CHAPTER 6

Lessons Learned and Future Perspectives

The final chapter of this book contains three parts. The first part serves as an «executive summary», in which the authors outline key findings from the interviews. This part may be particularly useful for readers with a limited amount of time available, such as middle managers or top executives. The second part builds on the same framework but enriches and expands each finding and legitimizes it with excerpts from the interviews. The third part provides an outlook on digital technologies, and how organizations and society will cope with the challenge of digital transformation in the future.

As introduced at the end of Part 1, the book uses the meta-analysis of 18 digital transformation frameworks Bumann and Peter (2019) to identify six dimensions or «action fields» that are applied most frequently in the scholarly (and grey) literature. They encompass the areas of technology, culture, strategy, organization, customers, and people/employees.

Based on the qualitative findings and corporate narratives of the interviews, the authors have identified three clusters within this framework. The first cluster focuses on the category «technology», because the novelty of algorithms and software tools represents a challenge related to the fact that business units scarcely have obtained experience with this type of disruptive innovation and are confronted with a technology that may exceed their organizational capabilities.

The second cluster, comprising «strategy and organization,» refers to the upper levels of the Strategy Pyramid, by which companies define their approaches to digital innovations and restructure their organizations accordingly.

The third cluster identifies «culture, people and customers» as one of the most challenging hurdles, with deeply engrained routines and leadership styles from top management that may delay or prevent successfully leveraging digital innovations.

How to cite this book chapter:
Burger, C. and Weinmann, J. 2024. *Leveraging Digital Innovation: Lessons for Implementation.* Pp. 93–120. London: Ubiquity Press. DOI: https://doi.org/10.5334/bda.f.

Practitioners' summary: A digital innovation roadmap

The academic literature on digital transformation provides extensive analyses on the occurrence of certain topics and the «What?» (see e.g. Nadkarni & Prügl, 2021; Reis & Melão, 2023), but they often lack the practitioner's perspective tackling the question of «How?».

The intention of collecting the narratives of this book is exactly the «How?» – how can the process of implementing and leveraging digital innovations be successfully managed?

Based on the three clusters «Technology», «Strategy & Organization» and «Culture, People & Customers», the following graph sketches a roadmap and checklist for executives when they embark on the process of implementing a disruptive digital technology.

In the subsequent overview, the authors outline in sequential order the topics that the interviewees of this book portrayed as essential for their respective implementation:

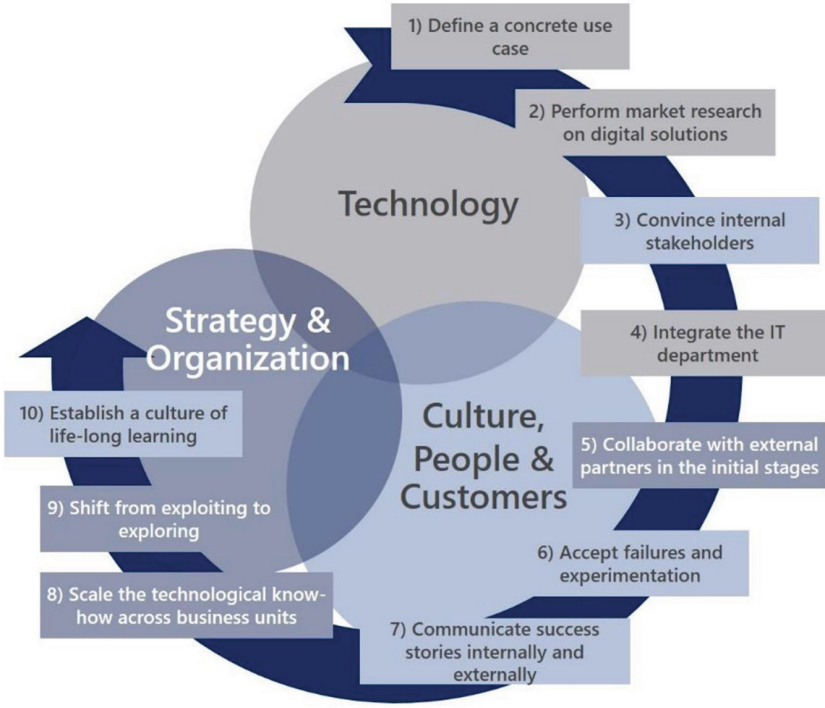

Figure 11: Digital innovation roadmap.
Source: Own illustration.

1) ***Define a concrete use case:*** Even more important is that the choice of technology is a compelling use case that justifies the effort. This can be either a concrete process optimization task, or a new business opportunity that requires an untested technological solution.
2) ***Perform market research on digital solutions:*** Instead of being fixated on specific digital technologies, the interviewees of this book appear to be agnostic towards the choice of the technology, as long as it serves the purpose as defined in the use case. In some of the best practice examples, conventional data analytics may suffice even if more sophisticated solutions, such as AI algorithms, sound more appealing and marketable.
3) ***Convince internal stakeholders:*** The buy-in within the organization requires communication skills, a solid, strategic network of like-minded peers, and patience. Various stakeholder groups must be managed effectively, especially top management, ensuring alignment with the strategic priorities of the organization. A further important stakeholder group are domain experts who are essential for the success in providing their specific knowledge to the project.
4) ***Integrate the IT department:*** Any disruptive digital technology is embedded in the larger operating system and has multiple interconnections with the legacy IT infrastructure. Representatives of the classical IT department remain essential in the facilitation and provision of resources, the implementation process, and the roll-out.
5) ***Collaborate with external partners:*** During the initial stages of the implementation, collaboration with academics, specialized consultancies or startups enables a head start with quick wins. In later stages, the organization can choose whether to build up internal expertise or remain in a mutually beneficial innovation ecosystem.
6) ***Accept failures and experimentation:*** Launching a disruptive digital technology always entails the risk of failure. A corporate culture that lacks psychological safety and the possibility of reporting errors is prone to stagnation or longer-term decline, also touching upon cultural topics, such as a «fail-forward» mentality and the promotion of a more entrepreneurial mindset.
7) ***Communicate success stories internally and externally:*** «Quick Wins» have an important psychological effect, both within the exploration team and the wider corporate audience, in particular the marketing and sales departments eager to position innovative content on social media platforms. In addition, a clear communication strategy may have a positive impact in terms of endowment and resources for the project, but may also serve as a role model for other departments within the corporation.
8) ***Scale the technological know-how across business units:*** Buying in know-how from outside providers may be a valid strategy in the initial stages of a project, but the longer-term objective of many interviewees

for these best practice cases seems to be an internal solution, building up proprietary algorithms and in-house expertise. This can materialize either via dedicated competence centers and technology ambassadors, the integration of externals within business units, or as a connected but legally separate organizational entity.

9) ***Shift from exploiting to exploring:*** Many projects described in this book started off as pragmatic tools for process optimization and enhanced operational efficiency, but they ended up as new business lines to be launched externally, thereby becoming new pillars of growth for the company.
10) ***Establish a culture of life-long learning:*** Transformations interfere with many established processes and may induce digital anxiety. Communication of adaptive changes is at the core of the cultural shift, inducing a sense of urgency and building on psychological phenomena such as loss aversion. Organizations must take all internal stakeholder groups into consideration, especially top management and domain experts, as well as their sales units, and important external customers.

This roadmap is not a guarantor for success. However, it builds on the cumulated experience of successful agents of change. As guiding principles derived from corporate experience, the next section of this book offers the possibility to delve directly into the testimonials of the interviewees, following the three clusters «Technology», «Strategy & Organization» and «Culture, People & Customers».

Technology

In the larger context of digital transformation, two contrasting approaches to technologies or, more precisely, information and data-processing technologies can be observed:

In the first approach, they are considered a necessary prerequisite but rather in a secondary, subsequent role – selected after a managerial, top-down decision process that defines the overarching strategic goals, such as outcome-based servitization, platform economy, or customer focus, as formulated in an exemplary way by German chemical company Henkel (2022).

The second approach towards technologies can be characterized imitation and strategic «Bandwagoning.» Bandwagoning is a typical phenomenon of corporations in situations of uncertainty, according to DiMaggio and Powell in their seminal paper on institutional isomorphism (1983). As digital transformation overthrows many established business practices and routines, it seems rational that organizations observe and imitate the activities of their competitors, they «follow the herd» with the intention to compensate their informational disadvantage vis-à-vis other companies they consider innovators and pioneers in their respective industry verticals. However, implementing a digital technology primarily because other organizations do it, or – even worse – just

for the sake of marketing purposes, as it happened for example during the Blockchain hype in some companies in the mid-2010s, typically does not lead to a competitive advantage or lasting economic success, especially when a technology is still in the stage of initial diversity with no dominant design having emerged yet.

Our interviews reveal, though, that a thorough understanding of digital technologies, their capabilities and limitations, can serve as a strategic trigger for internal process optimization or external business opportunities. Most importantly, discussing and defining a precise use case prior to the launch of any disruptive digital technology yields concrete, quantifiable results that can spearhead a larger, company-wide implementation, as the next section explains in greater detail.

Defining a concrete use case

Across all interviews, a recurring pattern suggests that a practical application of the digital technology is at the core of a successful implementation strategy. It can be observed that defining a plausible use case is the necessary precondition to get approval by key stakeholders in the organization. Given a larger portfolio of potential use cases, a focus on those that yield benefits quickly appears to be the most promising pathway. For example in the choice of RPA use cases, Stefan Weih from Allianz comments: «We started with projects that promised an early win.»

More concretely, the best practice cases of this book show that disruptive digital technologies are most likely to find corporate approval and get successfully implemented if the use case is clearly defined and corresponds to at least one of the following two objectives,

- either a concrete process optimization task,
- or a new business opportunity that requires an untested technological solution.

These two options correspond to our findings in the poll on the implementation of digital technologies, as presented in the introductory chapter.

In the first type of use case, a business unit faces a challenge that could be resolved with a hands-on, often quick-win implementation of, say, an algorithm. A typical example would be RWE's Forecast Combination Model (case 4). Increasing the precision of short-term weather predictions for renewable electricity generation assets has the advantage that – when operational – it immediately yields higher returns by reducing forecast errors. Thus, the use case becomes obvious to internal stakeholders. Given the frequency of the application, the model can be refined and improved, thereby contributing more generically to an effective risk mitigation strategy.

The second type of use cases concerns an extension of a company's portfolio of products or services, catering for adjacent or completely new

and disruptive markets with the support of digital technology. Uniper's move towards a Blockchain solution serves as an example for this motivation (case 8). Coming from conventional bulk natural gas trading, which involves big volumes in a low-margin commodity business and has been characterized by extensive manual and paper-based transactions in the past, the energy mid-stream company wanted to enter the market of small-scale liquefied natural gas (LNG): «There, decentralization, dis-intermediation, customer orientation, and flexible, small batches of molecules will be the future.» (Shevchenko, case 8) The complexity of transactions and coordination of actors involved in the value chain would not have been cost-effective with the conventional approach, so Uniper turned towards a Distributed Ledger Technology to reduce process costs via digitalization to tap into a new, more complex gas supply market segment.

The more a use case becomes ambitious by affecting or transforming the fundamental business model of the company, the more it may be perceived as a potential threat to some internal stakeholder groups. Christopher Kränzler, CEO of Berlin-based startup Lengoo, explains that a cautious approach may yield greater benefits than a far-reaching attempt to fundamentally overhaul the IT back-end: «I would advise everyone, who plans to get into machine learning, to never start implementing it in their core process, but in a peripheral process first. Winning acceptance for a technology is a fundamental success factor, and it is a lot easier to achieve this if you start with a process that is not essential to the user's everyday performance but ultimately has a positive impact on them.» (Kränzler, case 6)

The selection of the appropriate digital technology can be seen as a process of convergence between its evolving technical capabilities and the management know-how to connect them to relevant use cases. For example, the initial Blockchain and Distributed Ledger Technologies were fairly limited in terms of transactions per second and the respective complexity of the transactions, while being hampered by a relatively high energy consumption per transaction. Over the last years, new DLTs have been developed that tackle all three initial deficits, hence making DLTs more attractive for use cases. After four years of preparation, even the second-most highly valued DLT Ethereum succeeded in moving to the faster and more energy-saving proof-of-stake consensus mechanism (Chipolina, 2022).

Performing market research on digital solutions open to all technologies

In the best-practice cases of this book, corporate decision-makers appear to be agnostic towards the choice of the technology, if it serves the purpose as defined in the use case. The example of Chargeurs highlights this approach (case 9): «From a technical standpoint, the division's main objective was to find a technology that allowed its teams, partners, and customers to easily and securely share data. […] Of course, adapting a new technology can be

risky; it lacks maturity, and the success stories as to its implementation are still rare. However, since Blockchain was the only technology to satisfy the division's requirements, Chargeurs Luxury Materials went for it. If it worked, the strategic and organizational benefits would be high. […] With the help of Blockchain, Chargeurs Luxury Materials has been able to observe, for instance, if the weight of goods that have been received is the same as the weight of goods that have been shipped. If not, the system will automatically generate a notification and thus serve as a prevention of fraud as well.»

Another pragmatic approach is exemplified by Allianz (case 2). By implementing RPA, the company found a solution to how to deal with legacy IT: «RPA, by its nature, and being independent of the underlying systems, delivered what we were looking for. It was quite handy and fast to deploy. We also use it as a bridging technology to new systems. It bridges between the new target solution and the legacy systems; not only for pure data migration, but also to maintain the process in the time of transition.»

The agnostic approach to assessing all available options seems to be more promising than a predetermined focus on one technology – an observation that is equally true for the choice of potential partners for the implementation, as highlighted in the in the section on business strategies in this chapter.

Integrating the IT department

Another observation derived from the interviews relates to the integration of the new technologies into the IT legacy system. In particular, seamless access to existing data silos and warehouses is crucial for the success of a disruptive digital technology, as it is embedded in the larger operating system and has multiple interconnections and Application Programming Interfaces (APIs) with the front-end or back-end capabilities of the IT infrastructure.

A key role in this integration is played by the traditional IT department. Its changing role over the last decades may have been «a troubled one» in the overall context of organizations, as Ward and Peppard (1996) observe. It can be differentiated chronologically into three different phases. In the first phase, the perception of IT department could be coined «priesthood,» according to Peppard (2021), with all required knowledge to be located in the IT unit and the CIO as a functional manager. Following Peppard's characterization, the second phase in the perception of the IT department rather focused on its service functionalities and «partnership», with the objective of understanding business requirements as a vital ingredient of an organization's physical and informational infrastructure and the CIO as a «boundary spanner.»

Since awareness of the importance of digital transformation has steeply increased over the last five to ten years, the third phase of the IT department's changing role is characterized by a more pro-active integration into a company's strategy formulation and implementation, with the CIO as an «orchestrator» and the objective to «optimize opportunity from technology» (ibid.). The most visible

indicator for this increasing appreciation of data, analytics and communication issues is the emergence of a Chief Digital Officer (CDO) in the C-suite of especially larger corporations (Haffke, Kalgovas, & Benlian, 2016; Horlacher, 2016). Many of them have opted to allocate the task of accelerating digitalization and become «Digital Evanglist» or «Digital Advocate» – hence, one important future pillar of growth – to the CDO (Haffke et al., 2016), whereas traditional CIOs in this division of responsibilities rather have to deal with the complex objective to maintain legacy IT systems, ensure day-to-day operability and cybersecurity. Haffke et al. (2016) describe the separation of roles as an attempt to resolve the dilemma of ambidexterity that CIOs were previously facing. Some organizations, such as German chemical company Henkel, have returned to a unified solution by merging the two roles into a «CDIO» (König, 2021).

Throughout the cases in our book, though, the classical IT department remains essential in the facilitation and provision of resources and in the implementation process. This collaboration can materialize in facilitating access to existing data warehouses or the company's data lake, for example in the case of RWE's forecasting model for wind farms, as Dominik Felske (case 4) explains: «Since our model required the handling of huge amounts of real-time data, we collaborated with our IT department. They are responsible to maintain and organize our assets and have all the data available from the various wind farms, but the software, or the tool itself was developed by us.»

In the case of implementing AI at business school Saint Paul (case 5), the CIO personally joined the internal implementation team to ensure a seamless integration of the new functionality into the existing IT system using application programming interfaces (APIs).

Uniper's team to implement a Blockchain solution for LNG trading included not only Wipro as the external IT/Blockchain architect and consultant, but also the internal Uniper IT (case 8): «The in-house IT expertise at Uniper was an advantage so that all three partners were on the same page when working together,» Grigory Shevchenko from Uniper comments. «IT was excited to implement Blockchain. The major hurdle was that the legacy systems seemed just too stable to change. But once Blockchain was implemented, people were happy with it.»

The cases in this book are derived from anecdotal evidence, but they consistently highlight the role the IT department plays in the process of digital transformation. Its integration at an early stage of the implementation process is an important lever for the success of the overall project.

Strategy & Organization

The topics of strategy and organization are closely intertwined, as our interviews suggest, since all top-down strategic decisions must find their equivalent organizational reconfiguration to be successfully realized.

The academic and grey literature distinguishes between early adopters – or market leaders – and market followers (see e.g., Ismail, Khater, & Zaki, 2017). Our analysis reveals that also traditional companies, such as Berner Kantonalbank in Switzerland (case 10), manage to introduce lighthouses of radical digital innovation within selected business units acting as sandboxes and pockets of innovation within the organization. However, even if there is a decisive corporate vision from top management to become more digitally savvy, it still depends on individual agency and empowerment to establish the organizational prerequisites for an in-house digital venture.

Based on our interviews, a model of organizational ambidexterity (O Reilly & Tushman, 2004) has been observed to facilitate the implementation of disruptive digital technologies: Some teams act as «explorers» or corporate startups that are allowed to experiment, lose money (at least over a certain time span), fail and learn, whereas other units would simply «exploit» existing processes with only cautious and incremental steps of digital innovation (Osterwalder, Pigneur, Smith, & Etiemble, 2020). The best practice cases of this book span the entire spectrum of potential implementation strategies: First, developing an in-house solution, for example Turkcell in case 3 and RWE in cases 1 and 4 (albeit often with initial support of external consultants, academics, or IT specialists); second, establishing an ambidextrous organization, such as business school Saint Paul in Brazil (case 5); third, tapping into the wider innovation ecosystem via alliances and partnerships with long-standing external partners, like the Swiss Innofactory (case 10). All three approaches represented in the sample suggest that no «silver bullet» strategy exists, but each implementation challenge must be customized to the organizational context, the strategic intent, corporate culture, and digital expertise within the firm.

Notwithstanding, the interviews provide insights on three key questions during the different phases of the process of organizational implementation. Chronologically starting with the initiation, the first operational question relates to the options presented above, namely, whether new capabilities should be established in-house, or whether it yields faster results to team up with an external partner. Scaling the new technological capabilities across silos and business units is the next organizational question: How can a successful roll-out be secured? The third question relates to the move from internal process optimization to business model transformation and digital innovations that are exported beyond the organizational boundaries.

Collaborating with external partners

Should disruptive digital technology be established in-house, should a ready-made Software-as-a-Service solution be acquired externally, or should a long-term collaboration with an external partner be launched? Should the

organization strive for a unique solution customized to its needs, or should a larger yet less flexible consortium structure be joined?

The interviews with the practitioners reveal several trade-offs between the differing strategies. In case 4, the meteorological prognosis model, Dominik Felske of energy company RWE explains that off-the-shelf solutions are the conventional approach followed by many players in the industry: «When it comes to forecasting for utilities, you are always faced with the question whether you want to do it internally or externally. Most utilities come to the conclusion that in-house forecasting means high fixed costs. External forecasts are cheap. It makes more sense to buy them, find out how best to combine them and benchmark them against each other.» RWE decided to hire a Master's student from the University of Duisburg-Essen: «In his thesis, he developed a concept how to apply AI to choose the best forecasts by combining different forecasts – a concept we refined with him. After that he started to test his concept and implemented it in a monitoring tool.»

An approach often encountered in the cases of this book is the collaboration with academic institutions. In the other case of RWE (case 1), the company's representatives met several times with a professor, whose research area is the connection of the energy market and Artificial Intelligence, to receive state-of-the-art input. For their auction model, they launched an MBA project together with Berlin-based business school ESMT: «We used one of the student projects of ESMT to kick-start this initiative and build up our database. We had five MBA students working on the topic for six to eight weeks. We employed them for conceptualization, but also to build up a first, Excel-based model.» In a second step, RWE hired external experts and brought them together with their commercial domain experts and IT staff to develop and calibrate the tool and turn it into a format which allows people to comfortably use it.

At Turkcell, the implementation of RPA in business processes was steered and coordinated by an internal group specifically created for this purpose, yet accompanied by an outside consulting firm (case 3): «For the implementation process we used internal and external resources, including support from EY [an international consultancy]. At that time, we still needed to discover our roles and responsibilities. What should we do to construct the necessary infrastructure? How should we train our employees to expand RPA and how would we benefit from this technology? So we created a small organizational development team with people from different departments – from IT, Board of Directors' office, HR, Network Technologies – plus the external EY consultant. Our next step will be to hire a number of RPA developers.»

Buying in expertise from outside providers may be a valid short-term strategy, especially for sophisticated technologies, such as Blockchain. Energy midstream company Uniper, for example, used the expertise of a specialized consultancy for small-scale trading transactions based on a Distributed Ledger (case 8): «For the implementation process we used internal and external resources. That included us, Uniper IT, and Wipro as the external IT/Blockchain architect and consultant.»

São Paulo-based business school Saint Paul teamed up with IBM Watson to train it's AI-based student assistant «Paul,» using large parts of IBM's language recognition system – instead of developing its own customized language recognition algorithm (case 5): «We needed total confidentiality. We were developing an algorithm. Not developing from scratch, but customizing an algorithm with IBM. Bruna and I are professionals in business, education, and finance, therefore, we needed the help of IBM professionals.» However, they faced the challenge that Watson's mastery of the Portuguese language was less sophisticated than for English, so «Paul» cannot respond verbally and acoustically, but only as a chatbot.

Like Saint Paul, Stefan Sellschopp of Allianz envisaged a long-term partnership with a deep tech startup rather than a short-term consultancy service (case 7): «Autonomous driving is still new, and we are suffering from a lack of experience, which makes it hard to evaluate risk. Therefore, I contacted Peregrine Technologies. The idea was to understand traffic situations and the many ways they can change. […] We had to be able to automatically detect changes and judge the risks involved. […] With the help of Peregrine, we are able to solve these problems. […] Currently, we are in the process of turning our knowledge into a product, which we will offer to our customers from the autonomous vehicles side.»

The advantages of teaming up with an external partner range from speed of implementation or lack of internal expertise to becoming part of a mutually beneficial innovation ecosystem. Of course, they also bear the danger that solutions become too expensive or are cut out of a company's existing value creation. As data becomes the «New Oil» in tomorrow's economies, collaborations with outside partners especially in data analytics and AI may deprive companies of future sources of revenues and pillars of growth. In 2022, this phenomenon could be observed, for example, in the automotive industry, with some manufacturers like Volvo opting for Google's Android-powered infotainment system while others like the Volkswagen Group try to establish their own operating software called Cariad (Ruhkamp, 2022; Steinschaden, 2021).

Scaling the technological know-how across business units

Buying in know-how from outside providers may be a valid strategy in the initial stages of a project, but the longer-term objective of many representatives interviewed for these best practice cases seems to be an internal solution, building up proprietary algorithms and in-house expertise. The succeeding phase of the internal roll-out processes raises the question of how to scale the technology within the organization.

For example, Stefan Weih of Allianz explains his unit's strategy with respect to RPA (case 2): «While we relied on external consultants in the beginning to speed up our learning and to leverage experiences from other industries, we aimed for transferring knowledge and training people on automating

applications. Luckily, or you might say due to the character of this technology, within an intense one to two-week training, you achieve a lot if you have the right skilled people that you feed into such a training program.»

As highlighted in the section on technology, the IT department remains essential – also in the long-term implementation of many digital technologies, as in the case of better weather forecasting tools at RWE (case 4).

Innofactory made sure to have domain experts on board (case 10): «Around the second sprint, we decided that we had to bring all the 'product guys' into the project. They had to understand what we were doing in order for them to write a product description. By bringing in people and informing them early on in the project allows them to help you make a good product that will be accepted by the customers.»

From his experience as a provider of AI-based language translation technology for many corporate customers, Christopher Kränzler emphasizes the role of cross-silo communication (case 6): «We spoke to companies that develop machine learning applications and to companies that have successfully integrated machine learning into their business processes. That was the most important factor: Integrating machine learning into your entire business, not just within your IT team.»

Should a bottom-up approach be steered towards an own organizational unit? Our interviews suggest that there is no one-size-fits-all solution, but this decision rather depends on the context and the scope of the technology. In the case of RWE, the team opted for an integrated solution (case 4): «We never established a dedicated organizational unit. We brought our student in, who started in my team as an external analyst. By now he is fully integrated in our team. I think you should always incorporate the person who developed a model into your operational processes.»

By contrast, companies such as Allianz and Turkcell pursue the strategy to establish digital competence centers, which act as independent service units of experts who support different departments within the organization. They are complemented by selected domain experts that act as multiplier within individual business units.

In the case of RPA at Allianz, Stefan Weih describes the various stages of this process in the following way (case 2): «Concerning the organization, we relied for the pilots and the roll out on external resources to speed up the whole process. Right after the pilots, it became less and less. At the same time, we established a central competence center, which for some core application was in charge of the RPA bots used across a wider range of business units/countries, and which could help the more remote business units with expertise on certain use cases.» Their competence center did not have a physical location, but was set up online: «Building up this community of now more than 80 developers around the globe in that space was very interesting to see because we were actively managing the community. In the beginning, and now it's kind of running itself because they reach out to each other asking for help.»

After having bundled its RPA expertise in a Center of Excellence, Turkcell deploys the unit to educate technology ambassadors (case 3): «We [i.e., the Center of Excellence] determine ‹RPA champions› and train them so that they introduce RPA in their departments. Right now, we have more than 30 RPA champions in five departments, namely finance, supply chain management, HR, and network technology.»

Under certain conditions, though, the new technology faces cultural or administrative obstacles to be seamlessly integrated into the existing organization. For example, Brazilian business school Saint Paul chose a model of ambidexterity for the organizational implementation, setting up a new business called «LIT» that was completely detached from the business school itself (case 5): «At that time AI was available as a SaaS (Software-as-a-Service) model, thus we decided to found the digital platform LIT as a startup. […] LIT still provides its services to Saint Paul, and vice versa, but people now either work for LIT or Saint Paul. We needed to do that since the philosophy of LIT and Saint Paul differs. Saint Paul is a traditional business school, whereas a learning platform such as LIT is a disruptive element. It is based on AI, which needs a large number of interactions and A/B testing. In addition, it is a subscription service. These concepts cannot be applied to Saint Paul.» Even though there are many interlinkages between the two entities, Saint Paul's implementation strategy found approval among the workforce: «Most of our employees supported us when we trained and retrained Paul. They helped us to map different ways of asking the same question. They were our first users and our primary source of testing. And they saw and appreciated the results. Nevertheless, we decided to separate the operations. We could not have the same people working for both, the philosophy and the culture of the two are too different.»

Shifting from exploiting to exploring

Any implementation of a new digital technology entails an element of disruption. However, using digital technologies for process automation – in particular, cost-saving and efficiency gains – are a fundamental prerequisite to sustain a competitive advantage in the marketplace. Following a stepwise model of digital transformation (see Peppard, 2021), they are a means of process innovation, or «incremental innovation.» Already in 2012, US retail platform Amazon, for example, acquired a startup that provided the technology to incrementally replace humans by robots in its warehouses to collect the orders of their clients (Del Rey, 2019). Efficiency gains achieved by that type of automation are fundamental to maintaining a leading market position, but they do not alter or extend the business model of the company.

By contrast, when an assessment of internal know-how and technological capabilities leads to the conclusion that a fundamentally different business line could be built on top and be launched externally, it may become a new pillar of

growth for the company. Again, we revert to Amazon as a company that – over the process of revamping its digital infrastructure – realized that it had all foundations to establish an innovation platform on top of the existing cloud storage space it provided in data centers to its corporate clients. This became the starting point of Amazon Web Services (AWS), which turned out to be a significant and highly profitable line of business after the launch of AWS's predecessor in 2006 (Miller, 2016).

A similar pattern can be detected in our best practice case on Turkcell's implementation of RPA. After an assessment of the commercial RPA solutions that were available in the market, the Turkish telecommunications company decided to write the RPA code by themselves, calling it Ghost (case 3): «In the future Ghost may be one of the RPA tools globally available.»

French company Chargeurs confirms this observation, in which their business unit of Luxury Materials was able to attract new customers (case 9): «Luxury Materials decided to use Blockchain because this technology provided a value proposition for its customers. In the fashion industry it was thus the first company to offer end-to-end traceability. Due to this competitive advantage, the division gained new customers. In addition, it improved its standing in the fashion industry.»

Mark Chardonnens of Innofactory has similar plans (case 10): «For the next step, we want to open the marketplace. At the moment, you have to be a customer of the Berner Kantonalbank if you want to trade something on the marketplace. We also plan to open it up to third banks to bring their orders to the marketplace. We also want to make advances with respect to cryptocurrencies.» This announcement materialized, for example, when the bank joined other Swiss banks UBS, Credit Suisse, and Zürcher Kantonalbank to become a member of the Blockchain-based Central Securities Depository (CSD), operated by Swiss exchange SDX (Ledger Insights, 2022).

Culture, People & Customers

Out of the six major dimensions that characterize digital transformation frameworks, culture scores the highest (Bumann & Peter, 2019). This seems plausible, as «culture eats strategy for breakfast,» according to famous business science scholar Peter Drucker (Engel, 2018). The underlying prerequisite for digitally transforming an organization might be information technology, but the success of its implementation ultimately depends on the authenticity of top management to propagate new routines and practices among employees, and their respective willingness and curiosity to experiment with new apps, processes, and computing languages. Corporate culture has manifold manifestations, such as communication routines and terminology, behavioral standards and norms in human interaction, unspoken values and belief systems that create a sense of belonging and collective identity. People are the carriers, multipliers

and preservers of these corporate practices, and hence, they are the ones that can also change them.

However, no organization is a monolithic block with a uniform attitude towards digital technologies, nor homogeneous in the capabilities and ambitions of its workforce. The interviews reveal that often single business units – or even just individuals – get attracted to the opportunities disruptive digital technologies may offer, but they typically engage in smart stakeholder management to assemble a critical mass of supporters.

Convincing internal stakeholders is a necessary first step to implement disruptive digital technologies, irrespective of the hierarchical position and relative power of each corporate disruptor – even the CEO. Middle managers typically face a complex «sandwich» position, having to convince both their teams and their superiors of the commercial and technical validity of a proposed venture.

A key insight from the interviews relates to the ups and downs of the initial attempts to get acquainted with the technology and the definition of a relevant use case. From proof-of-concept to minimum viable product and to a prototype that can be tested, refined, and validated, teams may enter a psychologically stressful period of trial and error. Especially in companies with a strong engineering culture, in high-reliability organizations or in utilities ensuring critical infrastructure services, establishing a «fail-forward» mentality that encourages disclosing, discussing, and learning from errors may prove to be diametrically opposed to existing behavioral norms, attitudes and status systems. In any organization, though, internal marketing and the communication of early success stories across organizational boundaries increases acceptance within the workforce and approval from top management.

A further observation from the interviews is related to the challenge of how to maintain the momentum of change and establish a culture of life-long learning in the workforce. Particularly in information and communication technologies, innovation cycles have accelerated. Software expertise has an expiry date. New programming tools and computer languages appear in shorter intervals, but also strategic and managerial decisions must be taken, for example related to the cloud and external web services, cybersecurity, data protection regulation, or the combination of databases in warehouses and data lakes.

The interviews suggest that the implementation of disruptive digital technologies affects four major stakeholder groups in different ways. The first group consists of data scientists and data engineers. Typically, they are well-trained and specialized in their programming skillset, often with an IT background but without domain knowledge. The second group are domain experts, proven specialists in their field but without sophisticated programming skills. The third group are «knowledge managers» – executives who do not have to do the programming themselves, but who are either intrinsically or extrinsically motivated to gain a deeper understanding of the data technologies. They face the task of facilitating the communication between data scientists and domain experts, of strategically implementing and steering the process. For some of

them, the continuous adaptation to new data-related challenges may not be perceived as an opportunity but rather as source of acute stress, and be accompanied, more generically, by «digital anxiety» as a psychological overburdening that may negatively affect the knowledge manager's performance (Korotov & Sack, 2019). How to train and develop these groups to prepare for digital transformation has become a key question at business schools and in executive education trainings.

While internal users of the disruptive digital technologies often are domain experts, the fourth stakeholder group are external customers. They must be convinced of the benefits of getting acquainted with an unfamiliar functionality and trained in using it.

The following sub-sections highlight the interviews' insights on how managing different stakeholder groups is essential for the lasting success of a disruptive digital transformation project.

Convincing internal stakeholders

Each implementation of a new technology entails the provision of human and financial resources. A thorough analysis of different stakeholder groups or important individuals helps to identify in which direction internal promotion and marketing efforts should be steered to guarantee the necessary endowment of the project. As all organizations do not only consist of a formalized structure, in larger corporations often represented by a Matrix organization that sorts employees into a functional and a divisional unit, but also of informal networks among peers across departments and hierarchies, communication is the key to a successful implementation strategy (Carnabuci & Diószegi, 2015).

Obtaining support from top management is observed to be crucial for acceptance within the organization. Mark Chardonnens of Innofactory reports (case 10): «We then returned to the board members and put two TVs in front of them. […] We showed them the matching place and the matching engine. On the execution engine Etherscan, we showed that the transfer was made. This was a key moment in this project because most of the board members did not realize what Blockchain technology was. For the first time, they saw it in action as well as its power. […] This was really a huge moment.»

The buy-in within the organization requires communication skills, a solid network of like-minded peers, and patience, as Francesco Santoro's testimonial at Chargeurs shows (case 9): «While the project was met with considerable interest, people particularly wanted to know what was the business potential, the implementation challenges, and the customer feedback. Therefore, the division invested time to first present the Blockchain project to its own teams. For this purpose, it prepared presentations and demos with the help of its marketing experts.» Santoro explains the strategy he and his team pursued: «In the beginning, the priority of these presentations was to align the division's

operations and sales teams and instruct them as to the benefits and limitations of the new Blockchain platform. It was vital that they understood the system properly so that they could explain it to their customers. Then the division provided information about the project to all teams and employees of Chargeurs Group using the Group's newsletter, which is distributed on a quarterly basis. The information output regarding the Blockchain project and its main milestones continued during the whole process. This was extremely important as it was the first step to share the experience gained from this project with all other Chargeurs business divisions.»

An equally important stakeholder group are domain experts who are asked to provide their specific knowledge to the project. In the case of business school Saint Paul, the academic faculty had to be convinced to train the algorithm (case 5): «Many professors are conservative when it comes to new technologies, therefore we gave them time to understand Paul and answered the questions they had. […] After the initial barriers had been overcome, our faculty came on board.»

Even after the initial implementation, the communication with users and stakeholders remains an important strategic task, as Dominik Felske's testimonial in the case of RWE's auction model suggests (case 1): «Our tool is in place and established within our organization – the latter was maybe the biggest challenge. To achieve data quality and robust results was not easy, but it was nothing compared to getting stakeholder acceptance. It took us months, before stakeholders started to trust our model.» Explaining the functionality and providing transparency about the imperfections of the new application are essential for broader acceptance, as Dominik further explains (ibid.): «We went with our stakeholders through all details of the model and were absolutely transparent. We explained how the regression model worked and discussed the results it produced. We made it clear that we did not have an algorithm providing us with perfect results, but would rather offer the basis for a structured discussion and a sound comparison of auction results across global markets and technologies. We described how my team was going to interpret these results and deliver a value added.»

The perception of the success of a digitalization project hinges upon the expectations of various internal stakeholders. Setting the right Key Performance Indicators (KPIs) at Brazilian business school Saint Paul ensured a lasting support from the management board of the school (case 5): «This is the advantage that we discussed with our board members. If you start a project as we did, you traditionally think about budgeting, financial viability, ROI. If we had just focused on these aspects, we would have given up after two or three months. However, we agreed to shift our focus. In the long term, we would like to break even, but in the short and middle term, we are concentrating on the exponential curve regarding our users.» In an idealized setting, corporate disruptors can communicate a risk profile that entails a low risk with a high potential for efficiency gains or financial returns, often a quick win based on existing processes with little effort to acquire new data or merge isolated data silos.

The initiative to implement a disruptive digital technology can originate «bottom-up» from a middle management level or «top-down» from the CEO or the executive board of a company. In this selection of examples, we observe more frequently a bottom-up process, whereby individual units or managers within the organization identify an optimization or business opportunity within their sphere of responsibility and convince top management and major stakeholders to support the project. Ideally, their use cases match some element of the overarching Strategic Priorities or even the Strategic Intention within an organization's Strategy Pyramid and complement the existing toolkit of technological enablers. Some of our examples, such as the Innofactory (case 10), show that a simultaneous «bottom-up» and «top-down» momentum ensures long-term support, even if initial attempts do not yield immediate positive financial results.

Some companies in our book pursue a clear top-down strategy, with their top management being convinced of the value added of a certain technology. José Cláudio Securato, the founder and CEO of Brazilian business school Saint Paul, aims to democratize business education and to provide top-quality global learning for universal welfare empowerment by using digital technologies, as one of the objectives of his business school. The introduction of a machine learning algorithm to assist students hence is plainly in line with the school's Strategic Intention (case 5): «We hoped that AI would enable us to reinvent education in Brazil and make it affordable.»

Another top-down example is Robotic Process Automation at both Allianz and Turkcell (cases 2 and 3). In contrast to the intrinsic motivation of a business unit to implement a new technology because of a locally identified use case, top management appoints «technology ambassadors» who approach relevant teams, convince them and achieve a buy-in to make the implementation successful.

In the case of Turkcell, the trickle-down effect of a new technology was achieved with a multifaceted communication strategy: «To introduce RPA internally, we went to each department manager, explained RPA and described how their department would benefit from it, presented the advantages and disadvantages. We also use our internal communication channels to send infographics to all employees in order to familiarize them with RPA and increase their knowledge about this tool.»

Accepting failures and experimentation

In many established industries, the organizational culture has historically not been geared towards accepting errors and mistakes easily and in an institutionalized setting, as the startup scene has established, for example with so-called «Fuckup Nights,» which are used by entrepreneurs for sharing and discussing their failures with peers.

Launching disruptive digital technology always entails the risk of a failure. Brazilian business school Saint Paul embraced this uncertainty: «Our School was and is doing well, so we thought, let us be creative, and if we make mistakes, we'll learn from them, just as we'll learn from the mistakes other business schools made when they started their online courses.» Adriano Mussa comments: «Only Bruna and myself were aware of the fact that we would enter a trial and error period and had thus to accept that we would make mistakes. For months we worked very hard, had to throw away our results and start again. We knew that no member of our faculty would be willing to spend time on a project like that.»

Especially in the exploration phase of a new project, one way of establishing a more adaptive and flexible process culture is the use of Agile methods, as Dominik Felske of RWE explains: «We implemented our model with the help of Agile project management. We did several Sprints with other departments using internal resources only. We met every one to two weeks defining priorities and the next project elements to be implemented.»

Innofactory switched from the conventional waterfall methodology of project execution to Agile methods, as Mark Chardonnens explains, even in the context of a traditional Swiss bank: «We said, ‹Forget waterfall!› We started to apply Agile ways of working, with the goal of being technically ready within three months. At the end of November, we started with the first sprint. Already by the end of December, all of the technical functionalities and basic infrastructure were ready and installed, including all the network connections used to interact between the systems.»

Uniper used the user-centric ideation method Design Thinking in their IT innovation rounds: «This turned into a Design Thinking process and a number of workshops.»

Changing a corporate culture may prove hard in established, non-digital-native companies, but either the intrinsic motivation of individuals within the organization or competitive pressures, extrinsically, will enforce the change.

Communicating success stories internally and externally

An effective internal and external communication of early successes enables bottom-up initiators of digitalization projects to consolidate their status as «Early Adopters» in the organization. The positive repercussions of this perception are typically not only in line with a top management directive to «become more digital», but also have a positive impact in terms of endowment and resources for the teams that have implemented the technologies.

The case of Dominik Felske at RWE seems to confirm this observation (case 1): «By now our model is well-perceived within RWE. It is one of the examples to show that we are becoming more digital. People know that we have a ‹Forecast Combination Model›, but only a few understand what it does. Our internal

marketing helped to present our model to our board – as a positive example of digitization – which then helped us to increase our research budget.»

Successful projects can also serve as a role model for other departments within the corporation, as Francesco Santoro of Chargeurs reports (case 9): «The division Chargeurs Technical Substrates has by now decided to build a Blockchain platform for the traceability of technical textiles. This project started in June 2019. Their project team has been selected internally and they are working with the same startup for the technical developments Chargeurs Luxury Materials used. The division Chargeurs PCC Fashion Technologies is also looking into Blockchain to answer questions from their customers in the fashion industry. In short, the Blockchain project of Chargeurs Luxury Materials paved the way to adopt the technology on Group level for all cases where this technology will be advantageous.»

Establishing a culture of life-long learning – with employees and customers

Digital technologies require new skillsets. The interviews suggest that three stakeholder groups are affected in different ways.

The role of domain experts, for example, is to support the refinement process after implementation. Dominik Felske of RWE comments on the continuous improvements of their model (case 4): «It is a permanent updating and learning process, not only as far as the algorithm is concerned, but also how we interpret the results. In practice, we have learning sessions after every auction and check if we predicted the bid range within the probability curve we have. This is usually followed by a discussion. Do we have to calibrate? Should we take some data out?»

Domain experts are particularly valuable in the learning journey, combining their subject knowledge with the new digital application, as anecdotal evidence of the Allianz case on RPA suggest (case 2): «We built up the developer pool largely internally. We met very mixed experience around the globe. In the beginning, we started with high skill internal people. They were really a great advantage. In Brazil for example, a former teammate wanted to involve himself personally. He took the opportunity, became a developer, and accelerated the journey significantly, as he knew the business processes by heart from his own experience.»

Local units typically consist of knowledge managers and domain experts, but without the expertise provided by data scientists. Integrating the local units in the learning process is key to success, according to Stefan Weih from Allianz (case 2): «We started with a brainstorming and a small pilot, a very easy case, to obtain the buy-in of the local units. We achieved the proof of concept and with it the proof that it is working and delivers benefits to local business.» The RPA team would still provide guidance and support the selection of implementation

projects: «Then we had the two other components. We had the training so that right after the pilot the local team did not rely on some remote central team to help continue the journey, which often is a reason for failure of innovation projects. As a last piece during the implementation of that first use case, we already had created a prioritized pipeline of potential new applications with the local experts. Thus, the business, right after the pilot, was ready and knew exactly what to do next.»

The knowledge managers at Turkcell also foster a close partnership with local units (case 3): «Our organizational development team now works with each department in order to select process experts. These experts are familiar with RPA and know the needs of their department. Combining these two aspects, they decide which scenarios should be developed for RPA. Then we at the center of excellence of our AI team will start the development.» Similar to Allianz, their center of excellence also serves as gate keeper for new projects: «We have established control mechanisms in order to evaluate their plans by asking is it really worth to spend efforts on a scenario?» The decentralized decision making structure may also cause complications, though: «Sometimes it is difficult to manage people, in particular, when you cannot monitor them. That's the way it is when you have individual processes which have been initiated in a decentralized way.» The RPA experts at Turkcell provide training support via various media channels and also in direct interaction with their colleagues: «We have established a community platform where our RPA champions communicate with each other, ask questions and receive answers. In addition, we continue to encourage people to learn RPA and implement Ghost in their department. Furthermore, we work with our Turkcell Academy and design RPA training programs. So far we already have an online training program. The subjects include the basics of RPA, digital transformation, its advantages and disadvantages. There are also videos on how to use Ghost. And, of course, we support our RPA champions, because we know that they will drive RPA adoption within our organization.»

Adriano Mussa and Bruna Losada Pereira of business school Saint Paul sensed a certain degree of «digital anxiety» among their academic domain experts (case 5): «At the beginning, most of our faculty were afraid to transfer their knowledge to a robot, which we understood. However, by now – after two to three years – almost 70 percent of our faculty are working with Paul; but in the beginning, it was hard.» Active coaching may help, but also peer experience and initial success: «We didn't force anything. Most of our faculty said, ‹That's a beautiful project. I can create my content in LIT … but as to AI, I need to understand a bit more.› In the end they wanted to be part of the project. By now we have a number of professors waiting to participate and teach Paul new content.» Reducing Digital Anxiety is an on-going challenge at Saint Paul: «We still need to make more people use LIT. We have to make sure that neither faculty nor students are afraid to use AI. It's not easy to change habits.» But over time, the learning curve improved, and implementation

performance increased: «As with any AI project it was scary at the beginning. It was a shock when we analyzed the time sheet for the first course: We had invested 1,500 hours only on our side, IBM probably even more. But we were working on this project every month. Now we can teach a new course to Paul using only 16 hours of a faculty member.»

Beyond the internal constituency, a fourth stakeholder group that has to be trained is located outside the organization. For example, in the case of Chargeurs' Blockchain application the learning requirements stretch to the end users (case 9): «Organizationally the division is faced with the challenge to transfer full platform ownership and expertise from the project team to the end users, including those who have little IT expertise. This is difficult as the project manager was hired only temporarily from the Group and the platform's technical development was outsourced. The division's plan is now to train the end users and make sure that they acquire new competencies in IT without having either to ask for experts from the Group or hire someone from the outside.»

Christopher Kränzler from Lengoo confirms the importance of training, in their case related to the professional free-lance translators who get hired for cross-checking the machine translations (case 6): «Putting the end user first is paramount. When you start to develop machine learning applications, you must keep the people in mind that will be using the technology. When you move your idea from research into the real world and put your technology into production, you have to make sure that you include your user in every step of the way.» Lengoo actively integrated the relevant domain experts in the development of their tools: «In our case, we assembled a product team with people from our IT team, research team, and a translator. […] We are working very closely with our translators and continuously collect feedback in order to make sure that the software really makes their work easier, not harder or more complicated.» Relieving the concerns of their translators vis-à-vis machine translations is a major part of the learning process: «We have a community management team that makes sure that everybody understands that we apply our technology not to replace humans but to make them more efficient and increase their income.»

Digital transformation interferes with many established processes and may induce anxiety, as Grigory Shevchenko at Uniper reports (case 8): «The […] platform has been concepted and launched in a niche environment, nevertheless, it stood for disruption, which some people always consider to be threatening.» He describes the move to more fundamental changes in the following quote: «The rationale was better to deal with disruption before disruption deals with you.»

Technological progress will not come to a standstill – on the contrary, the pace of innovation will increase. The last section of this book provides some of the authors' observations and reflections on future developments in the digital realm.

Outlook: Pushing boundaries of the technically feasible

Bill Gates, the co-founder of Microsoft and philanthropist, is known for his insights and predictions about the future of technology. One of his most famous quotes is, «We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten.» This quote highlights the importance of considering the long-term impact of technology and societal change, rather than focusing solely on short-term advancements.

The idea that we overestimate short-term change and underestimate long-term change is supported by numerous studies and historical examples. For instance, a study conducted by the Gartner Hype Cycle, which tracks the maturity of various technology trends, found that new technologies often experience a «peak of inflated expectations» in the short-term, followed by a «trough of disillusionment» before eventually reaching a «plateau of productivity» in the long-term.

Additionally, throughout history, there have been instances where we have underestimated the long-term impact of certain innovations. For example, the Internet, which was first proposed in the 1960s, was initially seen as a tool for academic research and the military, but it has since transformed virtually every aspect of society. Similarly, the personal computer, which was invented in the 1970s, was initially seen as a niche product for enthusiasts and businesses, but it has since become a ubiquitous household item.

The text in italics was generated by a machine learning program called ChatGPT, based on GPT3.5 and released by OpenAI, a research and deployment venture sponsored – among others – by Elon Musk and US-based tech company Microsoft, using the following command: «Write a short essay in academic style on the quote by Bill Gates: ‹We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten.›» For an academic audience, ChatGPT's output may not reveal surprising insights, rather comparable to the intellectual depth and stylistic maturity of an informed pupil preparing for his or her A-level exam. In addition, the algorithm did not detect that Bill Gates just paraphrased a statement of US American futurologist Roy Charles Amara (1925–2007). Nonetheless, future releases of Large Language Models and other GenAI tools will become more sophisticated and move beyond their capabilities as «stochastic parrots,» with an increase of available and up-to-date data inputs, quantity and speed of calculation, and ever-better algorithms, according to Floridi (2023).

The global media attention that ChatGPT received after its launch and its record-setting user base (Hu, 2023), is a brief demonstration of a the enormous potential that digital technologies may unleash to disrupt the world as we know it. School teachers and university professors might revert to hand-written homework and exams, because all previously used software tools to detect plagiarism and copy-and-paste attempts to cheat will no longer be useful, because texts are instantaneously generated by a machine. One day not so far in the

future, students may even let a machine learning algorithm write their entire bachelor thesis.

In the world of businesses and corporations, the jobs of literally millions of software programmers might transform from developers of software code to «prompt engineers» who are specialized in finding the right commands for chatbots writing the actual software (Glen, 2022), because algorithms will provide equivalent results at a substantially lower rate of programming mistakes and in a much faster pace than their human counterparts could ever do. Even in highly sophisticated and well-paid professions, the rise of machines seems inevitable. In his seminal article «The Robots Are Coming for Wall Street,« published in the New York Times, Popper (2016) predicted that human judgment is soon to be replaced by robo-advisors. Many algorithms, for example for granting loans to individuals, are already established, and used in daily business practice, and many highly compensated functions in, say, stock trading might become fully automatized (ibid.).

Similarly, visual depictions and interpretations of verbal inputs made by humans will alter job configurations of artists, designers, and IT developers. Based on algorithms, computers will provide tailored and even animated solutions to practical applications, while only high-end content may be delivered by humans (Gupta, 2023).

Not astonishingly, this evokes important regulatory and ethical questions. Language-based software tools with similar capabilities like ChatGPT may be exploited for generating hateful, racist, or in other ways harmful or discriminatory texts (Beuth, 2023). Given their capabilities of producing computer code, which is just another language they can learn, they may be enhanced to automatically publish text for echo chambers in social media, and spam news platforms. DeepFakes in facial videos may become so realistic that it is no longer clear whether a person actually expressed specific sentences (Scientific Foresight Unit, 2021).

While Artificial Intelligence will radically alter our verbal and visual communication and human interaction, Blockchain and DLTs may cater for attractive use cases because of their fundamental axiom of decentralized decision mechanisms, with a multitude of atomized agents ensuring that no central control could manipulate or jeopardize the stability of established conventions. In particular, the emergence of an increasing number of Decentralized Autonomous Organizations may lead to a new perception of the boundaries of a firm, based not only on transaction costs, but also on the empowerment of the owners.

In many key industry sectors, such as the energy supply industry with an increasing amount of residential, decentralized producers of energy and a high potential of peer-to-peer energy trading, DLT applications may suffer from inter-platform competition with conventional digital solutions, slow technological progress in terms of low-frequency interactions, and contradictory and incompatible layers of regulatory complexity (Burger & Weinmann, 2022).

By contrast, DLT applications may emerge as technological winners whenever multiple agents along a value chain require access to specific pieces of information (Giegling, 2022). So-called Certificates of Origin may serve, for example, as a proof that a company reduces its carbon footprint by switching to renewable energies like wind or solar power (Amirifard & Taherdoost, 2023; Cali et al., 2022; Delardas & Giannos, 2023). Blockchain technologies prosper in applications such as the tokenization of real-world assets (Drogovoz, Kashevarova, & Starikova, 2024) or gaming (Teoh, 2023). They secure virtual territory in metaverses such as Decentraland or The Sandbox. Consumers and organizations may want to use these technologies to transfer their assets – be it a pair of virtual, customized sneakers or a non-fungible token (NFT) of a piece of art – from one metaverse to the next (see also Hutson, Banerjee, Kshetri, Odenwald, & Ratican, 2023; Huynh-The et al., 2023). Large corporations, such as Meta, invest vast amounts of their revenues in advancing haptic devices to enable a full immersion into virtual worlds (Böhm, 2022), or develop glasses that allow for real-time enhancement of visual information via Augmented or Mixed Reality, such as Google Glass (Nijholt, 2022) and Apple's Vision Pro (Stern, 2024).

Future applications of Blockchain and other Distributed Ledger Technologies may become the computer cloud of the future, a guarantor for secure and transparent transactions in a digital world where complexity is driven by customization and regulations. They may ensure digital security against hacking when the privacy of digital identity becomes increasingly important (Careja & Tapus, 2023).

With a perspective of scientific progress until the early 2030s, there are two applications of digital technologies that are breaching the boundaries of the expectable and will most likely impact our future way of living:

- First, Quantum Computing may lead to a «5th Industrial Revolution» in the future (Rietsche et al., 2022). The technology fundamentally differs from conventional, binary computer processes because of its capability to harness phenomena of quantum mechanics, such as superposition and entanglement, to speed up optimization and the simulation of complex systems, such as weather forecasts or traffic congestion. Once commercially available, it may be capable to overhaul cybersecurity and jeopardize existing solutions in, for example, encryption, fraud detection, or digital identities (Faruk, Tahora, Tasnim, Shahriar, & Sakib, 2022; Raheman, 2022). Beyond cybersecurity, the technology may serve to optimize the development of chemical-electrical battery technology, or speed up the development of medicinal drugs via protein folding of large biological molecules (Hao, 2022). Despite fast technological progress and some first applications (Arute et al., 2019), current commercial applications are still in an experimentation phase (Au-Yeung, Chancellor, & Halffmann, 2022).

For example, DHL, a global logistics company, used the quantum expertise of Honeywell, a technology-solutions provider, to run first trials optimizing the placement of parcels in containers (Hughes, 2021).

- Second, a neurological-electrical connection between a human organism and a computer may not only provide an opportunity for paralyzed patients to communicate with their environment, but also use their thoughts to direct and steer motoric movements, carried out with mechanic tools (Portillo-Lara, Tahirbegi, Chapman, Goding, & Green, 2021). In the further future, so-called Brain-Computer Interfaces (BCIs) may serve for cognitive or affective state estimation, detection of attention or mental fatigue, and adaptive human-robot interaction (Alimardani & Hiraki, 2020). Several companies are working on invasive and non-invasive BCI technologies, including Blackrock, BrainGate and Elon Musk's Neuralink (Hurley, 2023), or Synchron. While current non-invasive BCIs are not as accurate in the detection of neurological activities, invasive methods face challenges in terms of biocompatibility (Pisarchik, Maksimenko, & Hramov, 2019). The authors would of course raise important ethical questions related to technology, for example the possibility of manipulating or controlling a human being's thoughts and behavior «by directly sending commands to the brain» (ibid.).

The socio-economic evolution of human civilizations is closely linked to technological progress. With the steam engine, water turbines and combustion technology, the first Industrial Revolution sequentially developed more sophisticated methods for the transformation of energy, whereas – starting in the midst of the second half of the 20th century – the «current metaparadigm focuses on the transformation of information,» according to Hilbert (2020).

Some scholars emphasize the accelerated pace of the transformation (Su, Yuan, Umar, & Lobonț, 2022). For instance, compared to Moore's Law of a doubling of the number of transistors on a microchip about every two years with the cost of computers being halved (Moore, 1964), the rate of machine learning algorithms increasing their speed and accuracy is estimated to have doubled every 3.4 months (Saran, 2019). In the societal discourse, these rapid changes lead to differing assessments:

- The pessimistic perception of digital transformation and automation is based on the historical observation that technological progress has often led to a redefinition of tasks that humans perform (Deschacht, 2021). Functions that have previously been assigned to humans because of their capability to filter and synthesize available information may be taken over by machines. For example, Tschang and Almirall (2021) predict a «hollowing-out of middle-skill jobs.» Fears emerge that automation may eliminate entire professions, such as translators, lawyers or accountants (Céspedes, 2019; Crossley, 2018).

- By contrast, the optimistic perspective on the progress of digital technologies in economy and society typically follows the argument that technological innovations provide a stimulus to the labor market (Su et al., 2022). Human workers will be able to move from routine to non-routine jobs and concentrate on functions that lead to a higher degree of job satisfaction (Parker & Grote, 2022). This may include the interaction with clients and users for more sophisticated requests, but also an advanced deployment of device-driven technologies. The global «War for Talents» that emerged after the end of the COVID-19 pandemic (Botting, 2022) may not only accelerate the digital transformation of many industries, especially in countries with a general shortage of labor, but also ensure that they can sustain their levels of wealth by replacing scarce human resources with AI-enhanced robots, for example on shop floors or in mobile care for elderly people (Asgharian, Panchea, & Ferland, 2022).

When we started working on this book in 2019, many digital technologies were still viewed as experimental gadgets. Only a few companies tried to leverage the potential with regards to cost-cutting, revenue generation or simply trying to get up-to-speed by setting up the infrastructure to harness the new technologies.

Now, three years later, the momentum has increased significantly: OpenAI, the metaverse, digitization of assets have become part of the core strategy. Geopolitical turbulences, IT security issues and a fast-changing financial system accelerate the momentum even further.

The transformation of information will not stop at the doorsteps of any residential home or office. Leaders now have the task of incorporating disruptive digital technologies in operations and develop new revenue models by transforming legacy data silos into strategic assets of a company or organization and embarking on pilot use cases to implement disruptive digital technologies to gain a competitive advantage vis-à-vis competitors. New technologies will change the way decisions will be taken. However, any existential fear of a dystopian future in which a novel reign of machines will emerge and enslave or extinguish the human species, based on the empirical observation that our natural habitat is severely endangered by our lifestyle, seems too far-fetched (Floridi, 2022; Tariq, Iftikhar, Chaudhary, & Khurshid, 2023). Also, we may have time left to prepare ourselves for the day when «Singularity» will be reached, that is, when machine intelligence will surpass human intelligence, not only in highly selective fields of data analytics and specialization, but as a generic capability to digest knowledge and experience (Hoffmann, 2022).

For the time being, the authors of this book remain confident that we will be able to create a habitat populated by both humans and machines with a harmonious collective future of collective human intellect and digital technologies as their constructive complementarity (Tariq et al., 2023). As Rob Thomas, an IBM executive, comments on the effect of machine learning on the business

world, «AI is not going to replace managers, but managers that use AI will replace those that do not.» (Handley, 2020)

We hope that the case studies on implementing digital technologies and the respective lessons learned will help you to benefit from some of these pioneering experiences, gain valuable insights, and allow you to apply these technologies in the best way for yourself and your organization.