



Building a digital and sustainable future

How companies can pioneer
Twin Transformation



Branch Business & Information
Systems Engineering,
Fraunhofer Institute for Applied
Information Technology FIT



Building a better
working world

Management Summary

While most companies are still busy rethinking their identity in a digital world and mastering their digital transformation, the climate crisis is gaining speed. As a result, there is a growing corporate awareness toward increased alignment toward sustainability. Many companies already recognize that an immediate sustainability transformation is inevitable if we are to meet the various political, societal, and economic demands.

Although digitalization goals and sustainability goals may at first glance seem contradictory, there is unimagined potential in combining digital transformation and sustainability transformation. The ideal is to unleash this potential within the framework of a *Twin Transformation*. *Twin Transformation* puts the transformational forces of digitalization and sustainability on an equal footing, advancing efforts and rewards in digitalization and sustainability to the same extent. In this context, digitalization serves as a central lever for achieving sustainability goals; conversely, sustainability serves as a profound purpose and design framework for digital transformation.

This study identifies five key insights to motivate, inform, and support companies on their path to becoming Twin Transformers:

1 Twin Transformation levers synergies

Digital transformation and sustainability transformation are currently usually tackled by companies in isolation. This is due not only to the starting points regarding time, but also the content and the localization in different areas of responsibility within companies. Yet the two transformations have an unimagined synergetic potential. Thus, companies need to think about digital and sustainability transformation together so as to lever synergies, save resources, and act effectively and efficiently. Companies that lever the synergies of the two transformations are called Twin Transformers.

Digital transformation and sustainability transformation work synergetically and can only develop their maximum potential together. Digital transformation enables corporate sustainability through the considered use of digital technology capabilities such as data transparency or continuous learning.

2 Twin Transformation and its all-encompassing fields of action

Twin Transformation fields of action extend across all areas of a company, and are not limited to core areas such as IT or operations. Thus, it is crucial not to think about Twin Transformation only partially or – even worse – to approach it in silos; instead, one should understand and live it as a holistic transformation.

Twin Transformation's fields of action encompass all areas of a company and are interrelated; thus, they can only be addressed holistically, yet some fields act as levers for Twin Transformation.

3 The Twin Transformation Compass as an orientation for companies

Our Twin Transformation Compass shows more than 20 relevant fields of action, which help realize Twin Transformation through interdisciplinary and cross-departmental activities. The Compass orients and provides a holistic overview over which fields of action should be implemented in which area of the company and in what order.

The Twin Transformation Compass is the starting point for Twin Transformation and helps companies to identify where and how to start their Twin Transformation.

4 The IT organization and the finance department as catalysts for Twin Transformation

Activities of the IT organization and the finance department serve as a basis and catalyst for many action areas. For instance, the field of action *data transparency and analysis* focuses on changes that will help companies to make data-based decisions. This will enable them to quantify their choices' ecological consequences and will serve as a basis for algorithms to increase sustainability. Hence, finance and the IT organization should lead Twin Transformation and should support other business units.

The fields of action of the IT organization identified in this study serve as a launchpad for all further Twin Transformation missions. The finance department sets the guardrails for the planning and steering of the organization, providing targets, budgets, and incentives for Twin Transformation activities; these decide how swiftly different areas of the organization can drive Twin Transformation.

5 Twin Transformation as a springboard for further multi-transformations

The economic, social, and ecological challenges faced by companies are constantly growing. From a traditional stage of stability, most companies have moved into a phase of continuous change. By synergetically undergoing digital and sustainability transformation, resulting in organizational agility, companies work their transformation muscles, so that future transformations become more effortless.

Undergoing various transformations also develop relevant transformation capabilities, building resilience, which equips companies for future transformations.

Twin Transformation is an opportunity for a company to survive in times of crisis, characterized by digital competition, ecological challenges, and social tensions, and for it make positive contributions.

Our study seeks to help companies understand the levers and effects of Twin Transformation, and explains how to use them.





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Background information

Objective

This study intends to help companies understand Twin Transformation as a holistic transformation. It also identifies relevant fields of action for Twin Transformation and supports companies in planning and implementing them.

Methodology

The study's content is based on interviews with executives with in-depth digital or sustainability expertise and the editors' extensive experience from their work on digital and sustainability topics in practice as well as application-oriented research. The editors conducted 19 semi-structured interviews with 25 top management members responsible for digitalization and sustainability. The interviewees are from different disciplines and industries. Through open-ended questions in the three areas of digital transformation, sustainability transformation, and Twin Transformation, the interviews discussed various topics and current issues at the intersection of digitalization and sustainability. The insights gained from the interviews were then jointly reflected upon, discussed, and compared to the literature. We summarize our findings in the Twin Transformation Compass.

The authors warmly thank the interview partners, whose support and valuable thoughts made this study possible.

Defining "digital transformation"

We understand *digital transformation* as the use of digital technologies to improve or renew companies' value creation. Digital transformation helps companies to improve existing value propositions and develop new ones, leading to a new corporate identity (Wessel et al. 2021). The improvement of existing value propositions and the development of new ones are achieved through digital technologies.

Defining "sustainability transformation"

We understand *sustainability transformation* as the disruption of previous habits and dependencies to achieve changes toward more desirable states of ecological and social systems (Dorninger et al. 2020). We understand sustainability holistically in terms of its three dimensions: economic, ecological, and social (United Nations 2022).

The notion of sustainability should be understood as a generational contract. Sustainable actions consider the current generation's needs without disregarding the needs of future generations (European Commission 2019).

How Twin Transformation differs from existing streams that try to combine digitalization and sustainability

Twin Transformation enables companies to adopt a holistic perspective. It extends and incorporates existing concepts such as *Green IT* and *Green IS*.

▶ Green IT and IT sustainability

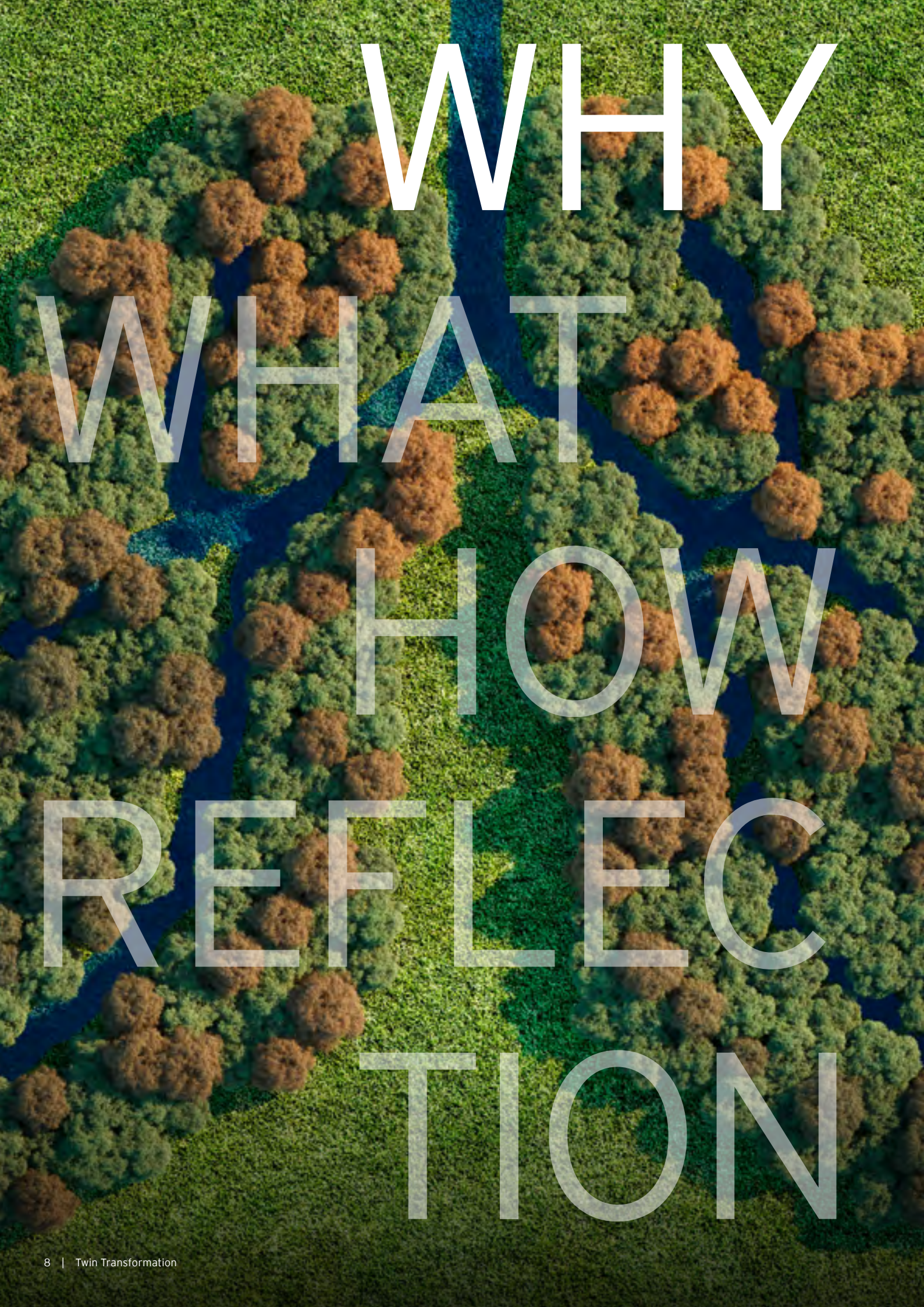
Green IT refers to measures and initiatives that reduce the negative ecological impact of manufacturing, operating, and disposing of IT equipment and infrastructure (Loeser 2013).

▶ Green IS

Green IS refers to practices that involve investing in using and managing IS to minimize the negative impact of IS, business processes, and digital products and services (Loeser 2013). Researchers emphasize the importance of solutions that contribute to ecologic sustainability, such as sustainability management systems (vom Brocke et al. 2013).

Interview partners

- ▶ **Gregor Bieler**, Aparavi Software AG, Co-CEO
- ▶ **Ezio Fantuzzi**, Generali Deutschland AG, Head of Sustainability
- ▶ **Sabine Haase**, Giesecke + Devrient Currency Technology GmbH, Business Line Digital Solutions
- ▶ **Andreas Hälbig**, Keller & Kalmbach GmbH, Head of Controlling/BI
- ▶ **Dr. Patrik Heiliger**, Union Investment, Senior Segment Developer
- ▶ **Carletta Heinz**, Heinz-Glas Group, Managing Partner
- ▶ **Nils Heise**, Generali Deutschland AG, Head of Digital Transformation
- ▶ **Mathias Kaldenhoff**, SAP Deutschland SE & Co. KG, Partner Sustainability & Innovation Management, Office of the CTO (Germany)
- ▶ **Rainer Karcher**, Allianz Technology SE, Head of IT Sustainability
- ▶ **Dr. Ralf Koeppel**, WashTec AG, CEO
- ▶ **Dr. Matthias Köster**, KHS Gruppe, Head of Sustainability Management & Strategic Projects
- ▶ **Theresa Lenz**, EnBW, Manager Digital Transformation
- ▶ **Anne-Käthi Leuenberger**, PostFinance AG, Co-Lead Corporate Responsibility
- ▶ **Dr. Christian Liedtke**, KUKA AG, Head of Strategic Alliances
- ▶ **Robert Mayer**, Fujitsu Technology Solutions GmbH, Head of IT
- ▶ **Sven Meier**, EnBW, Head of Digitale Transformation
- ▶ **Sybille Mutschler**, PostFinance AG, Head of Corporate Development
- ▶ **Nicole Pohl**, KHS-Gruppe, Senior Manager Corporate Social Responsibility
- ▶ **Gregor Sauerzapf**, Union Investment, Management Board Member
- ▶ **Dirk Schlesinger**, TÜV SÜD AG, CDO
- ▶ **Dr. Christian Schlögel**, Körber AG, CDO & Executive Board Member
- ▶ **Thomas Schott**, RAPA Gruppe, CIO
- ▶ **Gülray Stelzmüller**, Allianz Technology SE, CIO
- ▶ **Rüdiger Tröndle**, Union Investment, Head of Future Technologies & Digitalization



WHY

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1.

Why should companies think about digitalization and sustainability together?

Dealing with digitalization is now part of the daily lives of companies and individuals. Digital technologies have been finding their ways into our lives and work routines for almost three decades, transforming business models, structures, processes, and corporate cultures (CERN). Although many companies have embarked on digital transformation, they face significant challenges. For instance, the digital transformation success rate is still estimated at only 30% (Bonnet 2022). This is mainly due to the lack of well-trained specialists. The shortage of skilled IT staff is immense. Companies face the challenge of attracting young, well-trained specialists and of prevailing against competition in the labor market. As a result, digitalization initiatives often fail or progress slowly. Despite these poor prospects for success and the associated challenges, every company knows the need for digital transformation.

1. WHY

In addition to the profound changes and challenges of digital transformation, companies are increasingly confronted with the growing relevance of sustainability issues. Sustainability is no longer just a topic demanded by regulatory requirements and perceived obligations. It is becoming a priority in corporate strategies to respond to current events, such as energy crises, to ensure the company's long-term competitiveness. Further, the scientific certainty of global warming and its extreme consequences for the biosphere as a whole have become tangible: floods, forest fires, and other extreme weather events are forcefully shaking up society, politicians, and – above all – companies. Also, society's growing need for sustainability is reflected particularly in the younger generation. Young professionals want to have a positive impact on the world, and not only in their private lives. They demand that employers act in holistic, sustainable ways.

Implementing crucial and profound steps in relation to the UN Sustainable Development Goals (United Nations 2015) and the Paris Climate Agreement (UNFCCC 2016) is changing from a virtue to an absolute necessity in companies. Thus, sustainability is no longer just a goal for more efficient resource use from an economic perspective, or even an advertising tool. Instead, similar to digital transformation, it is transforming companies' business models in profound ways.

Businesses have an ambivalent role in society: while they are central to society's overall prosperity, contributing to 72% of GDP in OECD countries, they are also the source of more than 49% of global greenhouse gas emissions in sectors such as energy and manufacturing (Manyika et al. 2021). These are a significant driver of the climate crisis. This ambivalence highlights companies' social responsibility regarding achieving sustainability goals and demonstrates the need for systemic change. Firms must step up and take their place in a greener and more sustainable world through sustainability transformation. They must undergo strategic changes by tapping into new business models if they are to remain viable in a sustainably transformed society.

Companies have to operate simultaneously in a world that is both sustainable and digital. Yet, at first glance, digitalization goals and sustainability goals seem to be at odds. While digital transformation focuses on economic goals such as growth or profitability, sustainability transformation prioritizes ecological and social goals. Upon closer examination, it becomes clear that companies can realize the potentials of digital transformation and sustainability transformation synergetically if the two transformations' strengths are used to their mutual advantage. This synergetic interaction of digital transformation and sustainability transformation is Twin Transformation (EU Science Hub 2022; Ollagnier et al. 2022). Twin Transformation describes the simultaneous consideration of both transformations. Here, companies undergo a process that creates substantial added value for companies through the synergies of the activities of digital transformation and those of sustainability transformation.

We present the synergies of Twin Transformation and explain how companies can approach and master Twin Transformation.

LEARNINGS

- ▶ Even after many years, digital transformation is still at the heart of many transformation efforts.
- ▶ At the same time, sustainability is becoming necessary for every company.
- ▶ Addressing digital transformation and sustainability transformation together leads to synergies and innovations.
- ▶ Tackling societal and ecological challenges through Twin Transformation increases competitiveness.

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2. WHAT

2.1 Understanding and incorporating digital and sustainable synergies

Individuals and companies must think and act holistically about digitalization and sustainability goals. Twin Transformation is the synergetic interplays between digital transformation and sustainability transformation (see Figure 1). It is essential to approach these together and to reconcile what at first sight appear to be conflicting goals – such as economic growth and ecological resource conservation – and to play to the two transformations' respective strengths. Thus, companies should view all their decisions through the lens of both digitalization and sustainability. One-sided (for instance, purely economic) choices without consideration of their social and ecological consequences should be avoided.

Companies that think about and live digital and sustainability transformation together are known as Twin Transformers. Twin Transformers understand that they are in an ongoing transformation process driven by the requirements of digitalization and sustainability. It is necessary to transform if one is to survive in today's dynamic business environment.

Twin Transformers both align and fulfill their digital and sustainability transformation goals and measures. This applies to all innovations, initiatives, and other transformative activities.

While digital transformation is a lever for achieving sustainability goals in the context of Twin Transformation, sustainability transformation is the opportunity and purpose for digitalization.

Twin Transformation is the synergy of digital and sustainability transformation

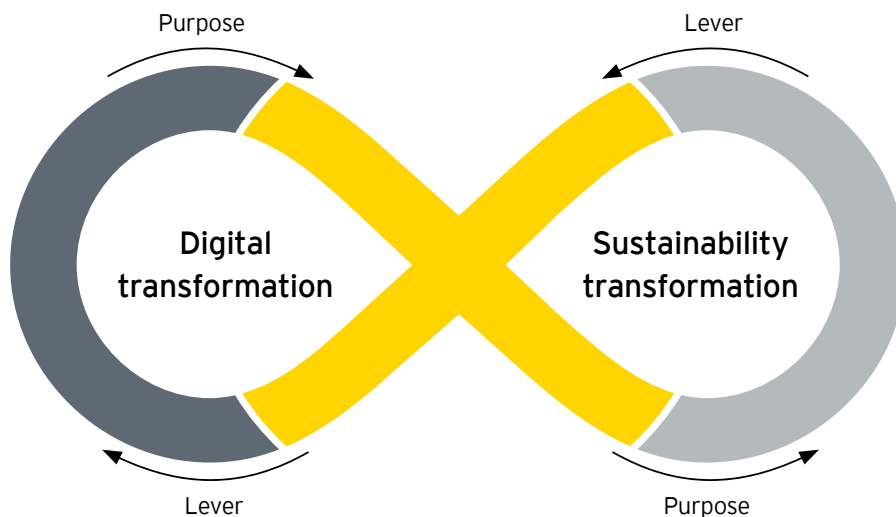


Figure 1

Source: Own illustration

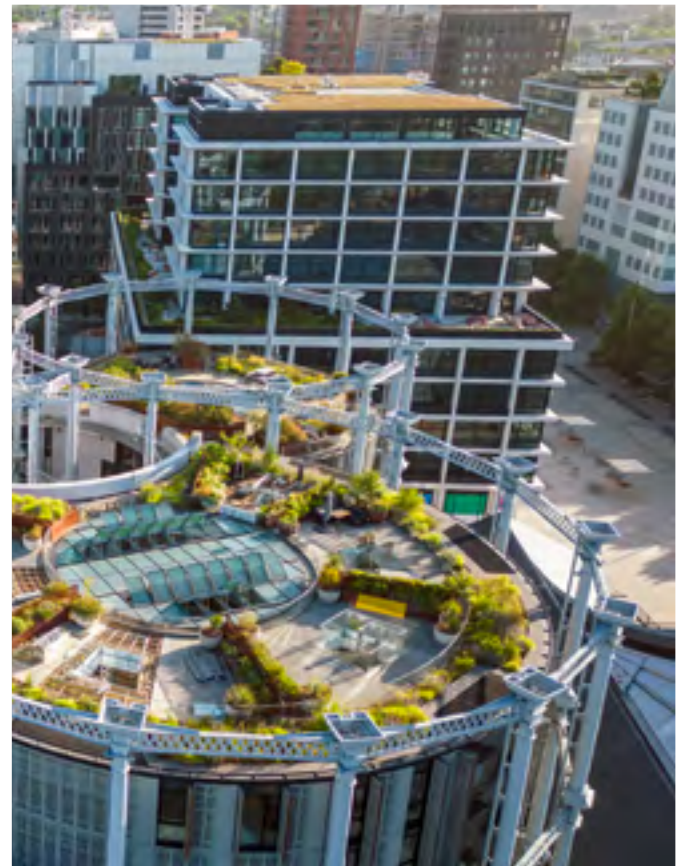
2.2 Digital transformation as a lever for sustainability

The multiple capabilities of digital technologies and therefore their transformative power, which companies can harness, enable the achievement of sustainability goals in a way that was not possible before. There are three levers of digitalization for sustainability:

1. shaping a sustainable IT landscape
2. empowerment of company-wide sustainability initiatives
3. data transparency to track sustainability goals.

In the first two levers, the IT organization plays a dual role in achieving sustainability goals. On the one hand, it is the IT organization's task to manage digital technologies to minimize negative ecological and social impacts. Examples include the downsizing of data centers by migrating to sustainable cloud technologies or implementing systems for comprehensive energy management. On the other hand, digital transformation helps companies to make their business model(s) sustainable through implementing digitally-enabled sustainability initiatives across the enterprise, such as setting up CO₂ emissions reporting or offering hybrid work. Already, most sustainability initiatives are based on digital technologies.

Finally, data in a processable and structured format are essential for achieving sustainability goals in this context. Many sustainability KPIs – such as energy consumption, CO₂ emissions, or machines' efficiency levels – can only be determined by using sensors and meters to measure physical parameters. The resulting data can provide information about current sustainability deficits and potentials for improvement within the company or its ecosystem (e.g., the supply chain). Through analysis tools and intelligent algorithms, companies can use the collected data to gain a holistic overview over their entire value chain and can continually learn about their activities' economic, ecological, and social impacts. Showing the current state through sustainability reporting provides transparency and enables ongoing learning effects based on the accumulated knowledge. These allow for the effective alignment, measurement, and control of Twin Transformation activities.



2. WHAT

2.3 Sustainability as an opportunity for digital transformation

While digitalization seems intuitive as a lever for achieving sustainability goals, sustainability transformation also holds critical opportunities for successfully mastering digital transformation's challenges. There are three levers of sustainability for digitalization:

1. a design framework for digital transformation
2. the purpose of digital transformation
3. the positioning as an attractive employer.

First, sustainability provides a defined design framework for digital transformation. Owing to the manifold capabilities and associated opportunities of digital technologies, digitalization reveals an infinite scope for companies to shape their future – illustrated for instance by the fact that long-established companies no longer have to operate in their existing business field. Instead, firms can self-disrupt through digital technologies, such that they can open entirely new business areas beyond their current product and industry boundaries. In this context, sustainability becomes an orientation tool that helps companies to navigate the infinite space of digital possibilities in a targeted way and to prioritize decisions according to the sustainability dimensions of ecological and social issues.

Second, sustainability serves as a corporate and societal guiding principle to create intergenerational equity. Thus, sustainability transformation can awaken people's willingness to use digital technologies and their staying power while doing so. As a goal, sustainability provides meaning to the deployment of digital technologies. Continuous change, predominantly driven by rapid technological change, requires cognitive power from employees and other stakeholders. Accordingly, companies' digital transformation usually fails, not because of technological changes, but because of cultural – and therefore human – components (Bitzer et al. 2021; Nadkarni and Prügl 2021). Thus, companies must establish cultural values and the appropriate mindset if they are to create a perpetual willingness

to change. Sustainability can act as a purpose, helping to shape digital transformation and providing a positive goal beyond economic metrics.

Further, a sustainable mindset is an opportunity to steer digitalization measures in an appropriate direction and to optimize the efficient use of resources. Thus, a company's purpose is not just a qualitative commitment, but also becomes a design characteristic of a digital and sustainably transformed company.

Finally, focusing on sustainability helps companies position themselves as attractive employers so as to attract future talent. These are needed to successfully shape not only digital transformation, but also Twin Transformation. Yet the war for talent goes beyond recruiting employees. Existing staff must also be intrinsically motivated and equipped with new digital and sustainability tools. In this way, sustainability can be integrated into employees' daily working lives.

LEARNINGS

- ▶ Digital transformation and sustainability transformation are in a synergetic relationship – **Twin Transformation.**
- ▶ In a synergetic relationship, digitalization is a lever for achieving sustainability goals.
- ▶ The availability of data and their analysis are key factors in enabling transparency and learning effects toward sustainability.
- ▶ A sustainability lens provides focus in the infinite design space of digital transformation.
- ▶ Sustainability serves as a purpose for digital transformation to maintain employee readiness and perseverance for ongoing transformation.
- ▶ Companies that act sustainably can position themselves as attractive employers.



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Digital technologies and their effects
on sustainability



3. HOW

Goals demand a concrete plan, especially for complex transformation projects such as Twin Transformation. Defining a Twin Transformation vision for the company is necessary before selecting fields of action and developing and implementing concrete, integrated digital and sustainability initiatives. In this vision, companies must combine sustainability and digitalization goals on an equal footing, with foresight and as vividly as possible. We recommend the integrated development of a digital and sustainable target picture that is developed interactively, iteratively, and in an interdisciplinary way at the board and management level and is then visualized for communication at all levels.

The Twin Transformation process begins with the self-assessment of the company's current maturity level regarding digital and sustainability transformation¹. Figure 2 shows questions for the company's self-assessment of its maturity level in relation to operating sustainably and digitally.

Companies can adapt or create their Twin Transformation target picture based on their self-assessment results. Implementing the target picture cannot be mastered by lone warriors in silos; it requires the collaborative cooperation of all employees in the company's various divisions. Skills bundling is the basis for the success of Twin Transformation. The IT organization and the finance department are crucial to such success, as other

¹ EY and Fraunhofer FIT offer to support companies in self-assessing their Twin Transformation maturity.

Sample questions for self-assessment of the maturity level of one's Twin Transformation

Self-assessment for digital and sustainable operating companies

Companies can use the following sample questions to make an initial rough self-assessment of how far along they are in Twin Transformation. This self-assessment is based on the maturity levels from 0 (non-existent) to 5 (leading) per question.

Area	Sample self-assessment question
Logistics and procurement	To what extent are sustainability criteria considered in the selection process for new providers or suppliers?
IT	To what extent does your company incorporate leading methodologies for IT asset management?
Infrastructure	To what extent does your company implement circular economy methods?
Operations	To what extent does your company use methods to monitor, optimize, and reduce CO ₂ emissions that originate from your on-site and off-site IT infrastructure?
Reporting	To what extent do you use are IT sustainability KPIs?

Figure 2

Source: Own Illustration

The Twin Transformation Compass



-  Supporting divisions
-  Value-creating business units



Figure 3

Source: Own Illustration

areas of the company (e.g., logistics, procurement, and HR) can only be successfully transformed with the targeted use of digital technologies and the necessary support by means of funding and resources. This holistic approach and IT's leverage effect are addressed below by presenting selected Twin Transformation fields of action we identified during this study.

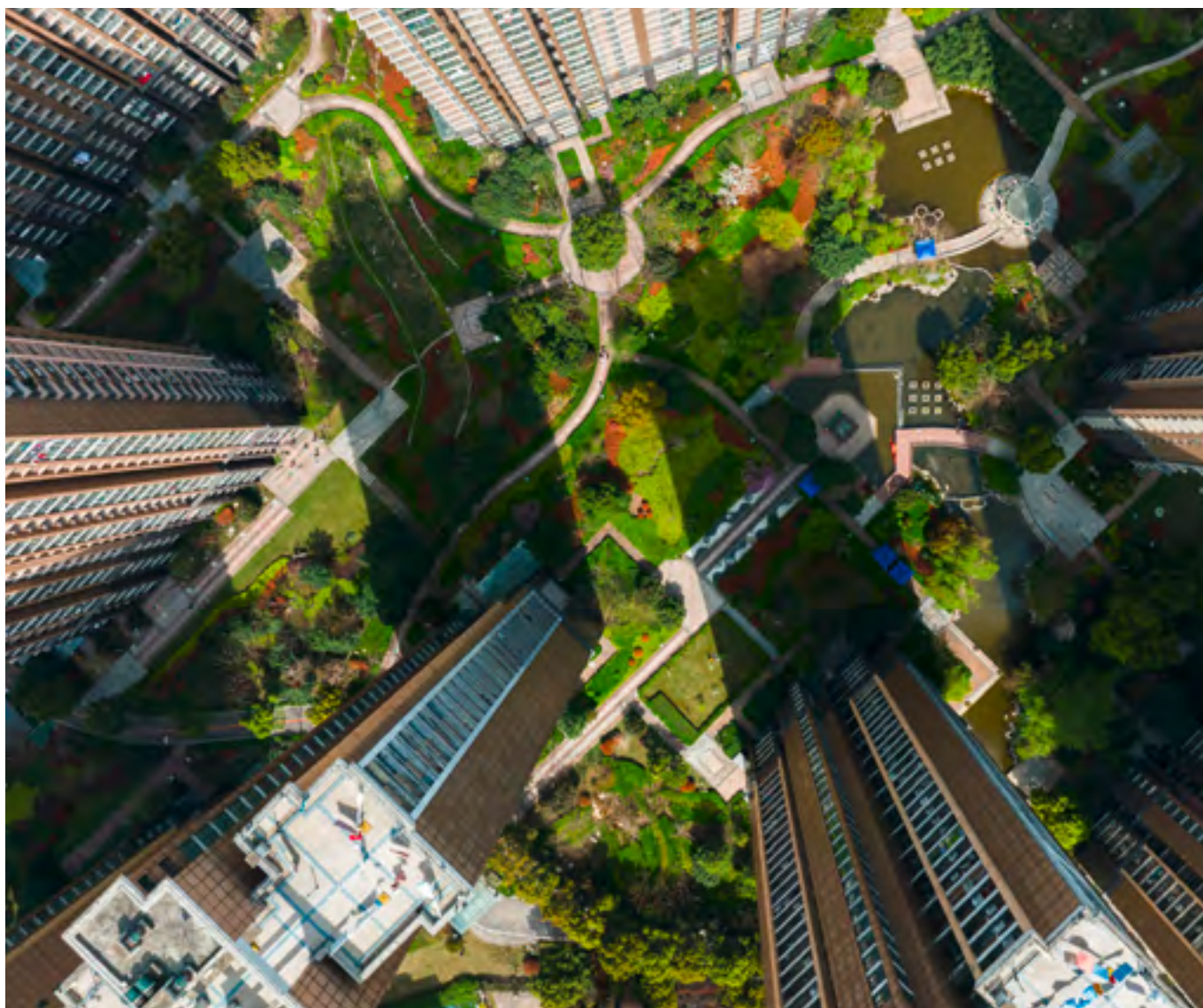
We structured the connections between the Twin Transformation fields of action and the business units using our Twin Transformation Compass (Figure 3), which helps companies to find orientation in Twin Transformation's uncertain waters and to master it systematically.

3. HOW

3.1 The Twin Transformation fields of action

The corporate culture is the foundation of all corporate areas. The digitalization and sustainability goals must be anchored in the corporate culture, which strongly influences Twin Transformation's success. The vision and the target picture must be fixed components of the corporate culture and therefore part of employees' daily work. A key factor is the exemplification of digitalization and sustainability principles across all management levels. Once this foundation has been laid, companies can systematically transform their divisions.

We will now present selected fields of action for Twin Transformation along the company divisions. Each field identifies the necessary prerequisites for initiating a successful Twin Transformation and shows the corresponding benefits. The presentation of concrete initiatives serves to describe the possibilities for operational implementation. Identifying fields of action and associated initiatives helps one to master Twin Transformation. The study allows for individual priorities.



At the core: Corporate culture

Corporate culture refers to the shared values, norms, attitudes, and behaviors that shape a work environment. It encompasses how decisions are made, how employees interact with one another, how communication takes place, and how goals are pursued. It shapes employee behaviors, performance, and the overall work atmosphere. It represents the company's collective identity and includes the shared beliefs and basic assumptions that employees accept. There are several starting points to foster a corporate culture that supports sustainability and digitalization:

► Vision and strategy

A clear vision and strategy for the company's Twin Transformation is crucial. While the vision should include digital and sustainable aspirations that employees find inspiring, the strategy describes the path to get closer to the vision. Owing to today's fast-changing business environment, the strategy should be adapted swiftly to new environmental conditions so as to stay on track while striving for the inspiring vision.

► Values and norms

It is necessary to define the values, norms, and behaviors that will accompany Twin Transformation. This includes emphasizing the importance of sustainability, innovativeness, openness to change, and digital literacy. Aligning all decisions with these norms and values will create a corporate culture that supports Twin Transformation.

► Leadership development

Leaders should be trained in the competencies that enable Twin Transformation, for instance, change management, innovation management, digital competencies, and sustainability. They should act as role models who exemplify change and inspire employees.

► Reward and recognition systems

Reward and recognition systems need to be adjusted to support the new values, norms, and behaviors – for instance, rewarding innovative ideas, sustainable practices, and digital skills development – so as to incentivize active participation in Twin Transformation.

► Communication and transparency

Employees should be continually informed about Twin Transformation. Thus, it is crucial to openly and transparently communicate progress, goals, and challenges. Leaders should encourage the open exchange of ideas and feedback to engage employees and strengthen their commitment to Twin Transformation.

► Employee participation

The leadership should communicate the importance of Twin Transformation and should engage employees to participate in the Twin Transformation process by creating platforms and mechanisms to gather ideas.

► Learning culture

A culture of continuous learning and adaptability is critical for both sustainability and digital transformation. Thus, leaders must encourage employees to take risks, learn from mistakes, and share best practices. They also need to create structures and resources for ongoing development and knowledge-sharing.

It is vital to implement these steps continually and to further develop the corporate culture in line with the transformations' goals. Successful transformation requires time, commitment, and a holistic approach that considers both the organizational structures and the persons in the company.



3. HOW

Business unit: Finance

Finance lays the foundations for sustainable action and ensures the already-achieved sustainability. The finance department sets guidelines for performance measures, budgets, and rewards. Thus, it holds a powerful position in companies and influences the corporate culture and thus decisions across the company. This involves protecting the interests of all company stakeholders and acquiring new capital providers. Interests have changed, and investors are increasingly emphasizing social and ecological sustainability in corporate governance. The finance department is increasingly being forced to consider and drive sustainability beyond economic KPIs. However, in this area, there are as yet no well-established mechanisms for decision-making, steering, controlling, and reporting. Thus, digital technologies are required to ensure transparency, provide real-time control, and enable tracking. The following four fields of action are crucial:

► **Sustainable external investments**

Green digital investments entail the funding and supporting of companies and initiatives that use digital technologies to address environmental and social challenges. Green digital investments steer capital flows, holding immense potentials for sustainability and triggering diverse dynamics throughout the economy. By investing in areas such as renewable energy, energy efficiency, smart cities, and the circular economy, companies actively contribute to a sustainable future and positive social impacts.

► **Sustainable internal Investments**

Strategic financing decisions must consider financial metrics and must include diverse nonfinancial aspects, so as to ensure sustainable transformation, for instance, water consumption or societal impact. Here, at the strategic level, the organization decides in which initiatives to invest and where enable the Twin Transformation of the organization. Without the necessary resources, the Twin Transformation cannot happen. Thus, this field of action enables all other fields of action.

► **ESG steering and controlling**

► **Integrated ESG reporting**



Deep dive: ESG steering and controlling

The evolving regulatory landscape compels companies to progress toward ever-higher sustainability standards. Companies are pursuing various approaches to sustainability and ESG standards; these can be clustered into four areas:

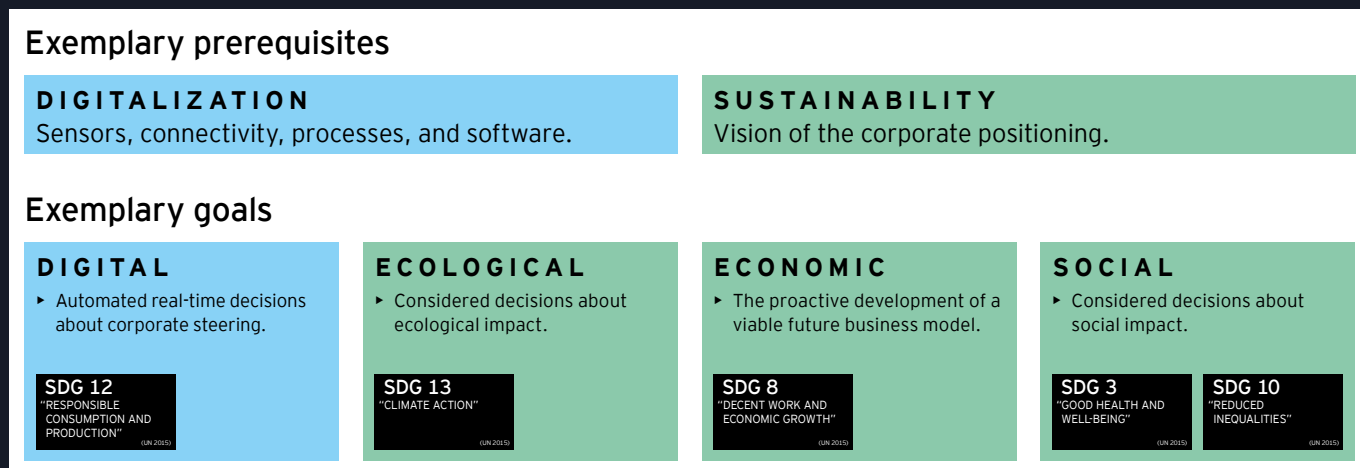
Approach 1: Reacting to compliance requirements, some companies focus on sustainability reporting and establishing internal controls to meet ESG standards.

Approach 2: Also reacting to compliance demands, some companies adopt an integrated approach to ESG reporting. They recognize the interdependencies between sustainability factors and incorporate them into their reporting practices.

Approach 3: Some companies go beyond mere compliance and integrate sustainability into their core business and management models. Sustainability and ESG considerations are integral to their control cycle and performance measurement frameworks.

Approach 4: Striving for long-term societal benefits, besides profit, some companies take a holistic approach. They align their management decisions and operations with generating overall value for all stakeholders. Further, they communicate their commitment to long-term benefits to external stakeholders.

Either way, the prerequisite for steering and controlling is transparency, which requires sensors, data, and connectivity, all connected to the digitalization of processes.



Example: A pharmaceutical manufacturer’s strategic decision

This pharmaceutical company demonstrates a proactive approach to sustainable management, recognizing the significance of integrating long-term societal benefits, alongside profitability. It has strategically incorporated sustainability into its operations and makes use of a

framework to identify areas for action. Levering digital solutions, it takes informed financial decisions to measure and enhance its societal impact, contributing to a sustainable future.

Takeaway

Make your company proactive by thinking beyond regulatory guidelines. Prioritize Twin Transformation fields of action in areas where you want to become a

leader. Depending on your decision, use your available resources to invest in these fields of action, and ensure compliance with regulations in less relevant areas.

3. HOW

Deep dive: Integrated ESG reporting

In today's dynamic regulatory landscape – which includes initiatives such as the CSDR (Corporate Social Responsibility Directive), the SFDR (Sustainable Finance Disclosure Regulation), the EU Taxonomy, and the EU Green Deal, – the finance sector faces the challenge of having to swiftly adapt to new requirements or even predicting upcoming policy changes.

Collecting sustainability data from various sources in the company helps ensure effective reporting (see [data transparency and analysis](#)). To facilitate timely reporting and comply with upcoming regulatory requirements, companies need automated data

collection, analysis, and presentation. This enables real-time data availability and thus not only reporting, but also allows them to respond and adapt swiftly to emerging changes. However, many companies lack the capability to achieve real-time evaluation. The successful implementation of both frequent analysis and real-time evaluation requires the adoption of technologies and processes. It is only through these advancements that companies can effectively navigate the evolving sustainability landscape. Collaboration with partners in digital ecosystems where companies share their data openly may help all participating companies to lay the foundation for their ESG reporting.

Exemplary prerequisites

DIGITALIZATION

Sensors, digitalized processes, data warehouses, software, and IoT solutions.

SUSTAINABILITY

Understanding of sustainability metrics.

Ausgewählte Ziele

DIGITAL

- ▶ Automated real-time reporting.

SDG 8
"DECENT WORK AND ECONOMIC GROWTH"
(UN 2015)

ECOLOGICAL

- ▶ Transparency regarding ecological ESG KPIs.
- ▶ A focus on steering ecological ESG KPIs.

SDG 13
"CLIMATE ACTION"
(UN 2015)

ECONOMIC

- ▶ Efficient reporting through automated processes.

SDG 12
"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

SOCIAL

- ▶ Transparency regarding social ESG KPIs.
- ▶ A focus on steering social ESG KPIs.

SDG 3
"GOOD HEALTH AND WELL-BEING"
(UN 2015)

SDG 10
"REDUCED INEQUALITIES"
(UN 2015)

Example: A company that specializes in vehicle washing systems

This company has made substantial investments into increasing its sustainability and developing a green business model. Reporting alone does not help it to become more sustainable, because it only promotes compliance with regulations. The company uses current and future requirements from regulations as a signal to automate its reporting processes because sustainability

reporting cannot function without digital, automated, and integrated solutions. Thus, it has built a digital infrastructure, which enables it to track all reporting relevant KPIs in real-time. Regulation is a duty that allows it to steer it toward its sustainability goals based on digital solutions.

Takeaway

Automating your sustainability reporting based on digital solutions enables timely adjustments and empowers you to steer your company toward sustainability. View evolving regulations as an opportunity to optimize operations,

beyond compliance requirements. Look beyond regulatory obligations to identify new potentials and improve sustainability.

Business unit: Information technology

IT is a company's strategically crucial cross-sectional function, influencing the entire value chain. Owing to the various IT-related tasks, the demand for IT specialists is constantly increasing. We consider the following fields of action to be particularly relevant in the context of Twin Transformation:

- ▶ **Open source for social justice**
More and more companies are publishing their code of internal applications. This leads to increased accessibility of advanced methods, solutions, and algorithms for the public and boosts a company's reputation among young professionals.
- ▶ **Green computing power**
With the steady increase in available computing capacity, stored data, and connected devices, emissions from IT use are becoming increasingly important. The IT organization can reduce a firm's emissions impact through more efficient digital technologies.
- ▶ **Process management**
Processes are a key lever for changing companies from the inside out. Digital process management uses digital capabilities such as process *mining* or *robotic process automation (RPA)* to uncover inefficiencies, conserving resources and innovating processes.
- ▶ **Data protection**
Personal data are well worth protecting in the context of social sustainability. Sensitive, systematic handling of data is required to avoid data leaks.
- ▶ **Data transparency and analysis**
- ▶ **Sustainable AI applications**



3. HOW

Deep dive: Data transparency and analysis

Digital technologies are the key to capturing and evaluating data. By collecting and analyzing data, the current state of business processes becomes transparent. Data and their analysis make the social and ecological dimensions tangible and quantifiable. Transparent sustainability indicators impact on two critical operational aspects: First, they enable improvement potential from the data. This facilitates targeted process optimization. Second, they create the basis for analyzing and forecasting corporate actions' impact on sustainability dimensions. At the same time, data volumes are increasing exponentially (The Information Service of the Institute of the German Economy 2019). Large numbers of data lead to higher energy consumption and therefore to higher CO₂ emissions.

Many companies still face the challenge of strategically using data, managing them and thus collecting the optimal number of data. The root of the problem is a lack of data strategy, specifically a lack of data governance mechanisms. Many companies don't know what potentials lie dormant in their data. Thus, the relevance of introducing a data strategy and data governance mechanisms is increasing, to introduce clear responsibilities for corporate data, avoid redundancies, and create the basis for the structured further use of the data.

Exemplary prerequisites

DIGITALIZATION

Data and data management strategy; data warehouse; custom data analytics solutions; data analytics capabilities.

SUSTAINABILITY

Understanding sustainability metrics.

Exemplary goals

DIGITAL

- ▶ Increase data literacy.
- ▶ Use data and metadata.

SDG 12
"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

ECOLOGICAL

- ▶ Reduce resource consumption and CO₂ emissions through the individual allocation of emissions.

SDG 13
"CLIMATE ACTION"
(UN 2015)

ECONOMIC

- ▶ Reduce costs by increasing efficiency.
- ▶ Increase competitiveness.

SDG 8
"DECENT WORK AND ECONOMIC GROWTH"
(UN 2015)

SOCIAL

- ▶ Promote equal opportunities and fairness.

SDG 10
"REDUCED INEQUALITIES"
(UN 2015)

Example: "No-code" or "low-code" initiatives

One example of a revolutionary type of data transparency and analysis is a no-code or low-code AI platform. Various startups enable structured data preparation, visualization, and the creation of machine learning models based on the company's data, regardless of the technical expertise of the employees involved. As the terms no-code and low-code imply, these platforms require little to no programming skills, relying instead on graphical user interfaces and configurations to create application software. The platforms directly access data stored in the cloud and enable the instant transformation and analysis of datasets. These startups outline

a future with democratic access to data and allow companies to make AI applications employee-centric. In such an environment, every employee can make data-based decisions, regardless of their department. Especially regarding employees and their impact on sustainability, data management offers great potential for raising awareness.

Takeaway

Teach your employees how to take data-driven decisions. Try to remove barriers to accessing datasets and train your employees in analytics methods.

Deep dive: Sustainable AI applications

AI focused on sustainability applications can take many forms in companies. AI can help to make processes more efficient and to avoid errors or other grievances through process automation. At the same time, companies should not neglect critical aspects of AI applications. For instance, the training and application of AI algorithms are significantly more energy-intensive

than conventional algorithms (Kratochwill et al. 2022). Further, existing AI applications have shown that they can also be subject to biases and should therefore be interrogated, especially in sensitive application areas. Overall, one should design AI applications to be sustainable and to contribute to achieving corporate sustainability goals.

Exemplary prerequisites

DIGITALIZATION

Data warehouse; sufficient training data; sufficient computing power; adequate infrastructure; combination of artificial and human intelligence.

SUSTAINABILITY

Definition of KPIs; use of software for monitoring and reporting; data availability on the supply chain, product components, and energy use.

Exemplary goals

DIGITAL

- ▶ Automated basis for decision-making.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

ECOLOGICAL

- ▶ Efficient processes.
- ▶ Saving resources.

SDG 13

"CLIMATE ACTION"
(UN 2015)

ECONOMIC

- ▶ Cost reduction by increasing efficiency and competitiveness.

SDG 8

"DECENT WORK AND ECONOMIC GROWTH"
(UN 2015)

SOCIAL

- ▶ Promotion of equal opportunities and fairness.

SDG 3

"GOOD HEALTH AND WELL-BEING"
(UN 2015)

Example: A service company with a focus on testing and certification

The targeted use of AI models is highly relevant to avoid so-called rebound effects, i.e., increased resource use owing to increased efficiency. This service company has recognized this problem and has made sustainable AI algorithms design a development theme. As in non-AI-related programming, there are more and less efficient solutions to challenges that lead to this goal. The distinctions are based for instance on the chosen

programming environments, the programming language in question, or the databases used. Design principles should be anchored in the company so as to guarantee a resource-optimized AI application.

Takeaway

Invest time up front in developing design principles for your algorithms. Consider from the beginning of the development process that effectiveness and efficiency are important for the sustainability of the codes.

3. HOW

Business unit: Logistics and procurement

Procurement and logistics processes influence product availability, quality, and sustainability. Digital technologies can be used in procurement to improve the selection and reviewing of suppliers and to establish integrated logistics planning. The following fields of action are particularly important in the context of Twin Transformation:

► **Sustainable decision support systems**

The use of digital technologies for evaluating and digitally supporting suppliers' selection regarding sustainability criteria is becoming increasingly important.

► **Integrated logistics planning**

Integrated logistics planning addresses the entire logistics planning process, from procurement to sales. Data are generated along this process, and consolidation is intended to reduce CO₂ emissions along the supply chain.

► **Supply chain management**



Deep dive: Supply chain management

Supply chain management combines the ability to query large numbers of data from suppliers in a trustworthy way and to evaluate sustainability information. The aim is to check whether the information provided by upstream trading partners is correct. This makes it possible, among others, to

make the supply chain and emissions transparent. Companies are increasingly under regulatory pressure to precisely measure, evaluate, and disclose sustainability indicators for the entire supply chain.

Exemplary prerequisites

DIGITALIZATION

Data strategy; availability of data; digital monitoring of the supply chain; a solution for querying sustainability key figures from suppliers.

SUSTAINABILITY

Understanding sustainability metrics; evaluating supply chain linkages.

Ausgewählte Ziele

DIGITAL

- ▶ Consistent and transparent data reporting for supply chains.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

ECOLOGICAL

- ▶ Reduction of resource consumption and CO₂ emissions through sound supplier selection.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

SDG 13

"CLIMATE ACTION"
(UN 2015)

ECONOMIC

- ▶ Savings through supply chain optimization.
- ▶ Efficient use of infrastructure.
- ▶ Proactive full employment.

SDG 8

"DECENT WORK AND ECONOMIC GROWTH"
(UN 2015)

SDG 9

"INDUSTRY, INNOVATION AND INFRASTRUCTURE"
(UN 2015)

SOCIAL

- ▶ Creating transparency throughout the supply chain.

SDG 10

"REDUCED INEQUALITIES"
(UN 2015)

Example: A network for data exchange

The network represents a collaborative, open data ecosystem for flexible supply chain management. It connects internationally operating players along the value chain, creating a standardized, global data exchange. Material flows along the entire supply chain are digitally traceable. For instance, participants can trace individual products and services, and can analyze

their carbon footprint along the whole value chain. Overall, with the help of a digital platform, the network can cover sustainability requirements in ventures with complex supply and value chains, making it a Twin Transformation project.

Takeaway

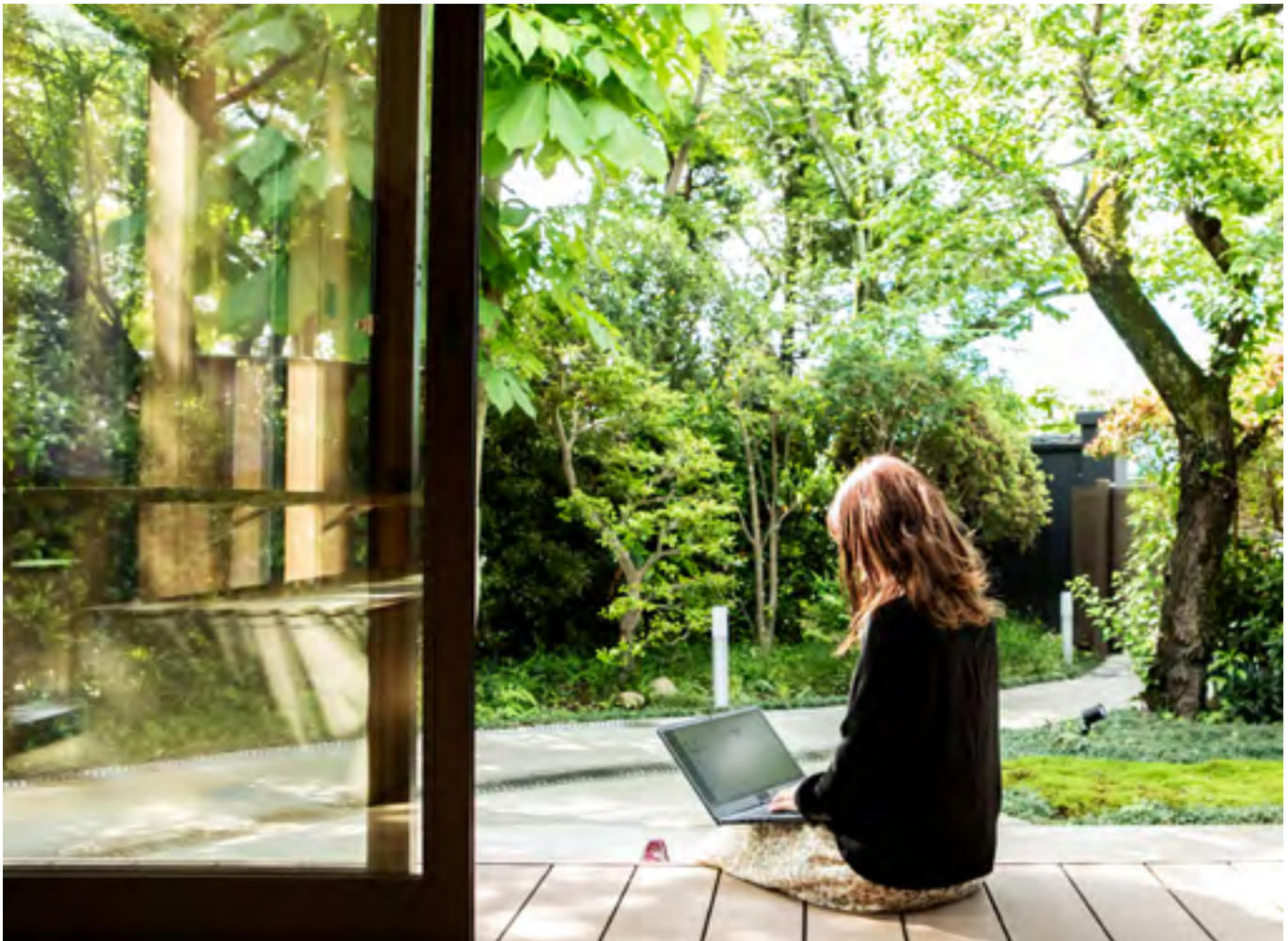
Bring together information from your enterprise ecosystem. Use standardizing technologies such as digital platforms and create guidelines for adequate data management along your entire value chain.

3. HOW

Business unit: Human resources

Digital technologies have roles in various stages of the employee lifecycle, as reflected among others in digitally supported recruitment, which becomes more inclusive and less subjective, in digital training measures on sustainability topics, and in the improvement of employees' wellbeing during work through sensors and actuators. In general, companies can use digital technologies to make the work environment more sustainable, increasing their attractiveness toward qualified professionals. The following fields of action are relevant in the context of Twin Transformation:

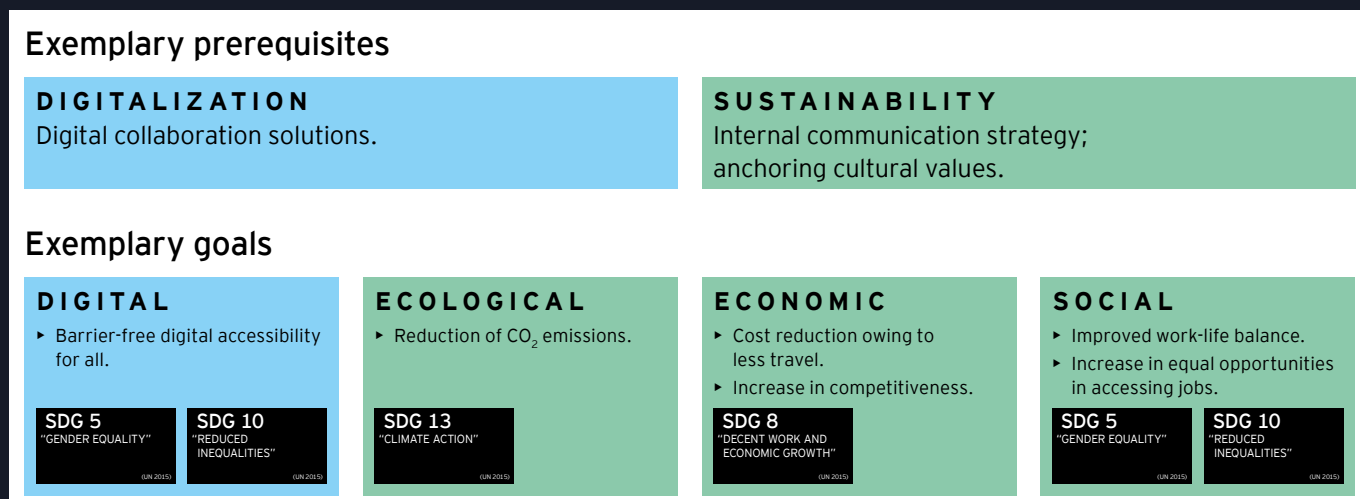
- ▶ **Recruit young talent**
The war for qualified specialists is intensifying. Decision-making factors such as sustainability as a company's overarching purpose are playing an increasingly important role among young specialists.
- ▶ **Employee development**
Training employees on sustainability topics forms the basis for mastering changes in corporate culture toward sustainability.
- ▶ **Digitally enabled diversity**



Deep dive: Digitally enabled diversity

Diversity is a significant challenge for most companies. Several studies have shown that diverse teams lead to innovation and, therefore, corporate growth (Rock and Grant 2016). At the same time, the number of women on German DAX boards is still only at 14% (AllBright Foundation 2022). Digitally enabled diversity consists of using digital solutions

to make workplaces as diverse and inclusive as possible. Measures such as mobile or flexible working can play a role here. At the same time, measures should be accompanied by a company-wide communication strategy so as to promote their implementation and acceptance.



Example: A company that specializes in web applications for version management

This company pursues an all-remote concept, meaning it has no fixed offices – all employees work decentrally in different countries. According to its convictions, the company enables maximum diversity, regardless of location, social environment, working time preferences, and personal circumstances. It has drawn up a manifesto to successfully implement this all-remote concept. It states, among others, that writing down knowledge is preferable to verbal communication, that all the company's processes must be documented, and that all information should be accessible to everyone.

From this initiative, it becomes clear that employee diversification in terms of maximum transformation capability requires a great deal of organizational effort. Only in a structured environment can diverse human resources collaborate in a targeted yet innovative way.

Takeaway

Find the middle ground for your company between searching for swift, flexible solutions and structure-giving specifications, and anchor this in your corporate culture. Establish cross-functional communication

channels and provide all employees with easy access to information. Try to not rely on verbal knowledge transfer; instead, ensure profound documentation of knowledge in the company.

3. HOW

Business unit: Research and development

Twin Transformation in R&D has two key aspects. While companies must manage to generate more sustainable and digital products in the Twin Transformation innovation pipeline, they must consider sustainability and digitalization requirements in research and development. This is also reflected in the key Twin Transformation fields of action:

- ▶ **Sustainability in research and development**
Companies should include sustainability criteria in developing new digital products and services (sustainability-by-design).
- ▶ **The Twin Transformation innovation pipeline**



Deep dive: The Twin Transformation innovation pipeline

While the demand for – digitally supported or enabled – sustainable products and services is already being felt in most companies, this is not yet visible in their number of initiatives. Enter the Twin Transformation innovation pipeline field of action. Twin Transformation will only succeed if a company develops the domain and specialist

knowledge to identify sustainable ideas and then implements them digitally. The systematic approach of agile working supports the skills for implementation and the domain knowledge for identification.

Exemplary prerequisites

DIGITALIZATION

Knowledge of technical possibilities; embedding of innovations in corporate strategy; openness to break new ground.

SUSTAINABILITY

Current company-related developments in sustainability; understanding sustainability metrics; monitoring future trends.

Exemplary goals

DIGITAL

- ▶ Create sustainable digital innovations by combining sustainable ideas and technical skills.

SDG 12
"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

ECOLOGICAL

- ▶ Prioritize projects with ecological potentials.

SDG 13
"CLIMATE ACTION"
(UN 2015)

ECONOMIC

- ▶ Improved reputation of the company.
- ▶ Orientation toward the long term.

SDG 8
"DECENT WORK AND ECONOMIC GROWTH"
(UN 2015)

SDG 9
"INDUSTRY, INNOVATION AND INFRASTRUCTURE"
(UN 2015)

SOCIAL

- ▶ Intensification of projects with social potentials.

SDG 5
"GENDER EQUALITY"
(UN 2015)

SDG 10
"REDUCED INEQUALITIES"
(UN 2015)

Example: A startup incubator

A mechanical engineering group has spun off its digital division to create a digital incubator and company builder so as to increase its innovation strength. This division has the task of developing digital business models in series and spinning them off if they promise success. The starting point for digital business models is concrete customer projects and associated challenges. The digital incubator concentrates primarily on *software-as-a-service* (SaaS) products, focusing on increasing machine efficiency and sustainable resource optimization based

on AI. The incubator's innovations contribute directly to the company's overall success by leveraging the other group divisions' products and services. Every time a new, digital business model is developed, attention is also paid to the *sustainability-by-design* requirement. Thus, sustainability forms part of every digital innovation.

Takeaway

Create organizational freedom for innovation in your company. Ensure that both digital and

sustainability guardrails are anchored in the earliest stages of idea generation.

3. HOW

Business unit: Infrastructure

The design and use of infrastructure strongly influence a company's sustainability. Digital technologies such as sensors and intelligent algorithms can be used to measure and improve infrastructure's sustainability. Key Twin Transformation fields of action are:

- ▶ **Digital health management**
It is becoming increasingly important to protect employees' health from hazards in the (digital) workplace. Digital technologies can be used in considered ways by companies to improve working conditions.
- ▶ **Circular building management**



Deep dive: Circular building management

Circular building management seeks to increase the longevity of products and building materials by reducing waste in the system. This means that buildings should be designed so that the individual components can be deconstructed and to ensure re-use.

This allows them to be used as resources in new products. Digital technologies (e.g., sensors) enable companies to monitor individual components and their conditions, creating the basis for their re-use.

Exemplary prerequisites

DIGITALIZATION

Digital infrastructure for tracking individual components of products and infrastructure; provision of sensor technologies.

SUSTAINABILITY

Availability of value chain data; understanding of sustainability key figures.

Exemplary goals

DIGITAL

- ▶ Digital asset management of components.
- ▶ Taking data-driven decisions.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"

(UN 2015)

ECOLOGICAL

- ▶ Increasing the service lives of products and infrastructure.
- ▶ Reducing waste.
- ▶ Ensuring the re-use of resources.

SDG 13

"CLIMATE ACTION"

(UN 2015)

ECONOMIC

- ▶ Cost reduction through efficient use of infrastructure.

SDG 8

"DECENT WORK AND ECONOMIC GROWTH"

(UN 2015)

SDG 9

"INDUSTRY, INNOVATION AND INFRASTRUCTURE"

(UN 2015)

SOCIAL

- ▶ Creating intergenerational equity by reducing resource use.

SDG 10

"REDUCED INEQUALITIES"

(UN 2015)

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"

(UN 2015)

Example: Sustainable building initiative

This initiative demonstrates the potentials of the Industrial Internet of Things for urban construction, using wood as a raw material. Particularly CO₂ emissions and resource consumption in urban construction must be optimized. In the future, AI applications will be used to make data-based decisions based on sustainability criteria regarding building demolition, construction, and renovation. AI could also enable optimal resource procurement. With sufficient data from appropriate forest stands regarding

individual trees' age, size, and quality, targeted felling in the interests of sustainability becomes possible. Digital transformation and sustainable transformation are merged in an efficient and nature-friendly way, leveraging the effects of other transformations.

Takeaway

Seek to base your building projects on data-driven models. However, consider not only the buildings' effectiveness and benefits; let sustainability aspects flow into your decision model.

3. HOW

Business unit: Operations

Consumers are increasingly demanding sustainable products and services. Twin Transformation helps companies to make the manufacturing of products and services sustainable and digital. It also enables the products and services to be designed for sustainably. Relevant Twin Transformation fields of action are:

- ▶ **Resource-centric process optimization**
The digital mapping of processes enables one to allocate emissions, energy consumption, and resources to specific products or services, forming the basis for the optimization of processes through digital technologies.
- ▶ **Green product and service portfolio**



Deep dive: Green product and service portfolio

The radiance of the green product and service portfolio field of action is underpinned by many corporate transformations. A successful example of the shift to a green product portfolio is the conversion of companies that were previously conventional meat producers and now offer meat and meat substitute products in equal measure. This transformation leads to a new external perception of the company, focusing on positive values such as modernity and openness. Similar

transformations can also be found in the service sector. For instance, more and more traditional car rental companies are transforming their conventional service portfolio into digital and sustainability mobility services. Overall, companies should manage which products and services they offer based on sustainability criteria. Digital technologies provide the tools for evaluating the product components or their processing by means of lifecycle analyses, among others.

Exemplary prerequisites

DIGITALIZATION

Assess the lifecycle and value chain of products through the use of digital technologies.

SUSTAINABILITY

Define binding sustainability criteria for products or services.

Exemplary goals

DIGITAL

- ▶ The holistic digital representation of sustainable products or services.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

ECOLOGICAL

- ▶ Sustainable production and supply of products.
- ▶ Extension of products' lifecycles.

SDG 13

"CLIMATE ACTION"
(UN 2015)

ECONOMIC

- ▶ Increased competitiveness.
- ▶ Cost savings through efficient processes.

SDG 8

"DECENT WORK AND ECONOMIC GROWTH"
(UN 2015)

SOCIAL

- ▶ Expansion of partner networks.

SDG 17

"PARTNERSHIPS FOR THE GOALS"
(UN 2015)

Example: Initiatives to promote green products and services from the financial industry

Companies have various options to make their product and service portfolio greener. Examples include initiatives that shift some offerings entirely to sustainable products or services, increasing the promotion of sustainability awareness in the products and services offered, or integrating third-party providers with sustainable products or services into their portfolio. One initiative is increasing

customers' awareness of their carbon footprint. One financial company is calculating the emission factor in 14 categories every month, using transaction data from card payments. These initiatives are examples of how companies can use existing digital technologies and solutions to add sustainability to their products.

Takeaway

Evaluate the possibility of adding sustainability aspects to existing products and services. Analyze which services in the portfolio are incompatible with sustainability transformation. Consider at which point the integration

of third-party services into your portfolio could make sense and when to develop your own services. Consider the market sensitivity regarding greenwashing – don't call something sustainable if this is in fact not the case.

3. HOW

Business unit: Sales and marketing

Digital technologies enable companies to collect and analyze data, creating the basis for communication with the market and avoiding greenwashing. Digital technologies also enable innovative digital and sustainability service offerings, such as renting instead of buying products. Twin Transformation is particularly effective in the following fields of action:

- ▶ **Digital service offering**
Digital technologies enable new sales and service channels, opening new customer groups and breaking down ecological burdens and social barriers. Services can be made available not only locally, but also globally, thereby reducing transaction costs.
- ▶ **Data-driven marketing management**



Deep dive: Data-driven marketing management

A recent study on large corporations' compliance with climate promises found greenwashing in 25 German companies (New Climate Institute, 2022). Social pressure for sustainability is leading consumers to change their purchasing decisions. Thus, it is becoming increasingly important for companies to disclose their sustainability figures transparently and to prepare them for customers in a way that is

appropriate for the target group through data-based marketing. The use of actual company data in marketing can help avoid greenwashing. The combination of increased data transparency and sustainability knowledge can help companies to implement this. Further, existing customers can be retained and new ones won over.

Exemplary prerequisites

DIGITALIZATION

Tracking and allocating emissions to individual products or services.

SUSTAINABILITY

Understanding sustainability metrics.

Ausgewählte Ziele

DIGITAL

- ▶ Increase transparency.
- ▶ Target group-oriented marketing.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION" (UN 2015)

ECOLOGICAL

- ▶ Saving resources.
- ▶ Creating transparency through sustainability indicators.
- ▶ Avoiding greenwashing.

SDG 13

"CLIMATE ACTION" (UN 2015)

ECONOMIC

- ▶ Increased competitiveness.

SDG 8

"DECENT WORK AND ECONOMIC GROWTH" (UN 2015)

SOCIAL

- ▶ Empowering consumers to take considered purchasing decisions.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION" (UN 2015)

Example: A startup from the field of energy transition

Transmission system operators must balance production and consumption. Renewable energies, above all those generated from solar and wind power, are subject to fluctuations; this represents a significant challenge for transmission system operators. This initiative aims to mobilize decentralized flexibility resources, such as privately used electric cars or heat pumps. Based on distributed ledger technology and the Internet of Things, an equilibrium is established in the grid by balancing the supply of the

transmission system operators and the demand of minor flexibility units. Notably, transmission system operators can inform the drivers of electric cars when an ample supply of electricity becomes available on the market and the time to charge the car's battery is therefore favorable. This startup is an impressive example of using digital technology and data to communicate ecological impact to existing customers and of attracting new customer groups through increased transparency.

Takeaway

Try to incorporate both supply and demand information into your production calculations. Use this information advantage to positively influence customer behaviors.

Evaluate other relevant data points in your customers' buying behaviors and constantly expand your data-driven marketing model.

3. HOW

Business unit: Customer service

Digital technologies can help to make both the maintenance and the evaluation of products and services more sustainable, improving them in terms of sustainability criteria. Sensor technologies and communication media are key in Twin Transformation. This can be seen in the two fields of action:

- ▶ **Intelligent evaluation of customer satisfaction**
Evaluating customer opinions is relevant and can be determined through digital technologies and methods such as the Net Promoter Score, helping to adapt products and services regarding customer demands and expectations toward sustainability.
- ▶ **Predictive maintenance**



Deep dive: Predictive maintenance

Predictive maintenance of machines and servers means predicting failures and early maintenance before a possible failure occurs. Many studies (e.g., Nangia et al. 2020) have already shown that emissions (e.g., caused by express deliveries) can be reduced and costs can be lowered through predictive maintenance with digital sensors. The digital

capabilities for predicting machine failures are complemented by sustainability metrics for selecting the best maintenance strategy and evaluating alternatives.

Exemplary prerequisites

DIGITALIZATION

Use of predictive maintenance; a collection of sustainability key figures using sensor technology.

SUSTAINABILITY

Conduct lifecycle analysis; understand sustainability metrics.

Exemplary goals

DIGITAL

- ▶ Selection of the most efficient maintenance strategy based on data.

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

ECOLOGICAL

- ▶ Saving resources.
- ▶ Reduction of CO₂ emissions.

SDG 13

"CLIMATE ACTION"
(UN 2015)

ECONOMIC

- ▶ Increasing competitiveness.
- ▶ Error-avoiding infrastructure use.

SDG 8

"DECENT WORK AND ECONOMIC GROWTH"
(UN 2015)

SDG 9

"INDUSTRY, INNOVATION AND INFRASTRUCTURE"
(UN 2015)

SOCIAL

- ▶ Creating intergenerational equity by reducing resource use.

SDG 10

"REDUCED INEQUALITIES"
(UN 2015)

SDG 12

"RESPONSIBLE CONSUMPTION AND PRODUCTION"
(UN 2015)

Example: An app for predictive maintenance solutions in mechanical engineering

Maintenance work and machine breakdowns are major factors that reduce a production chain's efficiency and therefore result in higher resource usage. A mechanical engineering group has developed an app for the predictive maintenance of mechanical systems. The app makes it possible to collect extensive machine data along the entire production chain; it also makes it possible to evaluate this data so as to establish smart maintenance management. Historical machine data, comparative data of different

machines, live data, and data regarding ecological aspects are used to proactively take AI-supported maintenance decisions. This app for predictive maintenance solution is an example of how digital technologies can optimize the use of resources in a company, making it more sustainable.

Takeaway

Collect as many data as possible in your production process. Use sophisticated machine learning-based models to reliably forecast upcoming maintenance work.

3. HOW

3.2 Leverage effects between the fields of action

A sequential view of the fields of action does not go far enough. As noted, Twin Transformation is characterized by holism and interdisciplinarity. There are links and leverage effects between the various fields of action. The following three fields have a very high leverage effect for the efficient rollout of Twin Transformation: *data transparency and analysis*, *sustainable AI applications*, and *employee training*.

Companies should prioritize these, as they act as transformation muscles for Twin Transformation. They represent an entry point for companies into Twin Transformation, as downstream fields of action are easier to implement once preliminary work has been done. The organizational anchoring of the first two fields of action mentioned in the IT organization illustrates the responsibility of IT management in Twin Transformation. The IT organization can and should drive and steer Twin Transformation with all its might.

We show various dependencies of the fields of action in Figure 4. Each can function as an enabled field of action. For instance, the link between *data transparency and analysis* (enabler) and *sustainable AI applications* (enabled) illustrates that the preparation and provision of data are a prerequisite for the introduction of sustainable AI applications.



Dependencies between Twin Transformation fields of action

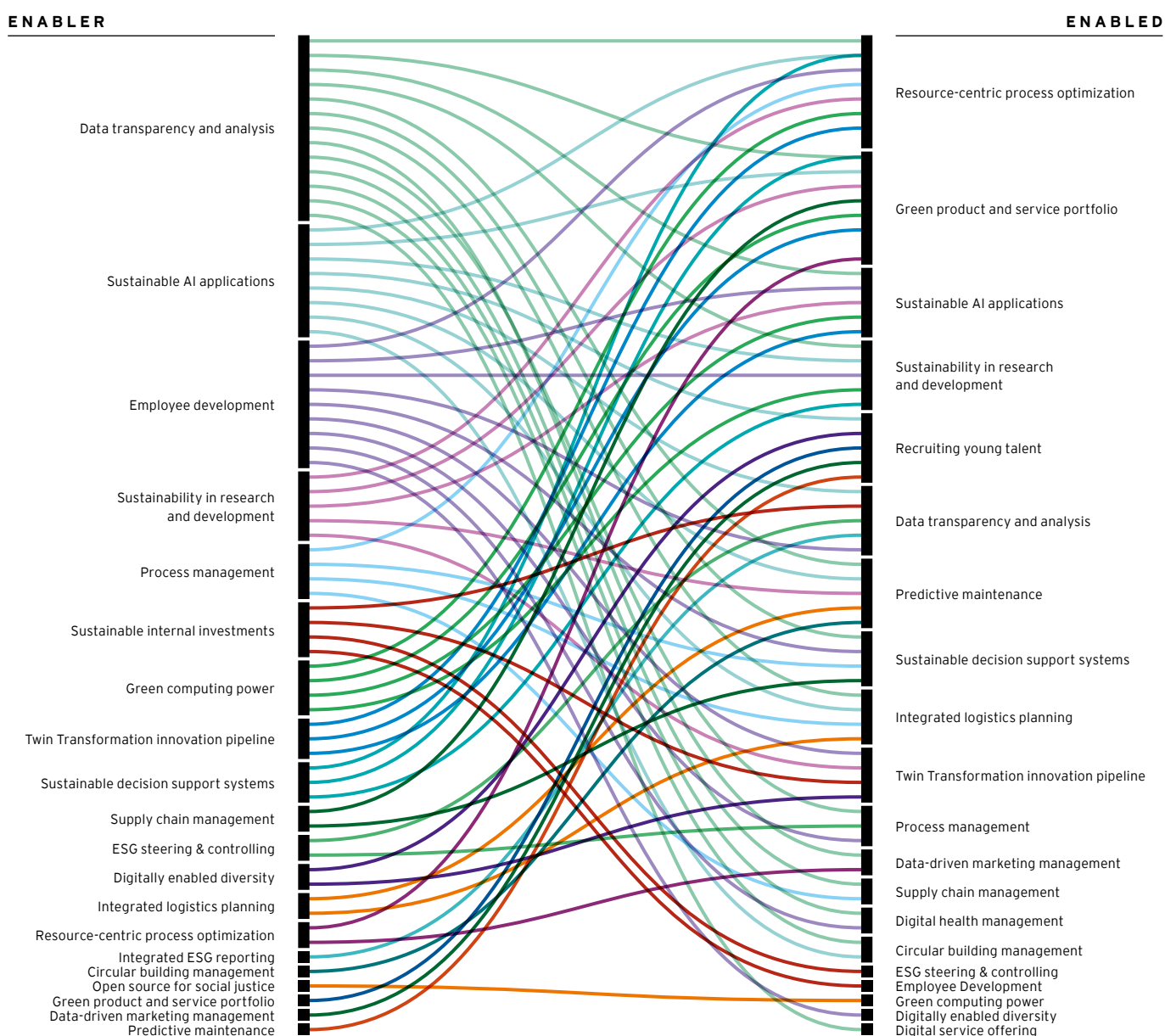


Figure 4

Source: Own illustration

3. HOW

3.3 Digital technologies and their effects on sustainability

Digital technologies have an enormous impact on sustainability. Table 1 summarizes the five most relevant ones in the context of Twin Transformation with great sustainability potential. The targeted use of digital technologies enables companies to solve current problems and significantly accelerates Twin Transformation. When

a company leveres these digital technologies' capabilities, it has a competitive advantage. For the five digital technologies, we show the capability and sustainability potential based on an example.

Overview over relevant digital technologies of Twin Transformation

Digital technology	Its capability/ies	Sustainability potential (examples)		
		Economic	Ecological	Social
Artificial intelligence	Self-learning	Detect fraud	Satellite monitoring of forests	Automatic transcription
Blockchain	Build trust	Currency trading	Supply chain monitoring	Nonfiat currencies
Internet of Things	Capture data and execute actions	Pay-per-use	Real-time emissions detection	Digital monitoring of health status
5G	Increase connectivity	Autonomous driving	The use of drones in agriculture to reduce fertilizer use	Fast Internet connection in rural regions
Robotic process automation	Increase efficiency	Automation of administrative processes	Reduction of emissions in production	Reduction of social barriers

Table 1

Source: Own illustration

LEARNINGS

- ▶ Twin Transformation impacts all essential areas of the company.
- ▶ The corporate culture shapes Twin Transformation.
- ▶ The IT organization and the finance department are catalysts for many Twin Transformation initiatives in the company.
- ▶ Data and their analysis form the foundation for realizing and implementing Twin Transformation.
- ▶ The Twin Transformation Compass guides the holistic and complex transformation.

WHY

WHAT

HOW

REFLEC

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4.

REFLECTION

Previously a voluntary and optional decision by companies, sustainable action is increasingly a societal requirement and a foundation for corporate survival. While sustainability is becoming more urgent, many companies are still struggling with the challenges of digital transformation and the aftermath of the COVID-19 pandemic. They find themselves caught between two major challenges. Companies can turn their transformation toward digitalization and sustainability, which supposedly is a mammoth task, into a real opportunity by initiating targeted Twin Transformation: There are great synergies between digital and sustainability transformation that can be systematically tapped. For instance, digital transformation is a valuable lever for implementing sustainability initiatives, and vice versa.

At the same time, increasing digitalization also has negative sustainability aspects. Digital technologies consume valuable resources, both in production and in use. The use of digital technologies can easily lead to a boomerang effect. Supposed savings through increased efficiency are not achieved through more intensive use of the technologies or more digital technologies; on the contrary, they can lead to an increase in resource consumption. Decisions in the context of Twin Transformation should be thought through, so as to promote the intended, targeted use of digital technologies, and to keep the boomerang effect as small as possible.

Twin Transformation trains the firm's transformation muscles

At first glance, the notion of a twofold transformation in the form of Twin Transformation can seem elaborate and opaque. This is why we developed the Twin Transformation Compass. IT connects existing areas in companies with fields of action in Twin Transformation and serves as a guide. The identified fields are a key starting point for Twin Transformation, but cannot be considered independently. The IT fields of action are an enabler for fields of action in other areas of the company, catalyzing Twin Transformation. IT managers should be aware of this influence and should spearhead Twin Transformation.

4. REFLECTION

The digital and sustainability transformations will not be the only transformations in the coming years. A multitude of transformational forces will impact on companies (see Figure 5). These include the ever-increasing number of IT attacks (cybersecurity transformation) or the shift toward agile ways of working to increase productivity (agile transformation). These various transformations require a cultural transformation that also encompasses the dynamic demands of new generations of employees. Cultural transformation is the foundation for further transformation projects. Thus, companies are in a constant state of change, which is no longer linear, with one transformation project after another, but is very dynamic owing to parallel transformation projects with sometimes divergent goals.

The multitude of transformations and challenges can lead to problems in companies. The successful completion of a transformation gives a company certain capabilities – hard and soft skills – that train the transformation muscles and thus promote further successful transformations. These include agile working methods, project management structures, elaborate reporting and transparency standards, skills in restructuring, change management, and communication. Soft skills such as the creation of a working culture that is conducive to change are essential since transformation projects are always accompanied by far-reaching changes for all employees.

Representation of multi-transformations

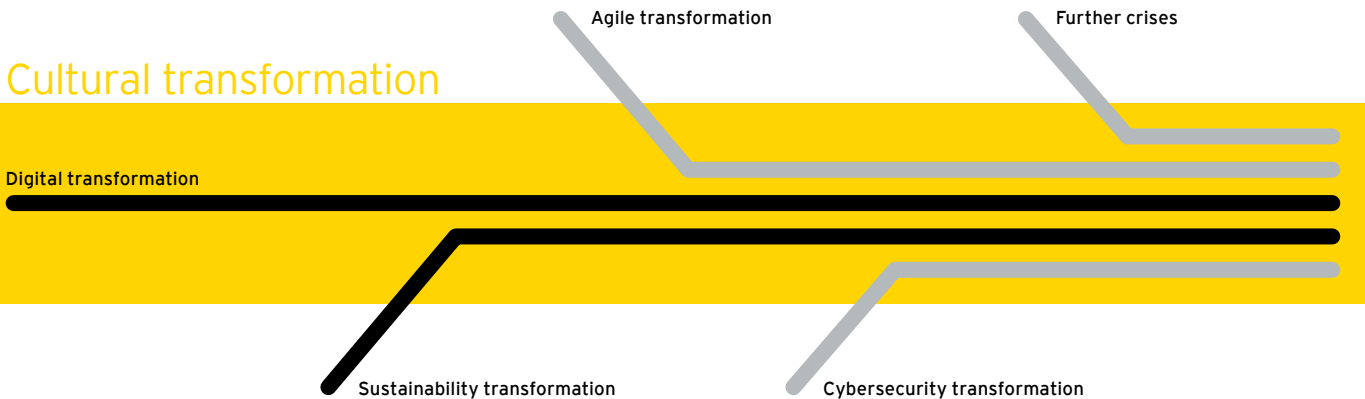


Figure 5

Source: Own illustration

Even if digital technologies are the central component of digital transformation, people ultimately have decisive influences on their use and success. Accordingly, companies must create a culture that welcomes and embraces change and thought leadership, where regular performance reviews and feedback are seen as potentials for improvement, and where challenges and new tasks are linked to personal growth. This culture is shaped mainly by managers

and the way they model these values. Employee training is a crucial success factor. If companies in Twin Transformation work their transformation muscles and culture, they will be more resilient and confident in future transformations. Companies with strong transformation muscles learn to combine and synergize the goals of several transformations in the future.

How we can help

Building on the action areas identified in the Twin Transformation Compass, companies face various issues, including:

- ▶ How do I develop a Twin Transformation target picture and a Twin Transformation strategy?
- ▶ How do I determine my company's maturity level regarding Twin Transformation?
- ▶ Which Twin Transformation field(s) of action should I start with?
- ▶ How do I approach the Twin Transformation fields of action in IT?
- ▶ How do I prioritize Twin Transformation initiatives?
- ▶ How do I implement Twin Transformation initiatives in a targeted way?
- ▶ How do I measure the success of my Twin Transformation?

We – EY and Fraunhofer FIT's Branch Business & Information Systems Engineering – would be happy to support your company with our wealth of experience in digital transformation and sustainability transformation and our knowledge of Twin Transformation.

Specifically, we would be happy to help you create a Twin Transformation strategy for your company. For instance, we can help you select and prioritize areas for action using the Twin Transformation Compass. We can also work with you to develop concrete initiatives to ignite Twin Transformation, and we can support you by accompanying Twin Transformation with a sophisticated communication strategy and by measuring its success.

Feel free to contact us ...



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