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# Business transformation in an age of turbulence – Lessons learned from COVID-19

Xishu Li<sup>\*,a</sup>, Maarten Voorneveld<sup>b</sup>, René de Koster<sup>c</sup>

<sup>a</sup> Lancaster University Management School, Lancaster University, LA1 4YX Lancaster, United Kingdom

<sup>b</sup> Leiden University, Leiden Institute of Advanced Computer Science, 2333 CA Leiden, The Netherlands

<sup>c</sup> Erasmus University, Rotterdam School of Management, 3062 PA Rotterdam, The Netherlands

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## ABSTRACT

The COVID-19 pandemic has caused global economic turmoil. Although many companies have suffered huge losses, some have flourished by changing their old ways of doing business. We investigate the business transformation process under drastic market changes and time pressure, with a focus on decision speed and structure in the decision & planning phase, the implementation structure and monitoring in the implementation phase, and reinforcement after the implementation. Through case studies in a variety of industries, including manufacturing, e-commerce, and finance, we explore how companies in specific contexts have dealt with the above-mentioned critical factors when transforming their business during the pandemic, whether the experienced transformation processes differ from theory, and if so, how. The examples of business transformations cover eight categories, including work from home, the use of augmented reality, internet of things, and business model redesign. Our findings reveal how these transformations are perceived and evaluated by companies one year into the pandemic. In addition, we show how decision speed, structure of the decision-making process, structure of the implementation process, and scale of the implementation impact the completion time of the transformations. Based on our results, we provide suggestions to companies for an effective business transformation in times of crisis.

## 1. Introduction

The COVID-19 pandemic caught the world off guard in 2020, causing global economic turmoil and bringing many businesses to the brink of collapse. Different from the economic crises that happened in the last two decades, the pandemic poses challenges that companies have never faced before in terms of the extent of market changes and the amount of response time (Amankwah-Amoah et al., 2021; Brem et al., 2021). For example, pandemic-induced lock-downs cut off (nearly all) supplies of critical raw materials and components overnight, leading companies to jump onto modern technology such as 3D printing to produce spare parts. Undoubtedly, such a technology could be the future of manufacturing as it dramatically reduces the number of steps required to make complex metal shapes and lessens dependence on distant suppliers. However, jumping onto a new technology is a decision every company would avoid, if it was not because of the pandemic.

If changing the old ways of doing business is a must in times of crisis, the most critical question is then how to change effectively. In the example of 3D printing technology, if a company decides to adopt it,

faces a paralyzing volume of big-bet decisions such as how to roll out the technology, considering other aspects of the manufacturing process, how to map out a timeline, and how to analyze and adjust during the implementation process. The ability to effectively transform business is critical not only to the survival of a company, but also to its rise in the midst and the post-phase of the pandemic (Gkeredakisa, 2021).

When facing a big crisis like the pandemic which arrives at overwhelming speed and enormous scale, the typical change process of many companies, big and small, may no longer be applicable. First, typical decision speed may be far too slow to keep up in such turbulence. Postponing decisions in an uncertain situation to wait for more information might make sense during business as usual. But when the environment is defined by urgency, waiting to decide is risky (Jadoul and Willi, 2021). For example, delaying the decision to adopt a new manufacturing technology to which there is only limited access can mean being preempted by competitors which require the same technology and can potentially harm more revenue. Second, the typical decision-making structure may need to be changed for an effective business transformation in the current situation. The two types of

\* Corresponding author.

E-mail addresses: [xishu.li@lancaster.ac.uk](mailto:xishu.li@lancaster.ac.uk) (X. Li), [m.j.voorneveld@sbb.leidenuniv.nl](mailto:m.j.voorneveld@sbb.leidenuniv.nl) (M. Voorneveld), [rkoster@rsm.nl](mailto:rkoster@rsm.nl) (R. de Koster).

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structures, i.e., bottom-up and top-down, both have their advantages and disadvantages. In the situation where problems come from almost every area of the operations, potential solutions are best understood by people who experience the problem first hand (Böhringer and Ruth-erford, 2008). Therefore, it could be beneficial to use the bottom-up approach. However, when facing a big crisis which requires drastic and immediate decisions, top-down decision-making may be necessary. Third, the typical implementation process may also need to be adjusted in the current situation. Following a structured implementation process, e.g., a roadmap process, is preferred when transforming business in a normal business context. However, this may not be possible in a chaotic situation. Forth, monitoring, which is of critical importance when implementing major organizational changes, may also not be possible in times of crisis. Last, business transformations require reinforcement. However, if they are the results of an immediate response to a crisis which is not expected to last, reinforcement may not be needed.

We investigate the business transformation process under drastic market changes and time pressure. Grounded in theory, we focus on decision speed and structure in the decision & planning phase, the implementation structure and monitoring in the implementation phase, and reinforcement after the implementation. Through case studies in manufacturing, e-commerce, cloud analytics, finance and AI appliance industries, we explore how companies in specific contexts have dealt with the above-mentioned critical factors when transforming their business during the pandemic. We study whether the experienced transformation processes differ from theory, and if so, how. The examples of business transformations cover eight categories, including work from home, the use of augmented reality, internet of things, and business model redesign.

Our findings first reveal that one year into the pandemic companies evaluate the effectiveness, as well as the success, of their transformations based on the completion time of the implementation. The pandemic has led companies to complete their transformations much faster than before, despite of the large scale of these transformations. We find that although companies have sped up the implementation, they have not done the same with the decision & planning. However, a fast decision helps shorten the implementation phase. When deciding on the transformations, companies have not had a preference for the top-down approach over the bottom-up approach and both approaches can lead to a fast completion, although a fast decision is usually made top-down. We also find that when implementing the transformations, companies have often deployed an ad-hoc unstructured strategy, rather than a well-defined roadmap process. However, a roadmap process helps companies complete the transformations faster. In the implementation phase, nearly half of the transformations have not been monitored, possibly due to fast decision speed and the top-down decision-making structure of these transformations. Although monitoring has not been prioritized by all companies in the implementation process, it plays an important role in determining whether the transformations should be reinforced. We show that most but not all transformations have been reinforced after the implementation.

Our research contributes to theory and practice in three ways: First, to theory by testing the typical assumptions on how different transformation processes impact the effectiveness of business transformations in a difficult business environment; Second, also to theory by gaining an understanding of what companies in different industries have done when they urgently needed to transform their business, what has worked and what has not; Third, to practice by providing suggestions to companies for an effective business transformation in times of crisis. In the remainder of the paper, Section 2 provides the related literature, Section 3 presents the theoretical model of business transformation, Section 4 describes our case study design, Section 5 presents the results, and Section 6 concludes the paper.

## 2. Literature review

Our research is related to two streams of literature: the management literature on business transformation, and the organization and entrepreneurship literature on corporate decision making. In the management literature, business transformation is an enabling process for operational priorities to leverage the abilities often created through technologies (Demirkan et al., 2016; Ebert and Duarte, 2018; Horlacher et al., 2016). The examples of technologies are digital tooling, sophisticated software such as risk assessment, forecasting, and transportation planning tools, IT and information systems (Abdelaal, 2018; Brynjolfsson and McAfee, 2014).

Venkatraman (1994) proposed a framework of IT-enabled business transformation based on two dimensions: the range of potential benefits from IT and the degree of company transformation. He found that potential benefits from IT deployment increase with the degree of business transformation. Particularly, the benefits from IT deployment are marginal if only superimposed on existing company conditions, whereas the benefits accrue when investments in IT functionality accompany corresponding changes in company characteristics. Marchand (2014) found that the degree of digital business transformation varies depending on the business context and thus the benefits of such transformation are often unevenly distributed between companies. Generally, companies go through transformations gradually, i.e., starting with evolutionary levels, including localized exploitation and internal integration, and then proceeding to revolutionary levels, including business process redesign, business network redesign and business scope redefinition, as the demands of competition and the need to deliver greater value to the customer increases (Venkatraman, 1994; Westerman et al., 2014). Companies can also select potential transformations based on long-term effects of these transformations on their business and the whole industry. The resulting transformation priority may not follow a gradual sequence from evolutionary to revolutionary levels (Young and Rogers, 2019).

Schwertner (2017) and Venkatraman (2017) identified the importance of speed, decision-making structure and implementation structure for the success of digital business transformation. Tabrizi et al. (2019) pointed out that 70% of all digital transformation initiatives do not reach their goals. One of the lessons learned from successful transformations is that companies need to adopt agile decision making, rapid prototyping and flat organizational structures. Berman (2012) explained that companies aiming to transform their operating models need to develop not just one solution, but a portfolio of capabilities for flexibility and responsiveness to fast-changing markets and customer requirements. Without a detailed and structured implementation plan, even in situations where companies recognize the importance of business transformation, performance may still suffer due to their inability to take the appropriate action (Morgan, 2008). We find that the majority of the management literature on business transformation focuses on the use of digital tools, particularly IT and information systems, and studies how companies can leverage modern technology to drive business growth. However, business transformations include more changes than the use of new digital tools and the goal of transformations may be to first survive and then grow. Such a motive could change the way companies decide on the transformation and how it will be implemented.

In the organization and entrepreneurship literature, fast decision speed is often associated with high organizational performance (Chen and Chang, 2012; Mueller et al., 2007). In addition, the structure of the decision-making process has a significant impact on the type of decisions organizations will make and the results of these decisions (Kim et al., 2014). Mom et al. (2007) investigated the influence of top-down, bottom-up, and horizontal knowledge inflows on managers' exploration versus exploitation activities, i.e., exploring new possibilities to cope with future business changes versus exploiting old certainties to meet today's business demands. They found that top-down inflows are positively related to the extent to which managers conduct exploitation

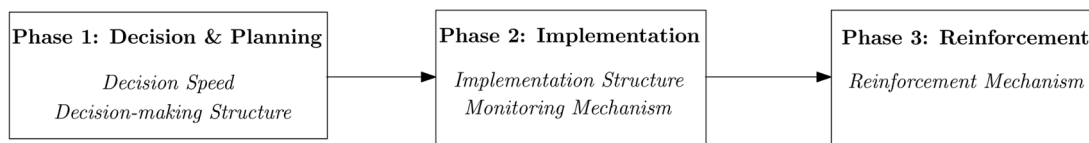


Fig. 1. Three phases of business transformation.

activities, whereas bottom-up and horizontal inflows are positively related to exploration activities. Chaudoir et al. (2013) studied factors affecting implementation success of health innovations. They identified factors related to the structure and the scale of the implementation. The majority of the organization and entrepreneurship literature on corporate decision making focuses on a normal business setting where risks of a decision are predictable to a certain extent. Thus, the findings on factors that impact the success of the decision may not be applicable to a difficult business environment, such as the pandemic.

Since the start of the pandemic, there have been a number of studies on COVID-19 related business transformations (e.g., Brem et al., 2021; Hodder, 2020). Using survey opinions from entrepreneurs in agro and pharmaceutical industries, Bhattacharjee and Jahanshahi (2020) found that the pandemic caused an increasing exogenous uncertainty among entrepreneurs and thus a rising retail price of commodities in these industries. Giones et al. (2020) studied entrepreneurial action under an exogenous shock with a focus on business planning, frugality, and emotional support. Using interviews, Kuckertz et al. (2020) studied the challenges startups face during the pandemic and how they cope with the effects of the crisis. Ebersberger and Kuckertz (2021) explored organizational actors' innovation response time to the challenges of the pandemic and found that startups respond 9-10 days faster to the pandemic than incumbents. Gregurec (2021) investigated how small and medium-sized enterprises (SMEs) operating in service industries have been coping with the disruptions caused by the pandemic. They found that when facing drastic market changes, revolutionary levels of transformations are necessary for the survival of SMEs. Markovic et al. (2021) also focused on SMEs, but from emerging markets where the traditional way of doing business is competitive. They provided recommendations to these companies for choosing the right business partners with whom to cooperate in innovation in the pandemic period. Corsini et al. (2021) studied a frugal innovation approach, a practice of doing more with less, as the digital fabrication maker's response to the pandemic. Whillans (2021) examined how teams adapted their activities during the shift to virtual work in the early months of the pandemic. By interviewing workers at a professional services firm, they identified several core activities such as relationship interactions that require additional adjustments for team work to successfully enact in the virtual environment. Gkeredakisa (2021) described how digital technologies accelerate innovation while raising coordination challenges of over-dependence and risky implementation that distorts work practices during the pandemic. Rakshit (2021) investigated the use of social media networks in the new product development for SMEs during the pandemic.

The recent research on COVID-19 related business transformation typically focuses on a specific industry or the use of a specific technology. However, improving business performance can be achieved through various types of transformations and the success largely depends on the business context. In addition, most of the COVID-19 related studies are conducted in the early months of the pandemic. At that time, transformations had not been fully implemented and results were not clear. We contribute to the literature by considering different industries and a wide range of transformations. Our research reveals how these transformations are perceived and evaluated by companies one year into the pandemic. We focus on designing traits of the optimal process for transforming business under drastic market changes and time pressure.

### 3. Theoretical model of business transformation

In the literature, a number of change models can be distinguished, such as Jick's ten-step model (Jick, 1991), Kotter's eight-step model (Kotter, 1995), and General Electric (GE)'s seven-step model (Garvin, 2003), to guide and instruct the implementation of major changes in organizations. Mento et al. (2002) provided a mind map which visually shows the similarities and differences between the three above-mentioned models. These models, as well as the majority of the change models in the literature, outline three phases of the change process: the decision & planning phase, the implementation phase, and the reinforcement phase. Fig. 1 depicts the three phases. Depending on the context of the problem, each phase may go through a series of sub-phases, each of which can last a considerable amount of time. Critical mistakes in any of the phases can have a devastating impact on the entire change process.

The first phase of business transformation is where companies decide whether a change is needed by analyzing the organization, the market and competitive realities and then plan for the change by creating a vision, communicating the vision and empowering others to act on the vision (Garvin, 2003; Jick, 1991; Kotter, 1995). As the starting point, the decision & planning phase is often the most important phase of the entire change process. Kotter's eight-step model dedicates five steps, from establishing sense of urgency to empowering others to act, for the planning phase, while Jick's ten-step model dedicates six steps to it, from analyzing the need of the organization for change to lining up political sponsorship. All steps in the planning phase involve careful evaluations, indicating that companies need to spend a large amount of time and effort on planning before they can implement the plan.

To decide which transformations to adopt and how, companies need to evaluate alternatives that differ on a number of attributes. Selection of the options depends on the time available to reach a decision. The allocation of less time than what is needed for making a decision can cause a feeling of time stress which can harm the quality of the decision-making process. However, research has showed that quick strategic decision-making positively impacts business performance (Baum, 2003; Bourgeois and K., 1988; Jones, 1993). Through analyzing eight high-tech companies' performance in high-velocity environments, Eisenhardt (1989) discovered that the quickest strategic decision-makers had the highest sales and profitability. Supporting this theory, Judge and Miller (1991) found that businesses with higher performance make faster strategic judgments in fast-paced situations. Baum (2003) also confirmed that fast strategic decision-making predicts subsequent growth and profit and mediates the relation of dynamism, munificence, centralization, and formalization with company performance. Forth and Chakraborty (2021) showed that rapid change deployment can help companies increase the odds of successful business transformations from 30 to 80 percent. Early lessons from the pandemic also indicated that the speed of decision making matters at least as much as the accuracy of action in managing during times of crisis (Jadoul and Willi, 2021). It is therefore interesting to explore how companies in different industries have decided and planned for their transformations during the pandemic, with a focus on decision speed. Particularly, we explore whether the following proposition holds true:

(1) When facing drastic market changes and time pressure, a fast decision is needed for an effective business transformation.

In addition to decision speed, the structure of the decision-making process is of critical importance in the decision & planning phase.

Generally, there are two types of decision-making structures: top-down and bottom-up (Kim et al., 2014). The top-down approach relies on higher authority figures to determine larger goals that will filter down to the tasks of lower level employees. In comparison, the bottom-up decision-making process gives the entire staff a voice in company goals (Steinheider, 2008). Top-down management reduces the amount of time it takes to make a decision and it makes decision execution easier for middle management as they have direct orders to act on without second-guessing or trying to decipher mixed signals (Heyden, 2017). Major company changes are often successfully adopted by utilizing drastic measures, enforced top-down from the highest decision-making level (Bogdandy et al., 2020). However, the top-down approach can come at the cost of long-term goals which rely on continuous engagement of middle and bottom employees who will be affected by the change. Involving bottom-up view points will be beneficial in carrying out many of the subsequent phases in the process of business transformation (Kotter, 1995; Lewin and Peeters, 2006; Nagy et al., 2014). Another advantage of bottom-up management is that it can retain talent, keep morale high and get project buy in, since it realizes shared ownership in the overall goals and objectives of the company. In times of crisis, on the one hand companies tend to make big changes, suggesting the necessity of the top-down approach. On the other hand, it is critical to make front-line employees dedicated to big changes, and thus the bottom-up approach may be preferred. Ebersberger and Kuckertz (2021) found that because of the bottom-up decision-making structure, startups have been able to bring innovations to market 9 to 10 days faster than incumbents in the pandemic period. Corsini et al. (2021) also mentioned that bottom-up decision-making is critical in resource-constrained innovation, which is an effective response to a crisis. We examine the type of decision-making structure companies have used during the pandemic, particularly, whether the following proposition holds true:

(2) *When facing drastic market changes and time pressure, top-down decision-making is needed for an effective business transformation.*

The second phase of business transformation is the implementation phase, where the focus of companies is often on developing a structured implementation process. Jick (1991) pointed out that the critical step in the implementation phase is to create a fit of systems and structures to enable change. Kotter (1995) further elaborated on a structured implementation process. His model recommends companies to plan for and create short-term wins to encourage staff during a protracted transformation process. People may quit and default to resistance status if there are no specific crucial and evident short-term victories. The longer the time required to accomplish business transformation, the more essential the achievable targets along the implementation process are. The idea of building a sequence of targets aligns well with a roadmap implementation strategy (Mento et al., 2002), which defines a goal or desired outcome and includes the major steps or milestones needed to reach it (Calo, 2017; Langsdorf, 2011; Aktar, Alam, Al-Amin, 2020). Such a roadmap also serves as a communication tool that helps articulate strategic thinking, i.e., the why, behind both the goal and the plan for getting there. A roadmap structure is not without its disadvantages in practice. There might be too much specificity for such a plan that does not match the organizational demands throughout the implementation process. An adequate balance between detail and flexibility is thus essential. Typically, a roadmap strategy is used for a transformation that is expected to take a longer period of time. Mento et al. (2002) pointed out that the implementation strategy should be determined to fit the required speed of the implementation. When a change is urgently needed, companies may opt for less formal, more frequent and nuanced business planning activities (Giones et al., 2020). In addition, the value of a structured implementation process is only realized when companies follow the planned structure. When dealing with chaos and fast unpredictable changes, a structured implementation process may not always be possible. We examine whether companies have deployed a roadmap implementation strategy during the pandemic, particularly whether the following proposition holds true:

(3) *When facing drastic market changes and time pressure, a roadmap implementation structure is needed for an effective business transformation.*

In addition to the use of a structured implementation process, monitoring the progress of the implementation is often discussed in the change management literature. Both Jick's and GE's change models specifically lay out a step in the implementation phase in which companies should create a monitoring system to assess the progress (Garvin, 2003; Jick, 1991). This involves creating and installing metrics to assess and chart program success (Barua et al., 2001). The notion of assessing the progress of change goes hand in hand with developing a small wins strategy, thus also with implementing a roadmap strategy. Schaffer and Thompson (1992) promoted focusing on results-driven programs that bypass lengthy preparations, and instead aim for quick measurable gains within a few months. The key is to measure variables logically related to important milestones in the change effort. Such variables are often financially measurable (Mento et al., 2002). Aladwani (2001) also suggested measure and monitor workers' anxiety and resistance.

Monitoring the progress of business transformation also aligns well the idea of frugality in the entrepreneurship literature, which has persisted over time as a means to a successful business in times of economic turbulence (Giones et al., 2020; Kirtley and O'Mahony, 2020). Frugality is defined as "one's general preference to conserve resources and apply an economic rationale in the acquisition of resources" (Michaelis et al., 2020). Thus, the disposition of frugality suggests entrepreneurs to have a long-term goal in place while being frugal, i.e., having short-term sacrifices, to achieve this long-term goal. The key here is to make sure that companies are in the right path to the long-term goal, and thus monitoring is essential. Similar to a roadmap structure, monitoring may not be possible in some contexts. When facing the pandemic which puts a pause to operations of many business, companies may have different goals than improving performance for their transformations, and thus the performance of these transformations may not be measurable and the progress could not be monitored. It is important to find out whether the transformations during the pandemic have been monitored, and if not, why. Particularly, we investigate whether the following proposition holds true:

(4) *When facing drastic market changes and time pressure, monitoring is needed in the implementation phase of business transformation.*

The final phase of business transformation is the reinforcement phase, where companies implement institutional changes in order to make the change last. In Jick's model, the last step is to reinforce and institutionalize the change (Jick, 1991). In Kotters model, the last step is to anchor the change initiative with the corporate culture (Kotter, 1995). Step 5 in GE's model deals with developing long-term plans to ensure that change persists and step 7 is concerned with altering staffing, training, appraisal, communication and reward systems, as well as roles and reporting relationships, to ensure that they complement and reinforce change (Garvin, 2003). George et al. (1999) studied mechanisms that reinforce organizational cultural change. These include an effective way of communicating new norms and values in a group and forming formal statements of organizational philosophy. Asking leaders and employees lessons learned from the experience of executing a transformation is also a part of the reinforcement phase (Daudelin, 1996; Kotter, 1995). The use of well-thought-out trigger questions is at the heart of the reflection process (Seibert and Daudelin, 1999). Although reinforcement is an essential part of almost all change models in the literature, practices have shown that if transformations are the result of an immediate response to a crisis, they may not be reinforced after business returns to normal. Through studying consumer behaviour during the COVID-19 crisis and in the subsequent lockdown period, Mehta et al. (2020) investigated the question how much of the transformation experienced during the pandemic will sustain. We examine whether companies have reinforced the transformations that they have implemented during the pandemic, and if not, why. Particularly, we investigate whether the following proposition holds true:

(5) *Business transformations that are implemented when facing drastic*



**Table 1**  
Overview of case study companies.

Industry	Company Description	Company Scale	Interviewees
Manufacturing	Company M, a provider and distributor of liquid goods	Over 70 operations sites in over 20 countries	Operations & technology directors
E-commerce	Company E, an e-commerce company	12 operational sites in over 10 countries	Regional ( <i>Europe, the Middle East and Africa</i> ) operations & commercial directors
Cloud analytics	Company C, an on-demand cloud computing platform	Over 75 operational sites in over 25 countries	Technology & commercial leader
Finance	Company F, a provider of cash transaction services	5 operational sites in 3 countries	National ( <i>Netherlands</i> ) operations & technology directors
AI appliance	Company A, a seller of AI appliance to construction companies	9 operational sites in 6 countries	Business development directors

*market changes and time pressure require reinforcement.*

The nature of our study is exploratory. We investigate how companies have transformed their businesses during the pandemic and explore the differences between the experienced transformation processes and theory.

#### 4. Case study selection and design

The criteria for case selection depend on the type of research question: descriptive, exploratory, or explanatory. With an exploratory research question, the cases selected should give maximal contextual information about a particular phenomenon (Gerring, 2008). Thus, we select five industries to conduct case studies: manufacturing, e-commerce, cloud analytics, finance, and AI appliance industries. These five industries have distinct supply chains and operations. Since the pandemic hits almost all supply chains and all players in a supply chain, it is important to explore how firms in different industries and with different supply chain positions respond to the crisis and how their responses differ from each other. Selection of companies from the five industries is based on our contacts with the company leaders and our first-hand knowledge of how much impact the pandemic has had on the company and how many changes the company has undergone. Our goal is to study companies which have actively responded to the crisis and thus have more experiences and lessons learned to share. Below, we elaborate on the companies we choose and the challenges they have faced during the pandemic. We focus on business transformations happened between March 2020 and March 2021, which we refer to as the pandemic period in this research.

In manufacturing industry, we select a leading provider and distributor (company M) of petroleum, gas and chemical products, which operates terminals worldwide for the handling of liquid goods. The pandemic has caused changes in energy supply and demand patterns and stopped engineers from coming to sites to perform equipment maintenance. Thus, the company has been actively looking for solutions to remain operational and safe. In e-commerce industry, we select a market leader (company E) with dominant market shares in over 10 countries. The pandemic has accelerated the shift towards a more digital world and triggered changes in consumers' online shopping behavior. It has posed a significant challenge to daily operations of company E. In cloud analytics industry, we select a leading provider (company C) of on-demand cloud computing platforms and application programming interfaces to individuals, companies, and governments. The pandemic has caused problems in cash flows of clients of this cloud analytics company

and led some clients to change their technology development pipeline and re-allocate their budget for current projects. As a consequence, company C has changed its business focus and offerings to better meet customer needs. In finance industry, we select a long-existing company (company F) which manages and maintains physical payments for banks in Europe. Brick and mortar banks and companies which rely on foot traffic have seen the biggest demand drop during the pandemic. Thus, when transforming its business, company F may have a different goal than companies in other industries, e.g., it is to survive instead of to stay ahead of the competition by keeping up with the changing market. In AI appliance industry, we select a startup (company A), formed four years before the pandemic, which provides smart home appliances to residential construction companies. The ability to present the value of their products to prospective customers is of great value to companies that sell appliances. The pandemic has limited marketing options of company A and caused it to rethink its business model. Table 1 provides an overview of the companies in our case studies.

The five companies in our case studies have different operational scales and such differences in scale is of critical importance in answering an explanatory research question. However, with the purpose of our research being exploratory, it is beneficial to include companies with different scales. Since the critical factors in our theoretical model do not necessarily depend on the type or size of the company, we do not differentiate between companies based on their background information in the analysis. In each case study, we conduct semi-structured interviews, containing three groups of questions. The first group contains six main questions which ask interviewees to provide specific background information on their company and the business transformations they have adopted during the pandemic. The second group contains four main questions, asking about the implementation results of these transformations, such as how long has it taken to complete the transformation and whether it has been reinforced. We also ask whether the transformation has been monitored during the implementation. The third group of questions contains nine main questions: four on decision speed; three on the structure of the decision-making process; one on the implementation structure; and one on the transformation scale. The detailed interview questions are presented in the appendix.

To select the appropriate interviewees in each company, we analyze industry reports and company press releases on COVID-19 related business transformations. There are two criteria for interviewee selection. First, the interviewees should have sufficient working experience in the current company or industry and know details regarding the operational aspects of the business. Second, to avoid biases, the interviewees should not be the one(s) who solely decided on the business transformations in our case studies. Based on these criteria, we choose two managers at the mid-to-senior management level (see Table 1 for the functions of the interviewees) from each company. We use the Delphi technique to interview two managers from the same company. We first conduct interviews with them separately and then aggregate their responses. If there was discrepancy in the responses, we share with the interviewees after each round of interviews and encourage them to revise their earlier responses in light of the answers of the other member of their panel.

We conducted the interviews in person in March, 2021, and in the native language of the interviewees, i.e., Dutch or English, to ensure easy communications. On average, an interview lasted 80 minutes. All interviews were recorded and transcribed shortly afterwards. We followed Erlingsson and Brysiewicz (2017)'s guide to interpret the interview data. As an initial step, we read the transcripts multiple times to gain a general understanding of what the interviewees were talking about. Using MAXQDA software, we divided up the text into smaller meaningful units and condensed these units further. To ensure that the core meaning was still retained, we labeled condensed units by formulating codes and then grouping these codes into categories. In the case that a clear meaning was still unavailable, we revisited the interviewee for further clarification.

**Table 2**  
Implemented transformations per company.

Company	Transformations, ranked based on company perceived importance from high to low			
M	AR	WFH	IoT	ML in operations
E	WFH	ML in operations	Predictive sales forecasting	
C	WFH	ML in customer support	ML in operations	Product feature change
F	WFH	ML in operations		
A	WFH	Business model redesign	VR	

## 5. Interview results

All interviewees in our case studies state that during the pandemic, their companies have set up at least temporary solutions to meet many of the new demands, and much more quickly than they had thought possible before the pandemic. These solutions, regardless of their complexities, are considered as business transformations as they have changed the companies' old ways of doing business, and can be divided into eight categories: (1) work from home (abbrev. as WFH), (2) augmented reality (abbrev. as AR) in remote assistance and maintenance, (3) internet of things (abbrev. as IoT) in manufacturing, (4) machine learning (abbrev. as ML) in operations or customer support, (5) predictive analytics in sales forecasting, (6) virtual reality (abbrev. as VR) in retail, (7) product feature change, and (8) business model redesign.

Among all eight types of transformations, WFH has been adopted by all five companies and is perceived as the most important transformation by four out of five companies. Although all interviewees view WFH as a regulatory constraint, rather than a company initiative, they agree on the critical importance of providing aids to WFH employees in the pandemic period. The smooth transition to WFH is a necessary condition for companies to stay operational. In addition to WFH, ML has been adopted by four out of five companies to operational aspects of the business. Below, we elaborate on the transformations of each company and how their importance to business operations is perceived by the company. Table 2 provides an overview of the results.

The business of company M in manufacturing industry involves daily maintenance of engineering equipment at sites. Thus, the primary goal of its transformations in the pandemic period is to ensure operations continue through remote solutions. First, it has implemented AR to safeguard the virtual presence of safety engineers at its maintenance sites all over the globe. The concept of AR was not new to the company before the pandemic, but the company only had limited experience. Since the start of the pandemic, the company has prioritized the roll-out of this technology and scaled up the adoption throughout the company. Second, WFH has been adopted, however, at the cost of efficiency, as IT equipment in manufacturing industry requires specific adjustments to allow remote access and such adjustments are usually not optimal. For example, before the pandemic, most software in company M would only be used on local networks for security reasons and employees manually connect local databases to enterprise resource planning (ERP) systems. In the pandemic period, such a manual connection was impossible as engineers could not go to sites to get the offline data. Thus, the company has developed an interface which connects ERP to a part of its offline databases. Due to partial database availability, several standard business procedures of the company have been delayed. Third, the company has adopted IoT at its production sites, that is to collect critical production data and use cloud analytics to turn this data into valuable insights about the efficiency of the operations. It is worth mentioning that the adoption of IoT has already been underway for 2 years in the company, and the pandemic has just accelerated the roll-out of this technology. Fourth, using data on the state of its equipment, the company has adopted ML to find patterns that help predict and ultimately prevent equipment failures.

In company E in e-commerce industry, the primary goal of its transformations is to quickly scale up the operations to keep up with the surge in demand. Three transformations have been adopted: WFH, ML in operations, and predictive analytics in sales forecasting. First, the company has developed many tools to ease the transition to WFH. The main goal of these tools is to facilitate decentralized collaborations between different departments and teams since such collaborations are of critical importance in dealing with a large amount of urgent operational issues that happen at the same time. Second, the company has used ML to identify potential operational issues, such as shortages of resources, which could result from decentralized decision making. Third, the company has adapted its sales forecasting models, e.g., by incorporating social media data, to predict abnormal demand patterns in the pandemic period.

In company C in cloud analytics industry, the pandemic has posed many financial challenges to its clients. Thus, the primary goal of its transformations is to help clients improve their cash flow and working capital position, for example, through postponing payments, minimizing invoice approval times, and maximizing the use of e-invoicing. Four transformations have been adopted: WFH, ML in customer support, ML in operations, and product feature change. First, similar to company E in e-commerce industry, company C has also implemented WFH tools which focus on facilitating decentralized collaboration. Second, the company has used ML in customer support with the goal to identify potential needs of current clients and develop effective interventions. Third, since the company has developed new operational processes to meet changing needs of its clients, it has also used ML to monitor these processes. Fourth, some of the current offerings of the company, e.g., virtual assistant AI technologies, require COVID-19 related updates. The company has taken rapid actions to adjust its product features.

Company F in finance industry has suffered severely from the pandemic. The primary goal of its transformations is to keep afloat while maintaining the affordability of its services. Two transformations have been adopted: WFH and ML in operations. First, company F has implemented tools which focus on shortening the process time of WFH related expense declaration. Second, the company has adopted ML to detect potential demand changes and labor supply constraints, which helps the company adjust capacity accordingly. The goal here is to reduce operating costs.

In company A in AI appliance industry, the primary goal of its transformations is to resume operations. There are three transformations: WFH, business model redesign, and VR in retail. First, WFH has been adopted. Similar to company M in manufacturing industry, WFH is challenging for companies that sell appliances. Previously, company A relied on parallel collaborations between engineers, e.g., some engineers test the equipment while others implement it. In the WFH setting, this workflow has changed to a sequential flow, e.g., the equipment is first tested by some engineers at home and then shipped to other engineers for implementation. The company has developed tools to ensure the smooth connection between remote employees. Second, the company has redesigned its business model and changed the target customer group. Before, the company employed a B2B business model and the main customers were construction companies of high-end residence buildings. In the pandemic period, the company has changed its business model to B2C since its have observed an increasing interest in home AI appliances from individual customers. The segment of elderly customers is the most interested customer group, possibly resulting from staying home alone. Thus, the company has shifted the focus to elderly residents. Since this customer group has special needs, the company has also changed its offerings. Third, in order to display its products to prospective customers without visiting their home, the company has built a temporary site at a remote location where customers can visit and the company uses VR to showcase its products.

**Table 3**  
Transformation scale and completion time.

Company	Transformations	Scale	Completion Time (compared to before)
M	AR	Companywide	1 Week (faster)
	WFH	Companywide	1 Week (faster)
	IoT	Unit-specific	Ongoing
	ML in operations	Unit-specific	2 Months (faster)
E	WFH	Companywide	1 Week (faster)
	ML in operations	Companywide	1 Month (equal)
	Predictive sales forecasting	Unit-specific	1 Week (equal)
C	WFH	Companywide	1 Week (faster)
	ML in customer support	Companywide	1 Month (equal)
	ML in operations	Unit-specific	2 Months (slower)
	Product feature change	Unit-specific	1 Month (faster)
F	WFH	Companywide	1 Week (faster)
	ML in operations	Unit-specific	2 Months (equal)
A	WFH	Companywide	3 Weeks (equal)
	Business model redesign	Companywide	3 Months (slower)
	VR	Companywide	2 Months (equal)

5.1. Transformation result

When asking about the result of the transformations of their companies, all interviewees state that all their transformations are effective and successful. This result is not unexpected as a strong evidence of an effective business transformation is that it keeps business running. In practice, company leaders also hesitate to admit any failure of their business transformations, at least not so quickly. When asking about how their companies evaluate the degree of the effectiveness of these transformations, all interviewees indicate that a shorter completion time leads a transformation to be evaluated as more effective. Here, the completion time is the time since the start of the implementation until it is completed. The value of a transformation only becomes apparent when it comes into effect. Thus, the amount of time it takes to complete the transformation is of critical importance for the success of the transformation. In the history of business transformation, a long completion time is often a key feature of failed cases (Chen et al., 2009). When facing drastic market changes and time pressure, e.g., in the pandemic, the requirement on the transformation speed could possibly be higher as companies are counting on transformations to save business. However, in such a business environment, big changes are often required and big projects take time to plan (Matta and Ashkenas, 2003).

We asked the interviewees to not only describe the time it takes to complete the transformations in the pandemic period, but also to describe the scale of the transformations and to compare the completion time with that of transformations of a similar type or scale before the pandemic. Table 3 presents an overview of the scale and the completion time of the transformations.

Despite of their large scales, the majority (13 out of 16) of the business transformations has been completed faster than before the pandemic, or at least with a similar speed. Companies have seen this result as a proud business achievement and a sign of their resilience, considering the severity of the crisis. For the three transformations, e.g., IoT in company M, companies have spent a longer time to complete due to the large amount of investment required. For each company, the transformation with the highest perceived importance is always the one which has taken the shortest amount of time to complete. However, a correlation between the perceived importance and the completion time of the transformations does not necessarily exist. For example, in companies M, E, and C, the least important transformation has been completed faster than some more important transformations. One possible explanation is that these transformations, e.g., predictive sales forecasting in company E, require a small amount of company resources, and thus a short completion time.

The scale of the implementation is often said to be directly impacting the success of the transformation (Brynjolfsson and Hitt, 2000). A

**Table 4**  
Decision & planning phase.

Company	Transformation	Decision Speed (compared to before)	Decision-making Structure
M	AR	2 Weeks (faster)	Bottom-up
	WFH	1 Day (faster)	Top-down
	IoT	Decided before COVID-19	Bottom-up
E	ML in operations	3 Months (equal)	Bottom-up
	WFH	1 Day (faster)	Top-down
	ML in operations	1 Month (slower)	Bottom-up
	Predictive sales forecasting	1 Week (faster)	Bottom-up
C	WFH	1 Day (faster)	Top-down
	ML in customer support	3 Months (slower)	Bottom-up
	ML in operations	2 Months (slower)	Bottom-up
F	Product feature change	1 Day (faster)	Top-down
	WFH	1 Day (faster)	Top-down
A	ML in operations	1 Month (slower)	Bottom-up
	WFH	1 Day (faster)	Top-down
	Business model redesign	6 Months (slower)	Top-down
	VR	1 Month (slower)	Bottom-up

companywide implementation involves more difficulties, compared to a small-scale unit-specific implementation, and thus may fail at a faster rate (Davenport, 2018). However, companies are more dedicated to large-scale transformations. If more resources are put to ensure a smooth implementation, it is plausible that these transformations can be completed faster. Based on the interview results, a larger scale of the transformation tends to have a shorter completion time, compared to a smaller scale. In addition, transformations that are perceived as highly important have always been implemented companywide and such an implementation has had a shorter or at least a similar completion time than before. There is only one exception: business model redesign in company A. An explanation could be that company A is a startup that was only formed four years ago, and all transformations before or during the pandemic period have been rolled out companywide, thus for them the completion time depends more on other factors than on the scale of the transformation. In addition, redesigning the business model is considered as a major change for any company and such a change is expected to take longer time to complete.

5.2. Transformation process

**Decision & planning phase**

We asked the interviewees about the decision & planning phase of the transformations, particularly, about decision speed, the comparisons with the speed of previous transformations of a similar type of scale, and the dominant structure of the decision-making process. Table 4 provides an overview of the results.

Among all transformations, IoT in company M is the only transformation which was decided before the pandemic. In all companies, the decision on WFH has been made within a day, much faster than the other transformations in the pandemic period and the similar decisions that these companies took before. This is most likely due to government regulations that came into effect immediately at the beginning of the pandemic. Although the decision for WFH came at lightning speed, for half of the other business transformations, the decisions have taken a month or longer for companies to make. We also observe that the perceived importance of these transformations may have contributed to a decision being made within a day or weeks. But exceptions are noticeable. For example, it has taken company C only a day to decide to change some product features, but 3 months to decide to use ML in customer support which is perceived as more important than product



**Table 5**  
Implementation phase.

Company	Transformation	Implementation Structure	Monitoring
M	AR	Roadmap	Not monitored
	WFH	Unstructured	Not monitored
	IoT	Roadmap	Monitored
E	ML in operations	Unstructured	Monitored
	WFH	Unstructured	Not monitored
	ML in operations	Unstructured	Monitored
C	Predictive sales forecasting	Roadmap	Monitored
	WFH	Unstructured	Not monitored
	ML in customer support	Unstructured	Monitored
A	ML in operations	Unstructured	Monitored
	Product feature change	Roadmap	Not monitored
	WFH	Unstructured	Not monitored
F	WFH	Unstructured	Not monitored
	ML in operations	Roadmap	Monitored
A	WFH	Unstructured	Not monitored
	Business model redesign	Unstructured	Monitored
	VR	Unstructured	Monitored

feature change.

Our interview results reveal that during the pandemic, companies have not had a preference for top-down decision-making over the bottom-up approach. However, we find that the structure of the decision-making process is closely linked to decision speed. For the transformations which have been decided the fastest, i.e., within a day, companies have always used the top-down approach. In addition, top-down decision-making usually grants a fast decision, with one exception. In company A, when the idea to redesign the business model came directly from the top management, it still took six months before the idea was finally adopted. Similar to the reason why business model redesign has taken longer time to complete after the decision (see Table 3), when a transformation is considered as major and revolutionary, it requires approval and willingness to collaborate from all levels in the company in the planning phase and such approval takes time.

*Implementation phase*

We asked the interviewees about the implementation phase of the transformations, particularly, about the dominant structure of the implementation process and whether there is monitoring in place for the implementation. Table 5 provides an overview of the results.

For the majority (11 out of 16) of the transformations during the pandemic, companies have not followed a roadmap structure in the implementation phase, that is to define a desired outcome and steps or milestones needed to reach it, considering different future scenarios and specifying potential actions. Instead, our interviewees state that the implementation has been quite unstructured and ad-hoc since companies have limited experience in many of the new technologies and doing business in the pandemic in general, and thus it is difficult for them to assume future scenarios. Comparing the implementation structure with the perceived importance of the transformations, more important transformations often have an unstructured implementation. This may be related to the fact that important transformations likely receive a fast decision (see Table 4), and it is difficult to develop a roadmap strategy within a short amount of time.

When asking about the monitoring mechanism in the implementation phase, all interviewees agree on the importance of monitoring the progress of the implementation. However, nearly half (7 out of 16) of the transformations during the pandemic have had no such monitoring. They further explain the reason why there is no monitoring: in times of

**Table 6**  
Reinforcement phase.

Company	Transformation	Reinforcement
M	AR	Reinforced
	WFH	Reinforced
	IoT	Reinforced
E	ML in operations	Reinforced
	WFH	Reinforced
	ML in operations	Reinforced
C	Predictive sales forecasting	Reinforced
	WFH	Reinforced
	ML in customer support	Not Reinforced
F	ML in operations	Reinforced
	Product feature change	Reinforced
	WFH	Reinforced
A	ML in operations	Reinforced
	WFH	Reinforced
	Business model redesign	Reinforced
	VR	Not Reinforced

crisis, the primary goal of these transformations is to help companies operational, and thus the financial performance of a transformation is not as important as having the transformation implemented fast. There is no clear correlation between the structure of the implementation and whether it has been monitored. We also find that transformation that are perceived as less important by companies have usually been monitored. Similar to the previous finding that more important transformations likely have an unstructured implementation, the reason why less important transformations have been monitored may be because these transformations have been decided slower than more important transformations. Given more decision time, companies are likely to develop a monitoring plan.

*Reinforcement phase*

Finally, we asked the interviewees about the reinforcement of their business transformations. Table 6 provides an overview of the results. Among all 16 transformations, two have not been reinforced by companies after the implementation. All interviewees stress that reinforcement is important when the purpose is to make changes last. However, they admit that in times of crisis, not all changes need to last as companies expect some of the problems will be resolved and the old ways of doing business are more desirable. VR in company A has not be reinforced due to this reason. Since the company has changed its business model and now targets a different customer group, using VR to display their products at a remote site is no longer needed.

Another scenario where companies may not sustain a transformation is where they discover the problems they predicted earlier did not happen, and thus their solutions should not be reinforced. ML in customer support in company C is subject to this scenario. At the beginning of the pandemic, the company expected its clients to have problems with their cash flows, and thus they employed ML to provide customer interventions. However, very quickly the company learned that the problems were not as severe as expected. As a result, this transformation has been dropped by the company.

*5.3. Impact of transformation process on result*

We verify our five propositions on how different transformation processes impact the result of the transformation by comparing decision speed and structure in the decision & planning phase, the implementation structure and whether it has been monitored in the implementation phase, and whether it has been reinforced after the implementation with the completion time of the transformations. Table 7 provides an overview of the results. When comparing decision speed of the transformations with the amount of time it has taken to complete the implementation, there is a positive correlation between a fast decision (< 1 month) and a short completion time (≤ 1 month). It indicates that our proposition 1, that is, fast decision speed is needed for an effective

**Table 7**  
Three phases of business transformation.

Transformation (Completion Time)	Decision & Planning Phase		Implementation Phase		Reinforcement Phase
	Speed	Structure	Structure	Monitoring	Reinforcement
M1 (< 1 Month)	< 1 Month	BU	RM	NM	Reinforced
M2 (< 1 Month)	< 1 Month	TD	U	NM	Reinforced
M3 (> 1 Month)	N.A.	BU	RM	M	Reinforced
M4 (> 1 Month)	> 1 Month	BU	U	M	Reinforced
E1 (< 1 Month)	< 1 Month	TD	U	NM	Reinforced
E3 (< 1 Month)	< 1 Month	BU	RM	M	Reinforced
E2 (1 Month)	> 1 Month	BU	U	M	Reinforced
C1 (< 1 Month)	< 1 Month	TD	U	NM	Reinforced
C4 (1 Month)	< 1 Month	TD	RM	NM	Reinforced
C2 (1 Month)	> 1 Month	BU	U	M	Not Reinforced
C3 (> 1 Month)	> 1 Month	BU	U	M	Reinforced
F1 (< 1 Month)	< 1 Month	TD	U	NM	Reinforced
F2 (1 Month)	> 1 Month	BU	RM	M	Reinforced
A1 (< 1 Month)	< 1 Month	TD	U	NM	Reinforced
A3 (> 1 Month)	1 Month	BU	U	M	Not Reinforced
A2 (> 1 Month)	> 1 Month	TD	U	M	Reinforced

Notes: (1) Transformation in company X is indexed as X<sub>n</sub>, where n is the rank of this transformation in terms of perceived importance by the company; (2) In the column which shows the structure of the decision-making process, BU stands for bottom-up, whereas TD stands for top-down; (3) In the column which shows the structure of the implementation process, RM stands for roadmap, whereas U stands for unstructured; (4) In the column which shows monitoring of the implementation, M stands for monitored, whereas NM stands for not monitored.

business transformation, holds true. We find that both a top-down and bottom-up decision-making structure can lead to a fast completion. Therefore, we cannot confirm whether our proposition 2, that is, top-down decision making is needed for an effective business transformation, holds true.

Except for IoT in company M (M3 in Table 7) which requires a large amount of investment, a roadmap structure almost always leads to a short completion time ( $\leq 1$  month). It confirms that our proposition 3, that is, a roadmap implementation structure is needed for an effective business transformation, holds true. According to the comparison between completion time and monitoring, transformations that have been monitored have had a longer completion time than those that have not been monitored. Therefore, we cannot say that monitoring is needed in the implementation phase for an effective business transformation. However, monitoring plays an important role in determine whether a change should last. Only two transformations have not been reinforced after the implementation. The reason is that both companies have learned through monitoring that these solutions were not delivering expected financial results. This result indicates that our proposition 4, that is, monitoring is needed in the implementation phase, could still hold true. Since most of the transformations have been reinforced, we can conclude that our proposition 5, that is, reinforcement is needed, holds true.

We also discover the potential reasons why companies have not implemented monitoring for nearly half of the transformations. Comparing decision speed of the transformations with whether there is monitoring in the implementation phase, fast decisions are most likely linked to no monitoring. There is one exception: predictive sales forecasting in company E (E3 in Table 7). This company has made a quick decision, i.e., within a week, to adopt the transformation, and since monitoring mechanisms have long been used in the company for any change in the sales forecasting models, it has directly used these tools to monitor the new change. Monitoring has been implemented for slow decisions ( $\geq 1$  month) of business transformations. Top-down decision-making also leads to no monitoring, except for the business model redesign in company A (A2 in Table 7) which is considered as a major decision for this startup and thus requires monitoring. The bottom-up approach most likely leads to monitoring, except for one example: AR in company M (M1 in Table 7). This is probably due to the close link

between the bottom-up approach and slow decision speed which allows companies to have more time on planning the monitoring mechanism. It also shows that when designing the monitoring mechanism, bottom-up opinions could be valuable.

## 6. Conclusions and discussions

We study how companies have transformed their business in the pandemic period and investigate the impact of decision speed, the structure of the decision-making process, the structure of the implementation process and the scale of the implementation on the outcome of these transformations. We conduct case studies in five industries and the examples of business transformations in our case studies cover eight categories.

All companies indicate that the amount of time to complete the implementation should be considered when evaluating the effectiveness of the transformation in the pandemic period: the shorter, the better. This criterion already exists for business transformations in a normal context. The pandemic has put a higher implementation speed requirement on companies. In our case studies, the majority of the business transformations has been completed faster than similar transformations executed in company history. These vary from one week for transformations such as AR in remote assistance and maintenance to two months for transformations such as ML in operations. The barrier that prevents some transformations from being completed faster is still the large amount of investment required. Monitoring the progress of the transformations has been recognized by companies as important in the implementation phase. However, nearly half of the transformations have not been monitored in the pandemic period since the top priority of companies in times of crisis is to remain operational and the transition cost of the transformations is of a lesser concern.

Different from the completion time of the implementation, the time it has taken to decide on the business transformations has not been shortened substantially by the pandemic. It indicates that even under such market and time pressure, companies still prefer to think thoroughly about potential transformations. We find that a fast decision contributes to the reduction in the completion time of the transformations, although it most likely leads to no monitoring. In order to make a fast decision, companies need to adopt the top-down approach.

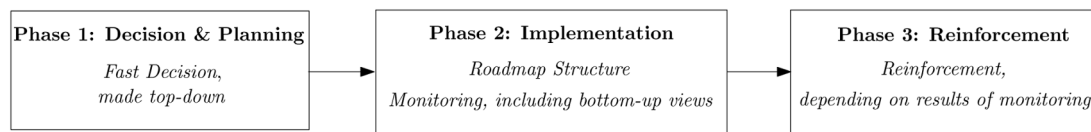


Fig. 2. Framework of business transformation.

Possibly because of the close link between the top-down approach and a fast decision, top-down decision-making also most likely leads to a short completion time and no monitoring of the transformations. The bottom-up approach may not necessarily reduce the completion time, but it likely leads the transformations to be monitored.

In the pandemic period, many transformations have not been implemented structurally. This is an expected result, considering the amount of changing regulations and market conditions at that time. A fast decision also likely leads to an unstructured implementation. However, a roadmap structure almost always reduces the completion time. In addition, a large-scale of the implementation leads to a fast completion, which results from a sense of urgency and unity in times of crisis.

#### Implications to theory

Based on our findings, the experienced business transformation processes during the pandemic differ from theory in three ways. First, the extant literature emphasizes the weight of the decision & planning phase in the change process, suggesting companies spend most of the time planning. We find that during the pandemic, a fast decision can be better than a right decision. Fast decision making helps companies complete the implementation faster and a transformation can only deliver benefits once it comes into effect. If it does not generate the expected benefits, it is still better for companies to learn this early, i.e., through a fast implementation. Second, the literature highlights the value of having a structured implementation process when transforming business, particularly for the implementation that is expected to take a long time as then companies have enough time to follow the structured plan. We find that during the pandemic, a roadmap implementation strategy can actually reduce the completion time of the implementation. When implementing a change in times of crisis, employees are more engaged in the process if they can see the end of the tunnel. Third, the literature stresses the importance of having a monitoring mechanism in place in the implementation process and considers it as inseparable from having a structured implementation. We find that during the pandemic, such correlation between monitoring and roadmap implementation does not necessarily exist. However, monitoring the progress of the implementation generates benefits in the reinforcement phase where companies need to decide which transformations should be discontinued.

#### Lessons learned from COVID-19

Based on our results, the lessons learned from the business transformations during the pandemic are as follows. First, effective business transformations when facing drastic market changes and time pressure rely on speed of acting. Second, both top-down and bottom-up decision-making can be beneficial in times of crisis. In order to make a fast decision, companies can use the top-down approach, while bottom-up views should be adopted when monitoring the progress of the transformation. Third, a structured implementation process can help speed up the transformation and such a structure can be planned in advance. Fourth, monitoring is still of value when implementing transformations during the pandemic. Not all transformations should be reinforced, monitoring helps companies decide which changes should be discontinued. Based on our findings, we propose in Fig. 2 a framework of business transformation for companies in times of crisis.

The COVID-19 pandemic has caused catastrophic economic effects, but it did not grind everything to a halt. It is still fortunate that technology has advanced so much that companies can remain operational and the crisis provides an opportunity for companies to change their old ways of doing business. Borrowing what Charles Dickens wrote in “A

Tale of Two Cities”, it was the best of times, it was the worst of times, it was the spring of hope, it was the winter of despair. Through effective business transformations, we believe that companies can come out of the crisis better than before.

#### Limitations and future research

Our study is not exempt from limitations, many of which offer opportunities for future research. First, we selected a particular set of potential factors which will affect the success of business transformation. We also selected a particular theoretical framing focused on the direct impact of a factor on the transformation. However, we admit that there might be additional and alternative factors such as organizational culture and trust, and arguments on how they affect the transformation. Extending our framework with additional theorizing might enable future research to further tease out the critical factors for the success of the transformation. Second, the effects of individual behavior on organizational transformations in difficult times were underexplored in our study. The micro-level of analysis may provide additional insights into how managers should make decisions in times of crisis and this should be incorporated in future research. Third, similar to other qualitative research on COVID-19 related business transformation, data in our study is subjective. We tried to overcome the potential bias in our interviewees’ responses by considering companies in a variety of industries and interviewing multiple people from different departments in each company. Future research might focus on one company and obtain detailed financial data for testing hypotheses.

#### Declaration of Competing Interest

none.

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#### Appendix A. Main interview questions

##### First group of questions

Q1a: What has been the most/least successful business transformation(s) during the pandemic (since March 2020)?

Q1b: Are these transformations directly induced by the COVID-19 crisis, or only circumstantially related?

Q1c: What was the context in terms of market changes of the most/least successful business transformation?

Q1d: Have prior business transformations been triggered by disruptive events and led to lasting market changes?

Q1e: Is the financial outcome of business transformation part of the success criteria?

Q1f: Is the speed of business transformation part of the success criteria?

##### Second group of questions

Q2a: How fast was the implementation process for the most/least successful business transformation?

Q2b: How does the speed of transformation compare to previous

transformations of a similar type or scale?

Q2c: What was the financial performance of the most/least successful business transformation?

Q2d: How does the financial Performance compare to previous business transformation of a similar type or scale?

### Third group of questions

Q3a: When did the decision process leading to the business transformation start? did it start after the COVID-19 crisis?

Q3b: Was there any preparation done before the COVID-19 crisis?

Q3c: How fast was the decision process for the most/least successful business transformation?

Q3d: How does decision speed compare to previous business transformation of a similar type or scale?

Q3e: Which parties were involved in the decision making process for the most/least successful business transformation?

Q3f: Was the decision made top-down or bottom up?

Q3g: What was the sequence of actions leading up to the decision?

Q3h: What was the structure of the implementation for the most/least successful business transformation?

Q3i: What was the scale of the implementation for the most/least successful business transformation?

### References

- Abdelaal, K.Z., 2018. Digital business transformation and strategy: what do we know so far?. *10.13140/RG.2.2.36492.62086*.
- Aktar, M.A., Alam, M.M., Al-Amin, A.Q., 2021. Global economic crisis, energy use, CO<sub>2</sub> emissions, and policy roadmap amid COVID-19. *Sustain. Prod. Consum.* 26, 770–781.
- Aladwani, A.M., 2001. Change management strategies for successful ERP implementation. *Bus. Process Manag. J.*
- Amankwah-Amoah, J., Khan, Z., Wood, G., 2021. COVID-19 and business failures: the paradoxes of experience, scale, and scope for theory and practice. *Eur. Manag. J.* 39 (2), 179–184.
- Barua, A., Konana, P., Whinston, A.B., Yin, F., 2001. Managing e-business transformation: opportunities and value assessment. *Sloan Manag. Rev.* 43 (1), 36–44.
- Baum, W., 2003. Strategic decision speed and firm performance. *Strateg. Manag. J.* 24 <https://doi.org/10.1002/smj.343>.
- Berman, S.J., 2012. Digital transformation: opportunities to create new business models. *Strategy Leadersh.*
- Bhattacharjee, A., Jahanshahi, A., 2020. The COVID-19 crisis brings spring season for translucent activity. does it result in exogenous uncertainty for the entrepreneurs and bound-less commodity pricing. *Asian J. Multidiscip. Stud.*
- Bogdandy, B., Tamas, J., Toth, Z., 2020. Digital transformation in education during COVID-19: a case study. *Proceedings of the 11th IEEE International Conference on Cognitive Infocommunications (CogInfoCom)*. IEEE, pp. 000173–000178.
- Böhringer, C., Rutherford, T.F., 2008. Combining bottom-up and top-down. *Energy Econ.* 30 (2), 574–596.
- Bourgeois, L., K, E., 1988. Strategic decision processes in high velocity environments: four cases in the microcomputer industry. *Manag. Sci.* 34, 816–835.
- Brem, A., Viardot, E., Nylund, P.A., 2021. Implications of the coronavirus (COVID-19) outbreak for innovation: which technologies will improve our lives? *Technol. Forecast. Soc. Chang.* 163, 120451.
- Brynjolfsson, E., Hitt, L.M., 2000. Beyond computation: information technology, organizational transformation and business performance. *J. Econ. Perspect.* 14 (4), 23–48.
- Brynjolfsson, E., McAfee, A., 2014. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. W.W. Norton and Company.
- Calo, R., 2017. *Artificial intelligence policy: a primer and roadmap*. UCDC Rev. 51, 399.
- Chaudoir, S.R., Dugan, A.G., Barr, C.H., 2013. Measuring factors affecting implementation of health innovations: a systematic review of structural, organizational, provider, patient, and innovation level measures. *Implement. Sci.* 8 (1), 1–20.
- Chen, C.C., Law, C.C., Yang, S.C., 2009. Managing ERP implementation failure: a project management perspective. *IEEE Trans. Eng. Manag.* 56 (1), 157–170.
- Chen, S.T., Chang, B.G., 2012. The effects of absorptive capacity and decision speed on organizational innovation: a study of organizational structure as an antecedent variable. *Contemp. Manag. Res.* 8 (1).
- Corsini, L., Dammicco, V., Moultrie, J., 2021. Frugal innovation in a crisis: the digital fabrication maker response to COVID-19. *R&D Manag.* 51 (2), 195–210.
- Daudelin, M.W., 1996. Learning from experience through reflection. *Organ. Dyn.* 24 (3), 36–48.
- Davenport, W., 2018. Why so many high-profile digital transformations fail. *Demirkan, H., Spohrer, J.C., Welsler, J.J., 2016. Digital innovation and strategic transformation. IT Prof.* 18 (6), 14–18.
- Ebersberger, B., Kuckertz, A., 2021. Hop to it! the impact of organization type on innovation response time to the COVID-19 crisis. *J. Bus. Res.* 124, 126–135.
- Ebert, C., Duarte, C.H.C., 2018. Digital transformation. *IEEE Softw.* 35 (4), 16–21.
- Eisenhardt, K., 1989. Making fast strategic decisions in high-velocity environments. *Acad. Manag. J.* 27, 299–343.
- Erlingsson, C., Brysiewicz, P., 2017. A hands-on guide to doing content analysis. *Afr. J. Emerg. Med.* 7 (3), 93–99.
- Forth, R.D. L., Chakraborty, 2021. *Increasing-odds-of-success-in-digital-transformation*. Garvin, D.A., 2003. *Learning in Action: a Guide to Putting the Learning Organization to Work*. Harvard Business Review Press.
- George, G., Sleeth, R.G., Siders, M.A., 1999. Organizing culture: leader roles, behaviors, and reinforcement mechanisms. *J. Bus. Psychol.* 13 (4), 545–560.
- Gerring, J., 2008. Case selection for case-study analysis: qualitative and quantitative techniques. *The Oxford Handbook of Political Methodology*.
- Giones, F., Brem, A., Pollack, J.M., Michaelis, T.L., Klyver, K., Brinckmann, J., 2020. Revisiting entrepreneurial action in response to exogenous shocks: considering the COVID-19 pandemic. *J. Bus. Ventur. Insights* 14, e00186.
- Gkeredakisa, L.A.B., 2021. Crisis as opportunity, disruption and exposure: exploring emergent responses to crisis through digital technology. *Inf. Organ.* 31 (1).
- Gregurec, T.T., 2021. The impact of COVID-19 on sustainable business models in SMEs. *J. Sustain.* 13 (1098) <https://doi.org/10.3390/su13031098>.
- Heyden, S., Mariano, K.B., Fourn, A.S., 2017. Rethinking ‘top-down’ and ‘bottom-up’ roles of top and middle managers in organizational change: implications for employee support. *J. Manag. Stud.* 54 <https://doi.org/10.17863/CAM.7235>.
- Hodder, A., 2020. New technology, work and employment in the era of COVID-19: reflecting on legacies of research. *New Technol. Work Employ.* 35 (3), 262–275.
- Horlacher, A., Klarner, P., Hess, T., 2016. Crossing boundaries: organization design parameters surrounding CDOs and their digital transformation activities.
- Jadoul, N.S., Willi, 2021. *Agility-in-the-time-of-COVID-19-changing-your-operating-model-in-an-age-of-turbulence*.
- Jick, T., 1991. *Implementing Change: Note*. Harvard Business School Pub.
- Jones, J., 1993. *High Speed Management: Time-Based Strategies for Managers and Organizations*. Jossey-Bass: San Francisco, CA.
- Judge, W., Miller, A., 1991. Antecedents and outcomes of decision speed in different environmental contexts. *Acad. Manag. J.* 34, 449–463.
- Kim, Y.H., Sting, F.J., Loch, C.H., 2014. Top-down, bottom-up, or both? Toward an integrative perspective on operations strategy formation. *J. Oper. Manag.* 32 (7–8), 462–474.
- Kirtley, J., O’Mahony, S., 2020. What is a pivot? Explaining when and how entrepreneurial firms decide to make strategic change and pivot. *Strateg. Manag. J.*
- Kotter, J.P., 1995. Why transformation efforts fail. *Harvard Bus. Rev.* 73 (2), 59–67.
- Kuckertz, A., Braendle, L., Gaudig, A., Hinderer, S., Reyes, C.A.M., Prochotta, A., Berger, E.S., 2020. Startups in times of crisis-a rapid response to the COVID-19 pandemic. *J. Bus. Ventur. Insights* 13 (169).
- Langsdorf, S., 2011. *EU Energy Policy: From the ECSC to the Energy Roadmap 2050*. Brussels: Green European Foundation.
- Lewin, A.Y., Peeters, C., 2006. Offshoring work: business hype or the onset of fundamental transformation? *Long Range Plan.* 39 (3), 221–239.
- Marchand, W., 2014. *Digital business transformation: where is your company on the journey*.
- Markovic, S., Kaporic, N., Arslanagic-Kalajdzic, M., Kadic-Magljalic, S., Bagherzadeh, M., Islam, N., 2021. Business-to-business open innovation: COVID-19 lessons for small and medium-sized enterprises from emerging markets. *Technol. Forecast. Soc. Chang.* 170, 120883.
- Matta, N.F., Ashkenas, R.N., 2003. Why good projects fail anyway. *Harvard Bus. Rev.* 81 (9), 109–116.
- Mehta, S., Saxena, T., Purohit, N., 2020. The new consumer behaviour paradigm amid COVID-19: permanent or transient? *J. Health Manag.* 22 (2), 291–301.
- Mento, A., Jones, R., Dirndorfer, W., 2002. A change management process: grounded in both theory and practice. *J. Chang. Manag.* 3 (1), 45–59.
- Michaelis, T.L., Carr, J.C., Scheaf, D.J., Pollack, J.M., 2020. The frugal entrepreneur: a self-regulatory perspective of resourceful entrepreneurial behavior. *J. Bus. Ventur.* 35 (4), 105969.
- Mom, T.J., Van Den Bosch, F.A., Volberda, H.W., 2007. Investigating managers’ exploration and exploitation activities: the influence of top-down, bottom-up, and horizontal knowledge inflows. *J. Manag. Stud.* 44 (6), 910–931.
- Morgan, R., 2008. Managing business transformation to deliver strategic agility. *Strateg. Chang. Brief. Entrep. Financ.* 17 (5–6), 155–168.
- Mueller, G.C., Mone, M.A., Barker, V.L., 2007. Formal strategic analyses and organizational performance: decomposing the rational model. *Organ. Stud.* 28 (6), 853–883.
- Nagy, B., Blair, E., Lohrke, F., 2014. Developing a scale to measure liabilities and assets of newness after startup. *Int. Entrep. Manag. J.* 10, 277–295.
- Rakshit, 2021. Social media and the new product development during COVID-19: an integrated model for SMEs. *Technol. Forecast. Soc. Chang.* 170, 120869.
- Schaffer, R.H., Thompson, H.A., 1992. Successful change programs begin with results. *Harvard Bus. Rev.* 70 (1), 80–90.
- Schwertner, K., 2017. Digital transformation of business. *Trakia J. Sci.* 15 (1), 388–393.
- Seibert, K.W., Daudelin, M.W., 1999. *The Role of Reflection in Managerial Learning: Theory, Research, Practice*. Quorum, London.
- Steinheider, W., 2008. From the bottomup: sharing leadership in a police agency. *Police Pract. Res.* 9, 145–163. <https://doi.org/10.1080/15614260802081303>.
- Tabrizi, B., Lam, E., Girard, K., Irvin, V., 2019. Digital transformation is not about technology. *Harvard Bus. Rev.* 13, 1–6.
- Venkatraman, 2017. *The Digital Matrix: New Rules for Business Transformation Through Technology*. Greystone Books.



- Venkatraman, N., 1994. It-enabled business transformation: from automation to business scope redefinition. *Sloan Manag. Rev.* 35.73–73
- Westerman, G., Bonnet, D., McAfee, A., 2014. *Leading Digital: Turning Technology into Business Transformation*. Harvard Business Press.
- Whillans, P.T., 2021. Experimenting during the shift to virtual team work: learnings from how teams adapted their activities during the COVID-19 pandemic. *Inf. Organ.* 31 (1).
- Young, A., Rogers, P., 2019. A review of digital transformation in mining. *Min. Metall. Explor.* 36 (4), 683–699.

**Xishu Li** is an assistant professor of Management Science at Lancaster University Management School, Lancaster University, United Kingdom. She received her PhD from Rotterdam School of Management, Erasmus University, the Netherlands, in 2019. Her research interests are capacity investment, new product development, supply risk assessment, transportation planning and gig economy. Her work has been published at journals such as POM, DS and IJPE.

**Maarten Voorneveld** is a PhD student of Operations Research at the Leiden Institute of Advance Computer Science (LIACS), Leiden University, the Netherlands. He received his MSc from the Science and Innovation Management, Utrecht University, the Netherlands, in 2012. His research interests are business transformation, digitization, artificial intelligence, and internet of things.

**René (M.) B.M. de Koster** is a professor of logistics and operations management at the Department of Technology and Operations Management (TOM), Rotterdam School of Management (RSM), Erasmus University. His research interests are warehousing, material handling, container terminal operations, behavioural operations and sustainable logistics. He is the author and editor of eight books and over 230 papers published in books and journals such as OR, POM, JOM, TS, IISE T, EJOR, and Interfaces. He is in the editorial boards of eight academic journals, a fellow of two research schools, and founder of the Material Handling Forum. He chairs RSM's Department of TOM.