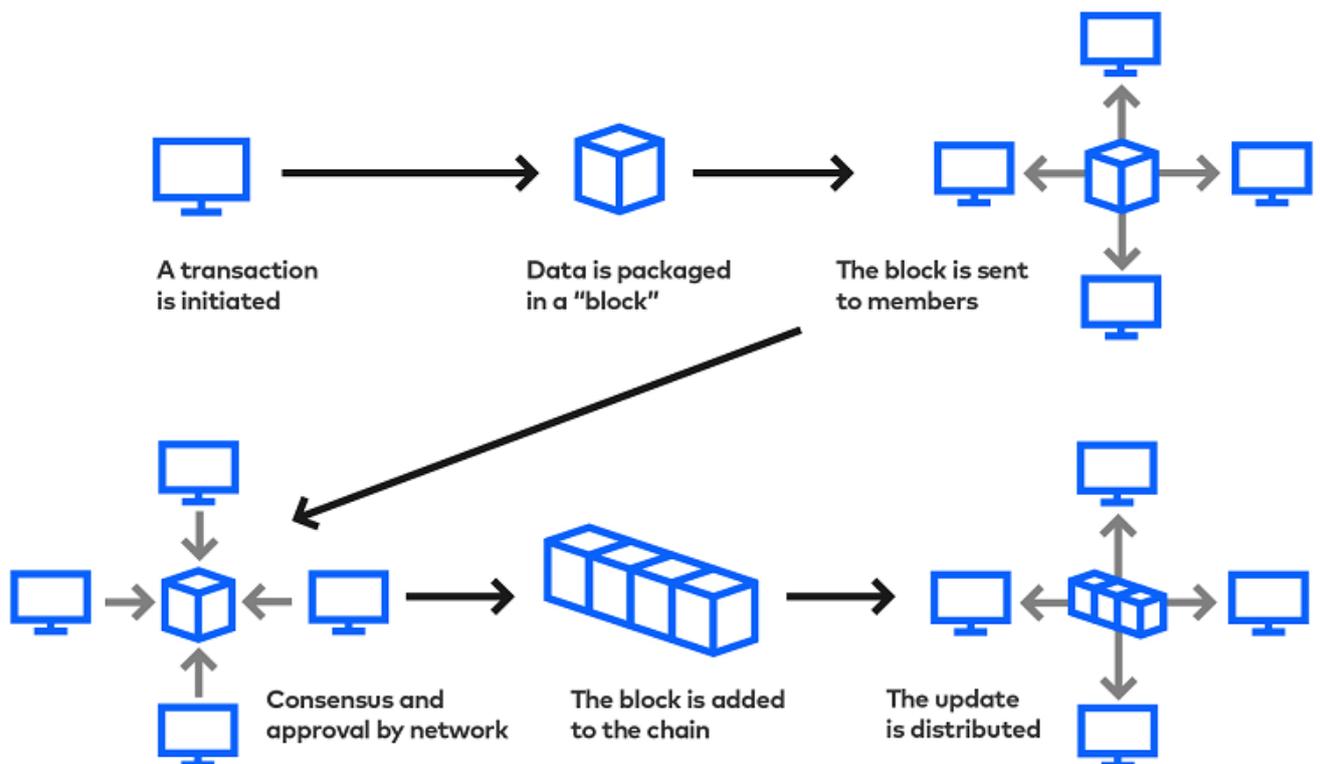
Blockchain



Many people know it as the technology behind Bitcoin, but blockchain's potential uses extend far beyond digital currencies. Banks and firms are falling over one another to be the first to work out how to use it. So what exactly is blockchain, and why are Wall Street and Silicon Valley so excited about it?

What is blockchain?

Currently, most people use a trusted middleman – such as a bank – to make a transaction. But blockchain allows consumers and suppliers to connect directly, removing the need for a third party. Using cryptography to keep exchanges secure, blockchain provides a decentralized database, or “digital ledger”, of transactions that everyone on the network can see. This network is essentially a chain of computers that must all approve an exchange before it can be verified and recorded. To sum it up, a blockchain is a growing list of records, called blocks, which are linked using cryptography.



How does it work in practice?

Information held on a blockchain exists as a shared — and continually reconciled — database. This is a way of using the network that has

obvious benefits. The blockchain database isn't stored in any single location, meaning the records it keeps are truly public and easily verifiable. No centralized version of this information exists for a hacker to corrupt. Hosted by millions of computers simultaneously, its data is accessible to anyone on the internet.

“Picture a spreadsheet that is duplicated thousands of times across a network of computers. Then imagine that this network is designed to regularly update this spreadsheet and you have a basic understanding of the blockchain.”

– Ian Khan (Blockchain Author)

Why is it so revolutionary?

The technology can work for almost every type of transaction involving value, including money, goods, and property. Its potential uses are almost limitless: from collecting taxes to enabling migrants to send money back to family in countries where banking is difficult. Blockchain could also help to reduce fraud because every transaction would be recorded and distributed on a public ledger for anyone to see.

What are the key attributes?

- | | |
|----------------------------|---|
| 1. Decentralization | Before Bitcoin came along, we were more used to centralized services: You have a centralized entity which stored all the data and you'd have to interact solely with this entity. In a decentralized system, the information is not stored by one single entity. In fact, everyone in the network owns the information. |
| 2. Transparency | Every person's identity is hidden via complex cryptography and represented only by their public address. While the person's real identity is secure, you will still see all the transactions that were done by their public address. This level of transparency has never existed before within a financial system. |
| 3. Immutability | Immutability, in the context of the blockchain, means that once something has been entered into the blockchain, it cannot be tampered with. This makes blockchains so highly reliable and trailblazing. |

The three main properties of Blockchain technology which has helped it gain widespread acclaim are 1. Decentralization, 2. Transparency, and 3. Immutability.

Who is using blockchain?

In theory, if blockchain goes mainstream, anyone with access to the internet would be able to use it to make transactions. Currently only a very small proportion of global GDP is held in the blockchain. But research suggests this will increase significantly in the next decade, as banks, insurers and tech firms see the technology as a way to speed up settlements and cut costs.

4. Case Studies



While we have been discussing technological trends individually in the previous chapter, we now want to take a broader view at how they combine and supplement each other. To do so, we will now focus on automated driving, digital twins, Industry 4.0, and smart cities as case studies.

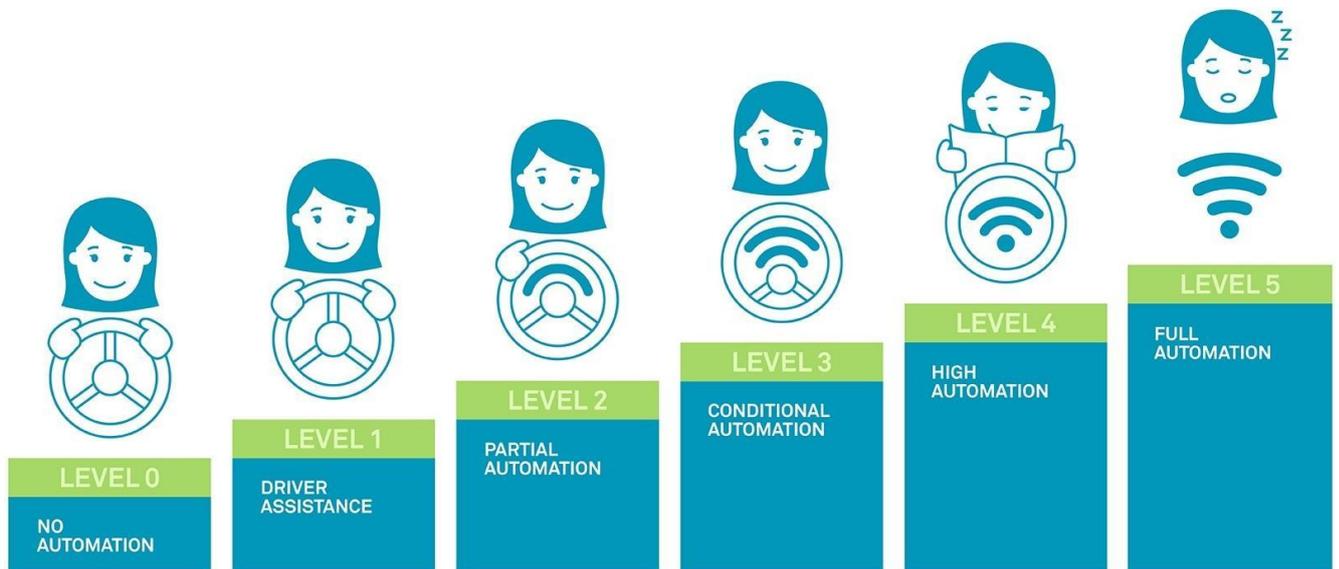
Automated Driving



Self-driving vehicles are cars or trucks in which human drivers are never required to take control to safely operate the vehicle. Also known as autonomous or “driverless” cars, they combine sensors and software to control, navigate, and drive the vehicle.

Currently, there are no legally operating, fully-autonomous vehicles available for the mass market. There are, however, partially-autonomous vehicles – cars and trucks with varying amounts of self-automation, from conventional cars with brake and lane assistance to highly-independent, self-driving prototypes.

Different cars are capable of different levels of self-driving, and are often described by researchers on a scale from level 0 to level 5:



- Level 0** All major systems are controlled by humans.

- Level 1** Certain systems, such as automatic braking, may be controlled by the car, one at a time.

- Level 2** The car offers at least two simultaneous automated functions, like acceleration and steering.

- Level 3** The car can manage all safety-critical functions under certain conditions.

- Level 4** The car is fully-autonomous in some driving scenarios, though not all.

- Level 5** The car is completely capable of self-driving in every situation.

Though still in its infancy, self-driving technology is becoming increasingly common and could radically transform our transportation system (and by extension, our economy, and society). Based on automaker and technology company estimates, level 4 self-driving cars could be for sale in the next several years.

Functionality

The self-driving car is a great example of a combination of multiple technologies introduced in the last lesson. While the design details of the cars developed by Google, Tesla and other major automakers vary, most self-driving systems use the **Internet of Things**: The cars create and maintain an internal map of their surroundings, based on a wide array of sensors, like radar, lasers, high-powered cameras, and sonar. A software then processes those inputs and sends instructions to the vehicle's "actuators," which control acceleration, braking, and steering.

Cloud services often enable communication between the car and other cars on next-generation traffic lights. Those traffic rules are mostly hardcoded, but narrow **Artificial Intelligence** is what allows predictive modeling and smart object discrimination. That means, knowing the difference between a bicycle and a motorcycle. While most human only needs a few driving lessons until they can drive well enough, an autonomous car needs thousands of hours and millions of data points to learn it, which is enabled by **Big Data**.

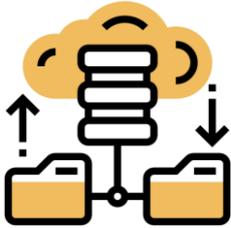
Impacts

The costs and benefits of self-driving cars are still largely hypothetical. More information is needed to fully assess how they'll impact drivers, the economy, and the environment.

- **Safety** is an overarching concern. Self-driving vehicles could, hypothetically, reduce the number of car crashes and traffic deaths since software could prove to be less error-prone than humans. However, cybersecurity is still a chief concern.
- **Equity** is another major consideration. Self-driving technology could help mobilize individuals who are unable to drive themselves, such as the elderly or disabled. But the widespread adoption of autonomous vehicles could also displace millions of professional drivers.
- **Environmental** impacts are a serious concern and major uncertainty. Accessible, affordable, and convenient self-driving cars could increase the total number of miles driven each year. If those vehicles are powered by gasoline, then transportation-related climate emissions could skyrocket. If, however, the vehicles are electrified – and paired with a clean electricity grid – then transportation emissions could drop significantly.

You can see autonomous driving is a combination of multiple digital trends and with this, it will most likely transform not only the way we use cars but also the way we think about transportation and logistics more broadly.

Digital Twins



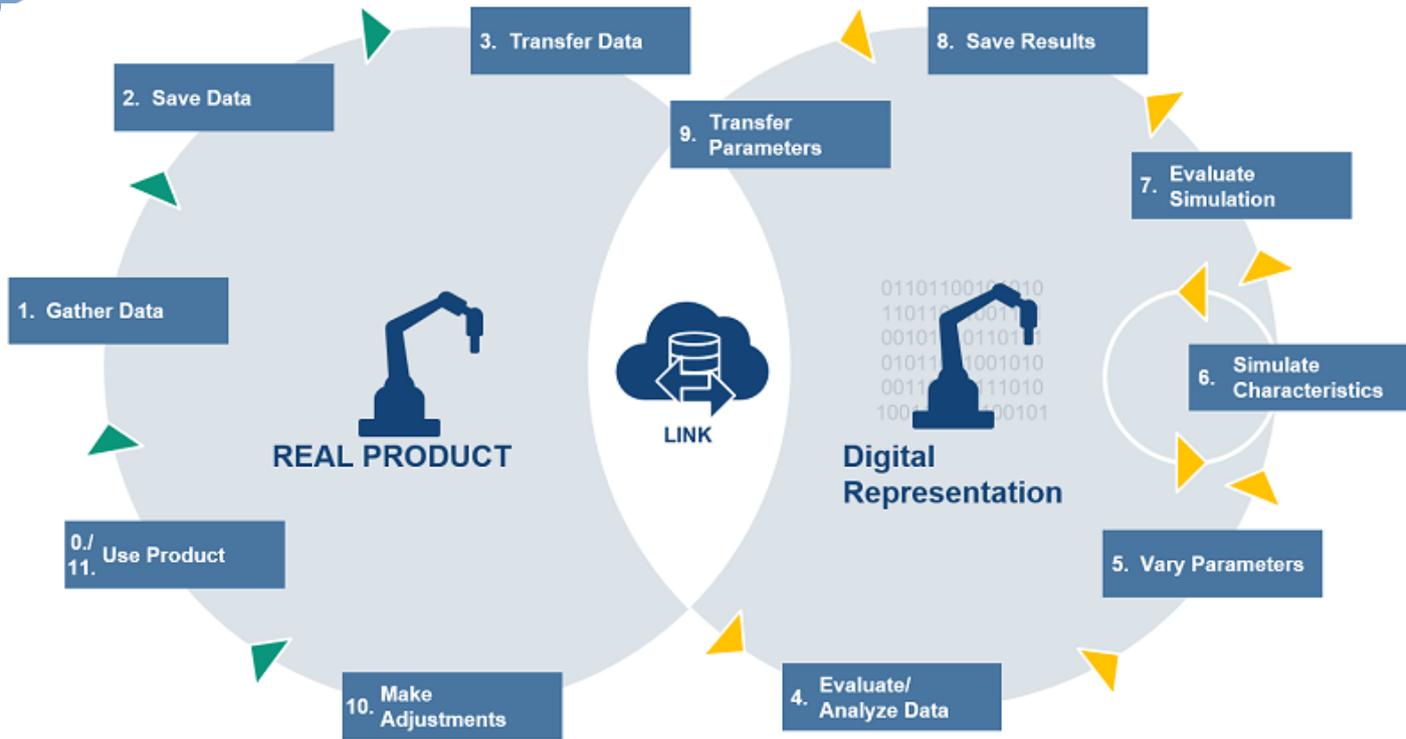
A **Digital Twin** is a digital replica of a physical entity. By bridging the physical and the virtual world, data is transmitted seamlessly allowing the virtual entity to exist simultaneously with the physical entity. The digital twin provides both the elements and the dynamics of how the physical twin operates.

The technology behind digital twins has expanded to include large items such as vehicles, buildings, factories, and even cities, and some have said people and processes can have digital twins, expanding the concept even further. The idea first arose at NASA: full-scale mockups of early space capsules, used on the ground to mirror and diagnose problems in orbit, eventually gave way to fully digital simulations.

How does a digital twin work?

A digital twin begins its life being built by specialists, often experts in data science or applied mathematics. These developers research the physics that underlie the physical object or system being mimicked and use that data to develop a mathematical model that simulates the real-world original in digital space.

The twin is constructed so that it can receive input from sensors gathering data from a real-world counterpart. This allows the twin to simulate the physical object in real-time, in the process offering insights into performance and potential problems. The twin could also be designed based on a prototype of its physical counterpart, in which case the twin can provide feedback as the product is refined; a twin could even serve as a prototype itself before any physical version is built.



Digital-twin use cases

Objects such as aircraft engines, trains, offshore platforms, and turbines can be designed and tested digitally before being physically produced. These digital twins could also be used to help with maintenance operations. For example, technicians could use a digital twin to test that a proposed fix for a piece of equipment works before applying the fix the physical twin.

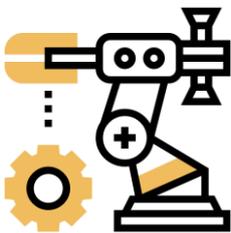
Digital-twin business applications are found in a number of sectors:

- **Manufacturing** is the area where rollouts of digital twins are probably the furthest along, with factories already using digital twins to simulate their processes.
- **Automotive** digital twins are made possible because cars are already fitted with telemetry sensors, but refining the technology will become more important as more autonomous vehicles hit the road.
- **Healthcare** is the sector that produces the digital twins of people we mentioned above. Band-aid sized sensors send health information back to a digital twin used to monitor and predict a patient's well-being.

Benefits of digital twins

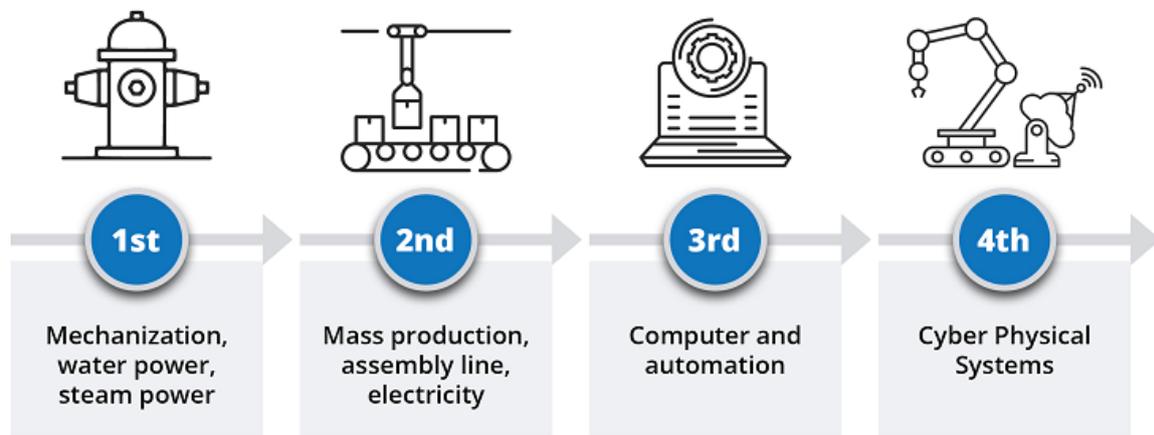
Digital twins offer a real-time look at what's happening with physical assets, which can radically alleviate maintenance burdens. Chevron is rolling out digital twin tech for its oil fields and refineries and expects to save millions of dollars in maintenance costs. And Siemens says that using digital twins to model and prototype objects that have not been manufactured yet can reduce product defects and shorten time to market. But keep in mind that digital twins aren't always called for, and can unnecessarily increase complexity.

Industry 4.0



Industry 4.0 is a name given to the current trend of automation and data exchange in manufacturing technologies. It includes cyber-physical systems, the Internet of things, cloud computing and cognitive computing. Industry 4.0 is commonly referred to as the fourth industrial revolution.

The term "Industry 4.0" originates from a project in the high-tech strategy of the German government, which promotes the computerization of manufacturing and is linked to the fourth industrial revolution (see: Chapter 2). When you bring the modern technologies we have discussed all together, it gives you a picture of what the state of the art production factory should look like: a fully integrated, automated and optimized system.



Industry 4.0 fosters what has been called a **smart factory**. The smart factory represents a leap forward from more traditional automation (third industrial revolution) to a fully connected and flexible system. It is a system that can self-optimize performance and learn from new conditions in real-time, and autonomously run entire production processes.

The ability to adjust to and learn from data in real-time can make the smart factory more responsive, proactive, and predictive, and enables the organization to avoid operational downtime and other productivity challenges.

Key Benefits

What are the benefits of building a smart factory? The reasons that companies embark or expand on the smart factory journey are often varied and cannot be easily generalized. However, undertaking a smart factory journey generally addresses five broad categories:

- **Asset efficiency:** Every aspect of the smart factory generates reams data that, through continuous analysis, reveal asset performance issues that can require some kind of corrective optimization. Such self-correction can yield greater overall asset efficiency.
- **Quality:** The self-optimization can predict and detect quality defect trends sooner and can help to identify discrete human or machine causes of poor quality. A more optimized quality process could lead to a better-quality product with fewer defects and recalls.

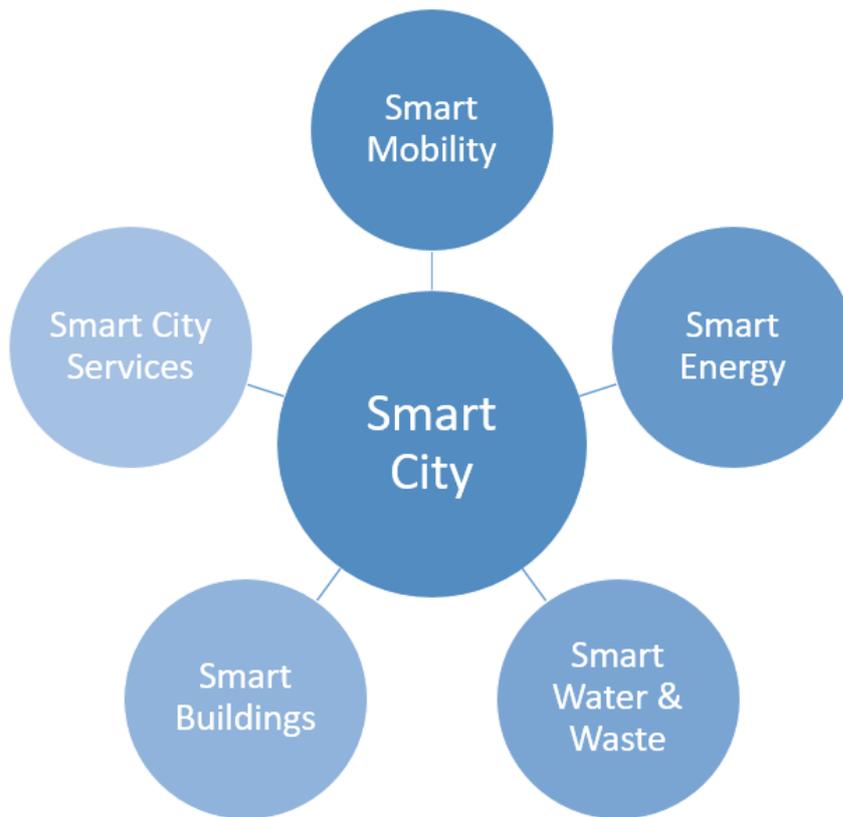
- **Lower cost:** Optimized processes traditionally lead to more cost-efficient processes – those with more predictable inventory requirements, more effective hiring and staffing decisions, as well as reduced process and operations variability.
- **Sustainability:** The types of operational efficiencies that a smart factory can provide may result in a smaller environmental footprint than a conventional manufacturing process, with greater environmental sustainability overall.
- **Safety:** Greater process autonomy may provide for less potential for human error, including industrial accidents that cause injuries.

Smart City



A **Smart City** is an urban area that uses different types of electronic Internet of Things (IoT) sensors to collect data and then use these data to manage assets and resources efficiently. Smart cities use data and technology to create efficiencies, improve sustainability, and create economic development.

This includes data collected from citizens, devices, and assets that is processed and analyzed to monitor and manage traffic and transportation systems, power plants, water supply networks, waste management, crime detection, information systems, schools, libraries, hospitals, and other community services. Let's now focus on five basic smart city components and their impact:



1. Smart Mobility

Smart Streets are capable of acquiring data and delivering information and services to and from millions of devices, which includes information about traffic, road blockages, roadworks, etc. Smart Parking Management systems with wireless sensors can be used to find the vacant location for a vehicle at different public places. Smart Mobility also includes Connected Charging Stations in parking systems, shopping malls, airports, and bus stations across the city.

2. Smart Energy

The Smart Grid is an electricity supply network that uses digital communications technology to detect and react to local changes in usage. Smart grids are digitally monitored, self-healing energy systems that deliver electricity or gas from generation sources. Gateways can provide a broader view of energy distribution patterns to utility companies with high connectivity and real-time analytics. Consumers and utilities with smart meters can monitor their energy consumption.

3. Smart Water & Waste Management

Smart water management enables the city to monitor the quality of tap

water as well as the condition of lakes and rivers. Smart solutions for tracking wastes help municipalities and waste service managers the ability to optimize wastes, reduce operational costs, and better address the environmental issues associated with an inefficient waste collection.

4. Smart Buildings

Smart heating and ventilation systems monitor various parameters such as temperature, pressure, vibration or humidity of buildings and properties. Wireless sensor network deployment is the key to ensuring appropriate heating and ventilation. These sensors also collect data to optimize the HVAC systems, improving their efficiency and performance in the buildings.

5. Smart City Services

Smart kiosks can play an important role in providing different city services to the public such as Wi-Fi services or free mobile charging stations. Sensors (cameras, street lights) for real-time monitoring can be implemented in risky areas or areas prone to accidents. Upon detecting any crime, or mishap, these sensors can alert the citizens to avoid such areas temporarily.

Smart sensor networks, Internet of Things (IoT) and connected technologies are the key solutions for smart city implementation. In the end, the real conditions for success reside in data interoperability and in knowing how to access and share data in standard formats (such as with APIs). The challenge is to make these data available in a readable format that can be reused by all.

5. Managing Digital Transformation



Digital transformation is reaching businesses across every industry. Businesses must go digital, but many do not know how to approach this transformation. In this chapter, we will look at a simple 4-step model on how to start based on expert opinions.

Leading Digital Transformation

For digital transformation to succeed, it is vital to understand what can go wrong and to have a solid process in place. Scientists have worked with hundreds of companies undergoing digital transformation and identified four crucial points:

Have a digital mindset

Explain why transformation is necessary

Set the right goals

Focus on the user

1. Have a digital mindset:

By having an open-minded attitude about the benefits that digital technologies can bring to people, processes, and businesses, we open a new world of opportunities. Eliminating the idea of technology boundaries enables us to re-imagine each aspect of the business' entire purpose and value-generation chain. Being open to a digital mindset will unlock previously unseen business model possibilities.

2. Explain why transformation is necessary:

Everyone involved needs to understand the reasons behind digital transformation. You're asking people to change, if they haven't bought into the why, it's not going to happen. Those at the top have to take the time to make sure the company is bought in – from board members to interns – or risk jeopardizing company culture, and the long-term success of the project.

3. Set the right goals:

Before beginning digital transformation, organizations must identify their end goal. Beyond the clear need to remain competitive and improve market share, some companies may choose to digitally transform so they can serve their customers better, by introducing new products or services. Others may digitize to streamline internal processes or free up their employees' time to do less mundane tasks. Take the time to outline these desired outcomes, as this will define the sort of digital strategy you should be creating.

4. Focus on the user:

Technology sits at the heart of any digital transformation initiative, be it

new project management software to use internally or specific digital products created to appeal to new customers. Either way, the reality is clear: if it is difficult to use, people will not use it. This is particularly important from a talent management standpoint. When an increasingly large percentage of the workforce are digital natives, in-house technology must be intuitive, or this talent will simply go elsewhere.

Traps of Digital Transformation

Business leaders are in a high-stakes game. Many have embarked on programs to reinvent their businesses. The rewards for success are enormous, while the consequences of failure are drastic. Transforming your business has risks. Successful leaders know how to spot them and avoid them.

A clear understanding of what really matters to the success of digital transformation and what doesn't, however, can make all the difference. For this reason, we analyzed dozens of both successful and less successful digital transformations to get at the six root causes of where they go wrong:



1. Excessive caution:

Paradoxical though it may sound, we believe companies need to take more risk, not less. Recent McKinsey research reveals that companies that do best follow bold and disruptive strategies. They make big bets on new technologies and business models, champion a test-and-learn culture where every failure is an opportunity to improve, and launch change programs that transform their whole business.

2. Lack of focus:

Many companies have adopted a “let a hundred flowers bloom” philosophy that encourages broad experimentation. Such an approach generates excitement and learning, but it can also be self-defeating if not carefully managed. Running too many competing initiatives dissipates management focus and starves promising ideas of the resources they need for a successful scale-up.

3. Running out of money:

Some digital transformations run into difficulties because costs rocket while savings or revenue growth take longer than expected. Leading companies start by targeting quick wins to unlock value so that the effort funds itself, often within the first three months. In fact, this approach can be so effective that the most successful companies generate more savings or revenues than are needed to fund a transformation.

4. Lack of discipline:

Agility and speed are second nature to a digital organization, but energy can turn to chaos if it isn't channeled purposefully. Leaders need to be systematic about identifying and capturing business value, which begins with creating transparency into, and useful metrics to track, the progress of digital initiatives.

Many companies focus on output-based KPIs such as profit growth, digital revenues as a percentage of total revenues, or reduction in capex. But such broad metrics don't isolate the factors that contribute to a given result. It's more productive to develop a set of simple input metrics tracking elements such as SEO conversion and app traffic while making it clear who owns each item and is accountable for the result.

5. Failure to learn:

A surefire way to sink a transformation is to stop learning. Successful companies reward experimentation because learning from mistakes helps a company get it right the next time, which in turn fosters more creativity. A review of teams at Google found that when employees felt they could take risks without being shamed or criticized for failure, they did better work.

6. Going too slowly:

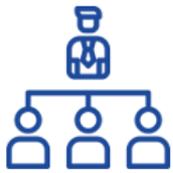
However quickly you think you are going, chances are it isn't fast enough. Speed is of the essence when it comes to reacting to market changes and capturing revenue opportunities before competitors do.

Organizing Digital Transformation

"It would be trite to say 'such and such is the best organizational structure for digital transformation'", says Clare Barclay, chief operating

officer of Microsoft UK, “you have to look at what the scenario is for the organization in question.”

Once you have established your goals and laid the foundations of your digital strategy, you must assess your organization’s capabilities to select the best possible organizational structure for your digital transformation project. Here are four possible ways to do so:



**Top-Down
Management**



**Strategic
Partnerships**



**Innovation
Labs**



**Change
Teams**

1. Top-Down Management:

Many organizations may embark on a digital transformation project at the behest of the board or senior management. In some situations, this makes the CEO the driving force behind the digital transformation project. Such was the case with Louise O’Shea, chief executive officer of price comparison website confused.com. With Ms. O’Shea at the helm, the company decided to break their business model and start again, using artificial intelligence and automation. Most importantly, Ms. O’Shea initiated the creation of an internal school for technology, to teach employees about the new technology coming in and reskilling them for the new roles they were to occupy.

2. Strategic Partnerships:

“Beginning the initiative, we really understood our limitations – this was crucial” explains Alan Talbot, chief information officer of Air Malta. Having identified the technical areas where they were not equipped, the airline chose to bring on board two-hybrid integration and connectivity partners, MuleSoft and Ricston. Locally-based Ricston actually came and worked at the Air Malta headquarters throughout the process, so they could fully understand the organization’s needs. “The fact that we could augment our team with these experts, and have their presence here on our premises, relating with the rest of our team, that was significant, because they could savor and understand what working for an airline is really like.”

3. Innovation Labs:

One possible way to explore new technologies is to trial your digital strategy in a digital garage or innovation lab. This allows companies to innovate and test theories without disrupting the day-to-day running of the organization. Car manufacturer Porsche has created the Porsche Digital Lab to test artificial intelligence, blockchain and the internet of things, with a view to improving both the driving experience in their vehicles and working conditions for their employees. Likewise, IT provider Fujitsu has established a number of Digital Transformation Centres across the globe to act as innovation hubs where their customers can come to ask questions about new digital tech.

4. Dedicated Change Teams:

A fourth possible method for enacting your digital transformation is to establish a dedicated change team – or a number of change agents – within the organization. Organizations can choose to hire outside consultants or identify natural innovators from within the ranks. These change agents work together to drive the digital strategy and are responsible for going into each team or department to lead specific change projects. “One thing I would advocate,” says Ms. Barclay, “is that these change agents are people who consider this their full-time day job, rather than trying to carve the role out of someone else’s already very busy day.”

6. Conclusion



Digital transformation is the integration of digital technology into all areas of a business, fundamentally changing how you operate and deliver value to customers. It’s also a cultural change that requires organizations to continually challenge the status quo, experiment, and get comfortable with failure.

Because digital transformation will look different for every company, it can be hard to pinpoint a definition that applies to all. However, in

general terms, we define digital transformation as the **integration of digital technology into all areas** of a business resulting in fundamental changes to how businesses operate and how they deliver value to customers.

Beyond that, it's a **cultural change** that requires organizations to continually challenge the status quo, experiment often, and get comfortable with failure. This sometimes means walking away from long-standing business processes that companies were built upon in favor of relatively new practices that are still being defined.

Outstanding and groundbreaking technological developments within the last years include Big Data, Cloud Services, Internet of Things (IoT), Additive Manufacturing, Cyber Security, Artificial Intelligence (AI), as well as Blockchain. Combining these technologies enables automated driving, digital twins, Industry 4.0 and Smart Cities, to name a few.

A **digital transformation strategy** aims to create the capabilities of fully leveraging the possibilities and opportunities of new technologies and their impact faster, better and in a more innovative way in the future. A digital transformation journey needs a staged approach with a clear roadmap, involving a variety of stakeholders, beyond silos and internal/external limitations. This roadmap takes into account that end goals will continue to move as digital transformation de facto is an ongoing journey, as is change and digital innovation.

Although disruption has long been a threat for some industries, the rise of digital technologies has accelerated the pace of disruption in virtually every industry, creating immense ambiguity and unease.

Meanwhile, **uncertainty continues to accelerate** in the broader business environment as the rate at which new technologies emerge increases exponentially – all while competition becomes increasingly fierce. The dominance of established leaders has never been more under threat. However, these changes are also creating **immense opportunities**, and the tools to prosper during the age of digital disruption are accessible and available.

1. Introduction



Welcome to Design Thinking!

Thinking like a designer can transform the way organizations develop products, services, processes, and strategy. Design Thinking allows managers to use creative tools to address a vast range of challenges.

Design Thinking brings together what is desirable from a human point of view with what is technologically feasible and economically viable. It is a systematic, human-centered approach to solving complex problems within all aspects of life. The approach goes far beyond traditional concerns such as shape and layout. And unlike traditional scientific and engineering approaches, which address a task from the view of technical solvability, user needs and requirements, as well as user-oriented invention, are central to the process.

Design Thinkers step into the end-users' shoes – not only interviewing them, but also carefully observing their behaviors. Solutions and ideas are concretized and communicated in the form of **prototypes** as early as possible so that potential users can test them and provide feedback – long before the completion or launch. In this way, Design Thinking generates **practical results**.

Three important factors make Design Thinking successful:

- the collaborative interaction of multi-disciplinary and decision-capable **teams**,
- flexible **workspace** for collaborative work
- and a workflow that follows the Design Thinking **process**.

In this course, we provide an overview of design thinking and work with a five-step model and several tools to help you understand design thinking as a problem-solving approach. We also look at a detailed case study of an organization that used design thinking to uncover compelling solutions.

2. What is Design Thinking?



Design thinking in its most arbitrary form is the act of “thinking like a designer”. However, despite extensive literature on the topic, there is no singular agreed-upon definition. In this chapter, we will discuss four of the most popular definitions of design thinking.

Problem Solving

Every design starts with a problem at the very beginning: People needed to shelter from the rain and sleep in the cave but it’s too humid, so here came with the house. They needed to cover their bodies, so the clothes were designed. People needed to hunt and the stones were too sharp, so they had tools. People need to drink water and it’s too far to the river, so cups were made.

Any design is a purposeful demand solution starting from the problem. Consider this: You work for an organization in East Africa. The organization sells treadle pumps (used for farmland irrigation) to the local farmers. After years of operation, you notice that in some regions the treadle pumps sell extremely well, while in other regions they don’t sell at all. You’ve been tasked with generating sales of the pumps in those weak-performing regions.

What do you do? We will get to the answer is just a minute.

Design Thinking is a problem-solving framework. Tim Brown, CEO of IDEO, defines design thinking like this:

“The mission of design thinking is to translate observation into insights and insights into products and services that will improve lives.”

The goal of improving lives is an important endpoint to the process of design thinking. In fact, it's what design thinking is all about: finding fresh, creative solutions to problems, but in a way that puts people and their needs first.

So, what exactly is design thinking and how can you use and apply it to solve any problem? Comparing traditional problem-solving techniques with design thinking can answer these questions:

- **Traditional:** Traditional problem-solving often takes a methodical, almost scientific form. Pinpoint a problem, define the steps to take and tools to use to reach a solution, then stick to the plan and hope for the desired result. It's straightforward, but not always flexible, innovative or effective. What if the issue identified isn't the real source of the problem? What if the steps don't lead to the right solution?
- **Design Thinking:** Instead of starting with a problem, design thinking starts with observation. It's informed by an understanding of the culture and the context of a problem (what people need), rather than the problem.

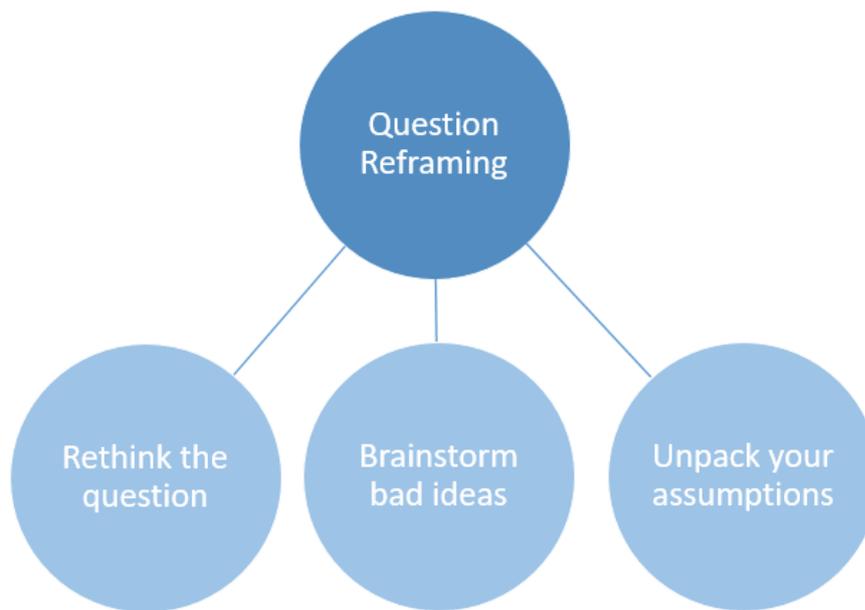
Design thinking came to the rescue for the organization selling treadle pumps in East Africa. They were able to identify why their product wasn't selling in some regions and they found a solution. The solution didn't surface after an analysis of the problem itself — low sales. It wasn't found after an 8-hour corporate brainstorm in a New York high-rise, with people in suits debating over charts and economic forecasts. The solution was born from a deep level of observation of the people who weren't buying the pumps, and the cultures they were a part of.

Problem Reframing

Everything really comes down to solving problems. To be successful and a leader in your field, you not only have to come up with good solutions; you need to be innovative. And that can feel like waiting for lightning to strike.

Sometimes we need to reposition our own problems. People do not actually need mobile phones (nouns). People only need to communicate (verbs). So the problem at the cell phone level may be important. The important thing is how to make people communicate better and more conveniently.

Reframing a problem helps you see it as an opportunity. Tina Seelig, who has been teaching classes on creativity and innovation at Stanford University School of Engineering for 16 years, offers three techniques for finding innovative solutions:



1. Rethink the question:

Start by questioning the question you're asking in the first place. Before you start brainstorming, Seelig suggests you start "frame-storming": brainstorming around the question you will pose to find solutions. For example, if you're asking, "How should we plan a birthday party for David?" you're assuming it's a party. If you change your question to, "How can we make David's day memorable?" or "How can we make David's day special?" you will find different sets of solutions.

Refocusing the question changes our lens: Memorable is different than special – memorable might involve a prank, for example. Once you reframe the questions, you might decide to select the best or address them all. Each new question opens up your ability to generate new ideas.

2. Brainstorm bad ideas:

When an individual or group is tasked with being creative, often there's pressure to only come up with good ideas. Seelig likes to challenge teams to only think of bad ideas.

“Stupid or ridiculous ideas open up the frame by allowing you to push past obvious solutions,” she says. “There is no pressure to come up with ‘good’ ideas. Then, those terrible ideas can be re-evaluated, often turning them into something unique and brilliant.”

Once you have a list of bad ideas, brainstorm how they can become good ideas. In one of Seelig's classes, a bad idea was selling bikinis in Antarctica. A group that was tasked with making this idea a good one came up with the idea to take people who want to get into shape on a trip to Antarctica. By the end of the hard journey, they would be able to fit into their bikinis. Their slogan was “Bikini or Die.”

“Selling bikinis in Antarctica sounds like a really bad idea. But within five seconds, when asked to look at it differently, the team came up with a way to transform it into a really interesting idea,” she says.

3. Unpack your assumptions:

Another way to reframe a problem is to challenge its perceived limitations or rules. Ask, “What are all of the assumptions of the industry?” Make a list and turn them upside down by thinking about what would happen if you did the opposite.

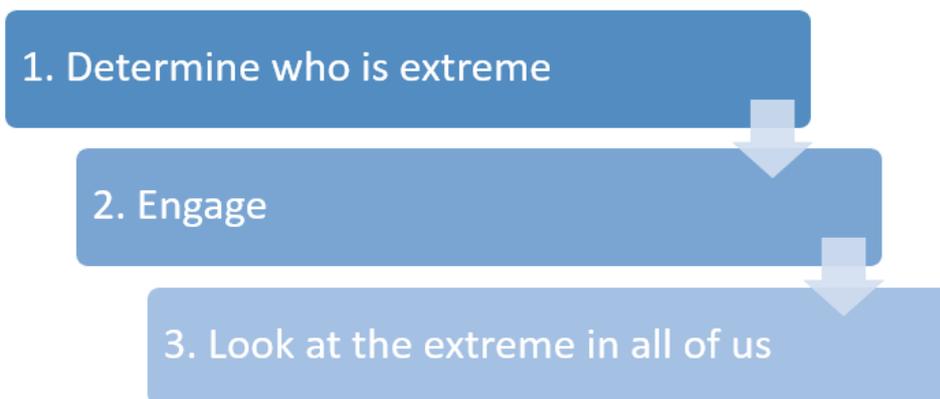
Seelig says this is a hard exercise because a lot of our assumptions are deeply ingrained. “Cirque du Soleil challenged assumptions about what a circus is. Instead of cheap entertainment for kids, they turned it into a high-end event for adults that competes with the theatre or opera,” she says. “In addition, Southwest challenged the assumption that airlines had to have fixed seat assignments. This opened the possibility of having riders line up before each flight—a radically different approach to seating.”

Focus on Extreme Users

Designing a solution that will work for everyone means talking to both extreme users and those squarely in the middle of your target audience.

An idea that suits an extreme user will nearly certainly work for the majority of others. And without understanding what people on the far reaches of your solution need, you'll never arrive at solutions that can work for everyone. More importantly, talking to Extreme users can spark your creativity by exposing you to use cases, hacks, and design opportunities that you'd never have imagined.

You work on a solution with extreme users in mind by following three simple steps:



- **Determine who is extreme:** Determining who is an extreme user starts with considering what aspect of your design challenge you want to explore to an extreme. List a number of facets to explore within your design space. Then think of people who may be extreme in those facets. For example, if you are redesigning the grocery store shopping experience you might consider the following aspects: how groceries are gathered, how payment is made, how purchase choices are made, how people get their groceries home, etc. Then to consider the aspect of gathering groceries, for example, you might talk to professional shoppers, someone who uses a shopping cart to gather recyclables (and thus overloads the cart), product pullers for online buyers, people who bring their kids shopping with them, or someone who doesn't go to grocery stores.

- **Engage:** Observe and interview your extreme user as you would other folks. Look for workarounds (or other extreme behaviors) that can serve as an inspiration and uncover insights.
- **Look at the extreme in all of us:** Look to extreme users for inspiration and to spur wild ideas. Then work to understand what resonates with the primary users you are designing for.

When you speak with and observe extreme users, their needs are amplified and their workarounds are often more notable. This helps you pull out meaningful needs that may not pop when engaging with the middle of the bell curve.

System Thinking

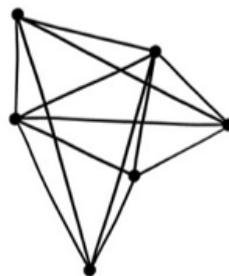
Design thinking is a process of integrating different things into a system. We must observe the entire system that involves innovation. For example, when designing medical devices, we cannot consider the needs of users individually.

The systems we need to consider will involve many elements: busy doctors, stressful work, patient's mood, hospital space, and the rest of the equipment. Equipment manufacturers, government medical insurance, etc. are all within our scope of innovation.

Disconnected Projects



Interconnected System



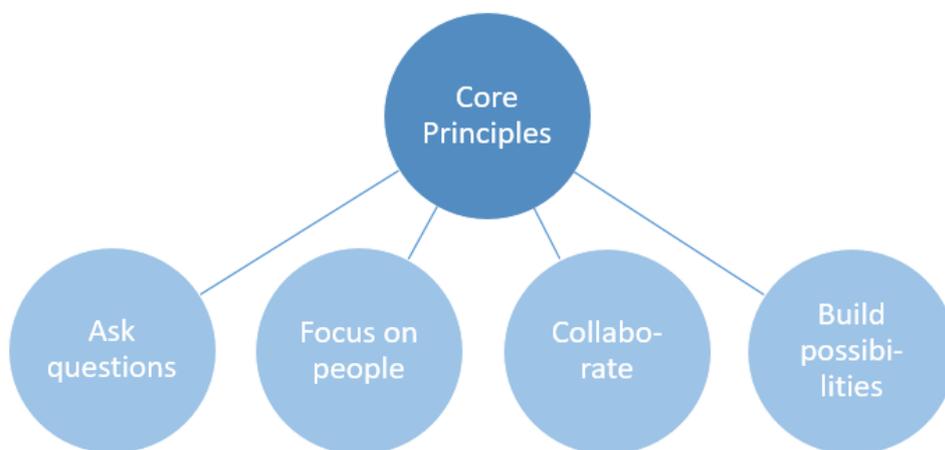
That's why **systemic design thinking** is a recent initiative that integrates system thinking and human-centered design, with the intention of helping with complex projects. The recent challenges coming from the increased complexity caused by globalization, migration or sustainability render traditional design thinking methods insufficient.

Systemic design intends to develop methodologies and approaches that help to integrate systems thinking with design thinking towards sustainability on an environmental, social, and economic level. It is a pluralistic initiative where many different approaches are encouraged to thrive and where dialogue and organic development of new practices play a major role.

3. Core Principles



The popularization of design thinking as a tool for innovation resulted in large global corporations adopting design disciplines into their ways of working, for example, Google, Samsung, and IBM. While all of these might differ in detail, they commonly share these four core principles:



- **Always ask questions:** The only way to get to answers is to simply ask questions, both to yourself and your colleagues. The more questions they ask, the better the answer can be.
- **Focus on people:** Design thinking is a human-centered approach to innovation that draws from the designer’s toolkit to integrate the needs of people, the possibilities of technology and the requirements for project success. It’s not ‘us versus them’ or

even ‘us on behalf of them.’ For a design thinker, it has to be ‘us with them.’

- **Collaborate:** Using the full mental power of the people involved is key. Usually, companies don’t do that because they’re stuck in old structures and linear processes with departments fighting with each other, and large hierarchical systems.
- **Build your process around possibility:** Design is built on the possibility of the never-seen-before. Design thinking starts with understanding, exploring and materializing a solution or a concept.

4. Five Stages of Design Thinking



The Hasso-Plattner Institute of Design at Stanford (d.school) is the leading university when it comes to teaching Design Thinking. The five stages of Design Thinking, according to d.school, are as follows: Empathise, Define (the problem), Ideate, Prototype, and Test.

Empathise



“Empathise” is the first stage of the Design Thinking process. In the empathise stage, your goal, as a designer, is to gain an empathic understanding of the people you’re designing for and the problem you are trying to solve. This process involves observing, engaging, and empathising with the people you are designing for in order to understand their experiences and motivations, as well as immersing yourself in their physical environment in order to have a deeper personal understanding of the issues, needs and challenges involved.

Empathy is crucial to a human-centered design process such as Design Thinking, and empathy helps design thinkers to set aside his or her own assumptions about the world in order to gain insight into their users and their needs. Depending on your time constraints, you will want to gather a substantial amount of information at this stage of the Design Thinking process.

In the Empathise stage of a Design Thinking process, you will develop the empathy, understandings, experiences, insights, and observations on which you will use to build the rest of your design project.

The following are some of the most popular Empathise methods:

- Assume a beginner's mindset
- Ask What-How-Why
- Conduct interviews
- Build empathy with analogies
- Use photo and video user-based studies
- Use personal photo and video journals
- Create journey maps

It is how important to develop the best possible understanding of your users, their needs, and the problems that underlie the development of the particular product or service you are aiming to design.

Define the problem



During the Define stage, you put together the information you have created and gathered during the Empathise stage. This is where you will analyze your observations and synthesize them in order to define the core problems that you and your team have identified up to this point.

A problem statement is important to a Design Thinking project because it will guide you and your team and provides a focus on the specific needs that you have uncovered. It also creates a sense of possibility and optimism that allows team members to spark off ideas in the Ideation

stage, which is the third and following stage in the Design Thinking process. A good problem statement should thus have the following traits. It should be:

- **Human-centred:** This requires you to frame your problem statement according to specific users, their needs and the insights that your team has gained in the Empathise phase. The problem statement should be about the people the team is trying to help, rather than focusing on technology, monetary returns or product specifications.
- **Broad enough for creative freedom:** This means that the problem statement should not focus too narrowly on a specific method regarding the implementation of the solution. The problem statement should also not list technical requirements, as this would unnecessarily restrict the team and prevent them from exploring areas that might bring unexpected value and insight to the project.
- **Narrow enough to make it manageable:** On the other hand, a problem statement such as “Improve the human condition,” is too broad and will likely cause team members to easily feel daunted. Problem statements should have sufficient constraints to make the project manageable.

To illustrate, instead of defining the problem as your own wish or a need of the company such as, “We need to increase our food-product market share among young teenage girls by 5%,” a much better way to define the problem would be, “Teenage girls need to eat nutritious food in order to thrive, be healthy and grow.”

The Define stage will help the designers in your team gather great ideas to establish features, functions, and any other elements that will allow them to solve the problems or, at the very least, allow users to resolve issues themselves with the minimum of difficulty. In the Define stage, you will start to progress to the third stage, Ideate, by asking questions which can help you look for ideas for solutions by asking: “How might we... encourage teenage girls to perform an action that benefits them and also involves your company’s food-product or service?”

Ideate



During the third stage of the Design Thinking process, you are ready to start generating ideas. You've grown to understand your users and their needs in the Empathise stage, and you've analyzed and synthesized your observations in the Define stage, and ended up with a human-centered problem statement. With this solid background, you and your team members can start to "think outside the box" to identify new solutions to the problem statement you've created, and you can start to look for alternative ways of viewing the problem.

The main aim of the Ideation stage is to use creativity and innovation in order to develop solutions. By expanding the solution space, the design team will be able to look beyond the usual methods of solving problems in order to find better, more elegant, and satisfying solutions to problems that affect a user's experience of a product.

There are hundreds of Ideation techniques such as Brainstorming, Co-Creation Workshops, Mindmapping, and Storyboards. It is important to get as many ideas or problem solutions as possible at the beginning of the Ideation phase.

Brainstorming is a great way to generate many ideas by leveraging the collective thinking of the group, by engaging with each other, listening, and building on other ideas. This method involves focusing on one problem or challenge at a time, while team members build on each other's responses and ideas with the aim of generating as many potential solutions as possible. These can then be refined and narrowed down to the best solution(s). Participants must then select the best, the most practical, or the most innovative ideas from the options they've come up with.

Here are a few guidelines that will help you in the Ideation stage:

- **Set a time limit**
- **Start with a problem statement and stay focused on the topic:** Identify the core subject or the main aim of the exercise. Condense the main issue into a problem statement and condense it into a short "How Might We" sentence. You may

even be able to synthesize this into a single word. Your ideas should always branch off from this central headline.

- **Defer judgment or criticism, including non-verbal:** The brainstorming environment is not the time to argue or for question other members' ideas.
- **Encourage weird, wacky and wild ideas:** Free thinking may produce some ideas that are wide off the mark, but brainstorming is about drawing up as many ideas as possible which are then whittled down until the best possible option remains.
- **Aim for quantity:** Brainstorming is effectively a creative exercise, in which design thinkers are encouraged to let their imaginations run wild. The emphasis is on quantity, rather than quality at this stage.
- **Build on each others' ideas:** One idea typically leads on from another; by considering the thoughts, opinions, and ideas of other team members during the brainstorming session, new insights and perspectives can be achieved, which then inform one's own ideas.
- **Be visual:** The physical act of writing something down or drawing an image in order to bring an idea to life can help people think up new ideas or view the same ideas in a different way.
- **One conversation at a time:** Design thinkers (or brainstormers) should focus on one point or conversation at a time so as not to muddy their thinking and lose sight of the thread or current objective.

Prototype



The design team will now produce a number of inexpensive, scaled-down versions of the product or specific features found within the product, so they can investigate the problem solutions generated in the previous stage. Prototypes may be shared and tested within the team itself, in other departments, or on a small group of people outside the design team. This is an experimental phase, and the aim is to identify the

best possible solution for each of the problems identified during the first three stages.

Prototypes are built so that designers can think about their solutions in a different way (tangible product rather than abstract ideas), as well as to fail quickly and cheaply, so that less time and money is invested in an idea that turns out to be a bad one.

The solutions are implemented within the prototypes, and, one by one, they are investigated and either accepted, improved and re-examined or rejected on the basis of the users' experiences. By the end of this stage, the design team will have a better idea of the constraints inherent to the product and the problems that are present, and have a clearer view of how real users would behave, think, and feel when interacting with the end product.

For instance, when developing software, a design team may produce a number of paper prototypes, which the user can gradually work through in order to demonstrate to the design team or evaluators how they may tackle certain tasks or problems. When developing tangible devices, such as the computer mouse, designers may use a number of different materials to enable them to test the basic technology underlying the product. With advances in 3D printing technology, producing prototypes is now often a more instant and low-cost process.

It is important to remember that prototypes are supposed to be quick and easy tests of design solutions. Here are a few guidelines that will help you in the Prototyping stage:

- **Just start building:** Design Thinking has a bias towards action: that means if you have any uncertainties about what you are trying to achieve, your best bet is to just make something. Creating a prototype will help you to think about your idea in a concrete manner, and potentially allow you to gain insights into ways you can improve your idea.
- **Don't spend too much time:** Prototyping is all about speed; the longer you spend building your prototype, the more emotionally attached you can get with your idea, thus hampering your ability to objectively judge its merits.
- **Remember what you're testing for:** All prototypes should have a central testing issue. Do not lose sight of that issue, but at the

same time, do not get so bound to it so as to lose sight of other lessons you could learn from.

- **Build with the user in mind:** Test the prototype against your expected user behaviors and user needs. Then, learn from the gaps in expectations and realities, and improve your ideas.

Test



Designers or evaluators rigorously test the complete product using the best solutions identified during the prototyping phase. This is the final stage of the 5 stage-model, but in an iterative process, the results generated during the testing phase are often used to redefine one or more problems and inform the understanding of the users, the conditions of use, how people think, behave, and feel, and to empathise. Even during this phase, alterations and refinements are made in order to rule out problem solutions and derive as deep an understanding of the product and its users as possible.

When conducting a user test on your prototype, it is ideal to utilize a natural setting (i.e., the normal environment in which your users would use the prototype). If testing in a natural setting proves difficult, try to get users to perform a task, or play a role, when testing the prototype. The key is to get users to be using the prototype as they would in real life, as much as possible.

Here are a few guidelines that will help you in the Testing stage:

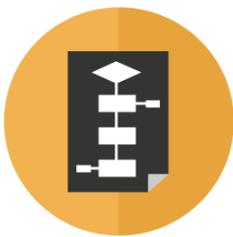
- **Let your users compare alternatives:** Create multiple prototypes, each with a change in a variable, so that your users can compare prototypes and tell you which they prefer (and which they don't). Users often find it easier to elucidate what they like and dislike about prototypes when they can compare, rather than if there was only one to interact with.
- **Show, don't tell: let your users experience the prototype:** Avoid over-explaining how your prototype works, or how it is supposed to solve your user's problems. Let the users'

experience in using the prototype speak for itself, and observe their reactions.

- **Ask users to talk through their experience:** When users are exploring and using the prototype, ask them to tell you what they're thinking. This may take some getting used to for most users, so it may be a good idea to chat about an unrelated topic, and then prompt them by asking them questions such as, "What are you thinking right now as you are doing this?"
- **Observe:** Observe how your users use — either "correctly" or "incorrectly" — your prototype, and try to resist the urge to correct them when they misinterpret how it's supposed to be used. User mistakes are valuable learning opportunities. Remember that you are testing the prototype, not the user.
- **Ask follow up questions:** Always follow up with questions, even if you think you know what the user means. Ask questions such as, "What do you mean when you say ...?", "How did that make you feel?", and most importantly, "Why?"

If users experience difficulties, the design team must revisit their list of potential solutions and strategies in order to establish new ways to solve the same problems. Testing can also help identify previously unconsidered problems. The users' feedback is priceless; without an understanding of what users need in order to carry out their activities and tasks, the iterative design process and solution will fail.

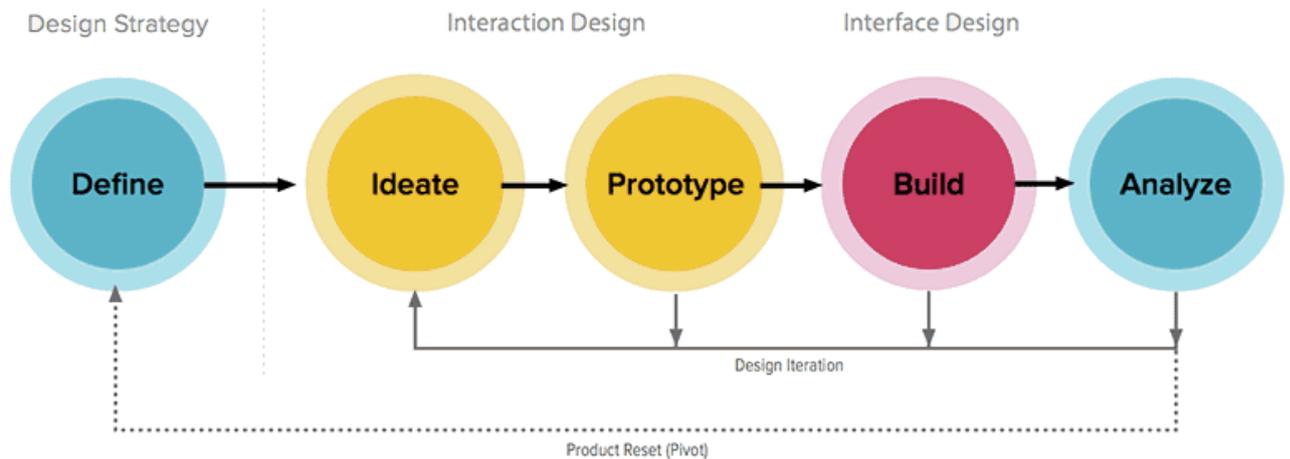
5. Other Design Thinking Models



The simplicity of the "Five Stages Model" is considered both an advantage and a disadvantage. That's why two newer models called ZURB and the Double-Diamond method expand the "Five Stages Model" by introducing new important aspects.

ZURB

The **ZURB Design Thinking** Model shares the D.School's simplicity but also considers important stages such as building the final product and getting feedback. The ZURB model includes five stages; **Define, Ideate, Prototype, Build** and **Analyze**. The last two stages represent the build of the final product and analysis of the market impact and user feedback.



This model presents two types of the iteration cycles; the design iteration, and the product reset (pivot):

- The first type includes the iteration between the stages ideate, prototype, build and analyze. If something wrong happens, the team can iterate between the four stages above to file problems and improve the product.
- The second iteration process is a hard reset. If there is a major failure or the product does not meet the requirements, the product resets and returns directly to the define stage to repeat the process from scratch and define the problem again.

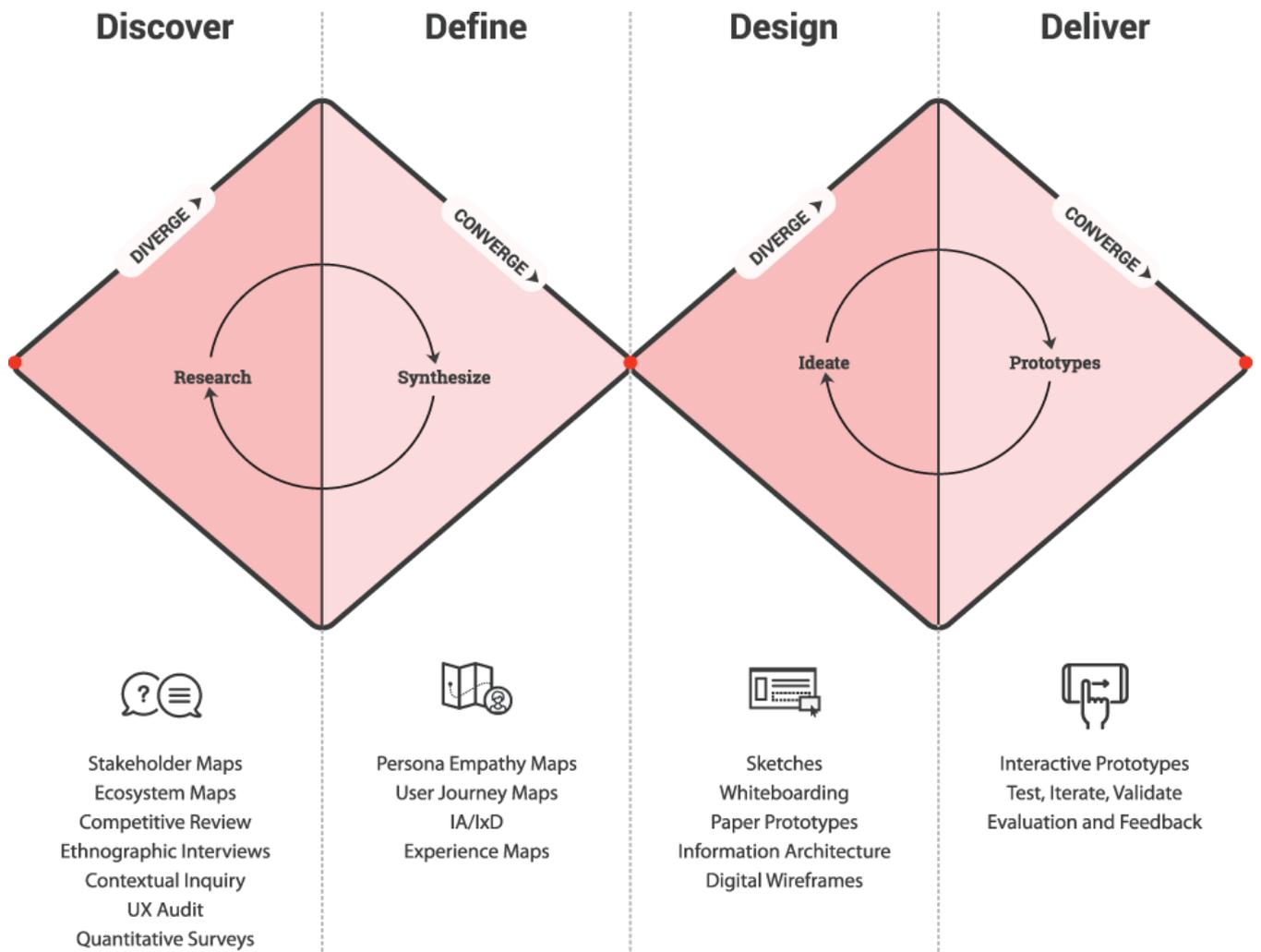
You have probably noticed that the “build” and “analyze” phases are two stages that we have not seen so far:

- The build phase is where you take all the information and feedback gathered from prototyping and you begin to build the product with design layouts and build upon your already established front-end coding. Thus, resulting in your final iteration.
- Once your product has been made available for the world audience, you should dive right into the analyze phase of the

design process. In this phase, you will gain insight into your newly published product. You attain these insights through product research and user feedback.

Double-Diamond

The Double Diamond Diagram was developed by the **British Design Council** as part of their in-house research to identify how leading companies manage the design process. The Double-Diamond process includes four main stages; **Discover, Define, Design, and Deliver**. The first two stages define the project strategy, while the third and fourth represent the executive solution.



Using the double diamond, you approach problems and solutions by using two different types of thinking: divergent and convergent:

- **Divergent thinking:** think broadly, keep an open mind, consider anything and everything (Discover and Design phases)
- **Convergent thinking:** think narrowly, bring back focus and identify one or two key problems and solutions (Define and Deliver phases)

The four main phases are as follows:

- **Discover:** The first quarter of the Double Diamond model covers the start of the project. Designers try to look at the world in a fresh way, notice new things and gather insights.
- **Define:** The second quarter represents the definition stage, in which designers try to make sense of all the possibilities identified in the Discover phase. Which matters most? Which should we act on first? What is feasible? The goal here is to develop a clear creative brief that frames the fundamental design challenge.
- **Design:** The third quarter marks a period of development where solutions or concepts are created, prototyped, tested and iterated. This process of trial and error helps designers to improve and refine their ideas.
- **Deliver:** The final quarter of the double diamond model is the delivery stage, where the resulting project (a product, service or environment, for example) is finalized, produced, and launched.

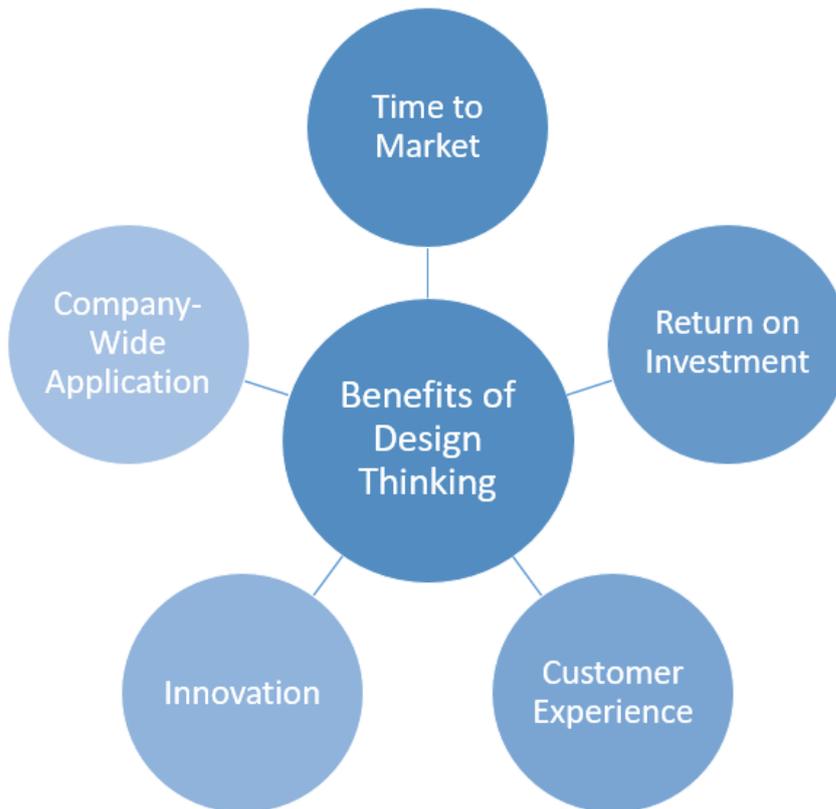
6. Benefits of Design Thinking



As a manager, you have a pivotal role to play in shaping the products and experiences that your company puts to market. Integrating Design Thinking can add huge business value, ultimately ensuring that your

products are desirable for customers and viable in terms of company resources.

With that in mind, let's consider some of the main benefits of using Design Thinking at work:



- **Significantly reduces time-to-market:** With its emphasis on problem-solving and finding viable solutions, Design Thinking can significantly reduce the amount of time spent on design and development—especially in combination with lean and agile.
- **Cost savings and a great ROI:** Getting successful products to market faster ultimately saves the business money. Design Thinking has been proven to yield a significant return on investment; teams that are applying IBM's Design Thinking practices, for example, have calculated an ROI of up to 300% as a result.
- **Improves customer retention and loyalty:** Design Thinking ensures a user-centric approach, which ultimately boosts user engagement and customer retention in the long term.

- **Fosters innovation:** Design Thinking is all about challenging assumptions and established beliefs, encouraging all stakeholders to think outside the box. This fosters a culture of innovation which extends well beyond the design team.
- **Can be applied company-wide:** The great thing about Design Thinking is that it's not just for designers. It leverages group thinking and encourages cross-team collaboration. What's more, it can be applied to virtually any team in any industry.

Whether you're establishing a Design Thinking culture on a company-wide scale, or simply trying to improve your approach to user-centric design, Design Thinking will help you to innovate, focus on the user, and ultimately design products that solve real user problems.

7. Lean & Agile Management



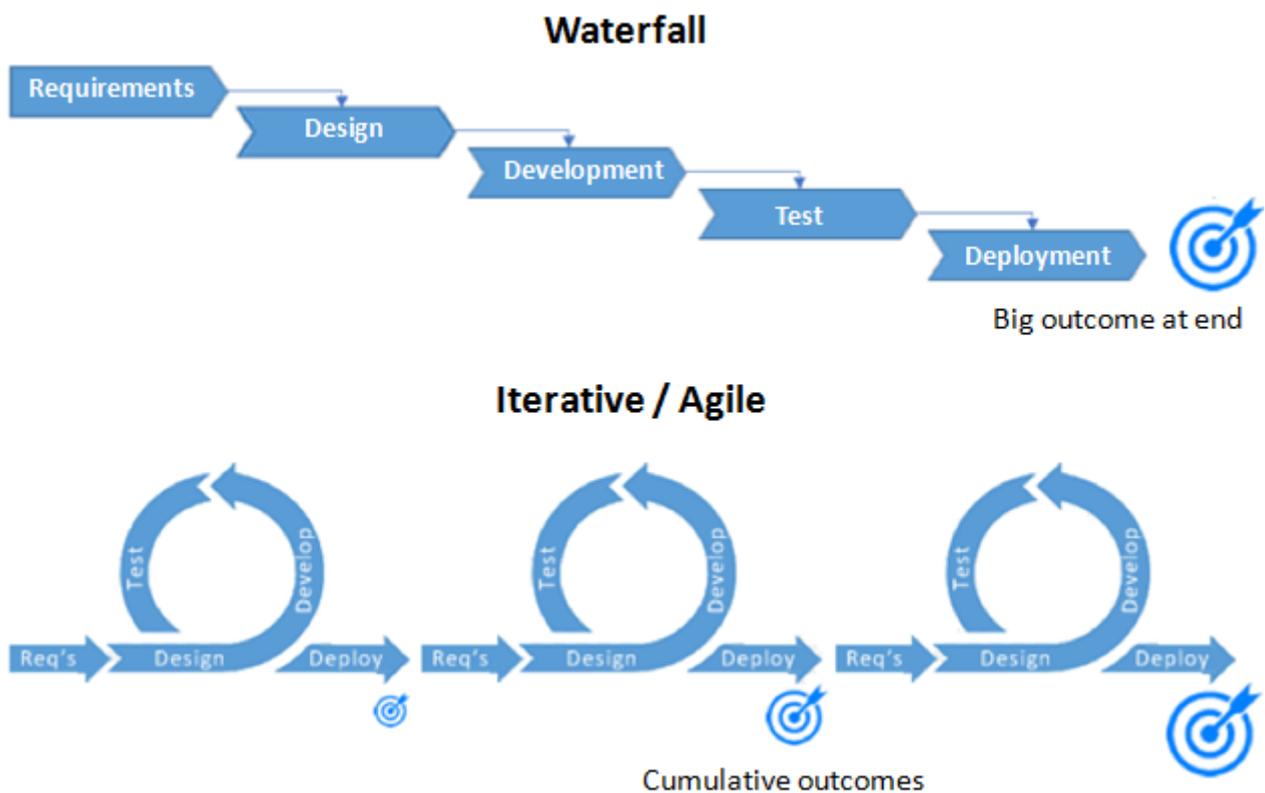
Now that we know what Design Thinking is, let's consider how it fits into the overall product management process. You may have heard terms like "lean" and "agile" in the work environment already. It is important to understand what these two approaches are and how they interact with Design Thinking.

Based on the principles of lean manufacturing, **lean management** focuses on streamlining the work process as much as possible—minimizing waste and maximizing value. Some core tenets of lean management are:

- Cross-functional collaboration between designers, engineers, and product managers.
- Gathering feedback quickly and continuously, ensuring that you're constantly learning and adapting as you go.
- Deciding as late as possible and delivering fast, with less focus on long-term deliverables.
- A strong emphasis on how the team operates as a whole.

Lean management is a technique that works in conjunction with **agile** development methods. Agile is a software development process that works in **iterative**, incremental cycles known as sprints. Unlike traditional development methods (such as the **waterfall** method), agile is flexible and adaptive. Based on the Agile Development Manifesto, agile adheres to the following principles:

- Individuals and interactions over processes and tools.
- Working software over comprehensive documentation.
- Customer collaboration over contract negotiation.
- Responding to change over following a plan.



Design Thinking, lean, and agile are often seen as three separate approaches. Companies and teams will ask themselves whether to use lean or agile or Design Thinking—but actually, they can (and should!) be merged for optimal results.

Why? Because applying Design Thinking in a lean, agile environment helps to create a product development process that is not only user-centric but also highly efficient from a business perspective. While it's true that each approach has its own modus operandi, there is also

significant overlap. Combining principles from each can be crucial in keeping cross-functional teams on the same page—ensuring that designers, developers, product managers, and business stakeholders are all collaborating on one common vision.

Design Thinking is how we explore and solve problems; Lean is our framework for testing our beliefs and learning our way to the right outcomes; Agile is how we adapt to changing conditions with software.

As we've learned, Design Thinking is a solution-based approach to exploring and solving problems. It focuses on generating ideas with a specific problem in mind, keeping the user at the heart of the process throughout. Once you've established and designed a suitable solution, you'll start to incorporate lean principles—testing your ideas, gathering quick and ongoing feedback to see what works—with particular emphasis on cross-team collaboration and overcoming departmental silos. Agile ties all of this into short sprint cycles, allowing for adaptability in the face of change. In an agile environment, products are improved and built upon incrementally. Again, cross-team collaboration plays a crucial role; agile is all about delivering value that benefits both the end-user and the business as a whole.

Together, Design Thinking, lean, and agile cut out unnecessary processes and documentation, leveraging the contributions of all key stakeholders for continuous delivery and improvement.

8. Case Study



You might be thinking by now: “This is great but how is this going to help to quickly make my product a reality?” In order to make Design Thinking somewhat more tangible, we will discuss a detailed case study in this last part of the course.

Case Study: Intro

Imagine that you found yourself at a meeting with an entrepreneur, a few managers, and many ideas flying around the room. Your direct competitor had recently released a new application and the tension was palpable. The company wanted to go out with something new on the market, to avoid losing ground to your competitor.

They prepared a document with some requirements, a vague idea of what the product should look like, and how much should it cost.

“We have to follow what others have done, with a lower price,” the Marketing Director said. “We have to create a more usable system, which simplifies the user journey,” added another manager. “We have to change the way we collect information, simplify it and integrate our processes with third parties,” said another. “It will take us months,” the technical manager shook his head, who mentally translated all those requests into hundreds of hours of code to be implemented.

The product in this case study concerns a so-called hub communication software. This piece of software managed different channels (email to SMS, fax to VoIP) and it was created for the web and mobile platforms. The product was originally created a few years before, but its usability was poor. At the time of the launch, the competitor was far ahead in terms of user experience. Moreover, they had an excellent mobile app, which was gaining ground in the mobile app store.

Company X was a traditional process-driven company, familiar with traditional projects. It was new to the idea of creating a product with the help of Design Thinking. More notably, they feared the unknown. What if the new product would have an undesirable or unpredictable effect on their customer user base? This lack of control didn't inspire confidence.

The meeting described above did not lead to a clear definition of what the product to be achieved actually was. You only knew that you had to hit the target as soon as possible.

However, as the project progressed and a competitor was beginning to gain traction, consent from the company was solidifying. Despite some initial perplexity and fear, this was an opportunity to learn what would bring real value to their user base and potentially attract more users by making a streamlined lightweight product.

This prompted the company to look for approaches that they haven't tried before, in order to have a complete product built on time even if it's going to have only essential features at its launch. You decided to use the Design Thinking process and focus on the things that would really bring value to the end-user and thus, beat the competition by bringing only what's necessary to the customer.

Case Study: Empathise

The goal of this phase is to understand your customer, by searching and gathering information about their business. During this phase, we can use several different tools, such as interviews, focus groups, observations, and surveys.

In the most literal sense, empathy is the ability to understand and share the emotions of others. In design thinking, empathy is a “deep understanding of the problems and realities of the people you are designing for.”

Your first step was to ensure that the Highest Paid Person's Opinion (otherwise known as HiPPO) was not ruling over everyone else's. Therefore, together with managers and the founder, you have compiled a list of possible stakeholders to be involved in the decision-making process.

In a day-long meeting, you compiled the first list of 30 names (between employees, functional managers, and customers) that could be contacted directly and then you also picked a target audience of 4000 customers (about 10% of their recurring customer user base).

You tried to “normalize” our target customer base as much as possible, by including diversity in terms of gender distribution, industry, and other data points. To add an additional level of complexity, the physical location of the sample to be interviewed were all divided into different cities and in some cases countries. You now had points of contacts to carry out interviews and questionnaires.



The group was organized to carry out the interviews remotely, following a scripted set of questions and some basic rules:

- Try to understand the main “What, How, Why” behind every behavior.
- Make sure the interviewee used a webcam and that there was sufficient distance from the camera to be able to at least partially include the body language.
- Record all interviews, in case they need to be seen in the future.

You prepared your interview questions with the intention of understanding which main features should be enhanced or eliminated, such that you could quickly build a new version that responded to the needs of your users.

For the second group of users, you prepared a series of questions in a Google form. You opted for multiple-choice questions, with some formulated open-ended questions to facilitate more interaction from the users, including a question requiring the user to try the new version of the product just available in closed beta.

The first results of the interviews were encouraging, as the interviewees were open to providing feedback on the weaknesses and the strengths of the system.

Case Study: Define

In this phase, we collect and categorize information from the Empathize phase. It's here where we define User Personas and User Journeys.

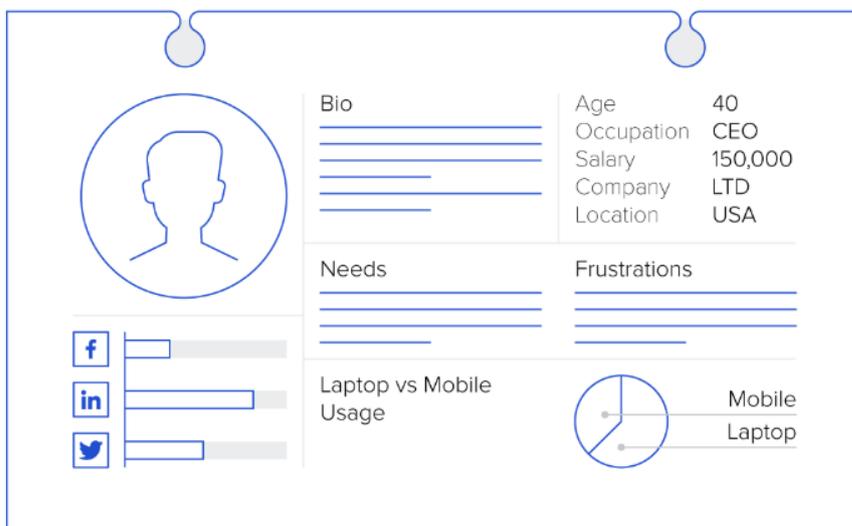
The dictionary meaning of define is "to determine the identity and the essential qualities of a notion." In your case you want to define the following:

- your ideal customers
- their problems
- the solutions to their problems
- the needs and fears of your customers that you had to address

In the design thinking terms, the define phase is where you analyze your observations and synthesize them into core problems that you have identified.

You had a sufficient database to understand what the real problems were. In addition to the feedback received in the Empathize phase, it contained points that were highlighted by Company X employees but had never been pointed out to management, as well as strengths, weaknesses, and other problems that have never been taken into account.

The next action was to create your User Personas. During this brainstorming phase, you involved the entire extended team.



For each Persona, you identified their biography, their approach to technology, their use of social media, preferred brands, their needs, and ideas and speculated on what would have been their Customer Journey.

After this, you had selected the common client User Personas and had a finished set of data coming from interviews and surveys. This was the right time to get your hands dirty.

During the definition phase, you tried to transform a generic definition of a problem like, “We need a product that will increase our sales by 10%,” into a more specific solution like: “Men and adult women, between 35 and 45 years that are working in an office need to receive communications that have a legal validity to be sure that the sender is actually who they say they are.”

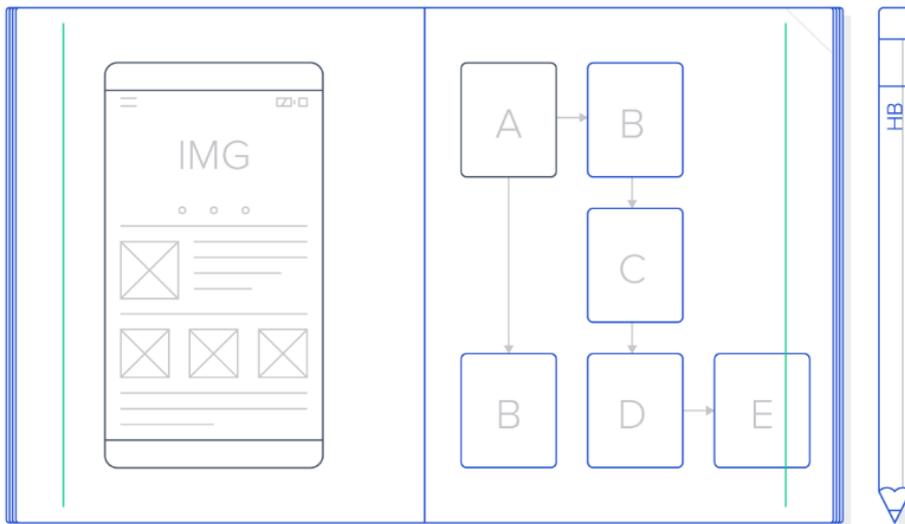
At this point in the project process, you had completed brainstorming sessions around our users, hypothesized solutions, and kept an open mind to every possible innovation. “The only stupid idea is the one never expressed” was the mantra.

In a short time, bearing in mind who your subjects were, you had a clear view of what was useful to our users, along with what needs and fears you should address along the customer journey.

Case Study: Ideate

One step further from the definition is the Ideation phase, where the key is forming real concepts and solution, not just abstract definitions. In design thinking terms, ideation is “the process where you generate ideas and solutions through sessions such as Sketching, Brainstorming, Mindmapping, Worst Possible Idea, and a wealth of other ideation techniques.”

Your team decided to proceed to work in a Lean way when producing materials and reviewing them. For example, designers and other members of the team have agreed that to be as fast as possible, the best solution would be to start with drawings on paper and to share photos of them in the group. Only then you would produce the most interesting designs on a computer.



For each sketch that was produced, you gathered information from users, you defined a set of solutions and you came back to those users (whenever it was possible and as often as it was possible) to test with them the process and the result.

Case Study: Prototype

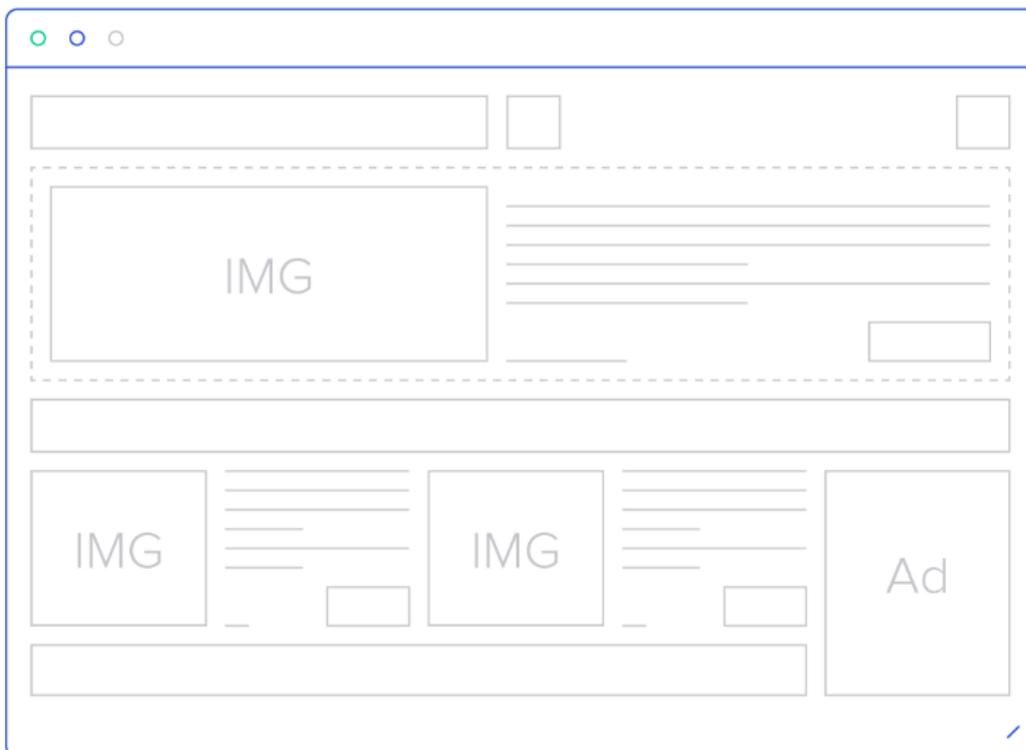
During this phase, something tangible is created, that will allow you to verify your idea in real life. Don't overcomplicate and create this prototype as quickly as possible.

During the prototype phase, it was finally time to make your definitions and ideas come to life. A prototype is the first, original model of a proposed product, and this is exactly what you set out to build. By design thinking standards, the prototype stage is where you create inexpensive, scaled-down versions of the real product to investigate solutions from the previous stages.

After almost ten days from the beginning of your journey, you arrived at the crucial moment, a meeting with a developer team where you had a chance to check your assumptions and estimations. After a session of consultation and definition with the team of developers, you weighed the stories and understood that the major effort of the development work will be in the development of the back-end system. Alongside this, you also realized that creating the front-end systems will be a much shorter

exercise. Thus, you decided to create a front-end prototype using the components which already existed in the system to save time.

After three days you had your first version of the prototype ready. It had “fake” data which reflected the behavior of the software you were aiming to create. Some accessory elements were missing, but the software in that state visually represented a good percentage of total content planned.



At the end of two weeks of work, you had software that you could try and test with actual users. You used user experience monitoring software to analyze how users were navigating your prototype.

Case Study: Test

Verify your idea in real life with actual users. Get feedback. Ask questions on how to improve it. Translate this collected knowledge into a final product.

After the definition, ideation and prototype phases it was finally time to see if your product actually worked in real life. In design thinking terms,

testing means putting the complete product to trial using the best solutions created in the prototyping phase.

In your case, the testing phase did not only take place at the end, but it was a constant loop of feedback and iteration whenever it was possible. At the end of each accomplished step, you tried to get feedback from users or customers, before convincing yourself to move on to the next phase.

Once the prototype was completed, it was time to test it with the widest possible audience and check with them how effectively it met their needs, understand their perception, and understand if it accomplished their goals.

The testing phase specifically included a walkthrough prototype where users were able to see the new workflow and perform actions, along with a few sessions where the team directly observed users, while tracking their responses. A simple questionnaire was used where users were asked to score the process from 1-10.

The testing phase was later extended to the whole team and some individuals outside the organization (customers and users) who during the earlier sessions, had willingly consented to give their feedback on the implementation of the system.

The results of this testing were encouraging. The stakeholders of the Company X were able not only to see the mockups but to try out and “touch” the product for the very first time. The extended team had the opportunity to test and verify their assumptions and correct them over time within a period of two weeks.

With the help of Design Thinking, you were able to collect data, ideas, personas, feedback and create your first tangible prototype. It was then time to roll up your sleeves and start developing the final product.

Instead of using more traditional approaches and producing things in sequential steps, you have chosen to iterate through the five design thinking stages. Empathize. Define. Ideate. Prototype. Test. This became your mantra and allowed you to produce a very well-received product.

Using Design Thinking has led you to save time, and in turn, save costs spent on the project. You were not working on millions of different features, but only on a few, well thought through actions that were clear to everybody in the team. Most importantly, you were able to deliver the product and value that users needed.

9. Conclusion



In this course, you learned that Design Thinking has a human-centered core. You now possess a deep understanding of how it encourages organizations to focus on the people you are creating for, which leads to better products, services, and internal processes.

In employing design thinking, you are pulling together what's desirable from a human point of view with what is technologically feasible and economically viable. It also allows those who are not trained as designers to use creative tools to address a vast range of challenges. The process starts with taking action and understanding the right questions. It's about embracing simple mindset shifts and tackling problems from a new direction.

Throughout this course, you saw that design thinking can...

- help you or your team spot unmet needs of the people you are creating for,
- reduce the risk associated with launching new ideas,
- generate solutions that are revolutionary, not just incremental, and
- help organizations learn faster.

Design Thinking has become more than just a creative process. What was originally intended as an innovation method, has advanced to a completely new way of seeing people in relation to work, of imagining the concept of work. The appeal of Design Thinking lies in its ability to

inspire new and surprising forms of creative teamwork. “We-intelligence” is the new catchword and collaboration the foundation for a new work awareness.

1. Introduction



Innovation has been one of the hottest topics of the last couple of decades and innovation management is a source of much debate: Some argue that the very definition of innovation means that it can't be managed, whereas others believe in building systems for the purpose of creating more innovation.

As you can probably guess, the reality isn't as black and white. So, let's first take a step back and consider what the term means. Most dictionaries simply refer to innovation as being “*the introduction of something new*”. This isn't the same as simply inventing something new, such as a product, as it also needs to be launched and introduced to the world.

As is evident from the definition, there's an endless variety of different kinds of innovations. This is the root cause for many of the disagreements related to innovation: people often use the generic term when they really are referring to a small subset of innovation, and even then, strictly from the point-of-view of their own organization and past experience.

Innovation management refers to the handling of all the activities needed to “introduce something new” – which in practice means things like coming up with ideas, developing, prioritizing and implementing them, as well as putting them into practice, for example by launching new products, or by introducing new internal processes.

Innovation management is the process by which innovation is managed or dealt with by affecting certain decisions, practices and actions, as a response to an opportunity.

Why is innovation management needed? It is necessary for a multitude of reasons. They are:

- **To map the innovation process.** Innovation management creates a bird's eye view of the entire innovation process and enables the top management to identify areas of improvement. It also helps identify newer ideas and assess whether they are in sync with the big-picture view of the company.
- **To forecast market conditions better.** Innovation management creates a foresight of the market. It helps forecast changes in the market, identifies newer market segments and monitors customer trends. It also detects competition on the existing business models and charts out measures to face it.
- **To ensure proper timing of market introduction** and reduce risks of delayed innovation. Faulty timing of innovative steps is one of the main reasons for the failure of a project. When a product or service introduction is delayed, it loses its competitive edge over its competitors and is doomed to failure.

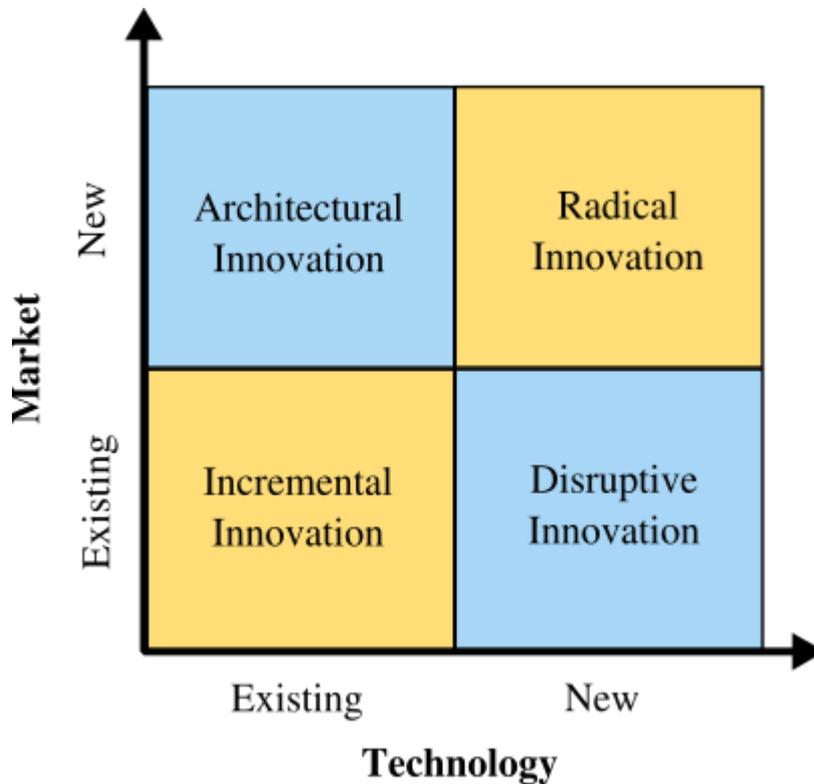
2. Basics of Innovation



It is remarkable how many people are under the false assumption that companies are either innovative or not. This is a very simplistic perspective that does not take into account the different key elements of innovation management as well as the types of innovations that companies can pursue.

Innovation Matrix

You've probably heard people talk about disruptive innovation, incremental innovation or radical innovation. These are all terms people use to classify innovation into different types. For this chapter, let's break down innovation into two dimensions: Technology and Market, which gives us the following four types of innovation:



1. Incremental Innovation:

Incremental Innovation is the most common form of innovation. It utilizes your existing technology and increases value to the customer (features, design changes, etc.) within your existing market. Almost all companies engage in incremental innovation in one form or another. Examples include adding new features to existing products or services or even removing features (value through simplification).

2. Disruptive Innovation:

Disruptive innovations shape a new market. Disruptive innovation, also known as stealth innovation, involves applying new technology or processes to your company's current market. It is stealthy in nature since newer tech will often be inferior to existing market technology. There are quite a few examples of disruptive innovation, one of the more prominent being Apple's iPhone disruption of the mobile phone market.

3. Architectural Innovation:

Architectural innovation is simply taking the lessons, skills and overall technology and applying them within a different market. Most of the time, the risk involved in architectural innovation is low due to the reliance and reintroduction of proven technology. Though most of the time it requires tweaking to match the requirements of the new market.

4. Radical Innovation:

Radical innovation is what we think of mostly when considering innovation. It gives birth to new industries (or swallows existing ones) and involves creating revolutionary technology. The airplane, for example, was not the first mode of transportation, but it is revolutionary as it allowed commercialized air travel to develop and prosper.

The four different types of innovation mentioned here – Incremental, Disruptive, Architectural and Radical – help illustrate the various ways that companies can innovate. There are more ways to innovate than these four. However, you can use the innovation matrix and the four categories to clarify the concepts to yourself, as well as to classify the initiatives in your innovation portfolio.

Key Elements

The simplest way to understand the topic is to break it down and discuss each of the key aspects related to innovation management separately. This chapter introduces the four innovation management aspects that we typically use: Capabilities, Structures, Culture, and Strategy.

1. Capabilities

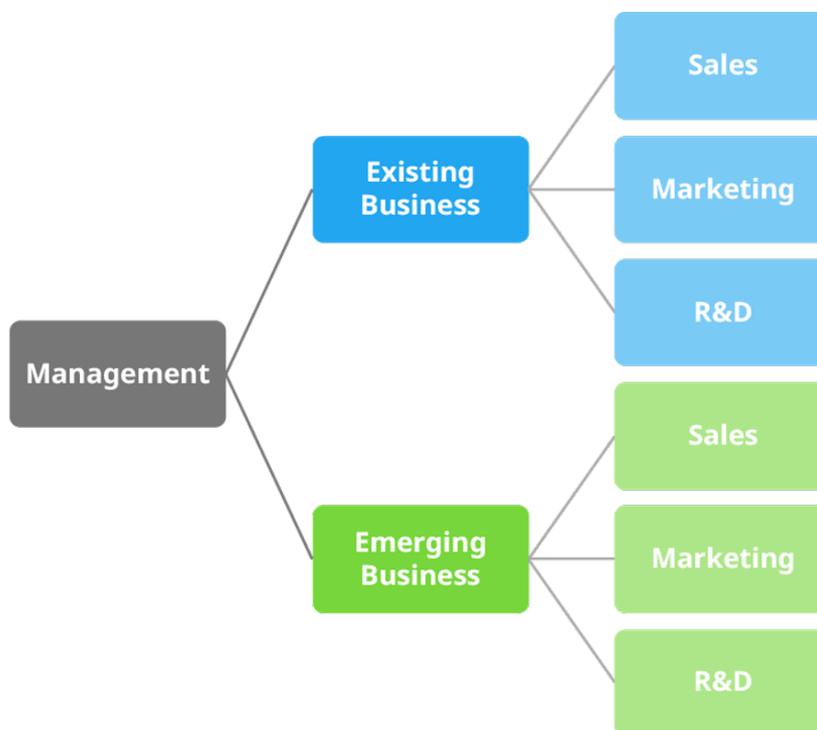
Capabilities cover the different **abilities and resources** the organization has for creating and managing innovation. The capabilities aspect revolves primarily around people, as innovation relies heavily on the abilities of both individuals and teams collectively.

It refers first and foremost to the abilities, unique insights, know-how and practical skills of the people working for the organization. However, it also covers areas, such as the information capital and tacit knowledge of the organization, as well as their other resources and available financial capital, all of which might be required to create innovation.

2. Structures

Structures **enable the effective use of the capabilities**. If every new innovative initiative is forced to go through the same processes as minor changes to the existing organization, it's very likely that many innovations will be smothered.

One of the more popular trends to create a more innovative organization is to work towards building a so-called **ambidextrous organization**. This simply means that the organization is structured in a way that allows new businesses to be independent of the pre-existing ones:



3. Culture

Culture is what **enables the organization to acquire the capabilities related to people**. With the right kind of pro-innovation culture, the organization is much more likely to be able to recruit and keep the right people in the organization. An appropriate pro-innovation culture emphasizes the need to always think of ways to get better, values speed as well as learning, and considers failure as just a normal part of the process for creating anything new.

4. Strategy

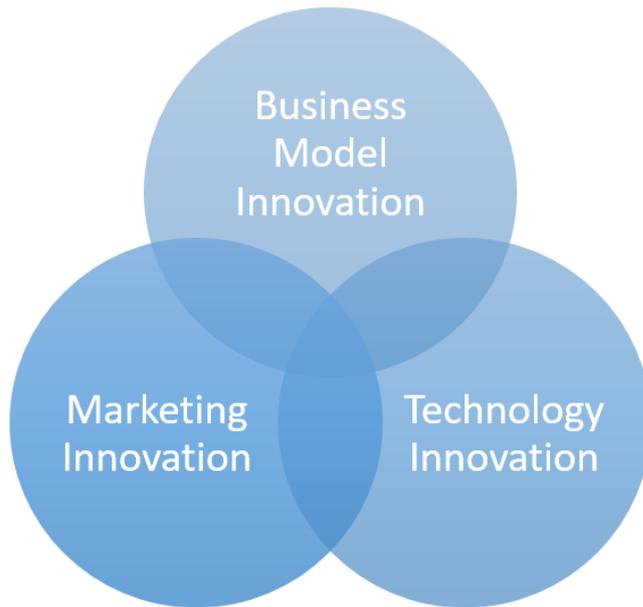
A strategy is, simply put, the plan the organization has for achieving long-term success. But what's critical to understand is that **strategy is ultimately about making a choice** between a number of feasible options to have the best chance of "winning" and this choice shouldn't obviously be separated from the execution. In essence, innovation is one of the means to achieving your strategic goals.

Thus, the key is for your innovation activities to be aligned with your strategy, which, however, is often easier said than done. In practice, you need to provide the organization with enough freedom to actually innovate, but also still need to take into account certain practical constraints, such as your strategic focus, available resources, and your own capabilities.

All four aspects affect the organization's ability to innovate and manage innovation, which is exactly why improving it is rarely a straightforward exercise with a simple solution. If you want to be effective at managing innovation, it's paramount for you to be able to understand both the big picture, as well as the individual components that make it up.

Types of Innovation

While The Innovation Matrix is a solid framework for classifying innovation from the market point of view, another perspective is to look at the source of innovation. Usually, innovation falls into one of the following three categories:



1. Business Model Innovation:

Business model innovation is all about the ability to rethink your current business to find new revenue streams and maintain a competitive advantage. It can be done either by improving an existing business model or by looking for new ways to provide value. Many previously successful company has failed in business model innovation because instead of envisioning possible future innovations, they've been too busy with their current operations.

2. Technology Innovation:

A general misconception is that innovation breakthroughs are *always* based on fascinating and costly technologies. However, most of the great innovations still utilize new technology. For many industries, technology is the major player when seeking a competitive edge and increasing profit margins. Technological innovation means generating new ideas based on technology, capability or knowledge to produce a new solution to a real or perceived need and to develop this solution into a viable entity.

3. Marketing Innovation:

Marketing innovation is about finding new unique channels and tactics to promote your offering but also the ability to find new markets and create new value propositions that others aren't able to (or do not want to) provide. This can be done for example by launching your technology,

product or business model in new unconventional places or by promoting your existing offering in a way it hasn't been promoted before.

3. Innovation Concepts



Having established that innovation management is a complex field, it helps to understand some of its widely accepted theories, models and concepts. While none of them have the ability to capture the essence of innovation by themselves, they each make excellent points about innovation.

Innovator's Dilemma

The Innovator's Dilemma is the decision that businesses must make between catering to their **customers' current needs** or adopting new innovations and technologies which will answer **their future needs**. This is a constant problem for companies and has already claimed a long list of victims. Although the Innovator's Dilemma was first popularized in a book written by Harvard professor Clayton Christensen in 1997, his warning still rings true today.

Businesses that listen too closely to customer feedback can easily fall into the trap of stagnation, even though they reacted directly to what their consumers wanted – or at least what they thought they wanted. Although market research is a very valuable tool, it can only tell innovators so much because consumers aren't necessarily the best judges of what they want.

Henry Ford, American automobile manufacturer and founder of the Ford Motor Company, summed this up perfectly when he purportedly said:

“If I had asked people what they wanted, they would have said faster horses.”

Although it's uncertain whether or not he actually said this, it emphasizes the point that when it comes to new ventures, the customer isn't always right.

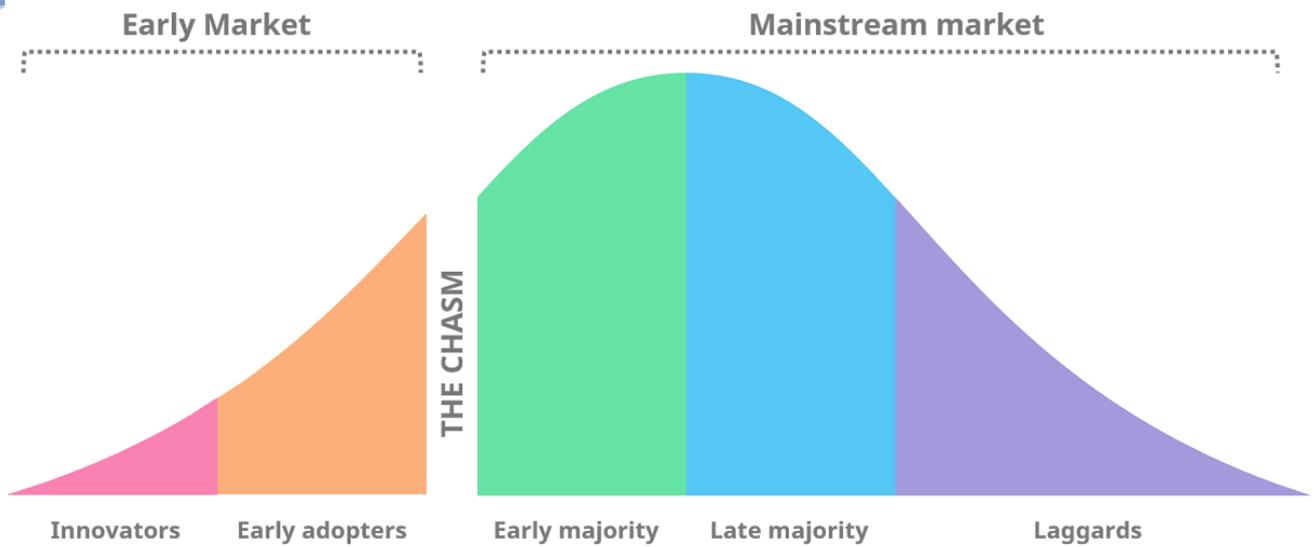
Businesses are constantly faced with two choices – they can either continue doing what they know is currently working well (exploit the markets), or adopt disruptive advancements in an attempt to stay relevant (explore the markets). The predicament is faced by all companies and is only going to intensify as innovative technology continues to expand.

In academic literature, this phenomena is described as **organizational ambidexterity** or simply **Explore-Exploit dilemma**. “Being ambidextrous” is the ability to successfully combine the exploiting of all the investments that have been made to date and constantly exploring new areas and opportunities. This calls for dual thinking and organizational design to optimize the two orientations. The right balance between exploiting and exploring is hard, but extremely important for a company's survival in the economic competition.

Technology Adoption Lifecycle

The Technology Adoption Lifecycle was first introduced by American organizational theorist Geoffrey Moore in his 1991 book *Crossing the Chasm*. It builds on the research on the diffusion of innovations and explains why companies with disruptively innovative products (and/or technology) often have a hard time reaching success with the mainstream market.

The basic idea is that the entire market can be represented with a bell curve that can be divided into segments based on how eager the customers are to adopt new technology with each segment having their own sets of expectations and desires.



Other innovators are usually the first ones to adopt new innovations. They want to be the first ones to try new things and are willing to tinker by themselves to make things work. After these initial innovators, there is a slightly larger segment of early adopters who aren't quite as willing (or able) to tinker but are otherwise almost as eager to get their hands on new technology.

Innovators and early adopters are continuously looking for ways to do things better and consider technology and innovations as sources of competitive advantage. As a result, they are often willing to pay a premium for new innovations, even though they might be lacking, or even defective, in certain ways.

The majority, however, is much more pragmatic. Even the early majority is much more risk-averse; they are looking for proven solutions at a reasonable price.

The chasm is the huge difference between the expectations of the early adopters and the expectation of the early majority. For companies to be able to cross the chasm, they need to find new ways to make their products more attractive in the eyes of the early majority.

Developing the product and changing the way you talk about it to suit the majority can often mean making compromises that alienate the innovators and the early adopters that allowed your early success. This

can be a very painful process that many companies find difficult, not only psychologically, but also in practice.

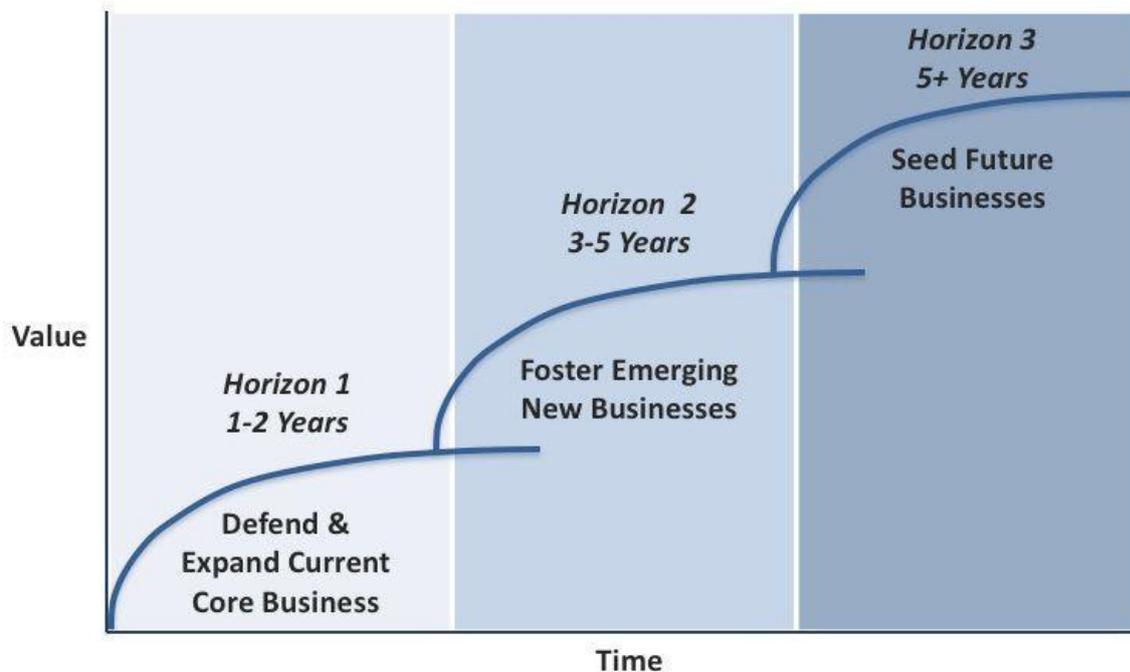
However, if you are able to make the leap, you are likely to be able to have a more scalable, and often a more profitable business, as the majority is where the economies of scale start to kick in.

This concept is very closely linked to the innovator’s dilemma. For a disruptive innovation to be successful and find ways to take over the mainstream market from the incumbent, they need to figure out ways to cross the chasm.

Three Horizons of Growth

Created by McKinsey & Company, the “Three Horizons of Growth” is quite a popular model for helping organizations structure their initiatives and find an appropriate balance between short-term and long-term projects in their portfolio.

The basic idea of the model is quite simple: for a company to maximize its growth potential, it needs to simultaneously work on projects within different horizons:



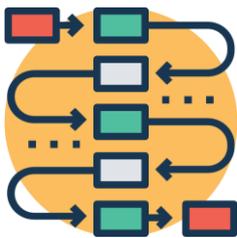
If you focus solely on incrementally improving your existing business with horizon 1 initiatives, you might see solid short-term increases in your numbers, but will ultimately sacrifice the long-term growth of the company in doing so.

The reverse applies if you focus solely on disruptive innovation of horizon 3 and completely neglect your current business. You might have a bright future, but you might be out of business before you ever get there.

To maximize growth potential, you need to simultaneously work on projects for all three horizons.

By finding the right balance, you'll not only maximize your growth potential but also decrease the risk of your business portfolio.

4. Innovation Processes



Different companies have very different processes for managing innovation. On one side, there are those who believe in **agile and lean, often pull-based processes**, and on the other side, there are those who support more **rigid and formal, mostly push-based processes** for managing innovation.

Push vs. Pull

The first question is whether the organizations operate on a more push or pull-oriented manner in their innovation work:

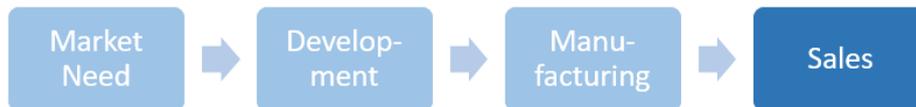
- **Push-based models** to innovation are more **internally and technologically oriented**. Push-oriented organizations know (or at least assume to know) the challenges of the market, and the users, and are simply looking for the best ways to address these challenges, usually with new technology. Classic examples of push-based organizations are Apple or IKEA.

- **Pull-based models**, on the other hand, are more **customer and market-oriented**. Pull-oriented organizations are looking for ways to adapt to changing markets and customer demand. They are usually focused more on listening to customers, learning from them and on moving fast.

Tech-push innovation



Market-pull innovation



One of the advantages of being pull-based is that it typically requires much less upfront investment than being push-based due to faster **time to market** and smaller **marketing budgets**. This, naturally, is one of the key reasons for many startups being pull-based organizations.

Phase-Gate Process

The Phase-Gate Process (also known as the “the waterfall process” under certain circumstances) is probably the single most famous process for product innovation with variations of the process having been around since the 1940s.

The model is based on the undeniable fact that there are always more ideas than there are resources. The point is that **each idea will have to go through certain pre-determined phases** in their development. At the end of each phase, there is a “gate”. When the idea reaches a gate, it will be assessed by using certain pre-determined criteria. If the idea is able to pass the assessment, it will receive additional investment and be able to proceed to the next phase.



This process helps eliminate obviously bad ideas and is quite effective at allocating resources to ideas that seem to be progressing well. It helps ensure that every innovation matches the goals and standards of the management.

The challenge with this approach is that, by definition, standardization of the phases and the metrics easily leads to only approving similar ideas, often the incremental and easily understandable ones. The phase-gate is a perfect example of a process that can easily lead to the innovator's dilemma under certain circumstances. By carefully considering the phases of the process and the metrics used for the gates, these challenges can, however, be alleviated.

The Phase-Gate Process often works well in situations where the ideas are similar by nature, the operating environment is highly predictable, and the challenges are more technical in nature.

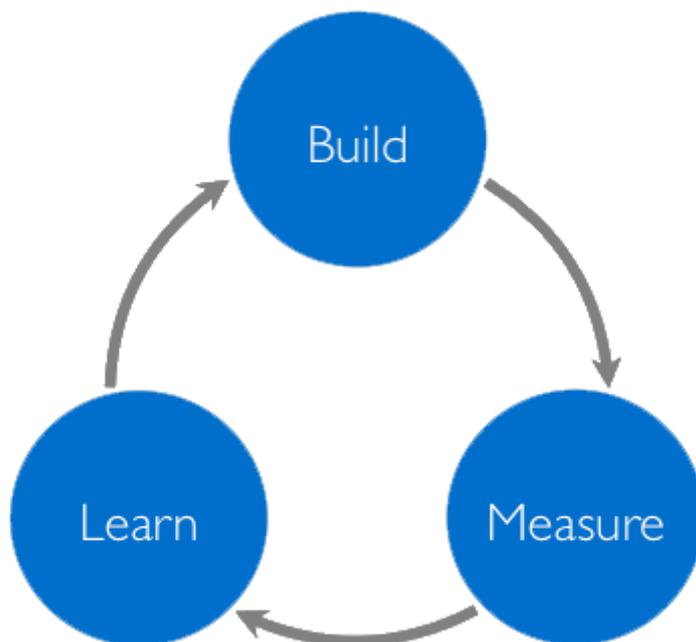
While the phase-gate model is typically used with the traditional waterfall approach, for which it was designed, it can also be used in an iterative manner with agile methods.

Lean Startup

On the other end of the spectrum from the phase-gate, there are people who believe that the best innovations come from simply equipping smart people with enough time and the right resources to make their ideas happen.

The majority of processes are somewhere in between these two, so we'll share another model that many organizations have adopted recently, this one closer to the less formal side of the spectrum, namely the Lean startup.

The **Build-Measure-Learn Feedback Loop** is the main component of the Lean Startup Model for building and testing new ideas. The core ideology behind Build-Measure-Learn Feedback Loop is to launch a new idea or concept to the market as quickly as possible to gain experience and gather feedback for further improvement.



It is much more pull-oriented than the phase-gate and is designed specifically to address market risk more than technology risk. The main idea of the Lean startup model is to rapidly test and validate the assumptions related to the product-market fit between your innovation and your target market in order to learn and adapt as quickly as possible.

This obviously makes the approach well suited for organizations operating in an unpredictable, complex or rapidly changing environment but is perhaps not ideal for the kind of organizations that the phase-gate approach is well suited for, such as those in highly regulated industries.

Another important component is the **Minimum Viable Product (MVP)**. The MVP is defined as the version of a new product a team uses to collect the maximum amount of validated learning about customers with the least effort. In other words, the MVP is a basic version with the smallest number of capabilities that will deliver enough value to potential paying customers who will give you feedback. Introducing a minimum viable product is the opposite of taking a lot of time to build a finished product, hoping the customers to come to you.

Open Innovation

Recently, growing attention has been devoted to the concept of **Open Innovation** – both in academia as well as in practice. The distinction between open innovation and closed innovation is determined by the way in which innovation is created:

- **Closed innovation** is based on the view that innovations are developed by companies themselves. From the generation of ideas to development and marketing, the innovation process takes place exclusively within the company.
- **Open innovation** means opening up the innovation process beyond company boundaries to increase innovation potential through active use of the environment. Innovation therefore arises through the interaction of internal and external ideas, technologies, and processes.

Henry Chesbrough, Director of the Center for Open Innovation of the at the University of California, coined the term and described how companies have shifted from closed innovation processes towards a more open way of innovating. He defined the term as follows:

Open Innovation is a paradigm that assumes that firms can and should use external ideas as well as internal ideas.

Open innovation offers several **benefits** to companies:

- Reduced costs of conducting research and development
- Potential for improvement in development productivity
- Synergism between internal and external innovations

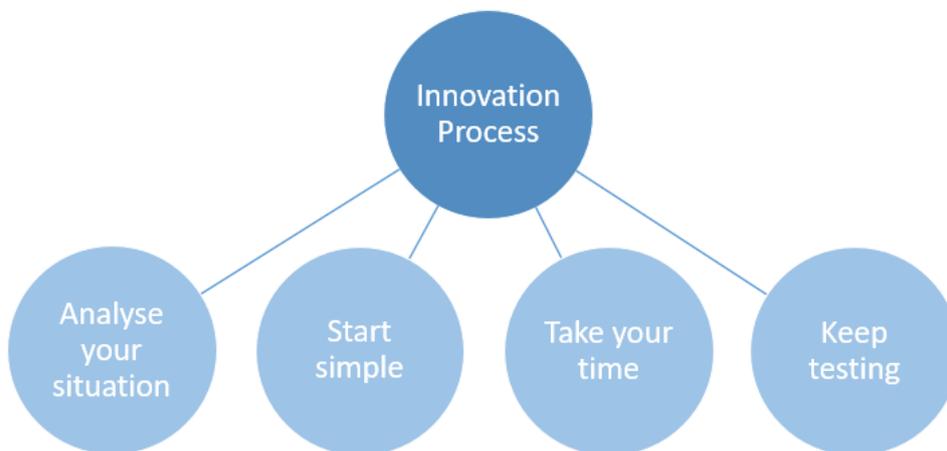
However, open innovation is also associated with some **risks**:

- Possibility of revealing information not intended for sharing
- Losing the competitive advantage by revealing intellectual property
- Increased complexity of controlling innovation

Open innovation is not completely new: In the 17th century, Europe's six seafaring nations initiated a competition to find a precise way to navigate the seas. A more accurate method of measuring time to find longitude, to be exact. The competition inspired the great minds of the time – including Galileo Galilei – to come up with innovative solutions to the dilemma. This was a very early form of open innovation.

The Right Process

The process of figuring out the right innovation management process, or processes, can be a challenging effort. As innovation is, by nature, highly unpredictable, the only way to see how a certain process could work for you is to try it out in real life. Hopefully, with the help of our four tips you can get more out of your decision-making process:



1. Analyze your situation:

Are you working in a small or large organization? What are the most important strategic goals in your industry? Have a look at the existing case examples, as this helps you to learn from other's successes and possible mistakes they've made down the road. Start with those that have been proven to work for the types of industries and organizations you're operating in.

2. Start simple:

Don't make things too difficult for yourself in the beginning. Unless you already have a clear vision for where you want to start from, it's better to start with a simple innovation management process.

3. Take your time:

You don't need to announce company-wide processes right away! Start by testing these processes first in smaller units or through shorter trials especially if a large organization is in question. Through trial and error, start doing wider trials and implementations.

4. Keep testing:

If you're working in a larger organization, you'll almost inevitably need more than just a single process for the different types of innovations in different parts of the organization, so there's no point in trying to fit everything to a single innovation pipeline.

Just start simple in one area of the organization and adapt as you learn how the process works. There's no point in being concerned about getting everything just right from the beginning as it's very unlikely to happen.

5. Measuring Innovation (KPIs)



While many aspects related to innovation are difficult to measure, there are a number of metrics, often referred to as KPIs (Key Performance Indicators), that are commonly used to measure innovation activities. In general, there are two types of metrics that we can use for measuring: input and output.

Input Metrics

As the name indicates, input metrics, are used for measuring your investments. An investment can be for example **money, time or talent** devoted to a specific activity related to innovation management.



Measuring inputs is a great way to gain insight into how your resource allocation or innovation portfolio matches your strategy and can be considered to also cover metrics regarding the process itself: e.g. how many ideas are passing through to a certain phase.

Some examples of input metrics include:

- Research & Development (R&D) spend as a percentage of sales
- The number of innovation projects started
- The number of new ideas in the pipeline
- Number of new employees in R&D

In general, input metrics are a great starting point for measuring innovation because they are responsive. When measuring inputs, you're able to react to changes sooner. It is, however, important to keep in mind that **input doesn't guarantee output**. Even if you had all the possible resources in the world, you may still never see the results you want if you're not doing enough of the right things or aren't doing them well enough.

Output Metrics

The other end of the spectrum is output metrics, which is a term that is used to refer to your returns. In other words, output metrics measure the **results of your innovation investments**. As such, they indicate if your investments are actually turning into something useful.



Here are some examples of output metrics:

- Number of new products launched in X amount of time
- Revenue/profit growth from new products
- ROI of innovation activities
- Actual vs. targeted break-even time for new products

In general, organizations are more likely to rely on outputs than inputs. Although outputs are satisfying to measure, they are typically less actionable as they often **don't tell you what went well or what went wrong**. In addition, changes in output metrics show only a certain time after the activities have taken place, which especially in the case of disruptive innovation, can be quite a long time.

Therefore, it might not be smart to focus on measuring ROI too early. Instead, in the beginning, it would be smarter to assess the time horizon, i.e. how long it will take to break-even. In later stages, it makes more sense to pay closer attention to outputs.

Choosing Your Metrics

Every organization is different, so there's no such things as a universally applicable set of innovation metrics that would work for everyone. Regardless, you get what you measure, in both good and bad, which is why it's important to choose metrics that best suit your situation.

For example, if your innovation unit focuses solely on short-term revenue goals and you hold people accountable for those goals, people will find ways to create more revenue. Some of them might just work harder and "do the right thing", but others will find ways to reach the goals in less beneficial ways, such as by shifting focus towards scaling sales and marketing prior to having a solid product-market fit for their innovation.

Here are a few tips for getting the most out of your KPIs:

- Find a good balance of input and output metrics.
- Focus on just a few metrics at a time and set goals using just these metrics.
- In general, the more risk and uncertainty you face, the more you should focus on input metrics as the correlation to output metrics is difficult to see.
- Don't try to force the same metrics for everyone in the organization.
- It's better to start with too few than too many metrics.
- Don't be afraid to change the metrics once you learn more.

6. Success or Failure?



Managing innovation is not easy – many inaccuracies creep up in the innovation management process. However, taking some risks is necessary in today's increasingly complex business world. A successful path can be charted if you avoid some common mistakes and follow some essential guidelines:

Key Success Factors

The key success factors are – more or less – the opposite of the named challenges and a combination of many of the points we've made previously in this course. Here we want to summarize the six most important points you should remember:



1. Continuous Improvement

This first point is probably the most important one: If you improve your infrastructure, processes, or services on a daily basis, you'll end up with more time to focus on value creation. If you've also been working to improve your individual skills during this time, you'll be much more productive with the time you have. A mindset of continuous improvement is also tremendously helpful for cultivating a culture that's focused on getting better and innovating.

2. Value Creation

Many innovators are in the pursuit of chasing their vision, which can sometimes lead them to, unfortunately, lose sight of the end goal: creating value for your customers. As long as you know your market and your customers while continuing to focus on creating as much value for them as possible with your innovations, you're likely to go in the right direction.

3. The Lean Startup

In general, speed is of the essence when it comes to innovation. The Lean Startup we discussed in this course is a great framework for a number of reasons, but the key reason for its success is the build-measure-learn feedback loop. The aim is to continuously improve your offering so that you eventually deliver precisely what your customers want.

4. Allocation of Resources

Any organization needs to be clear and purposeful when it comes to resource allocation. For an organization to be successful, they should identify their willingness to take a risk and their desired level of returns, as well as the timeline for that, and use them to craft a strategy. Once the strategy is in place, one should continuously seek to monitor progress and make sure that the resources are still appropriately allocated.

5. Empowering Culture

The days of heroic single inventors are, for the most part, behind us. The vast majority of innovation created in these days is the result of a team of innovators. Without the right mix of talent, along with the right culture, it's increasingly difficult for teams to come up with innovations in today's increasingly complex world.

6. Focus

Just like a lack of focus can easily be one of the key challenges preventing innovation, remaining focused is one of the key success factors for creating them. You are guaranteed to increase your odds of being successful when you're focused. To do something that others can't, you have to be willing to put in the work that others don't.

Key Challenges

Innovation is very difficult to get right, and every organization is guaranteed to run into a number of different challenges on their journey to become more innovative. We'll outline four of the more common challenges below so that you're aware of them and can start to watch out for them in your organization:



1. Oppressive Hierarchy:

If an organization has a lot of hierarchy, and the management has a very top-down, often micro-managerial, approach to their job, it is likely to lead to employees becoming more passive. You'll recognize that this is an issue if you hear people say things like "This isn't what I get paid for". Innovation, by definition, is all about exceeding expectations and current limitations.

2. Poor Culture:

A person has a *growth mindset* if they think that who they are isn't just something that's passed on to them but is instead something they can work on, for example by acquiring new skills and learning new things. The same goes for the organizational culture. Without a culture that's growth-oriented, the organization is simply highly unlikely to innovate.

3. Lack of Resources & Infrastructure:

Without any processes, resources or infrastructure in place for implementing ideas, it will be difficult for people to achieve impact, even if they wanted to.

As a manager, it's your job to do the best you can to provide your team with the resources and capabilities they need to be successful and the same most certainly applies for innovation.

4. Lack of Vision & Focus:

Great innovations are often born from people having a vision for creating something that doesn't yet exist, and the same applies to organizations. When your organization has a clear and compelling vision,

you are much more likely to attract people who are passionate about your mission and willing to put in the extra effort to actually come up with innovations.

Without focus, you are likely to spread your resources too thin and to create too much overhead. This will lead you to be unable to execute on any of the ideas well enough to really be the best at it. If you have a clear vision and focus, you'll also be much better equipped for seeing those innovative ideas through to implementation and eventually to successful innovations.

Innovation and Risk

It is natural to fall into the trap of thinking that risks have negative effects. The concept of risk is too often seen as purely a negative issue that one should look to minimize. However, **risk is defined as the potential of something either gaining or losing value**, which means that it simply represents the uncertainty related to that something.

As working on innovation always involves a lot of uncertainty, you should look at risk as more than just something to minimize.

For example, early-stage startups in general have very little to lose, which is why they're willing to bet 100% of their resources on working on a single ambitious project with a very high likelihood of failure in the hopes of achieving a large potential upside.

On the other hand, there are tons of established companies that are highly risk-averse and even though they might have a lot of resources, they're only willing to invest them in initiatives that have a virtually guaranteed return.

The **risk of not improving** basically means that if you just keep on doing what you've always done, it's just a matter of time before you'll be out of business. In some industries, this might take decades, but in certain fast-moving ones, it might be mere months before you lose your competitive advantage.

So, not taking any risks at all can be considered to be the biggest negative risk factor of them all. It has no upside but has a guaranteed long-term negative risk of 100%.

7. Google: Eight Pillars



The greatest innovations are the ones we take for granted, like light bulbs, refrigeration, and penicillin. But in a world where the miraculous very quickly becomes common-place, how can a company, especially one as big as Google, maintain a spirit of innovation year after year?

Susan Wojcicki, VP of Advertising at Google, defines and explains Google's eight pillars of innovation. These pillars have allowed the company to grow exponentially and stay innovative.

1. Have a Mission that Matters

Work can be more than a job when it stands for something you care about. Google's mission is to 'organize the world's information and make it universally accessible and useful.' Gmail was created to address the need for more web email functionality and more storage.

2. Think Big but Start Small

No matter how ambitious the plan, you have to roll up your sleeves and start somewhere. It is necessary to look at all steps, even the minor ones. By taking the smallest initiatives, one can generate great, new ideas.

3. Strive for Continual Innovation, not Instant Perfection

Iterating allows companies to identify what works early and be able to respond properly. Some Google products are updated every day. It's much better to learn these things early and be able to respond than to go too far down the wrong path.

4. Look for Ideas Everywhere

It is important to hear ideas from all sources; therefore great managers spark conversations with all employees with idea boards. Thus, problems are approached from different perspectives.

5. Share Everything

Google employees know pretty much everything that's going on and why decisions are made. By sharing everything, you encourage the discussion, exchange, and re-interpretation of ideas, which can lead to unexpected and innovative outcomes.

6. Spark with Imagination, Fuel with Data

Google allows employees to dedicate 20% of their week to focus on whatever they want. Wojcicki says that "what begins with intuition is fueled by insights." and many Google products started life in employees' 20 percent time.

7. Be a Platform

Open technologies allow anyone, anywhere, to apply their unique skills, perspectives and passions to the creation of new products and features. Thus, everyone is involved in the development.

8. Never Fail to Fail

Google AdSense and Google Answers were both uncharted territory for the company. While AdSense grew to be a multi-billion-dollar business, Google Answers (which let users post questions and pay an expert for the answer) was retired after four years. Even with failed expenditures, professionals learn from these experiences.

Although it is quite difficult to transfer all eight assumptions to other companies and industries, Google is a great case study of how we can formulate and implement innovation successfully.

8. Conclusion



Now that we've covered all the most important aspects of innovation management, you might be wondering "where to go from here". Since innovation management is such a challenging and massive field, there obviously isn't a specific answer to this question.

We usually recommend starting by assessing your current state first and then proceeding to identify the apparent bottlenecks in your organization's innovation work. Some parts, such as certain processes, might be easier to fix than other aspects like culture, which will without a doubt take more time.

Once you've fixed the bottlenecks, it's then time to start focusing on building your capabilities in all four of the different key aspects we introduced at the beginning of this course.

If you want to move your business forward, you should focus on trying to get better every day and use all the possibilities to improve and learn to make sure you're constantly moving to the right direction.

Your strategy and the level of maturity of your business set a direction to choosing your innovation KPIs, and if you keep a balance between input and output metrics, you'll eventually see if you're doing enough of the right things to be able to achieve your goals.

While it's important to fix any obvious bottlenecks you might have, don't use all of your time to simply work on weaknesses. Innovations are born from being exceptional and different at something, as opposed to being average at everything.

This obviously takes time, so you'll need to take it step-by-step. And remember that just like successful strategies work, innovation is all about the execution.

1. Introduction



Welcome to Change Management!

Change Management is a common buzz word in today's businesses. The way businesses manage change and how successful they are at it, depends largely on the nature of business, the change and the people involved.

Change is an alteration of a company's strategy, organization or culture as a result of changes in its environment, structure, technology or people. A manager's job would be very straightforward and simple (not to say boring) if changes were not occurring in these areas. Good managers have the competence to manage change. These changes can be alterations in structure (design of jobs, span of control, authority relationships or coordinating mechanisms), in technology (equipment, work processes or work methods) as well as in people (behaviors, perceptions, expectations or attitudes).

Change Management is the structured approach for ensuring that changes are thoroughly and smoothly implemented and for achieving lasting benefits of change. The change management focus is on the wider impacts of change, particularly on people and how they, as individuals and teams, move from the current state to the future state. The change could range from a simple process change to a major system change to achieve the organization's potential.

Change Management is a term for all approaches to preparing and supporting individuals, teams, and organizations in making organizational change.

2. Reasons for Change



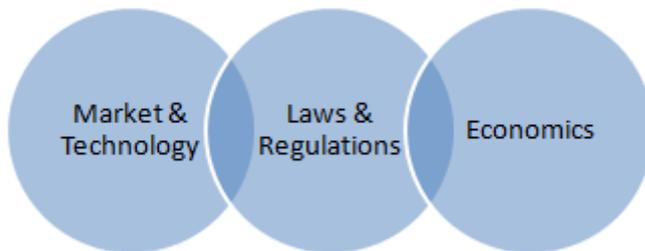
We will start this course by asking ourselves why change is necessary. A complex structure like an organization is typically driven by **external factors** as well as **internal factors** in regard to the need for change, which we will examine in this first chapter.

External Forces

There are a number of external forces that create an explicit need for change. The **external environment** is all about **factors that occur outside of the company** that cause change inside organizations and

are, for the most part, beyond the control of the company. Customers, competition, the economy, technology, political and social conditions, and resources are common external factors that influence the organization.

External forces of change are often classified under three broad categories:



1. Market situation and technology

The global marketplace has created a huge need for change because of globalization, internationalization, and a more flexible and dynamic situation. Some of this could not have occurred without the various and dramatic changes in technology. An example of the changing marketplace is the deregulation of many industries and the trend towards privatization.

2. Government laws and regulations

Government laws and regulations can have a large impact on an organization such as with deregulation. Organizations have to change because it is now prescribed. New tobacco taxes and the legislation requiring tobacco manufacturers to disclose the harmful effects of tobacco smoking, for example, have created huge pressures on some large organizations in the USA and Europe. These organizations now have to change to ensure their economic viability.

3. Economics

Finally, these economic ups and downs have a dramatic effect on organizations as well on domestic markets as the worldwide economic influence continues on organizations. This phenomenon could be seen during the last financial crisis. The effects were recognized in the USA first; then they hit Europe, Japan and finally the rest of the world. As a consequence, several automobile manufacturers have announced production cutbacks and reduced employment.

External forces for change include:

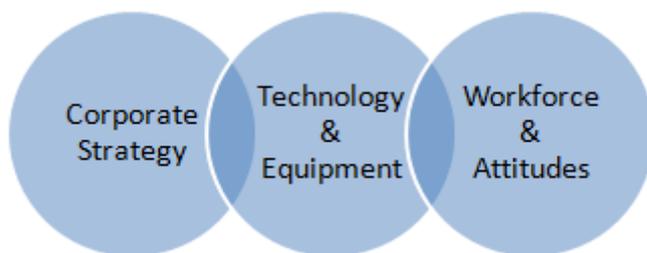
1. market & technology, 2. laws & regulations, and 3. economics.

Even though the external environment occurs outside of an organization, it can have a significant influence on its current operations, growth, and long-term sustainability. Ignoring external forces can be a detrimental mistake for managers to make. As such, it is imperative that managers continually monitor and adapt to the external environment, working to make proactive changes earlier on rather than having to take a reactive approach, which can lead to a vastly different outcome.

Internal Forces

The **internal environment** of an organization refers to events, factors, people, systems, structures, and conditions inside the organization that are generally under the control of the company. The company's mission statement, organizational culture, and style of leadership are factors typically associated with the internal environment of an organization.

Parallel to the external reasons, there are three different internal forces for change:



1. Corporate strategy

It is not unusual for an organization to change its strategy. It can lead e.g. to a large number of changes if the organization decides to adopt a new distribution methodology or a new logistic strategy. Also, a merger will change an organization's way of acting. For example, a company decides to enter the e-commerce business.

2. Technology and equipment

The introduction of new equipment or new technology is another internal force for change which affects an organization. The implementation of

new technology needs new processes or structures. Through this, employees will have to be trained for new work processes or new jobs.

3. Workforce and Employee attitudes

The composition of an organization's workforce never stays static because it changes in terms of gender, age or education. New employees join the organization and other people leave. With these changes, managers may need to redesign work and workgroups in order to ensure the job requirements match the skills of the people. Lastly, employee attitudes such as the level of job satisfaction can lead to either negative or positive forces for change.

Internal forces for change include:

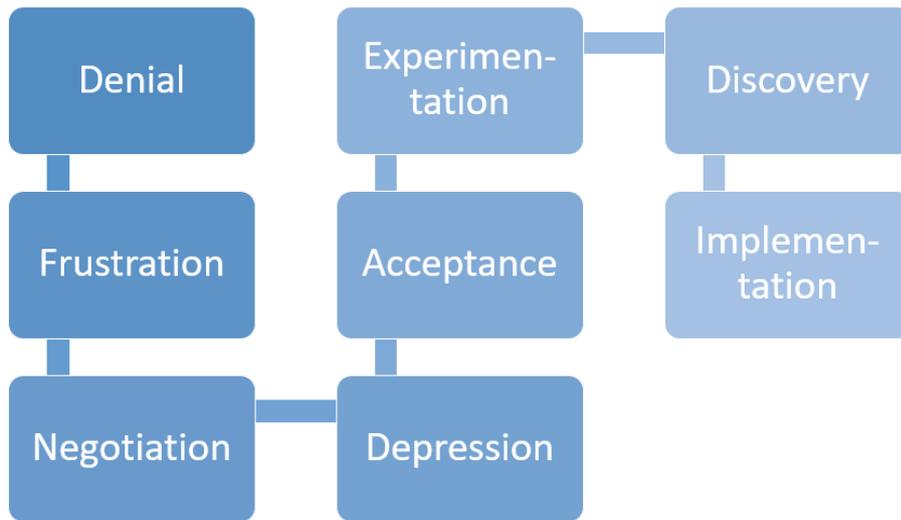
1. corporate strategy, 2. technology & equipment, and 3. workforce & attitudes.

As such, it is the internal environment that will influence organizational activities, decisions, and employee behavior and attitudes. Changes in the leadership style, the organization's mission, or culture can have a considerable impact on the organization.

Dealing with Change

Change management generally is difficult but no undoable. With a world closing in every day, companies are forced to critically reassess and, if necessary, change their business model, but also their organizational structure or their corporate culture.

Habits are a normal part of every person's lives, but they are often counterproductive when dealing with change. As humans, **we are not very good at changing**. We see changes as a negative thing that something creates instability and insecurity. This is the reason why a normal change management process often evolves through eight different mental phases:



1. **Denial:** We will fight the change to protect the status quo.
2. **Frustration:** When we realize that we cannot avoid the change, we become insecure.
3. **Negotiation:** We try to save what we can.
4. **Depression:** We realize that none of the old ways can be incorporated into the new.
5. **Acceptance:** We accept the change, and start to mentally prepare ourselves.
6. **Experimentation:** We try to find new ways, and gradually remove the old barriers.
7. **Discovery:** We realize that the change will improve our future possibilities.
8. **Implementation.** We finally implement the change process.

A change management process evolves through a number of mental phases.

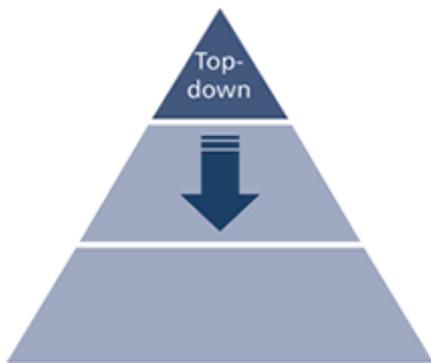
3. Origins of the Field



How should we implement change within our organization? To answer this question, we have to look at the origins of change management in the 1950s and the rivalry between advocates of **top-down approaches** and **bottom-up approaches**.

Top-down Management

Top-down organizations are characterized by the relatively low influence of subsystems. With the exception of the top management, employees are placed in a given process pattern. The organization's units are coordinated within a system of regulations and the organization's **development is steered from top-down**.



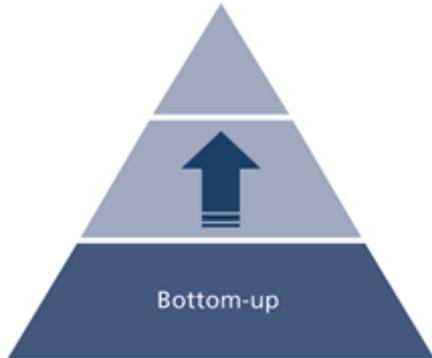
In a top-down approach, strategic direction, policy, and planning occur at or just below the highest level of a company.

For example, a company's board of directors may develop and pass down its expectations in the form of strategic plans. From the strategic plans, company management develops the policies and action plans required to meet the strategic goals and passes them on down to the line management and supervisors.

Bottom-up Management

Bottom-up organizations are characterized by the relatively high influence of subsystems. The organization's development is carried by involved employees. A structural partial autonomy is conceded to the single subsystems. The organizations' units are relatively independent in their execution of problems and could be basically capable of surviving on their own. Regulations are found primarily in the form of

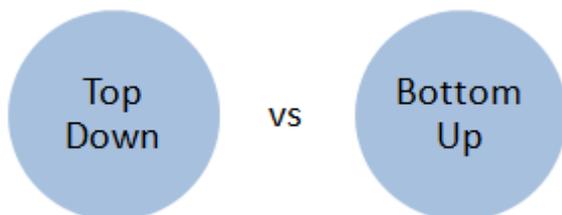
general behavioral instructions and the basis of “Common Sense”. The organization’s development is, therefore, **developing itself bottom-up**.



In a bottom-up organizational approach, a company develops its policies, plans and directions from ideas, suggestions and solutions contributed from all levels of the company, inclusively encouraging employee participation in decision-making, problem-solving, and strategic planning.

More and more companies are using the bottom-up management style in their daily work. Companies like The New York Times, Ernst & Young and IBM are implementing elements of the management style throughout their hierarchy. These companies each offer unique methods of including employees at all levels of the decision-making process. The popularity of the bottom-up approach is growing, but many organizations are still hesitant to adopt it.

Comparison



Comparing the bottom-up and top-down approaches, the advantage of a bottom-up orientation lies with the possibility of adapting the rhythm of the development and the capacity of the organization for development. Small changes can be achieved at short notice or immediately while lasting changes run smoothly and could guarantee a constant

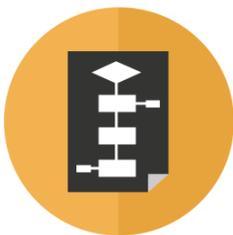
improvement of the problem-solving capacity of the enterprise. On the other hand, permanent change processes and the constant restlessness linked with such change processes can also affect negatively the organisation, as possibly no clear direction is recognizable any longer.

Few enterprises are ready for a radical change in their orientation as demanded in a top-down approach. No organization is able to reorganize itself and the whole value-added chain ad hoc. Frequently the longevity of the soft factor “enterprise culture” is underestimated. Changes in the enterprise culture need time and, hence, are an object of evolutionary and participative approach and not a revolutionary and authoritarian process. The advantages of the top-down approach are the straightforward attempt of comprehensive, department-covering thinking and action and the focus on the central processes.

Nowadays, within modern change management approaches, top-down and bottom-up approaches are mixed. Analysis and the strategy development is mainly done top-down whereas continuous process improvement is driven from the bottom-up. A constant dialogue between the involved parties guarantees constant improvement and focusing on the core requirements.

In most modern companies top-down and bottom-up approaches are mixed.

4. Change Models



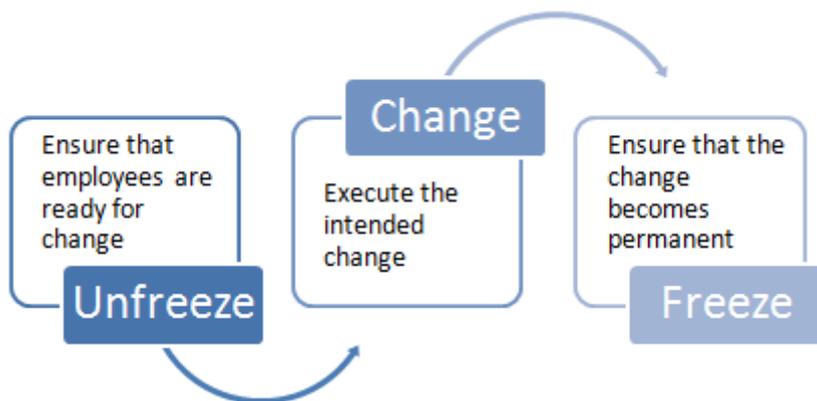
Change management models are useful in that they describe and simplify a process so that we can understand and apply the principles. The top models of change management described in this chapter have proven their value but all focus on very different processes and outcomes.

Lewin: Three-Stage Model

Kurt Lewin's three-stage model is the most famous model of change. His model has come to be known as the **Unfreeze-Change-Refreeze Model**. He noted that the majority of people tend to prefer and operate within certain zones of safety.

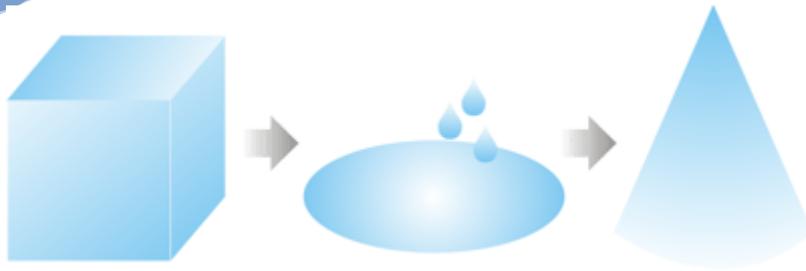
Lewin recognized three stages of change:

- **Unfreeze:** Most people make an active effort to resist change. In order to overcome this tendency, a period of thawing or unfreezing must be initiated through motivation.
- **Change (also titled Transition or Move):** Once change is initiated, the company moves into a transition period, which may last for some time. Adequate leadership and reassurance are necessary for the process to be successful.
- **Refreeze:** After change has been accepted and successfully implemented, the company becomes stable again, and staff refreezes as they operate under the new guidelines.



While this change management model remains widely used today, it is takes time to implement. Of course, since it is easy to use, most companies tend to prefer this model to enact major changes. Lewin's model will be discussed later in this course (Chapter 5) in more detail.

Lewin's theory of change used **blocks of ice** as a metaphor. If you have a large cube of ice but you want is a cone of ice, what do you do? First, you must melt the ice to make it amenable to change (unfreeze). Then you must mold the iced water into the shape you want (change). Finally, you must solidify the new shape (refreeze).



Kotter: 8-Step Change Model

Since the publication of his highly regarded book, *Leading Change*, Harvard Professor John Kotter has been highly regarded as a recognized global expert on change leadership. Kotter’s model builds on the work of earlier researchers like Kurt Lewin by providing a fuller context for implementing change in modern organizations.

Kotter’s eight-step model explains the process leaders can follow to effectively lead change in their organizations. It’s a broad model that covers topics that include communication, planning, team building, senior leadership sponsorship, organizational reward systems, influence and negotiation, and organizational behavior.



The 8 steps in Kotter’s model are as follows:

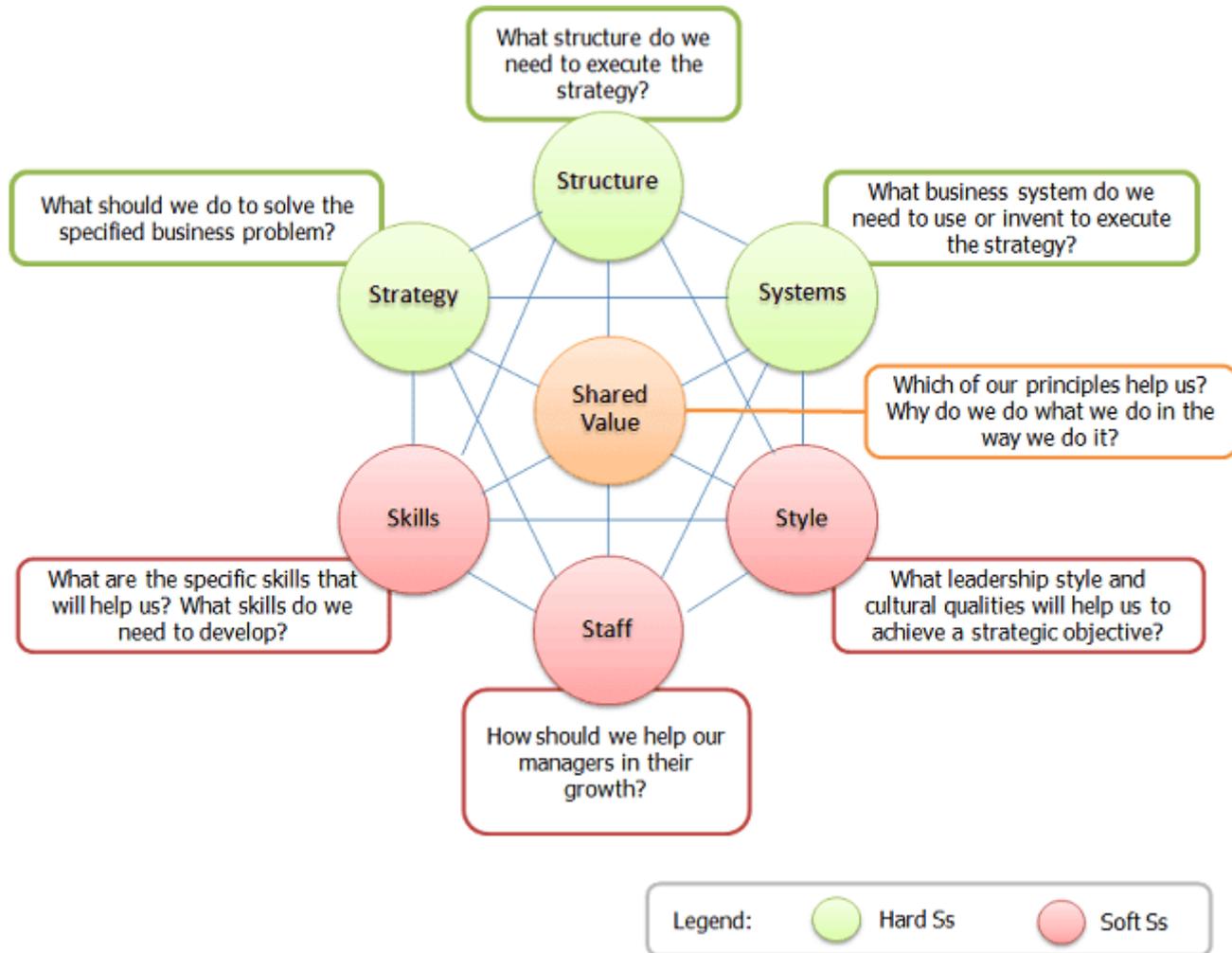
1. **Increase urgency:** Inspire people to move, make objectives real and relevant.
2. **Build coalitions:** Get the right people in place with the right emotional commitment, and the right mix of skills and levels.
3. **Get the vision right:** Get the team to establish a simple vision and strategy focus on the emotional and creative aspects necessary to drive service and efficiency.
4. **Communicate:** Involve as many people as possible, communicate the essentials simply, to appeal and respond to people's needs. De-clutter communications – make technology work for you rather than against you.
5. **Empowerment actions:** Remove obstacles, enable constructive feedback and lots of support from leaders – reward and recognize progress and achievements.
6. **Create short-term wins:** Set aims that are easy to achieve – in bite-size chunks. A manageable number of initiatives. Finish current stages before starting new ones.
7. **Don't let up:** Foster and encourage determination and persistence – ongoing change – encourage ongoing progress reporting – highlight achieved and future milestones.
8. **Make it stick:** Reinforce the value of successful change via recruitment, promotion, and new change leaders. Weave change into culture.

Each of the steps that Kotter outlines in his process is important, but none may be as crucial as the first one. Kotter noted that for change to happen at least 75% of the company's management has to be on board. That's why it is so important to take the time and effort to build the urgency necessary to get others to buy-in to your change-related projects.

McKinsey: 7-S Model

Consultants at McKinsey & Company developed the **7-S Model** in the late 1970s to help managers address the difficulties of organizational change. The model shows that organizational immune systems and the many interconnected variables involved make change complex and that an effective change effort must address many of these issues simultaneously.

The 7-S Model is a tool for managerial analysis and action that provides a structure with which to consider a company as a whole so that the organization's problems may be diagnosed and a strategy may be developed and implemented. The model looks at the seven key elements that make the organizations successful:



As depicted in the image above, the McKinsey 7-S model involves seven interdependent factors which are categorized as either “hard” or “soft” elements.

- “**Hard**” elements are easier to define or identify and management can directly influence them: these are strategy statements; organization charts and reporting lines; and formal processes and IT systems.
- “**Soft**” elements, on the other hand, can be more difficult to describe, and are less tangible and more influenced by culture.

However, these soft elements are as important as the hard elements if the organization is going to be successful.

The 7-S Model illustrates the interconnections of elements that define an organization's ability to change. This theory helped to change managers' thinking about how companies could be improved. It says that it is not just a matter of devising a new strategy and following it through. To be effective, your organization must have a high degree of it or internal alignment among all the seven Ss.

Each S must be consistent with and reinforce the other Ss. All Ss are interrelated, so a change in one has a ripple effect on all the others. It is impossible to make progress on one without making progress on all. Thus, to improve your organization, you have to master systems thinking and pay attention to all of the seven elements at the same time.

The 7-S Model is a valuable tool to initiate change processes and to give them direction. A helpful application is to determine the current state of each element and to compare this with the ideal state. Based on this it is possible to develop action plans to achieve the intended state:

To help with successful organisational change, the 7-S Model is a good tool to use, especially in the following sequence:

- **Understand the current state:** Where are we now? What is our current strategy? How are we performing?
- **Understand the future state:** Where do you want to go? What is the strategy? How competitive will you be?
- **Create a 7-S Model review on the current state:** Understand all the current elements with the organization at present.
- **Create a 7-S Model review on the future state:** What would the seven elements look like if they were all in tandem to suit the new direction?
- **Compare the future framework with the current state** and create a plan to address the actions to fill the gaps in each of the 7 elements.

Gleicher: Change Formula

The **Change Formula** is a mathematical representation of the change process, developed by David Gleicher.

The basic notion is that, for change to occur, the costs of change must be outweighed by dissatisfaction with the status quo, the desirability of the proposed change, and the practicality of the change. There will be resistance to change if people are not dissatisfied with the current state of the organization, or if the changes are not seen as an improvement if the change cannot be done in a feasible way, or the cost is far too high.

The equation says three factors must be present before meaningful change can take place:

- **D = Dissatisfaction** with the status quo. Simply continuing with things is not an option.
- **V = Vision** of what is possible. There is at least a vague sense of a better future.
- **F = First practical steps** that can be taken towards the vision. These steps have to be concrete and acceptable.

Change Formula:
 $(D \times V \times F) > R$



If any of these factors D, V, and F are missing then the others are canceled out and you will not be able to overcome resistance (R). And if the multiplication of these three factors is greater than R – the resistance to change – then change becomes possible.

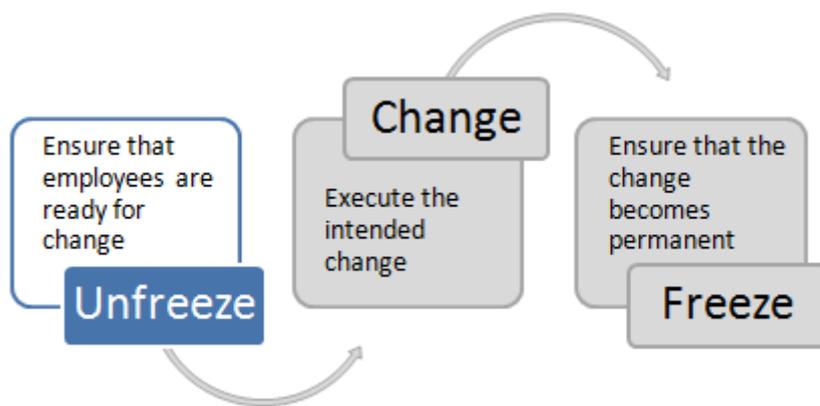
When planning for change you need to make sure all three factors are present before you start. When trouble-shooting during a change you can use the formula to work out why you may be having problems. It also provides a useful evaluation tool to assess the final outcome.

5. The Change Process



The change management process is the sequence of steps that a manager needs to follow to apply change management to a project. Kurt Lewin proposed the **Unfreeze-Change-Refreeze Model**, which was briefly discussed in chapter 4.

I. Unfreeze



A basic tendency of people is to seek a context in which they have relative **safety** and feel a sense of control. In establishing themselves, they attach their sense of identity to their environment. This creates a **comfortable stasis** from which any alternatives, even those which may offer significant benefits, will cause discomfort.

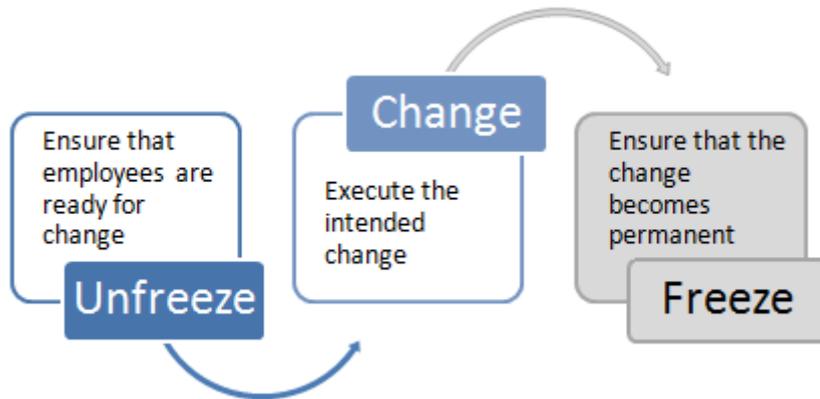
The term 'change ready' is often used to describe people who are unfrozen and ready to take the next step. Some people come ready for change whilst others take a long time to let go of their comfortable current realities.

Here are some ways to make it happen:

- **Burning platform:** Expose or create a crisis
- **Command:** Just tell them to move
- **Evidence:** Hard data is difficult to ignore

- **Restructuring:** Redesign the organization to force behavior change
- **Envisioning:** Done well, visions work to create change

II. Transition



A key part of Lewin's model is the notion that change, even at the psychological level, is a **journey** rather than a simple step. This journey may not be that simple and the person may need to go through several stages of misunderstanding before they get to the other side.

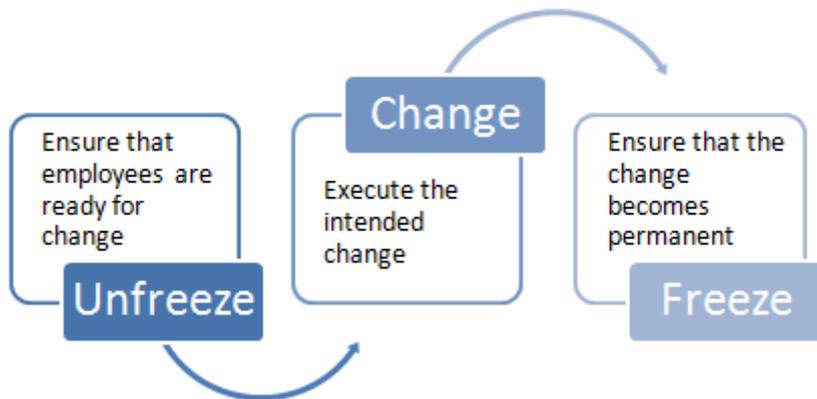
A classic trap in achieving change is for leaders to spend months on their own personal journeys and then expect everyone else to cross the chasm in a single bound. Transitioning thus **requires time**. Leadership is often important and when whole organizations change, the one-eyed person may consider himself a "king". In such a case, some form of coaching, counseling or other psychological support will often be very helpful.

Although the transition may be hard for the individual, often the hardest part is to make a start. Even when a person is unfrozen and ready for change, that first step can be very scary. People become comfortable in temporary situations where they are not accountable for the hazards of normal work and where talking about change may be substituted for real action.

- **Challenge:** Inspire them to achieve remarkable things
- **First steps:** Make it easy to get going
- **Involvement:** Give them an important role
- **Open space:** People talking about what concerns them

- **Shift-and-sync:** Change a bit – then pause

III. Refreeze



At the other end of the journey, the final goal is to ‘refreeze’, to **establish a new place of stability**. In practice, refreezing may be a slow process as transitions seldom stop cleanly, but go more in fits and starts with a long tail of bits and pieces. There are good and bad things about this.

In modern organizations, this stage is often rather tentative as the next change may well be just around the corner. What is often encouraged, then, is more a state of ‘slushiness’, where freezing is never really achieved (theoretically making the next unfreezing easier).

The danger with this is that many organizations have found that people fall into a state of ‘change shock’, where they work at a low level of efficiency and effectiveness as they await the next change. ‘It’s not worth it’ is a common phrase when asked to improve what they do.

- **Burning bridges:** Ensure there is no way back
- **Evidence stream:** Show them time and again that the change is real
- **Golden handcuffs:** Put rewards in their middle-term future
- **Institutionalization:** Build change into the formal systems and structures
- **Reward alignment:** Align rewards with desired behaviors

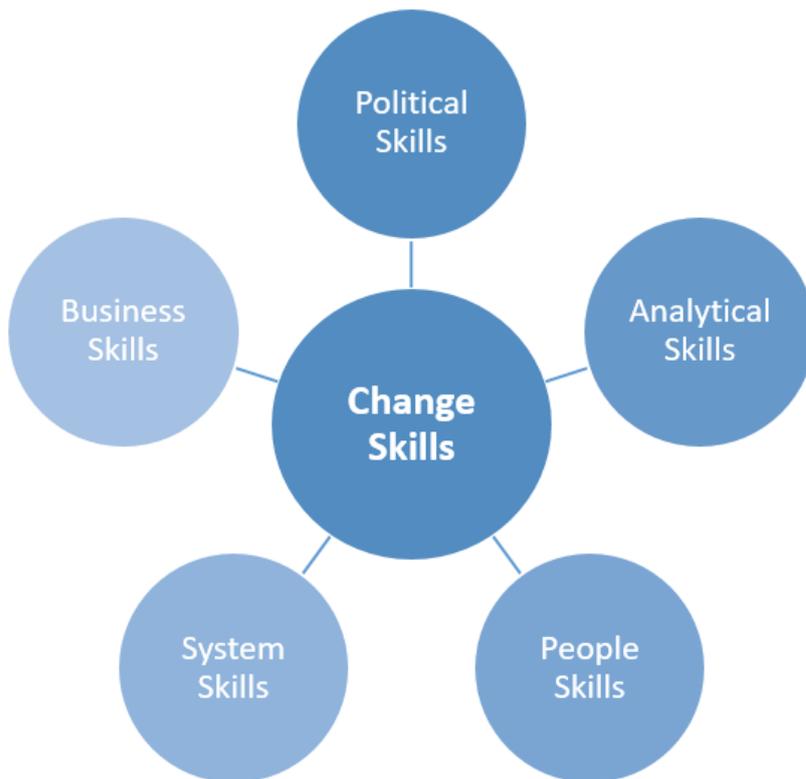
6. Strategies and Skills



Managing the kinds of changes encountered by and instituted within organizations requires an unusually broad set of skills and strategies. In this chapter, we will briefly discuss the most essential change skills and change strategies that managers need to master today.

Change Skills

Every effective change manager needs a set of specific skills:



1. Political Skills

Organizations are *social systems*. Therefore, organizations are intensely political. Change agents dare not join in this game but they have to understand it. Managers and employees have to deal with conflicts and to compromise on disputes on a daily basis. This is one

area where you must make your own judgments and keep your own counsel.

2. Analytical Skills

Furthermore, change agents need advanced analytical skills. Two particular sets of skills are very important here: *systems analysis* and *financial analysis*. Change agents must learn to take apart and reassemble operations and systems in novel ways, and then determine the financial and political impacts.

3. People Skills

People are the most important resource of an organization. The skills most needed in this area are those that typically fall under the heading of communication or interpersonal skills. To be effective, we must be able to listen and listen actively, to restate, to reflect, to clarify without interrogating, to lead or channel a discussion, to plant ideas, and to develop them. Part of the job of a change agent is to reconcile and resolve the conflict between and among different points of view.

4. System Skills

Every organization can be seen as a *system*. In the past, managers typically took one part and focused on that. Then they moved all attention to another part. Systems theory has brought a new perspective for managers: Now, more managers are recognizing the *interrelations* of the parts. There are two sets of system skills to be mastered: Computers and the larger, information processing systems (in which computers are so often embedded) are generally known as *hard systems*. Compensation systems, appraisal systems, promotion systems, and reward and incentive systems in a company are *soft systems*. A good change agent understands that both system types are important.

5. Business Skills

Finally, every change agent should understand how a business works. This entails a basic understanding of accounting (where the money comes from and where it goes), knowledge of markets and marketing, products and product development, customers, sales, buying and selling, as well as human resource management.

Effective change managers need to master 1. political skills, 2. analytical skills, 3. people skills, 4. system skills, and 5. business skills.

Change Strategies

For successfully leading and completing a project, various strategies can be applied. When deciding which strategy to follow, the manager needs to take specific characterizations of the organization (type of business, age of employees, etc.) into account.



1. Directive Strategies

This strategy highlights the manager's right to manage change and the use of authority to impose change with little or no involvement of other people. The advantage of the directive approach is that change can be undertaken quickly. However, the disadvantage of this approach is that it does not take into consideration the views or feelings of those involved in the imposed change. This approach may lead to valuable information and ideas being missed and there is strong resentment from staff when changes are imposed rather than discussed.

2. Expert Strategies

This approach sees the management of change as a problem-solving process that needs to be resolved by an 'expert'. This strategy is mainly applied to more technical problems and will normally be led by a specialist project team or an outside consultant. The advantages of

utilizing this strategy are that experts play a major role in the solution and the solution can be implemented quickly as a small number of 'experts' are involved. Again, there are some issues in relation to this strategy as those affected may have different views than those of the expert.

3. Negotiating Strategies

This approach highlights the willingness on the part of senior managers to negotiate and bargain in order to effect change. This strategy acknowledges that those affected by the change have the right to have a say in what changes are made, how they are implemented and the expected outcomes. The disadvantage of this approach is that it takes more time to effect change and the outcomes cannot be predicted. The advantage is that individuals will feel involved in the change and be more supportive of the changes made.

4. Educative Strategies

This approach involves changing people's values and beliefs in order for them to fully support the changes being made and move toward the development of a shared set of organizational values which individuals are willing, and able to support. A mixture of activities will be used: persuasion; education; training and selection, led by consultants, specialists, and in-house experts. The disadvantage of this approach is that it takes longer to implement. The advantage is that individuals within the organization will have positive commitment to the changes being made.

5. Participative Strategies

This strategy stresses the full involvement of all of those involved in the anticipated changes. The process will be less management-dominated and driven more by groups or individuals within the organization. The main disadvantages of this process are the length of time taken before any changes are made. However, the benefits of this approach are that any changes made are more likely to be supported due to the involvement of all those affected. The organization and individuals also have the opportunity to learn from this experience, thus increasing their skills, knowledge, and effectiveness.

Best Strategy?

These five change strategies are not mutually exclusive and a range of strategies can be employed to effect change. Part of the skill of effective

change management is to recognize what strategy to employ, and when, where and how to use it. Other issues such as health and safety, accessibility and union representation may also need to be taken into consideration when deciding what strategy to adopt.

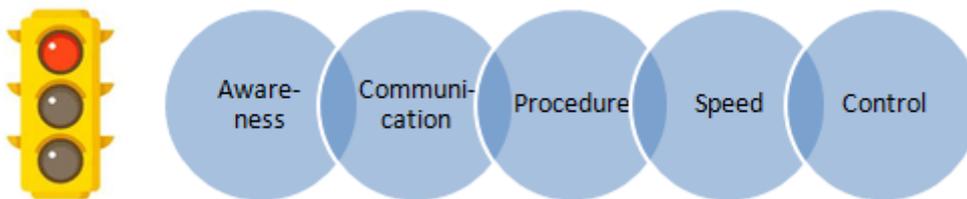
But no matter which model is used, it has to be supported and clearly communicated by the top management. The executive board has to act as a role model and should start the change process by directly communicating with the people affected by the change. The executive board has to confirm the changed strategy, organization and business culture by being an example and they have to be supportive of the departments and managers affected.

7. Failure or Success?



There are a number of reasons why some change projects fail while others succeed. In this chapter, we will take a look at the most common failure and success factors. Keeping these factors in mind will enhance your chances to successfully complete change projects within your organization.

Failure Factors



1. Insufficient Awareness

A change process never begins without reason. Mostly there is a trigger for change processes. Triggers can be diverse, like new legal

requirements, increasing competition or internal reasons. Normally these triggers are discussed extensively amongst top management. This way, **awareness** of existing problems and the necessity to make changes arise. In practice, only part of the information makes its way to the lower leadership level. The lower level manager and his or her employees afterward often see little necessity for change.

There are some more reasons which also depend upon **information flow**. New executives in a company try to protect workers from disturbance and difficulties so that they are more productive and can work undisturbed. But this buffering or protection is often misunderstood. If the workers do not have a transparent view of the situation of the company, it is unlikely that they will support the change process.

2. Insufficient Communication

In most change projects, the biggest mistakes are made in the area of communication. Experience shows that at the beginning, during, and at the realization of changes the **communication frequency** is often too low. Change processes require information events and sometimes discussion forums. Information is also provided only in part. It is even more harmful if the relevant information is published step-by-step.

3. Inappropriate Procedure

The wish to involve employees in an “eat or die” mentality is often found in IT projects. In such a project, employees must work with the new software or hardware, regardless of whether they were involved or not in its implementation. This style of management is extremely bad. Employees do not obtain any information about the progress of the change-project and are informed later only e.g. by a mail about the use of the new software. Often employees will boycott the new system and use it as little as possible.

Further examples of an inappropriate procedure or a “**bad style**”, which should be avoided, include ignoring objections or counterarguments, making remarks in public about opposite doubters, and presentation of incorrect facts in support of the wanted change. This behavior is counterproductive and is often returned in kind by the concerned persons, normally as a boomerang, by actively delaying the targeted changes or letting them fail altogether.

4. Workload and Speed

Every enterprise and every organization needs continuous adaptation to changed general conditions and factors in order to survive in the present markets or in the environment of the organization. Correspondingly, the tact of change processes is often set by outside factors.

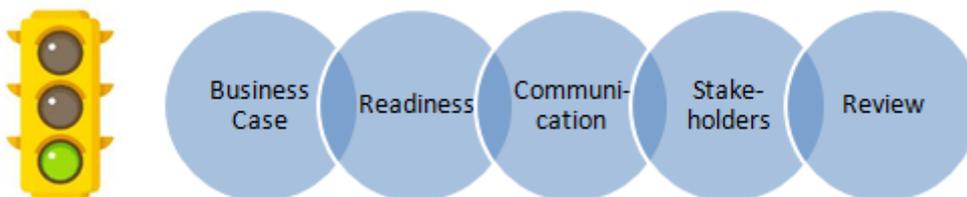
With the high speed of change processes and the high number of changes, more “**speed mistakes**” are surfacing. Changes are often initiated too early (the company, the employees or customers are not ready) or realized too late (product was introduced already by other enterprises). In addition, people can stand only a certain amount of change at a certain time. If this amount is being extended, the people won't go on. This may not be immediately externally recognizable. It can also appear in the form of fewer motivations.

5. Lack of Control

If a change process is initiated, one should also pay attention to the sustainability of the targeted changes. In many cases, too little **controlling** attention is paid during implementation. Sometimes it is difficult to measure the success of the implementation, especially when employee behavior should be taken into account.

Furthermore, the problem of **accountability** can be added. Even if customer contentment or business numbers increase, how can one prove that this is associated with the realization of a new strategy or structure? There can be many other good reasons for such developments and these could lie outside the enterprise. Therefore controlling real results requires some complex and extensive instruments.

Success Factors



1. Build a Business Case

A **Business Case** is the description of the reasons for the project and the justification for doing it. The Business Case should set out the problem or situation addressed by the proposal, the implementation plan, the expected costs, the anticipated outcomes and benefits and the expected risks associated with the proposal's implementation. The Business Case Process should ensure that both the value and risks inherent in the proposed project are clear in that the delivery of the outcomes and benefits can be tracked and measured.

2. Determine Readiness

There are some tools to evaluate how ready your organization is or if you will need to conduct a pre-change intervention. If you can answer most of the following questions with "yes" your company is ready for the change:

- Are the organization's top managers strong supporters of this change?
- Do I understand what is wrong with the way things are now?
- Do I have all the information I need to get on board with this change and I understand the sense of urgency?
- Do I have a clear picture of how the organization will be different after the change has been implemented
- Do I know where to go for help if I have questions, concerns, or challenges related to the change?

If the results indicate that your organization is not ready for a change, pre-changes have to be made.

3. Improve Communication

Communication is one of the most important factors in the change process. It has already been mentioned that poor communication has a deep impact on the success of a change. Poor communications will at best hinder progress and at worst sink the project. There is another tool to make sure that everybody knows what is and will be going on in the upcoming change process: The **Communication Plan**.

There are a lot of different ways in which to communicate. Bulletin boards, cafeteria postings, cascading communication trees, change booklets, corporate newsletters (feature section), department or enterprise meetings, emails, focus groups, frequently asked questions memos, intranet pop-ups, leaflets, one-on-one meetings, posters,

presentations, project newsletters, roadshows, team meetings, word of mouth and workshops should be utilized. Participants indicated that face-to-face communications were the most effective. Face-to-face interactions included group and team meetings, presentations and demonstrations and one-on-one discussions.

Communication should always be open and “risk-free”, where employees can ask questions. Also, using different types of communication is better than just using one channel.

4. Involve Stakeholders

One of the most important things in change management is to get people involved. One thing is to get **senior management** on your side. Without this high-level buy-in, change will often fail. So before you start make sure that you have the support of management.

On the other hand, there are the **employees**. They need to feel like being part of the changes they are involved in. Keep them involved and informed about changes you are trying to make. Often people who are affected by change processes are not really involved, which has primarily two results: Fear of loss of time and too little know-how of the means by which to integrate the many concerned persons. Possible losses of time are relocated in the case of nearer consideration. In fact, the integration of stakeholders takes time, but normally it costs more time if the realization of the change process slows down if people do not believe in the change.

5. Review the Change

After the change project is implemented a review of the change is necessary. It is important to get the opinions of the participants in order to ascertain whether they are satisfied with the change. Also, a review will provide you with important information that can be used in upcoming change projects. This will improve further change projects and help to avoid mistakes.

One solution could be a **workshop** with the people who are directly involved with the implementation. All the people who are affected by the changes should have an opportunity to relate their experiences. The main for this is that the success of the change process can be measured by this method, but also that employees are given the certainty that their opinion is valued.

8. Conclusion



Change management is the correct understanding of the **organization** that wants to be changed, the correct understanding of the **people** who are willing to change, the effective **realization** of change, and the understanding the **dynamics** of change.

Changes should be facilitated by the organizational structure because this enhances adaptation and flexibility. A simple organizational structure will reach a simple dynamic environment or, on the other hand, a simple dynamic environment needs a simple structure only. For a complex dynamic environment, an adhocracy will be needed.

Adhocracy means more democracy and less bureaucracy. One of the most important points is the people because they form the organization. The culture of the organization includes its way of working, attitudes and norms. These facts are at the core of every change and they are difficult to handle. Personal modifications regarding attitudes or skills in leadership or communication are hard to identify but ineffectiveness can be indicated by problems and conflicts in the management of human resources.

Most failed change projects underestimated or simply did not take into account the human factor. To avoid this failure the assistance of change experts or change agents (in most cases professional consultants) should be sought. Not only that most employees have no or little experience in the field of change management. In most cases, people are used to their environment and emotionally unwilling to change. When the change process is not guided by externals, it is highly recommended that executive managers familiarize themselves with the toolbox of change management.

Last but not least, it is easy to be preachy about change. It is easy to tell others to change their habits, attitudes, and behavior. But one can only

make partial adjustments to one's personality. And, of course, that requires loads of inspiration. If you wish to remold your company or organization, first make sure you really want the change and get enthusiastic about the opportunities.