Impact & Opportunities in Civil Aviation Sector in India post Covid-19

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Abstract:

The Airline Industry is used to having strict norms which were implemented post-2001 World Trade Centre attack. Due to COVID 19 period the norms will be entirely health and safety-centric, the focus being on the passengers. The social distancing norms in the Aircraft is very difficult to follow due to the economic considerations which are related to airline operations. In fact, the new norms set up by Regulators like DGCA, EASA, FAA will further increase the cost of the operation of the Airline Industry. This will increase the pressure on operational cost thereby increasing the passenger and cargo fare. However, this may in turn result in passengers becoming averse to air travel given the economic situation worldwide reflecting the domino-effect. Hence, in situations like these, efficient and cost-effective alternatives will be needed to balance the industry. In fact, the current pandemic (COVID-19) will bring new opportunities for the multifaceted aviation sector. This research paper is trying to focus on the impact of COVID-19 on the aerospace and aviation sector. It is also trying to find opportunities for aviation and allied sectors post the pandemic. The authors have assessed all the Airlines, Aerospace component manufacturers, Ground service support companies and service providers to understand the impact & opportunities of the pandemic situation on them by taking opinions from the people directly or indirectly associated with the industry. Further, the authors tried to pinpoint opportunities within the sector especially after the favourable policies for the industry were formulated by the Indian Government during Covid-19 crisis.

Key Words: Covid-19, pandemic, civil aviation, MRO, opportunities, operational cost, Regulatory Approvals

Introduction:

The aviation sector, especially Civil aviation, is going through an economic trough. The situation is unprecedented, and the consequences are worse than anything witnessed in history including the aftermaths of 9/11, SARS, the 2008 global financial crisis. According to IATA, the Airline industry may undergo a loss of USD 314 billion in 2020. In fact, IATA has asked for financial aid and stabilization packages from governments to safeguard the Aviation industry. According to IATA[6], it is expected to take another 4 years for the air industry to normalise the air traffic and match the 2019 traffic. Strict Hygiene rules for the Airline Industry will become the new normal and will be followed till perpetuity. As of January 2020, the passenger traffic in India stood around 293.99 million. This number is inclusive of domestic passenger traffic which reached around 235.44 million and international traffic reached around 58.55 million. The domestic freight traffic till January 2020 reflected around 1.14 million tonnes. The International freight traffic stood at 1.70 million tonnes. Entire aircraft mobility (domestic and international) reached around 2.19 million till January 2020. By 2023, aircraft fleet in India was expected to grow in substantial numbers and India was to become the third-largest aviation market in the world. However, post-COVID 19 this scenario may change as the civil aviation Industry stats go back to what they were 4 years ago. Apart from the direct impact on the Airline industry, there are a few

indirect impacts as well. The major impact will be on the Aviation Maintenance, Repair and Overhaul organisations, ground services companies who support the industry, OEM i.e. original equipment manufacturers[4] etc. Moreover, as international traffic has come to a stand-still the cargo mobility has also reduced which resulted in non-availability of aircraft parts affecting the MRO industry. The ripple effect could be on MRO Industry which is 100% dependent on the Airline Industry. Any travel reduction will jeopardize this industry as it is dependent on the Airline sector and further dependent on OEM's for the supply of parts and equipment. With the current travel restrictions, a negative impact can be seen on the supply chain related to the component delivery affecting the delivery schedule which will further aggravate the problem. Hotel Industry[5] which supplies food to the airline industry will see a massive reduction in demand if new norms are adopted as the number of passengers will reduce. ATF suppliers' industry, in addition, can get affected due to less demand for air travel. Ground services companies will have to pay higher operational costs due to new restrictive norms which will eventually lead to an increase in overall cost and reduce profits. E-commerce travel companies will also face a drop in their business. All these problems reflect a cause-effect relationship. With every economic downfall, there have been a gamut of opportunities surfacing, as seen in the past. Similarly, here too, opportunities can be identified.

The research caters to achieve the following objectives:

a. To identify risks on businesses in the aviation sector post pandemic.
b. To find the avenues for organizations involved in the civil aviation sector in India. These avenues are expected to improve the operational efficiency and decrease the cost of operation of the airlines.
c. To identify opportunities for all other stakeholders like MRO Industry, Fuel Supply companies, OEM's of Aircraft component manufacturing companies & Airport operators who are public sectors as well as private sectors.
d. To quantify the benefits of the stated opportunities and assist the mentioned organizations to work on future strategies by using insights through this paper.
e. To help budding entrepreneurs tap new opportunities to align with the Atmanirbhar Bharat (self-reliant India) Ideology of India.

A research of this stature is needed for making future policy decisions and strategies. From a managerial perspective, whenever a forecast is made, externalities should be included too. This research will help to understand the externalities and help individuals make better strategic decisions and realistic forecast models instead of relying entirely on economic assumptions and not include anomalies.

Data and research are spread across the digital domain and validity of the same is a major point of concern. Hence, a research to understand the objectives is needed, to provide concise solutions and insights of the domain which is vast. A field like Aviation is expected to move the world in a very impactful manner. Major innovations taking place across the spectrum of transportation, will benefit mankind by increasing safety and ease of transmit. This research will help organizations take economically better decisions and not compromise on safety.

This research contributes towards the managerial research area as the outcomes will help managers and management of any organization take key strategic decisions, optimise resources and cost to have more efficient services without compromising customer experience and safety. The research is an attempt to analyse the impact of lockdown due to the pandemic on the airline industry in India. The possible challenges that this industry might face, have been highlighted. Certain mitigation strategies are given with this study to

provide relief against the losses bearded by the industry. The travel bans across countries had drastically reduced the air traffic during the first half of the year 2020. However, the domestic industrial activities picked up due to lifting of lockdown in major parts of the country in Aug 2020 onwards. Hence domestic travel will increase due to increased economic activity. This will ensure the revival of domestic air travel.

Literature Review

In a study by KPMG[14], the aviation industry contributes 4 percent of the global domestic product. It supports more than 65 million jobs across the globe. The industry would have seen more than 40 million commercial flights adding to the air traffic carrying more than 4.7 billion passengers and 65 million tons of cargo, in the year 2020 if the pandemic didn't bring the world to a standstill.

Agarwal Anshul[15], in his paper, explained about the contraction in the passenger demand from 60% to 30%, endangering the commercial viability of airlines operation. The industry is fragile to withstand the cyclic momentary shocks caused by oil price fluctuation, demand flux, currency fluctuations. Airlines in India requires a robust structural reform in its operating strategies, business model, revenue and pricing strategies to combat the repercussions of the pandemic.

According to the IBEF[1] rising income group and working population increase will develop and sustain the demand for the Airline Industry. Further 12-15% of total airline revenue is spent on MRO activities which is the 2nd most expenditure for an airline. Hence MRO industry is an opportunity in the Aviation sector. Foreign investment up to 49% is allowed under automatic route in schedule Airlines including regional air transport segments. Further $6B to 7B investment is expected to be in the Airport Infrastructure between FY18-23.

As per Financial Express[2] in 2020, MRO industry further received stimulus in terms of GST reduction from 18% to 5%. This will immediately result in cost competitiveness of Indian MRO resulting in more growth of Indian MRO Industry as because of GST disparity many of the Indian Airlines were sending their Aircrafts to Sri Lanka or Singapore resulting in no growth of Indian MRO. Now that things will improve in this segment as well.

Melligeri[3], the CEO of Aequs also points out that there is a good possibility of manufacturing in the Aerospace component manufacturing segment. Large pool of manpower in the country is an asset. India has potential to transform itself into an aviation hub.
Further IATA points out that 2020 & subsequent 2 years are going to affect the passenger revenues at risk. Government must give further financial relief packages to Industry for its sustainability of the Aviation sector.

As per Rajarajan[17], aviation Industry majorly focusing on cost cutting across all the operational verticals wherein PBH contracts helps a lot. It clearly defines PBH agreement. Also article talks about key determinants for identifying the parts included in PBH Contracts. This helped in determining the PBH opportunity for Airline sector.

Research Questions

In this paper Researchers are trying to answer the following questions:

a. Is there any demographic dependency on the aviation sector while adapting to technology?

b. Does demand in civil aviation in India depend on economic support, UDAN scheme, NSOP by the government and on leasing cost of the aircraft?
c. Is the cost of operations dependent on regulatory norms, fuel cost, number of support services and hygiene, passenger carrying capacity and on aviation insurance cost?
d. Does demand for MRO services depend on tax on the industry, dependency on India over China and demand in logistics?
e. Is there any dependency of technology on operational cost?

Methodology

The objective of the study:

The research caters to achieve the following objectives:

a. To identify risks on businesses in the aviation sector post pandemic.
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e. To help budding entrepreneurs tap new opportunities to align with the Atmanirbhar Bharat (self-reliant India) Ideology of India.

Materials and Method:

Tools for data collection: Primary and Secondary data
Primary Data: Interviews of corporate leaders in Civil (Commercial/ General) Aviation
Analysis: SPSS software

Research Type:

It's Qualitative research where interviews were taken from professionals of Defence Aerospace Industry. Here Stratified sampling was carried out. Strata were taken from the sector only as the sector personnel has the knowledge.

Conceptual Limitation:

Getting approval to Indian companies or SME's for entering specialized domains like manufacturing of parts from Indian & Regulators from abroad. These Regulators are Director-General of Civil Aviation (DGCA), European Aviation Safety Agency (EASA) and Federal Aviation Administration (FAA).

Data Analysis:

Here initially Researcher found out the correlation between various factors such as Economic Stimulus, increase in regional connectivity: UDAN, NSOP demand and reduction in aircraft leasing cost.

1. Data Correlation

		Domestic Aviation operations will match its 2019 traffic level, in India in the coming 2 years	Economic Stimulus	Increase in regional connectivity: UDAN	General aviation/ non-scheduled operation (NSOP) demand
Pearson Correlation	Domestic Aviation operations will match its 2019 traffic level, in India in the coming 2 years	1.000	.189	.095	.268
	Economic Stimulus	.189	1.000	.468	.070
	Increase in regional connectivity: UDAN	.095	.468	1.000	.073
	General aviation/ non-scheduled operation (NSOP) demand	.268	.070	.073	1.000
	Reduction in aircraft leasing cost or acquisition cost	-.070	.063	-.076	.105

Table 1: Correlation (SPSS output) between Achieving Indian Aviation Traffic Levels of 2019 and various reasons to achieve it.

As per above Table 1, The factors namely: Economic Stimulus, increase in regional connectivity: UDAN, NSOP demand and reduction in aircraft leasing cost are correlated with aviation operations to match 2019 traffic levels. There exists a weak positive correlation with coefficients (0.189, 0.095 and 0.268). The economic stimulus is correlated with increasing connectivity through UDAN and demand of NSOP. Increase in regional connectivity (through UDAN) is correlated with demand of NSOP. All the mentioned factors have weak positive correlation. Reduction in aircraft leasing cost is negatively correlated with operations level matching 2019 traffic and increasing regional connectivity but is positively correlated with economic stimulus and NSOP demand.

		Domestic Aviation operations will match its 2019 traffic level, in India in the coming 2 years	Stricter regulatory compliance requirement with respect to Sanitisation & Maintenance cost	Increase in Fuel cost	Increase in support services cost due to Hygiene requirement	Reduction in aircraft passenger carrying capacity due to norms	Increase in aviation insurance cost
Pearson Correlation	Domestic Aviation operations will match its 2019 traffic level, in India in the coming 2 years	1.000	.079	.043	-.173	.072	.149
	Stricter regulatory compliance requirement with respect to Sanitisation & Maintenance cost	.079	1.000	.089	.316	.002	-.039
	Increase in Fuel cost	.043	.089	1.000	.150	-.303	.086
	Increase in support services cost due to Hygiene requirement	-.173	.316	.150	1.000	.230	.146
	Reduction in aircraft passenger carrying capacity due to norms	.072	.002	-.303	.230	1.000	-.042
	Increase in aviation insurance cost	.149	-.039	.086	.146	-.042	1.000

Table 2: Correlation between Achieving Indian Aviation Traffic Levels of 2019 and various reasons affecting it.

As per Table2, Stricter regulatory compliance requirement with respect to sanitization and maintenance cost and operations level reaching 2019 level are correlated (weak positive correlation). Increasing fuel cost and operations reaching 2019 level are correlated. Increase in support services cost due to hygiene requirement is negatively correlated with operations reaching 2019 level. Increase in aviation insurance cost and reduction aircraft passenger capacity is positively (weak) correlated to the operations level reaching 2019 traffic. Stricter regulatory norms are in correlation with increasing fuel cost, increase in support services, reduction in passenger capacity (all weak positive correlations) and negatively (weak) correlations with increasing aviation insurance cost. Increasing fuel cost is negatively (weak) correlated with reduction in passenger capacity and positively correlated with the rest (weak). Increase in support services due to hygiene requirements is positively (weak) correlated with stricter regulatory compliance, increasing fuel cost, reduction in aircraft passenger carrying capacity and increase in aviation insurance cost. Reduction in aircraft passenger carrying capacity due to norms is negatively correlated with increase in fuel cost and increase in aviation insurance cost (weak negative) and positively correlated with rest factors. Increase in aviation insurance cost is negatively (weak) correlated with stricter regulatory compliance and reduction in passenger carrying capacity due to norms. It is positively (weak) correlated with other factors.

		Do you think large scale Civil Aerospace Components and parts manufacturing will start in India?	Aviation Maintenance, Repair & Overhaul (MRO) activities will increase in India due to local Demand	Tax reduction on MRO Industry from 18% to 5% in Mar 2020	India be alternative to China for Manufacturing and MRO activities	Will an increase in demand for logistics enforce indigenization
Pearson Correlation	Do you think large scale Civil Aerospace Components and parts manufacturing will start in India?	1.000	.264	-.267	-.245	-.234
	Aviation Maintenance, Repair & Overhaul (MRO) activities will increase in India due to local Demand	.264	1.000	-.251	-.164	.007

Tax reduction on MRO Industry from 18% to 5% in Mar 2020	-.267	-.251	1.000	.097	.149
India be alternative to China for Manufacturing and MRO activities	-.245	-.164	.097	1.000	.125
Will an increase in demand for logistics enforce indigenization	-.234	.007	.149	.125	1.000

Table 3: Correlation between increasing manufacturing of components in India and various reasons affecting it.

Large scale components and parts manufacturing is negatively (weak) correlated with tax reduction, increasing preference of India over China and increase in demand for logistics and positively (weak) correlated with MRO activities increasing due to increase in local demand. Increase in MRO activities due to local demand is negatively (weak) correlated with tax reduction and preferring India over China. It has weak positive correlation with rest. Tax reduction has positive correlation (weak) with increased preference of India over China and increase in demand for logistics (indigenization). It is negatively (weak) correlated with rest.

2. Survey Details

75.9% participants of the survey are from the Aviation sector including services and MRO and 24.1% participants are from other fields.

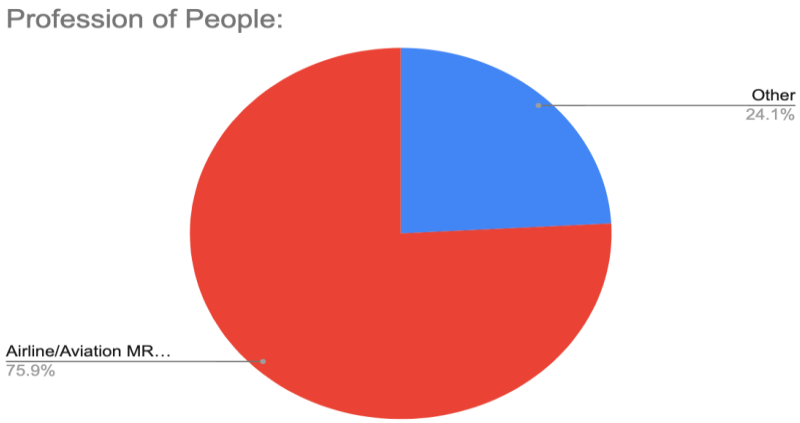

Figure 1: Chart describing demography of the participants by profession.

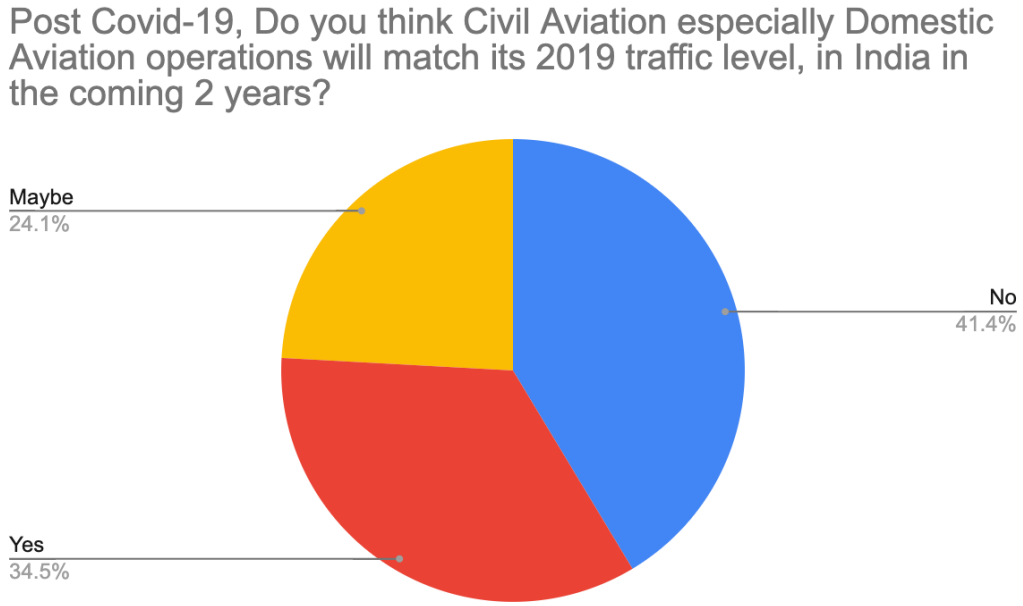

Figure 2: Responses to question: Post Covid-19, do you think civil aviation especially in aviation operations will match its 2019 traffic level, in India in the coming 2 years?

According to 41.4% of the participants, civil aviation operations won't be able to match the 2019 post COVID 19 period. 34.5% of the participants think that it is possible to achieve 2019 traffic levels while 24.1% are uncertain about the same. The percentage saying No, is significant. There can be a backlash in the aviation industry to reach the 2019 air traffic level. This addresses the first objective of the research to investigate the risk attached with the sector.

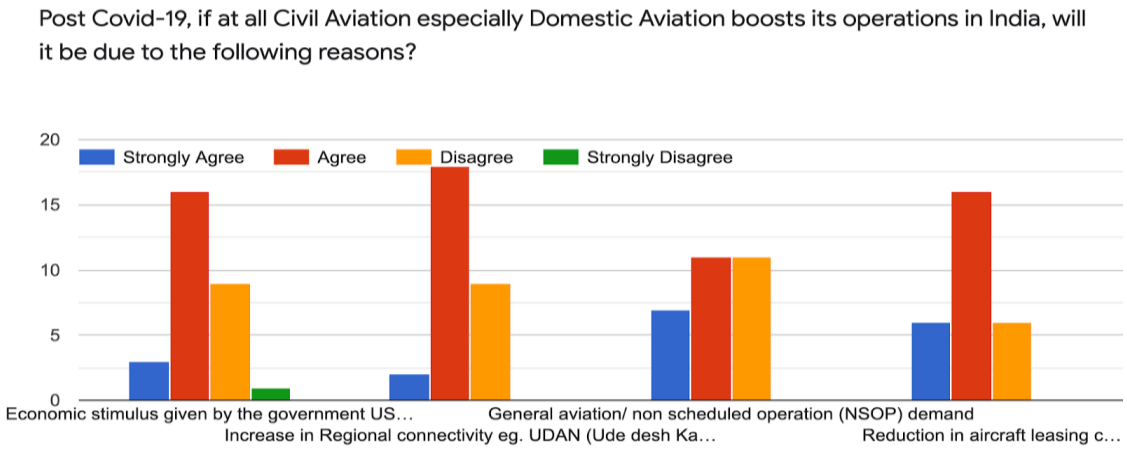

Figure 3: Response to the question: Post Covid-19, if at all Civil Aviation especially Domestic Aviation boosts its operations in India, will it be due to the following reasons?

32% agree (more 4% strongly agree) that economic stimulus given by the government can help boost the operations in aviation in India. 36% agree (more 2% strongly agree) that government initiatives like UDAN can help increase domestic travel. 24% agree (more 14% strongly agree) that non-scheduled operation (NSOP) demand can lead to increased domestic traffic and 32% agree (more 12% strongly agree) reduction in aircraft leasing can reduce operational costs. Overall respondents agree that the four stated stimulus options can

increase air traffic to balance the loss already bearded by the sector. This response helps to work towards the second, third, fourth and the fifth objective of the research to bring out avenues and leveraging upon the initiatives and stimulus by the government.

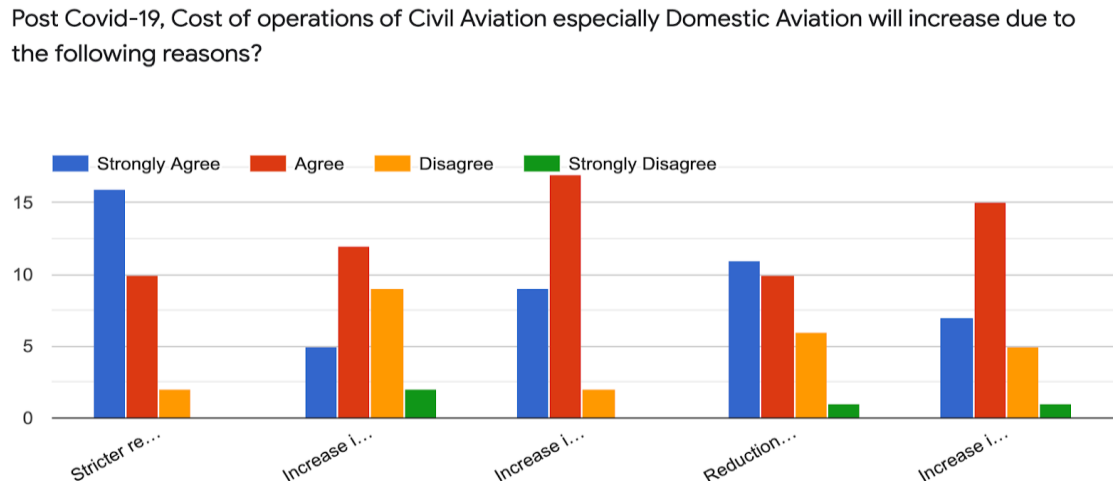

Figure 3: Response to the question: Post Covid-19, cost of operations of civil aviation especially domestic aviation will increase due to the stated reasons: Stricter regulatory compliance requirement with respect to Sanitisation & Maintenance cost, Increase in Fuel cost, Increase in support services cost due to Hygiene requirement, Reduction in aircraft passenger carrying capacity due to norms, Increase in aviation insurance cost

52% (including both participants choosing strongly agrees and agree) participants agree that stricter regulatory compliance requirements with sanitisation and maintenance cost will increase cost of operations. 32% (including both participants choosing strongly agrees and agree) participants believe that increase in fuel cost is one of the reasons for operational cost to increase. 52% (including both participants choosing strongly agrees and agree) participants agree that increase in support services cost due to hygiene requirements will increase the operational cost. 44% (including both participants choosing strongly agree and agree) agree that reduction in aircraft passenger carrying capacity due to norms will increase operational cost and 44% (including both participants choosing strongly agree and agree) believe that increase in aviation insurance cost will increase the operational cost. This helps is identifying the risks associated with the sector which caters to the first objective of the research.

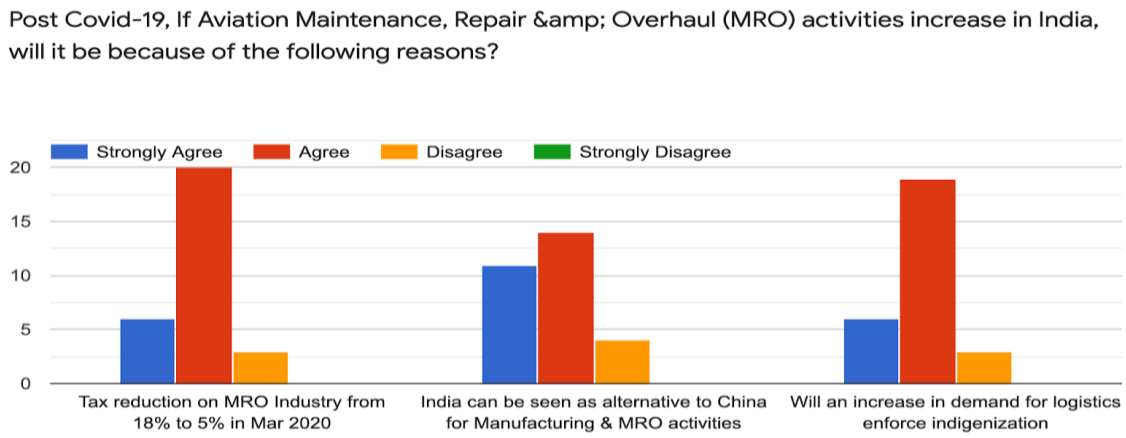

Figure 4: Response to the question: Post Covid-19, if aviation maintenance, repair and overhaul activities increase in India, will it be because of the stated reasons.

52% (including both participants choosing strongly agrees and agree) of the participants agree that MRO activities in India will increase if the tax on the MRO industry is reduced from 18% to 5%. 50% (including both participants choosing strongly agrees and agree) agree that if India is seen as an alternative to Chinese MRO market, then the demand in India will increase. 50% (including both participants choosing strongly agrees and agree) participants believe that increase in demand for logistics will enforce indigenization eventually increasing MRO activities in the country. This helps in identifying newer avenues and opportunities in the sector across fields supporting the second, third, fourth and fifth objective of the research.

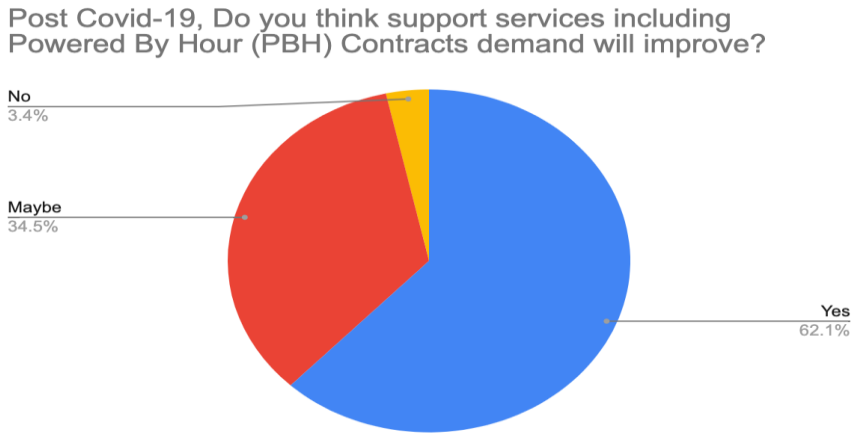

Figure 5: Response to the question: Post Covid-19, Do you think support services including powered by hour (PBH) contracts demand will improve?

62.1% of the participants believe that the demand in support services including powered by hour (PBH) contracts will improve post Covid-19 and 34.5% are unsure (maybe responses) about the same. The PBH contracts allow an organization or department to manage their budgets in an efficient manner. It is a method to optimize cost by reducing MRO item purchases and improving profits. This response helps in achieving the second, third, fourth and fifth objective of the research giving room to budding entrepreneurs.

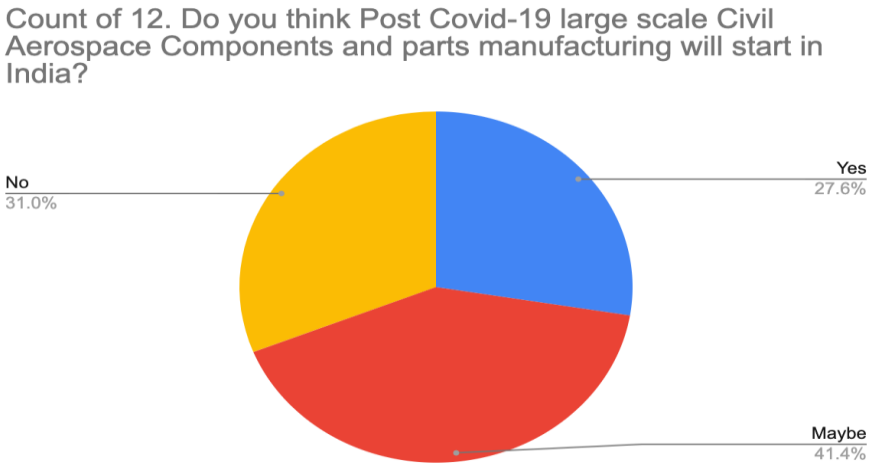

Figure 6: Response to the question: do you think post covid-19 large scale civil aerospace components and parts manufacturing will start in India?

27.6% of the participants agree that post covid-19 there will be an increase in manufacturing of civil aerospace components and parts in India which will be propelled by various Indian stimulus packages and initiatives. 41.4% are undecided which is still a significant number. The response supports the research to achieve the third and the fifth objective of the research to identify opportunities and opening avenues for start-ups.

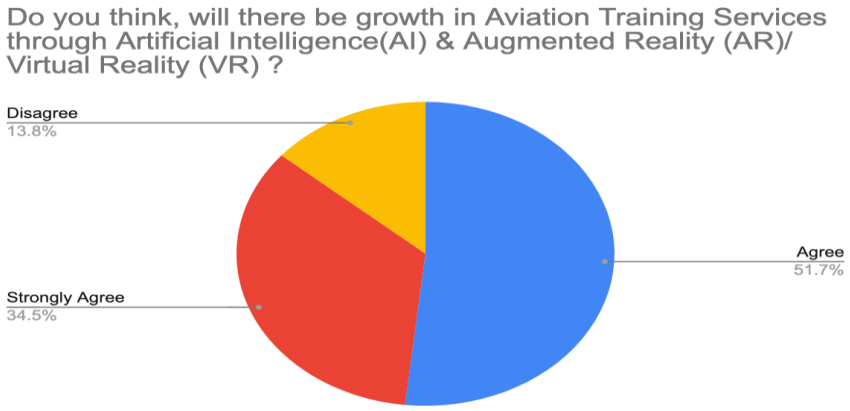

Figure 7: Response to the question: do you think, will there be growth in aviation training services through artificial intelligence (AI) and augmented reality (AR)/ Virtual reality (VR)?

51.7% of the respondents believe that emerging technologies including artificial intelligence, augmented reality and virtual reality, will assist the aviation training services and impact it heavily. The demand of these technologies will increase on a larger scale causing a disruption in the sector. The response achieves the second, third and fifth objective of the research to come up with newer technology firms to support and increase employment.

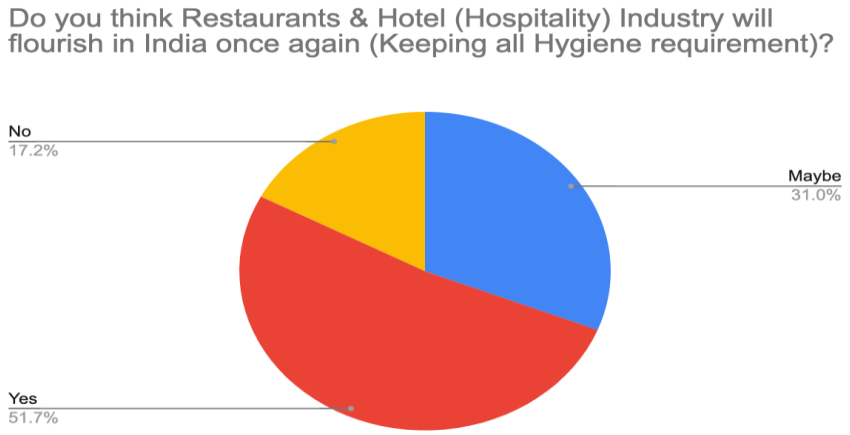

Figure 8: Response to the question: do you think the restaurant and hotel (hospitality) industry will flourish in India once again (keeping all hygiene requirements)?

51.7% of the respondents believe that the hospitality industry will flourish once again as the situation stabilizes. 31% are undecided but overall creates an optimistic view for this sector. This response achieves the second, third and fifth objective of the research.

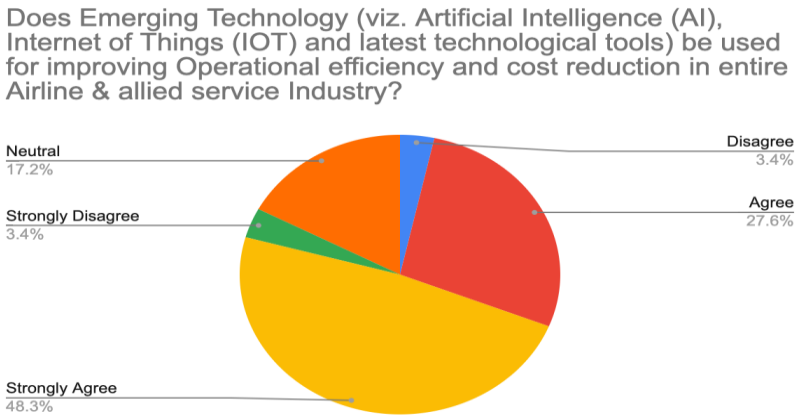

Figure 9: Response to the question: does emerging technology be used for improving operational efficiency and cost reduction in the entire airline and allied service industry?

48.3% strongly agree and 27.6% agree with emerging technologies impacting the sector by improving operational efficiency and reducing cost in the sector including its allied service sectors too. The relevance of emerging technology is often spoken of and is expected to disrupt the sector heavily eventually removing redundancy and giving rise to newer opportunities. This response to this question achieves the second and third objective of identifying investment opportunities.

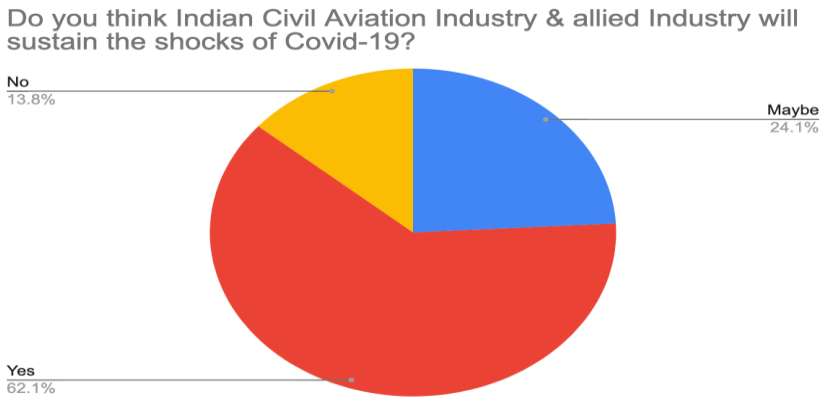

Figure 10: Response to the question: Do you think Indian civil aviation industry and allied industry will sustain the shocks of Covid-19?

62.1% are optimistic that the Indian civil aviation industry and its allied industries will be able to sustain the shocks of Covid-19. This is a major result, stating that irrespective of the consequences faced, the industry will eventually overcome the losses. This response helps to achieve the fourth objective as a quantified response to expecting more opportunities to come up with strategic decisions and forecasting.

Discussion and Outcome

The Airline Industry was affected very badly due to Covid-19. Further operational cost will also increase for this industry due to PPE and other protective measures. Also, there will be additional cost due additional technical compliance requirement viz. Air conditioning & ventilation system. Subsequently it impacted on Aircraft manufacturers as well as OEM's. International Air traffic may take time for normalcy. However Indian domestic aviation market may pick up with new norms and the way of functioning. Post Covid-19 there could be good demand for General aviation which means non-scheduled operation (NSOP) with smaller Aircraft as certain segments of the population of the country prefer to travel separately due to Covid-19. Further there could be good demand for cargo transfer of material because of utmost sophistication used in cargo handling in the Air Industry as compared to normal road transport wherein Multiple touchpoints exist. Hence domestic aviation industry may pick-up in a short span of time despite demand shrink forecasted by some of the experts. Further reduction in fuel cost will make it rational for UDAN (Ude Desh Ka Aam Naagrik- i.e. Regional connectivity) scheme which will further increase air transport for Tier2 cities as well. Further the economic stimulus given by the government USD 275B (almost 10% of GDP) will further drive the industrial demand of the country, booming all the industries including aviation.

The Maintenance, Repair & Overhaul (MRO) facility for Base Maintenance & Component maintenance industry largely depends on Airlines. Being the Airline Industry expected to get affected by 46%. The MRO industry also may get affected with similar numbers. However, if we will investigate opportunity in actual, almost eighty per cent of civil aviation space doesn't have MRO capability in India due to 2 major limitations. i.e. Tax on MRO Industry and Technical Knowhow. Hence major Indian airlines i.e. Indigo, SpiceJet used to send their aircraft to neighbouring countries such as Sri Lanka, Singapore, and Dubai for major maintenance activities. This is nothing but direct transfer of Indian requirements to foreign countries resulting in loss of job opportunities for Indian people. However, in Mar 2020 Indian government reduced tax on MRO Industry from 18% to 5%. This will eventually lead to great opportunities in these sectors. In fact, recently Indian carriers are signing all major maintenance contracts withs Indian MRO companies. This is evident from Spicejet-AirIndia (AIESL) Maintenance deal in May 2020.

Indigo Airlines started an innovative trend in India by off-loading regular maintenance to PBC / PBH (The Support services like Performance Based Contract (PBC) or Powered by Hour (PBH) Contracts) contractors. Wherein, PBH[16] contractor is responsible for component maintenance and they will be paid based on aircraft availability for flying. Presently, all the other private airlines are following the Indigo airline PBH model. However, post Covid-19 this has increased the financial burden on the Airline as they had to pay for PBH contractors like Air France Industries and Lufthansa. However, post Covid-19 all Domestic services are already started with reduced capacity and international services may start in a few months. Eventually lot of maintenance activities will have to be carried out in India which will force the transfer of technical knowhow to India by these PBH as well foreign OEM's. Hence this will give one more opportunity for Indian Industry who are in support service business or having partnerships with foreign PBH contracting organizations.

Due to Covid-19 the precision (Component or parts) Manufacturing industry got affected as many of the Aircraft and subsequent Tier2 & Tier3 suppliers expected to lose their business. However, India is already lagging in Precision Manufacturing. Barring a few companies like Aequs, Cyient, Tata's India have limited components manufacturing capability. But due to government emphasis on local manufacturing, and there is huge international pressure of shifting manufacturing facilities to India from China may benefit India. Further there is great

inhouse demand for domestic civil aviation, India will have to start manufacturing of critical spares. There are many foreign OEM's contemplating shifting their business to India by having India centric manufacturing.

Prior to Covid 19 this Industry was not existing in India. Only a few of the MRO tried to do the local manufacturing of tools & test benches (aircraft special tools and test benches manufacturing). However later they faced the regulatory hurdle to prove the equivalency of local manufactured tools and test benches. Due to growth of MRO Industry, which is looking for cost effective solutions and acceptance of ARINC668 methodology for equivalency by Indian and foreign regulators, many of the new SMEs may come to this segment of business in India. These are specialised jobs wherein you require people with a high level of skill set. OEM purchased tools are very expensive. However, these tools and test benches can be manufactured in India at a fraction of the OEM prices. As per Industry expert it is estimated to be ⅓ of the OEM cost. This business is yet to be explored by the Indian manufacturer. Indian companies may export these special tooling to OEM's in future.

The Ground Support Services firms include companies that provide Aircraft ground support firms, on-ground Aircraft cleaning services firms, Aviation fuel firms, ticketing service firms. All these firms are affected substantially. The entire ground support services segment went in a limbo causing major unemployment. However, domestic travel revival can grow this sector as well. The growth is expected to take time but once, the regulations relax, this sector will gain its strength.

Training Services based industry is the subset of Airline and MRO Industry, it has also got affected substantially. However, this segment can also get the opportunity of local training as many of the Airlines will be reluctant to send their staff abroad for training. Virtual classrooms are going to be the new normal for training organizations. Simulators are already used for training in this Industry including cockpit and cabin crew. MRO staff can also be trained virtually on AR/VR (Artificial Intelligence (AI) & Augmented Reality (AR)/ Virtual Reality (VR)) based training modules. No doubt regulators will have their reservations initially, but the entire training business may take a new shape. The training organizations need to obtain DGCA CAR147 approval which may get amended to suit the new business environment.

Many of these hotels (Restaurant and hotel industry) have started home delivery of food. New regulations have increased their operation cost due to certain mandatory reforms for example conducting health check-up of the working staff at regular periods using the medical instrument registered and making extra purchases for sanitizers, masks and gloves. Some hotels allowed international passengers (Indian Nationals from foreign countries under Vande Bharat Mission) to be quarantined in their hotels in order to raise revenues because of the mandate that international passengers coming to India, must stay quarantined for 15 days. However, new and additional regulatory norms may delay recovery of this sector. Further economic stimulus which is given by the government will enhance the probability of recovery of this sector.

Apart from application of Emerging technology like Artificial Intelligence as stated in the discussion above, Internet of Things in Aviation Industry will help in predictive maintenance of Aircraft and its components thereby reducing the cost of the industry. This will further give opportunity to Indian Civil Aviation Industry.

Implications:

The Civil Aerospace sector was in the growth stage in India. However, Covid-19 has worsened the probability to leverage the sector's capability to flourish. But after assessment of this sector

in detail it is found that there still exist opportunities for everything innate to the sector and not having gained their due recognition. These opportunities are highlighted in the outcome of this research. General aviation, Cargo transport, Aircraft Component Manufacturing, Aircraft Maintenance Repair Overhaul (MRO) Services, Aircraft special tools and test benches manufacturing, Support services to Powered by Hour (PBH) are some of the areas where opportunities still exist. These segments have tremendous growth potential due to the expected domestic travel demand Post Covid-19 supported by economic stimulus and increase in industrial activities. However, the regulatory and the Government support will further boost its operability and profitability. The research tries to answer all the stated questions. According to most individuals, adapting to new technology, will help reduce operational cost. To increase the demand for civil aviation in India, economic stimulus, reduction in leasing cost of aircraft and government initiatives can help. The cost of operations is correlated with how stringent the regulatory norms are, aviation fuel cost, number of support services, hygiene norms, passenger carrying capacity of an aircraft and the insurance cost. We can see an increase in MRO services and organizations when they get tax benefits and when logistics demand increases within the country. This will increase preference of Indian origin goods when compared to Chinese counterparts.

Future Research

This research can be taken further by implementing econometrics and analytics models to validate the dependent and independent variables. A comparative analysis can be done to do a trend analysis by taking historic data of the aviation industry during the great depression, recession and the financial crisis. This will help build forecasting models to strategize businesses and increase the ability to absorb risk. This will make the sector robust and be well prepared in case it faces any similar economic shock. The research restricts in finding correlation within various factors mentioned. Further analysis can be done to check dependency. Better results will be obtained with more responses.

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