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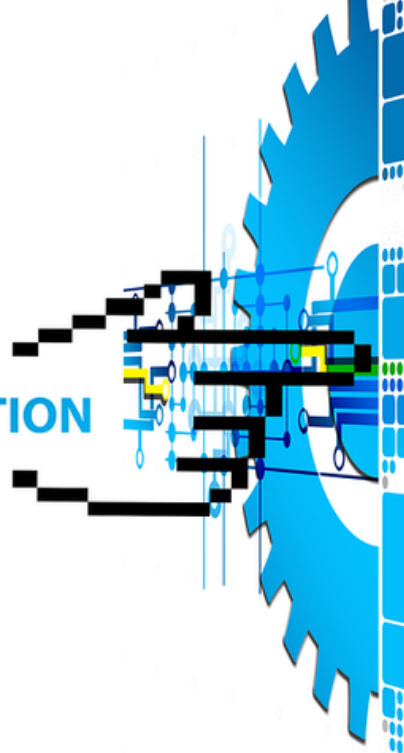
DIGITAL
TRANSFORMATION

WHITEPAPER ON DIGITAL TRANSFORMATION

06

ABOUT THIS DOCUMENT

This document is created under Project FOReSiGHT, by the project team.

Leading organization: The University of Zagreb.

It is part of our FOReSiGHT Kit for Foreseeing and Integrating Digital Transformation (DT) Skills.

ts English Version may also be found on the BLOCKS Platform. https://platform.blocks.ase.ro/

The Project

Project FOReSiGHT - Flexibility and Resilience in Digital Transformation and Intelligent Automation – Advanced Skills and Tools for Academia and Entrepreneurs.

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Disclaimer

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Introduction

Purpose of the whitepaper

A whitepaper on digital transformation serves as an authoritative guide designed to help readers understand and navigate the complex landscape of digital transformation. Its purpose is to provide in-depth insights, backed by rigorous research and data, on how digital technologies reshape industries and business operations.

This whitepaper aims to provide a comprehensive overview of the current state and future prospects of DT. It is designed to serve as a valuable resource for a broad audience, including policymakers, business leaders, researchers, and anyone interested in understanding the impact and implications of DT. We have drawn on various sources, such as industry and regulatory reports, to ensure a balanced and informed perspective.

The primary objectives of this whitepaper are:

- To present an economic perspective on DT, highlighting its potential benefits and challenges.
- To introduce an DT framework based on four strategic pillars: invest, experiment, maintain, and divest, providing guidance for organizations on how to approach and manage DT.
- To explore the different work personas in DT and the skills required for DT workers, offering insights into the human aspect of DT.
- To provide insights on the state of DT in specific European countries, including Romania, Germany, Belgium, Italy, and Croatia.
- To discuss current trends in DT and their implications for the future.

Through this whitepaper, we hope to contribute to the ongoing dialogue on DT, providing readers with the knowledge and insights they need to navigate this rapidly evolving field.

Basics of Digital Transformation

Digital Transformation (DT) can be broadly defined as integrating digital technology into all business areas, fundamentally changing how organizations operate and deliver value to customers (Berman, 2012). It is also a cultural shift that requires organizations to continually challenge the status quo, experiment often, and get comfortable with failure. This transformation can impact every aspect of an organization, from its internal processes and employee engagement to customer relations and service delivery.

The concept of DT has its roots in the advent of digital technology. However, it was only in the explosion of internet usage in the late 1990s and early 2000s, and more recently, the rapid advances in digital technologies, that digital transformation became a key strategic consideration for organizations worldwide (Matt, Hess & Benlian, 2015).

Today, DT is considered necessary for any organization that aims to stay competitive and relevant in a constantly evolving digital landscape. Gartner's report states, "Digital business is not a sideline, it's mainstream. It's the way the world works, and the way business gets done" (Gartner, 2022).

The importance of DT can also be seen in its wide range of potential benefits for organizations. McKinsey reports that businesses undergoing digital transformation are likely to see a significant boost in their profitability compared to those that do not (Bughin, Catlin, Hirt & Willmott, 2018). Furthermore, according to a UiPath report, organizations embracing DT can increase efficiency, improve customer experience, and create new business models and revenue streams (UiPath, 2022).

In 2021[1], global spending on digital transformation would exceed 1.59 trillion USD, a 20 percent increase over the previous year. The global spending on digital transformation is expected to be 3.4tn USD in 2026, with the most digitally competitive country: Denmark and the Leading approach to digital transformation being brought by Cloud extensions to existing solutions. Extending existing IT solutions through cloud extensions was the most popular strategy for digital transformation among organizations worldwide in 2022, with the global public cloud market predicted to be worth more than USD 490 billion. As of 2022, about 90% of organizations worldwide have adopted cloud technologies, the highest acceptance rate of any developing technology.
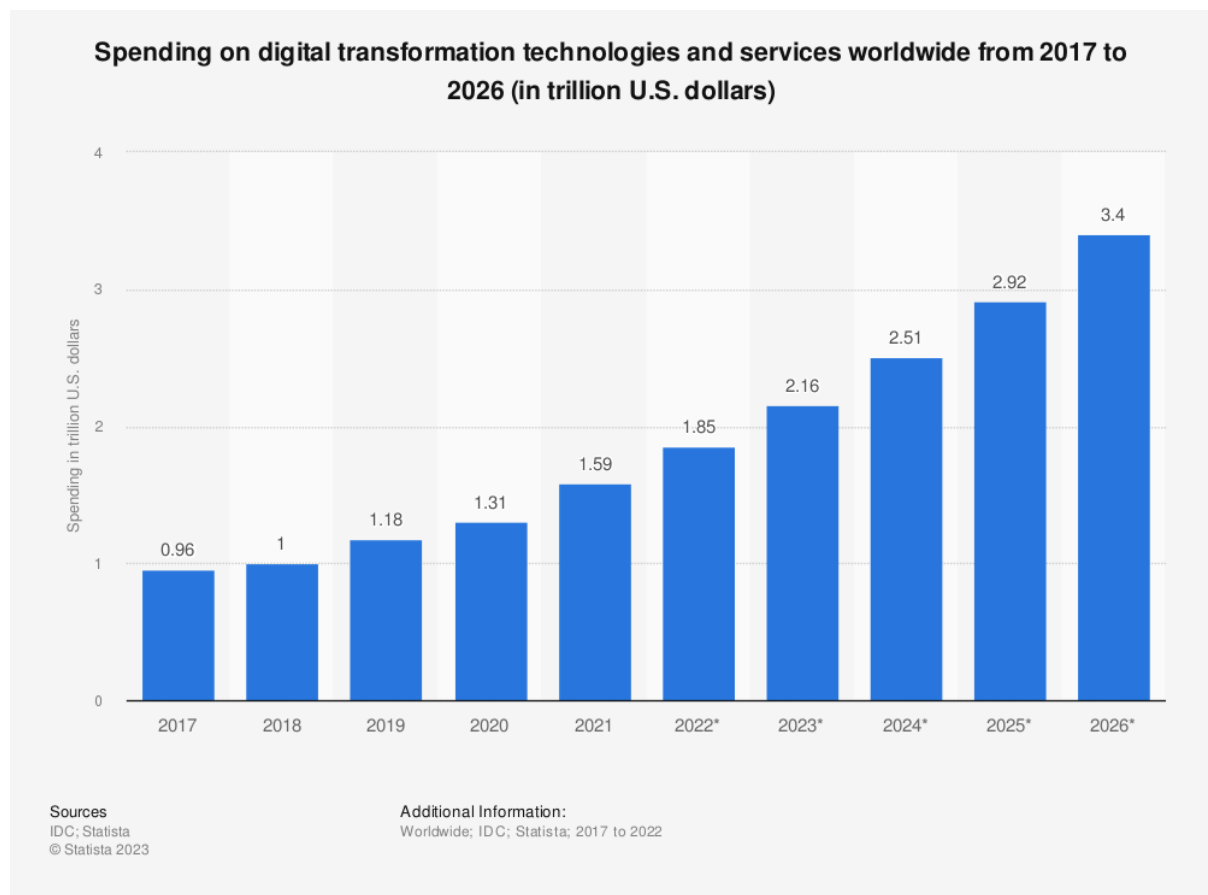
The critical role of DT is further underscored by the ongoing COVID-19 pandemic, which has accelerated the shift toward digital ways of working, learning, and interacting. Consulting firms such as EY and Deloitte highlight that digital transformation has enabled

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[1] https://www.statista.com/topics/6778/digital-transformation/#topicOverview

businesses to continue operating during the pandemic and will likely remain a key factor in post-pandemic recovery and growth (EY, 2021; Deloitte, 2021). The pandemic is thought to have accelerated digital transformation efforts, with the surge of remote labor encouraging organizations to adopt cloud technologies.

However, DT is not just about technology. It is about reshaping businesses to be agile, customer-centric, and innovative and driving change that can reverberate across an entire industry (Bearing Point, 2021). It requires a clear strategy, collaborative effort, and a deep understanding of current and emerging digital technologies, their potential uses, and their potential impacts.

In conclusion, DT has evolved from being a trendy buzzword to a strategic imperative for organizations of all sizes and across all industries. Its importance lies in its ability to enable businesses to tap into the potential of new technologies, improve their operations and customer experiences, and adapt to a rapidly changing business environment.

Spending on digital transformation technologies and services worldwide from 2017 to 2026 (in trillion U.S. dollars)

Year	Spending
2017	0.96
2018	1
2019	1.18
2020	1.31
2021	1.59
2022*	1.85
2023*	2.16
2024*	2.51
2025*	2.92
2026*	3.4

Sources
IDC; Statista
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Additional Information:
Worldwide; IDC; Statista; 2017 to 2022

Source: Statista, 2023[2]

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[2] https://www.statista.com/topics/6778/digital-transformation/#topicOverview

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Eight Essential Digital Technologies

Artificial Intelligence (AI)
Augmented Reality (AR)
Blockchain
Drones
Internet of Things (IoT)
Robotics
Virtual Reality (VR)
3-D Printing
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The Need for Skilled Workers in DT

In an increasingly interconnected and digital world, the demand for professionals with digital transformation skills has skyrocketed. With the rise of technologies such as artificial intelligence (AI), machine learning, cloud computing, and data analytics, organizations across the globe are in the throes of profound transformations. These digital advancements, while enabling unprecedented efficiencies and capabilities, also necessitate a workforce equipped with the knowledge and skills to harness their full potential.

According to a report by Gartner (2023), over 70% of businesses are in some stage of digital transformation, but they often need help finding skilled workers who can drive these initiatives effectively. This talent shortage represents a significant challenge for companies navigating their digital journey. Professionals skilled in digital transformation are critical in providing strategic guidance, overseeing the implementation of new technologies, and ensuring that these changes deliver the anticipated benefits.

Reports from leading consulting firms such as EY, Bearing Point, McKinsey, and Deloitte further highlight the increasing need for digital talent. In a 2023 report, EY highlighted the "increasing gap between the supply and demand for digital skills" (EY, 2023). This gap is not limited to technical skills alone but also encompasses a broader set of capabilities. As per a Bearing Point study, businesses are not merely seeking individuals with IT or data
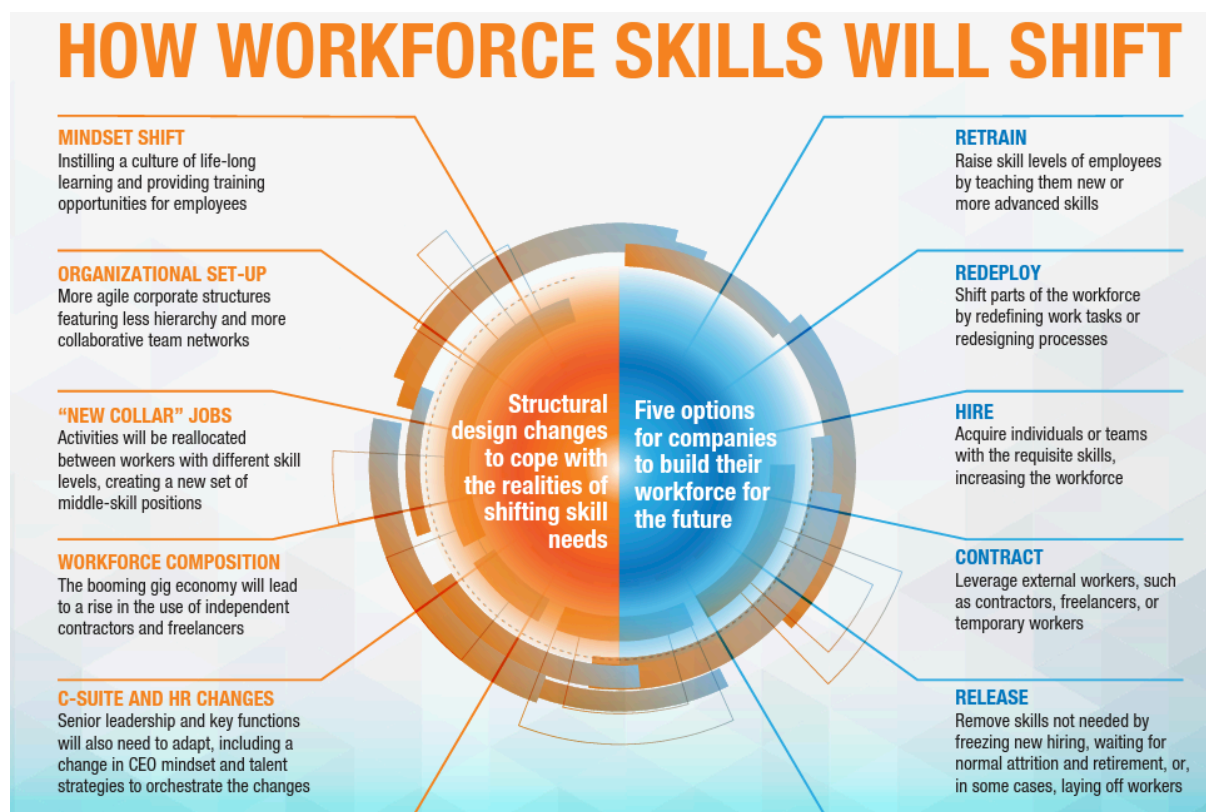
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[3] https://www.pwc.com/us/en/tech-effect/emerging-tech/essential-eight-technologies.html

science knowledge; they require 'T-shaped' professionals who possess a depth of expertise in one area and a breadth of knowledge across multiple domains (Bearing Point, 2023).

Digital transformation involves a significant cultural shift and requires individuals who can balance technical acumen with skills in change management, strategic thinking, and collaboration. As noted in a McKinsey report, "the demand for translators who can connect digital technology capabilities with practical applications in the business context has never been greater" (McKinsey, 2023).

Moreover, the evolution of automation technologies has created an increased need for professionals skilled in intelligent automation (IA). A report by UiPath (2023) stated that organizations implementing IA see substantial benefits but often grapple with a shortage of personnel who can effectively leverage these tools.

Addressing the talent gap in digital transformation is crucial. If unaddressed, it can limit organizations' ability to adapt to changing market conditions, innovate, and maintain competitiveness. Therefore, investing in training and development to equip the workforce with the requisite skills is vital for businesses navigating the digital era.

HOW WORKFORCE SKILLS WILL SHIFT

MINDSET SHIFT
Instilling a culture of life-long learning and providing training opportunities for employees

ORGANIZATIONAL SET-UP
More agile corporate structures featuring less hierarchy and more collaborative team networks

"NEW COLLAR" JOBS
Activities will be reallocated between workers with different skill levels, creating a new set of middle-skill positions

WORKFORCE COMPOSITION
The booming gig economy will lead to a rise in the use of independent contractors and freelancers

C-SUITE AND HR CHANGES
Senior leadership and key functions will also need to adapt, including a change in CEO mindset and talent strategies to orchestrate the changes

Structural design changes to cope with the realities of shifting skill needs

Five options for companies to build their workforce for the future

RETRAIN
Raise skill levels of employees by teaching them new or more advanced skills

REDEPLOY
Shift parts of the workforce by redefining work tasks or redesigning processes

HIRE
Acquire individuals or teams with the requisite skills, increasing the workforce

CONTRACT
Leverage external workers, such as contractors, freelancers, or temporary workers

RELEASE
Remove skills not needed by freezing new hiring, waiting for normal attrition and retirement, or, in some cases, laying off workers

Source: McKinsey, 2018[4]

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[4] https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce

Despite the significant benefits of DT, its adoption is challenging. These include the need for significant upfront investment, the complexity of integrating DT with existing systems, and the need for skills and expertise to manage and maintain these systems. Therefore, a structured approach to learning and skills development is essential to harness the full potential of DT.

The challenges associated with developing skills in DT highlight the need for a structured approach to curriculum development. A structured curriculum ensures that students are exposed to the latest DT technologies and could develop the skills they need to succeed in their field.

What is digital business transformation?

Defining Digital

The [online version of the Merriam-Webster dictionary](#) offers seven definitions for the term "digital", but two are particularly relevant to the context of this article. The first describes the term "digital" as "of, relating to, or being data in the form of especially binary digits", such as the compilation of a software program into binary code. The second signifies an action "done with a finger", such as interacting with mobile devices, as visually depicted in the next figure.

Limited definition of the term digital

These two definitions offer a good starting point for defining the term "digital", but in order to be applicable to the current business world, additional dimensions must be taken into account. For instance, these definitions do not specifically call out the notion of customer experience, when they probably should. Automation and cybersecurity are also important facets in this new hyperconnected era, and they are absent from these definitions. Finally, with social platforms becoming less novel and more intuitive, they have become ingrained in their users' lives to the point of becoming an extension of themselves. As illustrated in the next figure, the term "digital" is difficult to define, as it encompasses many interdependent ideas that suggest a new way to reach and securely transact with clients.


Expanded definition of the term digital

The number of concepts associated with the term "digital" may leave many organizations wondering how to apprehend a digital transformation to meet the demands of the new economic model. Their interconnectedness may even muddy the articulation of a digital strategy that must increasingly take into consideration economic value, risk and return on

capital invested. Often, in the rush to become digital and stay on par with the competition, many companies neglect to fully comprehend what it means to go digital.

To help this select group of organizations, the next section introduces the **Digital Transformation Framework**, a frame of reference to assist businesses in articulating, modeling and pricing digital strategies. Its integration to an Enterprise Architecture framework is then highlighted as a means to reify digital transformations, and in particular through the elaboration of business and technology blueprints.

However, going digital is not the same as being digital.

In the context of this article, and as depicted in Figure 3, going digital refers to the identification and sequencing of a set of activities to achieve a targeted digital state. Becoming digital alludes to the execution of these planned course of actions to reach a predetermined future digital shape. Being digital represents a state of connectivity via numerical methods and devices. This interconnectedness is coupled with distinct measurable characteristics that reflect a distinct state of an organization's business and technology architectures.
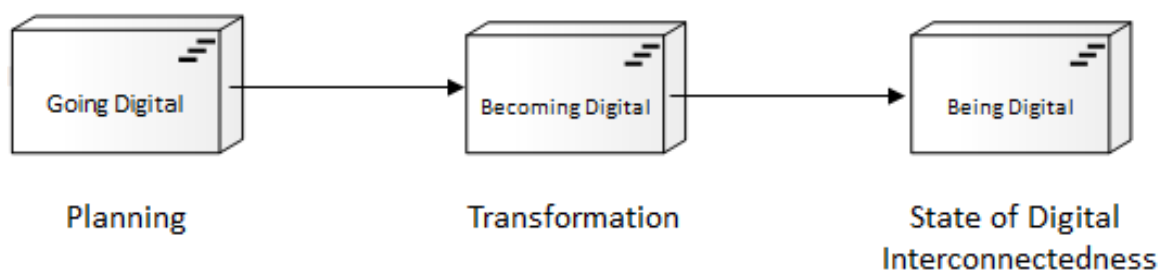
Digital stages

Therefore, being digital may be less about the newness of technologies used by an organization, and more about its level of connectivity to other firms, and its ability to leverage business and technology capabilities offered by external parties to further advance stated business goals faster, better and cheaper. This connectedness is inspired by both the UML Composition and Aggregation relationships, and is closely related to the concept of the "composable" enterprise. Consequently, understanding the desired level of business and technology composition an organization would like to achieve is key to planning, mapping and communicating the business intent of a digital transformation, as shown in Figure 4.
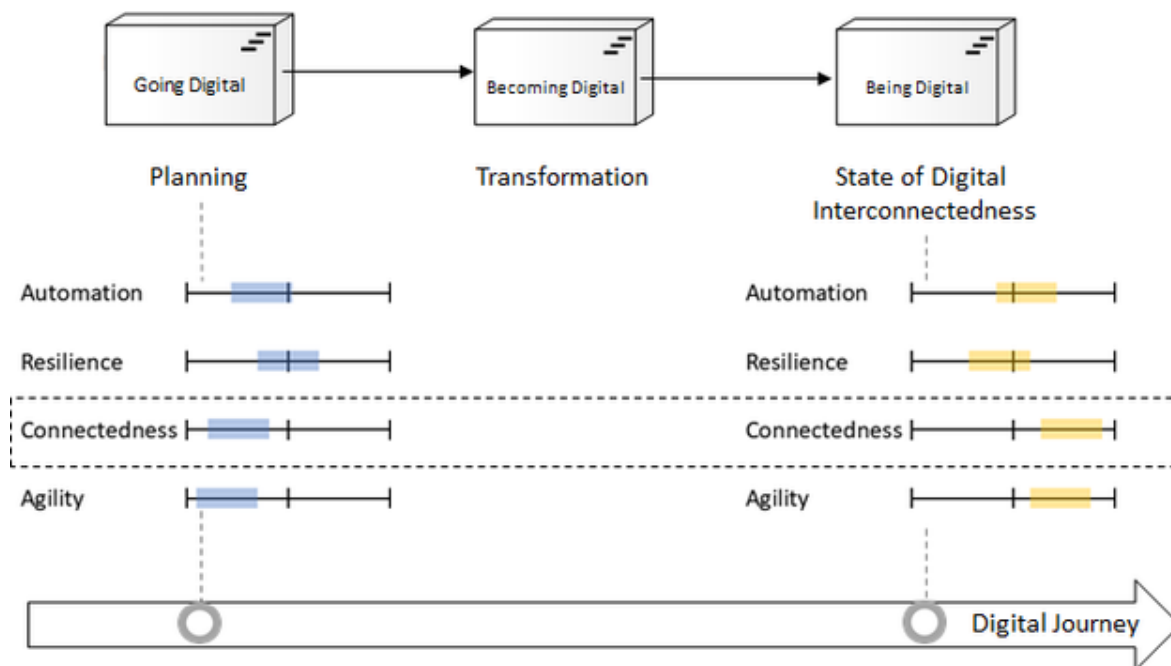
Digital stages in action

Introducing the Digital Transformation Framework

Building on the expanded definition of the term "digital", we introduce in the Digital Transformation Framework (DTF), a frame of reference to guide digital transformations. At a high level, the (DTF) has one foundation layer and three pillars. This framework shall be revisited further in this white paper through the four pillars of invest, experiment, maintain and divest.

Starting from the bottom, the framework has its base rooted in cybersecurity, a critical dimension, given the degree to which the digital world and its underlying economy is consistently under attack. Moving to the top left corner of Figure 5, the first pillar of the frame of reference is defined. It is labeled "Digital theme", and proposes six key categories to logically organize the levers that organizations can pull to become digital. The second pillar, labeled "Customer Orientation", suggests that clients, whether internal or externally facing an enterprise, are at the heart of any digital transformation. Finally, the last pillar, labeled "Competency Level", indicates the level of excellence and efficiency an organization would like to achieve, for a given digital theme, as a possible way to distinguish itself from its competitors. The Competency Level pillar offers three possible distinct values: "Competitive", "Industry" and "Minimum", as shown in the diagram below.
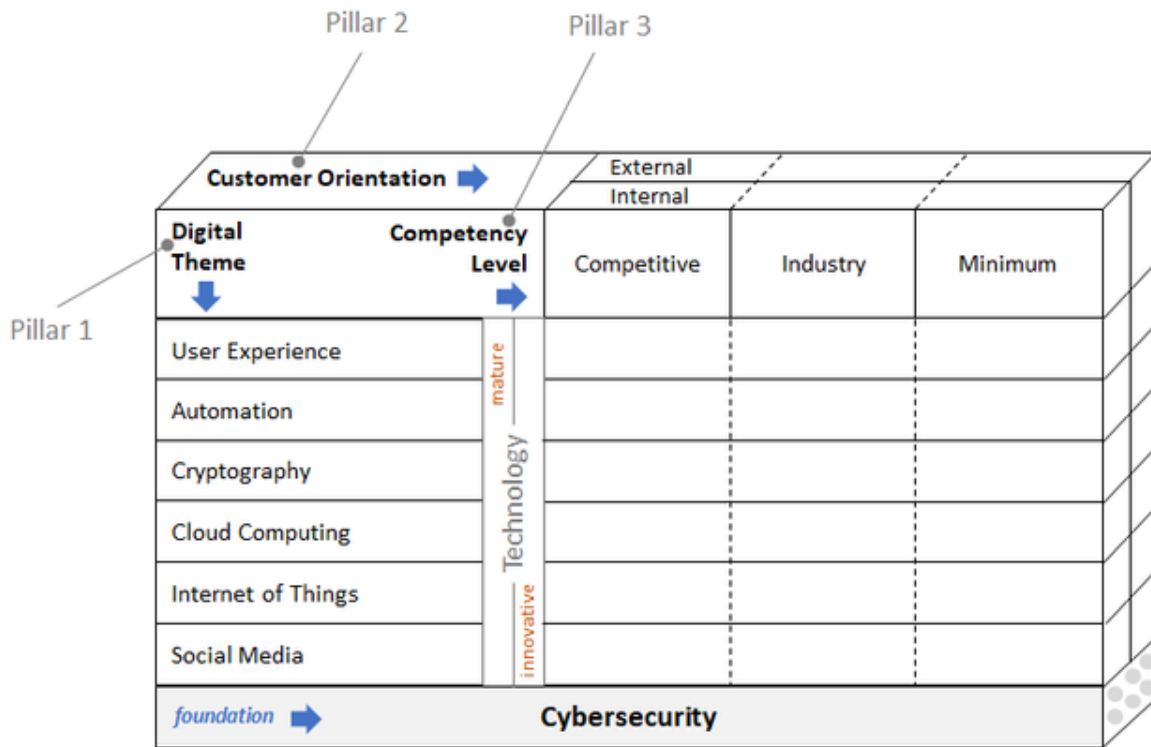
The digital transformation framework

A "Competitive" value indicates that an enterprise has strategically decided to invest resources and capital into one or more digital themes to differentiate itself from its direct competition in the hope of generating superior economic performance and brand advantages. An "Industry" value signals that the organization has decided to invest into digital themes to only match its peers' digital strategy, and the broader business segment it competes in. The "Minimum" value suggests that the firm does not consider any of the digital themes to provide any strategic advantage based on its current business model, and therefore has decided to invest to levels below amounts spent by its competitors or the industry in general.

Digital transformation is happening, whether we like it or not – and it's a great idea to join in now, while it is still young.

If you're wondering what does digital transformation mean, you're not alone. It's a new concept that, while has been happening for a while, is only really just starting to be discussed.

Digital transformation is fundamentally the use of technology to change the way people do things. This can apply to all areas of life – there was a digital transformation with cleaning homes when the hoover was invented – but in this post, we are going to look at digital transformation in the workplace specifically.

There are many differences between today's workplace and [that of the 80s and 90s](#). But the most notable is technology. Offices used to just have a computer with a huge monitor, and clunky keyboards. Nowadays ultra-fashionable hardware like Mac computers and interactive displays are in; and they're not only chic but useful as well.

So what is digital transformation in business, exactly? Many businesses across the world are starting to think about digital business transformation.

Digital business transformation is fundamentally changing how businesses work together. This can be done through many ways.

We are already aware of the many ways that **technology is present in the workplace**. They include things like:

- [Huddle Rooms](#) – these are small meeting rooms with a focus on technology, maybe with facilities like wireless charging to get work done quickly and efficiently. Huddle rooms also typically contain an interactive display.

- Software – programmes like [Trello](#), [Slack](#) and [Google Docs](#) have developed into must-haves in offices.

- Hardware – interactive displays, smartphones for work and tablets all have their place in the modern workplace.

What is digital transformation in business?

There are many examples of digital transformation in business. The digital transformation revolution isn't just happening in the office; casual dining restaurants like Applebees and [TGI Fridays are starting to use artificial intelligence](#) to give customers a more personable experience.

Many companies in all sorts of niches are experimenting with new digital services and capabilities. They are also reskilling employees to give them the necessary know how to work in this new business climate. It's also one of [millennial's expectations in the workplace](#); an age group who will make up the core of the US workforce in the not-so-distant future.

However, it's important to remember that digital transformation in business doesn't change what a business does, but it changes how it does things in 2021. We shouldn't be looking

to change the fundamentals of businesses – banks should still be banking and retail companies should still be producing goods.

But we can use technology to work smarter and better.

Some **key ways** that digital transformation is doing so are:

COLLABORATION

Collaboration is a key part of the workplace of the future, and technology is making it more and more feasible. Using collaboration applications, employees can easily connect with others, and huddle rooms are fantastic places for collaboration.

Technology like interactive displays, a great interactive whiteboard alternative, are a great help as well; the main interactive display can connect with people on other devices, meaning that work can be easily streamlined and connected.

BUSINESS CULTURES CHANGING

Employees are being asked a lot more about what they consider to be best for the company; businesses are becoming less like a dictatorship and more like a community. Remote teams have this too; with technology enabling them to chat and share ideas a lot more.

REMOTE WORK

Onto remote work, which is a key part of the digital transformation pie. More and more people are starting to work outside the office, whether it be full-time or just for a few days a week. Digital transformation in the workaplce is aiding this; but also very important are new mindsets about remote working and its benefits.

CUSTOMER CENTRIC

Digital workplaces of the future are a lot more focused on customers than before. Using technology like bots to gauge customer interest and cookies to investigate what a target audience is more interested in, technology can be a crucial tool to help learn about customer mindset.

ENGAGE EMPLOYEES MORE

Employee engagement costs businesses a lot of money each year, so using technology to increase this is a fantastic idea. Employee engagement is equal to

employee satisfaction, so one of the biggest goals of digital transformation should be to keep workers happy and involved.

Technology can help this by providing employees with the tools to stay engaged and on top of their work and also encouraging business collaboration. Using tools like interactive displays, employees can be more involved in work, doodle notes, and easily save webpages and images. It's a much more appealing way to work.

INCREASED PROFITS FOR FORWARD-THINKING BUSINESSES

Businesses who think more about technology are likely to increase their profits. Technology for business like paperless archiving, big data storage, cloud communications and mobile apps all help businesses to work to make the biggest profits possible.

There are also multiple ways to streamline technology to ensure that profits stay high. For example, by using bots to do menial jobs, more brains can work on creative roles and expand businesses like that.

GIVE EMPLOYEES MORE CREATIVE JOBS

The benefits of streamlining technology are great for employee retention and satisfaction as well. With the increase in technology, employees are less likely to need to rely on tedious jobs like data entry, and can focus more on fun, creative opportunities. This is one of the benefits of artificial intelligence; office workers are free to do the bigger jobs, which they are likely to find much more interesting!

RESILIENCE TO CHANGE

Any business adopting digital transformative approaches now is at a great advantage when it comes to future changes. The working world can change a lot in a short space of time, and making sure that any business is on top of digital change can only have benefits. Being resilient to change, and constantly thinking about the future as well as the present, is a crucial way to do this.

THINKING ABOUT THE WORLD

Businesses in 2020 should be making a real effort to be sustainable. Whether that be purchasing from ethical traders or producing goods slowly rather than engaging in fast consumerism, the environment needs to be taken into account in this modern age.

Using technology, research and communications have never been easier, and they can really help a company's environmental policy.

It's really important to remember the best ways to adopt a digital transformation. While it can seem just like adding lots of technology, it's also more focused on the transformative part of the term.

Ways that this is done include:

•　　　Putting employees and customers first – letting everyone involved in the business have their say about business decisions. Technology aids this by using bots and collaborative software.

•　　　Use [digital savvy employees](#) to lead – people who have the know-how about the digital revolution may be the best employees to lead this change, no matter what position they are in the company currently.

•　　　Workplace of the future should be in mind all the time – digital transformation is not just about the present, it is about what will happen decades into the future as well.

•　　　Think outside the box – there are plenty of ways technology can benefit the offices of today and the future, and some have not even been discovered yet. Maybe your business can come up with ideas of their own?

•　　　Upgrade digitally – having only the best hardware and software is crucial for the digital transformation age in business.

Digital transformation is the cultural, organizational and operational change of an organization, industry or ecosystem through a smart integration of digital technologies, processes and competencies across all levels and functions in a staged and strategic way .

Digital transformation *(also DX or DT)* leverages technologies to create value and new services for various stakeholders *(customers in the broadest possible sense)*, innovate and acquire the capabilities to rapidly adapt to changing circumstances.

While DX is predominantly used in a business context, it also impacts other organizations such as governments, public sector agencies and organizations which are involved in

tackling societal challenges such as pollution and aging populations by leveraging one or more of these existing and emerging technologies.

In some countries, such as Japan, digital transformation even aims to impact all aspects of life with the country's Society 5.0 initiative (which has some similarities with the Industry 4.0 industrial transformation vision).

Digital business transformation – a holistic approach

Digital technologies – and the ways we use them in our personal lives, work and society – have changed the face of business and will continue to do so. This has always been so but the pace at which it is happening is accelerating and faster than the pace of transformation in organizations.

Digital transformation is probably not the best term to describe the realities it covers. Some prefer to use the term digital business transformation, which is more in line with the business aspect. However, as an umbrella term, digital transformation is also used for changes in meanings that are not about business in the strict sense but about evolutions and changes in, for instance, government and society, regulations and economic conditions on top of the challenges posed by so-called disruptive newcomers. It's clear that changes/shifts in society have an impact on organizations and can be highly disruptive as such when looking at transformations from a holistic perspective. No company, industry, economic actor/stakeholder and area of society stands on its own.

It is key to recognize the umbrella term dimension of digital transformation at all times. While digital transformation maturity models can help in defining visions they are too simplistic and/or general in practice.

Digital transformation:
Developing core capabilities across various business areas
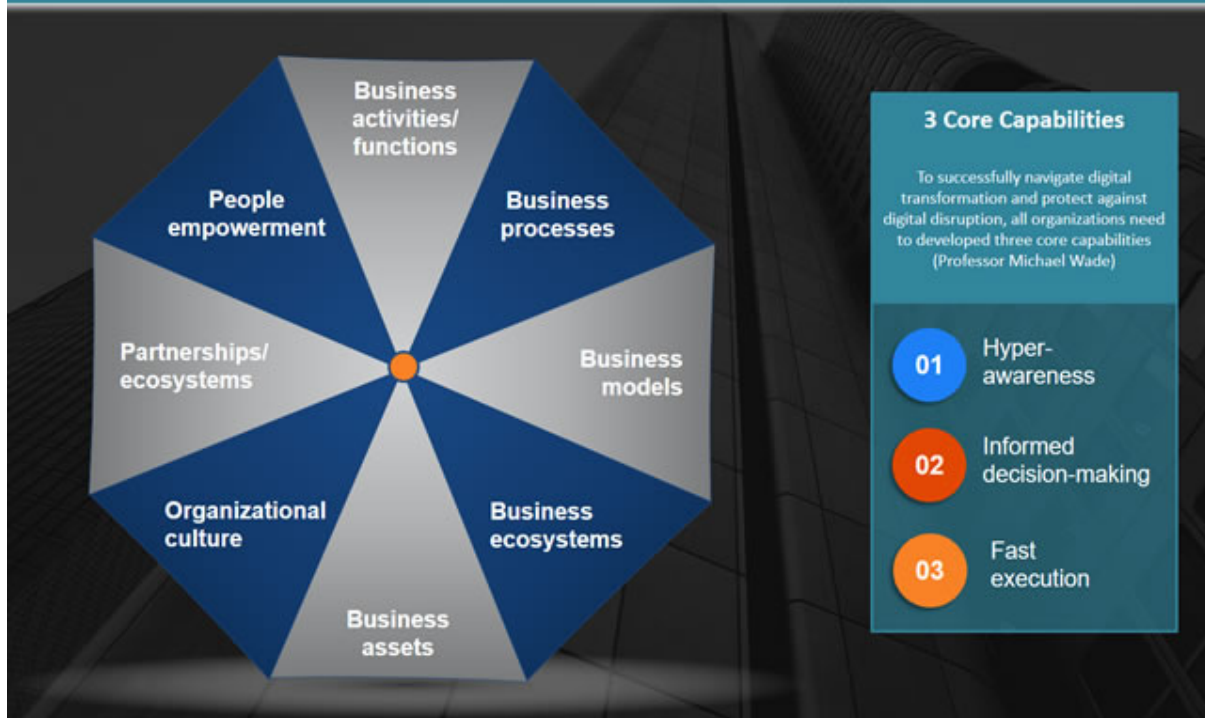
Digital transformation – developing core capabilities across various business areas

Digital transformation covers a huge number of processes, interactions, transactions, technological evolutions, changes, internal and external factors, industries, stakeholders and so forth. So, when reading advice on digital transformation or reading reports and predictions it's essential to keep this in mind. Although there are common challenges, goals and traits in organizations across the globe, there are also enormous differences per industry, region and organization. What could make sense in one region, doesn't have to make sense in another, even if we just look at regulatory environments.

Technological evolutions and technologies, ranging from cloud computing, big data, advanced analytics, artificial intelligence, machine learning and mobile/mobility (a key game changer) to the Internet of Things and more recent emerging technological realities are 1) enablers of digital transformation and/or, 2) causes of digital transformation needs *(among others as they impact behavior of consumers or reshape entire industries, as in the digital transformation of manufacturing)*, and/or 3) accelerators of innovation and transformation. Yet, technology is only part of the equation as digital transformation is by definition holistic.

Digital transformation in the integrated and connected sense which it requires can, among, others, touch upon the transformation of:

- **Business activities/functions**: marketing, operations, human resources, administration, customer service, etc.

- **Business processes**: one or more connected operations, activities and sets to achieve a specific business goal, whereby [business process management](#), business process optimization and business process automation come into the picture *(with new technologies such as [robotic process automation](#))*. Business process optimization is essential in digital transformation strategies and in most industries and cases is a mix of customer-facing goals and internal goals today.

- **Business models**: how businesses function, from the go-to-market approach and value proposition to the ways it seeks to make money and effectively transforms its core business, tapping into novel revenue sources and approaches, sometimes even dropping the traditional core business after a while.

- **Business ecosystems**: the networks of partners and stakeholders, as well as contextual factors affecting the business such as regulatory or economic priorities and evolutions. New ecosystems are built between companies with various background upon the fabric of digital transformation, information, whereby data and actionable intelligence become innovation assets.

- **Business asset management**: whereby the focus lies on traditional assets but, increasingly, on less 'tangible' assets such as information and customers *(enhancing customer experience is a leading goal of many digital transformation "projects" and information is the lifeblood of business, technological evolutions and of any human relationship)*. Both customers and information need to be treated as real assets in all perspectives.

- **Organizational culture**, whereby there must be a clear customer-centric, agile and hyper-aware goal which is achieved by acquiring core competencies across the board in areas such as digital maturity, leadership, knowledge worker silos and so forth that enables to be more future-proof. Culture also overlaps with processes, business activities, collaboration and the IT-side of digital transformation. In order to bring applications faster to market changes are required. That's the essence of DevOps: development and operations. In order to make IT and OT work together in businesses/processes/activities, change is

required too *(it's not just the information and operational technologies, it's the processes, culture, collaboration)*. Etc.

- **Ecosystem and partnership models**, with among others a rise of co-opetive, collaborative, co-creating and, last but not lost, entirely new business ecosystem approaches, leading to new business models and revenue sources. Ecosystems will be key in the as-a-service-economy and in achieving digital transformation success.

- **Customer, worker and partner approaches.** Digital transformation puts people and strategy before technology. The changing behavior, expectations and needs of any stakeholder are crucial. This is expressed in many change subprojects whereby customer-centricity, [user experience](#), worker empowerment, new workplace models, changing channel partner dynamics etc. (can) all come in the picture. It's important to note that digital technologies never are the sole answer to tackle any of these human aspects, from worker satisfaction to customer experience enhancement. People involve, respect and empower other people in the first place, technology is an additional enabler and part of the equation of choice and fundamental needs.

This list is not exhaustive and de facto the several mentioned aspects are connected and overlap. We do look at some less business-related 'digital transformation' phenomena and at so-called disruptions but the focus is on the business, which by definition means a holistic digital transformation view whereby aspects such as customer experience, technological evolutions and innovation with a clear purpose, instead of a buzzword, are crucial elements.

5 Must-Read Guides to Digital Transformation

We will take a look at some of the most valuable and informative **digital transformation guides** out there. These materials touch on various factors that must be considered in our journey to digital transformation.

1. Online Guide to Digital Business Transformation [i-scoop](#)

The guide kicks off by touching on the 'essence' of digital transformation and how to make this a holistic approach within your organisation, followed by several chapters that dive into

the evolutions of digital transformation and 'how it is present across various business processes and industries'. In fact, this universal approach makes it ideal for organisations in just about every market, from retail and manufacturing to healthcare and banking (and much more).

2. The Ultimate Digital Transformation Roadmap [hellosign](#)

This 'no-nonsense' Digital Transformation Roadmap, created by Hellosign provides with a clear cut, 10-step explanation for getting your organisation in full control of digital initiatives and instilling effective digital-first strategies. Hellosign's theory is that 'if you define the importance of digital transformation through cultural and financial signals, your more likely to get your entire team on board when it comes time to launch and scale your efforts'. That's why their guide start with tips on how to get the full support of your management team before you do anything. And we couldn't agree with this more…

3. The Ultimate Guide to IT & Digital Transformation [digitalmarketinginstitute](#)

This guide – written by the Digital Marketing Institute – is heavily focused on IT departments, helping them find ways to work more efficiently and drive digital transformation. Here you'll find tips about adopting new technologies early, matching the pace of digital, collaboration with other departments and more.

4. Define, Price and Plan a Digital Transformation. [infoq.com](#)

InfoQ's guide is somewhat different from most other guides to digital transformation. They show that while there are tons of articles listing the reasons behind digital transformation failures, there are 'very few that offer an actionable and comprehensible approach to help organisations plan and execute their digital strategy more effectively'. And that is exactly what they do in this guide by introducing a framework and breaking down the building blocks of that framework.

5. The Complete Guide to Digitial Transformation in the Workplace [avocor](#)

Avocor's Complete Guide to Digital Transformation in the Workplace explores how new, interactive hardware interacts with emerging and existing software applications to transform team collaboration. Examining how interactive displays and enabled workstations

can create virtual meeting spaces, Avocor's guide explains how off-the-shelf communication hubs such as Trello, Slack, and Google Docs can expand a company's recruitment reach. The gig economy offers a rich resource of talent from around the world, but integrating them into the workplace has always been a struggle. Until now. Find out how to engage your employees on a deeper level through interactive displays and the technologies that everyone is carrying about in their pockets.

The Economic Perspective of Digitalization

Introduction to digitalization

Digitalization is reshaping the economy in many ways. The manufacturing industry is moving toward data-driven smart manufacturing which needs new capabilities of designing smart products (Sakao et al., 2021). High level of smartness leads to service-dominant logic (Zheng et al., 2019) in business models, also known as servitization. Digitalization is enabling companies to move from product-centric model to digital service-oriented modes with higher value – generation potential (Adrodegari and Saccani, 2017). The servitization, that is driven and enabled by digitalization, changes the customers' value propositions and foster co-creation with customers to meet their needs and requirements (Lenka et al.,2017). Digital servitization is *"transformation in processes, capabilities, and offerings within industrial firms and their associate ecosystems to progressively create, deliver, and capture increased service value arising from a broad range of enabling digital technologies such as the Internet of Things (IoT), big data, artificial intelligence (AI), and cloud computing"* (Sjödin et al., 2020:479). However, many companies invest in new digital business models, but their returns in terms of revenue enhancement are generally modest or negative (Linde et al., 2021). This situation is called a "digitalization paradox" where investing in digital services fail to deliver greater profits. The literature suggest that digitalization requires different way of working to foster agility and to include customers in value co-creation processes (Paluch et al., 2019, Sjödin et al., 2020). Moreover, the companies should take time to evaluate the business impact and profit potential of new business model opportunities (Linde et al., 2021).

Digitalization can be a key factor for success and survival in a highly competitive market for some industries (Vrontis et al.,2021). However, it largely depends on the context (Bondarouk et al., 2017). For some companies, depending on the size, the industry and the country, digitalization will have a negligible effect. There are also authors that question disruptive and transformative effects of digitalization due to technical, legal and social constraints to the introduction and activation of robotics and AI (Upcaurch, 2018). Nevertheless, the dominant approach recognises the transformative nature and enormous potential of digitalization megatrend to completely reshape business models and economy in general.

Digital transformation involves the redesign of business practices to incorporate digital technology within all facets of the business (Bounfour, 2016). Digitization is the foundation of digital entrepreneurship and digital transformation. The management, and the successful implementation thereof, is what allows for lucrative digital entrepreneurship and digital transformation to take place (Antonizzi and Smuts, 2020).

Digitization and diffusion of new technologies require firms to adapt their business model and develop new digital activities and perform them in a way that creates value. This will be the basis for growth and competitiveness (Sohl et al., 2018). The digitalization process can support successful innovations, enabling firms to create novel offering configurations (Cenamor et al., 2017), enhance the understanding of customer needs (Metallo et al., 2018) and create an ecosystem of collaborations with those actors that are outside the firms' boundaries (Hakanen and Rajala, 2018). The key will be to integrate „traditional" human skills into new digital skills (Travoletti et al., 2021).

The digital transformation of economic activities affects the work of entrepreneurs by providing tools that support their activity, but also as they change the very context in which entrepreneurs operate (Secundo et al., 2020). Entrepreneurs must adapt to the evolution of their context as the ICT disseminates and people become more familiar and proficient with digital technologies. The coronavirus disease 2019 (COVID-19) pandemic, and the consequent lockdown have accelerated and amplified this phenomenon.

IBM Institute for Business Value (2019) found that firms with a cohesive strategy for integrating digital and physical elements can successfully transform their business models and set new directions for entire industries. They do this by focusing on two areas: reshaping their customer value proposition with the use on new dana and information, mobility and connectivity, and transforming their operating models relying on data optimization.

Digitalization brings numerous benefits for firms. It improves communication, coordination and access to information thus reducing transactions costs. It helps small and medium firms integrate on the global market, facilitates access to different resources and supports innovation. However, there are certain costs of digitalization as well. Some jobs may

disappear as artificial intelligence will be used more intensively. There is a gap in technology adoption among firms which results in productivity gap as well. The biggest challenge is the initial transition to digital technologies (OECD, 2021). Once this transition is made, there are strong complementarities in technologies that can drive further adoption. Additional long term structural obstacles remain such as financial gap, infrastructure gap and skills gap among countries (OECD, 2021).

Namely, in today's very dynamic business environment, firms need to strengthen existing and develop new comparative advantages in order to keep pace with rapid changes in technology, demand and global competition. In this task, firms, but also countries, optimize their competitive forces and strengthen economic performance and efficiency through innovation (Goksoy et al., 2013). Innovation is also the key to achieving sustainable development, which makes it the key to the competitiveness.

Digital awareness, that includes readiness, education and acceptance of digital utilization, is expected to be an antecedent of the digital transformation of working practices (Li et al., 2018, Garzoniet al., 2020). However (Corvello et al., 2021) find that entrepreneurs are not adequately supported through, for example, the development of specific ICT tools, or educational resources dedicated to them. It is necessary to understand that the use of technology is an evolutionary and practice-based phenomenon, rather than the result of rational choices (Piercy and Carr, 2020). Digital tools need to be designed for an incremental adoption. Planning and training will be crucial.

Digitalization and business models

Digital economy and the emergence of digital business and network platforms acts as a catalyst for the development of new elements within business models. The interactions of digital clients with digital organizations opens up a new perspective for everyone and emphasizes the necessity to learn and understand new solutions (Kotarba, 2018). In the digital economy, the traditional value-added model based on tangible assets is no longer valid but is moving to a platform model where value-added is created in a circular fashion so that feedback and data are key resources for value creation (Franc et al., 2021).

Digitalization has brought radical changes in business activities and has transformed business models, specifically in value creation, value delivery, and value capture (Linde et al., 2021). The transformation is related to value creation which moves closer to customers, providing the opportunity to react and adjust promptly or in a real time. This transformation requires new capabilities that usually surpass manufacturing companies' core competencies.

To really understand the digital transformation and its effects on business, it is necessary to explain the role of enabling digital technologies. Higher level of connectivity between smart things, based on the Internet of Things (IoT), is bringing new opportunities, such as specialization of smart components to improve performance and enable higher level of automation. Big data are enhancing the quality of sensing resulting in higher data quantities and also improving algorithms to interpret the massive amounts of sensing data (Sjödin et al., 2020). It enables more advanced statistical analysis and more informative decision making. Artificial intelligence (AI) enables smart objects to sense, reason and perform actions based on the input data to reach a goal (Langley et al., 2020). There are many areas where AI is contributing to increase the level of smartness. It is used in planning to achieve a goal by constructing a sequence of actions from the initial state and forms a representation of reasoning (Langley et al., 2020). It is also applied to machine learning to improve the interpretation of the sensing data or to learn how some actions lead to desired objectives. Further application is related to knowledge representation, semantic interoperability that leads to smart environments, among others.

Langley et al. (2021) introduced a term "Internet of Everything (IoE)" that expand the IoT concept by adding links to data, people and (business) processes. It is considered as a network of connections between these actors and data flows between them. From the business perspective, it is important to realise the transformative effect of IoE that can be seen through technology-enabled business models and co-creation within service ecosystems. Literature review suggest that two dominant streams of research on digitalization and digital transformation, (1) one focusing on the transformation and adaptation of digital business models and (2) second on value creation in service ecosystems.

According to Massa et al. (2017) business models are seen as attributes of firms in terms of the activities and the outcomes that determine the performance in markets. Smart things have the potential to complement employees' capabilities and improve overall efficiency

(Marinova et al., 2017.), but also to replace people in some tasks so they can focus on improvement and innovations. Moreover, smart things are bringing the opportunity for flexible adaptation, that opens new market opportunities or help companies to avoid the threats (Drnevich and Croson, 2013). Considering IoE trend, network-level business models are becoming more relevant than the firm centric business models (Adner, 2017). Company's processes are very often interdependent with its partners. The value creation process within network-level model is boundary-spanning (Zott and Amit, 2010). Therefore, digital transformation stimulates cross-sectoral innovations and brings industries to work together. The competitive landscape intensifies and entry barriers to existing markets reduce with digital transformation. Companies should reconsider their strategies, especially regarding value propositions. To conclude, smart things are challenging companies to develop their business models toward network business model. They have to find their path starting from low smartness level up to fully autonomous, adaptive, interconnected network-based model.

Service dominant logic starts with premise that service, as the application of competences for the benefits of another, is the basis of all exchange. Therefore, all economies can be understood as service economies (Sjödin et al., 2020). Service ecosystem requires coordination mechanisms through which actors co-create value and enact resource-integrating practices (Ng and Wahenshaw, 2018). These activities occur within institutions with enforcement guarantees that could be formal or informal. Within service dominant logic, institutional arrangements ae rules and values that drive behaviours.

Value co-creation mechanisms are used both for identifying specific customer needs, and to respond to their emerging or changing needs (Zheng et al., 2019). Value co-creation consists of the following steps: co-design where users engage in value design process, co-implement through direct interaction and agent interaction (platform providers or suppliers), and co-evaluate that includes system-related evaluations (service performance), context-related evaluations (environmental information), and human-related evaluations (user experience).

Perspective that merges technology enabled business models with service ecosystem could help companies to improve their IoE business models. According to Langley et al. (2020) it can provide a multi-layered understanding of IoE, from micro to meso to macro level (figure 1). At the micro level the customers are benefiting because of better, more customized, and personalized product and service. Smartness enables higher level of autonomous operation that saves time and effort. It is also useful for service employees because higher level of smartness enables more adaptive and flexible working

environment. Meso level is related to the changes in industries and institutional arrangements. Meso level norms are used at the micro level and that enables better understanding of IoE, especially regarding human role at the meso level as a moderator and as a perpetrator of conflicts driven by their need to appropriate connected resources to aid value creation (Langley et al., 2020). At the macro level changes are needed in economies and institutions. New business models and service ecosystems are bringing together previously unconnected industries and sectors. The digital transformation toward more opened, interconnected system means that whole sectors and each organization within the sectors should embrace smart things and adopt their business model and institutional norms and regulations. This approach brings many challenges, especially in aligning institutional arrangements within and between different sectors.
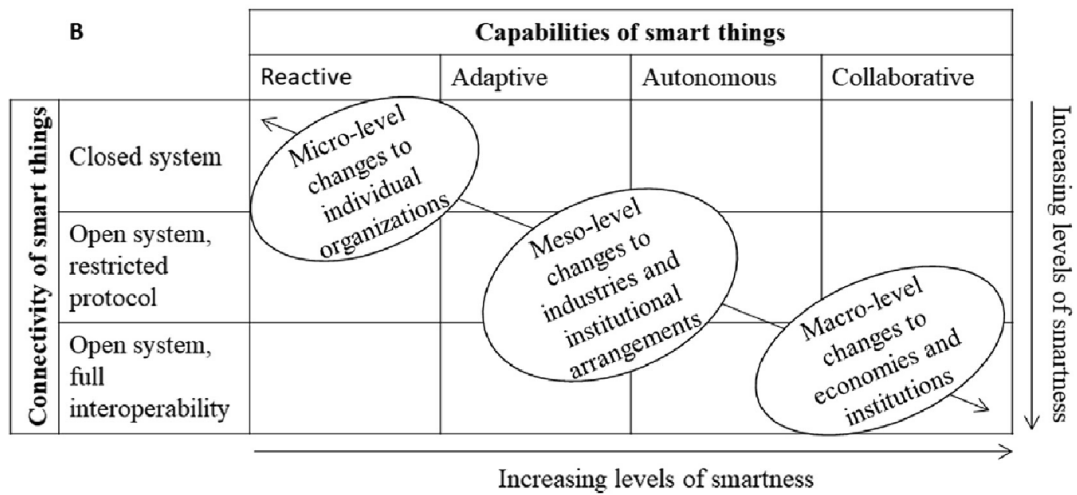
Levels of smartness in IoE perspective

Moreover, digital business models are moving from capital expenditures to an operating expense model where customers are paying for the outcome. All these challenges can lead companies into common traps or digitalization paradox. Three common traps are (Linde et al., 2021):

1. Pushing out a digital business model without understanding customer value. This is often related to the managements' ignorance of what customer want or what is willing to pay.

2. Promoting additional gains without understanding the value delivery process. This trap is related to the situations when there are no delivery routines for digital sales.

3. Getting sold on the digital opportunity without understanding the profit formula. Some examples are: lack of benchmark for analysing financial parameters for digital services, miscalculation of the costs of transforming organization to digital offerings.

To overcome the challenges and common traps of business model transformation, Linde et al. (2021) proposed following steps for implementing digital business model:

- Phase A: Assessing digital opportunity value by conducting customer opportunity screening and refining the value proposition.
- Phase B: Managing digital opportunity risks by assessing business model opportunity risks and revising the new business model to handle risks.
- Phase C: Modelling digital opportunity financials by conducting financial sensitivity scenario analyses and formalize contractual control mechanisms.

Companies should ensure that their business models address true customer needs, align it with their internal strategies, and maintain judicious balance between risk and reward (Linde et al., 2021).

New digital environment calls for more agile and co-creative innovation processes (Parida et al., 2019). Agility refers to the company's ability to adopt to changes in a dynamic environment (Sjödin et al., 2020). Smart objects, IoT and deep learning algorithms can increase coordination and cooperation thus facilitating cross-border business (Cooke et al.,2019). Another business perspective used to increase the value of digital technologies is a platform based approach. Digital platforms can be divided into two categories: product dependent digital platforms, such as digital services for product reconfiguration, real-time monitoring, and product independent digital platforms or e-services (Zheng et al., 2019).

Sakao et al. (2021) proposed Adaptive and Intelligent Life Cycle Engineering (AI – LCE) that is composed of already existing activities, such as design, production, maintenance, remanufacturing which doesn't have to be arranged in sequence but coordinated with relevant activities as needed. Business intelligence and IoT realize interrelations between and among the activities with shorter time to respond and higher accuracy of information (Sakao et al., 2021). The result is more agile and flexible system able to continuously improve and evolve. Proposed model reduce time for adjustment and change, compared to current practices in life cycle engineering because adjustments are directly implemented

within product lifecycle or in the real time. Moreover, accuracy is improved based on effective problem identification and solving, using AI techniques (Sakao et al., 2021). The implementation of the AI – LCE requires high level of digitalization and integration of data. It brings some challenges related to the integrity and data safety, especially when using external platforms or data storage.

Another trend in the industry is adaptive remanufacturing that aims to increase resource efficiency by extending the life cycle of capital goods (Burggräf et al., 2021). It is industrial process through which used products are restored to a like-new or even better state.

Smart Product Service System

Zheng et al. (2019) defined Smart Product Service System (Smart PSS) as: "An IT-driven value co-creation business strategy consisting of various stakeholders as the players, intelligent systems as the infrastructure, smart, connected product as the media and tools, and their generated services as the key values delivered that continuously strives to meet individual customer needs in a sustainable manner." Smart PSS can be seen from three aspects: technical, business, and social aspect.

Technical aspect includes data driven platform, convergence of human and machine intelligence, IoT to enable connectivity, cloud-edge computing for information processing, AI techniques, CPS and AR, and Big Data analytics for success of business intelligence decision making (Zheng et al., 2019).

Business aspect can be analysed based on the value proposition perspective, value creation perspective, and managerial implementation perspective. From value proposition perspective, Smart PSS enables digital servitization in which smart, connected products help to generate e-services, including both product-dependent services and product independent ones. In the Smart PSS stakeholders are actively engaged in a value co-creation process through a service-platform based on open innovation environment that includes contribution from service providers and users (Zheng et al., 2019). Besides digitalization capabilities, the management should include product-service innovation,

value chain process, organizational change, human resources, and customer relationship management into an overall consideration.

Social and environmental aspect considers Smart PSS as an ecosystem of open innovation useful for solving societal challenges profitably and sustainably (e.g. smart cities or smart living). Smart PSS could help in addressing the sustainability issues (increased resource efficiency, extended lifespan) (Zheng et al., 2019). The servitization in general is aimed at reducing environmental impact and achieving sustainability in circular economy.

Smart PSS and digital servitization should be implemented using micro-service innovation approach (Zheng et al., 2019). It is based on the three principles: incremental micro-service investments, sprint-based micro-service development, and micro-service learning by doing. Digital services should not be planned as one large initiative, but as an iterative process in which providers and customers agree on and prioritize initial opportunities to exploit digitalization together. Modularity in the micro-service approach enables better understanding, developing, testing, and making resilient to changing conditions. A sprint-based micro-service development focus on quick, iterative development of micro-services. The essence is the acceptance that customer problems cannot be understood fully up front, and focus must be on maximizing teams' ability to deliver micro-service quickly but with high adaptation possibilities (Zheng et al., 2019). The agile co-creation process means that teams should continuously apply, test and refine solutions to enable micro-service learning by doing capability development. This way team is having ongoing focus on capability development and service delivery is evolving through learning by doing (Zheng et al.,2019).

Digital Transformation Framework

The Digital Transformation (DT) framework presented in this whitepaper is designed to guide organizations in their DT journey. It is based on four main strategic pillars: Invest, Experiment, Maintain, and Divest. Each of these pillars represents a different stage in the lifecycle of a DT initiative and provides a strategic approach to managing it.

For this framework, we consider 5 key technologies under DT and run them through the four pillars: Artificial Intelligence (AI) and Machine Learning (ML), Cloud Computing, Big Data Analytics, Internet of Things (IoT), Cybersecurity.

1. **Invest:** The first pillar of the DT framework involves allocating resources to technologies that have proven to be beneficial and have the potential for significant growth.

   o AI and ML: Companies like Google and Amazon have heavily invested in AI and ML to improve their services and create new offerings. For example, Amazon's recommendation system is powered by ML algorithms (Source: McKinsey).

   o Cloud Computing: Many organizations are investing in cloud solutions to improve scalability and flexibility. Netflix, for instance, relies on cloud computing for its content delivery (Source: Gartner).

   o Big Data Analytics: Companies like Walmart and American Express invest heavily in big data analytics for customer insights and decision-making (Source: EY).

   o IoT: Firms like GE and Siemens have invested in IoT for predictive maintenance and real-time monitoring (Source: UiPath).

   o Cybersecurity: With the increasing threat landscape, companies like IBM and Raytheon have invested heavily in cybersecurity technologies (Source: Deloitte).

3 Key Digital Transformation Statistics You Should Know — FinancesOnline REVIEWS FOR BUSINESS

1 Top benefits of adopting a digital model — Source: PTC

- improve operational efficiency — 40%
- meet changing customer expectations — 35%
- improve new product quality — 26%
- increase design reuse — 25%
- reduce product development costs — 24%
- introduce new revenue streams — 21%
- reduce the cost of poor quality — 14%
- increase first pass yield — 5%
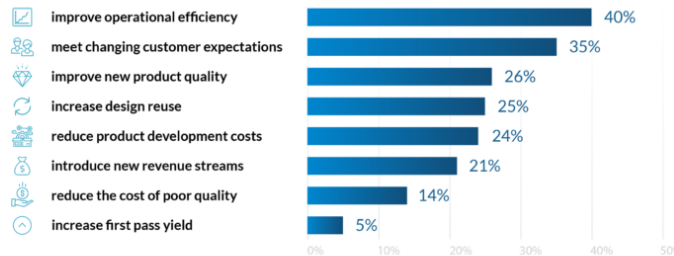
2 What does "digital business" mean to organizations? — Source: IDG

- 52% — Enable worker productivity through tools such as AI-assisted processes
- 49% — Ability to better manage business performance through data availability
- 46% — Meet customer experience expectations

3 Who is holding back companies' digital transformation initiatives? — Source: Franke Group

- CEO or board of directors — 37%
- no one — 32%
- senior executive team (C-suite other than CEO) — 32%
- department heads — 26%
- middle managers — 18%
- line employees — 10%
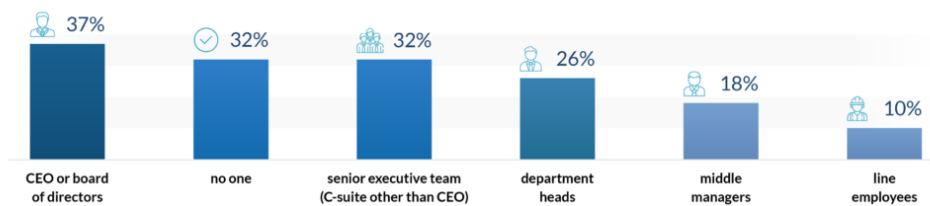
Source: FinancesOnline, 2023[5]

2. **Experiment:** Once the investment has been made, the next step is experimenting with DT. This involves testing new technologies that have potential but still need to be fully proven or integrated into the business. The experimentation phase is crucial for understanding DT's potential and limitations within the organization's specific context, as it can leverage an investment already made.

   - The same technologies mentioned above are also being experimented with in various industries.

   - AI and ML: Companies like Zara experiment with AI for fashion forecasting (Source: BCG).

   - Cloud Computing: Many small and medium businesses are experimenting with cloud solutions to understand their benefits (Source: Gartner).

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[5] https://financesonline.com/digital-transformation-statistics/

- Big Data Analytics: Organizations in healthcare and finance are experimenting with big data for predictive analytics (Source: EY).

- IoT: Companies in agriculture and manufacturing are experimenting with IoT for smart farming and Industry 4.0 (Source: UiPath).

- Cybersecurity: Businesses are experimenting with emerging cybersecurity technologies like AI-based threat detection (Source: Deloitte).

3. **Maintain:** Maintaining involves continuing with technologies currently providing value and essential for business operations. After successful experiments, the focus shifts to maintaining and scaling the DT initiatives. This involves monitoring the performance of the DT, continuously improving them, and ensuring they deliver the expected value. It also includes managing risks or challenges and ensuring the organization's DT capabilities align with its strategic objectives.

   - Maintenance of these technologies is crucial for their effective functioning.

   - AI and ML: Companies like Uber and Lyft maintain their AI algorithms for ride allocation and pricing (Source: McKinsey).

   - Cloud Computing: Businesses like Adobe maintain their cloud-based software services (Source: Gartner).

   - Big Data Analytics: Retailers like Amazon maintain their big data systems for customer insights (Source: EY).

   - IoT: Companies like Philips maintain their IoT devices in the healthcare sector (Source: UiPath).

   - Cybersecurity: All businesses maintain basic cybersecurity measures like firewalls and antivirus software (Source: Deloitte).

The most commonly cited reasons that companies avoided a digital stall are strong commitment and clarity on their strategy.

Primary reason that organization has avoided a digital stall,
% of respondents reporting no loss of momentum[1]

Strong alignment and/or commitment across organization	24
Clarity on transformation's strategy	19
Strong core competencies	13
Significant disruption in market and/or business environment[2]	11
Distinctive transformation strategy	10
Aligned culture and ways of working	10
Sufficient resource allocation	9
Good design of transformation	5

[1]Question asked only of respondents who said their organizations' digital transformations or major digital investments did not stall or fail to scale. Figures were calculated after removing respondents who said "don't know" (15% of total responses); total n = 302.
[2]For example, the market outperformed in an area where the organization had placed its bets, or there was a significant economic upturn.

McKinsey
& Company

Source: McKinsey, 2020[6]

4. **Divest:** The final pillar of the DT framework is divestment. Not all DT initiatives will deliver the expected results or remain relevant as the organization and its environment evolve. The divestment stage involves identifying such initiatives and strategically withdrawing from them. This could involve reallocating resources to more promising areas or rethinking the approach to DT.

- AI and ML: Companies may divest from AI projects that fail to deliver expected results (Source: McKinsey).

- Cloud Computing: Businesses may divest from cloud services that are costly and do not meet their needs (Source: Gartner).

- Big Data Analytics: Organizations may divest from big data projects if they do not provide actionable insights (Source: EY).

- IoT: Companies may divest from IoT devices that are not secure or do not provide expected benefits (Source: UiPath).

- Cybersecurity: Businesses may divest from outdated cybersecurity technologies (Source: Deloitte).

- Companies may divest from specific technologies and invest in others, as per the reasons listed in a 2021 EY report.

Q **What is the impact of the following trends on your divestment decisions over the next three years? (Select one.)**

Increase in tech valuation multiples
| 71% | 20% | 9% |

Advances in automation, artificial intelligence and machine
| 69% | 26% | 5% |

Transition to the cloud and SaaS
| 66% | 33% | 1% |

Enterprise security consolidation
| 65% | 23% | 12% |

Internet of Things and edge computing
| 62% | 34% | 4% |

- Increasing impact
- Same impact as today
- Decreasing impact
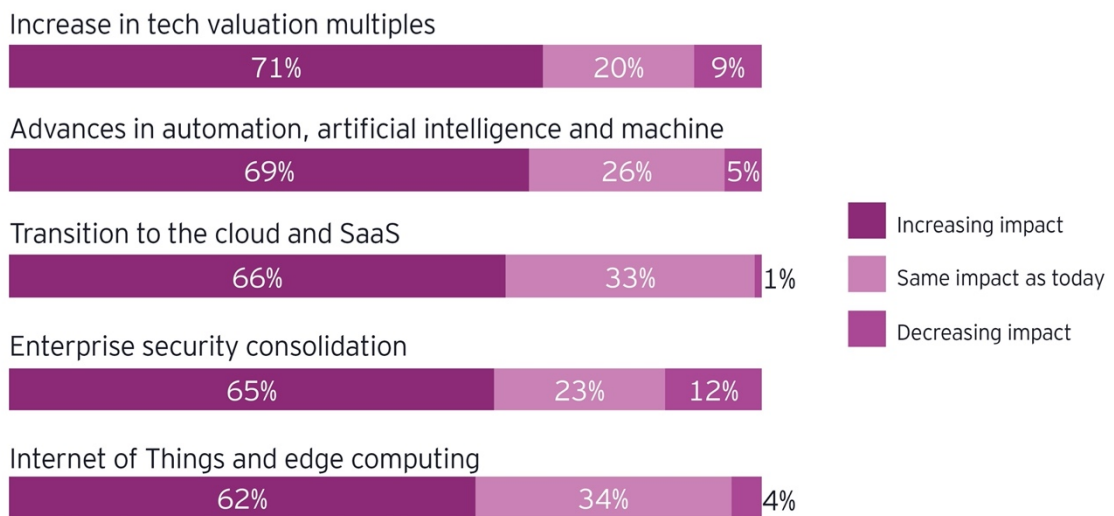
Source: EY, 2021[7]

What factors do you use to identify non-core businesses/assets for divestments? (Select all that apply.)

- Does not leverage company's core capabilities — 46%
- Lower revenue/profitability profile than other businesses — 70%
- Insignificant cash contributor — 57%
- Diminishing customer demand — 37%
- Not aligned to company's vision/mission — 37%
- Capital needs exceed willing capital allocation — 70%
- Not a contributor to long-term value creation (e.g., improved operational sustainability, adaptive business model) — 71%

What did you do with the funds raised from your most recent divestment? (Select all that apply.)

- Invested in technology — 79%
- Invested in new products/markets/geographies — 65%
- Returned funds to shareholders — 53%
- Paid down debt — 47%
- Made an acquisition — 28%
- Bought back shares — 14%
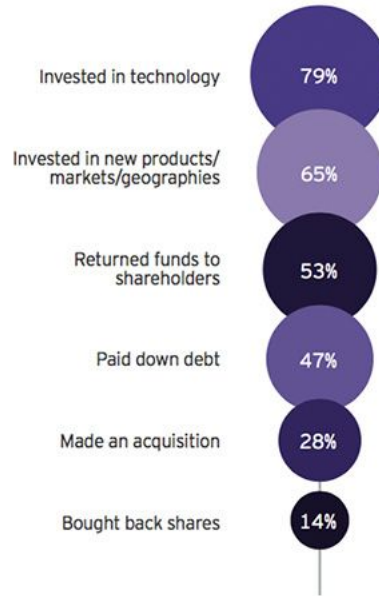
Source: EY, 2021[8]

There are several reasons why a digital transformation deployment may fail.

TOP 10
Reasons For Digital Transformation Failure In 2023

1. Misalignment in Scope
2. Unrealistic Expectations
3. No Processes re-engineering
4. Over-customizations
5. Poorly Written Bolt-ons
6. Poor Change Management
7. No Enterprise Architecture
8. No Master Data Governance
9. Poor System Selection
10. Uncontrollable issues

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Q ElevatIQ

Source: Elevatiq, 2023[9]

[8] https://www.consultancy.asia/news/4217/7-in-10-asian-companies-plan-to-divest-portfolio-business
[9] https://www.elevatiq.com/post/digital-transformation-failure/

This DT framework provides a strategic roadmap for organizations embarking on their DT journey. By following these four pillars - Invest, Experiment, Maintain, and Divest - organizations can navigate the complexities of DT and harness its potential to drive innovation and growth.

For each pillar, an assessment of the market via Gartner's Magic Quadrant may be used. The Magic Quadrant is *"tool that provides a graphical competitive positioning of technology providers to help you make smart investment decisions. Thanks to a uniform set of evaluation criteria, a Magic Quadrant provides a view of the four types of technology providers in any given field: Leaders execute well against their current vision for changing market rules but do not yet execute well. Visionaries understand where the market is going or have a vision for changing market rules but do not yet execute well. Niche Players focus successfully on a small segment or are unfocused and do not out-innovate or outperform others. Challengers execute well today or may dominate a large segment but do not demonstrate an understanding of market direction."*
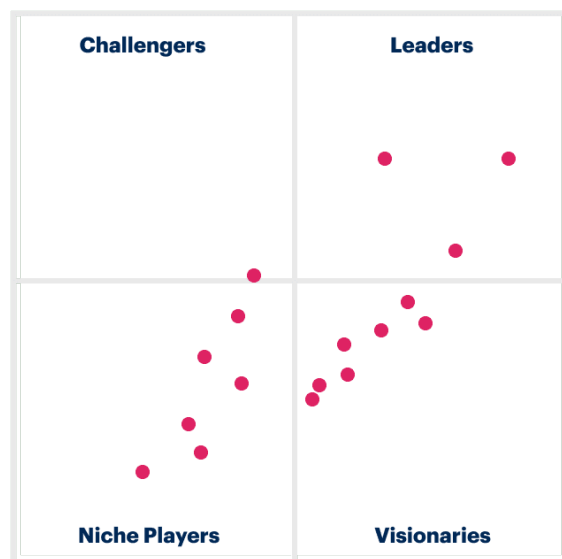
For instance, for 2022, the Magic Quadrant for Cloud Infrastructure and Platform Services (CIPS) looked like this:

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[10] https://www.gartner.com/en/documents/4004033

CHALLENGERS   LEADERS

Amazon Web Services

Microsoft

Google

Alibaba Cloud

Oracle

Tencent Cloud
IBM

Huawei Cloud

ABILITY TO EXECUTE

NICHE PLAYERS   VISIONARIES

COMPLETENESS OF VISION   As of June 2022   © Gartner, Inc

Gartner.

Source: Gartner, 2022[11]

Work Personas in DT

In the context of digital transformation, work personas refer to the different roles that individuals play in an organization as it undergoes technological change. These roles are shaped by the interplay of technology and human factors, and they evolve as new technologies are adopted and integrated into business processes.

The Digital Strategist. This persona is responsible for understanding the strategic implications of new technologies and guiding the organization's digital transformation efforts. They need to be well-versed in various IA technologies and understand how these technologies can be leveraged to achieve business objectives.

The Data Scientist With the rise of ML and AI, the role of the data scientist has become increasingly important. This persona is responsible for developing and implementing ML models, interpreting data, and providing insights that can guide decision-making.

The RPA Developer This persona is responsible for designing, developing, and maintaining RPA bots. They need to have a good understanding of business processes, as well as the technical skills required to work with RPA tools.

The AI Ethics Officer This persona is responsible for ensuring that the organization's use of AI is ethical and compliant with relevant regulations. They need to understand the ethical implications of AI and be able to navigate the complex legal landscape surrounding its use.

The Change Manager This persona is responsible for managing the human side of digital transformation. They need to be able to manage resistance to change, facilitate training and development, and ensure that employees are engaged and motivated during the transformation process.

These work personas are not rigid categories but represent different roles that individuals may play at various stages of the DT lifecycle. In many cases, a single individual may take on multiple personas, depending on the organization's needs and the DT initiative's specific context.

Understanding these work personas can help organizations to effectively manage their DT initiatives, ensuring they have the right skills and expertise at each stage of the DT lifecycle.

Skills Map of DT Workers

The successful implementation and management of DT initiatives require a diverse set of skills. These skills can be broadly categorized into technical skills and soft skills, each of which plays a crucial role in different stages of the DT lifecycle.
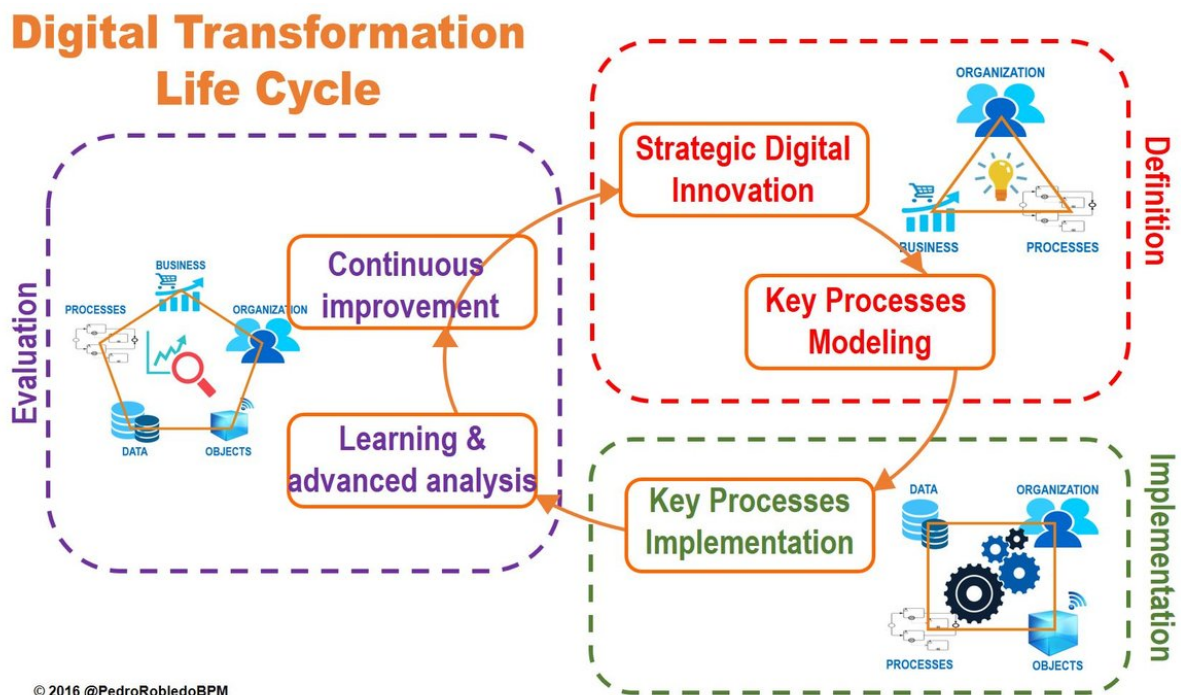
<div align="right">Source: PedroRobledoBPM, 2016[12]</div>

In the era of Intelligent Automation (IA) and digital transformation, the skill set required by workers has significantly evolved. The following skills have been identified as crucial for workers in the digital transformation landscape:

1. **Understanding of IA Technologies**: Workers need to have a basic understanding of IA technologies like Robotic Process Automation (RPA), Machine Learning (ML), Natural Language Processing (NLP), and others. This understanding enables them to leverage these technologies effectively in their respective roles. **Technical Skills**

   o **Scripting**: This involves the ability to write scripts in languages such as Python, which are often used in automation tasks.

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[12] https://albatian.com/en/blog-ingles/digital-transformation-life-cycle/

- o **Source-code management**: Familiarity with tools like Git for managing and tracking changes to source code is essential.

- o **Kubernetes**: Knowledge of Kubernetes, a platform for automating the deployment, scaling, and management of containerized applications, is increasingly important in the era of cloud computing.

- o **Security**: Understanding security principles and practices is crucial to protecting IA systems from threats.

- o **Testing**: Skills in testing methodologies and tools are needed to ensure the quality and reliability of IA systems.

- o **Observability and Monitoring**: The ability to monitor IA systems and observe their performance and behavior is key to maintaining their effectiveness and troubleshooting issues.

- o **Network awareness**: Understanding network principles and technologies is important for designing and implementing IA systems.

- o **Programming**: Proficiency in programming languages, such as Java or C#, is often required for developing and customizing IA solutions.

- o **Mechanical knowledge**: A basic understanding of mechanical principles may be required for certain roles, such as those involving robotics.

2. **Data Literacy**: The ability to read, understand, and communicate with data is a critical skill. This includes understanding data sources, data analysis techniques, and data visualization.

3. **Digital Ethics and Privacy Knowledge**: With the increased use of AI and data, understanding the ethical implications and privacy concerns associated with these technologies is crucial.

4. **Agility and Adaptability**: The digital landscape is constantly evolving, requiring workers to be agile and adaptable to new technologies and methods.

5. **Collaboration and Communication**: As digital transformation often involves cross-functional teams, the ability to collaborate and communicate effectively is essential.

6. **Problem-Solving Skills**: The ability to identify, analyze, and solve problems is particularly important in a digital transformation context, where new challenges and issues can arise from the implementation of new technologies.

7. **Leadership and Strategic Thinking**: Workers need to be able to think strategically and lead initiatives in the digital transformation journey.

8. **Empathy**: Understanding and considering the human impact of DT initiatives is important, particularly concerning issues such as job displacement.

9. **Innovation**: The ability to innovate and think creatively is key to identifying new opportunities for automation and developing effective solutions.

10. **Teamwork**: DT initiatives typically involve cross-functional teams, requiring the ability to work effectively with others.

These skills are not exhaustive and the required skill set can vary depending on the specific role and industry. However, they provide a general guide to the skills highly valued in the digital transformation era.

Insights on DT in Specific European Countries

DT in Germany: Current state and future prospects

Based on the "Digitalreport 2023" by ESCP's European Center for Digital Competitiveness[13], the following is a summary of the current state of digital transformation in Europe, focusing on Germany as a representative case. Please note that the information is derived from the.

The digital transformation is seen as a crucial factor for the future prosperity of Germany and, by extension, Europe. A significant majority of the population (77%) believes that the country's future heavily depends on rapid advancements in digitalization. This sentiment is shared across all social strata, although noticeable differences exist in the degree of conviction.

Despite the recognized importance of digitalization, there is a widespread perception that Germany, and potentially other European countries, are lagging in this area. As of 2023, 96% of the leading figures from politics and business believe that Germany is trailing in many areas of digitalization. This represents a slight increase from 89% in 2019.

However, optimism about the country's ability to catch up in the digital race has significantly decreased over the past year. While in 2022, 51% of the leaders believed that Germany had good chance of catching up quickly, only 28% hold this view in 2023. Meanwhile, the proportion of leaders who see limited or no chances for Germany to catch up has increased dramatically.

The responsibility for driving digitalization is primarily placed on politics and business. 74% of the leaders see politics in a key position, and two-thirds also see the economy playing a significant role. Citizens and science are seen as less influential in this process.

The report also indicates that there is a perception that the current German government, a coalition of SPD, the Greens, and the FDP, is not driving digitalization more decisively than the previous government.

The digital landscape in Germany has been undergoing significant transformation, with advancements in various sectors such as internet use, social media, and mobile technology.

Internet usage in Germany[14] has seen a steady increase over the years. The proliferation of high-speed internet connections and the widespread availability of digital devices have contributed to this growth. There were 77.53 million internet users in Germany at the start

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[13] https://digital-competitiveness.eu/wp-content/uploads/ESCP014_Digitalreport-2023.pdf

[14] https://datareportal.com/reports/digital-2023-germany

of 2023, which means internet penetration stood at 93.1 percent. Internet users in Germany decreased by 67 thousand (-0.09 percent) between 2022 and 2023.

Social media has become an integral part of the digital landscape in Germany. The user numbers for top social platforms in Germany have significantly increased, and Germany was home to 70.90 million social media users in January 2023, equating to 85.1 percent of the total population. Platforms such as Facebook, Instagram, Twitter, and LinkedIn have seen a surge in user numbers. These platforms are used for social interactions and play a significant role in business marketing strategies, news dissemination, and even political campaigns.

The use of mobile devices in Germany has seen a significant increase. Smartphones have become ubiquitous, and their use extends beyond communication. They are used for a variety of purposes, including shopping, banking, navigation, and entertainment. A total of 119.6 million cellular mobile connections were active in Germany in early 2023, with this figure equivalent to 143.6 percent of the total population. The rise of mobile use has also led to the growth of mobile applications, offering services that cater to various user needs.

In conclusion, the state of digital transformation in Germany is dynamic and evolving. The increase in internet use, social media engagement, and mobile use indicates a society that is rapidly embracing digital technologies. This digital transformation presents numerous opportunities and challenges that need to be navigated carefully.

While digital transformation is seen as a critical factor for the future of Europe, there is a growing concern about the pace of progress, particularly in Germany. Both political and business sectors are seen as key drivers of digitalization, indicating the need for a collaborative approach to accelerate digital transformation.

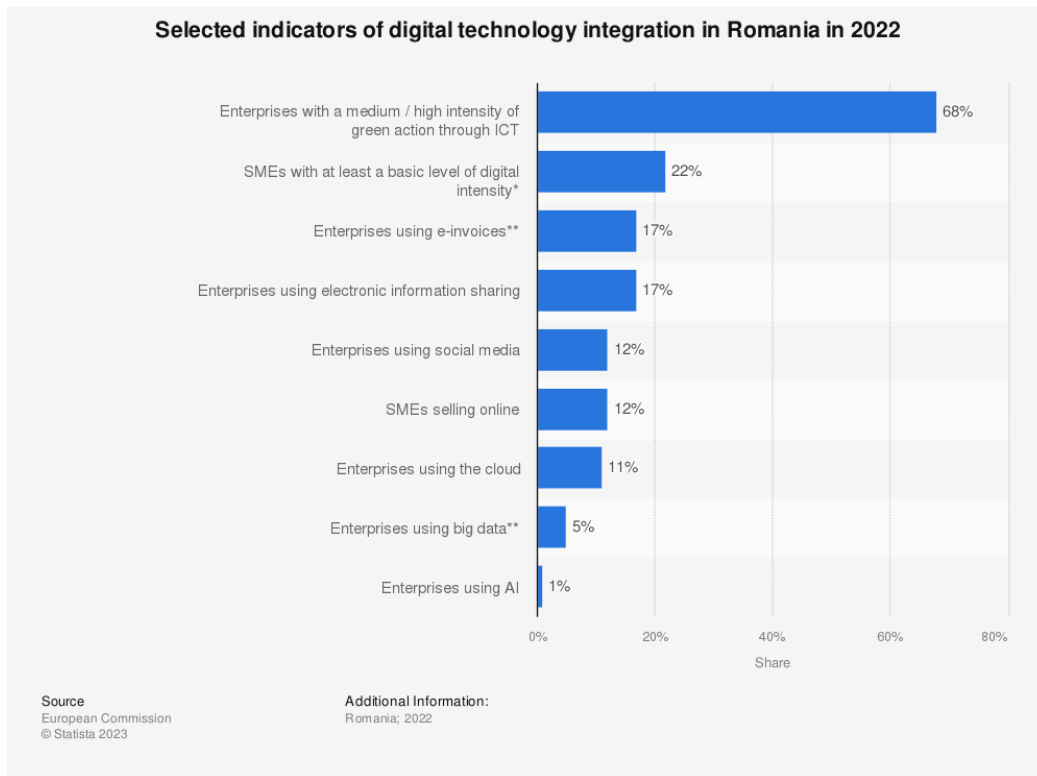## DT in Romania: Current state and future prospects

As of 2023, Romania has made significant strides in digital transformation, with a notable increase in internet usage, social media adoption, and mobile connectivity. This progress is reflected in the data provided by DataReportal[15] in their "Digital 2023: Romania" report.

As of the start of 2023, Romania had 17.82 million internet users, representing an internet penetration rate of 88.9 percent of the total population. This indicates a growth of 4.1 percent or 705,000 new users compared to the previous year. However, it is worth noting that 11.1 percent of the population remained offline at the beginning of the year, suggesting there is still room for growth in internet adoption.

Social media usage in Romania has also seen substantial growth. As of January 2023, the country had 13.50 million social media users, equating to 67.3 percent of the total population. This figure represents a significant portion of Romania's internet user base, with 75.8 percent of all internet users using at least one social media platform.

Mobile connectivity in Romania has exceeded the total population, with 29.15 million active cellular mobile connections in early 2023. This figure is equivalent to 145.4 percent of the total population, indicating that many individuals have more than one mobile connection.

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[15] https://datareportal.com/reports/digital-2023-romania

Selected indicators of digital technology integration in Romania in 2022

Enterprises with a medium / high intensity of green action through ICT	68%
SMEs with at least a basic level of digital intensity*	22%
Enterprises using e-invoices**	17%
Enterprises using electronic information sharing	17%
Enterprises using social media	12%
SMEs selling online	12%
Enterprises using the cloud	11%
Enterprises using big data**	5%
Enterprises using AI	1%

Source
European Commission
© Statista 2023

Additional Information:
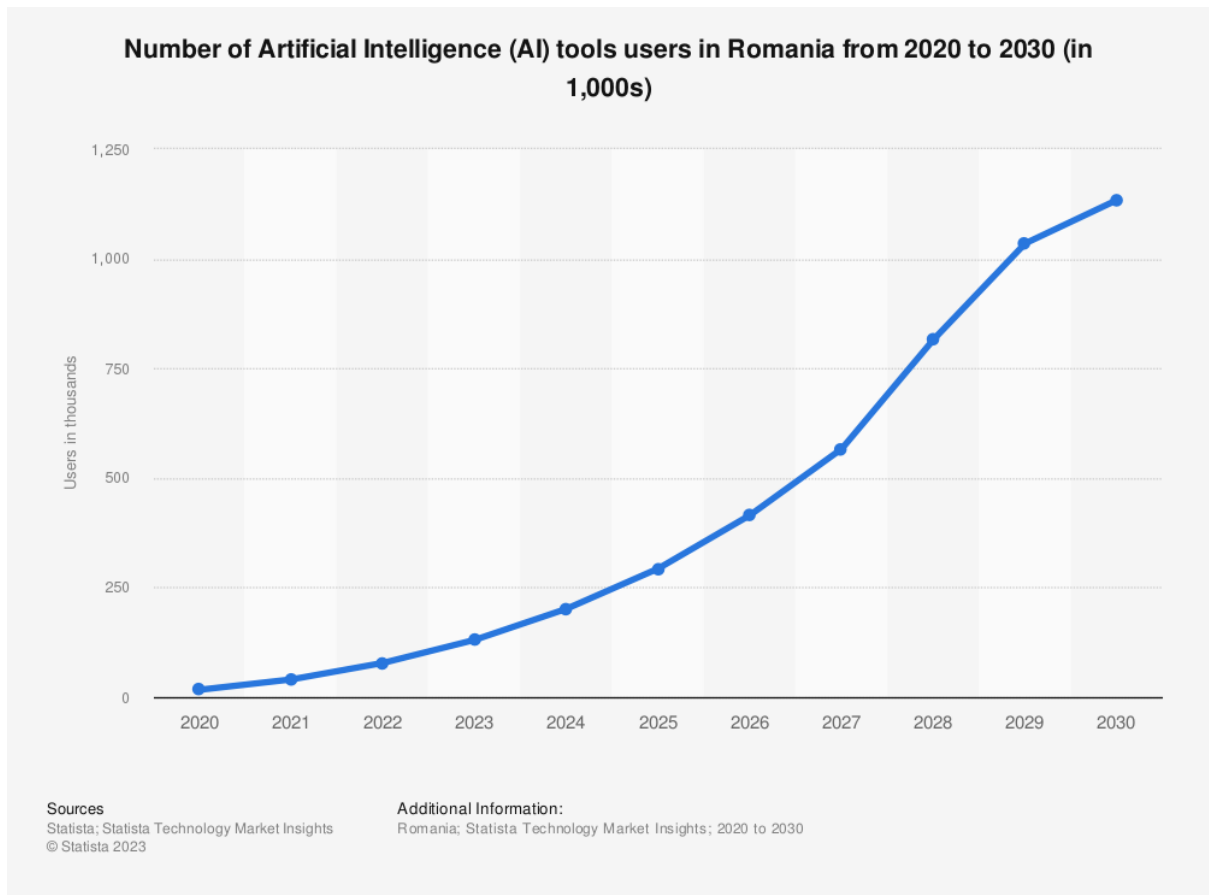Romania; 2022

Source: Statista, 2023[16]

Romania is a paradoxical example of AI market. Home of the largest unicorn in RPA, UiPath, the country is riddled with luddites[17]. Automation may affect the automotive and textile industries[18] (significant in the country's overall economy), with some 800.000 jobs lost, according to a 2017 report of the National Bank of Romania[19]. The trend of users of AI is expected to grow exponentially, from an estimated 77,890 users of AI tools in 2022 to a projected 1.1 million by 2030.

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[16] https://www.statista.com/statistics/1385519/digital-tech-integration-romania/
[17] https://emerging-europe.com/news/romanias-luddites-push-back-against-automation/
[18] https://joint-research-centre.ec.europa.eu/system/files/2021-11/jrc126870.pdf
[19] https://www.bnr.ro/DocumentInformation.aspx?idDocument=28192&directLink=1

Number of Artificial Intelligence (AI) tools users in Romania from 2020 to 2030 (in 1,000s)

Sources
Statista; Statista Technology Market Insights
© Statista 2023

Additional Information:
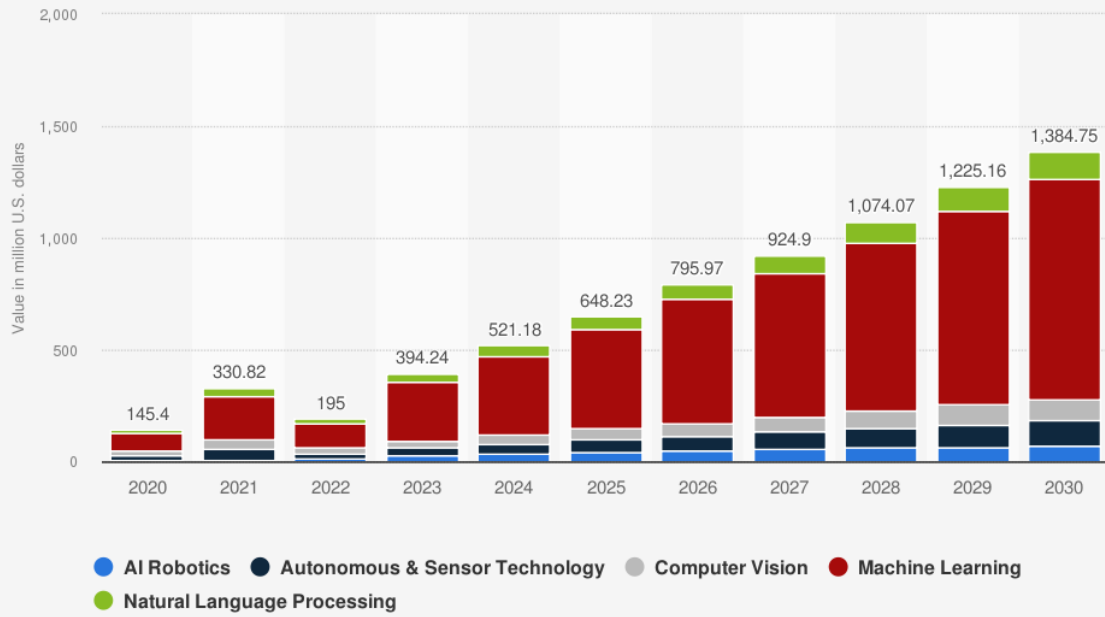Romania; Statista Technology Market Insights; 2020 to 2030

Source: Statista, 2023[20]

The value of the market is growing as well, from 195 million USD in 2022 (most of it in machine learning) to 1.4 billion USD forecasted for 2030.

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[20] https://www.statista.com/statistics/1401096/romania-ai-tools-users/

Value in the Artificial Intelligence (AI) market in Romania from 2020 to 2030 (in million U.S. dollars)

Legend:
- AI Robotics
- Autonomous & Sensor Technology
- Computer Vision
- Machine Learning
- Natural Language Processing

Data labels: 145.4 (2020), 330.82 (2021), 195 (2022), 394.24 (2023), 521.18 (2024), 648.23 (2025), 795.97 (2026), 924.9 (2027), 1,074.07 (2028), 1,225.16 (2029), 1,384.75 (2030)

Sources
Statista; Statista Technology Market Insights
© Statista 2023

Additional Information:
Romania; Statista Technology Market Insights; 2020 to 2030

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[21] https://www.statista.com/statistics/1401096/romania-ai-tools-users/

Innovation in DT: Flexibility, Resilience, and Foresight

Digital transformation is a dynamic and multifaceted process requiring a strategic innovation approach. This approach should be characterized by flexibility, resilience, and foresight.

The Importance of These Three Elements in DT

1. **Flexibility**: Flexibility in digital transformation refers to the ability of organizations to adapt to changing circumstances and incorporate new technologies into their operations. This requires a flexible approach that can accommodate the integration of digital and physical elements and adapt to the evolving digital landscape.

2. **Resilience**: Resilience in digital transformation is about the capacity to recover quickly from difficulties and maintain operations in the face of disruptions. This highlights the role of technologies like automation in enhancing the resilience of organizations during their digital transformation journey.

3. **Foresight**: Foresight in digital transformation involves anticipating future trends and changes in the digital landscape and making strategic decisions based on these insights. This underscores the importance of foresight in identifying and leveraging emerging technologies for digital transformation.

Moreover, the European Commission emphasizes the role of research and innovation in driving digital transformation in Europe.

Find out more about this in our Algorithmic Governance Whitepaper.

Incorporating these elements into DT strategies involves a combination of technological, organizational, and strategic measures. Technologically, it involves using advanced IA technologies that can adapt to changing requirements and recover from disruptions. Organizationally, it involves creating a culture of innovation and learning where employees are encouraged to experiment with new ideas and approaches. Strategically, it involves closely monitoring technological and market trends and preparing to adjust DT strategies in response.

In conclusion, innovation in digital transformation is a multifaceted process that requires flexibility, resilience, and foresight. By adopting a flexible approach, enhancing resilience, and leveraging foresight, organizations can effectively navigate their digital transformation journey and unlock new sources of value.
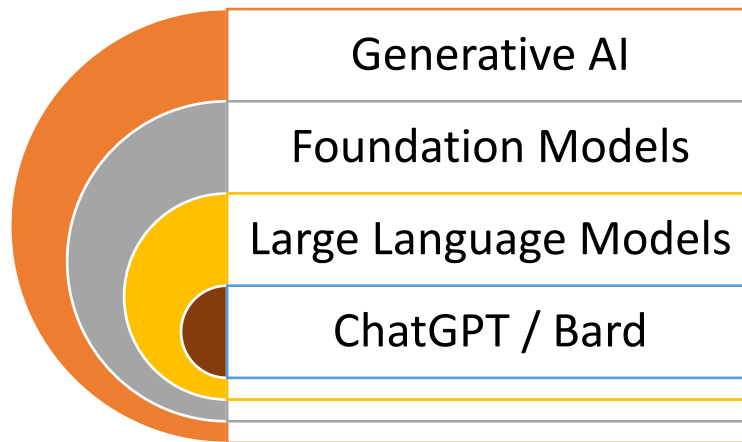
Digital transformation, a term that encapsulates the integration of digital technology into all areas of a business, is currently experiencing several key trends. One of the most prominent trends is the increasing adoption of artificial intelligence (AI) and machine learning (ML) technologies. According to Gartner, these technologies are used to automate processes, improve decision-making, and create new business models. Similarly, reports from consulting firms such as UiPath, EY, and McKinsey highlight the growing use of robotic process automation (RPA) to streamline operations and increase efficiency.

Source: Gartner, 2023[22]

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[22]https://www.gartner.com/en/articles/gartner-top-10-strategic-technology-trends-for-2023

Focusing on the trends for the next 10 years in 2022 was not reflective of the shifts that occured in 2023 with Generative AI becoming mainstream. By early 2023, the talk of the town was ChatGPT and the potential uses and risks of this technology.

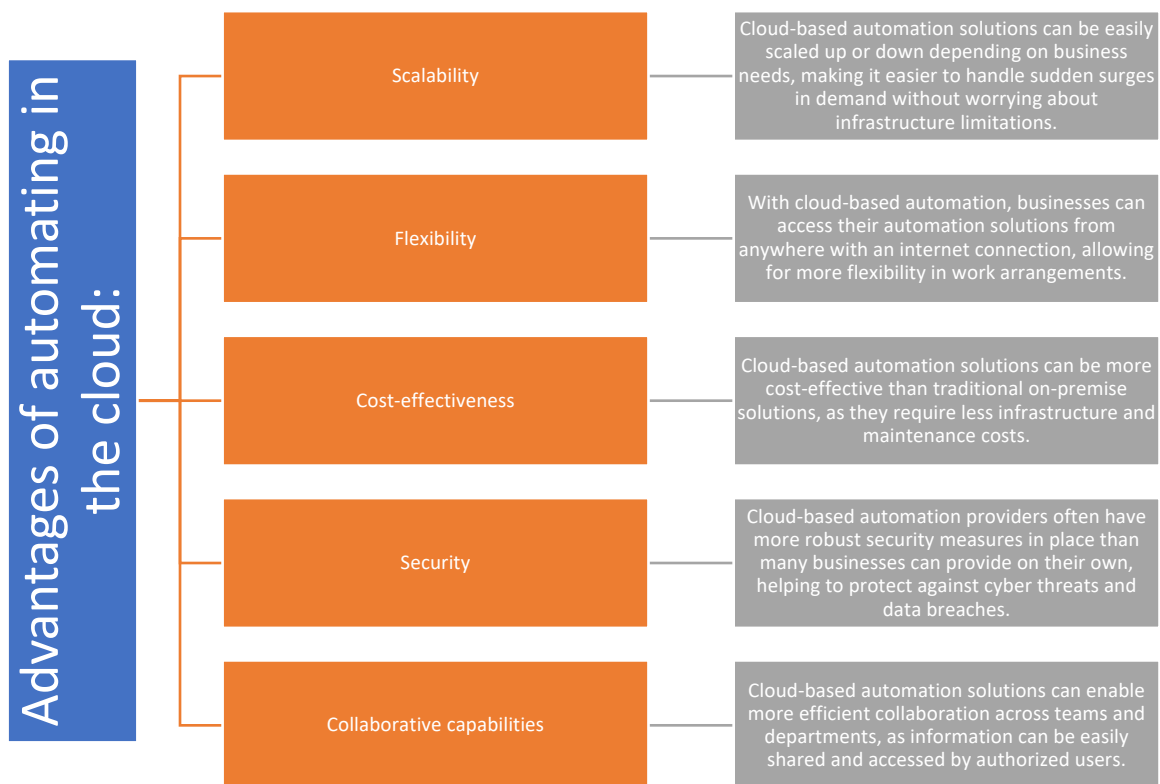Generative AI is not the only trend evident in 2023.

Greater adoption of Robotic Process Automation (RPA)	RPA has been gaining momentum in recent years as businesses seek to automate repetitive tasks and improve efficiency. Finance departments have been early adopters of RPA, using it to automate tasks such as invoice processing and payment reconciliation. Marketing departments can also benefit from RPA by automating tasks such as social media posting and email marketing campaigns. Intelligent Process Automation (IPA)
Intelligent Process Automation (IPA)	IPA is the next evolution of RPA, combining automation with artificial intelligence and machine learning to enable more complex and cognitive tasks..
Increased use of Artificial Intelligence and Machine Learning(AI)	Artificial intelligence and machine learning (ML) have been among the most significant technological advancements in recent years, and their impact is only set to grow in 2023. From chatbots and virtual assistants to autonomous vehicles and predictive analytics, AI and ML are being integrated into an ever-expanding range of applications across industries.
Low-code/No-code Development	Low-code and no-code development is a way for businesses to create applications without requiring traditional coding knowledge. This is achieved through visual interfaces and drag-and-drop tools that allow anyone to create software applications with ease. This trend has been gaining traction in recent years, with the rise of platforms like Monday.com. The benefits of low-code and no-code development are clear. It allows businesses to create custom software applications quickly and easily, without the need for extensive coding knowledge. The growing importance of data management and governance
The growing importance of data management and governance	Effective data management and governance are becoming critical for businesses in all industries, regardless of their size. The increasing use of cloud-based solutions and the growth of big data have resulted in an explosion of data, making it difficult to manage, analyse, and use it effectively. This has made data governance a key concern for businesses. By implementing a comprehensive data management and governance system, businesses can streamline their data management processes and ensure that data is clean, accurate, and consistent across all systems.
Expansion of cloud-based automation solutions	Cloud-based automation solutions are becoming more prevalent as businesses seek to reduce the cost and complexity of on-premises solutions. Marketing departments can benefit from cloud-based automation by using tools such as marketing automation platforms to manage and automate marketing campaigns. For example, a cloud-based marketing automation platform can be used to manage email marketing campaigns, social media posting, and lead scoring. This can reduce the time and effort required to manage these processes, and improve the overall effectiveness of marketing campaigns.
Rise of Hyper-Automation	Hyper-automation is a step further than traditional automation, using advanced technologies like AI, machine learning, and robotic process automation to create ful

Source: SYSCOR, 2023[24]

Another significant trend is the shift toward cloud computing. As noted by Deloitte, businesses are increasingly moving their operations to the cloud to enhance scalability and flexibility. Furthermore, the European Commission and European Parliament have emphasized the importance of data privacy and cybersecurity in

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[24] https://syscor.ai/2023/03/14/7-automation-trends-to-look-out-for-in-2023-and-beyond/

digital transformation, with new regulations being implemented to protect consumer data. Lastly, Bearing Point's reports indicate a trend toward customer-centric digital transformation, where businesses leverage digital technologies to improve customer experiences. These trends underscore the evolving nature of digital transformation and its growing impact on business operations.

Advantages of automating in the cloud:		
	Scalability	Cloud-based automation solutions can be easily scaled up or down depending on business needs, making it easier to handle sudden surges in demand without worrying about infrastructure limitations.
	Flexibility	With cloud-based automation, businesses can access their automation solutions from anywhere with an internet connection, allowing for more flexibility in work arrangements.
	Cost-effectiveness	Cloud-based automation solutions can be more cost-effective than traditional on-premise solutions, as they require less infrastructure and maintenance costs.
	Security	Cloud-based automation providers often have more robust security measures in place than many businesses can provide on their own, helping to protect against cyber threats and data breaches.
	Collaborative capabilities	Cloud-based automation solutions can enable more efficient collaboration across teams and departments, as information can be easily shared and accessed by authorized users.

Source: SYSCOR, 2023[25]

[25] https://syscor.ai/2023/03/14/7-automation-trends-to-look-out-for-in-2023-and-beyond/

Conclusion: DT and Public Policy Delivery

Digital Transformation (DT) is a profound change in business and organizational activities, processes, competencies, and models to fully leverage the changes and opportunities of a mix of digital technologies and their accelerating impact across society in a strategic and prioritized way. In the context of public policy delivery, DT can significantly enhance the efficiency, effectiveness, and reach of public services.

Public policy plays a crucial role in fostering DT. It can create an enabling environment that encourages the adoption of digital technologies, promotes digital literacy, and ensures that the benefits of DT are widely shared across society. Here are some ways in which public policy can foster DT:

1. **Promoting Digital Infrastructure**: Public policy can facilitate DT by investing in digital infrastructure. This includes high-speed internet connectivity, data centers, cloud computing facilities, and other digital technologies that form the backbone of the digital economy.

2. **Encouraging Digital Literacy**: Public policy can promote digital literacy through education and training programs. This can help ensure that all members of society have the skills needed to participate in the digital economy and benefit from DT.

3. **Ensuring Data Protection and Privacy**: Public policy can foster trust in digital technologies by implementing robust data protection and privacy laws. This can help ensure that personal data is handled responsibly and that individuals' privacy is respected.

4. **Supporting Innovation**: Public policy can foster DT by supporting innovation. This can be achieved through policies that encourage research and development, provide funding for start-ups and innovative projects, and create a regulatory environment that is conducive to innovation.

5. **Promoting Inclusivity**: Public policy can ensure that the benefits of DT are shared widely across society. This can be achieved by implementing policies that promote digital inclusivity, such as providing affordable internet access, promoting digital literacy, and ensuring that digital services are accessible to all, including people with disabilities.

In conclusion, public policy plays a crucial role in fostering DT. By creating an enabling environment, promoting digital literacy, ensuring data protection and privacy, supporting innovation, and promoting inclusivity, public policy can ensure that the benefits of DT are widely shared across society.

More insights on public policy and digital transformation interaction may be found in our whitepaper on Algorithmic Governance.

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