



# Intelligent Technology, COVID-19 and Corporate Innovation Based on Case Study and Empirical Study

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**Abstract.** The study focus on whether the digital economy impacts the effect of epidemic on the enterprises' innovation performance. We raised the question of innovation at the micro level. In today's pandemic, it is essential to give innovators some experience and ideas at the micro level. So our answer to this question is valuable. Through empirical study, we find that the digital economy increases the impact. We listed typical cases of technological innovation from Amazon and JINGdong, analyzed the similarities and differences in these cases, and summarized some directions and experiences of technological innovation during the epidemic. Finally, Through empirical research on the interaction between COVID-19 and the digital economy, we find that the digital economy improve the positive impact of COVID-19 on innovation. We suspect that the digital economy will improve the flexibility of corporate decision-making. We concluded that the innovation needed today is no longer aimless innovation, but innovation with a purpose.

**Keywords:** Digital economy · covid-19 · corporate innovation

## 1 Introduction

Covid-19 is a sudden public events. It has serious affected the market. The main impacts are less investment scale and less operating profit [1]. According to scholars' research, they effect Enterprises' decision and performance. At the end of 2019, a terrible plague suddenly swept the world. People had to wear masks and close the city walls to block the spread of the virus. This disaster immediately disrupted the world order, production had to halt, the economy declined, and people were in turmoil.

Huang et al. indicated that the epidemic decreases the desire of enterprises to develop economic activities and one of the main reason is cash flow tension [2]. Luo found that the impacts of epidemic on the small and media value is stronger it on the big enterprise [3]. Epidemic also creates uncertainty. Scholars has found two opposite effects. The uncertainty will let enterprises delay the investment until the uncertainty is reduced [4]. The uncertainty also let banks choose a conservative policy [5]. Therefore, the investment of the innovation could be decreased. However, the uncertainty also encourages

enterprises to innovate to decrease the negative impact of uncertainty and get advance after the event [6]. Xie et al. have an empirical study on Chinese listed companies and found that the epidemic make the enterprise innovation upward offset [7].

“Artificial Intelligence (AI) is a potentially powerful tool in the fight against the COVID-19 pandemic. Since the outbreak of the pandemic, there has been a scramble to use AI. “

“This article analyzes the effects of this worldwide phenomenon on certain technologies and how this may improve our lives. It presents technologies that relate directly to the treatment of the virus as well as those that have been used to adapt to living under this crisis. “

Many literature have described the technological and policy innovations in different fields and aspects, such as medicine, artificial intelligence and retail, under the influence of COVID-19 from a macro perspective, and summarized the development path suitable for today’s fight against the virus.

However, these literature lack some micro-specific examples to illustrate the specific situation and degree of technological innovation, and lack accurate examples to prove the progress of technological innovation in certain aspects under the epidemic.

Therefore, this article will introduce some specific typical cases of technological innovation during the pandemic to show the progress of technological innovation and the importance of innovation in the current era of the virus.

Digital economy has been researched for years. According to those research, it can improve the information circulation environment. The digital economy will decrease the cost of collecting external information. It also can increase the communication between consumers and enterprises, which will help enterprises make innovation [8]. Additionally, the information flow between banks and enterprises based on digital economy will alleviate corporate financing constraints [9]. In the epidemic period, the electronic commerce takes place of the offline transaction. And work on-line become a way to keep the business run. It play a positive role about economy. However, we find that there is a little of literature research how the digital economy effect the impact on innovation of emergent event.

Hope this essay can give some assistance to prevent the covid-19 in micro aspect and inspire some new innovations in different areas and aspects in order to improve humanity’s living condition during covid-19 period even in the future. These information can be used by people who involve in innovation.

## 2 Theoretical Analysis and Hypothesis

Digital economy have create the platform of information communication and it decrease the constraints of space. Therefore, it can decrease the negative impact of epidemic and improve the positive impact of the epidemic. The development of digital economy let work online become possible, and the innovation and work can run during the epidemic. Additionally, the electronic commerce will let enterprises get revenue, it will keep the cash flow and increase the confidence. The information flow between the enterprises and banks will increase the financing capability. Xv et al. also found that the digital economy increase the level of economic development [10]. Besides, the digital economy

also creates the uncertainty and decreased the market segmentation, which means that enterprises more hope to get advanced. The new market based on digital economy creates by the epidemic also need the innovation.

The research found that the uncertainty make the enterprise do innovation. However, the digital economy decrease the certainty because it accelerates the information flow. Meanwhile, the economy decrease the effect of epidemic. Therefore, the motivation of innovation will be decreased thus, the study propose the first hypothesis.

H1a: The digital economy increases the positive impact on innovation of the epidemic.

H1b: The digital economy decreases the positive impact on innovation of the epidemic.

H1c: The digital economy increases the negative impact on innovation of the epidemic.

H1d: The digital economy decreases the negative impact on innovation of epidemic.

### 3 Research Design

#### 3.1 Model Building

First, To prove whether the digital economy impacts the multiple linear regression to test the impact of epidemic and digital economy. The model is processed as follows:

$$\text{Innovation}_{t+i} = \alpha + \beta_0 \text{Epidemic}_{t,i} + \beta_1 \text{Control}_{t,i} + \mu \quad (1)$$

$$\begin{aligned} \text{Innovation} = & \alpha + \beta_0 \text{Epidemic}_{t,i} + \beta_1 \text{DEI}_{t,i} + \beta_2 \text{Epidemic}_{t,i} \times \text{DEI}_{t,i} \\ & + \beta_3 \text{Control}_{t,i} + \mu \end{aligned} \quad (2)$$

#### 3.2 Variable Selection

##### 3.2.1 Explained Variable

Innovation: We use the number of patents to measure the innovation. We add all kinds of patents the enterprise get in the year. Add one to it and take the natural logarithm.

##### 3.2.2 Explanatory Variable

Epidemic: epidemic is a classified variable and it change with the time. In 2019, the variable is 0. In 2020, the variable is 1.

DEI: Refer to the research of Shen et al. [11], we use the entropy evaluation method to measure the the development of digital economy and calculate the digital economy index(DEI). We choose the digital economy foundation, digital industrialization and industrial digitization as three level one indicators and refine to 12 variables. Table 1 shows the variables and the source of the data.

**Table 1.** The main information of variable of DEI:

indicators	variable		data source
digital economy foundation	number of domain names	+	China National Bureau of Statistics
	number of Internet broadband users	+	China National Bureau of Statistics
	number of Internet port	+	China National Bureau of Statistics
	telephone penetration rate	+	China National Bureau of Statistics
	telephone exchange capacity	+	China National Bureau of Statistics
	Long distance optical cable length	+	China National Bureau of Statistics
digital industrialization	Income from information technology services	+	China National Bureau of Statistics
	Software product revenue	+	China National Bureau of Statistics
industrial digitization	Rural access subscribers	+	China National Bureau of Statistics
	Proportion of electronic payment enterprises	+	China National Bureau of Statistics
	Total telecommunication services	+	China National Bureau of Statistics
	Number of websites of 100 enterprises	+	China National Bureau of Statistics

### 3.2.3 Control Variable

Refer to literature, we choose the 4 variable: the Size of enterprise (Size), the net profits rate(profit), the age of enterprises(Age) and the degree of foreign trade (open).

## 4 Data Source and Describe Statistics

The number of patents is got from CNRDS database, other variable is got from the CSMAR database. To reduce the effect of the extreme values, And the maximum 1% and the minimum 1% of all variables were winsorized. The Table 2 shows the descriptive statistics of all the variable.

Reported by Table 2 the standard division of innovation is huge. It shows that the innovation of each corporation have great difference.

**Table 2.** The descriptive statistics of all epidemic

	average value	standard deviation	minimum value	lower quartile	median	upper quartile	maximum value
Innovation	3.01264	1.65702	0	1.94591	3.17805	4.11087	7.09207
DEI	0.02957	0.01945	0.00252	0.00677	0.03054	0.04811	0.05689
Size	22.48773	1.33134	20.04565	21.53448	22.28991	23.21076	26.53899
Profit	0.02883	0.09051	-0.43029	0.01302	0.03768	0.06810	0.21855
Age	20.62897	5.66280	8.42	16.67	20.42	25.17	35
Open	13.81492	9.03923	0	0	18.56331	20.38253	24.21685

### 5 Empirical Analysis

The results of the regression is shown in Table 3. In the regression results of regression formula (1), the coefficient of epidemic is significantly positive at 0.1% level. And in the result of regression formula (2), the coefficient of the interaction of the digital economy and the epidemic is significantly positive at 10% level. It verifies the H1a.

**Table 3.** The result of empirical analysis

	innovation	
	(1)	(2)
Epidemic	0.235972*** (5.934)	0.069278 (0.900)
Epidemic*DEI		3.571647. (1.657)
DEI		3.233771. (2.211)
Size	0.471032*** (31.013)	0.473398*** (31.205)
Profit	1.225587*** (5.555)	1.212196*** (5.505)
Age	-0.025687 *** (-3.832)	-0.024327*** (-6.706)
Open	0.056249*** (25.215)	0.055972*** (25.118)
intercept	-7.982617*** (-23.583)	-8.134952*** (-23.931)

note: In parentheses are t Value; \* \* \*, \* \*, \*. Represent significant at statistical levels of 0.1%, 1%, 5% and 10% respectively

The results of the control variable indicate the coefficients of profit, open and enterprise size are positive at 0.1%, which because the size and profit means the enterprise has more funds and accumulation of scientific research ability and face to a stronger compete. The coefficient of the age is negative, we assume the reason is that those enterprises have the ability to keep their market and do not focus on innovation.

## 6 Stability Test

### 6.1 Change the Model

Considering that the characteristic of the explained variable, we choose the Tobit model to test the result of the empirical experiment. The result is shown in **Table 4**.

Reported by the Table 4. The coefficient of epidemic is positive at 0.1% level, and the coefficient of the interaction of epidemic and DEI is positive. It prove H1a.

**Table 4.** The result of stability test

	innovation	
	(1)	(2)
Epidemic	0.256791*** (5.775)	0.070665 (0.821)
Epidemic*DEI		4.236495. (1.757)
DEI		2.848191. (1.738)
Size	0.491243*** (28.918)	0.493766*** (29.102)
Profit	1.505477*** (6.014)	1.489850*** (5.965)
Age	-0.029450*** (-7.256)	-0.028080*** (-6.913)
Open	0.062652*** (24.974)	0.062342*** (24.884)
logSigma	0.459627*** (42.652)	0.457408*** (42.444)
intercept	-8.547311*** (-22.561)	-8.693346*** (-22.853)

note: In parentheses are t Value; \* \* \*, \* \*, \*,. Represent significant at statistical levels of 0.1%, 1%, 5% and 10% respectively

## 7 Case Study

### 7.1 Amazon Go

Background: Amazon Go is a chain of convenience stores in the United States and the United Kingdom, operated by the online retailer Amazon. Different from the traditional retailing structure of Amazon, Amazon first combine physical selling with data technologies in Amazon Go to achieve fully automatic selling. The stores are cashierless, thus partially automated, with customers able to purchase products without being checked out by a cashier or using a self-checkout station. As of 2020, there are 29 open and announced store locations in Seattle, Chicago, San Francisco, London and New York City. The unmanned supermarket launched by Amazon Go conforms to the trend of the Times to some extent when the virus is rampant. Due to the transmissibility of the virus, people hope to reduce the risk of face-to-face transmission of the virus. This is a typical technological innovation in the era of COVID-19.

### 7.2 JD Drone

Background: JD.com, also known as Jingdong and formerly called 360buy, [12] is a Chinese e-commerce company headquartered in Beijing. It is one of the two massive B2C online retailers in China by transaction volume and revenue, a member of the Fortune Global 500 and a major competitor to Alibaba-run Tmall. JD.com has become the first e-commerce company to deliver goods by drone at a time when many cities in the country remain in lockdown due to the spread of coronavirus.

JD.com's first delivery was to a village near Baiyang Lake in Hebei Province in the north of the country on Friday. It has said on its website that it will employ this method of delivery during the coronavirus outbreak which has killed 909 people and infected more than 40,200 in China so far.

### 7.3 Key Problems

Why is this technological innovation needed today?

Retail has traditionally been largely a “people’s game”, but in the aftermath of the pandemic, our innate preference for a “human touch” seems to have diminished. This not only promotes e-commerce, but also paves the way for the accelerated application of technological advances in retail, as their usefulness has increased. The retail industry is gradually incorporating digital technologies that could be particularly valuable in the post-pandemic “new normal” to prevent the loss of consumer and employee experiences. Because of the pandemic, large parts of the world are locked down and people have to avoid face-to-face communication. This has meaningfully accelerated the “new retail” revolution. The impact and immediacy of this environmental factor is driving offline retailers to be creative and adopt digital solutions to avoid seeing their returns reduced to zero.

What technological innovations were used by them separately?

### 7.3.1 Amazon

Amazon Go's new "no lines, no checkout" shopping experience has attracted a lot of attention from the retail and tech worlds.

Amazon Go users first need to download and install a mobile application called Amazon Go. After installation, you will log in using your Amazon account ID and password. When you log in for the first time, the app guides you through a nine-step animation tutorial. This tutorial shows you how to scan yourself into the store and how to shop. The whole tutorial took about a minute. Next, the app displays a two-dimensional bar code to identify the user and scans it to enter the store.

Entering the Amazon store is a bit like entering a subway station, an experience that is familiar to us. But there's usually an Amazon employee or two in an orange T-shirt standing at the store door helping people with any problems, most of the time explaining to customers that they need to download an app and how it works. As more people get used to entering stores this way, there will be less need for entrance staff.

Customers can pick up items from open shelves and walk out of the store to buy and pay for them. The shopping experience is that simple. So Amazon Go isn't about showing off, it's about solving real problems with lines and checkout.

### 7.3.2 JD Drone

Jd UAV is committed to building a trunk, branch and terminal uav navigation logistics system, covering the vast rural areas of the country, and realizing the connectivity from village to village and county to county. The goal of JD is to gradually establish the trunk and branch logistics network, and eventually build a globally integrated intelligent logistics network, realize the 2-h logistics life cycle, and improve the shopping experience of consumers.

At present, JD UAV is building a three-level logistics system of UAV and navigation, establishing trunk, branch and terminal UAV logistics and distribution, and gradually building an integrated UAV intelligent logistics network.

## 8 Conclusion

Through the empirical study of the interaction between the epidemic and the digital economy, we find that the digital economy has increased the positive impact of epidemic on innovation. We guess that the digital economy will let the enterprises have ability to change their behavior and decisions. Therefore, to face with the complicated situation, we suggest the companies increase the degree of digitization and governments improve the digital foundation.

We have presented typical and exact case of technology innovation during pandemic from Amazon and JD. They both combine new technology to different area and achieve efficient innovation. By comparing the two cases, we can conclude that both of them have combined high and new technologies in a specific field. For example, Amazon has combined cloud payment and automatic identification technology with physical stores, thus realizing zero contact in physical stores. Jd.com, on the other hand, has applied uav technology to the express delivery industry, which not only improves the



efficiency of express delivery, but also reduces the risk of virus transmission. Of course, we need innovation, innovation in this area. Today, the technological innovation we need is different from the previous one, and it is no longer a divergence. For example, we need to consider where there are innovations, we need to identify within the box and a certain field before, and innovate within a certain range, Or innovate within a certain range, and that's it. Like two examples, two different spreaders have achieved the purpose of reducing the risk of the virus, which is in line with innovation in the era of epidemic innovation. Today, mankind is at an unprecedented and important juncture, and the community with a shared future for mankind is facing an unprecedented difficulty. When the epidemic is raging, technological innovation is the most important and the most important aspect that cannot be ignored. Only by evolving faster than the virus can we truly survive this crisis. This article provides us with typical cases of technological innovation, which are closely related to epidemic innovation, and also provide us with ideas and experiences for further innovation, which are inseparable from the theme. Nevertheless, the research does not analyse the difference between small and median size enterprise and big size enterprise of the impact of digital economy on epidemic effect. We hope the later research will focus on it. For the unknown situation in the future, this article can provide some innovative references and experiences, so as to provide some ideas and directions for future innovation. It is hoped that this research can bring some innovative inspirations to readers.

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