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The Window of opportunity brought by the COVID-19 pandemic: An ill wind blows for digitalization leapfrogging

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Abstract

We analyze how the COVID-19 pandemic crisis created the window of opportunity (WOP) in the digital industry and digital applications. These led to the leapfrogging of digital transformation in China. This was considered a major contribution to the pandemic recovery in early to mid-2020. By exploring this phenomenon, we examine alternatives for sustainable development during such turbulent circumstances mediating the destruction arisen from the crisis. We unveil the mechanisms that reveal the large-scale digitalization that emerged as part of the response to managing the crisis. We find that during this crisis in China, the WOPs from policy, technology and demand perspectives facilitated the leapfrogging of the digital transformation in numerous social and economic areas. More importantly, we also discover that the WOPs are unevenly distributed among firms, time, and locations. Based on these results, we put forth that the COVID-19 pandemic brings a relative window of opportunity (RWOP) to society, impacting industries and firms. However, these impacts are disproportionately distributed. To the best of our knowledge, this is one of the first studies to illustrate how a social crisis leads to WOPs enhancing digital transformation. Furthermore, this also ultimately provided a coping mechanism to deal with the pandemic.

Keywords: COVID-19, window of opportunity, leapfrogging, digital transformation, digitalization, China

1. Introduction

In late 2019, the outbreak of COVID-19 became a global crisis due to its rapid spread and enormous social, economic and ecological impacts. By December 31st, 2020, there were over 118 million cases confirmed globally. The wide lockdown in China and elsewhere created enormous impacts on human society. Business practices, public services and people's lifestyles were primarily affected. It is usually considered that such a crisis leads to an economic recession and social downturn (Nicola et al., 2020). However, the COVID-19 pandemic surprisingly facilitated a remarkable surge of digital transformation in China, which eventually aided the country's ability to cope with the pandemic. A wide variety of digital technologies such as cloud office, online education, smartphone apps of healthcare, public emotion consolation system, online entertainment, online public services, agile production, etc., were rapidly adopted. These actions significantly improved the social and economic climate for fighting against the pandemic. We consider the surge of the digital transformation nationwide as leapfrogging (Lee and Malerba, 2017) and observe that these WOPs were induced by the COVID-19 pandemic.

We also believe that the leapfrogging of digitalization is beneficial in tackling the COVID-19 pandemic. The established literature summarizes how successive changes in an industry's leading position are recognized as a "catching-up cycle" (Lee and Malerba, 2017). Incumbents are unable to maintain their advantages, thereby allowing latecomers to catch up. Scholars have gradually started to use the concept of "window of opportunity" in their research to refer to the definition, triggers, processes, and mechanisms of the catch-up cycle. Thereby, characterizing the opportunities arising from technological changes, changes in demand, institutions/policies, as well

as other factors such as social movements. The recent research on the impact of the COVID-19 pandemic has focused on the reactions from business firms' such as resilience (van Hoek, 2020), adaption of marketing strategy (Wang et al., 2020), and the restructuring of the global value chain (Verbeke, 2020). Yet, little research exists on how a social crisis might be an alternative source of building competitive advantage (Zahra, 2020) and how this can lead to positive benefits for firms (Teece, 2020). It was observed that a few firms outperformed others during the pandemic period. In particular, some firms were more successful in their digitalization process. Such divergent performance during the social crisis requires further investigation into the impact of social disturbance on business operations. Thus, in this study, we attempt to shed light on the question of how the WOPs emerging from a social crisis, such as the COVID-19 pandemic, foster the development of firms. To be specific, we focus on exploring how the WOPs led to the rapid digitalization of Chinese firms.

We conducted a qualitative analysis of the firms' behaviors during the COVID-19 pandemic to understand how social crises lead to differences in performance. In the catching-up literature, scholars use the leading firms' global production and market shares to measure the advancement of an industry (Mowery and Nelson, 1999). Also, the suggestion exists, that the leadership of an industry can be illuminated by the improvement of the leading firms' innovation and technology capability (Hain et. al., 2020). Therefore, we use multiple cases of leading firms to illuminate the outcome of industry digitalization. Our findings demonstrate that a social crisis such as the COVID-19 pandemic manifests itself as WOPs for business firms. Specifically, we illustrate how the pandemic resulted in different WOPs, namely political, technological and demand related. More importantly, rather than evenly distributed or absolute opportunities, we identify that the WOPs brought by external turmoil such as the COVID-19 pandemic provide relative opportunities

for firms. Thus, we conclude our findings with a concept of the relative window of opportunity (RWOP) that emerged from the social crisis.

Our results have three major contributions. First, we contribute to the literature by extending the scope of WOPs from a one-dimensional to a two-dimensional concept with the idea of RWOP. The established literature on WOPs summarizes the contributory attributes of WOPs as, the orientations (endogenous and exogenous), the sources (policy-related, technology-related and market related), and the legibility (instant or repetitive ones) etc. (Lee and Malerba, 2017). Our findings of RWOPs extend the current studies of the WOP by identifying the significant core features of the relativeness. In so doing, our understanding of the WOP literature is enriched. Second, our study shows how RWOPs impact on firms during the COVID-19 pandemic period. This is demonstrated by the three key features of RWOP, namely, diversity, dynamism and complexity. Such results provide new insights into these three pillars of RWOPs. They also provide greater understandings of the divergent performance of firms, when facing WOPs as a result of social crises such as COVID-19. Finally, our observations of Chinese firms' performance following digitalization during the COVID-19 pandemic, responds to the call of crisis management. As China is one of the first pioneered countries experiencing the pandemic (and possibly also the first one recovered from the pandemic), the experience of China may provide practical guidelines for other regions. This is especially true to those still trying to grapple with the crisis, such as the United States, the European Union, and Latin American countries (Yu and Pang, 2020).

2. Literature review

2.1 The Window of opportunity

Within the realm of the literature on WOPs, Lee and Malerba (2017) summarize how WOPs

emerge from change or incongruity in the external environment and conclude that there are three types of WOP, i.e., policy-related, technology-related and demand-related. Business practices usually involve the interaction of these three main types of WOP and firm strategy. Together these elements determine the success of less competitive firms and enhance their competence and capabilities (Kang and Song, 2017). WOPs can be further classified into being "major" or "marginal" (Lee and Malerba, 2017). When important WOPs are open, the potential for change in leadership is greater for those firms that engage in increasingly aggressive competitive behaviors (Guennif and Ramani, 2012; Lee and Malerba, 2017).

Policy or institutional changes are important factors that lead to the formation of WOPs, as was seen with the catch-up process of the Taiwanese and Korean high-tech industries in the 1980s and 1990s (Lee and Lim, 2001). This was also visible in the Indian pharmaceutical industry from the 1950s to 2010s (Guennif and Ramani, 2012). Lee and Malerba (2017) summarize these catching-up cases and formally propose the concept of an institutional (policy) window. Early studies indicate that WOPs primarily result from discontinuity in business environments, and thereby offer firms the potential to leapfrog alongside their technological capabilities. Landini et al. (2017) use simulation analysis to conclude that radical technological discontinuities create WOPs for latecomer firms and economies. Yet, the size of WOPs may vary depending on the extent of the technological discontinuity. Changes in demand, especially qualitative shifts in the business cycle, also contribute to the formation of WOPs (Lee and Malerba, 2017). Due to the business cycle development, incumbents may experience difficulties and the latecomers therefore are able to enter the market at a lower cost as compared with normal times (Mathews, 2005).

Existing studies on the WOP are based on the long-term evolution and developments of business firms and industries. Therefore, the focus of established studies is on the impact of WOPs

on firm performance over a much longer duration. The underlying assumption is that the benefits of WOPs on focal firms are gradual and visibility of these benefits can take a long time. In other cases, such as during major social disturbances, little research exists as to how such external disruptions may develop as WOPs. Other studies focus on how firms may take advantage of radical technological change to build competitive advantage (Coccia, 2017). However, those studies on disruptive technological change assume an expected positive influence on firms when confronted with the technological change. Yet, when regarding how negative external disturbances may lead to WOPs, less is known.

2.2 Windows of opportunity in a turbulent environment

The outbreak of the COVID-19 pandemic caused serious social and economic turbulence and many firms were led into and experienced a business crisis mode. Firms' strategies for dealing with environmental turbulence such as: financial crises, terrorist attacks, natural disasters, etc. have been studied in the strategic management literature. Environmental turbulence may deteriorate market order, restrain demand, disorder supply chain, and cause financial loss to firms. Therefore, firms often take a defensive retrenchment strategy that involves cutting unnecessary costs, for example, human resource redundancies, etc. (De Figueiredo et al., 2019). Some researchers think passively reorganizing business operations may not be an optimal strategy and consider this may magnify the negative impact of the crisis (Chakrabarti, 2015). Therefore, more researchers advocate the proactive strategy in order to deal with environmental turbulence (Lim et al., 2009). The uncertainty in the business environment caused by external crises may enable the firms' expansion (Reymen et al., 2015). New business models may emerge as a responsive solution to the crisis (Xiong et al., 2021). Environmental turbulence may become opportunities for firms to

carry out mergers and acquisitions. Such can be the case, especially when target firms' difficult business position is due to the emergence of the crisis (Wan and Yiu, 2009). Based on the two alternative arguments, whether a firm sees digitalization as a solution to emerging business challenges depends on how the crisis is perceived as a WOP. This would necessitate prior organization experience, top management teams' knowledge of the crisis, as well as insights into its characteristics (Oetzel and Oh, 2021). Furthermore, this would also involve the various strategic resources cumulated before the crisis (Kang and Song, 2017).

3. Methodology

We conducted a qualitative analysis, precisely, an intrinsic case study (Creswell, 2007) to thoroughly describe how a pandemic induces the leapfrogging of digital transformation in China, as well as its facilitating mechanisms. Our case selection followed the principle of theoretical sampling (Yin, 2003). The selected cases need theoretical development consisting of two broad categories: traditional sectors and internet-based industries. These two sectors had either limited business involvement in digitalization, or their development prior to the pandemic was very slow. Albeit, after the outbreak of the pandemic, both experienced dramatic growths. Our sample is of digital transformation in China since the outbreak of COVID-19 in late 2019. This is presented as the analyzed sample and object. We only selected those industries actively and efficiently alerted to the WOPs that had resulted from the pandemic.

Our secondary data is derived from governmental policy, national and international press, and industry reports. Corroborating evidence from multiple sources of our data triangulate the accuracy of the outcomes of this study (Creswell, 2007). Our data ranges from December 31st, 2019 (when the first infected case was reported), to May 30th, 2020, being the date of the deactivation of the

first-level public health emergency in China. This date was commonly viewed as the official signal of the end of the spread of the COVID-19 pandemic in China. Market demand for intelligent systems, computing and communication technologies, such as cloud computing, big data, 5G, AI, machine learning, computer vision, thermal, ultrasound, etc., rose sharply during the pandemic. This has been attributed to the social distancing and quarantine policies that were enforced during this crucial time. The pandemic created the WOPs, which became the main driver of digital transformation development.

We conducted an embedded analysis (Yin, 2003) of various WOP types driven by digital transformation. After a detailed examination of a variety of reports, we commenced with a description of the case. We then highlighted significant statements. These enabled us to focus on key issues whilst analyzing themes (Creswell, 2007). These are clustered accordingly into policy-related, technology-related and demand-related windows (Lee and Malerba, 2017). Chronological illustration, classification and comparative discussions collaborate to reveal the outcomes of the analysis. Following conclusions regarding the essence of the digital transformation leapfrogging in China, we interpret how WOPs are constituted against the backdrop of COVID-19.

4. Findings

The sudden outbreak of COVID-19 and the resulting institutional responses caused tremendous social turbulence and upheaval. This situation led to governmental interventions, technological discontinuity and changes in demand. This, in turn, developed into diverse and significant WOPs for fast digitalization in China. For instance, some new digital technology such as 5G, cloud computing and auto-driving benefited from these new conditions. Thereby, they could capitalize

on such technological discontinuity acting as a critical factor towards leapfrogging.

4.1 Institutional windows

In response to the COVID-19 crisis, the Chinese government introduced a series of policies and regulations. In the early stage of the emergency, government policies focused on contagion prevention as well as diagnosing and treating patients. The first policy instrument was issued on January 23rd after the Wuhan lockdown to fight against the pandemic.[i] Facing the sudden cut-off of transportation nationwide, firms were obliged to respond agilely with alternatives, especially for those whose operation relies on physical interaction. Between February 5-18, 6 Chinese governmental departments issued 26 policies and regulations related to COVID-19 treatment and prevention and over 100 billion CNY (around 14.5 billion USD) was directly allocated to healthcare organizations.[ii] The financial incentives mobilized the firms to tackle the urgent demand and contribute to the anti-pandemic endeavor. During the later stages of the pandemic, in addition to disease prevention and treatment, the government also paid attention to promoting the adoption of digital technologies. These technologies overcame the social distancing induced physical obstacle and enabled the firms to acquaint, develop and improve their capability of doing business remotely. Central and regional governments took effective actions through various policy instruments. For example, the Hangzhou Municipality in Zhejiang Province published a white book to guide and encourage the adoption of AI technologies in business operations and public services[iii]. On April 16th, the Ministry of Science and Technology released a notice to promote the adoption of interactive technologies such as AI and big data in pandemic prevention and control[iv]. These institutional contingencies boosted the development of digitalization rapidly in a pragmatic manner. Figure 1 illustrates the evolution of government interventions alongside the emerging

COVID-19 crisis in China.

Insert Table 1 about here

However, not all policies dedicated to the COVID-19 pandemic brought the expected positive outcomes. In response to negative impacts, 13 governmental departments in China issued documents encouraging webcasting in e-commerce [v]. While some companies successfully conducted webcasting, many other SMEs considered it cumbersome. Webcasting consists of two parts, the "actors" in the video content and the "story" in the live broadcast. The video contents of many well-known accounts were duplicated imitations. In the live broadcast, some of the key data, such as sales and user interactions (the number of followers, comments, likes, viewers, and interactions), were unable to be verified. Pursuantly, users and consumers showed their dissatisfaction of such disorder, which caused havoc and damage to the industry.

The multi-dimensional policies issued by the Chinese government not only put the domestic pandemic under control, but also induced the institutional WOPs which enabled the firms to accelerate and leverage digitalization technologies. Nevertheless, consistent with the point of view that WOPs may breed unexpected consequences (Guennif & Ramani, 2012), the firms lacking adequate resources did not benefit from the institutional WOPs. On that account, institutional WOPs were distributed inequitably among firms and locations, although the mutual objective nationwide was clearly shared by the instructions from the central governmental committee.

4.2 Technological windows

Developing digital technologies rode the wave of COVID-19 and the regulations and policies attached great importance to furthering the development of these technologies. On February 3rd, 2020, the Chinese Central Political Bureau hosted a conference addressing the need to increase scientific research efforts for coping with the crisis[vi]. Following this, various government agencies emphasized the use of advanced information technologies such as big data, cloud computing, AI, 5G and the IoT. For example, SenseCare, a leading Chinese AI firm, developed a COVID-19 module in lung CT imaging equipment to rapidly detect infection[vii]. The tech giant Tencent, developed an integrated system actualizing multiple AI functions, including electronic pass, face recognition, and contactless temperature measurement for use at entry checkpoints[viii]. Applications were developed based on cloud computing and 5G mobile networks, thereby ensuring stability and efficiency of real-time information transfer. The combinations of advanced digital technologies and traditional industries are employed to tackle the pandemic with three main efficacies, namely: medical support, public sentiment mediation, and maintenance of social order. In other industrial scenarios, for example, disease diagnosis, civil governance, telecommunications, etc., such equipment and technologies were further applied. Table 1 presents the details of these technologies.

It was observed that during the turbulent situation, large firms were stronger in transforming the institutional WOPs into technological WOPs. They could opt for more proactive strategies to enhance their competitive advantages (Reymen et al., 2015). However, small firms' market share risked being diluted by larger ones. We consider such divergence between large and small companies as part of the relevance of WOPs (Huang et al., 2021). The positioning of firms in the industrial value chain differed their responses to the technological WOPs caused by the asynchronous of digitalization that cast the uneven distribution of WOPs in the time axis.

As a negative consequence, the abundant application of digital technologies might violate

users' privacy and raised serious concerns among the public. For example, the health code system developed by Alibaba was implemented throughout the country by the government forces as an essential means of pandemic control. Based on the instant reading of personal health information and big data technology, the system identifies the population into three categories: the green code corresponds to those who tested negative to COVID-19, the yellow code is for suspected cases, and the red code is for those who tested positive. It enabled the government to execute stricter control over people's traveling and even outdoor activities. Besides the serious concerns about privacy violation, people also worried that the system might be misused by the service providers and government for their own benefit.

Insert Table 1 about here

4.3 Demand-related windows

The suspension of business activities and related lockdown of most cities caused a discontinuity of demand. This eventually led to demand-related WOPs, *viz.* demand transitioning from offline to online platforms. Table 2 shows where demand changed significantly for industries due to the COVID-19 crisis. Following the outbreak of the pandemic, the Chinese government required all schools to follow the "school gate closed study" rule. Shortly, more than 270 million students in primary schools, secondary schools, and universities shifted from in-class lessons to online classrooms[ix], although online education was rarely implemented before. Since the beginning of January to May 2020, the demand of online/virtual classes, sky-rocketed and created more than 20,000 newly registered online education companies. In the first half of 2020, the total financing

for online education providers was 14.34 billion CNY (about 2.22 billion USD), around a 48.3% increase than that of the previous year.

In embracing the WOPs created by the emergence of the online education market, some firms experienced rapid growth and development. For example, Tomorrow Advancing Life (NYSE: TAL) offers after-school education for students with offline schools in a few main cities as well as an online education platform targeting students nationwide. In early 2020, after the breakout of the pandemic, TAL merged with an online English training institute, Dada ABC, and exponentially expanded its online service. Even though the number of offline students drastically declined because of the pandemic, the surge of online courses led to a dramatic increase in financial return. In the first three quarters of 2020, TAL provided after-school courses to 3.4 million students. When compared with the same time period of the previous year, this is hugely significant with an increase of 46.5%.

Insert Table 2 about here

Not all education firms benefited from this virtual education wave. Top online education companies such as Yuanfudao and Zuoyebang received investments to develop their products and services. These were substantial, amounting to 1 billion USD and 750 million USD. Some firms were slow to respond to the new market demands and were too late to adapt and transition their services online. The WOPs related to institutional, technological, and market demands are open to all companies. Meanwhile, those firms that have increased resilience to deal with the pandemic, are those that exhibit greater agility in their digitalization capabilities and processes.

The emergence of the COVID-19 pandemic as a public health crisis causes changes in the

manner and structure of consumer demands. It was a process of virtualization of the traditional offline business. Firms lacking in strategic sophistication were filtered out from the competition. Nevertheless, for the firms acting and shaping strategies agilely, the turbulence of the external environment is a WOP enabling faster growth. We see this as the asymmetrical characteristic of WOPs (Huang et al., 2021), which enhanced the irregular distribution of WOPs among firms.

4.4 Summary of findings

From the above case studies, we capture the integral characteristics of WOPs emerging from the social crisis caused by the COVID-19 pandemic. Institutional WOPs played a dominant role in the leapfrogging of digitalization in China. Contingency policies were the principal force in responding to the crisis and induced the institutional WOPs. The lockdown policies changed the consumption modes and business practice, and further led to the change of customer demand in the market. Shifting to novel business practices based on remote operations entails a solid technological foundation, without which the chaos could deteriorate rather than being controlled. This induced the technological WOPs, which were seized by firms possessing better technological capability and agility. The lockdown policies also bred new needs of consumers and induced the demand WOPs. The institutional, technological, and demand-related WOPs enabled fast digitalization in the country, whilst also projected divergent effects among different industries, firms, and locations.

5. Discussions and conclusions

In order to understand the role of a strong social crisis as WOPs, we used Chinese firms' digitalization during the COVID-19 pandemic as a context. Our results indicate that the social

crisis resulted in WOPs for business firms. Nonetheless, such opportunities are not equal for all firms, nor are they evenly distributed through time and spatial dimensions. Therefore, we argue that the WOPs that consequently transpired because of the COVID-19 pandemic are relative windows of opportunity (RWOPs). This is due to the three characteristics of the RWOP being diversity, dynamics, and complexity.

5.1 Diversity of WOPs

As with the organizational diversity of different organizational compositions, WOPs have multiple attributes. The established literature involves the study of five main perspectives of WOPs. These consist of level, size, importance, source, and relationship with the firm and reflects the WOP diversity. WOPs are able to transform in an uncertain context (Keats and Hitt, 1988). This demonstrates that WOPs in an erratic environment encounter more interactions contributing to the intricacy and formation of WOPs. Consequently, opportunities may become increasingly complex and dynamic. Further investigations are necessary, to show how extreme cases of social disturbance, such as the COVID-19 pandemic may affect business activities. In particular, WOPs during the pandemic might differ from existing studies on those time periods unaffected by such extreme social disturbance.

WOPs are highly correlated with timing. Mathews (2005) concludes that companies mostly enter during the downturn phase of different industry cycles, rather than enter during the recovery phase. Established literature also emphasizes the importance of geographical differences in WOPs rather than the spatial dimension of WOPs. Drawing on Hannan and Freeman's (1984) study of organizational inertia, we argue that WOPs may also have inertia; and a firm's prompt response to WOPs is influenced by its routines and practices. Observations of inertia are scarce in the short-

term when a crisis is being faced or when the post-crisis era commences.

5.2 Dynamics of WOPs

We also consider WOPs to be a dynamic rather than static concept. First, in the early stages of new technology emergence and before a dominant product is formed, the transformation of exogenous and endogenous WOPs confirms the metamorphosis from an exogenous to endogenous opportunity (Morrison and Rabellotti, 2017). During a period of instability, such possibilities can be catalyzed into an increased state of arousal, i.e., endogenizing innovation and changes in demand. This is followed by a continuation of industry standard-setting (Lee and Malerba, 2017). Our study validates that similar WOPs in varied contexts lead to diverse outcomes (Guennif and Ramani, 2012). By seizing the WOPs created by the COVID-19 pandemic, (such as online education services), newly emerged or adopted technology can grow exponentially. Social crises can facilitate the potential interactions of the demand-related window with the technological window, which together benefit firms with digital transformation capabilities.

5.3 Complexity of WOPs

We find that WOPs are complex: for Duncan (1972) the greater environment complexity is, the more different elements to be handled are. The complexity of WOPs is manifested in the fact that the formation of WOPs requires the participation and interactions of multiple actors. When analyzing the issue of WOPs, early studies of the national system of innovation recognize how this interaction of multiple players must be considered (Guennif and Ramani, 2012; Lee and Malerba, 2017). Our results on digitalization transformation during the COVID-19 period in China, demonstrates that the formation of WOPs requires the complex interaction of various types of

organizations. These organizations include government authorities, business firms, non-profit organizations as well as new ventures. Thereby, involving a vast array of participants throughout the entire business community. Hence, WOPs resulting from the social crisis have greater complexity than those in non-crisis times.

5.4 Relative window of opportunity

From the above-mentioned features of diversity, dynamics and complexity, we argue that WOPs induced by the COVID-19 pandemic are relative, as an extension of the established WOP studies. This novel concept emerged from our analysis of the measures against the COVID-19 pandemic in China. Relative windows of opportunity (RWOPs) possess a different intensity and degree in terms of time, space, and inertia. The first is chrono-relativeness. WOPs are not homogeneous in the time dimension and may have discontinuities. A firms' capability to recognize and seize the windows of opportunity may vary. This is due to the heterogeneity of the firms' resources and the contrasting perceptual capabilities of the top managers — which eventually influences firms' performance.

The second is spatial relativeness. The extent of pandemic development differs greatly across countries and regions, leading firms to adopt a variety of strategies to address the WOPs. Even those countries or regions with similar initial pandemic development, for example, China and Iran, can lead to completely disparate outcomes as governments implement diverse policy responses.

Finally, there is the relativeness of inertia. Inertia refers to the fact that the previous WOP may influence a later WOP. Online education during the pandemic fully exemplifies the inertia of the related WOPs. Before the pandemic, the opportunity for the online education industry was driven by the development of information technology. However, after the COVID-19 outbreak, and

regardless of the race to replace traditional offline teaching with online options, many parents and students reported their online education experiences as ineffective. This was described as falling far short of their expectations. It was also attributed to being the root cause of many new family disputes. In other words, the online education industry was at first driven by technological WOPs. Yet, when faced with further market WOPs, it continued to follow its existing technology-focused developmental path, rather than one focused and based on users' needs.

5.5 WOPs during turbulence

Usually, a process research focuses on the "sequence of events that describes how things change over time" (Van de Ven, 1992, p.169). However, we focus on a phenomenon snapshot during the COVID-19 pandemic where the induced WOPs promoted the wide adoption of digital technologies. Therefore, a process research is beyond the scope of this study, despite it warranting further scrutiny and investigation. Therefore, we address this suggestion as one of the future research options.

From where we stand, the latecomer enterprises' response strategies to WOPs appear to be proactive and persevering. Generally, the combination of WOPs and a proactive capability building strategy explains the reason for retaining industry leadership (Lee and Malerba, 2017). When WOPs emerge, facilitating a path-creating strategy requires sufficient knowledge and capabilities from latecomers (Kang and Song, 2017). According to Ramani and Urias (2018), latecomers having insufficient capability should invest in absorptive capacity building and reverse engineering, thereby, enabling them to respond to emerging WOPs.

However, when encountering crises, firms may respond with both proactive and persevering strategies. For instance, Wan and Yiu (2009) emphasize that the emergence of crises evokes

acquisition opportunities for firms. Proactive acquisition behaviors facilitate the accumulation of strategic resources for the acquirers. Conversely, in normal times, few firms respond to WOPs with persevering strategies, whilst these passive strategies might convert into WOPs during times of crisis. In an uncertain environment, when faced with constant change, firms adopting persevering strategies may outperform rivals who engage in aggressive strategic renewal tactics. The reason lays in the fact that too many changes in direction may undermine the value of strategic renewal (Wenzel et al., 2021).

Therefore, when responding to WOPs during crises, firms are required to act with greater strategic complexity. When responding to crises, resources and capabilities are not given the same importance, so that leveraging a firm's core competencies is the strongest defense against the challenges.

5.6 Conclusion

The novelty of WOPs expounded in this study answers the research question twofold. Firstly, we reveal the mechanism of WOPs emerging from social crisis, taking the response of COVID-19 in China, and unfold the characteristics of WOPs in the turbulent environment. Secondly, we zoom into the digitalization leapfrogging in the anti-pandemic procedure, and present business firms' action to take advantage of the WOPs in terms of digitalization. Essentially, we answer the questions of "how" by our qualitative endeavor. We observed that the leapfrogging of digital transformation benefitted China's fight against the virus, maintenance of social life and order, as well as the resumption of business activities. The crisis created institutional, technological and demand-related WOPs. Cloud computing, big data, 5G, AI and other technologies found strong market demand and became the main force of digital transformation. In this wave of digitalization,

the divergent performance of firms is strongly influenced by the relativeness nature of WOPs. Recognizing and understanding the relativeness of WOPs is important for both policymakers and decision-makers for improved management of social crises. Also, future actions to prevent other similar environmental turbulence can be carried out.

5.7 Practical Implications

Our study provides practical guidelines to government policymakers and to business executives. When tackling the social crisis, these actors should see through the situation and identify opportunities which have surfaced. They also need to be vigilant to those opportunities that have derived from the discontinuity of economic and social activities. Economic growth and social value are not irreconcilable when facing a social crisis. To be precise, keeping business activities running as usual is compatible with constraining some conventional operations. An appropriate regulation may not only reduce or eliminate the negative impact from the crisis, it can also create WOPs for future advancement. The relevance of WOPs recognized in the turbulent environment is the recessive gene which should have been studied and noticed. Recognizing the relevance of WOPs becomes more important for business executives. A radically changed environment in a short timeframe brings great challenges to business operations. However, the unevenly distributed opportunities may also push the executives to transfer or adapt to the turbulence with enhanced capability. The turbulent environment shakes up market demand structure, compelling actors to respond to erratic situations. For instance, policymakers issuing new regulations to control, and business executives leveraging resources and capabilities to adapt. In particular, the opportunity of digital transformation may emerge during the social crisis and may require further adaptations in the post-pandemic era. After the pandemic, society activities may return to normality, but digital

technology as a practical tool always remains, being an alternative channel for maintaining the societal order. During such processes, both policymakers and business managers must be aware of the potential drawbacks of rapid digital transformation in society, i.e., the issues related to privacy, digital stress, digital inequality, and the governance of digital technologies.

5.8 Limitations and future research

The case study approach enables us to scrutinize the features of WOPs in an abnormal situation from multiple perspectives. This is less likely achievable through a quantitative approach. Although our case study provides a landscape of how the COVID-19 pandemic created WOPs and led to the leapfrogging of digitalization in China, we acknowledge several limitations that may provide avenues for further inquiry. First, we studied digitalization as a solution to the social and economic crisis caused by the pandemic and focused on illuminating the outcome of digitalization. The process and mechanism at the micro-level by which firms responded to the WOPs, and actualized the digitalization need further exploration. Further study could explore the procedural mechanism by multiple firm case studies. Theoretically, the study of WOPs has yet to be interpreted in detail, let alone placed in the context of the dynamic time, space and industry inertia. This unacknowledged perspective entails cross-discipline communication along with quantitative and qualitative approaches in future studies.

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Table 1. Digital technology applied in different industries to cope with COVID-19 crisis

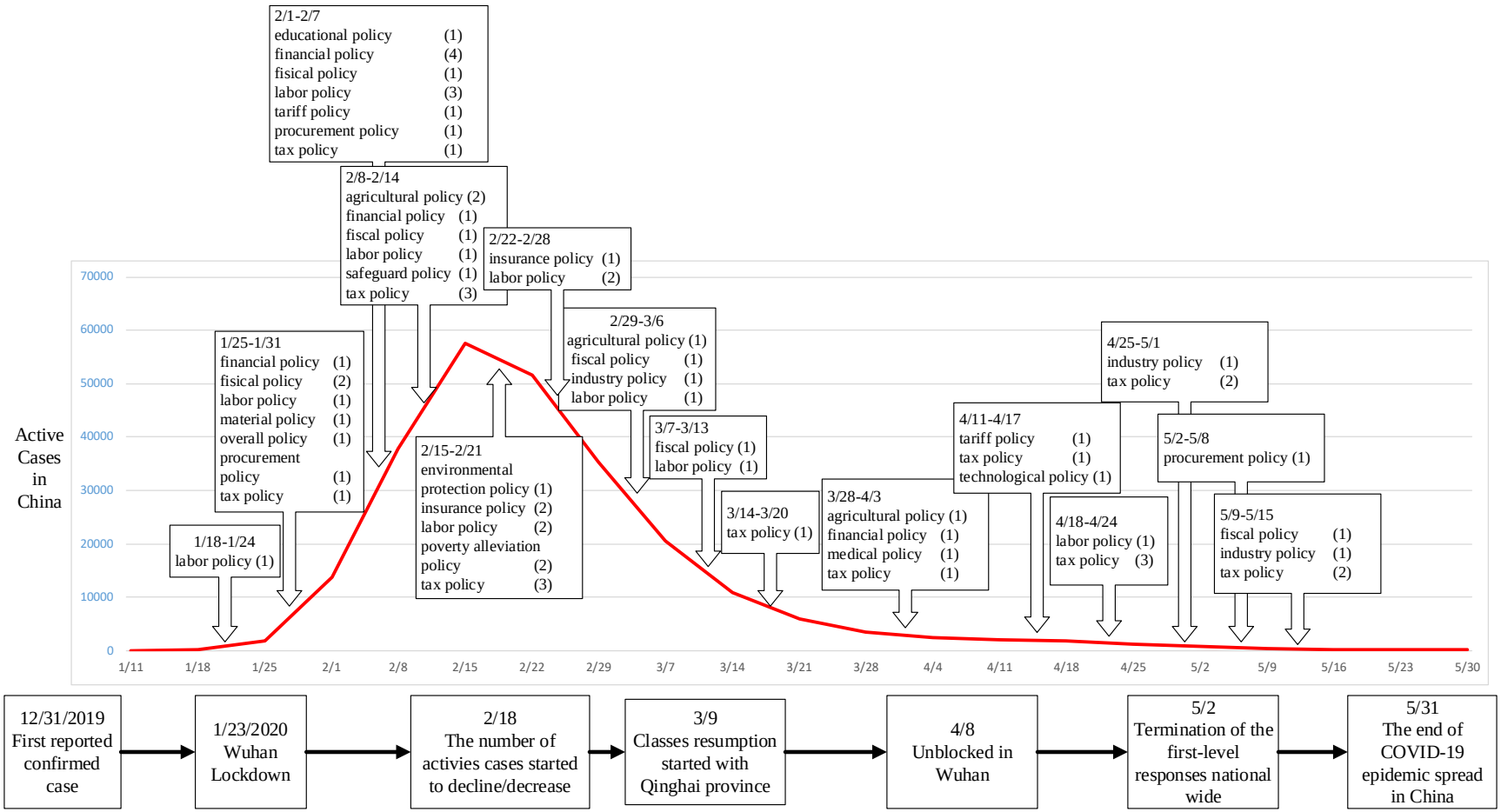
Industries	Application types	Implemented technology	Efficacies
Information sharing	Real-Time Monitoring, Information Collection and Broadcasting, Consulting, Prevention Material Management	AI, Big Data, Cloud Computing, Block Chain	Public sentiment mediation
Medical	Medical Diagnosis, Telemedicine, Hospital Management	AI, Big Data, Cloud Computing, 5G	Medical support
Government administration	Human Temperature Measurement, Population Monitoring, Regional Management, Digital Government	AI, Big Data, Cloud Computing, Block Chain, Internet of Things, 5G	Social order maintenance, Public sentiment mediation
Online education	Live Stream, Online Courses, Platform and Solution Support	AI, Big Data, Cloud Computing, 5G	Social order maintenance
Telecommute	Instant Communication, Co-Working Integrated Solutions, Document Sharing, File Transfer, Task Management	AI, Big Data, Cloud Computing, 5G	Social order maintenance
Finance	Loan Management, Customer Service, Supply Chain Finance	AI, Big Data, Block Chain	Social order maintenance
Logistic	Unmanned Distribution, Logistics Deployment, Contactless Delivery	AI, Big Data, Cloud Computing, Internet of Things	Social order maintenance
New retailing	Cashier-less Stores, Instant Delivery, Streaming Retailing	AI, Big Data, Cloud Computing, 5G	Social order maintenance
Social media	Pandemic Surveillance Mapping, Interactive Media, Social Network	AI, Big Data, Cloud Computing, 5G	Public sentiment mediation

Table 2. Demand change during COVID-19 crisis

Decline in demand		Increase in demand		Examples
Type	**Rate**	**Type**	**Rate**	
Shopping malls	○○○	Online shopping	●	In Q1 2020, the revenue of Wangfujing department store, a leading retailer in China, showed a 78.79 % like-for-like decrease; while the net income of Jingdong, a leading online retailer in China, is expected to grow by at least 10% year-on-year.
Cinemas	○○○	Online videos	●●●	The total national box office showed an 88 % year-on-year decrease in Q1 2020; while the demand for online videos outstripped supply.
Restaurants	○○○	Catering &Take away	●●	In January and February of 2020, the national catering revenue showed 43.1% like-for-like decrease.
Medical services	○○	Online medical care	●●●	During the Spring Festival of 2020 in late January, the number of visits of DXY.com, an online medical consultation service utilizing smartphone APPs, increased to 4.6 times compared to the period before COVID-19 pandemic. However, 94.1 % of hospitals experienced a like-to-like decline in cash flow during the pandemic.
Schools	○○○	Online education	●●●	270 million students used online education platforms for their studies.

Notes: 1. The symbol ○ indicates a decline in demand, and ● indicates an increase in demand. 2. The number of ○ or ● indicates the magnitude of the change.

Figure 1. The evolution of policy interventions by the Chinese government during COVID-19 period



Note: The numbers in parentheses indicate the number of policy types issued in the specified week.

Endnotes:

[i] http://www.gov.cn/xinwen/2020-01/23/content_5471751.htm
[ii] http://www.gov.cn/fuwu/zt/yqfwzq/yqfkblt.htm#1
[iii] http://www.xinhuanet.com/money/2020-04/11/c_1210553501.htm
[iv] http://zc.gjzwfw.gov.cn/art/2020/4/14/art_8_17270.html
[v] https://new.qq.com/omn/20200718/20200718A0KHCG00.html
[vi] http://www.gov.cn/xinwen/2020-02/03/content_5474309.htm
[vii] http://www.cs.com.cn/ssgs/gsxw/202002/t20200221_6028215.html
[viii] https://cloud.tencent.com/developer/news/690648
[ix] http://edu.sina.com.cn/l/2020-02-09/doc-iimxyqvz1397372.shtml