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Applications in Sciences in the prevention of COVID-19

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Abstract

Purpose: The main purpose of this work is to provide an overview of the COVID-19 issue, this article discusses in detail and fully the important and meaningful applications of Decision Sciences to the prevention of COVID-19. Because COVID-19 is an extremely hot topic and the most fascinating question in recent years, the research on this topic is very interesting and noticed by scientists.

Design/methodology/approach: In the scope of this study, we first introduce definitions and issues related to COVID-19 and study the negative impacts of COVID-19 diseases on all sectors of society. We then provide a comprehensive introduction to the applied aspects of Decision Science in the prevention of COVID-19.

Findings: The findings of our research help people have a correct, complete, overview, and comprehensive view of the COVID-19 issue. All COVID-19 issues are discussed in great detail and completeness in this article.

Originality/value: All the issues discussed in this study are original and new in the literary literature.

Practical implications: This will help the countries' leaders have the best way to fight the COVID-19 pandemic more effectively and cost-effectively.

Keywords: Discussion, Applications, Decision Sciences, COVID-19.

JEL Classifications : M1, M2, M4.

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1. Introduction

COVID-19 is a very difficult and complex issue for everyone in the current period. Consequently, topics or questions related to COVID-19 are always of interest to scientists and people and try to find ways to address them. Until now, COVID-19 is still raging and causing many difficulties and hardships for everyone in the world. Although there have been many measures to combat and limit COVID-19, this problem has not shown any signs of stopping, even though it has changed strains that are more dangerous.

There have been many important and profoundly practical studies on the subject of COVID-19 such as Maleki et al. (2020a) performed time series models (TSM) to model and forecast the spread and death rate of COVID-19 in the world. Maleki et al. (2020b) employed the TSM to predict and model the confirmed and recovered cases of COVID-19. Ali, et al. (2022) and Kheni and Kumar (2021) find that COVID-19 influences stock indices. Chu, et al. (2021) develop a latent pandemic space model to analyze the impact of the coronavirus disease. Duong, et al. (2021) study how limit-to-arbitrage factors affect idiosyncratic volatility during the Covid-19 period. Safi, et al. (2022) and Tajmouati, et al. (2022) examine the forecast models during the COVID-19 period. Others can be found in Alakus and Turkoglu (2020) compared the deep learning methods to forecast COVID-19 infection. Furthermore, Allen and McAleer (2021) offered predictions of COVID-19 cases and deaths in the US from state censuses and populations. The modes of immune activation and future challenges for COVID-19 vaccines are discussed in Teijaro and Farber (2021), and so on.

Scientific research on the topic of COVID-19 is diverse and rich and more and more new research, vaccines, and preventive measures against this pandemic. Because COVID-19 shows no signs of stopping, it is increasingly spreading in all countries around the world. This study is different from all previous studies on the topic of COVID-19. The primary concern of this work is to show an overview of the COVID-19 issue, this research presents in detail and fully the important and significant applications of Decision Sciences to the prevention of COVID-19. Readers may refer to Chang, et al. (2020) for more applications related to the COVID-19 disease. Readers could also use more advanced models, see, for example, Gasbarro, et al. (2007), Tiku, et al. (2000), Bai, et al. (2010), Ma and Wang, X. (2021), and Lv, et al. (2021) to examine the impacts of the coronavirus disease.

This paper is conducted as follows. Section 2 introduces the definition of Coronavirus and COVID-19 and how the virus causes disease. Section 3 presents the origin, structure, genomics, and findings of COVID-19. Section 4 also covers the effects of COVID-19 on society. Applications in Decision Sciences in the prevention of COVID-19 are provided in the next section. The conclusion is offered in the last section.

2. COVID-19

In Sections 2 and 3, we condense and summarize the contents based on the following link: **https://vnvc.vn/virus-corona-2019/**

2.1. Coronavirus

Coronavirus is a new virus strain that has never appeared in the world, this name is derived from Latin. Coronavirus is a very dangerous and fast-producing virus, it is covered with long outer spikes that interact with cells. In simple terms, this mechanism is similar to a key and a lock, thereby allowing the virus to enter the body of humans and animals. With such a mechanism, this virus is extremely dangerous, has a very fast growth rate, and penetrates the human body at a very fast rate.

Starting to break out at the end of December 2019, from a seafood market in Wuhan, central China, this Coronavirus at first was thought by many people as just a type of "strange pneumonia" or "inflammation of the lungs unknown cause". However, after only more than 100 days of its appearance, the acute respiratory infection caused by Coronavirus has quickly had a strong impact on economic and social fields around the world. Besides, it made financial markets wobble, the global economy fell into a very serious recession with unprecedented unemployment and poverty rates in history.

Coronavirus 2019 is a new strain of virus that causes an infection in the nasal cavity, or throat. There are currently 7 types of Coronavirus, some of which are not dangerous, but the following two are very dangerous and have caused a global pandemic: MERS-CoV and SARS-CoV.

In addition, there is an extremely dangerous strain of Coronavirus with the symbol 2019-nCoV or nCoV. It is also known as the "Wuhan Virus" which has been raging since the end of 2019 now. This is the causative agent of acute pneumonia, which has infected more than 100 million people and killed more than 2 million people worldwide.

2.2. How does Coronavirus cause disease?

Most of these coronaviruses have a very similar route of infection to other common cold viruses, which are: if an infected person coughs or sneezes without covering their mouth, this will lead to the release of tiny droplets into the air, which in turn will spread the virus to healthy people.

Besides, a healthy person touches or shakes hands with someone who has the Coronavirus or comes into contact with a surface or object containing the virus and then brings their hand to their nose, or mouth. This will cause the virus to pass to healthy or uninfected people. These are the main transmission mechanisms of this virus strain. However, there are very rare cases, showing that the Coronavirus spreads without scientists finding a specific cause.

2.3. COVID-19

The World Health Organization (WHO) has officially named the acute respiratory infection caused by a new strain of coronavirus (2019-nCoV) as COVID - 19. This name stands for coronavirus disease 2019, gathering all the keywords "corona", "virus", and "disease" and 2019 is the year that this virus caused a global catastrophe pandemic appeared.

However, until February 2020, the International Committee on Taxonomy of Viruses (ICTV) officially named the new strain of coronavirus "Sars-CoV-2". This is a different name from the name COVID-19 that WHO mentioned earlier. Scientists around the world have conducted research and classified a new strain of coronavirus, temporarily called 2019-nCoV by WHO with a gene sequence similarity to the previous Sars-CoV, with a similarity of up to 79.5%.

3. Origin of the COVID - 19 epidemic

3.1. Structure

Like other viruses, Sars Cov 2 virus penetrates deep inside cells, from which it will tame these cells into a replication machine, multiplying the virus many times over. If this goal is achieved, the amount of the Sars Cov 2 virus will be large enough to disrupt the immune system, leaving the human body no longer able to resist and infection.

Sars Cov 2 virus has a spherical shape, about 125 nanometers in diameter, is composed in order from inside to outside, including three components as follows: Nucleic acid core, protein shell, and outer shell.

3.2. Genomes

The coronavirus genome has a complex structure consisting of many components, as illustrated in **Figure 1**.

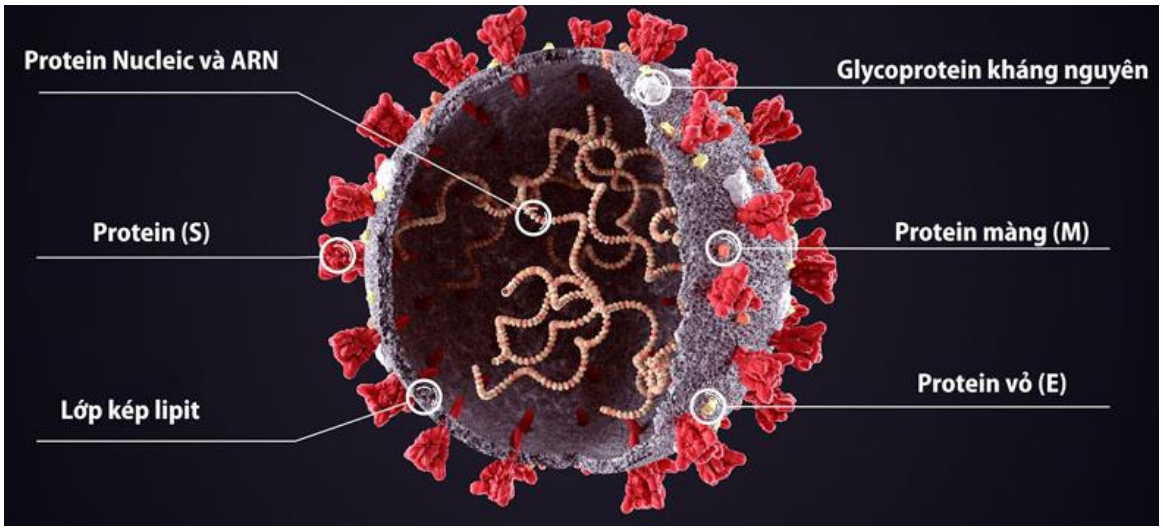

Figure 1: Structure of SARS - COV - 2 virus

For the sake of simplicity, we do not go into detail here. According to studies by scientists around the world, the genome of the coronavirus has the following similarities:

a) The similarity of 50% gene code compared with the MERS-CoV virus strain.
b) The similarity of 79.5% gene code compared with the SARS-CoV virus strain.
c) The similarity of 96% of gene code to the Coronavirus strain detected in bats, especially horseshoe bats.
d) The similarity of 99% of gene code to the Coronavirus strain found in the pangolin species.

Another point worth noting is when analyzing the Coronavirus, scientists found that the Coronavirus is the same species as the SARS virus in 2003 with a similarity of up to 94.6% of amino acid sequences.

3.3. When was it discovered?

The coronavirus was found by scientists in both animals and humans. Some strains of coronavirus that can cause the common cold or more severe are Middle East Respiratory Syndrome (MERS) or Severe Acute Respiratory Syndrome (SARS). Meanwhile, the new coronavirus is a new strain of virus that has never been found in humans before.

This new virus, called 2019-nCoV, had never been detected before the outbreak was reported in Wuhan City, Hubei Province, China in December 2019. The pandemic of acute respiratory infections caused by a new strain of coronavirus has lasted so far in 215 countries around the world, causing tens of millions of people to get sick, and millions of people to die around the world. So far, there has been no sign of "cooling down", but it also has other, much more dangerous strains.

3.4. Symptoms

The symptoms of people with COVID-19 have many signs to recognize. However, according to the warning from the US Centers for Disease Control (US CDC), when infected with Covid 19, one or all of the symptoms can appear at any time within 2-14 days. after being exposed to the new strain of coronavirus. Accordingly, the earliest signs to detect people with COVID-19 are:

The first sign to recognize someone with COVID-19 is a fever. Most children, as well as adults, will be identified as having a fever when their body temperature exceeds 38 degrees Celsius. Experts advise people that patients or suspected sick people should not rely on temperatures taken in the morning because viral fevers often cause the body's temperature to rise in the late afternoon or early evening.

A second possible sign to identify someone who may have COVID-19 is a dry cough. It should be noted that coughing is the earliest and most common COVID-19 symptom. And know that if a cough is caused by COVID-19 it will not be able to completely cure itself when taking regular cough medicine. This is a very important feature that everyone should pay attention to.

The third sign that is also a very recognizable sign is fatigue. Fatigue, exhaustion, or body aches are all symptoms of people with COVID-19. Research by WHO has shown that about 40% of the observations and tests of nearly 6,000 people with COVID-19 have experienced periods of fatigue. This state can last even longer, even lasting a few weeks after COVID-19 has ended.

However, it is a fact that the incubation period of 2019-nCoV is 14 days, which means that from the time of infection with Coronavirus until the onset of illness, it is 14 days before there are clear clinical manifestations. This makes the current control measures very difficult to detect the disease.

4. The Impact of COVID-19 on Society

As we know any society or any country, the labor force is a very essential component, playing an extremely important role in the development, stability, and prosperity of the country. In short, the labor force is the people who can provide labor for the country, the country wants to develop stably and sustainably, the workforce must be large, must be of high quality, and have to work based on modern machinery and science and technology.

In the current period of the dangerous COVID-19 situation, the workforce is severely affected, not only in Vietnam but also around the world. For the sake of simplicity of illustrating the data for a specific case, we chose the country Vietnam to illustrate the data on the workforce that has been severely impacted by the covid 19 pandemic. The data and **Figure 2** in this sub-section are collected based on the General Statistics Office of Vietnam, with the following link: https://www.gso.gov.vn/du-lieu-va-so-lieu-thong-ke/2021/04/bao-cao-tac-dong-cua-dich-covid-19-den-tinh-hinh-lao-dong-viec-lam-quy-i-nam-2021/

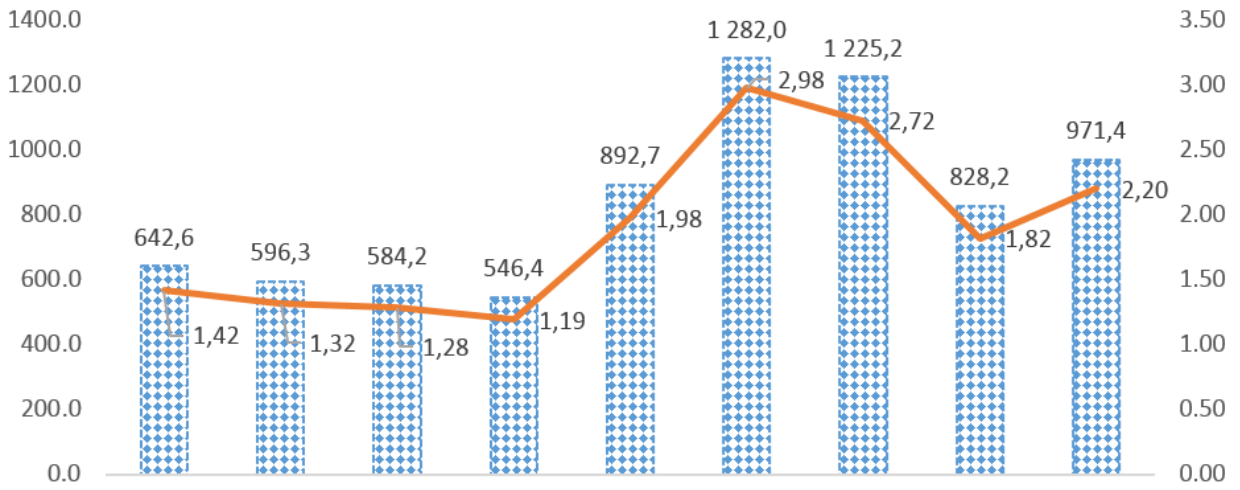

Figure 2: Number of people and underemployment rate in quarters, period 2019-2021

where the vertical bars in blue indicate the number of people, in thousand people, and the orange dotted line represents the percentage. Note that the blue vertical bar from position 1 to 4 indicates the 1st to 4th quarter of 2019, blue vertical bar from position 5 to 8 indicates the 1st to 4th quarter of 2020. The blue vertical bar in the last position represents the first quarter of 2021.

We now discuss the number of people and underemployment rate in quarters in Vietnam, in the period 2019-2021. The number of underemployed people of working age in the first quarter of 2021 is 971.4 thousand; an increase of 143.2 thousand people compared to the previous quarter and an increase of 78.7 thousand people over the same period last year. The underemployment rate of laborers of working age in the first quarter of 2021 is 2.20%; an increase of 0.38 percentage points compared to the previous quarter and an increase of 0.22 percentage points compared to the same period last year.

The underemployment rate of laborers of working age in the first quarter of 2021 in the agriculture, forestry, and fishery sectors is 3.88%, the industry and construction sector is 1.51%; the service sector is 1.76%. Although the agriculture, forestry, and fishery sectors still have the highest rate of underemployment in working age, compared to the same period last year.

The underemployment rate in this sector decreased by 0.8 percentage points, while that in industry and construction increased by 0.86 percentage points and the service sector increased by 0.31 points percent. Obviously, the outbreak of the COVID-19 pandemic has caused underemployment to spread to the industrial, construction, service, economy, finance, and tourism sectors, in general, all sectors.

Consequently, the project of joining hands to reduce the negative impact of COVID-19 has been discussed recently by the Communist Party of Vietnam. It has been pointed out in 14 provinces and cities of Vietnam, according to the online newspaper Communist Party of Vietnam (see https://dangcongsan.vn/kinh-te/chung-tay-giam-thieu-tac-dong-tieu-cuc-cua-covid-19-579265.html).

It has been seen that not only Vietnam but all countries around the world are very interested in effective ways to prevent this covid pandemic. Therefore, this article is very meaningful and important in the literature because it discusses the applications of Decision Sciences in the prevention of COVID-19. This will help the country's leaders have an overview from which to have the best way to fight the COVID-19 pandemic in a more effective and cost-effective way. These issues are thoroughly presented in the next section.

5. Applications in Sciences in the Prevention of COVID-19

5.1. Medical

In any pandemic, not just the current COVID-19 pandemic, vaccines are extremely important to people around the world. Vaccines can best help people reduce, or prevent certain diseases. Although it cannot completely prevent or combat the disease, it can help reduce it significantly. Therefore, vaccines to prevent or prevent COVID-19 are of great significance in the current period.

The Covid-19 vaccine is a type of vaccine with the main purpose of preventing the current very dangerous acute respiratory infection, it helps prevent the Coronavirus from attacking people. Up to now, many countries around the world have announced the successful production of vaccines against the Coronavirus and these vaccines have shown quite positive effects.

Currently, as far as we know, there are more than 100 COVID-19 vaccines that have been and are in the preclinical stages of development. All vaccines work by different mechanisms with the primary goal of conferring immunity. But with all these vaccines, the common mechanism is that in addition to producing antibodies against the virus that causes disease, this vaccine can also produce cells to fight the pathogens, and against them, if attacked in the future.

In the context of the increasingly dangerous COVID-19 pandemic, more and more strains and strains appear. It threatens the jobs, health, lives, and lives of millions of people worldwide. Therefore, scientists around the world have been racing against time, aiming to soon come up with safe and effective vaccines to help prevent the spread of the disease COVID-19.

Until now, it has been nearly two years since the COVID-19 pandemic broke out strongly in China, and potential COVID-19 vaccines have been entering the final stages before being officially released. According to the following link https://vnvc.vn/vaccine-covid-19/ , there are currently about 11 best vaccines against COVID-19 being researched and produced worldwide. It is detailed in **Table 1**.

Table 1: The 11 most popular vaccines against COVID-19 today

Order	**Name of vaccine**	**Manufacturer**	**Nature**	**Headquarters**
1.	AstraZeneca	The University of Oxford	Adenovirus	United Kingdom
2.	Ad5-nCoV	CanSino Biologics	Adenovirus	Tongji Hospital Wuhan, China
3.	BBIBP-CorV	Beijing Institute of Biological Products (CNBG); China National Pharmaceutical Corporation (Sinopharm)	Inactivated vaccine	Henan Province Center for Disease Control and Prevention, China
4.	BNT162b2	Pfizer, BioNTech	mRNA	Europe, North America and China
5.	CoronaVac	Sinovac	Inactivated vaccine	Sinovac Research and Development Co., Ltd
6.	COVAX-19	Vaxine Pty Ltd	Monovalent recombinant protein vaccine	Royal Adelaide Hospital (Australia)
7.	Covaxin	Bharat Biotech; National Institute of Virology	Inactivated vaccine	Bharat Biotech and National Institutes of Medicine (India)
8.	JNJ-78436735 (Ad26.COV2.S)	Johnson & Johnson	Adenovirus	Johnson & Johnson (US)
9.	mRNA-1273	Moderna	mRNA	Washington Health

				Research Institute
10.	NVX-CoV2373	Novavax	Spike protein of SARS-CoV-2 virus	Novavax
11.	Sputnik V	Gamaleya Research Institute	Adenovirus	Gamaleya Research Institute (Russia)

Some prominent studies on this issue are as in Belete (2021) reviewed the up-to-date status of candidate vaccines for the COVID-19 pandemic. Kashte et al. (2021) presented the rapid development, implications, challenges, and future prospects for COVID-19 vaccines. Besides, Koff et al. (2021) presented the development and deployment of COVID-19 vaccines for those most vulnerable. Teijaro and Farber (2021) introduced the modes of immune activation and future challenges for COVID-19 vaccines, and so on.

5.2. Applied Statistics

The two most used techniques in Statistics for research on the topic of COVID-19 are simulation and prediction techniques, and classification techniques. We now discuss the first technique.

5.2.1. Modeling and Forecasting

The study of simulation and prediction of suspected and confirmed cases in the near future for the COVID-19 pandemic is of great practical significance and extremely important during this dangerous pandemic period. These studies have profound implications and are reliable because they are based on scientific inferences. It not only helps the country's managers and leaders to consult and find the best way to cope but also helps the people to consult and prevent themselves before getting help from the government.

Some typical studies can be mentioned as Maleki et al. (2020a) employed time series models (TSM) to model and forecast the spread and **death rate of COVID-19** in the world. Maleki et al. (2020b) used the TSM to predict and model the confirmed and recovered cases of COVID-19. Alakus and Turkoglu (2020) compared the deep learning methods to forecast COVID-19 infection. Moreover, Allen and McAleer (2021) provided predictions of COVID-19 cases and deaths in the US from state censuses and populations. Some statistical methods can be considered further such as Newton's method, or selection model. It can be found in Pho (2022a, b), among others.

5.2.2. Clustering method

The clustering algorithm is a very widespread and important technique in statistics with the main purpose of how to divide data into different clusters so that the data in the same cluster have similar properties. The ultimate goal of this algorithm is to from the input data and the number of groups we want to find, specify the center of each group, and assign the data points to the corresponding groups. It can be further assumed that each data point belongs to exactly one group.

It can be used to classify high-risk countries as a cluster, or regions or localities with a high risk of infection as a cluster. This way is very practical because it helps the government, the leaders of the country will distribute medicines, vaccines, and measures against the COVID-19 epidemic at a greater rate to these places. This will make the fight against the COVID-19 pandemic more effective and cost-effective.

Some important studies on this topic as in Abd Elaziz et al. (2021) introduced the automatic clustering algorithm to segment COVID-19 CT images. Azarafza et al. (2020) presented the clustering approach to analyze the spread pattern of COVID-19 infection in Iran. In addition, Mahmoudi et al. (2020) compared the spread rate of Covid-19 in the high risks countries by using the fuzzy clustering approach. Zarikas et al. (2020) studied the classification of countries with COVID-19 cases based on the clustering technique, and so on.

5.3. Others

In addition to the studies on ways to prevent the COVID-19 pandemic for specific disciplines such as Medicine and Statistics as indicated in the subsections above. There is still a lot of other important research on this topic, some of which stand out as Chang et al. (2020) presented the future of tourism during the COVID-19 pandemic. McAleer (2020a) introduced seeking clarity in a world affected by COVID-19. Moreover, McAleer (2020b) offered a discussion on the recent COVID-19 study in JAMA.

Sinha et al. (2020) presented the status of COVID-19 infection in children. Daniel (2020) discussed education during the COVID-19 pandemic. Kawohl and Nordt (2020) studied the problem of unemployment and suicide during the period of COVID-19. Recently, McAleer (2021a) has presented a critical analysis of some recent medical research in Science on COVID-19, McAleer (2021b) discussed a critique of recent medical research on COVID-19 in JAMA, and so on. There's been a lot of excellent research on the subject of covid-19 lately like Burki

(2022), Chen et al. (2022), McGarry et al. (2022), Rosenberg et al. (2022), Su et al. (2022) and Watson et al. (2022).

6. Conclusion

This article studies the applications in Sciences in the current period with the strong outbreak of the COVID-19 pandemic. In this work, we provide a detailed and comprehensive introduction to the issue of COVID-19 and study the negative impacts the COVID-19 on all sectors of society. In addition, we have provided comprehensive coverage of the applied aspects of Decision Science in the prevention of COVID-19. Our research shows that, in general, it helps people have a correct, complete, overview, and comprehensive view of the COVID-19 issue. All COVID-19 issues are discussed in detail and completeness in this article. The important inferences drawn from the findings in our paper will help world leaders to get the best approach to combat the COVID-19 pandemic in the most effective and cost-effective way. Thus, our work will be helpful for academics, practitioners, and policymakers in their decision-making during the COVID-19 pandemic.

About the limitation of the article, it may be that we have not surveyed many places where the problems of COVID-19 occur and there have not been enough discussions on that aspect. Thus, academics and practitioners could extend our paper to conduct in-depth surveys for different countries in which the problems of COVID-19 are serious and provide more in-depth discussions on that aspect.

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