

## Strategies to Counter Supply Chain Disruptions for FMCG Brands during a Pandemic

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### CHRONICLE

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### ABSTRACT

The FMCG sector in developing nations is still not prepared to withstand any disruption brought on by the worldwide pandemic. In order to adapt to the new normal, businesses must make both micro and broad changes to their supply chain strategy. The goal of this research is to create plans to minimize any disruptions caused by upcoming pandemics. To restore the broken supply chain, a number of new implications and adjustments to the current attributes were proposed in the areas of sourcing, manufacturing, and distribution. Finding the fundamental drivers that are frequently impacted by the disturbance is part of the technique. The afflicted locations were the focus of the models' development. The ideas work as preventative measures intended to thwart the disturbance when and if it happens. In order to assess the model's viability, the Key Performance Indicators (KPI) value was ultimately retrieved with the aid of 25 industry experts. These suggestions may result in improved transparency, real-time monitoring, cost effectiveness, and responsiveness, among other benefits. Our analysis indicates that the KPI scores for procurement, production, and distribution are 92.86%, 82.14%, and 87.50%, respectively. The models' total viability is 87.50%. The most recent Covid-19 pandemic has provided us with a vivid illustration of what could go wrong in such circumstances. In both pandemic and non-pandemic conditions, the adaptation of stated suggestions at the aspect of sourcing, production, and distribution might result in a significant shift to organization-wide activities.

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## 1. Introduction

Consumer goods are finished products that are used by households instead of being used to create other products or services. These goods and services are utilized for private or household consumption, as the term suggests. Contrarily, fast-moving consumer goods (FMCG) are items that are inexpensive and easily bought. FMCGs include items like packaged foods, drinks, toiletries, over-the-counter pharmaceuticals, and related consumables. FMCGs usually only have a short shelf life. Perishable FMCGs include things like meat, fruits, vegetables, dairy products, and baked goods. Other goods with high turnover rates include packaged foods, soft drinks, household supplies, and toiletries. FMCGs have a low revenue margin, but they are frequently purchased in big quantities, which results in high overall profits. FMCGs are frequently cited as the best illustration of a high-volume, low-margin business.

The market for quickly disseminated consumer goods undergoes considerable changes when a pandemic occurs. The demand for consumer packaged goods (CPG) typically rises sharply. People try to reduce their likelihood of being affected by the pandemic's effects. The number of grocery store visits is significantly decreased from the perspective of the client. Some consumers hoard food and water, creating a chaotic environment with sharp variations in demand. As the information spreads across the supply chain as a result of this phony demand, the bullwhip effect is subsequently triggered. A pandemic severely hampers transportation. As a result, it is difficult to maintain even the most fundamental supply chain operations. Therefore, it appears that the functions of sourcing, logistics, distribution, and production are out of control. New products and services arise faster or are absorbed faster due to the pandemic.

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In several cases, the FMCG businesses were severely impacted by the Covid-19 pandemic. The demand for several product categories had sharply decreased, while it climbed significantly for others. For instance, in Bangladesh, sales of fresh and frozen meals, cosmetics, and toiletries have increased by 20–30%. On the other hand, sales of ready-to-wear clothing, beverages, and meals have dropped by roughly 30–40%. The demand for sanitizing products skyrocketed by 600–700%. However, variations in demand for various product categories eliminated the situation for net sales (FMCG Industry Review of Bangladesh, 2019). Rapid demand swings have severely hindered the FMCG industry's ability to plan effectively and run efficiently.

This article offers suggestions for managing the significant difficulties an FMCG company encounters during a disruption. It talks about the theoretical elements that might be taken into account when making suggestions. For an FMCG company, we have offered solutions for materials sourcing, manufacturing, and distribution. In order to determine whether the proposed models are capable of achieving their intended goals, Key Performance Indicators (KPI) was calculated for each.

## 2. Literature Review

A recovery approach for supply chain disruptions consists of a number of interrelated elements. A mixed-integer linear programming (MILP) model can integrate emergency procurement on the supply side with product adjustments by the manufacturer and backorder price compensation on the demand side to maximize total profit from product modifications. The heuristic approach is used in the model, which is based on the ILOG CPLEX toolbox. The proposed disruption recovery technique can lessen the manufacturer's financial loss from late deliveries and cancelled orders, according to trial data. There has been a decline in the impact of supply chain disruptions (Chen et al., 2021). Another strategy for enhancing the effectiveness of the supply chain is to conduct a pre and post-analysis of the quality and delivery data gathered from daily deliveries at the manufacturing facility. According to the study's conclusions, industrial organizations must carefully choose their suppliers (Salam & Khan, 2018).

FMCG companies, as the name implies, must manage products with little to no storage time. The downstream frequently has trouble predicting the quantity of these kinds of commodities and ends up either overestimating or underestimating. This is especially true when pandemics or other external circumstances have a big impact on a buyer's purchasing decision. Without an intelligent system supporting the information-sharing system, the corporation could not realize that demand has decreased. These unforeseen events can be avoided by properly utilizing the E-SCM service along with the integration of a centralized information system linking the downstream and upstream (Mbhele & Phiri, 2014). Sharing information in a vertical chain is comparatively simpler than in a horizontal chain. Because flat chain collaboration frequently results in the opening of trade securities that are uncomfortable for the organization. However, allowing some kind of cooperation among rivals has been successful. Collaboration is a working strategy where individuals join forces to achieve a common objective and gain a competitive advantage. People can cooperate to work toward a clear, common business objective through collaboration. In many instances, the businesses need to establish a mutually beneficial partnership in order to benefit both parties. One noteworthy area of collaboration for FMCG companies is the transportation industry. Transportation expenses may be optimized by the concurrent vertical and horizontal cooperation of various firms involved in the organization of transportation activities. This collaboration results in the elimination of found inefficiencies through the sustainable use of resources (Hajdul & Nowak, 2014).

Bull Whip effect, which is well known for its capacity to fake a sudden surge in demand for a product, can cause disruptions by leading sellers to overestimate their sales volume, which, in turn, leads to disruptions in the supply chain. The bullwhip generally comes from retailers, but it may also be traced back to those retailers' suppliers and manufacturers. However, exchanging inventory data and point of sale data can lessen the consequences of bullwhip, claims a 2020 study utilizing Excel macro and visual basic (Matharage et al., 2020) Due to uncoordinated ordering and production planning rules building up backlog over the disruption period, the ripple effect affects the bullwhip impact. A contingent production-inventory control policy is created to combat the ripple and bullwhip effects and presents evidence in support of information cooperation in SC disruption management. The possibility of a bullwhip effect must be taken into account by SC management during the capacity interruption and recovery phases (Dolgui et al., 2020).

The pandemic caused supply chain disruptions for many businesses due to the forward and backward propagation of breakdowns in global supply chain networks, underscoring the importance of supply chain network resilience. By analyzing the pandemic's effects on the FMCG sector and how supply chain resilience might increase in such situations, this research seeks to understand the impact of optimal decision-making during crises on supply chain resilience. The study also assessed the usefulness of current supply chain resilience decision support tools in emergency situations. Some of these models might also be helpful in making decisions in the event of an outbreak (Madhavi & Wickramarachchi, 2021). In addition, interruptions can be avoided by taking into account both product perishability and supply chain robustness. Restrictions on product perishability frequently result in safety stock reductions and increased transportation frequency. Increased safety stock may result from taking production capacity disruption risks into account. The developed simulation model revealed fresh managerial insights and doable suggestions on inventory, on-time delivery, and service level control using data from a quickly evolving consumer products sector (Rozhkov & Ivanov, 2018). In situations where there is a disturbance in the supply chain, resilient information systems lower the level of risk. The article was carried out in a qualitative manner using a semi-

structured interview schedule for supply chain specialists. Theme analysis was used to construct emerging categories. The results of this study identify serious inadequacies in present information systems and demonstrate how AI-driven solutions could benefit the ecosystem of disrupted supply chains in terms of cost savings and increased efficiency in a variety of areas. The framework shows how supply chain disruption, information systems, and artificial intelligence are related (Gupta et al., 2021).

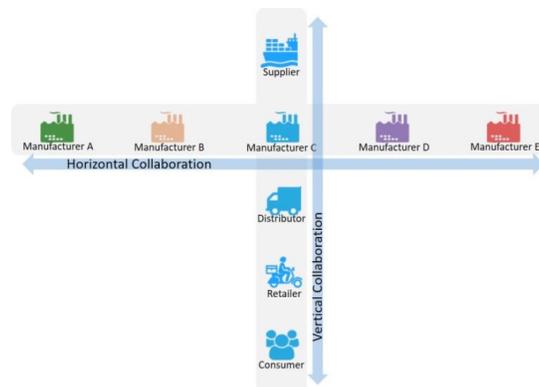
The supply chain resilience of an inventory model can be strengthened by using associated logistical services provided by the Physical Internet. In the traditional supply chain network architecture, businesses define and optimize their own logistics networks. As a result, the present logistics systems are a collection of autonomous heterogeneous logistics networks. The goal of the PI concept is to unite various logistics networks into one big, open, linked system. Some qualitative and quantitative data from this study may provide direction for the following phases (Yang et al., 2017). In this study, the most critical challenges facing the AIoT-powered supply chain were identified through a literature review and interviews with experts working in the FMCG sector as a potential case study. Applying nonlinear quantitative analysis to evaluate these issues allowed us to examine their significance and uncover the causal relationships between them. The results showed that inadequate infrastructure and cyber security are the two biggest problems affecting the AIoT-based supply chain (Nozari et al., 2022).

Systematic research on FMCG disruptions showed that the vertical chain's absence of information-sharing infrastructure, AIoT-based supply chain management, and horizontal collaboration are the usually advised parameters. Precautions comprise- the adoption of emergency procurement policies, Bullwhip effect mitigation, supplier selection and management can give businesses more extraordinary handling of the supply chain drivers on the cusp of a pandemic. In order to create a shield around an FMCG company, collaborative transportation planning, using ESCM to identify uncertainties, policy change, Internet of Things (IOT), Management Information System (MIS), and Machine Learning (ML) integration are all feasible strategies, therefore averting the consequences of any disruptions in the future.

### 3. Model Background

The routine operations of any industry are altered by a pandemic. These adjustments could involve delaying, starting earlier, or even stopping a crucial event that would have happened otherwise. It may also encourage the start of new policies. This assertion has already been supported by the literature review. The FMCG sector is most impacted, nevertheless, as they must keep order and supply in close proximity, unlike other sectors. In order for the consequences of disruption to be absorbed automatically, the supply chain of such sectors must be designed accordingly. An interview with 25 industry experts revealed the key issues as being inadequate supply, longer lead times, higher operational expenses, a lack of transparency between supply chain stages, etc. In such a case, sourcing, manufacturing, and distribution activities must be improvised. The following is a description of some theoretical elements that should be taken into account when resolving these issues.

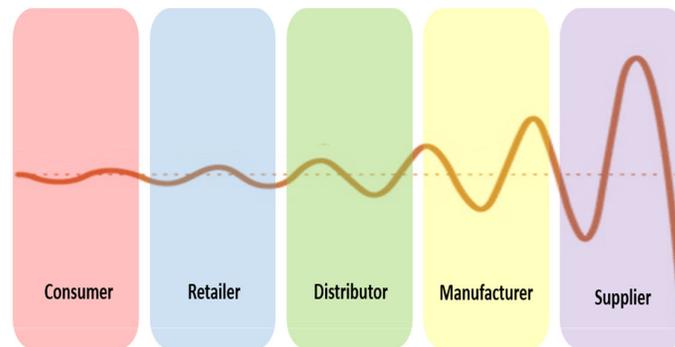
**i) Horizontal Collaboration:** Horizontal collaboration refers to alliances between companies that carry out similar functions or provide comparable goods and can gain from economies of scale by cooperating. These companies frequently compete directly with one another. Collaboration between two or more firms can have a positive impact on productivity, revenue, and the development of solutions with added value. On the other hand, not every business should have an intimate partnership. It requires total dedication from everyone/both parties and is often not an easy option. Both sides perform a risk/benefit analysis and take into account the market repercussions, including cost, competition response, customer perceptions, and commercial opportunity, to determine whether this strategy is feasible. A typical supply chain collaboration is shown in Fig. 1.



**Fig. 1:** Illustration of Collaboration

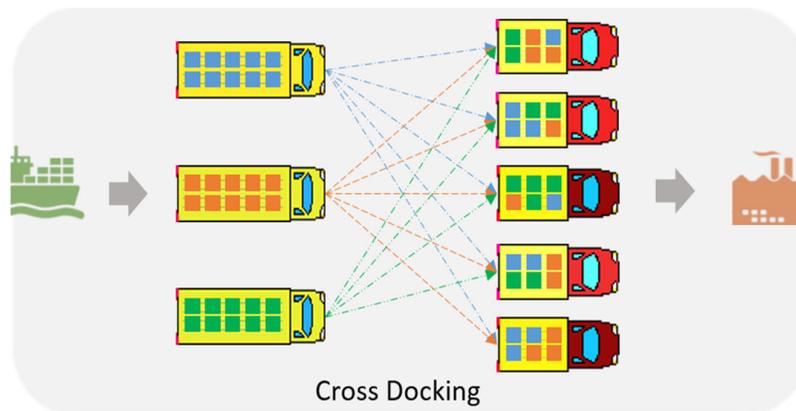
**ii) Predictive Maintenance:** The goal of predictive maintenance is to foresee when a piece of equipment will break down so that corrective repair can be scheduled prior to the breakdown. The objective is to schedule maintenance in the most convenient manner while optimizing the equipment's lifespan and avoiding damage to it. Predictive maintenance solutions typically include data collecting and storage, data transformation, condition monitoring, asset health evaluation, prognostics, decision support system, and a human interface layer. Manufacturers are quickly integrating Internet of Things (IoT) and AI predictive maintenance services into their processes and machinery. Companies that offer products, services, and system integration also specialize in predictive maintenance software. In order to follow Computer-Aided Design guidelines without further system programming, predictive maintenance with AI may be trained to identify equipment flaws visually and in patterns. It may also use algorithms to improve supply chains in a constantly changing market. Automatic abnormality detection reduces unexpected downtime and costs by quickly predicting when equipment may fail.

**iii) Bullwhip Effect:** The bullwhip effect (Fig. 2) is a theory for explaining inventory variations or inefficient asset allocation as a result of demand changes as you move further up the supply chain. As a result, upstream producers frequently see a loss in forecast accuracy as the distance between the consumer and the manufacturer widens. Supply chains, inventory placements, and complexity are unique to each industry. However, stocks can be reduced by 10 to 30 percent by comprehending the bullwhip effect and putting improvement methods into practice. In contrast, there can be a 15–35% reduction in stock-out scenarios and missed client orders (Singh, 2018).



**Fig. 2:** Bullwhip Effect

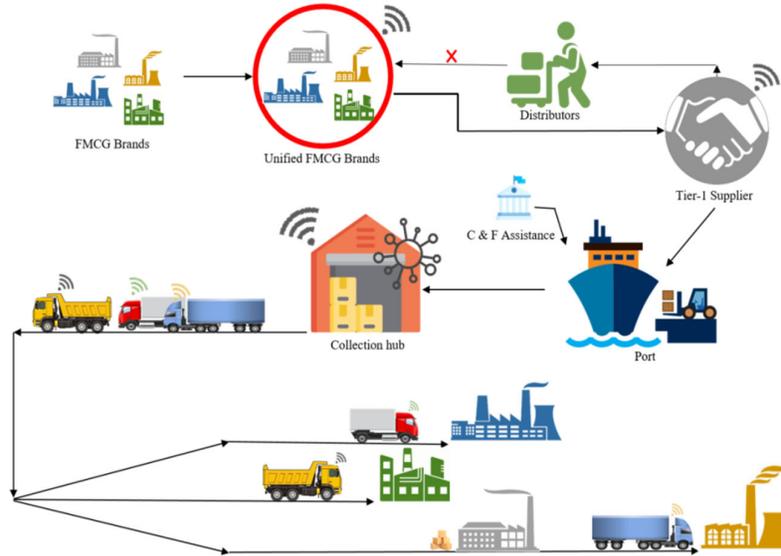
**iv) Cross Docking:** With little to no storage in between, cross docking is the act of unloading cargo from an incoming container and putting it into an outgoing shipment. A distribution center essentially functions as a sorting center rather than a storeroom or warehouse facility when enterprises apply the cross-docking technique described in Fig. 3. A cross-docking facility's distribution center's main job is to move goods quickly to the following step in the shipping process. Everything must be painstakingly organized according to inbound and outbound shipments due to the restricted storage space. Within 24 hours of their arrival at the docking station, inbound shipments are processed and exported after being quickly sorted and loaded onto trucks or shipping containers for departure.



**Fig. 3:** Cross Docking

#### 4. Proposed Models

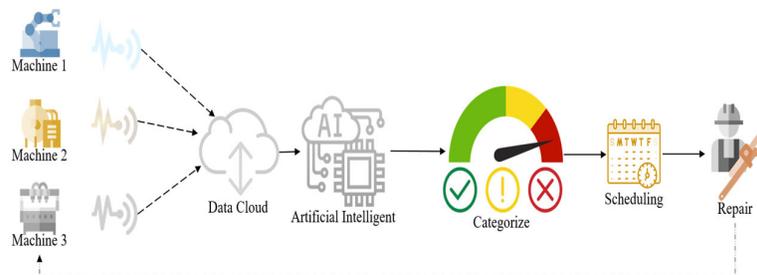
**i) Sourcing:** The suggested concept places a strong emphasis on creating a centralized system for purchasing. To forecast the amount of raw materials in the coming months, all FMCG companies can work together horizontally. Therefore, without the aid of a third party sourcing agency, collect the necessary raw materials by combining them directly from Tier-1 suppliers. Then, with the aid of a C&F Agent, they may quicken their sourcing, assist with port clearance, and store it in a single warehouse. Each FMCG company may easily transfer their pre-ordered share of raw materials by cross-docking into their facility thanks to the central warehouse's connection to an IoT cloud. The model is illustrated in Fig. 4.



**Fig. 4:** IoT-Based Unified Sourcing

A single sourcing strategy can create opportunities for FMCG businesses to collaborate vertically and horizontally, thereby lowering logistical costs. Prior until now, brands had to assess responsiveness and effectiveness. However, the unified model enables businesses to be both responsive and effective at the same time. Additionally, it makes the supply chain more transparent.

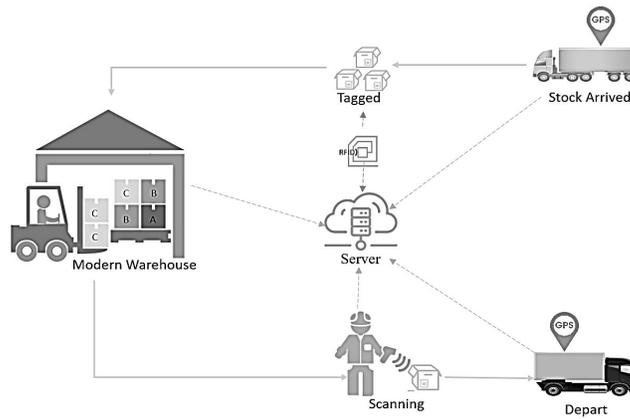
**ii) Manufacturing:** An Artificial Intelligence-based maintenance system as shown in Fig. 5 can ensure no service disruption during a production cycle. According to this concept, sensors and actuators should be used in machinery to collect real-time information on things like induced pressure, stress, torque, temperature, and vibration. These data will be analyzed in real-time and used by artificial intelligence to anticipate machine failure before it occurs when compared to a predetermined threshold value. There will be three zones in the indication set: green, yellow, and red. A maintenance and repair session will be planned for the equipment during its downtime once it enters the yellow zone. As a result, it can stop a production line or machine from suddenly breaking down.



**Fig. 5:** AI-Based Predictive Maintenance

The predictive maintenance model identifies failure at the earliest opportunity, providing the opportunity for error correction with the least amount of effort and expense. This boosts productivity and dependability. The machine tools are kept in top condition by predictive maintenance to handle demand during peak hours.

**iii) Distribution:** The management of warehouses is essential to increasing distribution efficiency. The model in Fig. 6 suggests categorizing the items in the warehouse in accordance with ABC Analysis's data on demand, risk, and frequency of distribution. The A category includes the commodities with the highest demand, while the C category includes the goods with the lowest demand. Each item's loading and unloading time will be greatly reduced as a result, which will eventually increase the percentage of on-time deliveries. Additionally, each packet of goods should contain an RFID tag so that one can clearly see how many items are in the inventory. This arrangement promotes contactless handling of items. Additionally, the delivery vehicles' GPS systems can be used to track travel distances and time. Real-time data analysis and route or model design that is more efficient can decrease average transit time.



**Fig. 6: Intelligent Logistical Operations**

The cloud-based inventory tracking that makes use of RFID tags and finished good categorization is promoted by intelligent logistics operations. As a result, there is a lower chance of running out of stock. With the help of this technology, delivery on time is guaranteed.

**5. Results**

A Key Performance Indicator (KPI) is a measurable statistic that demonstrates how successfully a company is achieving its primary objectives. A face-to-face interview with 25 industry professionals with in-depth knowledge of the FMCG business is included in the study. When determining KPIs based on the aspects of the suggested model, their opinions were taken into consideration. Tables 1, Table 2, and Table 3 show the KPIs that were calculated for sourcing, manufacturing, and distribution, respectively.

**Table 1**  
**Key Performance Indicators of Sourcing**

Model features	KPIs							Total
	Supply Chain Transparency	Reduced Sourcing Cost	Reduced Response Time	Better Risk Mitigation	Responsiveness	Increased Operational Excellence	Provides Effective Contract Management	
Centralized Warehouse	✓	✓	✓		✓	✓	✓	6
Sourcing from Tier-1	✓	✓	✓	✓	✓	✓	✓	7
Horizontal Collaboration	✓	✓	✓	✓	✓	✓	✓	7
IOT Cloud	✓		✓	✓	✓	✓	✓	6

The models covered in the prior part that underlie the sourcing criteria put a lot of emphasis on tier-1 producers, competitor collaboration, and a central warehousing facility with a visible IoT system. The impact and improvement that these features

can produce were taken into account while measuring the sourcing performance with KPI. Additionally, Table 1 revealed that Materials Sourcing had an impact of 92.86%.

**Table 2**  
Key Performance Indicators of Manufacturing

Model features	KPIs							Total
	Reduced Manufacturing Cost	Reduced Idle Time	High Responsiveness	Higher Efficiency	Improved Overall Monitoring	Increased Operational Excellence	Better Prediction of Future Risks	
Machine Learning		✓	✓		✓	✓	✓	5
Artificial Intelligence	✓	✓	✓		✓	✓	✓	6
Sensors & Actuators		✓	✓	✓	✓	✓	✓	6
Scheduled Maintenance	✓	✓	✓	✓	✓	✓		6

The suggested models for manufacturing include the following aspects, as indicated in Table 2, machine learning-based forecasting, AI-assisted predictive maintenance, scheduled maintenance, and more. We calculated the Key Performance Indicators (KPI), which came out to be 82.14%, using these features in the manufacturing process.

**Table 3**  
Key Performance Indicators of Distribution

Model features	KPIs							Total	
	Order Delivery Accuracy	On-Time Delivery	Better Utilization of Warehouse Space	Improved Overall Monitoring	Lesser Loading & Unloading Time	Higher Efficiency	Reduced stock out rate		Increased Operational Excellence
CMS	✓	✓	✓	✓		✓	✓	✓	7
ABC Analysis	✓	✓	✓		✓	✓	✓	✓	7
RFID	✓	✓	✓	✓	✓	✓	✓	✓	8
GPS	✓	✓		✓	✓	✓		✓	6

Distribution highlights include the Centralized Monitoring System, ABC Sorting, RFID tagging, and GPS. These characteristics are used to gauge the effectiveness of the distribution route in Table 3, and the proposal's KPI came in at an astounding 87.50%.

## 6. Discussion

Unified sourcing strategy is the first suggestion made to counter pandemic disruptions. For the purpose of locating, choosing, and obtaining commodities, similar groups must establish amicable relationships. As a result of the cooperation, economies of scale will be achieved. If the strategies of several organizations are in sync, the participating businesses would benefit from a variety of advantages, such as decreased logistics costs and higher productivity. The manufacturing process is highlighted in the following proposal where predictive maintenance model was covered. The manufacturing equipment can be improved and used to its best potential to meet demand in emergency situations with the help of the machine failure prediction. The distribution means are highlighted in the paper's final proposal. Planning for transportation can benefit from smart logistics. It controls and monitors the movement of raw materials and completed items, and the system can then transmit this data along each stage of the business. Categorized items, space optimization, and inventory automation are possible outcomes of this plan. 25 industry experts' opinions were taken into consideration for developing the Key Performance Indicators (KPI). Our research indicates that the KPI values for procurement, production, and distribution are

92.86%, 82.14%, and 87.50%, respectively. The models' total viability is 87.50%. The recommendations' proper execution could result in a rejuvenated FMCG supply chain.

## 7. Conclusion

Supply networks must either adapt or be sufficiently robust to weather the storm in the event of a pandemic or disruption. The FMCG industry is a booming one in most developing economies around the world. Due to the recent pandemic, it was extremely difficult to maintain supply chain operations since they were ill-equipped to handle the abrupt changes in demand and supply. This pandemic serves as a stark reminder that supply networks need to be adaptable enough to handle any circumstances. To do this, various strategies should be strengthened, including teamwork, predictive maintenance, and AI support. The majority of FMCG businesses in developing nations do not properly execute the aforementioned strategies. Additionally, they depend too much on China to get many raw supplies. We put forward three frameworks that could work well in the future to combat any pandemic situations. They will also contribute to the supply chain's overall improvement in performance and profitability. Companies should consider these ideas to reenergize their network and increase their competitiveness on the worldwide market. The study creates the possibility to test these frameworks in additional sectors. The absence of physical testing of the frameworks is one of the significant flaws in this research, though.

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