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THE IMPACTS OF THE COVID-19 PANDEMIC ON THE INVENTORY MANAGEMENT DECISIONS OF THE E-COMMERCE ENTREPRENEURS IN NAKHON RATCHASIMA, THAILAND

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Abstract

This research aims to study the impact levels of the COVID-19 pandemic and the relationship of such impact on the inventory management decisions. collecting information from e-commerce entrepreneurs in Nakhon Ratchasima, Thailand. The questionnaires were distributed and collected the final good samples from 370 persons. The data was statistical analysed with frequency distribution, percentage, mean, standard deviation and multiple regression. The results found that the coronavirus pandemic had the impact on inventory management decisions of the e-commerce entrepreneurs in Nakhon Ratchasima, Thailand at a high levels. There were the impacts in terms of declining in demand for products and services and the sudden changes in government policy influenced economic order quantity management decisions. The management of the working environment influenced reorder point level and lead time management decisions at the significance level of 0.01

Keywords: COVID-19, Business Impact, Inventory Management Decisions, E-Commerce Entrepreneurs

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Introduction

COVID-19 is a contagious disease caused by coronavirus. Theis new virus and disease had never been known before the pandemic in Wuhan, China, in December 2019. COVID-19 is spread globally and affects many countries across the globe (Gazi, 2020; Mustari et al., 2021). The most common symptoms of COVID-19 are cough, loss of taste, loss of smell and fatigue. The less common symptoms that may affect some patients are pains, headache, stuffed nose, runny nose, sore throat, diarrhea, conjunctivitis, rashes and fingers' and toes' skin color changes. These symptoms are initially and commonly mild. The symptoms gradually become obvious. Some patients are infected, but the symptoms are not severe (World Health Organization Thailand, 2020). The coronavirus pandemic in Thailand (Ampornphan, 2021) leads to many changes. The Thai government used important measures in order to slow down the coronavirus pandemic such as physical distancing, closing places where people gather such as schools, tutor schools, entertainment complex, stadiums and cinemas as well as curfew measures for nighttime (Supasorn, 2022; Urairak, 2022). However, there are very interesting issues. Although there are these measures, the issues in logistics and supply chain management must be continual and cannot stop. Especially, the logistics and supply chains that are related to consumer products; for example, necessary products and appliances for the people in the country. The situation made us aware of the importance of maximizing the efficiency and effectiveness of the supply chain management. The issues also include the fake news on websites. These cases are very frightening for the supply chain management because the demands in these cases will increase due to the anxiety and panic of consumers. Therefore, these demands will increase quickly if the anxiety and panic are stimulated. Consequently, the responsiveness of the supply chain system to the demands of the consumers is not low and it cannot cover all areas (Banomyong, 2020).

The logistic system's roles become very significant for the businesses and lives of the people during the coronavirus 2019 pandemic. People must spend most of their times at their homes because of the public sector's measures limiting the times to stay outside their houses. It is also including the Work form Home measure that most employees have to work at their homes. This measure is according to the practices of many countries across the globe for preventing the coronavirus infection and pandemic. It is not refusable that the coronavirus pandemic widely damages many sectors including the public health, social and economic sectors. In the economic sector, the coronavirus disease directly affects the logistic and supply chain systems of products. Particularly, the upstream and downstream of the logistic and supply chain systems are affected more significantly than other parts. For the downstream, most problems are caused by the periodically increased demands of the consumers due to the consumers' sensitivity to information and news. It is also because of their behavioral change from reducing their weekly purchase frequencies to purchasing products in bulk for meeting their needs. Some people change to purchase products from online. Thailand Development Research Institute (2020) reported about the hoarding disorder during the crisis of the COVID-19 pandemic that "if a crisis occurs, then the demands for products will be more fluctuating than the normal situation and the resource management depending on the market mechanisms may be problematic. The coronavirus pandemic crisis results in the demands for medical and consumer products for supporting quarantines. As a result, there are the competitions for necessities, the hoarding disorder and making profits from those necessities. Nevertheless, it was found that the people and the business sector have the hoarding disorder because the business sector has to make profits from the hoarded products by selling the products at the high prices. The people also hoarded the products in order to have enough products for living. Consequently, the prices of the products also tend to increase. This mechanism is an economic distress during the crisis." These factors are the main causes of the Bullwhip Effect. Nonetheless, the changed purchasing behaviors created significant challenges for inventory management activities. Stores must

adjust the times and quantities for filling shelves in each round according to the new behaviors of the consumers in order to ensure that the products on the shelves are enough for meeting the needs of the customers at any time (Opasanon, 2020).

Therefore, the coronavirus pandemic is the severely contagious disease affecting health to the contagious disease generally but it is also affecting the economic conditions. Large, medium and small enterprises (SMEs) are significantly and insignificantly affected by this crisis (Zaenuddin et al., 2022).

This research was therefore conducted in response to the research question: Situation of the COVID-19 epidemic in the past to know how does it affect e-commerce entrepreneurs such as impact affects their inventory management decisions or not. The research is also to find the guideline to mitigate the impact on businesses for SMEs and to be used as a lesson in business management under similar crisis conditions in the future.

Literature Review

The Impact of the COVID-19 Crisis on SMEs

The Impacts of the Decreased Demands for Products and Services: The products and services disappeared quickly in the market. For this crisis, the products and services did not gradually reduce because of the economic downturn. However, it was because the products and services that used to exist the market disappear due to the ceased productions and services since the government used the social distancing measure that is the disruption in the global supply chain (Phantharak, 2020).

1) The demands for the products and services were decreased (Purwanto et al., 2020; Shafi et al., 2020) because the consumers were frightened about the uncertain economic policies and employment terminations caused by the ceased productions and services. Consequently, these affected the incomes and expenses of the consumers as well as purchasing the products and the using services with long-term obligations such as real estates or capital goods. The investments were slow down until the investors were confidence (i.e., the demands affected the materialization) (Phantharak, 2020).

2) The production and service volumes were affected by the decreased demands. The businesses decreased their productivity according to the decreased demands until some businesses must be close and reduced costs in order to maintain the fluidity until the economy is restored (Phantharak, 2020).

3) The demands for the products and services were affected because of the closed businesses, unemployed consumers, and lowered salaries as stated. Hence, the consumers slowed down their consumption, and their demands were decreased (Phantharak, 2020).

The Impacts of the Lack of Raw Materials from Closing or Delaying International Shipments: In the cases that SMEs relied on the raw materials or imported products, the policies closing the countries for preventing the COVID-19 infections affected the production of SMEs or sales of the products imported by SMEs such as the congested ports and airports, the disrupted shipping routes and the decreased productivities of manufacturers. As a result, inventory management during the COVID-19 pandemic crisis must be adjusted (Phantharak, 2020). Closing the borders due to the COVID-19 epidemic. As a result, the inventory management process becomes more complicated (Zimon et al., 2021).

The Impacts on the Working Environment Management: The safety of the employees and stakeholders had the top priority in order to quickly respond to the global pandemic, even though it was difficult to adjust the working environments during the COVID-19 pandemic crisis because of the social distancing measures. For the procedures that are not designed for working at home, there are the following guidelines. Firstly, train the employees about 1 meter of social distancing while they are working in their workplaces. For employees who have to work and be close to other people, they must wear protective equipment. Secondly, the number

of the employees must be adjusted according to their workplaces in order to reduce the spread of the virus. Especially during rush hours, the working times may be shortened. The employees have to work in the areas that they do not have to meet other employees. Thirdly, reduce the overlapped times in order to lower the number of workers in periods and reduce infections (Phantharak, 2020). (Purwanto et al., 2020) Studying the impacts of the COVID-19 epidemic found that there was a need to reduce working hours in two shifts, and some employees received reduced salaries to Maintain business operations during this crisis.

The Impacts of a Sudden Change in Government Policies: The government wanted to promptly manage the COVID-19 pandemic according to the daily changes. The policies announced by the government also daily affected the management of SMEs. SMEs must not comply with the policies. Even though SMEs could not predict the changes in the government's policies; SMEs should make plans for complying with the policies including the 14-day quarantine measure for the risky employees, the curfew measure and the lockdown measure. SMEs that made plans in advance for the expected situations could efficiently manage their activities during the situations (Phantharak, 2020). (Fairlie & Fossen, 2022) also said that Covic-19 led to the closure of many businesses. It was found that the business lost a lot of sales which was affected by the lockdown from the government.

Inventory Management of E-Commerce Entrepreneurs in the COVID-19 Situation

Economic Order Quantity (EOQ): EOQ is the ideal order quantity a company should purchase to minimize inventory costs such as holding costs, shortage costs, and order costs. This production-scheduling model was developed in 1913 by Ford W. Harris and has been refined over time. The formula assumes that demand, ordering, and holding costs all remain constant (Fernando, 2022). The goal of the EOQ formula is to identify the optimal number of product units to order. If achieved, a company can minimize its costs for buying, delivering, and storing units. (Basha et al., 2020) studied inventory monitoring to improve the status of pharmaceutical inventory using the Economica Order Quantity (EOQ) inventory control technique. Keep inventory levels at the optimum level.

Safety Stock: Stock inventory usually consists of cycle stocks, or the inventory that is expected to be sold within a given period, and safety stock. Safety stock acts as a buffer amount that accounts for uncertainties such as: Excess demand Supplier delays Inaccurate demand or inventory forecasts Failure to place timely reorders Financial constraints Safety stock mitigates the risks and consequences of stockouts, allowing your supply chain to proceed as usual even after cycle stock runs out (Jenkins, 2022). (Merchant et al., 2022) has stated that the COVID-19 outbreak This results in a shortage of personal protective equipment (PPE). Therefore, it is recommended to store stock in reserve to meet the needs and severity of the current and future coronavirus epidemic.

Reorder Point (ROP): ROP is the minimum stock level a specific product can reach before you're prompted to order more inventory. But A reorder point is not a static number. It's based on your own purchase and sales cycles, and it varies on a per-product basis. However, once you have a handle on the patterns of a product, you're ready to start putting the variables together.The reorder point formula is daily unit sales multiplied by delivery lead time, with some safety stock for good measure (Wong, 2022).

Lead Time: Lead Time is the time between when an order is placed and when it is delivered. If a business knows how long a delivery lead time will be, it can use that information and its knowledge of when it need to receive something to figure out when to place an order (Luther, 2022). The impact of the COVID-19 epidemic resulting in high uncertainties such as lead time management using logistix simulation and optimization software can help make effective decisions in a variety of situations (Ivanov, 2020).

Research Conceptual Framework

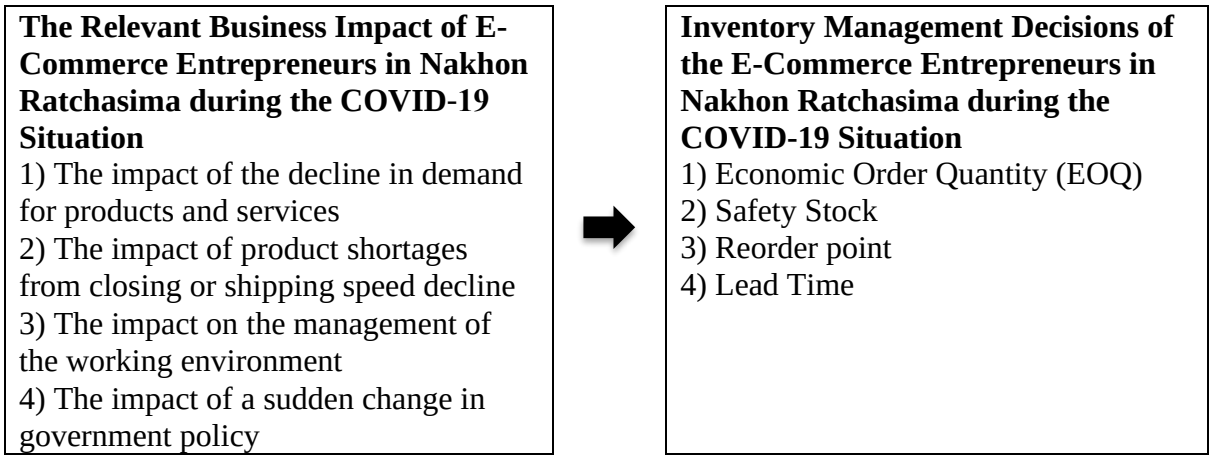

Figure 1 Research Conceptual Framework

Research Methodology

This research is a survey and quantitative research. The population of research is e-commerce entrepreneurs. The research team collected data from a sample in Nakhon Ratchasima, Thailand, a total of 370 persons with a questionnaire developed consisting of 4 parts: 1) general information about e-commerce entrepreneurs, 2) levels of relevant business impacts of e-commerce entrepreneurs in the situation of COVID-19, 3) inventory management decisions of e-commerce entrepreneurs in the situation of COVID-19, and 4) suggestions.

Statistics used in data analysis were frequency distribution, percentage, mean, standard deviation and multiple regression analysis. This research is accredited. The human research ethics was proved from the human research ethics committee Vongchavalitkul University according to the human research ethics certificate No.011/2021

Research Results

The results of the study on the impacts of the COVID-19 pandemic on the inventory management decisions of the e-commerce entrepreneurs in Nakhon Ratchasima, Thailand. It found that the opinion of the impact level was at a high levels. The decline in demand for products and services and sudden changes in government policy It was the issue that was most affected by entrepreneurs (Table 1).

Table 1 The impact levels resulting from the COVID-19 epidemic

Impact	Mean	Standard Deviation (S.D.)	Impact Level
1) The decline in demand for products and services.	4.53	0.48	Highest
2) Product shortages from closing or shipping speed decline.	3.49	0.49	Medium
3) The management of the working environment.	3.61	0.47	High
4) A sudden change in government policy.	4.53	0.47	Highest
Sum	**4.04**	**0.29**	**High**

The results of the analysis of the relationship between such impact on inventory management decisions in terms of economic order quantity management shown in Table 2. When considering the P-Values, it can be explained that the results support the H1 and H13 hypotheses; this explains why the coronavirus pandemic has caused the impacts of the decline

in demand for products and services and a sudden change in government policies that influence economic order quantity management decisions at a statistically significant level of 0.01. Furthermore, from analyzing the ability to predict dependent variables from independent variables, they can be predicted at 98.7% (Adjust $R^2 = 0.987$) which can be written in the form of a forecast equation as follows:

$\hat{Y} = 0.076 + 0.726(X_2) + 0.263(X_4)$

Table 2 The impact levels resulting from the COVID-19 epidemic on inventory management decisions on economic order quantity management.

Impact	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	SE	Beta		
(Constant)	0.076	0.041		1.834	0.068
1) The decline in demand for products and services.	0.726	0.041	0.732	17.889	0.000**
2) Product shortages from closing or shipping speed decline.	-0.003	0.006	-0.003	-0.460	0.645
3) The management of the working environment.	-0.003	0.006	-0.003	-0.508	0.612
4) A sudden change in government policy.	0.263	0.041	0.263	6.422	0.000**
$R = .993$, $R^2 = 0.987$, Adjust $R^2 = 0.987$, $F = 6769.136$, $N = 370$					

** Statistically significant at 0.01 level

The results of the analysis of the relationship between such impact on inventory management decisions in terms of Safety Stocks management shown in Table 3. When considering the P-Value, it can be described that the results do not support the hypotheses. The 4 aspects of the impacts of the COVID-19 epidemic situation does not influence on decision-making on inventory management in terms of Safety Stocks management as the results are not statistically significant at a 0.01 confidence level.

Table 3 The impact levels resulting from the COVID-19 epidemic on inventory management decisions on Safety Stocks management.

Impact	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	SE	Beta		
(Constant)	4.289	0.354		12.107	0.000
1) The decline in demand for products and services.	0.370	0.347	0.377	1.067	0.287
2) Product shortages from closing or shipping speed decline.	-0.025	0.050	-0.025	-0.488	0.626
3) The management of the working environment.	-0.002	0.052	-0.002	-0.046	0.963
4) A sudden change in government policy.	-0.268	0.350	-0.270	-0.765	0.445
$R = .120$, $R^2 = 0.014$, Adjust $R^2 = 0.003$, $F = 1.323$, $N = 370$					

The results of the analysis of the relationship between such impact on inventory management decisions in terms of reoder point level shown in Table 4. When the P-Value is taken into account from Table 4, it is clear that the H11 assumption is supported which is about the influence the coronavirus epidemic has on the management of the working environment

influencing reorder point level management decisions according to the manufacturer(s). It shows that it is statistically significant at a 0.01 confidence level and from analyzing the ability to predict the dependent variables from the independent variables, the result of the ability to forecast is 96.66% (Adjust $R^2 = 0.966$) which can be written in the form of a forecast equation as follows:

$\hat{Y} = 0.181 + 0.965(X_3)$

Table 4 The impact levels resulting from the COVID-19 epidemic on inventory management decisions on Reorder Point level

Impact	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	SE	Beta		
(Constant)	0.181	0.065		2.79	0.006
1) The decline in demand for products and services.	-0.068	0.064	-0.07	-1.073	0.284
2) Product shortages from closing or shipping speed decline.	-0.01	0.009	-0.011	-1.096	0.274
3) The management of the working environment.	0.965	0.009	0.982	101.851	0.000**
4) A sudden change in government policy.	0.063	0.064	0.065	0.988	0.324
$R = .983$, $R^2 = 0.966$, Adjust $R^2 = 0.966$, $F = 2600.061$, $N = 370$					

** Statistically significant at 0.01 level.

The results of the analysis of the relationship between such impact on inventory management decisions in terms of Lead Time management shown in Table 5. When the P-Value is taken into consideration from Table 5, it is clear that it supports the H12: assumption is supported which is about the influence the coronavirus epidemic has on the management of the working environment influencing lead time management decisions on inventory. It shows that it is statistically significant at a 0.01 confidence level. The ability to predict dependent variables from independent variables has a forecasting accuracy of 1.9 percent (Adjust R2 = 0.019), which may be expressed as the following forecast equation:

$\hat{Y} = 3.852 + -0.143(X_3)$

Table 5 The impact levels resulting from the COVID-19 epidemic on inventory management decisions on Lead Time management

Impact	Unstandardized Coefficients		Standardized Coefficients	t	P-Value
	B	SE	Beta		
(Constant)	3.852	0.319		12.091	0.000
1) The decline in demand for products and services.	-0.343	0.312	-0.385	-1.101	0.272
2) Product shortages from closing or shipping speed decline.	0.013	0.045	0.015	0.281	0.779
3) The management of the working environment.	-0.143	0.046	-0.159	-3.069	0.002**
4) A sudden change in government policy.	0.319	0.315	0.355	1.013	0.312
$R = .171$, $R^2 = 0.029$, Adjust $R^2 = 0.019$, $F = 2.744$, $N = 370$					

** Statistically significant at 0.01 level.

Conclusion and Discussion

The results of the study show that the epidemic situation of the coronavirus 2019 has impacted e-commerce entrepreneurs at high levels. The impacts of the corresponding research hypotheses can be described as follows: For the H1 and H13 hypotheses, the impact of a decline in demand for products and services and a sudden change in government policies influence inventory management decisions in terms of economic order quantity management. As a result of the uncertainty in the demand for products and services, the volume of products and services has decreased due to the rapid disappearance of the number of products and services from the market. This is in line with the findings of the study by Ho et al. (2021). To further explain, the pandemic has an impact on consumer spending and consumption habits, which is leading to supply and demand market uncertainties as well as the need for resource management and emergency supply storage. In this crisis, the volume of production of products and services is not gradually decreased from the economic slowdown but rather caused by the disappearance of products and services that were previously available in the market due to the cessation of production and services due to the government policy imposed on social distancing which also disrupted the global supply chain as there has been a reduction in products and services which is consistent with the study of Luman et al. (2021). By 2020, the pandemic reduced world manufacturing capacity by 10%, even though there have already been some vaccines available. Moreover, current travel restrictions were expected to be at a 7% recovery in 2021. The impacts reverse back to the quantity of production of goods and services being produced. As a result of the decrease in demand, the quantity of each order has changed and it may increase the overall cost of each order. This is because the quantity of each order is reduced but the cost per order remains the same, which means that the average purchase cost per piece increases. The entrepreneurs cut down their orders as demand has been declining until the point that some businesses were forced to close themselves and reduce costs to maintain liquidity to wait for the economic recovery (feedback loop into supply). As mentioned, this is in line with the study of Rerkngam et al. (2021) on the operational strategies and adaptation for logistics business survival during the COVID-19 pandemic. It was discovered that due to the decrease in the production outputs from the manufacturer, results in the reduction of the transport of raw materials. Entrepreneurs has therefore set up measures to support the company by finding additional jobs for employees in addition to generating income for employees. It also includes being a guideline to help businesses survive during the COVID-19 epidemic crisis.

For the H11 and H12 hypotheses, inventory management choices are influenced by how the 2019 Coronavirus Disease outbreak is managed in the workplace. It affects inventory management decisions on Reorder Point levels on the inventory of the manufacturer and Lead Time management which may be caused by a longer delay in working hours to lower the chance of infection by reducing the number of workers per session. Therefore, lead times and demand rates during the waiting period for newly ordered products have changed from the original ones. The final result is that there may be disruptions in sales and replenishment activities while minimizing the total inventory on hand. In addition, it is imperative to appoint a reorder point so that future orders can be fulfilled without interruption. This conclusion corresponds with the research by Chaiyakit (2020), stating that when the time of the raw material acquisition procedure changes, which is a variable that direct which is a factor that directly varies with the level of raw material inventory. As a result, the level of raw material inventory should be changed as well. So, it is necessary to calculate the level of raw material inventory for safety stocks and acquire a new reorder point that is suitable for a new order period. When the raw material inventory level has been adjusted, there will be a decrease in the raw material inventory level. As a result of the reduction of raw material inventory levels, it will result in a reduction in the Inventory cost of raw materials , interest on the opportunity cost of capital and it can reduce the storage space utilization.

For e-commerce entrepreneurs in this research, it indicates that when entrepreneurs are confronted with a coronavirus pandemic, adaptation is required. The size and quantity should be lessened concerning the products and order quantities, resulting in a decrease in revenues for the companies. As a result, entrepreneurs should prepare for the circumstance by changing their business strategies by cutting down unneeded expenses, and adjusting their existing resources to use them to create value in other ways as much as possible. This is to keep the company running. Also, the management of a specific work environment should also be planned to lower the number of employees in each period. Order management and the quantity of inventory should be planned in order to have the right amount by calculating the most economical order quantity together with the availability of inventory for safety stocks. Doing these will help lower the costs associated with uncertain order times. Moreover, as this research is a study from the COVID-19 epidemic period, which may be only a certain period of time, the results of this research can be used as a guideline for adjustment in the event that there is the spread of other diseases or other viruses or in other situations that the restrictions are imposed which refrain consumers from or travel or make consumers travel less.

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