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Impact of the COVID-19 pandemic on road freight transportation – A Colombian case study

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1. Introduction

Regional economic growth has remained a significant aim of regional planning since it is thought to increase people's quality of life. For a long time, economic growth in terms of per capita income or per capita Gross Domestic Product (GDP) has been a yardstick for measuring a region's development (Maparu & Mazumder, 2017). Today, achieving long-term economic growth is a significant issue for all countries, particularly those whose economies rely on non-renewable energy sources (Nasreen, Saidi, & Ozturk, 2018).

As a derivative economic development demand, freight transportation is critical to economic growth, especially in industrialized countries with a strong positive relationship to road transport. The empirical evidence in developing countries, such as Colombia, showed that economic growth has had linked to road freight transport regardless of comparisons with other economic sectors. This main objective of the paper is to assess the impact caused by the COVID-19 restrictions on freight transport by road to depict the challenge between freight transport performance and economic growth. The total freight transported in 2020 was predicted based on a time series analysis considering the system's performance. As a result, in 2020, the ton of freight transported became only 40% of the predicted freight in the most critical month. The analysis can help planners implement policies to improve freight transport behavior and react during future economic downturns. Events such as the COVID-19 pandemic demonstrate that freight transportation must be fast and flexible, is crucial to act in the short term, and consider the long-term recovery. In addition, cooperation among the various economic sectors’ stakeholders must be necessary.

The COVID-19 pandemic has wreaked havoc worldwide, with profound economic, environmental, and social implications. Fears about the economic situation have called attention to freight transportation performance as a derivative economic development demand. It is critical to economic growth, especially in industrialized countries with a strong positive relationship to road transport. The empirical evidence in developing countries, such as Colombia, showed that economic growth has had linked to road freight transport regardless of comparisons with other economic sectors. This situation clearly demands urgent attention in developing countries experiencing considerable difficulties in achieving economic growth while reducing road transport's external costs, independently of the efforts and strategies being made in developed countries more effectively.

Engström (2016) mentioned some advantages and disadvantages of on-road freight transport. From an economic perspective, purchasing a truck and working on the market requires only a tiny amount of money. It enables some shippers to operate their vehicles to supplement market supply. In terms of time, road freight is even more flexible. This refers to the pace in general, but it also notes that routes and timings can be modified and updated to meet individual needs. From a capacity point of view, although trucks have constraints either by weight or volume, they are adaptable. Trucks can accommodate small and large volume settings.
by varying the number of vehicles and/or frequency.

Road freight has significant and difficult-to-address adverse effects or impacts like externalities (van Essen, 2008). The consequences are felt on a local, regional, and global scale. The first group of effects is the GHG emissions and their consequences, such as severe weather, rising sea levels, and noise. A second group is road accidents that kill fewer people in many countries, but traffic safety remains a significant concern in several countries worldwide. Heavy trucks are involved in a disproportionate amount of accidents; however, they are not the trigger. Finally, the third group of effects is highway congestion which costs the public a lot of money, and according to the EU (European Commission, 2019), the cost to the EU economy is expected to be more than 1% of GDP (which is more than the EU budget).

The unpredictable spread of the COVID-19 pandemic has caused massive global disruption, with significant economic, environmental, and social consequences worldwide, including freight transport by road. Only world wars and the 1918 influenza pandemic can compare in terms of a wide variety of effects, including deaths, in such a short period (Hendrickson & Rilett, 2020). According to Loske (2020), the most worldwide commonly restrictions include: (i) Contact restrictions and social distancing rules; (ii) Temporary closure of trade and service companies and gastronomy, hotel business, and leisure facilities; (iii) Travel restrictions within a country and especially for non-essential travel; (iv) Obligation to wear a mouth-and-nose cover when using public transport.

The main objective of the paper is to assess the impact of the COVID-19 pandemic on freight transport by road. To that end, the study focuses on Colombia since this case study has some interesting characteristics. Firstly, freight transport and economy increase in developing countries, such as Colombia (OECD, 2015). Secondly, Colombia has invested heavily in infrastructure in the last years, intending to increase international competitiveness (Nieto-Garcia & Guzman, 2019).

In addition, Colombia has the fourth-largest economy in Latin America, and its short-term growth prospects are favorable by OECD standards. The economy has benefited from sound macroeconomic policies and the advantages of a commodities boom and strengthened its security conditions. Consequently, the Colombian government must deal with three significant issues: adapting to the commodities boom, increasing growth, and reducing income inequality (OECD, 2015).

Freight transportation costs in Colombia are constantly being manipulated, resulting in inefficiencies in the industry. For example, 22.4% of Colombian companies have their fleet, indicating a significant diversion of capital to investments unrelated to their core sector. Furthermore, more than half of all tractor-trailers, vans, buses, and minibusses in Colombia are over 11 years old, with 30% trucks over 21 years old. In reality, after Nicaragua, the country's vehicle fleet is the oldest in Latin America (Consejo Privado de Competitividad, 2019).

Colombia's GDP in 2020 fell by 6.8% compared to the previous year, and this rate is 101 tenths of a percentage point lower than the last year when the variation was 3.3%. As in a developing country, Colombia's GDP is coupled with transport activity growth (see Fig. 1) (DANE, 2021). Tourism, the country's level of exports and imports, and local commercial activities, in general, all affect the evolution of this industry.

As Nieto-Garcia and Guzman (2019) mentioned earlier, Colombia's infrastructure has gradually improved over the last two decades. In collaboration with technical and administrative agencies, the National Government has developed four Public-Private Partnership (PPP) infrastructure programs for road projects known as “generations of concessions.” There has been a significant change in road infrastructure investment from public to private. The government used to finance road construction before the 1990s. Due to Colombia's open economic policy, private investment has become a critical tool for developing and maintaining road corridors. The government’s and private investors’ partnership has made a significant impact in this direction. According to this information, Colombia is now in charge of the Fourth Public-Private Partnership Road Program (4G). Despite the economic, communication, goods transportation costs, and territorial cohesion benefits of those 4G projects, there has been no concrete evidence from studies or investigations explaining this modern infrastructure investment's economic, connectivity, and territorial cohesion benefits.

This paper addresses this research question: What impact has the COVID-19 pandemic had on road freight transport in Colombia and the economic growth (GDP)? This paper aims to contribute to the current state of the art by comparing a predicted total load transported and actual due to the COVID-19 pandemic. The results can help planners implement policies to improve freight transport behavior and react to unusual future economic downturns, especially in economies with a strong dependency on freight transport by road.

The remainder of this paper is structured as follows. First, the literature review presents state of the art concerning freight transport and economic growth. Then, the data description section shows the model data input collected for this research. Subsequently, the methodology section outlines the framework of the time series adopted for this research, while the results section presents the discussion of the modeling findings. Finally, we set conclusions from this analysis and point out recommendations for future scenarios.

2. Literature review

The literature review is divided into two categories: a. Freight transport and economic growth; and b. Road freight transportation in a period of economic singularity. The first part outlines the challenges in the relationship between freight transport and developed and developing economies. In contrast, the second part addresses the impact of
freight transport due to special periods (i.e., recessions, pandemics, disruptions, etc.).

2.1. Freight transport and economic growth

The relationship between economic growth and freight transportation is not new, but it is different in developed countries than in developing countries. Shafique, Azam, Rafiq, and Luo (2020) confirm the casual relationship between freight transport, economic prosperity, carbon dioxide (CO2) emissions, energy consumption, and urbanization. However, Kramarz et al. (2021) point out that developed economies like the EU had followed policies aiming to build intermodal transport networks to reduce those negative externalities.

Despite the support of authors such as Bennathan, Fraser, and Thompson (1992) for linearity assumptions in the relationship between GDP and transport demand – calculated in ton–km – transport demand is growing more slowly than economic growth. Various empirical studies evaluating historical evidence for decoupling and its prospects have been developed (Banister & Stead, 2003).

In developing countries, transportation by road is generally acknowledged to account for a large portion of GDP. As a result, the relationship between ton-km and GDP, known as “coupling,” has historically been used to forecast freight transportation demand patterns. However, Kveiborg and Foguerau (2007) claim that the element considered is industrial sector output rather than GDP. Due to their unprecedented versatility, trucks serve as a critical connection between manufacturers, companies, and customers, allowing them to locate wherever they want. As a result of this freedom, more equitable distribution of resources and employment between urban and rural areas can be achieved (Engström, 2016).

According to McKinnon (2007), the different decoupling rates among countries are dependent on the share of “intensive industrial sectors” in the overall economy. This means that specific industries, such as agriculture and mining, need more tonne-kilometers in their manufacturing processes than service industries. As services rise as a percentage of total GDP, economic growth outpaces transportation infrastructure. In France’s case, Joignaux and Verny (2004) claim that the increasing transportation distance is a significant factor in explaining the relationship between transportation demand and economic growth.

Maparu and Mazumder (2017) examine the long-run relationships between transportation infrastructures, urbanization, and economic growth in India from 1990 to 2011. They look at various subsectors of transportation infrastructures, such as road infrastructures, rail infrastructures, airway infrastructures, and port infrastructures. Their empirical findings reveal long-term correlations between variables, with causal relationships in most cases extending from economic growth to transportation infrastructure. Yao (2005) investigated the links between freight transportation, industrial development, and input inventory investment and concluded that freight movements and firms’ output and input inventory expenditure have a significant feedback impact on each other.

In the long and short run, Ben Jebli (2016) looked at the relationship between GDP and freight transport in the presence of other variables such as health indicators, combustible and waste use, and carbon dioxide emissions in Tunisia from 1990 to 2011. In Africa, road transport is the most available and used system. However, many road transport factors cause prolonged travel times in transport corridors. Different issues include conflicting rules and regulations, poor transport networks, and connectivity that constrain freight transport (Okyere, Yang, Aning, & Zhan, 2019). Transport cost is not affordable to most average-income African citizens, and the high cost is due to inefficiency in the transport system (Pedersen, 2001).

Wang et al. (2021) discovered an inverted U-shaped relationship between freight traffic turnover per person and Chinese economic growth. China’s overall economic growth is decoupled from freight development, and its transportation strength is waning; however, regional differences are visible. This means that high-demand sectors’ contribution to economic growth has decreased due to various factors, including the region’s manufacturing structure and geographical characteristics.

The relationship between country economy and transport is studied in all modes of transport. For example, Cong, Zhang, Wang, Xu, and Li (2020) and Kong and Liu (2021) investigated the link between port city economic variables and port throughput in the case of maritime transport. The results demonstrated that the impact of throughput on GDP could not be ignored. Multiple studies also studied the relationship between air transportation demand and GDP growth (Hakim & Merkert, 2019).

2.2. Road freight transportation in a period of economic singularity

The last decade has been marked by negative economic growth and general economic uncertainty for most countries. Several economic sectors experienced significant changes during that period, affecting freight transportation in various ways. Recently, the COVID-19 pandemic has affected freight transport as a crisis. These singularities are known as Black Swans. According to Taleb (2007), a Black Swan is an occurrence that meets three criteria: (i) It is an outlier because it occurs outside the sphere of regular expectations, (ii) It has an enormous impact, and (iii) Human nature causes us to fabricate explanations for its occurrence after the fact, making it seem foreseeable and explainable. Although this isn’t always the case, some people connect Black Swan with a crisis. However, not every crisis is a black swan. Hajikazemi, Ekambaram, Andersen, and Zidane (2016) explain that a typical storm, for example, is a crisis; only a hurricane-like Hurricane Katrina is a Black Swan because no one could have predicted the disaster’s scale and breadth.

Islam (2018) defines economic growth as growth in meeting individual and collective consumption demands. The decline in economic growth for a more extended period (i.e., recession) occurs as a part of the “The Limits of Growth” concept. During such an economic crisis, three policy concepts can be implemented: “austerity”; “business as usual,”; and “fiscal stimulus.” This paper examines the economic response to the 2008 recession in sustainable transport system development in Europe.

According to Moschovou and Giannopoulos (2021) and Moschovou and Tyrinopoulos (2018), the “traditional” relationship between GDP and national and international road freight transport output appears to hold for Greece, Spain, and Portugal, with positive elasticities but negative elasticities in Italy. Further investigation revealed correlations with the manufacturing sector’s output index, suggesting the countries’ low vulnerability to economic sector shifts.

From a supply-side point of view, Cui et al. (2021) describe that the COVID-19 pandemic has triggered many shocks to the transportation industries, increasing their protective costs and reducing output quality. On the demand side, they lower transportation demand in households and the manufacturing sector. They identify six COVID-19 pandemic shocks to transportation sectors: manufacturing and service sector shutdowns, a drop in overall expenditure, a drop in household usage, a drop in household demand for transportation, a lockout of transportation facilities, and a rise in the protective cost of transportation sectors.

As observed from the previous literature, extensive work was carried out to recognize and analyze freight transportation’s effect on a country’s economy. Regardless of the mode of transport, most previous contributions focus on studying the “coupling” or “decoupling” of this relationship. The findings depicted that freight transport is one main driver of the economic growth in developing countries irrespectively of the external costs faced by governments. Additionally, as far as the authors are aware, there is still a need for more in-depth investigation regarding the effect of singularities or black swan on freight transportation and its impact on a country’s economy. This is particularly interesting in
contexts such as in developing countries, in which typically its economy is coupled with transportation, especially by road.

3. Data description

Freight data was obtained through the National Freight by Road Registry (RNDC by its Spanish acronym) application developed by the Minister of Transportation of Colombia (2021). This application is a comprehensive database comprising all the necessary information on freight movements within the country managed by the ministry to track all the freight by road and evidence the evolution of freight information. The database allows collecting multiple data types through various queries, but the monthly trip information was selected for this study. The data was extracted from January 2015 to December 2020. Following some of these variables are going to be explained. “Date” is the date (year and month) queried; “Type_vehicle” are the type of vehicles (40 different types); “Origin” and “Destination” are the location of the origin and destination for every trip. These variables are at the level of “Municipio,” an administrative division defined in Colombia corresponding to the municipality within the country; “Type_freight” is the type of freight transported on every trip (1254 different types); “Trips” is the number of trips; “Weight” is the weight of the freight; lastly, “Distance” is the number of kilometers traveled. The database has 8,077,240 records.

The freight data was treated twofold. The first way considers the data as it was collected, which allows developing a descriptive analysis described in a later section. The second way, which fulfills the paper’s objective, is aggregate. The data was aggregated by month to assess their trend, predict and later compare with other variables.

Concerning GDP, it was collected from the Statistics Department of Colombia (DANE, 2021) quarterly during the study period.

4. Methodology

After data collection was performed, a full and thorough process was performed to validate the data consistency, and we built the final database. After we decided to apply a time series analysis taking into account the characteristics of the data. When the time series has a seasonal variation, Seasonal ARIMA (SARIMA) is used. The order of autoregression (p) and seasonal autoregression (P), the order of integration (d) and seasonal integration (D), the order of moving average (q) and seasonal moving average (Q), and the length of the seasonal period (s) are the seven key parameters specified when fitting the SARIMA \( \{p, d, q, P, D, Q, s\} \) model.

Box, Jenkins, Reinsel, and Ljung (2016) proposed building a SARIMA model which needed at least 50 observation samples (the best would be 100) (Wang, Feng, & Liu, 2013). The selection of SARIMA processes was conducted using Akaike’s information criterion (AIC).

Generally, the original time series \( \{Y_t\} \) utilizes a lag operator \( B \) to process \( \text{SARIMA}(p, d, q)(P, D, Q)(s) \). A seasonal ARIMA model may be written as:

\[
\phi(B)\Phi(B^s)(1 - B^s)^dY_t = \theta(B)\Theta(B^s)e_t, (1)
\]

Where \( \phi(B) \) and \( \Phi(B^s) \) are polynomials of order \( p \) and \( q \), respectively; \( \Phi(B^s) \) and \( \Theta(B^s) \) are polynomial in \( B \) of degrees \( P \) and \( Q \), respectively.

The basic steps of the methodology are as follows (see Fig. 2) (Permanasari, Hidayah, & Bustoni, 2013; Wang et al., 2013):

(1) **Sequence stationary process.** To improve the forecast with low order models is convenient to eliminate possible cyclical and seasonal behavior. We usually remove this seasonal behavior through differentiation. The autocorrelation function (ACF) classifies potential seasonal and/or cyclical components in the time series. In general, if the series is non-stationary, difference processing smoothest it out with one- or two-time differences.

(2) **Identify model.** The time series can be converted into a stationary one by removing seasonal and/or cyclical components. According to the smooth stationary sequence number procedure, the difference between the autocorrelation (AC) and partial autocorrelation (PAC) functions primarily determines the preliminary model's order number. In general, this approach falls short of fully identifying a model. The trial-and-error process is calculated for many different models based on the Akaike Information Criterion (AIC). Comparison is used to determine the final model.

(3) **Parameter estimation.** A parameter-estimated nonlinear least squares approach is proposed. Preliminary estimates for parameter optimization are obtained using the nonlinear least-squares approach for the chosen model.

(4) **Prediction model testing.** The residual series is handled using the chi-square test method to determine if the series is a white-noise series. Unfortunately, there is no helpful knowledge extraction if the residual sequence is not a white-noise sequence, and the model needs improvement.

5. Results

This section summarizes the most relevant results from the time series analysis. First, we report some preliminary findings and then the seasonal behavior of freight transport in Colombia. Then, we show the modeling results by comparing the predicted load and the actual load transported in 2020.

5.1. Preliminary results

From the perspective of Origins and Destinations for freight, Bogota city (capital of Colombia) is the most producer and attractor of load. Bogota is the significant origin or destination of load transported every month (6 of 10 pairs connect with Bogota). Also, Buenaventura and
Cartagena cities, where the principals’ ports of Colombia are located, are an attractor and generator center of most freight trips. Furthermore, the primary sources and destinations are departmental (local) journeys, indicating that movements are made over short and medium distances. As a result, Valle is the department that centralizes the most goods transit, both for its industrial districts and the port of Buenaventura, resulting in 24 million tons generated last year, mobilized in 1.4 million trips. With 15.7 million tons, Cundinamarca and Antioquia, with 11.2 million tons, are two other departments that stand out. Corn freight, which accounted for 5.6 million tons in 2020, is followed by cement, mortar, and concrete cargoes, which accounted for 4.4 million tons, malt beer (2.3 million tons), water (2.2 million tons), and rice cargo, which accounted for 1.9 million tons.

As shown in Fig. 3, the coupling between GDP and freight is maintained over time. However, After reviewing which event could significantly reduce tons per month, the freight data has interesting downward trends like outliers in July 2016 and April 2020. The following unexpected, relevant and interesting situations were found:

- Firstly, in July 2016 – Trucker’s strike - The strike is due to the carriers’ demand for a higher price for freight transportation, a more affordable price for fuel, and lax rules on cargo licenses. After 38 days of strike, several country regions were short of food and medicines (Palomino, 2016). The truck’s strike had a cumulative effect because it spent more than 7 weeks with some roads blocked, causing significant disruption in freight transport. However, it did not decrease the GDP growth since police guarantee supplies traveling in convoys with escorts.

- Secondly April 2020 – COVID-19 Pandemic. Due to the spread of COVID-19, the National government of Colombia proceeded to restrict the temporary closure of trade and service companies and gastronomy, hotel business, and leisure facilities, considerably reducing freight transport (Decreto 531–8 de Abril, 2020).

At this point, it is worth noting that GDP does not depend solely on transportation-related activities, which means that its reduction is not as abrupt as transport activities. In conclusion, it can be said that the general trend, regardless of the outliers described, recognizes that the greater the freight transport, the greater the GDP.

5.2. Seasonal behavior

Fig. 4 shows the seasonal behavior of load transported on the road by the freight transport sector. Briefly, it can be seen that the tons of freight transported year after year showed a growth trend with slightly different changes over months. However, two periods are observed where freight transportation decreased considerably (July 2016 and April 2020), as described above.

The seasonal changes in freight (monthly) shown in Fig. 4 do not show similar patterns irrespectively of the year analyzed. The Figure depicts that freight in single months has seasonal fluctuations during the year, and significant volume changes (breakpoints) could be identified in the 2 months mentioned before.

5.3. Forecasting

To fit a SARIMA model, R software (R Core Team, 2020) was used. Given multiple values of p, d, q, P, D, Q, and S, the R package “forecast” (Hyndman & Khandakar, 2008) uses maximum likelihood estimation (MLE) to fit the best SARIMA. In other words, it maximizes the probability of obtaining the data that we have observed. The best fit model from the data is $\text{SARIMA}(0, 1, 1)(1, 0, 0)[12]$. Other statistics are $\text{loglikelihood} = -450.38$, $\text{AIC} = 906.76$, $\text{AICc} = 907.19$ and $\text{BIC} = 912.99$.

Fig. 5 shows how freight transport should be in 2020 and how it was made in 2020. As can be seen, the effect of the COVID-19 pandemic on freight transportation was very high. To such an extent, only 40% of the expected freight was transported. As mentioned above, in Colombia, the country’s economic growth is strongly coupled with the growth of the transportation sector. Therefore, if there is an abrupt reduction in the transportation of goods, the economy will be affected.

6. Conclusion and future research

The COVID-19 pandemic had a negative effect on the growth of the freight forwarding sector in Colombia. Due to the different restrictions defined by the rapid expansion of the pandemic, freight transportation stopped growing as it was doing in previous years. As well know, transportation management is provided by the companies providing the service. However, its profitability is affected by external factors (such as the COVID-19 pandemic) that directly affect operational costs due to...
vehicle infrastructure, vehicle technology, government policies. For this reason, the state should implement a regulatory policy for the system (Bogetić, 2021).

The analysis can help planners implement policies to improve freight transport behavior and react to unusual future economic periods. Therefore, the following different points of view are analyzed to strengthen the freight transport sector.

The first point is the infrastructure; the country’s lack of adequate basic infrastructure increases logistics costs for companies; thus, it discourages foreign investment. To the extent that road conditions in the country should be improved, there will be more significant development of the different economic sectors and increased demand for freight transportation. Additionally, the investment in basic infrastructure will generate better access routes and, therefore, increase the supply, which will help cover the totality of the current demand. As a result, the greater the investment, the greater the road infrastructure. However, this
paradigm has pointed out another important debate on sustainable growth. There are significant difficulties faced by government and entities to achieve economic growth while reducing road transport's external costs. Therefore, developing countries are increasing infrastructure for road transport, trying to improve the country's situation regardless of focusing on more sustainable transport.

Another point is the regulation; it is essential to implement the profitability model to improve regulatory decision-making, considering that the country's vehicle fleet does not meet traffic conditions to their age. It increases logistic costs and generates a negative impact on the environment. There are efficient measures that help mitigate contamination by freight vehicles, such as incentivizing cleaner vehicles, optimizing routes, and sharing freight.

The COVID-19 pandemic has taught that, in general, freight transportation should be:

(i) Fast and flexible. Because of its flexibility in terms of policy strategy and adaptability to various circumstances, Development Policy Financing is considered a mechanism to provide budget support in times of crisis. In these cases, speed of response is critical; the government must change its policies, personnel, and service portfolios to meet the most pressing needs of various economic sectors.

(ii) Predictable. It isn't just about the cash. Although providing resources and financial assistance is crucial in the short term, it is also critical to consider the long-term recovery. Often, this necessitates concentrating on a few key structural and policy changes that can begin during the crisis and be expanded during the recovery phase to help restore institutions and improve preparedness for future shocks. It isn't just about the cash. Although providing resources and financial assistance is crucial in the short term, it is also critical to consider the long-term recovery. Often, this necessitates concentrating on a few key structural and policy changes that can begin during the crisis and be expanded during the recovery phase to help restore institutions and improve preparedness for future shocks. And, since we now know that the environment will have changed significantly since the disaster, including modes of contact, travel, employment, and participation in collective activities, it is critical to employ innovative thinking to develop more effective emergency preparedness strategies. Because of these significant internal and external socio-economic climate changes, some countries must reconsider their development strategies.

(iii) Coordination. In times of crisis, there must be cooperation among the various economic sectors' stakeholders. This assists in cushioning the blow and preparing for recovery. Extensive inspection and evaluation processes based on facts are also needed to ensure transparency and accountability.

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(i) Fast and flexible. Because of its flexibility in terms of policy strategy and adaptability to various circumstances, Development Policy Financing is considered a mechanism to provide budget support in times of crisis. In these cases, speed of response is critical; the government must change its policies, personnel, and service portfolios to meet the most pressing needs of various economic sectors.

(ii) Predictable. It isn't just about the cash. Although providing resources and financial assistance is crucial in the short term, it is also critical to consider the long-term recovery. Often, this necessitates concentrating on a few key structural and policy changes that can begin during the crisis and be expanded during the recovery phase to help restore institutions and improve preparedness for future shocks. It isn't just about the cash. Although providing resources and financial assistance is crucial in the short term, it is also critical to consider the long-term recovery. Often, this necessitates concentrating on a few key structural and policy changes that can begin during the crisis and be expanded during the recovery phase to help restore institutions and improve preparedness for future shocks. And, since we now know that the environment will have changed significantly since the disaster, including modes of contact, travel, employment, and participation in collective activities, it is critical to employ innovative thinking to develop more effective emergency preparedness strategies. Because of these significant internal and external socio-economic climate changes, some countries must reconsider their development strategies.

(iii) Coordination. In times of crisis, there must be cooperation among the various economic sectors' stakeholders. This assists in cushioning the blow and preparing for recovery. Extensive inspection and evaluation processes based on facts are also needed to ensure transparency and accountability.
