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The Economic Impact of the Indira Gandhi International Airport, Delhi

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FOREWORD

One of the features of India's growth promotion story is a concerted effort to rapidly build public infrastructure using public-private partnerships (PPPs). PPPs, if done well, can give citizens the best of both worlds: good service delivery outcomes from large public infrastructure investments through their efficient construction and management by the private sector.

This is nowhere more true than in transport, and more specifically for air transport. Air travel, the fastest mode of freight and passenger traffic with wide-ranging interlinkages with other sectors of the economy, can provide tremendous direct and indirect benefits for the local, regional, and national economies it serves. An efficient, national civil aviation infrastructure has the potential of bringing down transport costs, promoting commerce, expanding culture and communications, and ultimately drawing people closer.

Successive Indian governments have realized that aviation can be a game changer in accelerating economic growth and have taken significant steps to boost sector growth and attract private investment in airports and airlines. During the past ten years, India has recorded dramatic growth in air traffic. Passenger traffic has grown at an annual rate of more than 13 percent for over a decade, one of the highest in the world. A major part of this growth in passenger traffic is due to domestic operations. Globally, India has now emerged as the third largest aviation market for domestic passenger traffic.

Prime examples of PPP in Indian aviation are new and redeveloped metro airports in the past decade. The largest of these, the Indira Gandhi International Airport (IGIA) in New Delhi, handling 57.7 million passengers in 2016-17, has also emerged as the largest airport in South Asia, and one of the world's fastest growing ones. According to the Airbus Global Market Forecast for 2016-35, domestic air traffic in India is estimated to grow more than five-fold over the next 20 years.

This NCAER research study, carried out with the support of Delhi International Airport Limited (DIAL), the IGIA operator, seeks to assess the current and future economy-wide impact of the IGIA. Just on the face of it, as anyone who has used the airport will know, the entire area around IGIA, including in the neighbouring Gurugram area of Haryana, has been transformed in recent years.

Airports are no longer places where planes just take off and land but have evolved into major business enterprises with spatial impacts and functional implications that extend deep into metro and non-metro areas. They are vital hubs in global transport and logistics flows. Airport growth can be linked to the growth of the economy through improvements in productivity due to better access to markets, enhanced links between firms providing greater access to resources and domestic and international markets, reduced transactions costs, increased domestic and international competition, greater tourism, greater market integration, agglomeration, and scale impacts, and specialization. As with any large-scale infrastructure development, along with these benefits airport-led urban development can also come with economic, environmental, and cultural costs and risks.

The economic interaction of any airport with the rest of the economy is therefore complex and intricate, with direct, indirect, and induced effects on output, incomes, value added, and employment, and with these impacts running both ways between the airport and the economy. How can we measure this impact?

This NCAER IGIA impact assessment study builds on NCAER's long-standing analytical work on input-output tables, giving us quantitative assessments under different scenarios of what this impact is and would be in the future. Since input output tables are for specific years, the team has updated them with the latest data available and expanded them to capture activities related to airport operations. The base year for this work is 2014-15. Besides its research findings, this enhancement of NCAER's input-output tools is a significant contribution of the study that will allow NCAER to undertake further research into the impact of large-scale infrastructure development.

The study finds that IGIA makes a substantial contribution to both employment and value addition, and this is expected to increase further with air traffic growth. To sustain this impact, an important implication of the expected rapid growth in air traffic is for IGIA to expand its capacity significantly to handle the growing demand for both passenger and freight while minimizing congestion. Indeed, in part as a result of this study, I believe that the management of IGIA and DIAL is undertaking an exhaustive review of their initial master plan with a view to increasing the airport capacity through runway and terminal development and deployment of high-quality airport management systems to augment the airport's capacity to handle the rise in traffic. This would also include the synchronised development of airside and landside infrastructure, terminals, and support facilities.

While doing this study, NCAER and the research team have benefited intellectually from the interactions with DIAL management and staff. In particular, I would like to thank Mr Indana Prabhakara Rao, CEO of IGIA and DIAL, Mr Subir Hazra, Vice President, Strategic Planning Group at DIAL, and the entire team of dedicated managers and staff for their wonderful cooperation in carrying out this research. We are also grateful to the 3,500 or so passengers who took part in the passenger survey and to the many government agencies, concessioners, airlines, freight forwarders, and cargo operators for sparing their valuable time during the course of this work.

We are considering extensions of this work to examine in greater detail the regional, as opposed to the national, impact of IGIA and its socio-economic dimensions, both to be based on newly developed social accounting matrices for this purpose.

Shekhar Shah

New Delhi
March 31, 2017

Dr Shekhar Shah
Director-General

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NCAER and the study team would like to thank Mr Indana Prabhakara Rao, Chief Executive Officer of the Indira Gandhi International Airport, Delhi International Airport Private Limited (DIAL), and the team of officials for their support and cooperation in conducting this study.

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The study team is also thankful to the thousands of passengers, government agencies, concessioners, airlines, freight forwarders, and cargo operators supporting the IGIA for sparing their valuable time to respond to the study questionnaires.

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ABBREVIATIONS

AAI	Airport Authority of India
ACI	Airport Council International
AERO	Aeronautical
ATAG	Air Transport Action Group
ATC	Air Traffic Control
ATM	Aircrafts Movement
BCAS	Bureau of Civil Aviation Security of India
BCIA	British Construction Industry
BDDS	Bomb Disposal & Detection Squad
BN	Billion
BPCL	Bharat Petroleum Corporation Limited
CAGR	Compound Annual Growth Rate
CIS	Change in Stocks
CISF	Central Industrial Security Force
CPD	Commercial Property Development
CSC	Cargo Service Centre
CSO	Central Statistical Office
DAMEL	Delhi Airport Metro Express Private Limited
DGCA	Director General of Civil Aviation
DIAL	Delhi International Airport Pvt Limited
DOM	Domestic
DTC	Delhi Transport Corporation
FIIs	Foreign Institutional Investors
FSI	Floor Space Index
GAWC	Globalisation and World Cities
GBA	Gross Building Area
GDP	Gross Domestic Product
GFCE	Government Final Consumption Expenditure
GFCF	Gross Fixed Capital Formation
GSP	Gross State Product
GVA	Gross Value Added
HD	Hospitality District
HPCL	Hindustan Petroleum Corporation Limited
ICAO	International Civil Aviation Organisation
INR	Indian Rupee
INT	International
I-O	Input-Output
IOCL	Indian Oil Corporation Limited
IPO	Initial Public Offering
JV	Joint Venture
LAC	Latin American Countries
MSF	Million Square Feet
NAS	National Account Statistics
NCAER	National Council of Applied Economic Research
NCR	National Capital Region
NCT	National Capital Territory
NIC	National Industrial Classification
Non-Aero	Non- Aeronautical
NSSO	National Sample Survey Organisation
OMDA	Operation, Management and Development Agreement

ONGC	Oil and Natural Gas Corporation
OOG	Out of Gauge
PAX	Passengers
PCE	Personal Consumption Expenditure
PCY	Per Capita Income
PFCE	Private Final Consumption Expenditure
PPP	Public Private Partnership
PPP	Purchasing Power Parity
PSF	Passenger Service Fee
PWC	Price Waterhouse Cooper
RAF	Royal Air Force
T1	Terminal 1
T3	Terminal 3
WLU	Work Load Unit

Executive Summary

1. BACKGROUND

India has recorded robust growth in air traffic during the last ten years. The passenger movement has grown at an annual rate of more than 13 per cent, which is one of the highest in the world. Airbus Global Market Forecast (2016-35) has estimated a more than five-fold growth in the domestic traffic of India over the next 20 years. At the global level, the number of total passengers transported by air has increased from 1.97 billion to 3.44 billion between 2005 and 2015. Such a heavy air traffic movement underscores the imperative need to create modern and efficient airports. During the year 2015, the world's busiest airport, Atlanta GA of the United States handled about 101.5 million passengers while the Indira Gandhi International Airport (IGIA), Delhi, which is ranked at the 25th place in terms of air traffic volume, handled about 46 million passengers. India's ranking for the year 2015 was 13th in terms of revenue passenger kilometres and 19th in terms of revenue freight kilometres, thus leading to an overall ranking of 16th in terms of revenue tonne kilometres.

An airport has a complex and intricate economic interaction with the economy in which it operates. Airports also have a multi-faceted impact on the economy in terms of direct, indirect, and induced effects on production, income, and employment. However, all airports may not have the same type of interaction with the city. This has resulted in the rising international practice of conducting economic impact studies for airports to produce quantitative and qualitative evidence of their importance for the economy.

The key objective of this study is to assess the current and future economy-wide impacts of activities and developments at the Indira Gandhi International Airport Delhi in terms of output, employment and value added. The base year for the study is 2014-15 while the terminal year for the projection is 2025-26.

2. REGIONAL SYNERGY WITH IGIA, DELHI

The development and growth prospects of the National Capital Region (NCR), and the IGIA, Delhi, are interdependent and present an excellent example of a synergistic development process.

With an estimated population of 18.4 million in 2016, Delhi was the fifth most populous city in the world and the largest city in India. Delhi is also one of the richest cities of India and is home to the second largest number of high net worth individuals (HNWI) or individuals with net assets of USD 1 million or more in India. According to a study of the 'Most Dynamic Cities of India', jointly conducted by 'Foreign Policy' and the 'McKinsey Global Institute', Delhi has been ranked as the 39th most dynamic city of the world.

Further, it is not Delhi alone that influences the demand on IGIA, Delhi, but the entire NCR as also northern states. The 33 districts falling under NCR constitute just about 4.8 per cent of all the districts of India in terms of the total number of districts, but they account for 8.35 per cent of the urban population and 7.75 per cent of the urban workers of India. During 2013-14, the estimated contribution of NCR to the national income was 7.9 per cent. NCR is also one of the fasted urbanising regions of India; the population of NCR is projected to cross 64 million by 2021. This reflects the enormity of the population and workforce of NCR which are dependent on IGIA, Delhi for air travel.

On the other hand, Delhi and NCR have greatly benefited from modernisation of the IGIA, Delhi in terms of growth and development. The passenger flow at the airport is more than three times the population of the National Capital Territory (NCT).

After modernisation, IGIA, Delhi, has become the busiest airport of India in terms of passenger and freight movement. It handled 48.42 million passengers and 787 thousand tonnes of freight during 2015-16, thus recording impressive annual growth rates of 18.1 per cent and 13.0 per cent for these two categories, respectively.

During 2015-16, IGIA, Delhi provided air connectivity in terms of both arrivals and departures to more than 14.15 million international passengers across 68 countries, and catered to 34.27 million domestic passengers from 57 Indian cities.

IGIA, Delhi contributes about 34.5 per cent of the total trade being transacted through all major airports of India. In terms of trade connectivity, the IGIA, Delhi facilitated export to 218 countries and import from 164 countries during 2015-16. During 2014-15, Delhi customs collected INR 10,000 crore at the airport, which amounts to about 5 per cent of the total customs duty collected by the government at the all-India level.

3. AWARDS AND RECOGNITIONS TO IGIA, DELHI

Since its modernisation, the IGIA, Delhi has bagged several awards for its overall performance, as delineated below:

- IGIA, Delhi won the best airport award from the Airports Council International within the category of 25–40 million annual passengers for the two consecutive years of 2014 and 2015.
- In 2015, IGIA, Delhi bagged two awards for being the best airport in Central Asia/India and having the best airport staff in Central Asia/India at the prestigious Skytrax World airport awards.
- In 2015, it won the prestigious Golden Peacock National Quality Award given by the Institute of Directors (India).
- On September 27, 2016, IGIA, Delhi became the only airport in Asia-Pacific and one of the world's few airports to achieve a Level 3+ carbon neutral status.
- IGIA, Delhi also became the first airport in India to achieve Platinum rating for its 'Green' Terminal 3 from the Indian Green Building Council (IGBC).

The survey of passengers indicates that 96 per cent of the passengers are satisfied with the services at the airport and more than 80 per cent of the passengers gave it more than 80 per cent marks for almost all services. However, people are relatively less satisfied with transport connectivity between the airport and the city, for which only 75 per cent of the respondents gave it more than 80 per cent marks.

4. FINANCIAL PERFORMANCE OF IGIA, DELHI

The airport has recorded a strong current financial performance in terms of gross profitability ratios and the PAT (profit after tax) to revenue ratio is comparable to international standards for the industry. An assessment of the distribution of sources of revenue shows that during the year 2015-16, about 68.66 per cent of the revenue was obtained from aero income, while 26.67 per cent was obtained from non-aero income. The remaining 4.67 per cent of the income was obtained from other sources. During recent years, the airport has reported an improvement in the collection of non-aero revenue. The revenue from non-aero sources went up from 593.23 crore in 2010-11 to 1146.34 crore in 2014-15, signifying an increase of 193.2 per cent in such revenue over the course of four years. While this growth is commendable, it is still desirable to reduce dependence on the regulated sources of revenue. Of the total revenue collected at the airport, 45.99 per cent is transferred to the Airport Authority of India, which is used inter-alia for infrastructure development.

5. ECONOMIC IMPACT ASSESSMENT (BASE YEAR 2014-15)

The economic impact assessment of IGIA, Delhi has been carried out by using the Input-Output (I-O) framework. In the course of this exercise, due care has been taken to avoid double counting of the direct outputs and indirect effects of flows. While direct effects are arrived at through activity-wise accounting of the output and employment, applications of appropriate multipliers for output, income and employment lead to economy-wide indirect effects and induced effects. These impacts are classified as Type-I impact (direct effect + indirect effect) and Type – II impact (direct effect + indirect effect + induced effect). Independently estimated multipliers have been applied on directly accounted output to assess Type-I and Type-II impacts. The base year for analysis is 2014-15.

5.1 Summary of the Aggregate Impact

The aggregate economic impact for the year 2014-15 is summarised in Table ES-1 for both Type-I and Type-II models along with direct effects. The direct output due to IGIA, Delhi for the year 2014-15 is estimated to be INR 33,139 crore. The direct impact is INR 7979 crore in terms of value added and 1.06 lakh in terms of employment (job creation). Corresponding to the Type-I model, the economic contribution is INR 31,366 crore in terms of value added and 6.09 lakh in terms of employment.

The Type-II impact model is more inclusive as it includes the induced impact of circular flows created by consumption expenditure in addition to the circular effects of inputs in the production system. Based on Type-II assessment for the year 2014-15, the aggregate impact of direct, indirect, and induced effects is as follows:

(1) **The impact of Value Added on national income is INR 80,724 crore, which amounts to 0.70 per cent of the national GVA. If the national impact is taken as a percentage of the GSDP of Delhi, it comes out to be 17.89 per cent. The value added in terms of US$ @INR65/US$ works out to be US$ 12.42 billion.**

(2) **Employment creation is worth 28.39 lakh when the direct, indirect and induced effects are accounted for, which amounts to about 0.56 per cent of the estimated total workers in the economy. Out of this, 11.63 lakh are estimated to be employed in the agriculture sector.**

Type-II employment captures all the workers (main as well marginal workers) associated with the formal and the informal sectors, including self-employed and farm labourers. It may be noted that the employment to output ratio is much higher in the agriculture and unorganised sectors, which account for the production of most of the food and consumer products of mass consumption. For this reason, the induced effect captured in the Type-II model leads to proportionately higher employment effects as compared to the value added effect.

TABLE ES-1: SUMMARY OF ECONOMIC IMPACT OF IGIA, DELHI

Summary of Economic Effect of IGIA, Delhi by Type of Impact Assessment Models (2014-15)			
Details	Direct Effect	Type-I Impact	Type-II Impact
		Direct + Indirect	Direct + Indirect +Induced
Output (INR Crore)	33139	91054	189831
Value Added (INR Crore)	7979	31366	80724
Employment (lakh)	1.06	6.09	28.39
Value Added (US$ billion) @ INR65/US$	1.23	4.83	12.42
Impact as Percentage of national income (2014-15)			
Value Added as Percentage of National Gross Value Added (%)	0.07	0.27	0.70
Value Added as Percentage of Total GSDP of Delhi (%)[1]	1.77	6.95	17.89
Employment (job creation) as Percentage of Total Workers (%)	0.02	0.12	0.56

Source (basic data): NCAER Research.

5.2 Distribution of Economic Impact across Sectors

In order to facilitate an appreciation of the economic impact of IGIA, Delhi, the distribution of aggregate impact across the major sectors of the economy such as agriculture, industry and services, is presented in Table ES-2 with respect to the Type-II model, wherein the direct, Indirect, and induced effects are captured.

(1) In absolute terms, the figures for value added created in the agriculture, industry, and services sectors are INR 8149 crore, INR 29,965 crore, and INR 42,610 crore, respectively; and the figures for the total employment created in these sectors is 11.63 lakh, 5.01 lakh, and 11.75 lakh, respectively.

(2) The distribution of value added between the agriculture, industry, and services sectors is 10.1 per cent, 37.1 per cent, and 52.8 per cent, respectively.

(3) The distribution of employment between the agriculture, industry, and services sectors is: 41.0 per cent, 17.6 per cent, and 41.4 per cent, respectively.

[1] For estimating the actual impact on the economy of Delhi, one needs to create an I-O Table or a regional social accounting matrix for Delhi, which can help in assessment of the actual impact on Delhi.

TABLE ES-2: DISTRIBUTION OF TYPE-II IMPACT ACROSS SECTORS

Distribution of Type-II impact across three major sectors				
Sector	Value		Share (per cent)	
	Value Added (INR crore)	Employment (Lakh)	Value Added	Employment
Agriculture	8149	11.63	10.1	41.0
Industry	29965	5.01	37.1	17.6
Services	42610	11.75	52.8	41.4
Total	80772	28.39	100	100

Source (basic data): NCAER Research.

5.3 Comparison with the Results of the Last Study

It may be desirable to compare the results of this study with the previous study undertaken in 2012 (based on data for 2009-10), even though the comparison may not be on an absolutely one-to-one basis because of several reasons, including a change in the estimation procedures of national accounts statistics. In addition, since the last study, the quantum of activities at the airport has increased tremendously. The direct output on which the indirect and induced effects are dependent increased almost five-fold from INR 7150 crore, as estimated in the previous study, to INR 33,139 crore in the present study (Table ES-3).

The Type-II impact (direct + indirect + induced) on GVA increased from INR 29,470 crore (amounting to 0.45 per cent of the national GVA) to INR 80,724 crore (signifying 0.70 per cent of the national GVA); and employment creation increased from 15.78 lakh (amounting to 0.34 per cent of the total workers) to 28.39 lakh (amounting to 0.56 per cent of the total workers).

TABLE ES-3: COMPARISON OF RESULTS OF THE CURRENT ECONOMIC IMPACT STUDY WITH THE 2012 STUDY

Details	Direct Effect		Total (Direct + Indirect)		Total (Direct + Indirect + Induced)	
	2012 Study	Current Study	2012 Study	Current Study	2012 Study	Current Study
Output (INR Crore)	7150	33139	20020	91054	49120	189831
Value Added (INR Crore)	4290	7979	12010	31366	29470	80724
Value Added as Percentage of National Gross Value Added (%)	0.065	0.070	0.18	0.273	0.45	0.70
Value Added as Percentage of Total GSDP of Delhi (%)	1.18	1.77	5.51	6.95	13.53	17.89
Employment (lakh)	0.64	1.06	5.16	6.07	15.78	28.39
Employment as percentage of Total all India workers	0.014	0.02	0.11	0.12	0.34	0.56

Source (basic data): NCAER Research.

6. FUTURE PROJECTIONS AND ECONOMIC IMPACT AT THE 2025-26 HORIZON

The economic impact of IGIA, Delhi for the next ten years has been assessed on the basis of the air traffic projection of NCAER estimates as well as that of the 2016 Review of the Master Plan. The terminal year for the projections is 2025-26. The ultimate impact considering direct, indirect, and induced effects (Type-II model) is summarised in Table ES-4.

BASED ON NCAER PROJECTION OF TRAFFIC IN 2025-26

• **The impact on value added after taking into account the direct, indirect and induced effects as described by impact models Type-II works out to be**	:	**INR 2,40,356 crore, 0.60 per cent of the estimated national GVA**
• **The impact on employment after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	:	**40.22 lakh, 0.58 per cent of the total estimated workers**

BASED ON MASTER PLAN PROJECTION OF TRAFFIC IN 2025-26

• **The impact on value added after taking into account the direct, indirect and induced effects as described by impact models Type-II works out to be**	:	**INR 2,27,506 crore, 0.57 per cent of the estimated national GVA**
• **The impact on employment after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	:	**38.04 lakh, 0.53 per cent of the total estimated workers**

As mentioned earlier, employment generation covers the main and marginal workers employed in the entire spectrum of economic activity including both the formal as well as informal sectors.

The impact on income in terms of US$ (converted @ INR65/US$) works out to be 36.98 billion and 35.00 billion, respectively, corresponding to air traffic projections of NCAER and the Master Plan. This effect is similar to that of Atlanta airport, wherein the traffic volume at about 100 million, is similar to that projected for IGIA, Delhi.

TABLE ES-4: SUMMARY OF DIRECT, TYPE-I AND TYPE-II IMPACT CORRESPONDING TO PROJECTED AIR TRAFFIC MOVEMENT DURING 2025-26 BY NCAER AND MASTER PLAN

Summary of Direct, Type-I, and Type – II impact (2015-26)						
Parameter	According to NCAER Projections of Air Traffic			According to projections of 2016 review of Master Plan		
	Direct Effect	Type-I Effect	Type-II Effect	Direct Effect	Type-I Effect	Type-II Effect
Value added (INR crore)	23743	93392	24036	22398	88399	227506
Value added (billion US$)	3.65	14.37	36.98	3.45	13.6	35.00
Employment (lakh)	1.52	8.67	40.22	1.43	8.17	38.04
Value Added as percentage of National GVA	0.06	0.23	0.60	0.06	0.22	0.57
Employment/Job Creation as Percentage of Total Workers (%)	0.02	0.12	0.58	0.02	0.11	0.53

Source (basic data): NCAER Research.

7. CONCLUSION

In our increasingly globalised world, airports represent not just the simple points of departure and arrival of passengers but go much beyond that. The growth of a city is significantly impacted by the improvement and expansion of airport services, better regulation of air traffic, and upgradation of infrastructure, which also foster dynamic linkages in city. This impact is, in essence, reciprocal, that is, a strong growth impetus in the development of a city or region leads to further expansion of airport activities. The catalytic effect of IGIA, Delhi is obviously reflected in huge investments made in Gurugram and other districts in close proximity of the airport. Thus, IGIA, Delhi and the industrial/institutional development around it present an excellent example of a synergetic two-way development process.

The economic contribution of IGIA, Delhi is substantially high in terms of both employment and value addition. This contribution is likely to increase further in absolute terms with the growth of air traffic.

The aggregate economic impact of IGIA, Delhi, including the direct, indirect, and induced effects for the base year 2014-15, is estimated as INR 80,724 crore in terms of value added, accounting for about 0.70 per cent of the national GVA; and 28.39 lakh in terms of employment, accounting for about 0.56 per cent of the total estimated workers.

The air traffic projection figures for the future years clearly points to the need for expanding the capacity of IGI airport to enable it to meet the growing demand of passenger and freight movements for avoiding congestion. Accordingly, the management of IGI airport has undertaken an exhaustive review of the initial Master Plan to increase the capacity of the airport. It has been proposed to build a range of runway and terminal development and high-quality infrastructure airport management systems to augment the airport capacity ahead of the increase in the traffic demand. The new strategy includes synchronised development of airside, terminals, landside, and support facilities.

On the basis of air traffic projections for the year 2025-26, the economic impact of the IGIA, including the direct, indirect, and induced effects, is estimated to be INR 2,40,356 crore, or about 0.60 per cent of the estimated national GVA. The impact on employment, on the other hand, is estimated to be 40.22 lakh, or about 0.58 per cent of the total estimated workers. The impact on value added for the terminal year 2025-26, when converted in US$ terms (@INR65/US$), works out to be US$ 36.98 billion.

Chapter 1

Introduction

1.1 INTRODUCTION AND BACKGROUND

Modern airports are vital hubs in the global conglomerate of people, freight, knowledge and commercial flows. In fact, most airports being developed today are much more than aviation infrastructures. They have now become multimodal and multifunctional enterprises with the ability to promote significant commercial and economic development not only within but well beyond their boundaries. Efficient connectivity is crucial for the creation of a growth-centric development model and for augmenting business opportunities. In view of the growing need for modernisation and efficient operation of airports, public-private partnership (PPP) models are increasingly being used to involve the private sector in the development and operation of airports. This is also true for the Indira Gandhi International Airport (IGIA), Delhi. The successful modernisation of the infrastructure of airports through PPP models has brought about a paradigm shift in the pattern of urban settlement and development making the concomitant regions gateways to modern India.

The importance of modern airports is also evident from the positive differential in the growth of major airports in terms of their activities such as passenger movements and real growth in the GDP of world economies. During the period 2005- 2015, the average growth of global movement of air passengers was 5.7 per cent as compared to a corresponding growth of about 2.6 per cent in the world GDP during the same period (Figure 1.1). Data with respect to India and China also show robust growth rates of 13.5 per cent and 12.5 per cent, respectively, in passenger movement even though the growth of their GDPs was lower. This implies that the income elasticity of passenger growth is higher than one as the passengers' preference for air travel increases at a faster rate than the national income. This also means that activities taking place at the airports make a much greater contribution to the national income as compared to the other sectors and may act as active drivers for the rest of the economy.

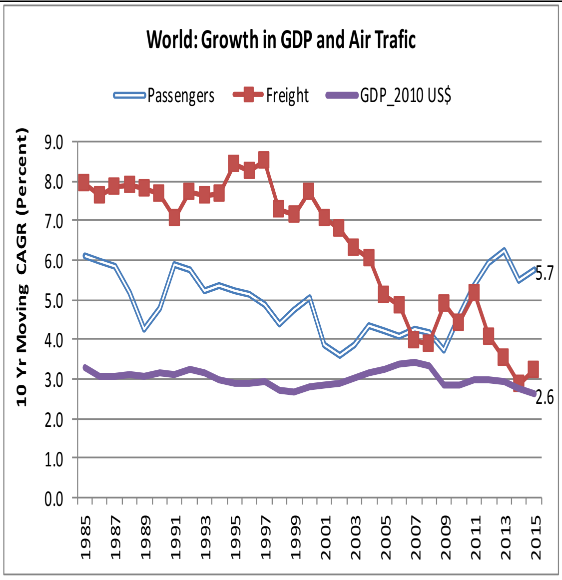
Studies have also found a link between the growth of airports and growth of the economy through improvements in productivity by way of better access to markets; enhancement of links between businesses and provision of greater access to international resources; reduced transactions costs; linking of markets and increase in competition within an economy; facilitation of tourism; market integration and scale impacts; and market agglomeration and specialisation.

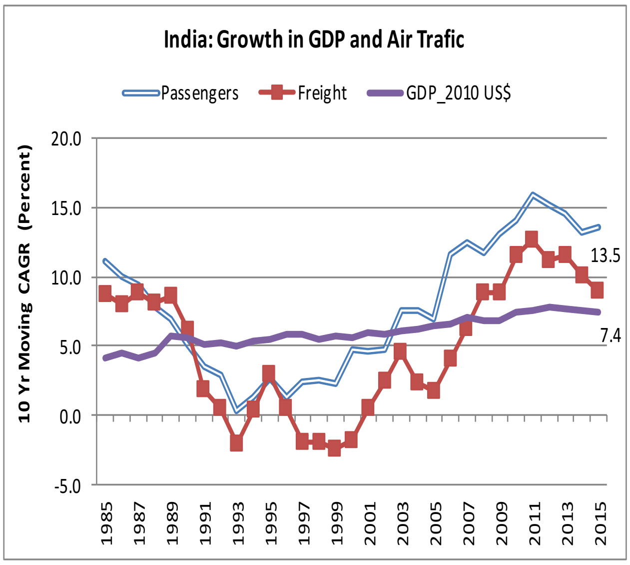
According to the 2015 Annual Report of the International Civil Aviation Organisation (ICAO), global passenger traffic grew at a robust rate of 5.6 per cent despite a sluggish economic environment. Asian airports such as those at Dubai, Shanghai (PVG), Bangkok (BKK), and New Delhi, experienced double-digit annual growth rates of 10.7 per cent, 16.3 per cent, 12.8 per cent, and 15.7 per cent, respectively, in terms of the number of passengers who embarked and disembarked at the airport.

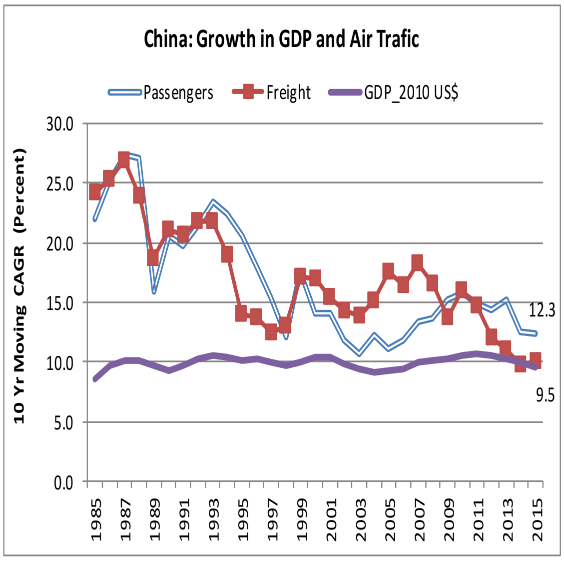
At the global level, the number of total passengers transported by air increased from 1.97 billion to 3.44 billion between 2005 and 2015. During the year 2015, the world's busiest airport of Atlanta GA, USA, handled about 101.5 million passengers while IGIA, Delhi, which handled 46 million passengers, was ranked at the 25th position.

FIGURE 1.1: GROWTH IN GROSS DOMESTIC PRODUCT (GDP) AND AIR TRAFFIC (INDIA, CHINA & WORLD)

Country	Details	Values			CAGR	
		1975	2005	2015	1975-2015	2005-2015
China	Passengers (million)	1.0	136.7	436.2	13.1	12.3
	Freight (million ton-km)	46	7579	19806	13.6	10.1
	Reg. Carrier Departures worldwide (million)	0.027	1.349	3.616	10.3	10.4
	GDP_2010 US$ (trillion)	0.2	3.5	8.8	6.9	9.5
India	Passengers (million)	3.8	27.9	98.9	5.1	13.5
	Freight (million ton-km)	211	774	1834	3.3	9.0
	Reg. Carrier Departures worldwide (million)	0.091	0.330	0.788	3.3	9.1
	GDP_2010US$ (trillion)	0.2	1.2	2.4	4.0	7.4
World	Passengers (million)	432.3	1970.1	3440.9	3.9	5.7
	Freight (million ton-km)	17236	136843	188000	5.3	3.2
	Reg. Carrier Departures worldwide (million)	9.24	24.23	32.96	2.4	3.1
	GDP_2010 US$ (trillion)	22.8	57.7	74.7	2.3	2.6







Source (basic data): World Bank.

India's ranking for the year 2015 was 13th in terms of revenue-passenger kilometres and 19th in terms of revenue-freight kilometre. Taking these together, the overall ranking of India in terms of revenue tonne-kilometres was 16th (Table 1.1). India recorded 140.4 billion revenue passenger kilometres as against 725.9 billion passenger revenue kilometres in China, and 1452.7 billion passenger revenue kilometres in the United States of America. With the current growth of air traffic, India's ranking is likely to improve further and if it follows the trajectory of China, India would need to improve its airport infrastructure enormously and quickly.

TABLE 1.1: COMPARATIVE PERFORMANCE OF AIR TRAFFIC IN TOP 20 COUNTRIES

Revenue tonne-kilometres, passenger-kilometres, and Freight tonne-kilometres on scheduled services[1,2]									
Country or group of countries	REVENUE TONNE-KILOMETRES (millions) (passengers, freight and mail)			REVENUE PASSENGER-KILOMETERS (millions)			FREIGHT TONNE-KILOMETERS (millions)		
	Total services (international and domestic)			Total services (international and domestic)			Total services (international and domestic)		
	Rank number in 2015	2015	2014	Rank number in 2015	2015	2014	Rank number in 2015	2015	2014
United States	1	170585	165687	1	1451694	1387790	1	37219	38225
China	2	84872	74434	2	725901	630823	2	19806	17823
United Arab Emirates	3	52101	47053	3	357194	319148	3	16647	15527
United Kingdom	4	31831	30862	4	283184	274966	10	5467	5917
Germany	5	31499	30783	5	244664	234201	7	6985	7184
Japan	6	23142	22068	9	167906	158096	5	8869	8662
France	7	22974	22211	6	184146	178138	13	4098	4151
Republic of Korea	8	22561	21753	16	119739	111594	4	11297	11125
Russian Federation	9	21061	20421	7	179680	176360	12	4761	4414
Turkey	10	18688	16442	10	157419	137171	14	2882	2630
Singapore	11	18616	18312	14	123329	121280	9	6154	6052
Canada	12	18217	16897	8	177507	162732	16	2075	2084
Qatar	13	17360	14293	17	108311	91799	6	7563	5993
Netherlands	14	15809	16041	18	103516	101424	11	5293	5726
Australia	15	15797	15363	11	144361	139899	18	1887	1907
India	**16**	**14344**	**12651**	**13**	**140474**	**121040**	**19**	**1834**	**1851**
Ireland	17	13166	11509	12	143527	125334	52	*139*	*126*
Brazil	18	12609	12299	15	122868	117760	21	1494	1597
Spain	19	11022	9671	19	103431	90949	27	1041	963
Malaysia	20	10912	11652	20	93692	98880	17	2006	2193

1. The revenue tonne-kilometres (RTK) in all tables of this Appendix are based on the actual passenger weights reported and used by Member States.
2. Previous year traffic figures have been restated based on actual reporting from Member States.

Source (basic data): ICAO (ICAO: http://www.icao.int/about-icao/Pages/default.aspx).

Such a significantly large movement of passengers through air transport, coupled with double-digit growth of this traffic, signifies a great opportunity for promoting innovative business ideas and underlines the need for the growth and development of airport infrastructure for the creation of what may be called 'airport cities'. Many airports across the world such as Beijing, Hong Kong, Amsterdam, and Sydney have capitalised on this idea.

In the case of many airports, the rental rates within the airport precinct are reported to be higher than the rentals per unit of floor area in the city centres, which underscores the benefits that accrue to a city for being located close to an airport. These benefits include the facility of multimodal transport and connectivity, and commercial and residential areas encompassing free trade operating zones, among other things.

According to the July 2015 World Report of ACI, the duty-free retail network served as a strong base for non-aeronautical revenues in regions such as the Middle East, Asia-Pacific and Europe. A well-developed network of duty-free shops is a big source of direct and indirect employment and earnings for the country. However, the efficient functioning of duty-free retail depends on several factors such as the volume of passengers, structure of products with free duty, other retail concessions, and the composition of passengers, including international, domestic, tourist, and business passengers.

Therefore, airport interaction with the rest of the city/region forms a virtuous cycle, and the growth and change in and around airports needs to be carefully planned with a vision about the future growth of the airport. The demand for development space within the precinct of an airport is likely to grow with the growth of business activities at and around the airport locations. Such a demand is likely to accelerate with increasing accessibility to a transport network and the speed of movement between the city and the area around the airport, which reduces transaction costs. On the other hand, developments around the airport may help in increasing the flow of passengers and freight at the airport, which, in turn, may help increase the business at the airport.

However, all airports may not be the same in terms of their interaction with the city/region. For this reason, there has been a rise in the international practice of the conduction of an economic impact study with respect to airports to derive quantitative and qualitative evidence regarding their importance for the economy. Several such studies have examined the impact of airports on the national and regional economies in terms of output, employment and income (Table 1.2). A large variation in economic impact can be seen in terms of the economic output vis-à-vis passenger movement.

TABLE 1.2: SUMMARY FINDINGS OF IMPACT STUDIES OF INTERNATIONAL AIRPORTS

Airports	Year of Study	Passengers Million	Economic Output (Value Added): US$ billion
Sydney[1]	2015	38	31
Hong Kong[2]	2015	57	12
Atlanta[3]	2015	101	64
Detroit	2014	32	10
IGIA, Delhi*	2016	53	16

Source: Various studies; *estimates for 2016-17 and INR/US$ rate of 65.

In India too, three studies have been conducted with respect to IGIA, Delhi, Mumbai airport, and Hyderabad airport, and these studies have shown a large impact in terms of employment but the quantum of output is relatively low in terms of absolute values (Table 1.2).

Measuring the economic impact of a fully developed airport is a complex proposition. It necessitates the identification of a myriad organisations involved in various activities at the airport, and estimation of the potential values of their output and employment as also their impact on a backward system of industries and organisations.

It is in this context that NCAER has conducted a second economic impact assessment study for IGIA, Delhi as a follow-up to a similar study conducted in 2012 (based on data for 2009-10) when the Hotel District

[1] http://www.sydneyairport.com.au/corporate/about-us/overview/fact-sheets/economic-impact.aspx.
[2] http://info.threerunwaysystem.com/pdf/en/economic_impact_study_of_the_three_runway_system.pdf.
[3] http://www.edrgroup.com/library/aviation/atlanta-airport-economic-impact-study-2014.html.

was still under construction and T 3 was in its initial stage of operations. Several developments have occurred since then, which have been taken into account in this study.

1.2 OBJECTIVES OF THE STUDY

The key objective of the study is to assess the current and future economic impacts of the activities and developments with respect to the IGIA, Delhi with 2014-15 as the base year. Specifically, it aims to:

1. Assess the of economic impact of IGIA, Delhi on the national economy in terms of:
    a. Output
    b. Income (Gross Value Added (GVA)), and
    c. Employment
2. Estimate the economic impact of IGIA, Delhi on the national economy along the future path of about 10 years including income (value added) and employment patterns.
3. Provide a qualitative assessment of the potential opportunities for interaction between IGIA, Delhi and the infrastructure of the city for facilitating greater contribution to the national and regional economies.

1.3 SCOPE OF THE STUDY

1. Qualitative assessment of the growth of Delhi and the National Capital Region (NCR) and its interaction with the growth of IGIA, Delhi.
2. Study of developments at IGIA, Delhi since its development and modernisation with respect to the following to facilitate an economic impact analysis:
    i. Passenger traffic and profile;
    ii. Cargo operations;
    iii. Government departments (CISF, Customs, Immigration, Airport Authority, Defence, etc.);
    iv. Scheduled passenger airlines;
    v. General aviation operators;
    vi. Freight handlers;
    vii. Retailers;
    viii. Metro operation;
    ix. Car rentals;
    x. Car parking operators;
    xi. Other commercial providers;
    xii. Hotels;
    xiii. Ground passenger transport operators;

xiv. Airport service providers; and

xv. Other commercial property development.

3. Assessment of the economic impact of the IGIA, Delhi at the national levels as of 2014-15 in terms of direct and indirect benefits pertaining to employment generation and contribution to income.
4. Long-term projection of economic impact of the IGIA, Delhi at the national level over the next 10 years.

1.4 STRUCTURE OF THE REPORT

This report is organised as follows: Chapter 2 outlines the methodology for the study, and application of the input-output analysis. Chapter 3 discusses the economy of Delhi and the National Capital Region (NCR), which is driving the demand at IGIA, Delhi. Chapter 4 presents a snapshot of IGIA, Delhi and its performance. An assessment of the economic contribution of IGIA, Delhi, is presented in Chapter 5. Chapter 6 covers the economic contribution of IGIA, Delhi at the 2025-26 horizons. Chapter 7 presents the results of the passengers' survey at IGIA, Delhi; and Chapter 8 summarises the key findings of the study.

Chapter 2

Methodology

2.1 INTRODUCTION

In an increasingly globalised world airports form major part of a country's infrastructure system that foster economic activities by providing fastest possible connectivity among cities and countries. Airports act as gateways for international commerce and tourism and generate employment. In fact, as a bi-directional process, systems of airports have also helped rapid globalisation by mediating movements of people and goods in growing volumes and in shorter times. Modern airports are no longer places where planes just take off and land but have evolved into major business enterprises with spatial impacts and functional implications that extend deep into both metropolitan and rural areas.

A large airport generates thousands of jobs directly and thousands more via forward and backward linkages. In a study done by Jan Brueckner to find the connection between airline passengers and regional employment growth, it has been found a 10-per cent increase in passengers generates a one per cent increase in regional employment, and even contributed to the increase in knowledge and service-based businesses (Brueckner 2003)[4].

Given the objectives and scope of the study outlined in Chapter 1, the methodology used for assessment of the economic impact of IGIA, Delhi is presented in this chapter.

2.2 CHANNELS AND TYPE OF ECONOMIC IMPACT OF THE AIRPORT

The airports have multi-faceted impact on the economy in terms of direct, indirect, and induced and catalytic effects on production, income, and employment.

<u>Direct impacts</u> result from activities, employment and income that is wholly or largely related to airport operations or usage of the services provided by the airport, either on site or in the surrounding area.

<u>Indirect impacts</u> are in the form of flow of second order effects on account of backward linkages of the direct effects on rest of the economy in terms of output, employment and income, which are generated in other sectors of the economy.

<u>Induced impacts</u> arise out of circulation of factor income through consumer spending of the direct and indirect income generated from airport related activities. Many researchers prefer to include this effect also in the total impact assessment of the airport activities.

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[4] Brueckner, Jan (2003). Airline Traffic and Urban Economic Development, Urban Studies 40(8): 1455-1469.

The catalytic impacts can be visualised in the form of spill-over effects and accelerators in activities such as increases in inward tourism, and overall improvement in performance/productivity of the supply-side of the economy including impacts on investment, trade, and connectivity around the precincts of the airport. Independent quantification of such effects is rather difficult. However, it can be argued that catalytic effects would have been captured in the induced effect itself.

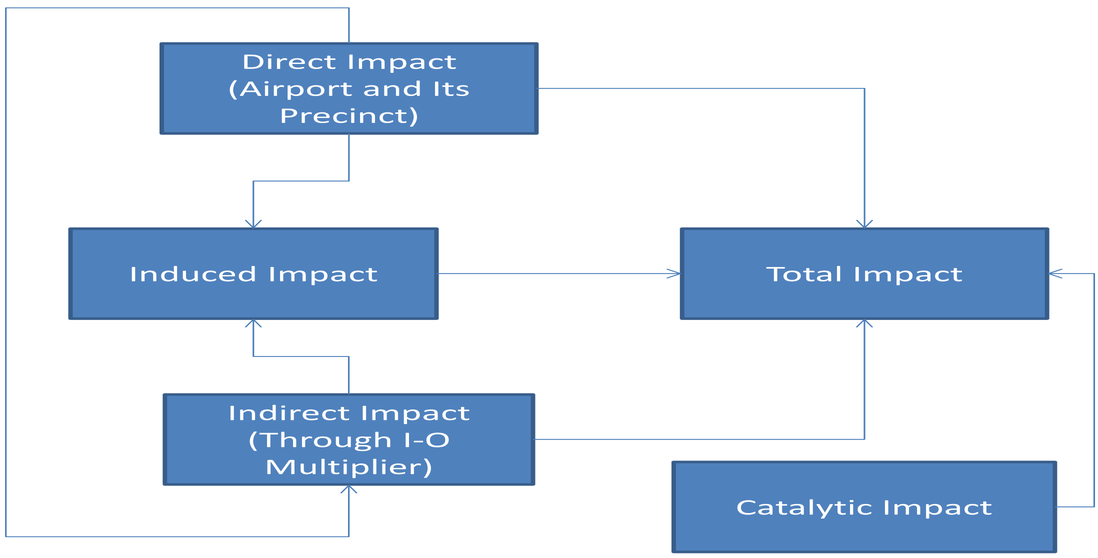
Therefore, for the purpose of this study two types of impact models are used to estimate the economic impact of IGIA, Delhi and the same are discussed and presented below.

- Type-I impact model: where direct and indirect impacts are considered for multiplier effect and
- Type-II impact model: where direct, indirect and induced impacts are considered for multiplier effect.

The two impacts are estimated using two separate sets of multipliers, which may be called Type-I multipliers and Type-II multipliers. Type-II multipliers are much higher than the Type-I multiplier and they incorporate those effects that are generally captured in social accounting matrix.

While capturing various effects of airport on the economy, care needs to be taken to avoid double counting of flows. A broad-based schematic diagram of impacts is presented in Figure 2.1.

FIGURE 2.1: SCHEMATIC DIAGRAM OF IMPACT ASSESSMENT FOR AIRPORT



Measurement of direct economic impacts requires collating financial and employment data for all the existing establishments whose activities are linked to the airport including airport authority, airlines, air traffic controllers, freight companies, retailers, government agencies, facilitators of movement of passengers and cargo, and other tenants. Details of income and employment of these activities are not readily available in government statistics. Therefore, data needs to be generated from primary survey, interviews, secondary sources and desk based research on extant literature. The current study therefore, involves extensive exercise of identification and listing of income generating activities both at the airport and away from airport which are directly linked to the activities at airport like freight forwarding, travel agency, city connectivity, etc. The data has been collected using structured instruments and interaction with the officials of DIAL, government agencies and other stake holders, secondary data sources, and primary survey at the airport and in the surrounding areas. Primary survey has been carried out for passengers, shop owners, agencies and establishments with different degree of success. A complete list of establishments and agencies were prepared to obtain the sample and population for the survey. Attempt was made to collect Information broadly on:

- Activity
- Employment
- Revenue
- Expenditure
- Salary and wages
- Other costs, etc.

Profiling of air passengers has been done based on interview of 3500 respondents.

2.3 APPLICATION OF INPUT-OUTPUT TABLE

There are several agencies involved in commercial activities linked to airports. These activities are located within the airport premises as well as outside and many of them are spread across entire country. Therefore, airports have economy wide effects through activities such as air transport, hotels, retail/concessionaires, cargo, freight forwarders, truckers, taxis and commercial property development within the premise of the airport and/or outside. Services at the airport also play a role in attracting tourists to the city, and in attracting investment and trade. Capturing the economic benefits of an airport therefore, requires a general framework which could link entire activities of the economy with the operations related to airport and capture the multiplier effects of production and supply of services.

Given the scope of the study, the input-output (I-O) framework has been considered as an appropriate approach to provide an assessment of the multiplier effects. Several studies mentioned in Chapter 1 and also studies by the International Civil Aviation Organization (ICAO) have used this framework for analysing economic impact of airports through multipliers.

Input-output tables present typical structure of the economic activities for the entire economy in terms of flows of inputs in production process across all sectors. These tables are prepared by central Statistical Organisation (CSO) at an interval of five years and often with a delay of 2-3 years. However these are very useful in generating multiplier effects of demand on one sector over the output of other sectors besides own effects. For this study the input-output table corresponding to 2013-14 has been prepared taking advantage of latest available supply use tables, and estimates provided in national account for 2013-14.[5]

A typical I-O table has a structure as presented in Table 2.1. The columns represent user industry and it has three sections namely intermediate user sectors, final user sectors and total output. The rows also have three sections namely producing sectors, value added and output. The user and producer section is square

[5] Singh, Kanhaiya and M.R. Saluja 2016. Input Output Table for India: 2013-14, Working Paper WP111, National Council of Applied Economic Research, New Delhi. URL: http://www.ncaer.org/publication_details.php?pID=274.

matrix and represent industrial activity. The column sums are equal to row sums so that total output is equal to total use.

TABLE 2.1: SIMPLIFIED METHODOLOGY: I-O FRAMEWORK

Supply from i^{th} industry	Intermediate uses (Uses in jth industry)			Final uses			Total Output
	Ind-1	Ind-2	Ind-n	PFCE	Other Final Use	Net Final Demand	
Ind-1	F_{11}	F_{12}	F_{1n}	C_1	G_1	Y1	X1
Ind-2	F_{21}	F_{22}	F_{2n}	C_2	G_2	Y2	X2
Ind-n	F_{31}	F_{32}	F_{3n}	C_3	G_3	Y3	X3
Value Added	V1	V2	Vn				
Value of Output	X1	X2	Xn				

Net Final demand = PFCE + GFCE + GFCF+ CIS + Net Export; GFCE: Government Final Consumption Expenditure; PFCE: Private Final Consumption; CIS: Change in stock; GFCF: Gross Fixed Capital Formation.

The input-output analysis starts with the calculation of input-output coefficients by dividing each entry of the I-O table by the corresponding column total. For the industry section of the table the input-output coefficient is a square matrix "A" which is used to estimate various multipliers as shown in equations (1) to (3).

(1) $X_i = \sum_{j=1}^{n} F_{ij} + Y_i$; $a_{ij} = \frac{F_{ij}}{X_j}$

(2) A = $\begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ & \cdots & a_{nn} \end{bmatrix}$

(3) AX + Y = X; X = $(I-A)^{-1}$ Y

"A" being the input-output coefficient matrix, which when subtracted from an identity matrix "I", then the resulting (I-A) matrix is known as Leontief matrix and $(I-A)^{-1}$ is the Leontief inverse matrix. Using the Leontief inverse matrix, various multipliers can be obtained like output multiplier, employment multiplier and income multiplier, which give estimates of direct and indirect effects resulting from change in final demand of a sector. These multipliers are referred as Type I multipliers as mentioned earlier. The Leontief inverse $(I-A)^{-1}$ itself presents output multiplier matrix as it reflects the direct and indirect requirements for domestic intermediates for one unit of final demand.

The Type-II multipliers are obtained by endogenizing value added and including the final consumption expenditure into the "A" matrix. When personal consumption expenditure and its corresponding counterpart, value added, is endogenized, value added becomes the source of revenue to finance final consumption expenditures of the household sector.

2.3.1 MEANING AND DEFINITIONS OF BASIC MULTIPLIERS

If the final demand of a particular product increases, there will be an increase in the output of that product to meet the increase in demand. This is known as direct effect. However, as producers need to increase their output, they would also need more inputs, therefore, there will also be an increase in demand for other sectors acting as inputs from their suppliers. This process goes on over the entire supply chain of the production system. This is known as indirect effect. This chain of events leads to increase in total production in the economy, which is more than the initial change in the final demand that triggered the chain of event, thus, giving rise to multiplier effect. These multipliers are very useful in assessing the impact of slew of economic activities taking place at the airport and outside airport related to airport operations.

OUTPUT MULTIPLIER

The column sum of the inverse matrix can be interpreted as output multiplier which reflects the cumulative revenues of the economy which are generated due to chain of flows of the output of one sector to other sector as input for that sector and so on. For example, if the output multiplier of jth sector is 2.5 then the increase of 1 unit in the final demand for this industry translates into cumulative revenues of 2.5 units in the economy.

EMPLOYMENT MULTIPLIER

The direct employment effect of one unit increase in final demand in sector j is obtained from j^{th} sector's employment to output ratio or employment coefficient. The total employment change per unit change of final demand in a sector j is estimated by multiplying the row vector of the employment coefficient with the Leontief Inverse matrix (M_{ij}).

INCOME MULTIPLIER

The direct income effect of one unit increase in final demand in sector 'j' is obtained from j^{th} sector's income (GVA) to output ratio or income coefficient. The total income change per unit change of final demand in sector 'j' is estimated by multiplying the row vector of the income coefficient with the Leontief Inverse matrix (M_{ij}).

2.4 SOURCES OF DATA

Estimation of economic impact for an airport is a complex process and large quantity of data is required for assessment of direct, indirect and induced effects. The preparation of appropriate I-O table also requires handling large data. These data are sourced from number of datasets and documents which is presented below.

1. Activity wise output and employment has been collected/estimated with respect to various activities at the IGI Airport with the help of DIAL.

2. Balance-sheet and P/L accounts of DIAL have been used to estimate output of revenue sharing enterprises.

3. Secondary data on National Accounts, I-O framework, Employment- Unemployment surveys, Consumption, etc. has been collected and used.

4. Data from Airport Authority of India (AAI) and Director General of Civil Aviation (DGCI) documents have been collated and used.

5. Data has also been collected through survey of passengers and enterprise. About five types of questionnaires were used to collect data.

6. Data and reports from international agencies such as International Civil Aviation organization (ICAO), Airports Council International (ACI), and International Air Transport Association (IATA) have been collated from their websites.

2.5 LIMITATIONS

Although I-O framework is one of the most comprehensive methods for capturing an economy-wide impact, like any other economic analysis, it faces limitations on account of several factors. Some of these include data availability, exact classification of activities and treatment of import contents in inputs. In view of the non-availability of adequate information, some approximations cannot be avoided.

Chapter 3

Delhi and the National Capital Region: Ensuring a Robust Demand for IGIA, Delhi

The development and growth of the National Capital Region (NCR) and IGIA, Delhi are interdependent. The international and national connectivity provided by IGIA, Delhi has helped the region in assuming centre-stage with respect to business development in North India. On the other hand, the prosperous population of the region has ensured sufficient demand for air travel at the airport to enable it to undertake its expansion and modernisation plans and attempt to become a truly world class airport.

3.1 DELHI IN LEAGUE WITH WORLD CITIES

Delhi, the national capital territory (NCT) of India, is a large city state that serves as hub for the broader development of contiguous region surrounding it. It is also one of the fastest growing states of India in terms of income as well as population. With an estimated population of 18.4 million in 2016, Delhi has occupied the position of fifth most populous city in the world and the largest city in India. Delhi is also one of the richest cities of India and it is home of second largest number of high net worth individuals (HNWI-individuals with net assets of USD 1 million or more) of India.

According to the Asia Pacific 2016 Wealth Report, India is home to the fourth largest population of millionaires in the Asia Pacific region, with 2.36 lakh such high net worth individuals, and a large share of these individuals reside in Delhi and Mumbai. In terms of number of multi-millionaires (individuals with net assets of US$ 10 million or more), Hong Kong topped the list with 9,650 such individuals, while Mumbai was ranked at the eighth place with 2,690 super-rich people and Delhi was placed at the 14th place with 1,340 such individuals.[6]

'Foreign Policy' in its issue of August 7, 2012 published a special report in partnership with the McKinsey Global Institute on 'the Most Dynamic Cities of 2025' looking at the 75 powerhouses of the coming urban revolution. In this report the cities are ranked according to the likely (forecasted) quantum of absolute addition of income (gross domestic product in billion US$) between 2010 and 2025 (Table 3.1). Delhi has been ranked as 39th most dynamic city of the world with likely addition of GDP of the order of 164 billion US$. Delhi leads Mumbai and Bangalore, which are ranked 53rd and 75th respectively.

[6] http://www.thehindu.com/business/mumbai-delhi-among-top-asia-pacific-cities-for-millionaires-asia-pacific-2016-wealth-report/article8147669.ece. Accessed: 13-10-2016.

TABLE 3.1: MOST DYNAMIC CITIES OF 2025

Rank by amount of Growth (US $)	City	Country	GDP (billions of U.S. dollars)			
			2010	2025	Total Growth	% Growth over 2010
1	Shanghai	China	251	1112	862	344%
2	Beijing	China	206	1028	822	398%
3	Tianjin	China	129	624	496	385%
4	São Paulo	Brazil	437	913	476	109%
5	Guangzhou	China	146	573	427	292%
6	Shenzhen	China	142	524	382	270%
7	New York	United States	1180	1553	373	32%
8	Chongqing	China	89	459	370	418%
9	Moscow	Russia	326	689	363	111%
10	Tokyo	Japan	1875	2219	344	18%
39	**Delhi**	**India**	**48**	**211**	**164**	**344%**
53	Mumbai	India	56	193	137	245%
75	Bangalore	India	29	129	100	350%

Source: http://foreignpolicy.com/2012/08/07/the-most-dynamic-cities-of-2025/.

Besides Delhi being capital of India; it has rich and very proud history with several world heritage monuments, museums, art galleries, architectural wonders, and bustling markets spread all across city. Delhi is centre of national and international politics, economic and social discourses and an effective learning/education centre. It is also home of embassies and conciliates of all countries spread across beautifully planned diplomatic zones marked with lush green lawns, wide roads and trees.

As a result, Delhi alone receives about 2-2.5 million international tourists every year. With the introduction of e-VISA and VISA on arrival facilities, Delhi has been on forefront of travelers availing these facilities. The IGIA, Delhi with its modern look and excellent ambience presents face of Indian Tourism. In recent years IGIA, Delhi has been marked as one of the fasted growing airports in terms of passenger movement as well as aircraft movement (Table 3.2). In 2015 the IGIA, Delhi acquired 25th position in top airports of world in terms of movement of passengers (Table 3.2).

TABLE 3.2: TOP 25 AIRPORTS RANKED BY TOTAL PASSENGERS

Top 25 airports ranked by total passengers, 2015								
Rank No.	City	Airport	Passengers embarked and disembarked (million)[1]			Aircraft movements (000)[2]		
			2015	2014	Growth (%)	2015	2014	Growth (%)
1	Atlanta, GA	Hartsfield-Jackson Atlanta International	101.5	96.2	5.5	882	868	1.7
2	Beijing	Beijing Capital International	89.9	86.1	4.4	590	582	1.4
3	Dubai	Dubai International	78.0	70.5	10.7	407	357	13.9
4	Chicago, IL	O'Hare International	77.0	70.0	9.9	875	882	-0.8
5	Tokyo	Tokyo International (Haneda)	75.6	72.8	3.8	439	426	2.9
6	London	Heathrow	75.0	73.4	2.2	474	473	0.2
7	Los Angeles, CA	Los Angeles International	74.9	70.7	6	656	637	2.9
8	Hong Kong	Hong Kong International	68.5	63.1	8.5	406	391	3.8
9	Paris	Aero port de Paris-Charles de Gaulle	65.8	63.8	3.1	476	471	1
10	Dallas/Fort Worth, TX	Dallas-Fort Worth International	64.2	63.6	1	681	680	0.2
11	Istanbul	Istanbul Ataturk International	61.3	56.7	8.1	447	440	1.6
12	Frankfurt	Flughafen Frankfurt/Main	61.0	59.6	2.5	468	469	-0.2
13	Shanghai	Pudong International	60.1	51.7	16.3	449	402	11.7
14	Amsterdam	Amsterdam	58.3	55.0	6	466	453	2.8
15	New York, NY	John F. Kennedy International	56.8	53.3	6.7	439	422	4
16	Singapore	Singapore Changi	55.4	54.1	2.5	351	347	1.2
17	Guangzhou	Guangzhou Bai Yun International	55.2	54.8	0.8	410	412	-0.6
18	Jakarta	Soekamo Hatta	54.1	57.2	-5.5	380	391	-2.8
19	Denver, CO	Denver International	54.0	53.5	1	548	566	-3.2
20	Bangkok	Suvarnabhumi International	52.4	46.4	12.8	320	294	8.8
21	San Francisco, CA	San Francisco International	50.1	47.1	6.2	430	432	-0.5
22	Incheon	Incheon International	49.4	45.7	8.2	308	293	5.2
23	Kuala Lumpur	KL International	48.9	48.9	0	353	341	3.6
24	Madrid	Aeropuerto de Adolfo Suarez Madrid-Barajas	46.8	41.8	11.8	367	343	7
25	New Delhi	Indira Gandhi International	46.0	39.8	15.7	349	324	7.9
		Total	1580.2	1495.7	5.6	11970	11695	2.4
1. Revenue and non-revenue air carrier passengers and passengers in direct transit; scheduled and non-scheduled services. 2. All aircraft Movements (commercial and non-commercial).								

Source (basic data): ICAO Annual Report 2015.

3.2 DELHI AND NATIONAL CAPITAL REGION (NCR)

Delhi has been experiencing phenomenal growth of population for several decades due to migration into the city not only from the adjacent states but also from other states such as Bihar. With population density of over 29,000 people per square mile, it is one of the most densely populated cities of the world. Given the scarcity of land, housing, transportation and problems of management of essential infrastructure like water supply and sewerage, adjacent urban areas of adjoining states have become satellite cities of Delhi. These satellite cities are now structured part of greater Delhi known as national capital region (NCR) and they share common and seamless infrastructure planned and developed under the auspices of NCR Planning Board (NCRPB), constituted under the NCRPB Act, 1985 with the key rationale to promote balanced and harmonized development of the region. NCR includes entire national capital territory of Delhi, thirteen districts of state of Haryana, seven districts of state of Uttar Pradesh and two districts of state of Rajasthan, with the Nation Capital as its core (Figure 3.1). [7] This means NCR constitutes of 33 districts out of 687 district of India.

FIGURE 3.1: NATIONAL CAPITAL REGION (NCR)

Sub-Region	Name of the Districts
Haryana	Faridabad, Gurgaon, Mewat, Rohtak, Sonepat, Rewari, Jhajjhar, Panipat, Palwal, Bhiwani, Mahendragarh, Jind and Karnal (**thirteen districts**).
Uttar Pradesh	Meerut, Ghaziabad, Gautam Budha Nagar, Bulandshahr, Hapur, Baghpat and Muzaffarnagar (**seven districts**).
Rajasthan	Alwar and Bharatpur (**two districts**).
Delhi	Entire NCT-Delhi.

Source: http://ncrpb.nic.in/ncrconstituent.php.

3.2.1 Distribution of Population among sub-regions of National Capital Region

According to the 2011 census, out of 377.11 million urban population of India, 31.5 million lived in NCR, which included 16.37 million people living in the national capital territory (NCT), just a little over half of the NCR population (Table 3.3). Similarly, out of 133.15 million urban workers of India, 10.32 million urban workers are engaged in NCR. It may be noted that districts falling under NCR including those of NCT, constitute just about 4.8 per cent of districts of India, while they carry 8.35 per cent urban population and 7.75 per cent urban workers of India (Figure 3.2). This reflects on the enormity of population and worker density of NCR that is dependent on IGIA, Delhi for air travel.

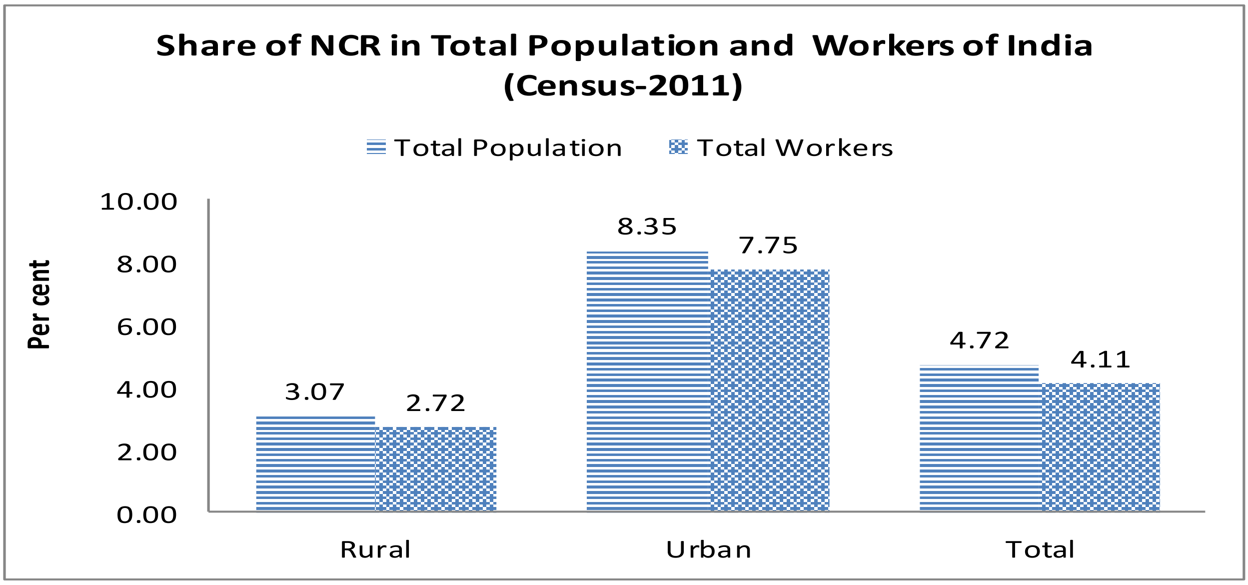
[7] ***Source***: http://ncrpb.nic.in/ncrconstituent.php.

TABLE 3.3: POPULATION AND NUMBER OF WORKERS IN NCR REGION AS PER 2011 CENSUS

Population (million)			
Region	Rural	Urban	Total
Total India	833.46	377.11	1210.57
Total NCR	25.62	31.50	57.11
Of which			
NCT-Delhi SUB-REGION	0.42	16.37	16.79
Rajasthan SUB-REGION	5.07	1.15	6.22
Uttar Pradesh SUB-REGION	10.49	8.23	18.72
Haryana SUB-REGION	9.63	5.75	15.38
Workers (million)			
Total India	348.60	133.15	481.74
Total NCR	9.47	10.32	19.79
Of which			
NCT-Delhi SUB-REGION	0.13	5.46	5.59
Rajasthan SUB-REGION	2.41	0.37	2.78
Uttar Pradesh SUB-REGION	3.46	2.61	6.06
Haryana SUB-REGION	3.47	1.89	5.36

Source (Basic data): Census 2011 and definitions of NCR planning Board.

FIGURE 3.2: SHARE OF NCR POPULATION AND WORKERS IN TOTAL POPULATION AND WORKERS OF INDIA

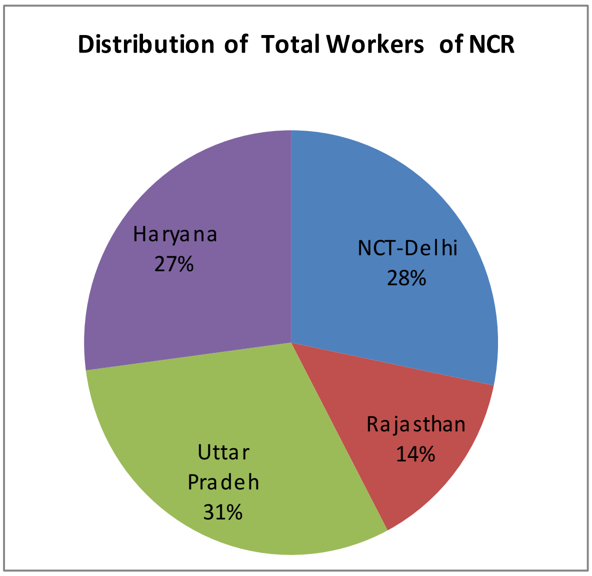


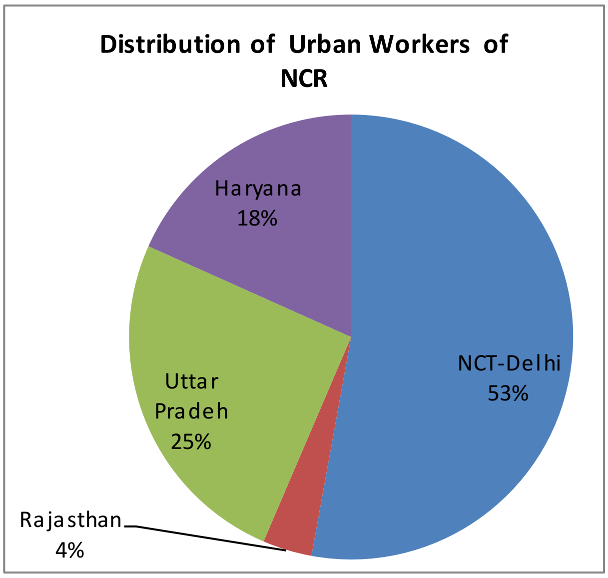
3.2.2 Distribution of Workers among the Sub-regions of NCR

Distribution of workers across its sub-regions can provide a good idea about the distribution of industrial and commercial activities across NCR. However, because of their higher income and purchasing capacity, it is important to look at the urban workers rather than total workers. Figure 3.3 shows that with 53 per cent share in urban workers NCT plays dominant role in commercial activity, which is followed by Uttar

Pradesh at 25 per cent. However, when both the rural and urban population is considered, the districts of Uttar Pradesh dominate, accounting for about a 31 per cent share of the workers.

FIGURE 3.3: DISTRIBUTION OF NCR POPULATION AND WORKERS AMONG STATES FORMING PART OF NCR





3.2.3 NCR Population by 2021

NCR is one of the fasted urbanising regions of India; it is projected that the population of NCR would cross 64 million by 2021. Based on the projections and policies given in the Regional Plan-2021 for NCR, it is expected that the population of the NCT-Delhi sub-region would be 23 million by 2021. The rest of the population would be absorbed in the other three sub-regions. The Uttar Pradesh sub-region would contribute about 20 million, the Haryana sub-region would have population of about 16 million, and the Rajasthan sub-region would account for a population of about five million.[8]

3.3 REGIONAL ECONOMY AND ITS SYNERGY WITH IGIA, DELHI

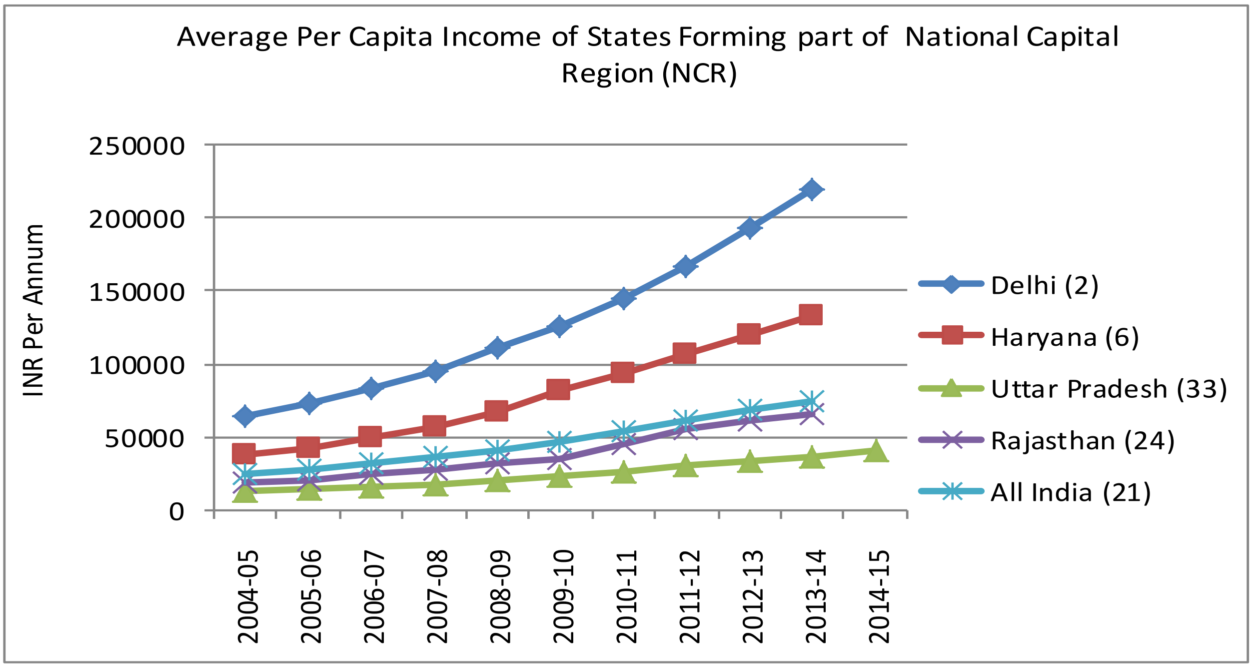
As mentioned earlier, the development and growth of NCR and the growth of IGIA, Delhi are interdependent. This calls for a brief review of the income and growth prospects of the region along with a study of the international and national connectivity provided by the IGIA, Delhi. These aspects of synergy development have been discussed in this section.

[8] ***Source***: http://ncrpb.nic.in/ncrconstituent.php.

3.3.1 NSDP Growth and Income of Delhi and its Neighbouring States

NCT and Haryana, two of the major states linked to NCR, are ranked second and sixth, respectively, in terms of the per capita income of 2013-14 (Figure 3.4 and Table 3.4). They are also among the fastest growing states of India in terms of real net state domestic product (NSDP) (Table 3.5). On the other hand, Uttar Pradesh and Rajasthan have per capita incomes below the all-India average (Figure 3.4). However, it may be noted that the districts of Uttar Pradesh and Rajasthan covered under NCR are among the richest districts of these states. As a result, the per capita annual income of the NCR is INR 1.35 lakh, which is almost twice that of the all India average (Figure 3.5).

FIGURE 3.4: AVERAGE PER CAPITA INCOME (NSDP) OF NCT AND THE NEIGHBOURING STATES FORMING PART OF NATIONAL CAPITAL REGION



Source (Basic data): Reserve bank of India.

TABLE 3.4: PER CAPITA INCOME GROWTH OF DELHI AND STATES FORMING PART OF NATIONAL CAPITAL REGION

States	NSDP per capita (Current) INR		CAGR (2004/05 – 2013/14 (per cent)
	2004-05	2013-14	
Delhi	63877	219979	14.7
Haryana	37972	133427	15.0
Uttar Pradesh	12950	36250	12.1
Rajasthan	18565	65974	15.1
All States	24143	74380	13.3

Source (basic data): RBI.

TABLE 3.5: ECONOMIC GROWTH OF DELHI AND STATES FORMING PART OF NATIONAL CAPITAL REGION

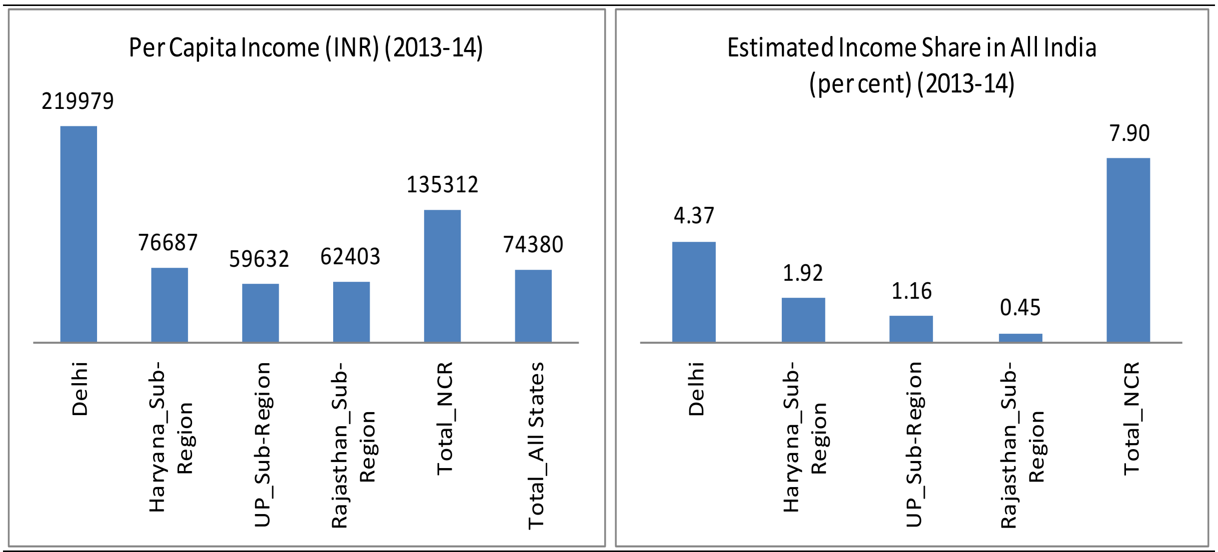
States of National Capital Region	NSDP (Constant) INR crore		CAGR (2004/05 – 2013/14 (per cent)
	2004-05	2013-14	
Delhi	94717	208368	9.2
Haryana	86222	178307	8.4
Uttar Pradesh	231029	403509	6.4
Rajasthan	112636	224632	8.0
All States	2494382	4952045	7.9

Source (basic data): RBI.

3.3.2 Contribution of NCR to the National Domestic Product

Estimates for 2013-14 indicate that NCR contributes about 7.9 per cent of the national income. Out of this, about 4.37 percentage points (55 per cent of NCR NSDP) are contributed by NCT, followed by 1.92 percentage points (24 per cent of NCR NSDP) by the Haryana sub-region and 1.16 percentage points (15 per cent of NCR NSDP) by the Uttar Pradesh sub-region and 0.45 percentage point (about 6 per cent of NCR NSDP) by the Rajasthan sub-region (Figure 3.5).

FIGURE 3.5: ESTIMATES OF PER CAPITA INCOME (NSDP AT CURRENT PRICE) OF THE SUB-REGIONS OF NCR AND CONTRIBUTION OF SUB-REGIONS IN NATIONAL INCOME FOR THE YEAR 2013-14



Source (basic data): CSO and RBI.

The development of NCR is broad-based with the economic activities taking place here ranging from industry to value added services. Delhi is a prime trading centre of the country, while the entire NCR is a major tourist attraction (Table 3.6). The states of Uttar Pradesh, Rajasthan, and Haryana, along with Delhi, attracted almost 32.4 per cent of the international tourists visiting India during 2014-15. These states thus became the top 10 tourist states of India during this period.

NCR is also known to have some of the best centres of higher education, which make this region more attractive for the development of the services sector, leading to higher growth of income.

TABLE 3.6: CONTRIBUTION OF DELHI AND STATES FORMING PART OF NCR TO TOURISM SECTOR OF INDIA

Top 10 States/UTs of India in Number of Foreign Tourist Visits in 2014			
Rank	**State/UT**	**Foreign Tourist Visits in 2014**	
		Number	**Percentage Share (%)**
1	Tamil Nadu	4657630	20.6
2	Maharashtra	4389098	19.4
3	Uttar Pradesh	2909735	12.9
4	Delhi	2319046	10.3
5	Rajasthan	1525574	6.8
6	West Bengal	1375740	6.1
7	Kerala	923366	4.1
8	Bihar	829508	3.7
9	Karnataka	561870	2.5
10	Haryana	547367	2.4
	Total of Top 10	20038934	88.8
	Others	2528716	11.2
	Total	22567650	100
	NCR States		**32.4**

Source (basic data): India Tourism Statistics at a glance 2014.

3.3.3 Air Connectivity of NCR

The development of NCR has been greatly enhanced by regular projects of infrastructure development, connectivity with the rest of India, and industrialisation. A number of existing and proposed developments, such as extension of the Delhi Metro throughout NCR, construction of expressways connecting Delhi NCR to other parts of the region, the Delhi-Mumbai Industrial Corridor and Dedicated Freight Corridor, and the development of Special Economic Zones (SEZs) are expected to have a significant impact on the economy of NCR.[9]

During recent years, the growth and development of Delhi and NCR as a whole has also greatly benefited from modernisation of the IGIA, Delhi. The passenger flow at the airport is more than three times the population of the capital territory.

The airport has brought much-needed high speed connectivity with the domestic and global economies in terms of both passenger movement as well as cargo movement. Supported by other policies such as the granting of e-visas to tourists, and increasing ease of doing business, the airport has helped NCR in increasing tourists, investment, ideas and businesses. The phenomenal growth of

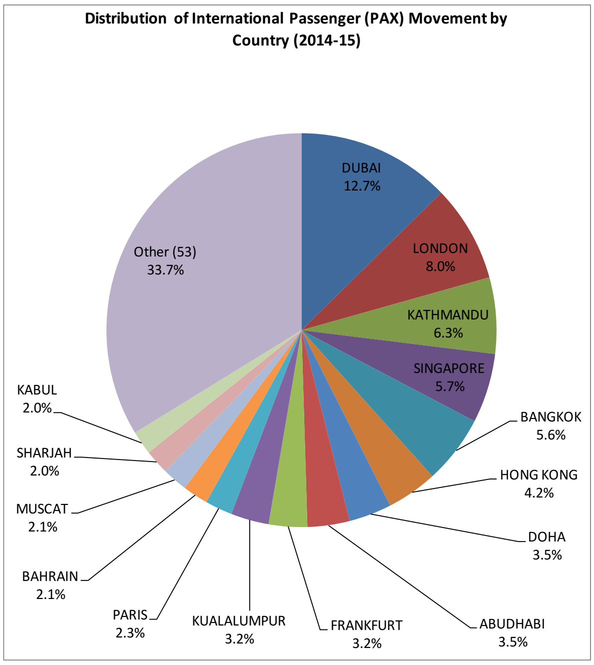
[9] Economic Profile of NCR 2015, NCRB
http://ncrpb.nic.in/pdf_files/Final%20Report%20of%20study%20of%20economic%20profile_17122015.pdf.

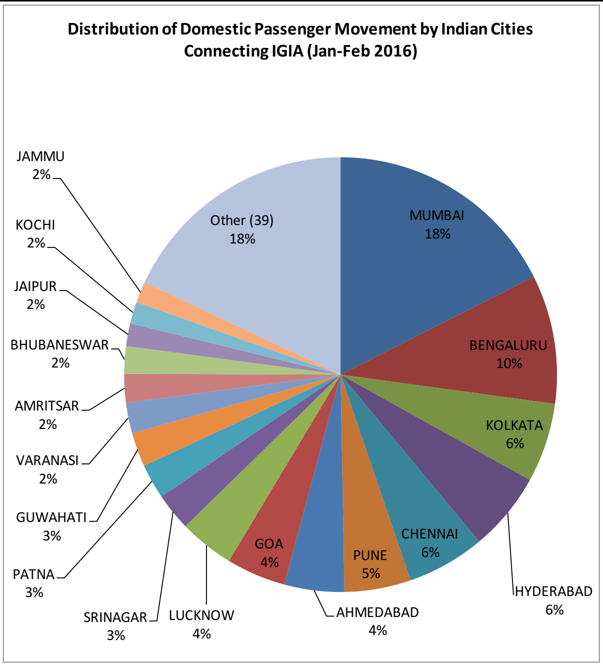
the adjoining regions of Haryana and Uttar Pradesh can be attributed to the international and domestic connectivity provided by the IGIA, Delhi.

During 2015-16, IGIA, Delhi provided air connectivity to more than 14.15 million international passengers (arrivals and departures) involving 68 countries and 34.27 million domestic passengers from 57 Indian cities.

Among international cities top fifteen cities in terms of volume of passengers movement include Dubai, London, Kathmandu, Singapore, Bangkok, Hong Kong, Doha, Abu Dhabi, Frankfurt, Kuala Lumpur, Paris, Bahrain, Muscat, Sharjah, and Kabul, which constituted about 64 per cent of passengers (Figure 3.6).

FIGURE 3.6: AIR CONNECTIVITY OF DELHI WITH INTERNATIONAL AND DOMESTIC CITIES.





Source (Basic data): DGCA.

On the domestic front, IGIA, Delhi provides air connectivity with 57 cities in the country. Most recent data on city-pair traffic shows that the distribution of city-pair movement of domestic passengers is not as broad-based as is the distribution of international traffic. Mumbai and Bengaluru, together form about 28 per cent of passenger traffic. Nearly 18 cities together form 72 per cent of the total traffic (Figure 3.6). This indicates the dominance of certain business centres, which drive domestic air traffic in India. Among these business centres Delhi enjoys highest air traffic movement among all of them.

3.3.4 Airborne International Trade

Air transport provides fastest business connectivity for light weight products with high value. Therefore, a vibrant air cargo at city airport helps in bringing critical advantage to the commercial sector of economy. The air cargo facility at IGIA, Delhi has been leading performer among major airports of India namely Mumbai, Bangalore, Kolkata, Chennai, Hyderabad, Kochi, and Ahmedabad.

According to the DGCI&S data of 2015-16, the value of airborne export and import from IGIA, Delhi was INR 62397 crore and INR 193506 crore respectively (Table 3.7). In terms of share of exports and imports from major airports of India, Delhi contributes 25.9 per cent of export and 38.7 per cent of imports. For 2015-16, total trade through IGIA, Delhi in value terms is of the order of INR 255903 crore, which is about 34.5 per cent of total trade through all major airports of India (Table 3.7). This is very impressive performance by the IGIA, Delhi in facilitating international trade for the national capital region.

In terms of trade connectivity, the IGIA, Delhi facilitated export to 218 countries and import from 164 countries during 2015-16. However, almost 74 per cent of export and 81 per cent of import is contributed by just about 15 countries (see Figures 3.7 and 3.8 for distribution). Leading countries for airborne export include United Arab Emirates, United States, Germany, United Kingdom, France, Japan, Hong Kong, and Singapore. Major countries involved in Airborne imports by India include China, United States, Switzerland, Ghana, United Arab Emirates, South Korea, United Kingdom, Japan, Vietnam, Hong Kong, and Tanzania.

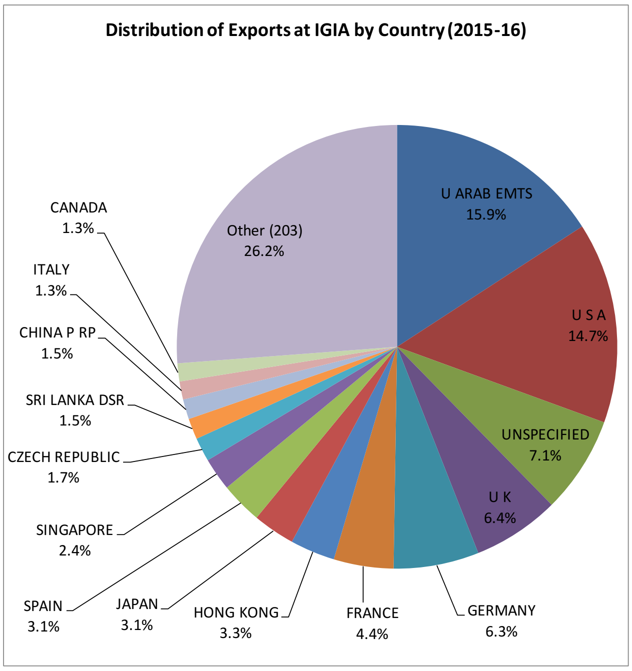
Figures 3.7 and 3.8 also indicate the distribution of products traded by NCR. Commodities that are exported by air freight include readymade garments, gold and other precious material, aircraft and spacecraft and parts etc. (Figure 3.7). On the other hand commodities that are imported through IGIA, Delhi include gold; telecom instruments; AC, refrigeration machinery; electronics components; electric machinery and equipment; electronics instruments etc. (Figure 3.8).

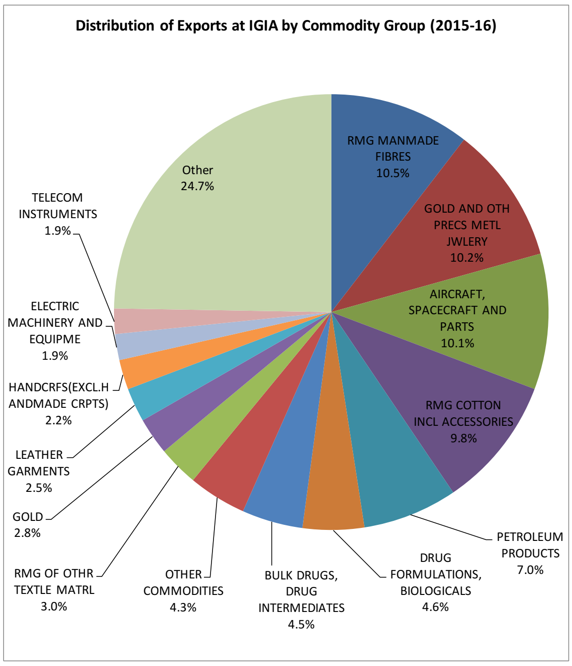
TABLE 3.7: AIR-BORNE INTERNATIONAL TRADE FROM DELHI AND OTHER CITIES

Exports By Air (2015-16)			**Imports By Air (2015-16)**			**Total Trade by Air (2015-16)**		
Airport	**Value (INR Crore)**	**Share (Per cent)**	**Airport**	**Value (INR Crore)**	**Share (Per cent)**	**Airport**	**Value (INR Crore)**	**Share (Per cent)**
BANGALORE	63813	26.4	**DELHI**	**193506**	**38.7**	**DELHI**	**255903**	**34.5**
DELHI	**62397**	**25.9**	MUMBAI	86389	17.3	MUMBAI	145197	19.6
MUMBAI	58808	24.4	BANGALORE	80826	16.2	BANGALORE	144639	19.5
HYDERABAD	22621	9.4	CHENNAI	64179	12.8	CHENNAI	82397	11.1
CHENNAI	18218	7.6	HYDERABAD	29527	5.9	HYDERABAD	52149	7.0
KOLKATA	11963	5.0	AHMEDABAD	22664	4.5	AHMEDABAD	22664	3.1
COCHIN	3472	1.4	KOLKATA	19510	3.9	KOLKATA	31473	4.2
			COCHIN	2861	0.6	COCHIN	6333	0.9
Total	241294	100.0	Total	499460	100.0	Total	740754	

Source (Basic data): DGCI&S.

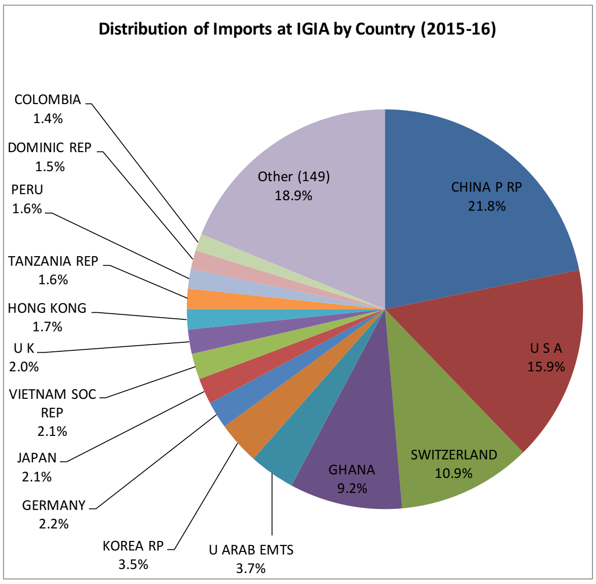
FIGURE 3.7: DISTRIBUTION OF EXPORTS BY COUNTRY AND COMMODITY

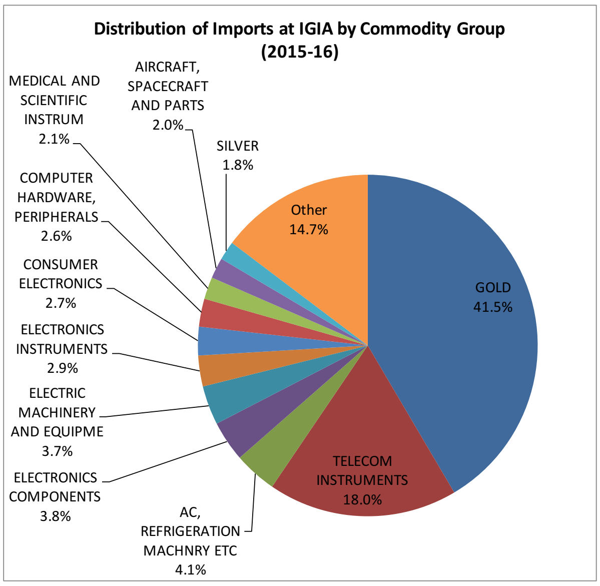




Source (Basic data): DGCI&S.

FIGURE 3.8: DISTRIBUTION OF IMPORTS BY COUNTRY AND COMMODITY





Source (Basic data): DGCI&S.

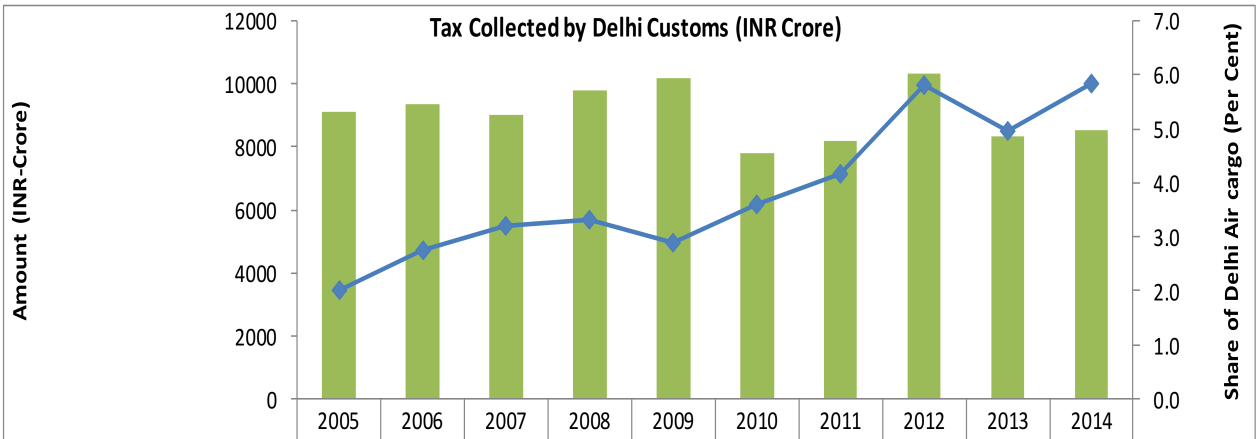
3.3.5 Tax Collection at the IGIA, Delhi

Presence of vibrant airport in the national capital region is also a big source of revenue for government exchequer. There are different sources of revenue for the government. The most important of them is collection of custom duties on imports. During 2014-15 Delhi customs collected INR 10000 crore, which is about five per cent of total customs collected by the government at all India level (Figure 3.9).

Other forms of tax collection include tax deducted as source (TDS) – deducted on payments to vendors, WCT-TDS deducted on payments to vendors, VAT, service tax net on CENVAT credit, income tax paid on income, labour cess. These taxes are collected by DIAL and deposited in government accounts. Annual collection of such taxes depends on business. For the year 2015-16 the amount was in the order of INR 1166 crore (Figure 3.10).

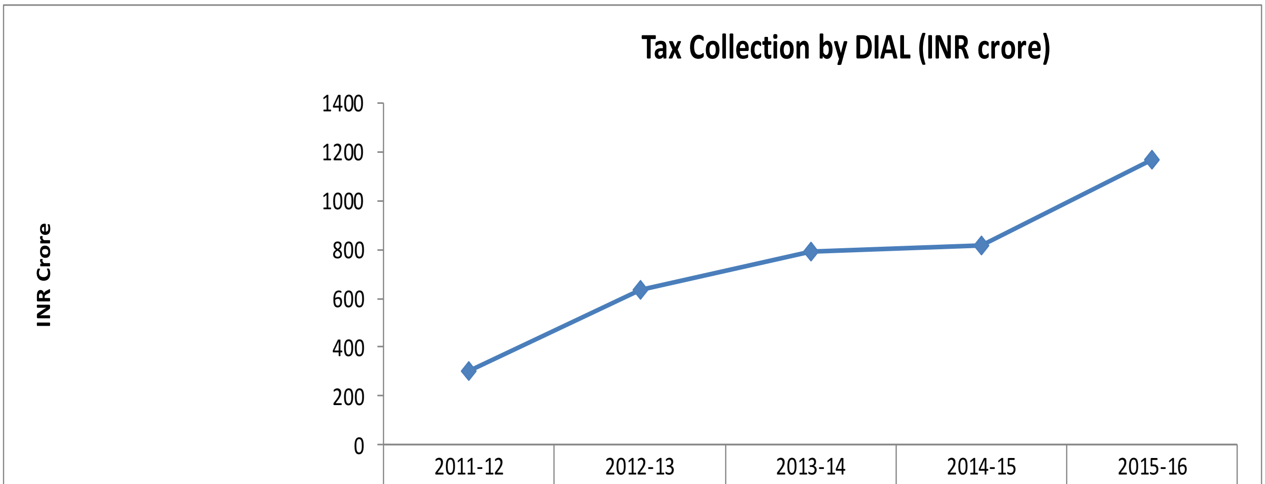
Clearly, collection of large amount of taxes at airport provides justification for the central government as well state government to make further investments to enhance city connectivity and other infrastructure in the area.

FIGURE 3.9: TAX COLLECTED BY DELHI CUSTOMS



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Share of Delhi in all India	5.3	5.5	5.3	5.7	5.9	4.5	4.8	6.0	4.9	5.0
Delhi Air Cargo	3464	4721	5488	5704	4954	6166	7128	9958	8496	10028

FIGURE 3.10: TAX COLLECTED BY DIAL



	2011-12	2012-13	2013-14	2014-15	2015-16
Tax Collection by DIAL (INR crore)	300	632	791	816	1166

3.4 NEED TO IMPROVE CITY TRAFFIC AND LINK TO THE AIRPORT

To sum up, it is clear that there is strong synergy between the performance of Indira Gandhi International Airport of Delhi and the national capital region with Delhi city state as its hub. Both complement each other for overall growth of the region and provide driving force for the development of entire country.

In order to harness the full benefits of this synergy, it is important to have smooth connectivity between NCR and the airport, which seems to be hampered by heavy traffic and congestion on main roads of Delhi. It remains a bottleneck in development of more vibrant synergy between airport and the NCR. Delhi loses a large number of man-hours while commuting between home and office through public transport by road due to the traffic congestion. As on 31st March, 2015, the total number of motor vehicles on road in NCT alone was 8.83 million, which is growing at about six per cent annually. Therefore, serious efforts are needed to accelerate transport and infrastructure projects for developing ring road and outer ring road to encourage uses of public transport in Delhi. Need for expanding mass rapid transit system (MRTS) cannot be overemphasised. Average ridership of Delhi Metro was approximately 24 lakh per day during 2014-15, which is expected to increase to 40 lakh with the completion of Phase – III. Total 187.41 Km length of Metro line has been completed under Phase-I & Phase-II in Delhi and will add another 117.57 KM of Metro rail in Phase III. With completion of all these projects overall connectivity of NCR regions with the airport is likely to improve.

However, infrastructure developments within the precinct of the airport are much better. Construction of a 1.3 kilometres long northern access road with 360 meter tunnel beneath the runway 28 has greatly helped in flow of traffic from the main airport road and NH8 to Terminal 3, but the access to airport road from different areas of NCR needs to be further improved significantly.

Chapter 4

IGI Airport, Delhi: A Snapshot

Indira Gandhi International Airport (IGIA), Delhi is spread over an area of 5106 acres and it is one of the biggest airports in India, acting as the primary civil aviation hub for the national capital region of India. IGIA is situated in Palam, a suburban area in South-West District of Delhi State. It is 15 Km South-West of New Delhi Railway Station and 16 Km from New Delhi City Centre (Connaught Place/ Rajiv Chowk).

4.1 HISTORY

Historically, Delhi has had two airports, namely Safdarjang Airport built around 1930 for civil operations and the Palam airport developed during World war – II for military operations. In 1962, because of space constraints and increasing passenger traffic the entire civil operation from Safdarjang Airport was shifted to Palam, which had much more scope of expansion in terms of area. The passenger traffic until the late 70s was about 12 lakh per year which included about 7 lakh domestic passengers. Air passenger traffic after the 70s witnessed a world-wide growth and reached nearly six million, including 1.7 million international passengers.[10] In 1986 the airport was renamed as Indira Gandhi International Airport (IGIA) after commissioning a new Terminal-II for international operations. With ever expanding passenger load, a need was felt during 2005-2006 to modernise the airport with futuristic vision and allow participation of private sector for its development, operation and management, which otherwise had had been managed by the Airport Authority of India (AAI).

Accordingly, in January 2006, a consortium led by GMR group was awarded the concession to operate, manage and develop the IGIA, Delhi following an international competitive bidding process. The GMR-led Consortium signed the Operations, Management and Development Agreement (OMDA) on April 4, 2006 with the Airport Authority of India (AAI) on a revenue sharing basis. The initial term of the concession period is 30 years extendable by another 30 years. GMR created a subsidiary company the Delhi International Airport limited (DIAL) for the management of the airport. Besides upgrading the existing terminals, DIAL commissioned a new runway 11-29 at IGI Airport on September 25, 2008. It also commissioned the new domestic departure terminal - 1D (T1D) on 26th February, 2009. In March 2010, DIAL completed the construction of integrated passenger terminal (Terminal 3) marking the completion of the first phase of development (see the new arrival hall in Figure 4.1). IGIA, Delhi is now capable of handling 62 million passengers per annum (MPPA). Terminal 3 (T3) has a modern 5 level in-line baggage handling system to eliminate baggage X-ray prior to check in, spacious security hold area with extensive food and beverages (F&B) and retail facilities, special contact zone for passengers with special needs and baggage handling area on a separate level allowing greater space for passenger amenities. The airport infrastructure is planned to be enhanced further based on passenger demand and market needs. With further

[10] http://web.archive.org/web/20120419022746/http://www.igiacustoms.gov.in/igi-airport.htm.

development according to latest version of Master plan, terminals and runway capacity is to be added in a modular manner to achieve an ultimate design capacity of 109-110 million passengers per annum.[11 12]

FIGURE 4.1: ARRIVAL HALL OF TERMINAL 3 OF IGIA, DELHI

4.2 A WORLD-CLASS MODERN AIRPORT

IGIA, Delhi is the busiest airport of India in terms of passenger and freight movement. It handled 48.42 million passengers and 787 thousand tonne of freight during 2015-16 recording impressive annual growth rates of 18.1 per cent and 13 per cent respectively.

4.2.1 The Best Managed Airport in Its Category

Under the Airport Service Quality (ASQ) programme of Airport Council International (ACI), IGIA, Delhi has been ranked at number one airport in its category of 25-40 million Passengers Per Annum (MPPA) for the year 2015.[13] This was second consecutive year of top rank in global ranking. For years 2011, 12 & 13 IGIA, Delhi had bagged 2nd Best Airport in its category.

In 2015, IGIA, Delhi also bagged two awards for the best airport in Central Asia/India and best airport staff in Central Asia/India at the prestigious Skytrax World airport awards.

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[11] http://www.newdelhiairport.in/our-company.aspx.
[12] Revised Master Plan Review 2015-16.
[13] http://www.aci.aero/Airport-Service-Quality/ASQ-Awards/Current-Winners/Best-Airport-By-Size/25-40million.

In 2015, it also won the prestigious Golden Peacock National Quality Award given by the Institute of Directors (India)

4.2.2 Carbon-Neutral Status

Most recently, the Indira Gandhi International Airport has become Asia-Pacific's only and one of the world's few airports to achieve a Level 3+ carbon neutral status. The announcement in this regard was made by the Airports Council International (ACI) during the Airport Carbon Accreditation certificate presentation ceremony in Montreal, Canada.[14] Level 3+, Neutrality is the highest level of environmental achievement available to airports under the programme and it is recognition of the airport's effort in reducing and offsetting emissions.

In addition, IGIA, Delhi became the first airport in India to achieve Platinum rating for its 'Green' Terminal 3 by Indian Green Building Council (IGBC).

Carbon neutrality occurs when the net carbon emission over an entire year is zero or when the airport absorbs or offsets the same amount of emission that was generated. To achieve this DIAL has installed 7.84 MW solar power plants and it is likely to increase the solar power generation to 20 MW by 2020. The energy efficiency measures implemented in IGIA, Delhi has been registered in UNFCCC (United Nations Framework Convention on Climate Change) as clean development mechanism project. The various emission saving measures implemented in DIAL have resulted in 51 per cent reduction in specific GHG emission (kgCO2/PAX) during the last five years. [15]

4.3 AVIATION FACILITIES AT IGIA, DELHI

With the modernisation of IGIA, Delhi, the infrastructure facilities at the airport have greatly improved. It has become the busiest airport in India in terms of passenger traffic and it is emerging as an important centre of cargo growth due to its central positioning with respect to Europe, Asia and Africa. Already the share of imports is highest among all other airports of India (see Section 3.3.4, Chapter 3). With the addition of Runway 11-29 in 2008 and commencement of operations at Terminal 3 in 2010, IGI Airport has become South Asia's largest aviation hub. In addition, a number of developments are proposed for further improvement of capacity and services, which is discussed in Chapter 6.

4.3.1 Terminals

There are four terminals for passenger operations and two Terminals for cargo handling at the IGIA, Delhi. Terminal 1 (T1) is exclusively used for domestic passengers (T1D for domestic departure and T1C for domestic arrivals), while Terminal 3 (T3) is an integrated terminal which handles both domestic and international traffic. Both T1 and T3 are used for scheduled services for handling passengers; while Terminal T-2 is presently being used for Haj pilgrims.

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[14] http://www.aci.aero/News/Releases/Most-Recent/2016/09/27/170-airports-including-new-carbon-neutral-airports-in-North-America-AsiaPacific-and-Europe.

[15] http://www.business-standard.com/article/current-affairs/delhi-airport-first-carbon-neutral-airport-in-asia-pacific-116092800204_1.html.

There are provisions to build Terminals 4, 5 and 6 at a later stage, once the traffic volume exceeds current capacity. With increasing cargo volume, a new cargo handling building is also possible to construct. These new terminals will increase the airport's annual passenger volume capacity to 109-110 million as stated earlier.

Terminal 1: is currently used by low cost carriers (LCC) - Indigo, Spicejet and Go Air for their domestic operations.

Terminal 1A: Terminal 1A was used by Air India and erstwhile Kingfisher until the commissioning of Terminal 3 in 2010. The terminal is now closed to operations.

Terminal 1C: Terminal 1C is used only for LCC domestic arrivals. The terminal has been upgraded with new expanded ‘meeters’ and greeter’s area’ and a larger baggage claim hall with 8 belts.

Terminal 1D: Terminal 1D has a total floor area of 40,924 m2, with a capacity to handle about 8 million departing passengers.

Terminal T2: Terminal T2 is presently being used for transporting Muslim pilgrimage to visit Saudi Arabia for Haj. Specified flights are arranged from this terminal to prevent disruption of other flights from the main airport. This terminal has the capacity to handle 9.4 million passengers per year and it is under renovation for handling regular domestic passengers.

Terminal 3: Terminal 3, opened in 2010, serves all international airlines and full service domestic carriers as well the recently launched Vistara and Air Asia India. Terminal 3 occupies 553887 m^2 with a design capacity of 34 million passengers annually (MAP) and it is world’s 8th largest passenger terminal. T3 is a two-tier building, with the bottom floor being the arrival area, and the top being the departure area. It has a nine level passenger terminal building and two piers each of which is 1.2 km long. This terminal has six common check-in islands, 168 check-in counters, 95 immigration counters (49 outbound and 46 inbound immigration counters), 78 passenger boarding bridges (including three passenger boarding bridges for A380 or similar sized aircraft), 14 baggage reclaim belts including two belts for out of gauge (OOG) bags, 30 parking bays, 30 security channels, 92 automatic travelators/walkways (longest one being 118 meters), 34 escalators, 63 lifts. Over 20000 square metres of retail space is also available in T3. The total additional area under aprons is 9.47 lakh square meters. T3 has a 90 room hotel and a multi-level car parking with capacity of 4300 cars.

4.3.2 Runway System

Currently IGIA, Delhi has three near-parallel runways: 11-29, 10-28 and 09-27 with a total length of 4.43 km, 3.81 km and 2.81 km each respectively with following specification.

- Runway 11-29, 4430mX60m (14530ftX200ft) Code 4F, with CAT IIIB ILS and AGL on both sides.
- Runway 10-28,3810mX45m (12500ftX151ft) with CAT IIIB ILS system and AGL on RWY 28, Cat I on the other hand.
- Runway 09-27 2813mX45m (9229ftX148ft) with CAT I facilities.
- Runway 11-29 is presently operated in a mixed mode while Runways 10-28 and 09-27 are operated in a segregated mode.

IGI Airport serves as a major hub or a focus destination for several Indian carriers including Air India, Indigo, Jet Airways, Spicejet, Go Air, Air Asia India and Vistara. Presently, the airport serves 56 international airlines and is directly connected to 62 international destinations across the world.

4.3.3 Cargo Zone

The cargo zone with two main Cargo Terminals is located 1 km east of Terminal 3. The two cargo terminals are known as Greenfield cargo terminal and the Brownfield cargo terminal. Brownfield terminal is operated by Celebi Delhi Cargo Terminal Management India Private Limited which is located at a distance of about 1 km from the main terminal T3 while the Greenfield terminal is operated by the Delhi Cargo Service Centre Private Limited. The total area under the Brownfield cargo terminal is approximately 70,000 square meters while the Greenfield terminal has an area of approximately 48,500 square meters.

4.3.4 City Connectivity

As indicated in Section 3.4, IGI airport has multimodal connectivity with Delhi, which includes an eight-lane motorway (National Highway 8) and the Delhi Aero Express. Following roadways provide the main access into IGI Airport:

- Northern access road towards Terminal 3
- Terminal 1 entry and exit roads
- Radisson road from the Radisson roundabout to airport
- Mahipalpur road providing access to Terminal 3
- Airport Express- Metro provides a fast rail access to Terminal 3 from New Delhi railway station/ city centre.

The airport is well connected by Delhi Metro from New Delhi railway station and Rajiv Chowk (Connaught Place) with check-in facility. Bus facilities are available to the Maharana Pratap bus terminal (Kashmir Gate) in every 25 minutes for which the travel time is approximately 50 minutes. Luxury air-conditioned buses depart from the international terminal. Delhi Transport Corporation buses ply from various location of Delhi to and fro from the airport. However, the backbone of city connectivity remains paid taxi operated by companies and individuals.

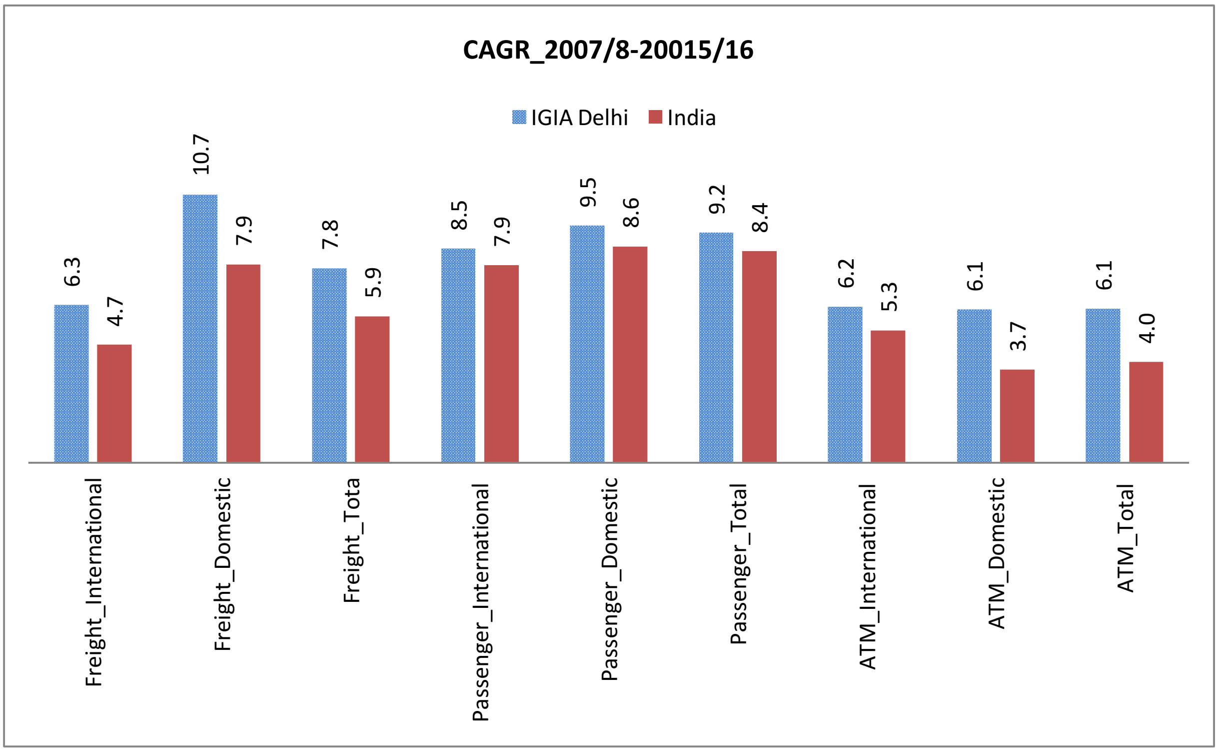
In particular, Terminal 3 is well connected with environment friendly multi modal transport facility from the northern side of the airport precinct. Dedicated metro express, 6 lane road infrastructure and northern accesses tunnel help in reducing traffic conjunction. It also significantly contributes in emission reduction and resource conservation in the vicinity of the airport. The metro rail station is located within 250 m from the building entrance. More than 5000 cars parking facility with natural light system is also located within the T3 infrastructure along with electrical charging facility. Metro connectivity at T1 will be available soon which will further improve connectivity at IGIA.

4.4 PHYSICAL PERFORMANCE OF IGIA, DELHI

The compound annual growth rate (CAGR) of IGIA, Delhi in terms of both domestic and international passenger movement, freight movement and aircraft movement has been much above the all India average during 2007/08 - 2015/16 (Figure 4.2). In terms of passenger movements, freight movements and aircraft movements, IGIA Delhi has recorded CAGRs of 7.8 per cent, 9.5 per cent, and 6.1 per cent respectively as against the all India growths of 5.9 per cent, 8.6 per cent, and 4.0 per cent respectively. In particular, the growth of IGIA, Delhi compared to all India average is much higher with respect to domestic and international freight movements, domestic aircraft movements, and domestic passenger movements. Clearly, being located in NCR, domestic factors are driving IGIA, Delhi more than all other airports.

Relatively higher growth of IGIA, Delhi can be attributed to several factors including synergy with the development of national capital region mentioned earlier, and the connectivity of Delhi being the capital city states with rest of the world.

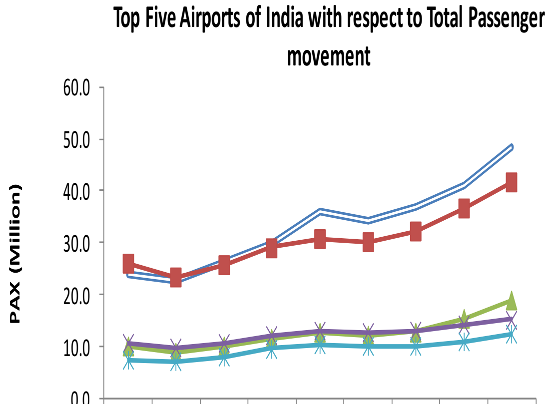
FIGURE 4.2: COMPOUND ANNUAL GROWTH RATES OF PERFORMANCE OF IGIA, DELHI AND ALL INDIA TOTAL DURING 2007/08 – 2015/16



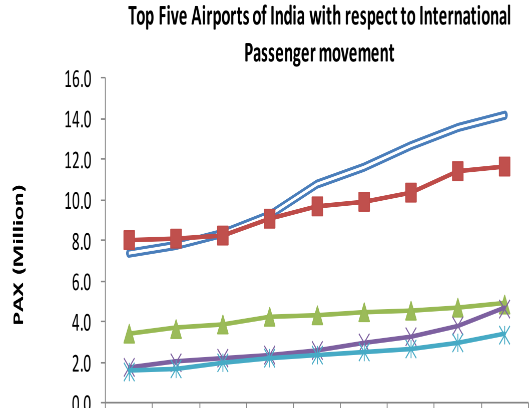
Source (basic data): Airport Authority of India.

As a result of its relatively higher growth, IGIA, Delhi has acquired the status of largest and busiest airport of India in almost all respects since 2014-15 (Figure 4.3). It was already top airport in terms of passenger traffic (both domestic and international) since 2010-11 leaving behind Chhatrapati Shivaji Maharaj International Airport (CSMIA), Mumbai to a distant second place. In terms of cargo movement IGIA, Delhi acquired the top position in 2014-15 surpassing CSMIA, Mumbai by a slender margin but in 2015-16 IGIA, Delhi has consolidated its top position with substantial gap of 82 thousand tons.

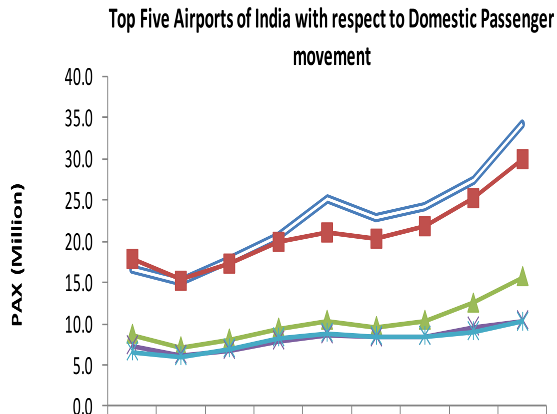
FIGURE 4.3: PERFORMANCE OF IGIA, DELHI IN COMPARISON TO TOP FIVE AIRPORTS OF INDIA



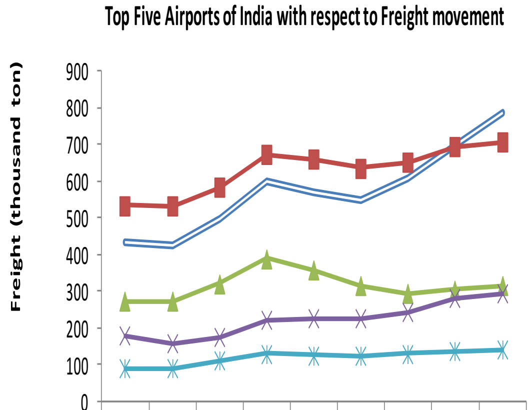
	2007	2008	2009	2010	2011	2012	2013	2014	2015
DELHI	24.0	22.8	26.1	29.9	35.9	34.4	36.9	41.0	48.4
MUMBAI	25.9	23.4	25.6	29.1	30.7	30.2	32.2	36.6	41.7
BANGALORE	10.1	8.8	9.9	11.6	12.7	12.0	12.9	15.4	19.0
CHENNAI	10.7	9.8	10.5	12.0	12.9	12.8	12.9	14.3	15.2
KOLKATA	7.5	7.0	8.0	9.6	10.3	10.1	10.1	10.9	12.4



	2007	2008	2009	2010	2011	2012	2013	2014	2015
DELHI	7.3	7.8	8.3	9.3	10.8	11.6	12.7	13.5	14.2
MUMBAI	8.0	8.1	8.2	9.1	9.7	9.9	10.3	11.4	11.6
CHENNAI	3.4	3.7	3.9	4.2	4.3	4.5	4.5	4.7	4.9
COCHIN	1.8	2.0	2.2	2.4	2.6	2.9	3.3	3.8	4.7
BANGALORE	1.5	1.6	1.9	2.2	2.4	2.5	2.6	2.9	3.4



	2007	2008	2009	2010	2011	2012	2013	2014	2015
DELHI	16.6	15.1	17.8	20.7	25.1	22.8	24.2	27.5	34.3
MUMBAI	17.9	15.3	17.4	20.0	21.0	20.3	21.9	25.2	30.0
BANGALORE	8.6	7.1	8.0	9.4	10.3	9.5	10.2	12.5	15.6
CHENNAI	7.2	6.2	6.7	7.8	8.6	8.3	8.4	9.6	10.3
KOLKATA	6.5	6.0	6.9	8.2	8.7	8.4	8.3	9.0	10.2



	2007	2008	2009	2010	2011	2012	2013	2014	2015
DELHI	433	426	497	600	568	546	606	697	787
MUMBAI	533	530	583	670	657	635	649	694	705
CHENNAI	271	272	321	389	357	316	292	304	316
BANGALORE	178	158	175	223	225	227	242	279	292
KOLKATA	91	88	110	130	126	123	130	137	140

Source (basic data): Airport Authority of India.

In the year 2015-16 IGIA, Delhi handled 34.3 million domestic passengers, 14.2 million international passengers and 787 thousand tons of cargo. A comparison of top five airports, namely IGIA, Delhi; CSMIA, Mumbai, Chennai International Airport, Chennai; Kempe Gowda International Airport (KGIA), Bangaluru; Netaji Subhas Chandra Bose International Airport (NSCBIA) Kolkata; and Cochin International Airport, Cochin presented in Figure 4.3 with respect to size of domestic passengers, international passengers, and cargo, shows that except Mumbai all other airports are far behind the performance of Delhi. It may be noted that Cochin has replaced Chennai in top five airports in respect of international passenger movement.

Complete statistics on performance of IGIA, Delhi with respect to domestic and international freight, passenger, and aircraft movement for the period 2007/08 - 2015/16 is presented in Table 4.1 along with its share in all India traffic movement. The same data is also illustrated in Figures 4.4 and 4.5.

From the data in Table 4.1 and Figures 4.5 and 4.5 it is evident that there is sharper change in the share of IGIA, Delhi with respect to domestic and international freight, and aircraft movements as compared to change in share of passenger movement. The share of IGIA, Delhi in terms of domestic freight has increased from 23.0 per cent in 2007-08 to 28.2 per cent in 2015-16 and in terms of international freight, the share has increased from 26.3 per cent to 29.7 per cent. The share of aircraft movement has increased from 16.3 to 19.2 per cent.

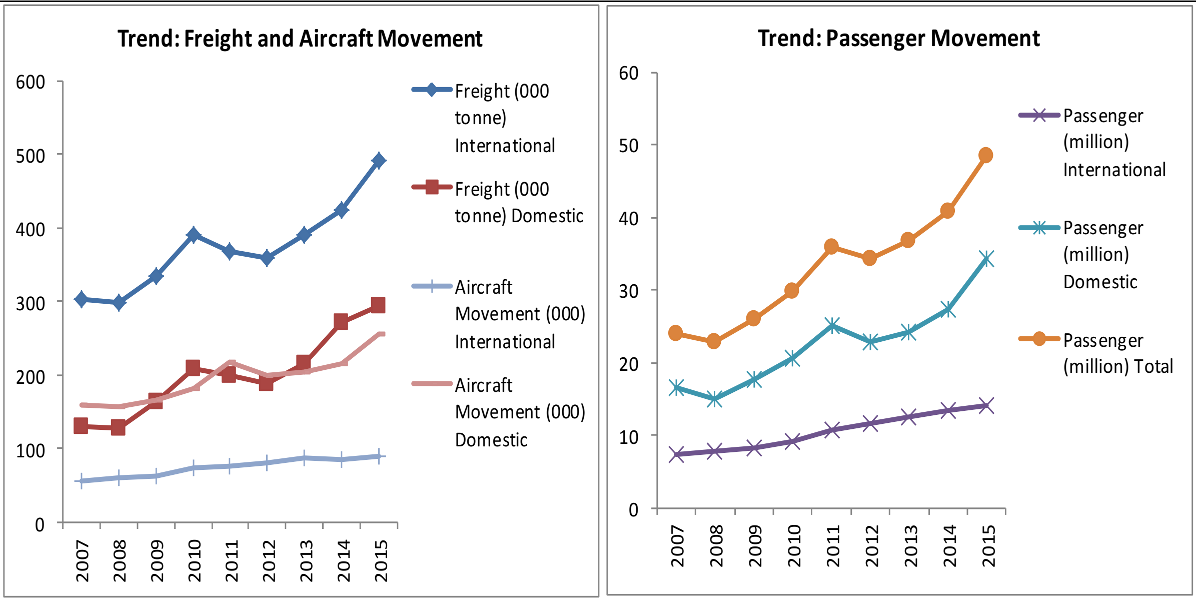
With respect to passenger movement, the share of IGIA, Delhi has marginal improvements, from 24.6 per cent to 25.9 per cent in international passenger movement, and from 19.1 per cent to 20.3 per cent in domestic passenger movement. However, during recent periods the share of international passengers has marginally declined from 27.2 per cent in 2013-14 to 25.9 per cent in 2015-16 indicating increasing international connectivity of other airports.

TABLE 4.1: PERFORMANCE OF IGIA, DELHI IN TERMS OF FREIGHT, PASSENGER AND AIRCRAFT MOVEMENT (2007/08 – 2015/16)

Year	Freight (000 tonne)			Passenger (million)			Aircraft Movement (000)		
	International	Domestic	Total	International	Domestic	Total	International	Domestic	Total
2007	302.0	130.9	432.9	7.3	16.6	24.0	55.0	158.6	213.6
2008	297.9	128.3	426.3	7.8	15.1	22.8	59.5	157.9	217.4
2009	333.5	163.9	497.4	8.3	17.8	26.1	63.4	165.8	229.2
2010	390.9	209.1	600.0	9.3	20.7	29.9	74.8	180.8	255.5
2011	367.8	200.5	568.4	10.8	25.1	35.9	76.9	218.6	295.5
2012	358.1	188.2	546.3	11.6	22.8	34.4	80.4	200.3	280.7
2013	389.9	215.8	605.7	12.7	24.2	36.9	86.2	204.6	290.8
2014	424.8	271.8	696.5	13.5	27.5	41.0	85.8	215.1	300.9
2015	492.1	295.1	787.2	14.2	34.3	48.4	89.1	255.0	344.1
Share in All India (per cent)									
2007	26.3	23.0	25.2	24.6	19.1	20.5	22.1	15.0	16.3
2008	25.9	23.4	25.1	24.6	19.5	21.0	22.0	15.3	16.7
2009	26.2	23.8	25.4	24.2	19.9	21.1	22.5	15.8	17.2
2010	26.1	24.5	25.6	24.5	19.6	20.9	24.9	16.5	18.3
2011	25.1	24.7	24.9	26.4	20.7	22.1	24.9	17.7	19.1
2012	25.5	24.0	24.9	26.9	19.6	21.6	25.6	17.2	19.0
2013	27.0	25.8	26.6	27.2	19.8	21.8	25.7	17.0	17.9
2014	27.5	27.6	27.5	26.6	19.7	21.6	24.8	17.1	18.8
2015	29.7	28.2	29.1	25.9	20.3	21.7	23.7	18.0	19.2

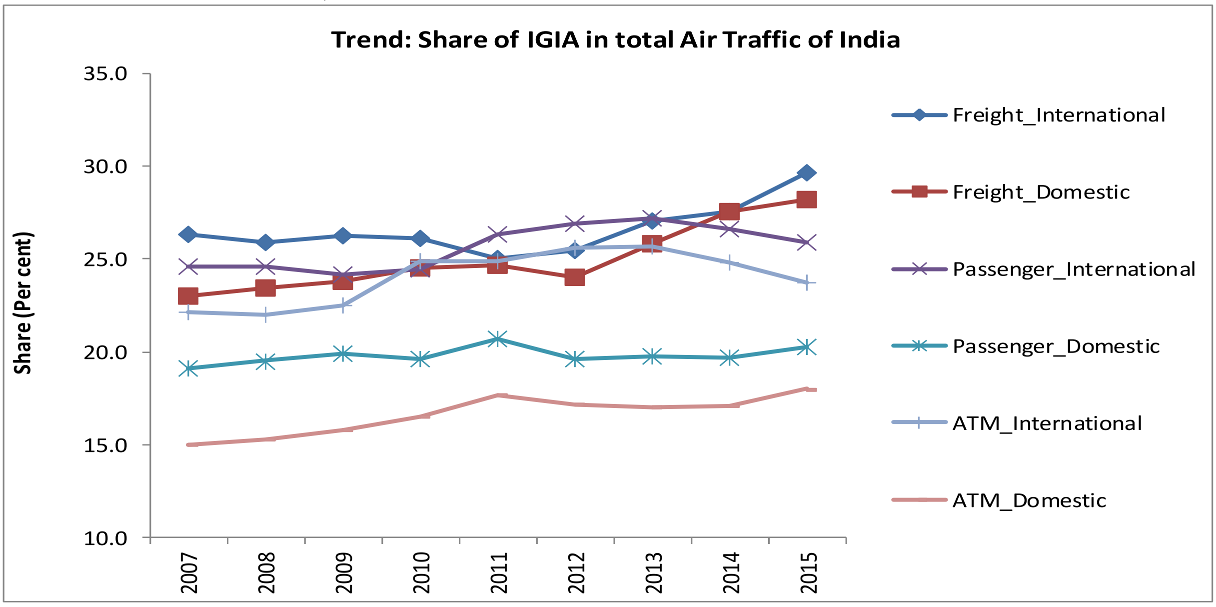
Source (basic data): Airport Authority of India. Year is the start year of financial year (2007 means 2007-08).

FIGURE: 4.4 TREND OF PERFORMANCE OF IGIA, DELHI IN TERMS OF TRAFFIC MOVEMENTS



Source (basic data): Airport Authority of India.

FIGURE 4.5: SHARE OF IGIA, DELHI IN TOTAL AIR TRAFFIC OF INDIA



Source (basic data): Airport Authority of India.

4.5 FINANCIAL PERFORMANCE OF DIAL, THE AIRPORT OPERATOR

As mentioned earlier, IGIA, Delhi is now operated by the Delhi International Airport Private limited (DIAL) under a concession agreement with the government of India. DIAL has revenue sharing arrangement with Airport Authority of India (AAI), according to which the revenue collected by DIAL from concessioners and other development fee charged for services provide at the airport is to be shared in the ratio of 45.99:54.01 between AAI and DIAL.

Efficient management of airport requires sound management of revenue and expenditure model. Figures 4.6 and 4.7 present total revenue collected and profit margins during last four years. Profitability ratios in terms of EBIDT (earnings before interest depreciation and tax) and PAT (profit after tax) to total revenue are presented in Figure 4.8.

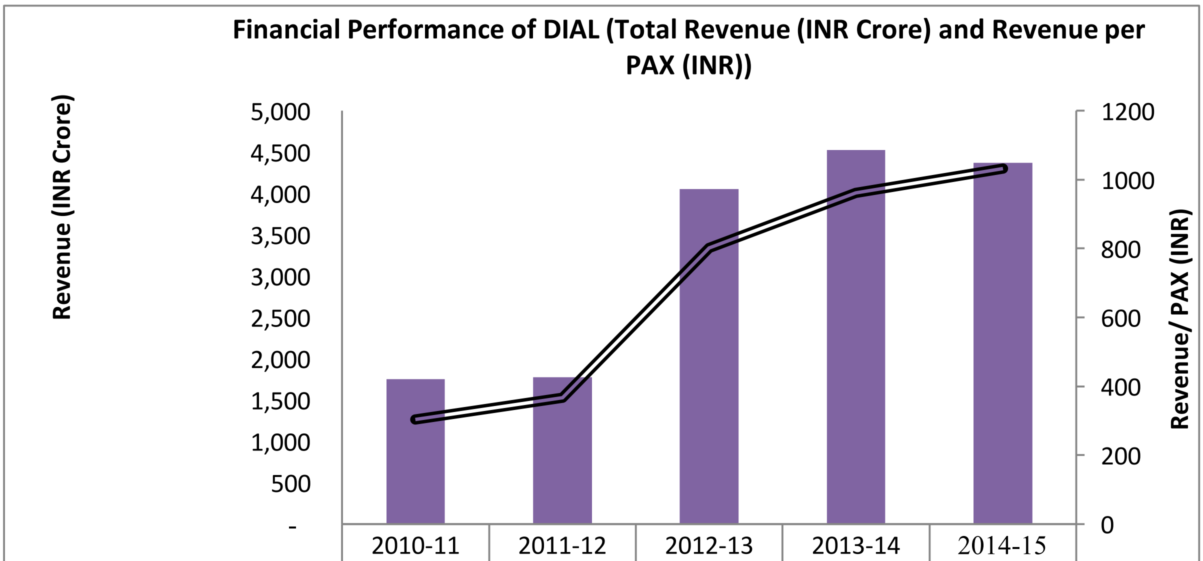
The revenue collected under various heads are presented in Figure 4.9 and the distribution of revenue by source is presented in Table 4.2.

Looking at the data in Figures 4.6, it seems that the airport revenue has improved greatly both in terms of absolute numbers and also in terms of revenue per PAX, which stood at INR 4298 crore and INR 1049 respectively during 2014-15. However, the profit margins presented in Figure 4.7 and 4.8 indicate gradual improvement in profits. As a result the cumulative profit after tax has entered into the positive zone. Given the strong growth in PAX, it is likely that the financial condition would improve further provided the revenue model remains the same. The gross profitability ratios are strong and PAT to revenue ratio is also comparable to international standards for the industry.

Distribution of revenue by source presented in Table 4.2 shows that for the year 2015-16, about 68.66 per cent of revenue is obtained from aero income, while 26.67 per cent is obtained from non-aero income. Remaining 4.67 per cent is obtained from other sources.

During recent years, there is improvement in collection of non-aero revenue. The revenue from non-aero sources has increased from 593.23 crore in 2010-11 to 1146.34 crore in 2014-15, which is an increase of 193.2 per cent over four years (Figure 4.9 and Table 4.2). This is commendable growth, yet it is desirable to reduce dependence on regulated sources of revenue, and therefore attempts are made to develop other sources of revenue more vigorously.

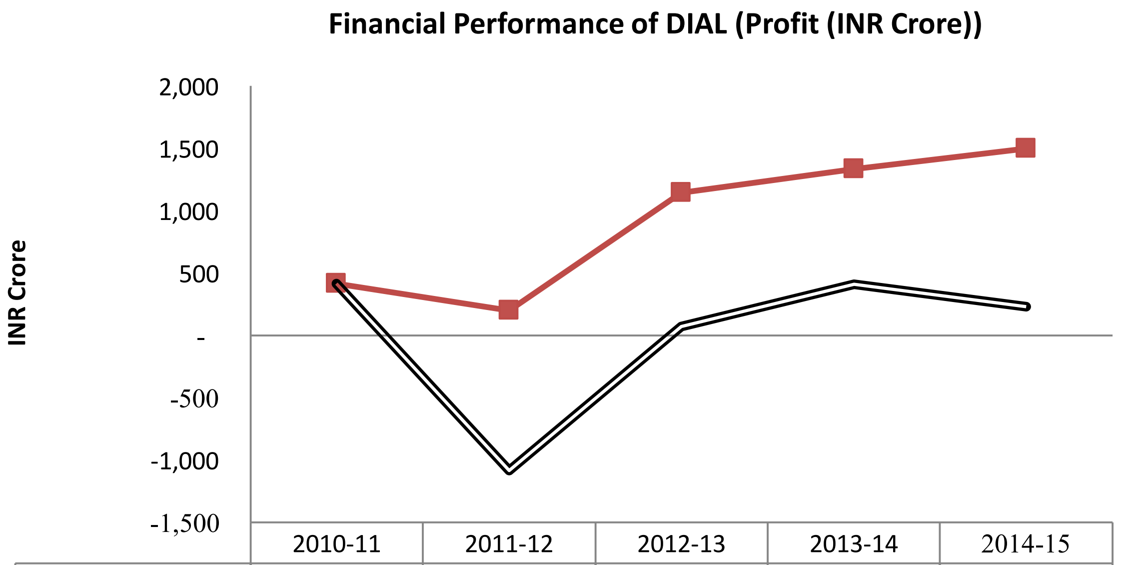
FIGURE 4.6: FINANCIAL PERFORMANCE OF DIAL: REVENUE AND REVENUE INTENSITY



	2010-11	2011-12	2012-13	2013-14	2014-15
Revenue/PAX (INR)	421	427	972	1086	1049
Revenue (INR Crore)	1,262	1,531	3,341	4,004	4,298

Source (basic data): DIAL.

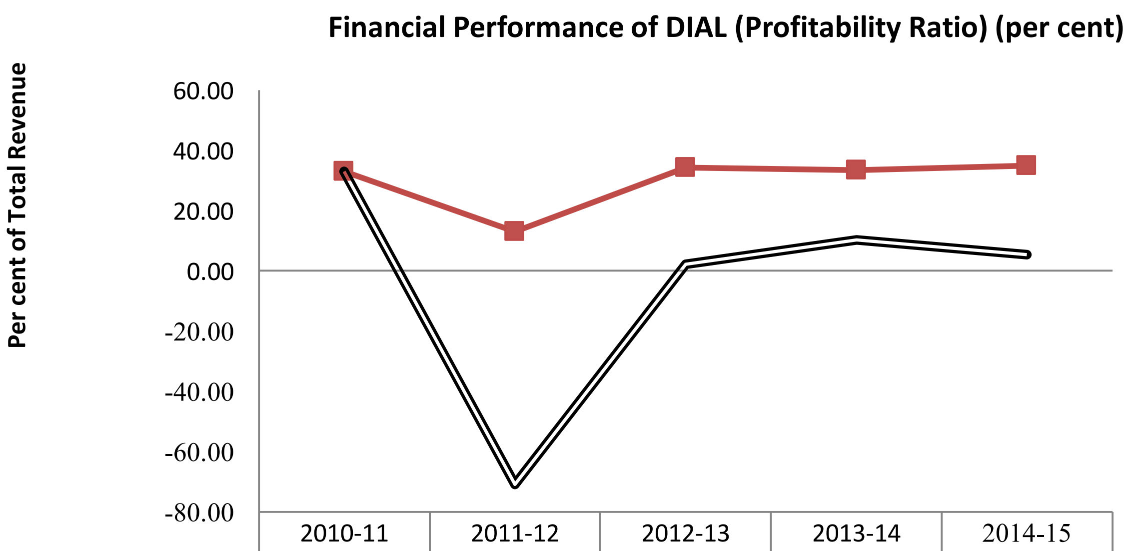
FIGURE 4.7: FINANCIAL PERFORMANCE OF DIAL: PROFIT



	2010-11	2011-12	2012-13	2013-14	2014-15
PBIDT	416	198	1,145	1,332	1,500
Profit After tax	416	-1,085	73	411	228

Source (basic data): DIAL.

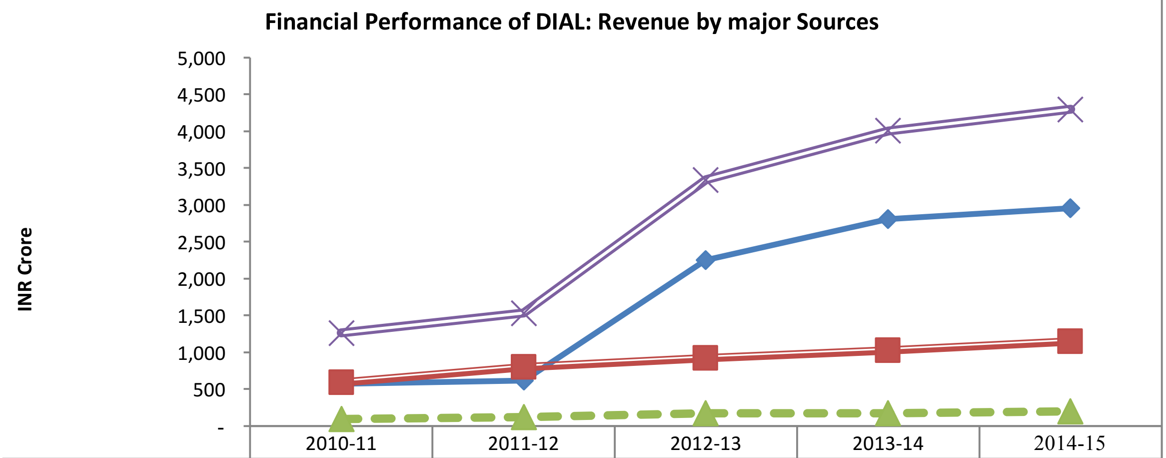
FIGURE 4.8: FINANCIAL PERFORMANCE OF DIAL (PROFITABILITY RATIO) (PER CENT OF TOTAL REVENUE)



	2010-11	2011-12	2012-13	2013-14	2014-15
PBIDT/Revenue	32.99	12.94	34.27	33.26	34.91
PAT/Revenue	32.99	-70.90	2.17	10.26	5.30

Source (basic data): DIAL.

FIGURE 4.9: FINANCIAL PERFORMANCE OF DIAL: REVENUE BY MAJOR SOURCES



	2010-11	2011-12	2012-13	2013-14	2014-15
Aero income	570.87	611.07	2,251.66	2,806.35	2,950.92
Non-Aero income	593.23	798.05	920.81	1,023.31	1,146.34
Other Income	97.57	121.82	168.97	174.78	200.32
Total Income	1,261.67	1,530.94	3,341.44	4,004.44	4,297.59

Source (basic data): DIAL.

TABLE 4.2: DISTRIBUTION OF REVENUE BY HEADS OF ITS SOURCES (PER CENT OF GROSS REVENUE)

Head	2010-11	2011-12	2012-13	2013-14	2014-15
Landing & parking	26.73	22.87	22.87	21.35	19.86
PSF	9.62	8.37	0.90	0.00	0.00
User Development Fee	0.00	0.00	39.69	45.09	45.46
Cute counter charges	0.40	0.30	0.31	0.27	0.26
Baggage X-ray	0.09	0.00	0.00	0.00	0.00
Fuel Farm	8.41	8.37	3.62	3.37	3.08
Aero Income	**45.25**	**39.91**	**67.39**	**70.08**	**68.66**
Advertisement	3.37	4.30	2.11	2.24	2.42
Duty Free	6.43	10.32	5.83	6.17	6.14
Duty Paid	2.22	2.77	1.63	1.82	1.70
Food & Beverages	3.05	4.02	1.83	1.71	1.73
Service Car Pak - Rental	1.33	1.40	0.46	0.24	0.24
Telecom	3.78	0.42	0.17	0.19	0.18
Car Rental	0.00	0.00	0.45	0.43	0.47
other services	0.00	1.15	1.27	1.10	1.00
Bank /ATM	0.00	0.65	0.34	0.37	0.39
Forex	0.00	2.67	1.26	1.20	1.17
Non Aero Commercial	**20.17**	**27.69**	**15.36**	**15.46**	**15.44**
Ground handling	3.52	3.18	1.70	1.57	1.98
Bridge Mounted Equipment	0.00	0.28	0.18	0.12	0.10
Flight Kitchen	2.29	2.39	0.99	0.89	0.94
Land & space	9.98	10.19	5.46	4.00	4.55
Courier X-ray	0.06	0.00	0.00	0.00	0.00
Cargo Revenue Share	9.66	7.07	3.22	2.89	3.14
Cargo Screening	1.29	1.32	0.60	0.58	0.49
Cargo others	0.04	0.00	0.06	0.04	0.03
Non Aero Others	**26.85**	**24.43**	**12.20**	**10.10**	**11.23**
Non Aero Income (Total)	**47.02**	**52.13**	**27.56**	**25.55**	**26.67**
CPD	**6.27**	**5.45**	**2.64**	**2.32**	**2.29**
Other Income	**1.47**	**2.51**	**2.42**	**2.04**	**2.38**
Gross Revenue	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source (basic data): DIAL.

Chapter 5

Economic Impact Assessment

5.1 INTRODUCTION

Following the methodology outlined in Chapter 2, the economic impact assessment of the IGIA, Delhi using Input-Output (I-O) framework is presented in this chapter. The first step in impact assessment using I-O framework requires identifying economic activities at the airport and then estimating direct output under different heads of activities. While carrying out this exercise care needs to be taken to avoid double counting of outputs and indirect effects of flows. After estimating the direct outputs for each activity, the resulting values are assigned to the sectors of standard I-O framework through meticulous mapping. Application of appropriate multipliers for output, income (in terms of Gross Value Added, GVA) and employment then leads to economy-wide direct effects, indirect effects and induced effects. These effects are grouped as Type-I model and Type-II model impacts. Type-I model impact includes direct effect indirect effect, while Type – II model impact includes direct effect + indirect effect + induced effect as discussed in Chapter 2.

In order to cover all the above effects, this chapter is organised as follows. The estimates of accounted direct impact are discussed in Section 5.2, while model results are presented in Section 5.3. The model results are first summarised in Sections 5.3.1 and then detailed distributions are presented in Sections 5.3.2 and 5.3.3. Specifically, Section 5.3.2 presents the distribution of impact by contributing sector, while Section 5.3.3 presents the distribution of impact on agriculture sector, industry and services. The distribution in Section 5.3.3 uncovers the hidden impact of airport on agriculture. Section 5.4 covers qualitative discussion on catalytic impact of airport. The base year for analysis is 2014-15.

5.2 ACCOUNTING OF DIRECT IMPACT

Measuring direct economic impacts requires gathering financial and employment data for a variety of economic activities taking place at the airport as also those activities of agencies, which are directly linked to the airport including airlines, cargo and freight companies, city transport system connecting airport, retailers, government agencies and other concessioners. In addition, the revenue shared with AAI also leads to several economic activities elsewhere. Therefore, all activities of AAI have to be accounted for in proportion to the share of revenue from IGIA, Delhi in the expenditures made through AAI. Several services and entire management of airport are provided by the airport operator DIAL, which requires careful accounting for its output in such a way that double counting is avoided in overall accounting.

5.2.1 Activities, Source of Data and Procedure for Estimating Accounted Output and Employment

Table 5.1 summarises the list of activities under which direct impact is accounted for. Table 5.1 also presents the sources of data and approach of accounting. For cases where direct and sufficient data is not available, indirect methods have been followed using ratios and norms for estimating direct output and employment. For example DIAL follows certain agreements with concessioners to collect revenue. In case data is not available from certain concessioner, DIAL information is used to estimate expected output of that concessioner. Similarly output of airlines specific to IGIA, Delhi is difficult to obtain directly, but their overall financial data is available. Therefore, appropriate ratios are used to obtain the share of output incidental to IGIA, Delhi. Such ratios and standards are presented in Table 5.2.

TABLE 5.1: HEADS AND APPROACHES FOR DIRECT ACCOUNTED IMPACT

Approach to Accounting Output and Employment: 2014-15			
Sl. No.	Activity	Approach for Output	Approach for Employment
1	Domestic Airlines	Estimated from aggregate Operating Revenue of domestic airlines.	Estimated from employment of all domestic airlines.
2	Foreign Airlines Less Cargo & ATF	DIAL Revenue sharing ratios and share of international airlines have been used to estimate sales revenue for the following: (a) Navigation Services (b) Cute counter charges (c) BME (d) Cargo Revenue Share (e) Cargo Others (f) Freight Forwarders Revenue is estimated based on survey data of Freight Forwarder and export from IGIA, Delhi	Estimated from sample data provided by DIAL Cargo employment estimated from information provided by DIAL Freight Forwarders employment is estimated using Survey data
3	DIAL Net of AAI Share	Financial statement of DIAL	Employees of DIAL and its outsource agencies
4	Airport Parking	Data provided by DIAL	Data provided by DIAL
5	Cargo & Freight Forwarding	Financial statement of DIAL and revenue sharing ratios	Data provided by DIAL and the share of domestic airlines in total freight handled at IGIA, Delhi
6	ATF (Foreign)	Bonded + ITP sales data provided by DIAL	Obtained from Model
7	ATF (Domestic)	Trading margin is considered on Duty paid component of ATF sales	Data provided by DIAL
8	AAI Share of DIAL Revenue	Proportionate Expenditures of AAI out of operating revenue of DIAL	Employment of AAI and its financial statement
9	Government Agencies	Employment and average expenditure used to estimate output	Data provided by DIAL
10	City Transport	Estimated using survey based distribution of passenger transport and average rates of respective modes	Estimates of drivers required to transport annual PAX for 2014-15
11	Retail Trade (Duty Paid)	Non-aero data of DIAL	Data provided by DIAL
12	Retail Trade (Duty Free)	Non-aero data of DIAL	Data provided by DIAL
13	Hotel and Restaurant (Retail)	Non-aero data of DIAL	Data provided by DIAL
14	Hotel (CPD)	Estimated from revenue data provided by DIAL	Data provided by DIAL
15	Flight Kitchen (Foreign)	Non-aero data of DIAL	Data provided by DIAL
16	Flight Kitchen (Domestic)	Non-aero data of DIAL	Data provided by DIAL
17	Communication	Non-aero data of DIAL	Obtained from Model
18	Banking	Non-aero data of DIAL	Obtained from Model
19	Insurance	Non-aero data of DIAL	Obtained from Model
20	Business Services	Non-aero data of DIAL	DIAL data
21	Community Services	Non-aero data of DIAL	Obtained from Model
22	Construction (DIAL)	Capital Stock data of DIAL	Covered under DIAL employment

Source (basic data): NCAER Research.

TABLE 5.2: SELECTED RATIOS AND STANDARDS USED IN ESTIMATION PROCESS

Selected Ratios (2014-15)		
1	Share of International Airlines in total freight handled by IGIA, Delhi	49%
2	Share of International Airlines in total passengers handled by IGIA, Delhi	18%
3	Share of International Airlines in total air traffic movement at IGIA, Delhi	15%
4	Share of IGIA, Delhi passengers handled by domestic airlines in total passengers handled by all domestic airlines	21%
5	Share of IGIA, Delhi freight handled by domestic airlines in total freight handled by all domestic airlines	25%
Revenue Sharing: Share of DIAL revenue in total Revenue of the following activities have been used to estimate the total Revenue from these activities from DIAL revenue mentioned in its financial accounts (2014-15)		
1	Landing & parking	100%
2	User Development Fee	100%
3	Cute counter charges	100%
4	Ground Handling by Third Party	13%
5	Bridge Mounted Equipment	13%
6	Land & space	100%
7	Cargo Revenue Share	33%
8	Cargo Screening	100%
9	Cargo others	100%
10	Rates of Freight forwarders (INR/tonne)	
10.1	Export/loading	13519
10.2	***Import/unloading***	***7984***

Source (basic data): NCAER Research.

5.2.2 Avoiding Double Counting

To avoid double counting, a systematic procedure has been followed, which includes the following measures:

1. All revenue collected by DIAL from various agencies has been deducted from the output of respective agency.
2. This allows the output of DIAL and AAI to be considered as sources of output being spent on management of IGIA, Delhi and building infrastructure elsewhere.
3. Air transport means domestic air transport. International Airlines are accounted for by the purchases they make at the IGIA, Delhi.
4. Ground handling has been split into domestic and foreign component. While foreign component is retained with foreign airlines, the domestic component is assumed to be covered under domestic airlines and therefore the same is not considered for direct accounting of output and employment.

5. Operation of terminal facilities such as airway terminals, airport and air-traffic control activities, ground service activities on airfields etc. with respect to domestic airlines are not accounted as these are covered under model.

Thus, about INR 3870 crore has been deducted from the vendor's revenue. And a similar amount has been considered as expenditure made by DIAL and AAI for their services at the airport and elsewhere with some adjustments. The item wise amounts netted from the accounts and transferred to DIAL/AAI are presented in Table 5.3.

TABLE 5.3: AMOUNTS (INR CRORE) DEDUCTED FROM REVENUE OF DIFFERENT ACTIVITIES (2014-15)

Accounting of DIAL+AAI Revenue: Portions deducted from Vendors (INR Crore)	
Domestic Airlines	2410
International Airlines	498
Flight Kitchen	40
Retail (Includes Retail Services)	338
Cargo and Freight Forwarders	157
Fuel Farm (Domestic)	107
Fuel Farm (Foreign)	25
Hotel and Restaurant (CPD)	98
Land and Space	196
Total	**3870**

Source (basic data): NCAER Research.

5.2.3 Accounted Direct Output and Employment by Activity

After the modernisation of IGIA, Delhi, it has demonstrated continuous progress in terms of quality and volume of operation. Its operations have increased manyfold and the economic activities around national capital region have reciprocated in supporting the airport by way of growing demand and opportunities for travellers.

In order to capture economic contributions of the airport, activity-wise direct output and employment has been meticulously compiled with the help of DIAL officials, surveys and questionnaires canvassed with the stakeholders. The compiled output and employment is presented in Tables 5.4 and 5.5; and Figures 5.1 and 5.2.

5.2.3.1 Directly Accounted Output

The total direct output due to various activities at the airport and by the AAI elsewhere for the year 2014-15 has been estimated at INR 33139 crore. It may be noted that this amount is net of revenue shared by concessioners with DIAL.

From Table 5.4 and Figure 5.1 following points can be highlighted:

(1) A major chunk of output is produced due to operations of airlines. Domestic airlines operating from IGIA, Delhi produce an output of INR 11820 crore, which is 35.67 per cent of total output.

(2) The second major contribution comes from purchase of petroleum products by the international airlines which contribute 34.71 per cent of the output.

(3) DIAL provides several services including management and housekeeping through outsourcing and all such activities taken together contribute about 6.86 per cent of output at the airport.

(4) Fourth important contributor to the total output is transport services providing connectivity between the airport and the city. Most of the contribution in this segment is attributed to earnings of paid taxi who are engaged in transporting almost 60 per cent of over 41 million passengers during the year.

(5) AAI share of total revenue collected by DIAL is spent on number of economic activities including construction and capital formation. Outputs purchased by AAI in proportion to shared revenue are 3.67 per cent of the total estimated output from the economic activities at the airport and elsewhere (owing to the expenditure of revenue earned at the airport but spent elsewhere).

(6) Freight forwarding and cargo operation is another set of direct activities linked to the airport operations. The charges for these services constitute about 3.19 per cent of total output.

(7) Other important and growing sources of airport output are the business centres in the precinct of the airport. In particular hotels in the aero-city contribute about 2.11 per cent to the total accounted output.

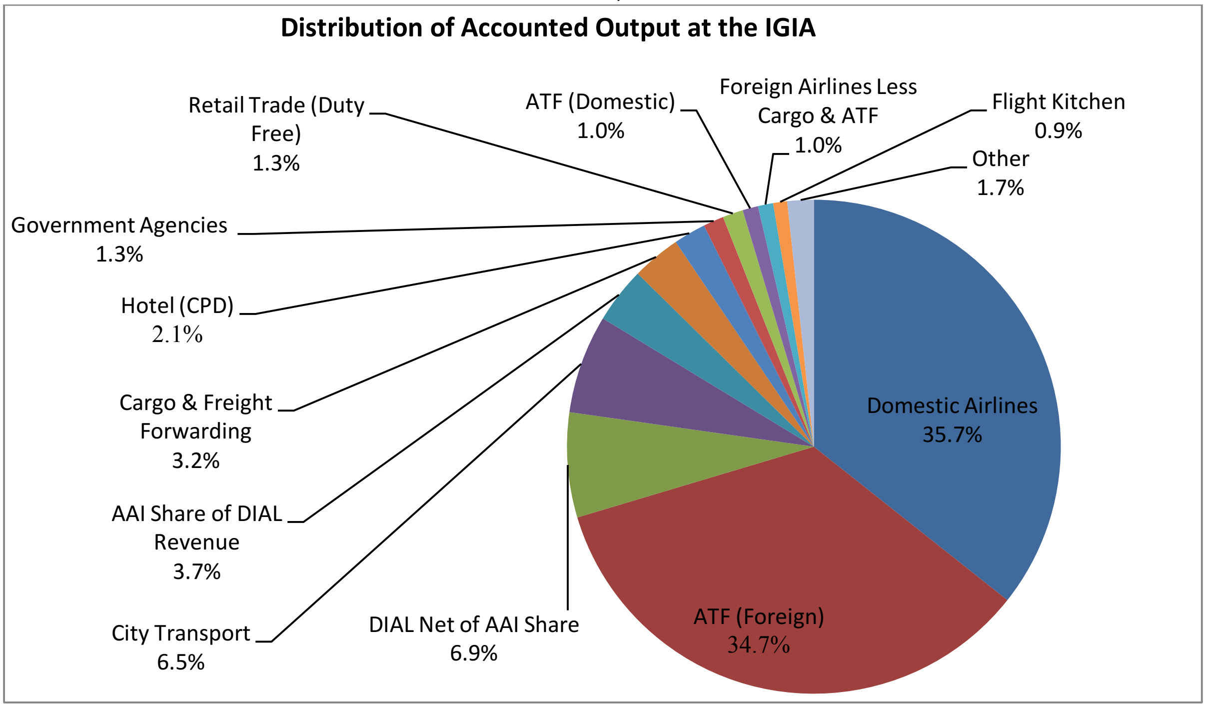
(8) There are several other activities including retail business, flight kitchen, etc., which contribute about 7.3 per cent of accounted output.

TABLE 5.4: DISTRIBUTION OF ACCOUNTED OUTPUT DUE TO THE ACTIVITIES AT THE IGIA, DELHI (2014-15)

Output Head	INR (Crore)	Share (%)
Domestic Airlines	11820	35.67
ATF (Foreign)	11501	34.71
DIAL Net of AAI Share	2274	6.86
City Transport	2139	6.45
AAI Share of DIAL Revenue	1215	3.67
Cargo & Freight Forwarding	1058	3.19
Hotel (CPD)	700	2.11
Government Agencies	444	1.34
Retail Trade (Duty Free)	444	1.34
ATF (Domestic)	338	1.02
Foreign Airlines Less Cargo & ATF	328	0.99
Flight Kitchen	304	0.92
Other	573	1.73
Total	33139	100

Note: Other include: Hotel and Restaurant (Retail); Business Services; Retail Trade (Duty Paid); Banking; Airport Parking; Communication; Community Services; Insurance; Construction (DIAL).
Source (basic data): NCAER Research.

FIGURE: 5.1 DISTRIBUTION OF OUTPUT AT THE IGIA, DELHI



Source (basic data): NCAER Research.

5.2.3.2 Directly Accounted Employment

The total direct employment associated with various activities at the airport and AAI activities elsewhere for the year 2014-15 has been estimated at 93971. It may be noted that this number includes employment of AAI in proportion to the share of revenue obtained by AAI in its total revenue. Table 5.5 and Figure 5.2 present the account of direct employment. The following points can be highlighted:

(1) Most employment intensive activity at the airport is city transport. It is estimated that about 33965 drivers and helpers must be engaged in transporting passengers from and to the airport. These constitute about 36.14 per cent of total direct employment due to the operations at the IGIA, Delhi.

(2) Cargo and freight forwarding is estimated to employ about 14928 persons during 2014-15 forming the second most employment intensive activity. It contributes about 15.89 per cent of directly accounted total employment.

(3) Domestic airlines effectively engage about 11948 persons for their Delhi operations and constitute 12.71 per cent of employment.

(4) A large number of government agencies are involved at the airport including security persons, customs, immigration and air traffic control. These are estimated to be 6874 persons forming about 7.32 per cent of the total accounted employment.

(5) A large number of persons are employed by DIAL either directly or through outsourcing to carry out management and maintenance of airport. The number of these persons is estimated as 6234, which is about 6.63 per cent of total employment.

(6) There are several hotels in the aero-city, which are reported to employ about 5600 persons forming about 5.96 per cent of total employment.

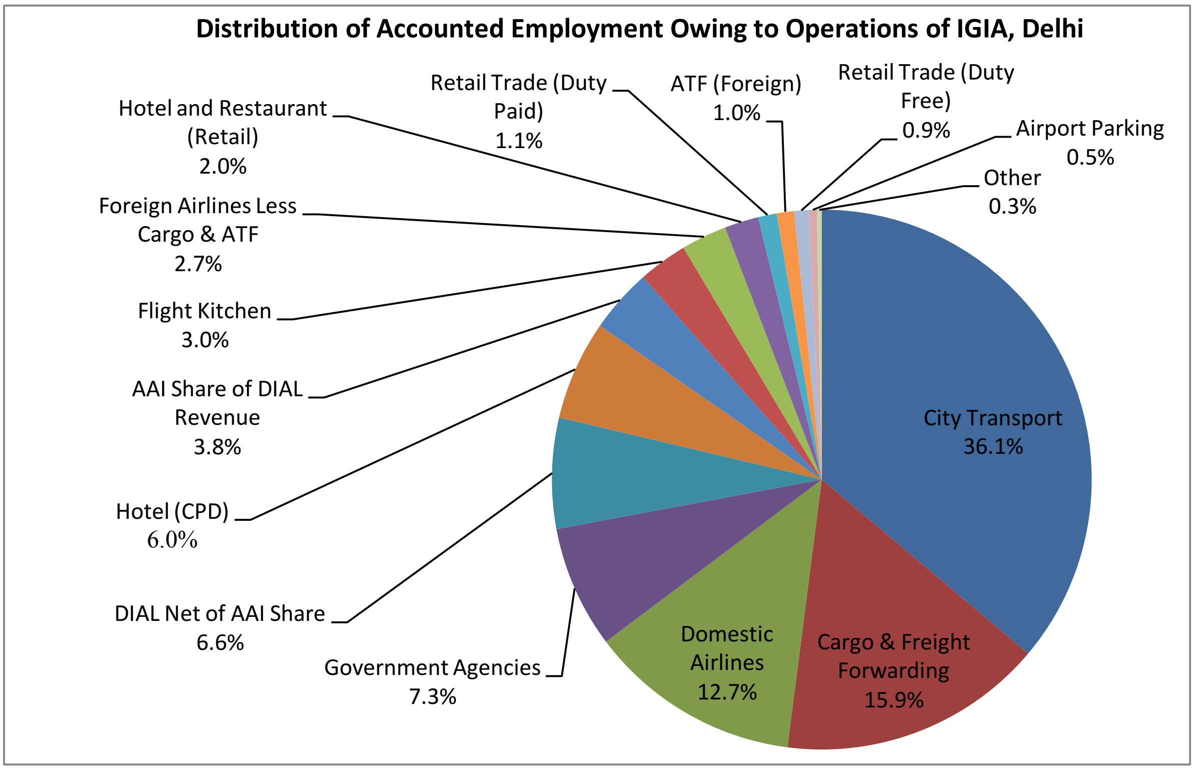
(7) Other contributors to employment include AAI, flight kitchen and retail business at the airport. These activities together contribute about 15.4 per cent of total accounted employment.

TABLE 5.5: ACCOUNTED EMPLOYMENT OWING TO THE ACTIVITIES AT THE IGIA, DELHI (2014-15)

Employment Head	Employment (numbers)	Share (%)
City Transport	33965	36.14
Cargo & Freight Forwarding	14928	15.89
Domestic Airlines	11948	12.71
Government Agencies	6874	7.32
DIAL Net of AAI Share	6234	6.63
Hotel (CPD)	5600	5.96
AAI Share of DIAL Revenue	3599	3.83
Flight Kitchen	2775	2.95
Foreign Airlines Less Cargo & ATF	2567	2.73
Hotel and Restaurant (Retail)	1918	2.04
Retail Trade (Duty Paid)	1050	1.12
ATF (Foreign)	970	1.03
Retail Trade (Duty Free)	823	0.88
Airport Parking	443	0.47
Other	276	0.29
Total	93971	100

Note: Other includes Business Services; ATF (Domestic); Communication; Banking; Insurance; Community Services; Construction (DIAL).
Source (basic data): NCAER Research.

FIGURE 5.2: DISTRIBUTION OF ACCOUNTED EMPLOYMENT OWING TO OPERATIONS OF IGIA, DELHI (2014-15)



Source (basic data): NCAER Research.

5.3 MODEL (I-O FRAMEWORK) RESULTS

Once direct outputs from different activities are obtained, these outputs are mapped with the national Input-Output sectors of India covering 28 sectors (Appendix A1). As noted in Chapter 2, the economic impact of airport related activities can be measured as backward linkages obtained from Type-I and Type-II multipliers of I-O framework. It may be recalled that Type-II impact differs from Type-I impact in the sense that the latter includes induced effect of consumption flows in addition to industry effects obtained from circulation of one product being used as input for the other and so on. Backward linkages of the outputs produced due to each activity related to airport operations are obtained by mapping on relevant use sectors of the I-O table. Since each of the use sector puts a demand on the supply sector, the total impact of all activities obtained from backward linkages, can also be presented across supply sectors on which demand is created.

Thus, the aggregate impact can be distributed by (1) contributing sectors, which is a set of 28 sectors on which outputs from airport operations/activities are spread; and (2) all sectors on which demand is created. In the second case results are presented after aggregating the impact in three core sectors namely, agriculture, industry and services. In case of Type-II impact model final consumption is also added to account for the demand of factor income. To facilitate the presentation of results and useful inferences, following structure is used. First the aggregate results are summarized and presented in Section 5.3.1. Section 5.3.2 presents distribution of impact across contributing sectors; and Section 5.3.3 presents the distribution of impact across three major sectors, namely, agriculture, industry, and services. In all these sections both Type-I and Type-II impacts are presented. Estimates of employment include main as well as marginal workers in both formal as well as informal sectors.

5.3.1 Summary Results of Assessment of the Economic Impact of the Airport

Following the above procedure and the method discussed in Chapter 2 the economy-wide aggregate impacts of the directly accounted outputs of IGIA, Delhi are summarized in Table 5.6. This Table presents results from both Type-I and Type-II models.

It may be note here that the economic impact presented here in terms of income and employment do not net out the imported inputs because of lack of information and therefore, the actual contribution of the airport may be little less than the estimates. However while estimating direct output which is most fundamental to the analysis, care has been taken to use domestic components only. Further, India's total import is just about 7-8 per cent of its annual output, which includes inputs as well as final consumption. In addition, imports of input are very competitive and hence it is efficiency enhancing. Therefore, it can be safely ignored in overall assessment of impact analysis.

5.3.1.1 Economic Impact on Output

The direct output is the basic data and it remains same as accounted total output of INR 33139 crore as discussed earlier. However, the model based estimates of output, which takes into account direct effects, indirect effects and induced effects for the base year 2014-15 are as follows:

• Output based on direct accounting	:	INR 33139 crore
• Output based on Type-I impact model (direct + indirect effects)	:	INR 91054 crore
• Output based on Type-II impact model (direct+indirect+induced effects)	:	INR 189831 crore

Thus about INR 98775 crore can be attributed to be induced effect on economic output due to circulation of consumption demand created by the factor income.

5.3.1.2 Economic Impact on Value Added

Value added is more common variable for reporting impact of airport activities.

• The direct effect of accounted output on value added of the economy is estimated as	:	INR 7979 crore 0.07% of national GVA
• The impact on value added after taking into account direct and indirect effects as described by impact models Type-I is estimated as	:	INR 31366 crore 0.27% of national GVA and

• The impact on value added after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be	:	INR 80724 crore 0.70% of national GVA and

In terms of US$ the Type-II impact is about US$ 12.42 billion (@INR65/US$), which compares broadly with estimates of other international airports provided in Chapter 1).

5.3.1.3 Economic Impact on Employment

Using sector outputs and employment linkages of respective sectors, total employment can be estimated independent of accounted employment. However, in order to appreciate the industry specific conditions, it is important to use the numbers obtained by actual accounting as guiding principle. Considering both these aspects, the overall direct employment works out to be 1.06 lakh, this is close to the accounted employment. It may be noted that several small activities, particularly those associated with AAI activities, which were not captured in directly accounted employment, are captured here. In the accounted estimate, only proportionate employment of AAI could be included. Thus, the direct employment estimate of 1.06 lakh is reasonable.

Considering the flow effects of inputs across sectors; and flow of economy wide consumption; the employment corresponding to Type-I and Type-II impact models, works out to be 6.09 lakh and 45.72 lakh respectively. This result is driven by the fact that the induced effect takes place through flow of consumption of inter-alia essential goods like food, and other consumer products, which are labor intensive. In contrast, the Type-I effect captures the industry effect only through chain of input demands because of its backward linkages. The factor income which induces further demand in the economy through additional consumption of goods, and savings and investment cycle plays key role in arriving at Type-II effect.

• The direct employment is estimated as	:	1.06 lakh 0.02% of total workers
• The employment after taking into account direct and indirect effects as described by impact models Type-I	:	6.09 lakh 0.12% of total workers
• The employment after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be	:	28.39 lakh 0.56% of total workers

The Type-II employment captures all workers (main as well marginal workers) associated with formal and informal sectors including self-employed and farm labourers. It may be noted that the employment to output ratio is much higher in agriculture and un-organised sectors where most of the food and consumers products of mass consumption are produced. It is because of this that the induced effect captured in Type-II model leads to proportionately higher employment effects as compared to value added effect.

TABLE 5.6: SUMMARY OF ECONOMIC IMPACT OF IGIA, DELHI

Summary of Economic Effect of IGIA, Delhi by Type of Impact Assessment Models (2014-15)			
Details	Direct Effect	Type-I Impact	Type-II Impact
		Total (Direct + Indirect)	Total (Direct + Indirect + Induced)
Output (INR Crore)	33139	91054	189831
Value Added (INR Crore)	7979	31366	80724
Employment (lakh)	1.06	6.09	28.39
Value Added (US$ billion) @ INR65/US$	1.23	4.83	12.42
Summary of Economic Effect of IGIA, Delhi as Percentage of National Income (2014-15)			
Details	Direct	Type-I Impact	Type-II Impact
		Total (Direct + Indirect)	Total (Direct + Indirect + Induced)
Value Added as Percentage of National GVA (%)	0.07	0.27	0.70
Value Added as Percentage of Total GSDP of Delhi (%)[16]	1.77	6.95	17.89
Employment/Job Creation as Percentage of Total Workers (%)	0.02	0.12	0.56

Source (basic data): NCAER Research.

5.3.1.4 COMPARISON WITH THE RESULTS OF THE LAST STUDY

It may be desirable to compare the results of this study with the previous study done in 2012. However, the comparison may not be like to like because of several reasons: (1) the method used in the current study uses disaggregated output from activities mapped over 28 sectors of input-output table to account for the entire output due to airport operations. The 2012 study had aggregated the entire system of activities in two broad sectors only. (2) The current study uses I-O table based on new series of national accounts statistics (NAS) with base year 2011-12, which follows different methodology of estimating national GVA leading to differences in the contribution of air transport to the national income. The 2012 study was based on older I-O table and the base year for the study was 2009-10. (3) The 2012 study was more dominated by the construction sector and the quantum of direct output from operations was small, while the current study has more of operational activities and the quantum of direct output from operations is several times more than the previous study. (4) Because of changes in estimation methodology of GDP for the economy, it was important to carefully update the I-O table. Therefore, for the purpose of this study a new I-O Table using latest Supply – Use tables and the 2011-12 series of NAS data for 2014-15 has been used to update the multipliers. Again, difference may arise because of updated multipliers.

Nevertheless, in order to present a comparative view, the broad results of the two studies are presented in Table 5.7, where impacts are compared as percentage of national product and state product for Delhi. The comparative statement in Table 5.7 shows that the activities of airport have increased substantially during last five years leading to a large increase in the quantum of impacts.

The direct output on which the indirect and induced effects are dependent has increased from INR 7150 crore in previous study to INR 33139 crore in present study, which is almost fivefold increase. Because of

[16] For estimating actual impact on the economy of Delhi, one need to create an I-O Table or regional social accounting matrix for Delhi and then the actual impact on Delhi can be assessed.

this basic difference and other differences explained above, the Type-I and Type-II impacts are estimated to be much higher in the current study as compared to previous study (Table 5.7). Specifically:

- Direct output has increased from INR 7150 crore to INR 33139 crore
- The Type-II impact (direct + indirect + induced) on GVA has increased from INR 29470 crore to INR 80724 crore; and the employment creation has increased from 15.78 lakh to 28.39 lakh
- Type-II impact on the value added as percentage of national GVA has increased from 0.45 per cent to 0.70 per cent
- Type-II impact on the employment as percentage of total workers has increased from 0.34 per cent to 0.56 per cent

TABLE 5.7 COMPARISONS OF RESULTS OF CURRENT ECONOMIC IMPACT STUDY WITH 2012 STUDY

Details	Direct Effect		Direct + Indirect		Direct + Indirect + Induced	
	2012 Study	Current Study	2012 Study	Current Study	2012 Study	Current Study
Output (INR Crore)	7150	33139	20020	91054	49120	189831
Value Added (INR Crore)	4290	7979	12010	31366	29470	80724
Employment (lakh)	0.64	1.06	5.16	6.09	15.78	28.39
Value Added as Percentage of National GVA (%)	0.065	0.070	0.18	0.273	0.45	0.70
Value Added as Percentage of Total GSDP of Delhi (%)	1.18	1.77	5.51	6.95	13.53	17.89
Employment as percentage of total all India workers	0.014	0.02	0.11	0.12	0.34	0.56

Source (basic data): NCAER Research.

5.3.2 Distribution of Impact by the Contributing Sectors (2014-15)

The entire accounted output has been mapped over 28 sectors consistent with the 130X130 sector I-O Table. In the following two sections the distribution of impact is presented by the contributing sectors for direct effect, and Type-I and Type-II effects in respect to output, value added and employment.

5.3.2.1 DISTRIBUTION OF DIRECT IMPACT BY THE CONTRIBUTING SECTORS

The distribution of direct output, direct value added and direct employments across contributing sectors are presented in Tables 5.8 to 5.10.

Output: Top three sectors contributing about 82 per cent of output include Petroleum products arising out of exports to foreign airlines, air transport (domestic carriers) and support and auxiliary transport services (Table 5.8).

TABLE 5.8: DISTRIBUTION OF DIRECT/ACCOUNTED OUTPUT IN TERMS OF INPUT - OUTPUT SECTORS

Output Head	**Output INR (Crore)**	**Share (%)**
Petroleum products (exports to foreign airlines)	11501	34.71
Air transport (domestic)	11820	35.67
Supporting and Auxiliary Transport activities	3723	11.24
Land Transport including via pipeline	2101	6.34
Hotels and restaurants	1180	3.56
Trade	932	2.81
Public administration	869	2.62
Construction	494	1.49
Business services	186	0.56
Other	332	1.00
Total	33139	100

Source (basic data): NCAER Research.

Value Added: In terms of value added also the top three sectors include Petroleum products arising out of exports to foreign airlines, air transport (domestic carriers) and support and auxiliary transport services but their contributions are smaller (Table 5.9). The value added of these sectors is just about 59 per cent. The contributions of land transport, hotels and restaurants, trade and public administration are equally prominent.

Employment: The distribution of contribution to employment is much different in comparison to both output and value added. Land transport contributes to employment to the extent of about 31.3 per cent, while supporting and auxiliary transport activities contributes 22.7 per cent, air transport 11.2 per cent, public administration 9.8 per cent, hotels and restaurants 9.7 per cent , construction 9.0 per cent (Table 5.10). It may be noted that employment depends on the labor intensity of the sector.

TABLE 5.9: DISTRIBUTION OF VALUE ADDED DUE TO DIRECT/ACCOUNTED OUTPUT IN TERMS OF INPUT - OUTPUT SECTORS

Output Head	**Value Added INR (Crore)**	**Share (%)**
Petroleum products (exports to foreign airlines)	1622	20.33
Supporting and Auxiliary Transport activities	1601	20.06
Air transport (domestic)	1476	18.50
Land Transport including via pipeline	924	11.58
Trade	664	8.32
Public administration	649	8.13
Hotels and restaurants	626	7.85
Construction	172	2.16
Business services	115	1.44
Other	129	1.62
Total	7979	100

Source (basic data): NCAER Research.

TABLE 5.10: DISTRIBUTION OF EMPLOYMENT DUE TO DIRECT/ACCOUNTED OUTPUT IN TERMS OF INPUT - OUTPUT SECTORS

Output Head	Employment (Number)	Share (%)
Land Transport including via pipeline	33369	31.34
Supporting and Auxiliary Transport activities	24173	22.70
Air transport (domestic)	11948	11.22
Public administration	10473	9.84
Hotels and restaurants	10293	9.67
Construction	9598	9.01
Trade	1990	1.87
Petroleum products (exports to foreign airlines)	845	0.79
Other	3789	3.56
Total	106479	100

5.3.2.2 DISTRIBUTION OF TYPE-I AND TYPE-II EFFECTS BY THE CONTRIBUTING SECTORS

The distribution of Type-I and Type-II impact on output, value added and employments by contributing sectors are presented in Tables 5.11 to 5.13 and Figures 5.3 to 5.5 respectively.

Distribution of Type-I and Type-II impact on Output by Contributing Sectors

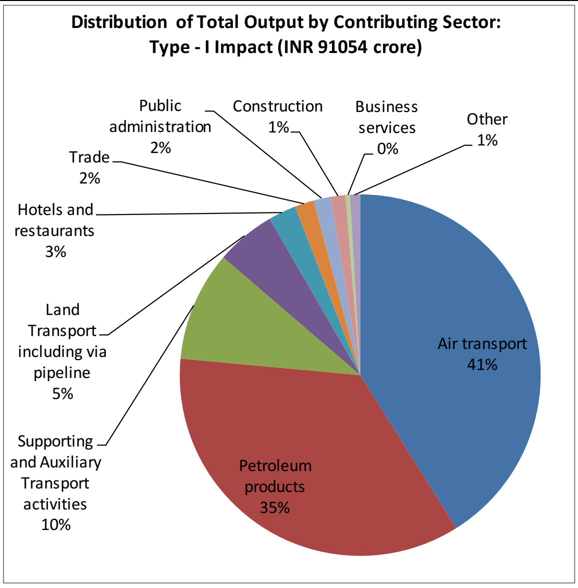
The distribution of outputs by contributing sectors with respect to both Type-I and Type-II impact models are similar in relative terms (Table 5.11 and Figure 5.3). Air transport (domestic) and petroleum products (sales to foreign airlines) contribute more than 70 per cent in both cases, which is followed by supporting and auxiliary transport activities. Land transport is the fourth largest activity at airport in terms of impact on national economy

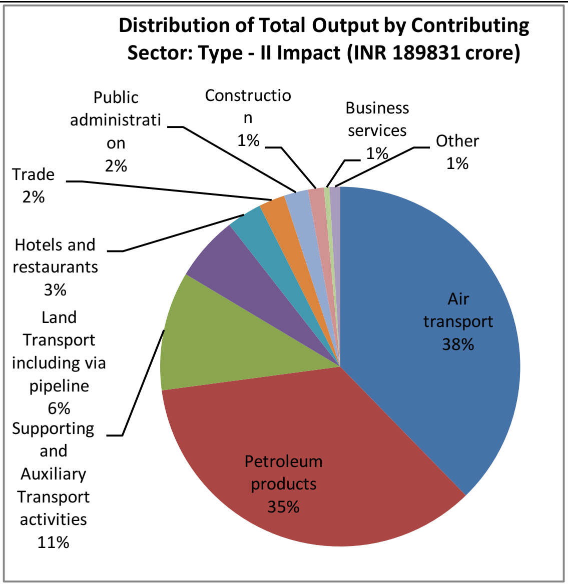
TABLE 5.11: DISTRIBUTION OF TYPE-I AND TYPE-II IMPACTS ON OUTPUT BY CONTRIBUTING SECTORS IN TERMS OF INPUT - OUTPUT SECTORS

Type - I Impact Model (Total Effect)			Type - II Impact Model (Total Effect)		
Output Head	Output INR (Crore)	Share (%)	Output Head	Output INR (Crore)	Share (%)
Air transport	37399	41.07	Air transport	71579	37.71
Petroleum products	32220	35.39	Petroleum products	66785	35.18
Supporting and Auxiliary Transport activities	8951	9.83	Supporting and Auxiliary Transport activities	20309	10.70
Land Transport including via pipeline	4857	5.33	Land Transport including via pipeline	11131	5.86
Hotels and restaurants	2269	2.49	Hotels and restaurants	6004	3.16
Trade	1567	1.72	Trade	4464	2.35
Public administration	1383	1.52	Public administration	4105	2.16
Construction	1222	1.34	Construction	2701	1.42
Business services	361	0.40	Business services	936	0.49
Other	826	0.91	Other	1817	0.96
Total	91054	100	Total	189831	100

Source (basic data): NCAER Research.

FIGURE 5.3: DISTRIBUTION OF TYPE-I AND TYPE-II IMPACTS ON OUTPUT BY CONTRIBUTING SECTORS IN TERMS OF INPUT - OUTPUT SECTORS





Source (basic data): NCAER Research.

Distribution of Type-I and Type-II Impact on Value Added by the Contributing Sectors

In terms of value added the ranking of sectors making contribution is not the same as output, the distribution of contributions is less concentrated (Table 5.12 and Figure 5.4). Petroleum products and air transport (domestic) contribute about 69 per cent of total effect on value added. Other important contributors include supporting and auxiliary transport activities, and land transport. As expected the distribution of value added with respect to both Type-I and Type-II impact models are similar.

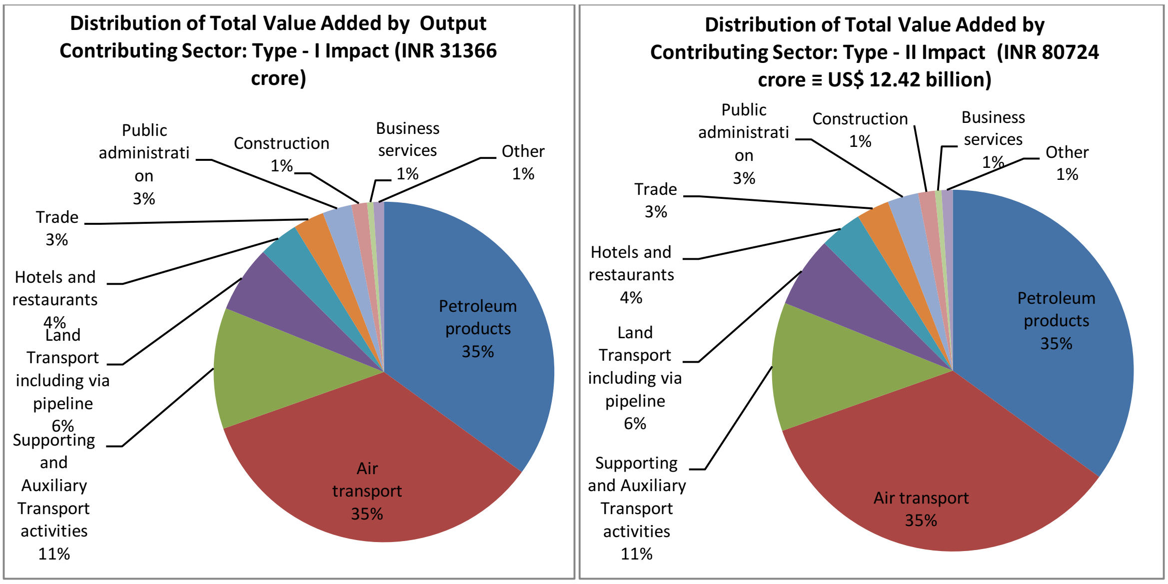
TABLE 5.12: DISTRIBUTION OF TYPE-I AND TYPE-II IMPACTS ON VALUE ADDED BY CONTRIBUTING SECTORS IN TERMS OF INPUT - OUTPUT SECTORS

Type - I Impact Model (Total Effect)		
Output Head	**Value Added INR (Crore)**	**Share (%)**
Petroleum products	10976	34.99
Air transport	10854	34.60
Supporting and Auxiliary Transport activities	3607	11.50
Land Transport including via pipeline	1992	6.35
Hotels and restaurants	1186	3.78
Trade	920	2.93
Public administration	864	2.76
Construction	470	1.50
Business services	183	0.58
Other	315	1.00
Total	31366	100

Type - II Impact Model (Total Effect)		
Output Head	**Value Added INR (Crore)**	**Share (%)**
Petroleum products	28248	34.99
Air transport	27934	34.60
Supporting and Auxiliary Transport activities	9283	11.50
Land Transport including via pipeline	5127	6.35
Hotels and restaurants	3052	3.78
Trade	2368	2.93
Public administration	2224	2.76
Construction	1209	1.50
Business services	470	0.58
Other	810	1.00
Total	80724	100

Source (basic data): NCAER Research.

FIGURE 5.4: DISTRIBUTION OF TYPE-I AND TYPE-II IMPACTS ON VALUE ADDED BY CONTRIBUTING SECTORS IN TERMS OF INPUT - OUTPUT SECTORS



Source (basic data): NCAER Research.

Distribution of Type-I and Type-II Impacts on Employment by the Contributing Sectors

Distribution of employment effect is presented in Table 5.13 and Figure 5.5, which indicate that air transport (domestic) and petroleum products (sales to foreign airlines) together with supporting and auxiliary transport activities make about 80 per cent of the contribution towards economy-wide employment generation. The distribution of employment effect by contributing sectors is also much different across Type-I and Type-II impact models. For example, contribution of petroleum product is just about 22.95 per cent in Type-I effect while it is 33.39 per cent in Type-II effect.

On the other hand the shares of land transport, hotel and restaurants, trade, public administration, and construction are higher in Type-I impact model as compared to Type-II model. Possibly the industry effect of these sectors is more dominant than the consumption flows.

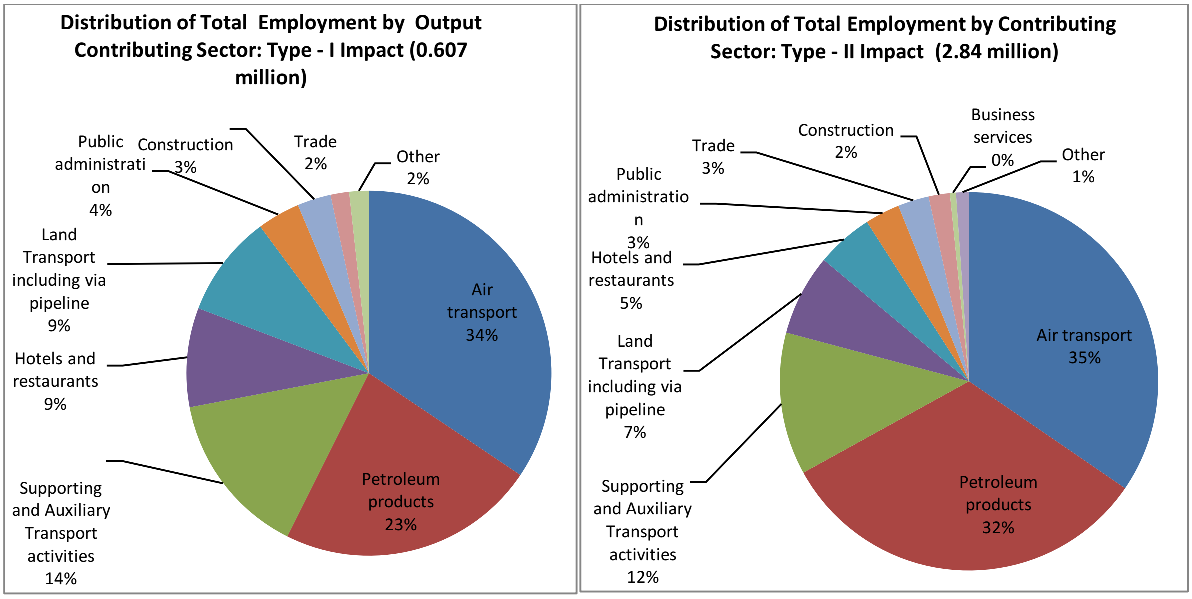
TABLE 5.13: DISTRIBUTION OF TYPE-I AND TYPE-II IMPACTS ON EMPLOYMENT BY CONTRIBUTING SECTORS IN TERMS OF INPUT - OUTPUT SECTORS

Type - I Impact Model (Total Effect)		
Output Head	Employment (Number)	Share (%)
Air transport	209589	34.43
Petroleum products	139744	22.95
Supporting and Auxiliary Transport activities	89053	14.63
Hotels and restaurants	53470	8.78
Land Transport including via pipeline	55165	9.06
Public administration	23075	3.79
Construction	18142	2.98
Trade	10015	1.64
Other	10565	1.74
Total	608817	100

Type - II Impact Model (Total Effect)		
Output Head	Employment (Number)	Share (%)
Air transport	981429	34.57
Petroleum products	920255	32.41
Supporting and Auxiliary Transport activities	345543	12.17
Land Transport including via pipeline	196829	6.93
Hotels and restaurants	137808	4.85
Public administration	84538	2.98
Trade	75435	2.66
Construction	51540	1.82
Business services	14683	0.52
Other	31253	1.10
Total	2839313	100

Source (basic data): NCAER Research.

FIGURE 5.5: DISTRIBUTION OF TYPE-I AND TYPE-II IMPACTS ON EMPLOYMENT BY CONTRIBUTING SECTORS IN TERMS OF INPUT - OUTPUT SECTORS



Source (basic data): NCAER Research.

5.3.3 Distribution of Impact on the Broad Sectors of the economy on Which the Demand Is Created

After analysing the distribution of impact of economic contributions of IGIA, Delhi, it is also important to examine the distribution of impacts in terms of demand created on agriculture, industry and services Table 5.14 and Figure 5.6 present the distribution of effects on these sectors corresponding to both Type-I and

Type-II impact models. It may be noted that absolute values of impact increases in regards to all parameters across all the three sectors but the extent of increase is different when flow of consumption is taken into account. The results also clearly bring out prominent impact of circulation of consumption flows on agriculture sector as captured by Type-II impact model.

In case of agriculture sector the impact estimated by Type-I model is proportionately much less than the estimates obtained by Type-II model. Specifically, Type-II results show an employment effect of 11.63 lakh in agriculture sector, while Type-I result shows only 1.01 lakh because the latter does not capture the effects of flow of factor income through consumption. This analysis therefore, unearths the hidden impacts of airport on employment in agriculture sector, which may not be obvious to several readers.

In terms of distribution of employment, the employment share of impact on services sector is 68.3 per cent in Type-I results and 41.4 per cent in Type-II results. The share of industry sector also is less in Type-II model as compared to Type-I model. In contrast, share of agriculture sector in Type-II model is 41.0 per cent as against 16.5 per cent in Type-I model.

In terms of value added, the impact is more on services sector as compared to both industry and agriculture. The share of agriculture in value added is less than ten per cent in both model of impact analysis.

TABLE 5.14: DISTRIBUTION OF ECONOMIC IMPACT (DIRECT, TYPE-I, AND TYPE-II) ON DEMAND ACROSS MAJOR SECTORS OF ECONOMY

Summary of Demand Side Effect of IGIA by Type of Impact Assessment Models as Percentage of GDP (2014-15)

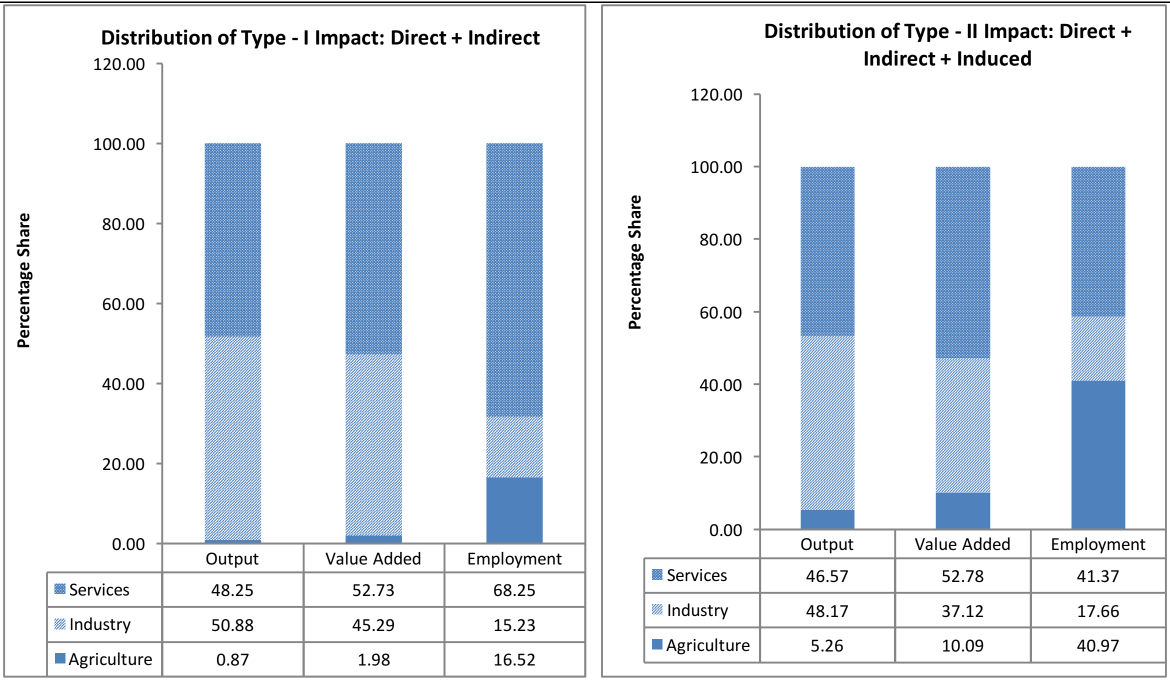
Sector wise distribution of Backward Linkages	Type - I Impact (Direct+Indirect)			Type - II Impact (Direct+Indirect+Induced)		
	Output (INR Crore)	Value Added (INR Crore)	Employment (lakh)	Output (INR Crore)	Value Added (INR Crore)	Employment (lakh)
Agriculture	790	621	1.01	9993	8149	11.63
Industry	46329	14206	0.93	91438	29965	5.01
Services	43936	16539	4.16	88400	42610	11.75
Total	91054	31366	6.09	189831	80724	28.39

DISTRIBUTION (PER CENT)

	Output	Value Added	Employment	Output	Value Added	Employment
Agriculture	0.9	2.0	16.5	5.2	10.1	41.0
Industry	50.9	45.3	15.2	48.2	37.1	17.6
Services	48.3	52.7	68.3	46.6	52.8	41.4
Total	100	100	100	100	100	100

Source (basic data): NCAER Research.

FIGURE 5.6: DISTRIBUTION OF TYPE-I AND TYPE-II IMPACT ON DEMAND ACROSS MAJOR SECTORS OF ECONOMY



Source (basic data): NCAER Research.

5.4 CATALYTIC IMPACT: AIRPORT – REGIONAL INTERACTION

The induced impacts included in Type-II results are likely to capture several aspects of development due to the presence of airport. Airports act as catalytic agents in development process of the region and the entire country. Some literature try to qualitatively separate them out but once factor income and consumption effect are made endogenous all aspects related to investment, local area development, tourism, industrialisation, competitiveness are likely to be covered. Therefore, this study does not treat catalytic effect as separate head of impact. However, it is important to discuss some of the channels that help developing synergy between airport and development.

In the globalised world aviation sector has become more competitive with the emergence of low cost carriers[17], concepts of hub and spoke networks[18], formation of global airlines alliances [19] along with steady privatization of airports[20]. A hub and spoke structure connects several investment vehicles, while each remaining individually managed, pool their assets together by contributing to one central investment vehicle. The smaller investment vehicles are referred to as the "spokes" while the central one is referred to as the "hub". This is also called a "master-feeder structure".

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[17] Button, K. (2009). Low Cost Airlines: A failed business model? Unpublished paper.
[18] Song, W. and Ma, Y. (2006). Hub-and-Spoke system in air transportation and its implications to regional economic development: A case study of United States. Chinese Geographical Science, 16(3):211-216.
[19] Burghouwt, G. and Huys, M. (2003), Deregulation and the Consequences for Airport Planning in Europe. *The Planning Review*, 154:37-44.
[20] Stevens, N. and Walker, A. (2008). Land Use at Privatized Australian Airports – Classification and Analyses. Aerlines Magazine 44. Netherlands.

With high pace of development and the growth of air traffic, airports have become more adaptive, entrepreneurial and proactive to the changing aviation dynamics. New concepts of synergy between city and airports are evolving in the form of “airport city”, “airport corridor”, and “aerotropolis”. Modern airports create infrastructure for meetings and greetings to facilitate networking for ideas, businesses, employment and income. The integrated development plans of airport invariably include expansion of transport network and hospitality industries to thrive in its precinct. This, in turn, promotes real estate businesses through establishment of malls, residential units and offices to cater to the need of multifarious activities that takes shape with the expansion of economic activities in and around airports. As a result a virtuous cycle of interdependent development is generated leading to efficient utilization of resources.

IGIA, Delhi has ambitious plan of developing aero-city with construction of hospitality districts and business centres spread over about 45 acres land. It has already established eight operational hotels with world class facilities. These hotels are at different stages of completion with current capacity of over 2300 rooms. When fully developed the capacity is likely to cross 5000 rooms. The growth of hospitality district of IGIA, Delhi is catalysed by easy connectivity with south Delhi and Gurgaon by road as well as the Delhi Metro, which has made it popular with business visitors and the travellers. The IGIA, Delhi has direct connectivity to National Highway-8. The Aero-city metro station and shuttle services to both domestic and international terminals make this place attractive and convenient for companies and institutions, and the business travellers. Within the vicinity of about 10 kilometres, several important organisations have established their offices, which include among others Accenture, Asian Development Bank, Airbus, Bombardier, Deloitte, Erickson, IBM, KPMG, McKinsey, Microsoft, Monsanto, World Bank, etc. It may be argued that these companies and many more located themselves near airport for easy connectivity. The catalytic effect of airport is also reflected in huge investments made in Guru Gram and other districts in close proximity. Thus, IGIA, Delhi and the industrial/institutional development around it presents an excellent example of synergy and two-way development process.

Chapter 6

Future Projections and Economic Impact at the 2025-26 Horizon

6.1 INTRODUCTION

Having estimated the economic contribution of IGIA, Delhi for the base year 2014-15, the objective of this chapter is to present economic impact at longer horizon of 2025-26. The motivation is to capture the dynamics of airport as it grows in throughput to the level of extant large airports. For example the current contribution estimated in US$ terms at about US$12.42 billion (Section 5.3.1, Chapter 5) is likely to increase with growth in traffic and business. In fact, given the current pace of growth of IGIA, Delhi it may soon reach the current level of today's Atlanta airport which handles over 100 million passengers and estimated to contribute about US$ 64 billion to the economy of United States.

In order to assess the economic contribution at 2025-26 horizon, it is pertinent to first assess the likely average path of passenger and freight movement at the IGIA, Delhi, which then can be used to project the economic impact under specific assumptions. However, projecting air traffic requires insight about both the global prospects of air traffic and the historical patterns of growth across major airports of the world. Therefore, the discussion in this chapter is organized as following. International evidences and trends in air traffic along with patterns of growth at selected high capacity airports are presented in Section 6.2. The methodology used for growth projection for IGIA, Delhi is discussed in Section 6.3. Traffic projection for IGIA, Delhi is presented in Section 6.4 and finally, the economic impact for the 2025-26 horizons is presented in Section 6.5.

6.2 INTERNATIONAL EVIDENCES AND TRENDS IN AIR TRAFFIC

According to Vision-2050 document of International Air Transport Association (IATA), in the past 40 years the volume of air travel has expanded tenfold and air freight has grown by a factor of fourteen. The world's economies have grown three to four times over the same period. Air transport has been one of the world's fastest growing economic sectors.[21] This report notes that the centre of gravity of the industry is shifting eastward with fructification of untapped potential of air transport services connecting the growing megacities and populations of the BRICS countries. The IATA report also talks about substantial increase in asset utilization and productivity improvements driven by changing business models and substantially increased competition. A liberalized market access became widespread over this period and many new airlines entered the industry. As a result the unit cost of air transport has reduced by almost 50 per cent

[21] https://www.iata.org/pressroom/facts_figures/Documents/vision-2050.pdf.

over the above period. With the passing of these benefits to consumers, the volume of operations has multiplied.

World Report (2016)[22] of Airports Council International (ACI) notes the power of growing middle class in key emerging markets that is leading the significant growth of intercontinental hubs in Asia-Pacific. The ACI report notes the fact that air transport's nucleus is moving eastward and India is poised to be one of the largest aviation markets in the world in the years to come. The India narrative of the report says 'the combination of a move towards a more liberalized market for aviation coupled with stronger economic fundamentals has helped to awaken the Bengal tiger to become one of the fastest growing markets in the world'.

6.2.1 China's Trajectory of Air Transport and Lessons for India

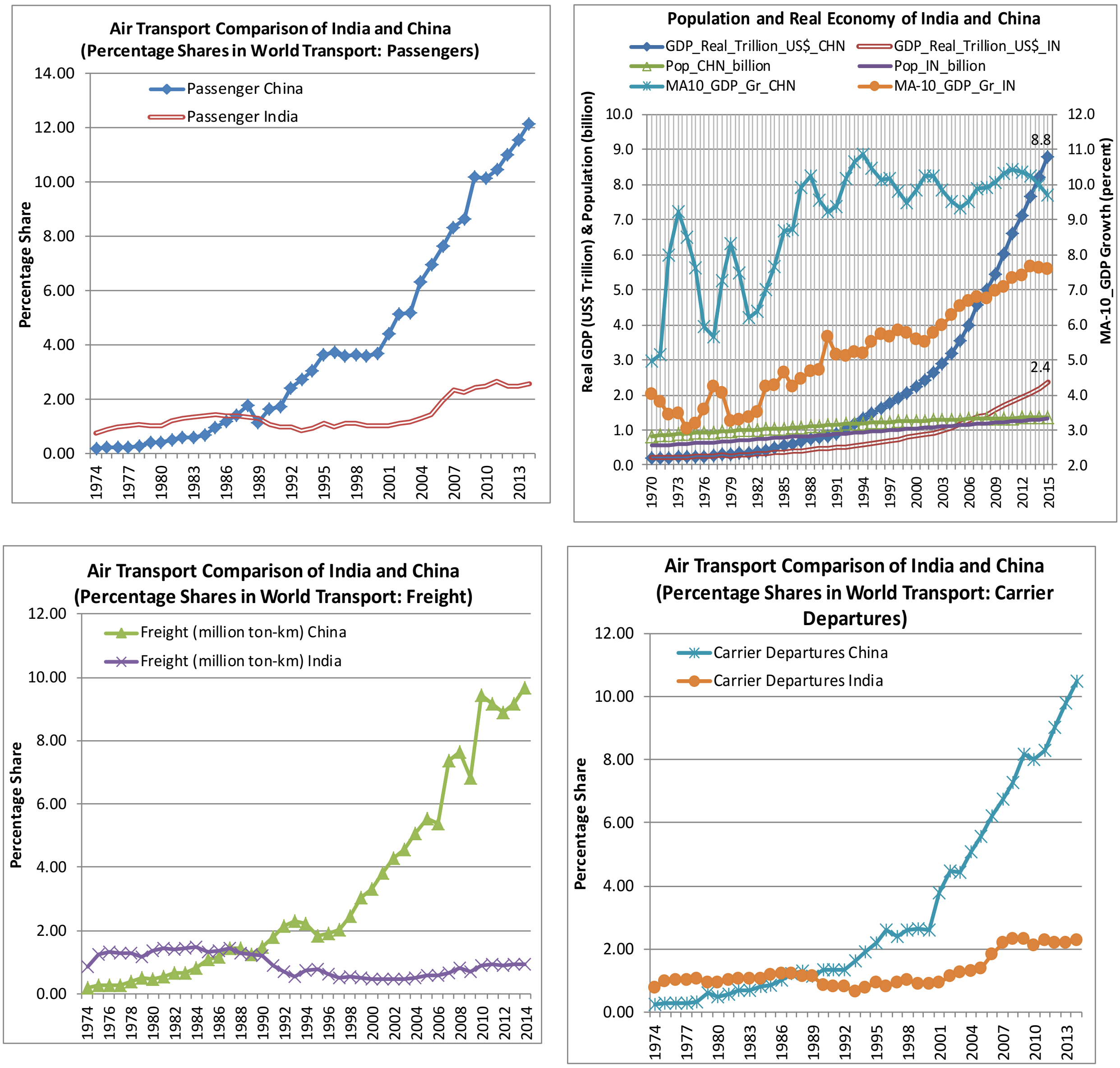
China and India, both are almost equally populated countries but China leads in terms of growth. Therefore, India can take advantage of data from China to foresee the events and infrastructure needs that are either associated with or follow growth. For this purpose, the data presented earlier in Chapter 1 is reproduced here in Figure 6.1 in a different way, where air traffic of India and China are presented as shares of the world volumes in order to normalise the comparison. Figure 6.1 presents data on size of economy, population, and 10 year moving average of real growth (MA-10) along with global shares of China and India in air transport.

China was about US$ 2.4 trillion economy in 2001, and at that time, its shares in passenger movement, carrier departure, and freight movement in world total was below four per cent. The moving average real economic growth had come down from peak of about 10.9 per cent in 1993 to 10.3 in 2001. However, it seems after crossing the threshold of this income, the air transport has had exponential growth despite slowing of GDP growth in latter periods. By 2013, Chinese economy grew to the level of about US$ 8.8 trillion and the shares of its passenger volume, carrier departure and freight volume in global air transport increased to 12 per cent, 9.7 per cent and 10.5 per cent respectively.

Considering the case of India, it became US$ 2.4 trillion economy (in real terms) in 2014-15 and it continues to grow at an average rate of 7.6 per cent (10 year moving average for 2014-15). The average per capita income of India is in the same range as that of China of 2001. With better income distribution in India, it can be argued that a formidable middle class is developing fast in India, which has capacity to afford air travel. The demand of such population on air travel is likely to grow at higher rate than income. Therefore, it is likely that India's air traffic growth will follow a similar trajectory as that of China in the next 10-15 years, which means an annual growth rate of about ten per cent (see Section 1.1 in Chapter 1). In such a situation IGIA, Delhi would have to bear its share of increased demand in coming years. Considering the historical fact that growth of IGIA, Delhi is much higher than all India average (see Figure 4.2, Chapter 4), and the fact that there is no immediate plan for another airport in the region; advance planning is needed for further expansion and development of IGIA, Delhi to meet the additional air traffic load. It is heartening to note that IGIA, Delhi is already working on this issue.

[22] http://www.aci.aero/News/ACI-World-Report.

FIGURE 6.1: AIR TRAFFIC CONCENTRATION IN CHINA AND INDIA AS SHARE OF GLOBAL TRAFFIC



Source (basic data): World Bank.

6.2.2 Effect of the Middle Class and Airbus Forecast of Air Transport in India

In yet another analysis, Airbus Global Market Forecast (2016-35)[23] prepared by Airbus shows strong and resilient global passenger traffic growth for the 20 year period of 2016-35 with air traffic (RPK) doubling every 15 years. The forecast highlights the role of new drivers in the development of modern air transport system. Airbus has projected demand of 33070 new aircraft (40 per cent of it for replacement) by 2030 recording a percentage change of 109 per cent over 2015. Yearly growth in air transport for 2016-35 is projected at 5.6 per cent in emerging/developing countries as against yearly growth of 3.7 per cent in advanced countries. The forecasts take into account the fact that global middle class[24] (households with yearly income between $20000 and $150000 at PPP (purchasing price parity) in constant 2015 prices) would move from 2.8 billion in 2015 to 4.8 billion in 2035. Out of 4.8 billion global middle class, 3.5 billion would be located in emerging economies. Considering the fact that a large proportion of this middle class would be from India, the forecast shows domestic traffic of India to grow more than 5-fold over 20 year. The Airbus forecast for domestic air traffic of India and international air traffic for Indian subcontinent is presented in Table 6.1. The forecast is quite aggressive for India. For the period of 2015-25, the annual compound growth rate (CAGR) for domestic passenger market is 10.9 per cent and for freight market it is 8.0 per cent. For the longer period between 2015 and 2035, the growth tappers down to 9.0 per cent and 6.9 per cent respectively.

In terms of international traffic the subcontinent is likely to experience a growth of about 6.4 per cent for both passenger and freight. Considering the fact that intra-regional traffic is very small and most of the global traffic flows to India, the growth for India could be little higher.

TABLE 6.1: PASSENGER AND FREIGHT FORECAST FROM AIRBUS GLOBAL MARKET FORECAST 2016-35

Passenger traffic forecast: per cent compound annual growth rate (CAGR)			
	CAGR based on non-oriented leg RPKs values (per cent)		
Flow	**2015-2025 CAGR**	**2025-2035 CAGR**	**2015-2035 CAGR**
World to Indian Subcontinent (Simple Average of different routes)	6.2	4.4	5.3
Indian Subcontinent to World (Simple Average of different routes)	6.6	5.5	6.0
Domestic India	10.9	7.1	9.0

Freight traffic forecast: per cent compound annual growth rate (CAGR)			
	CAGR based on oriented origin & destination FTKs values		
Flow	**2015-2025 CAGR**	**2025-2035 CAGR**	**2015-2035 CAGR**
World to Indian Subcontinent (Simple Average of different routes)	6.5	4.5	5.5
Indian Subcontinent to World (Simple Average of different routes)	6.4	4.7	5.6
Domestic India	8.0	5.8	6.9

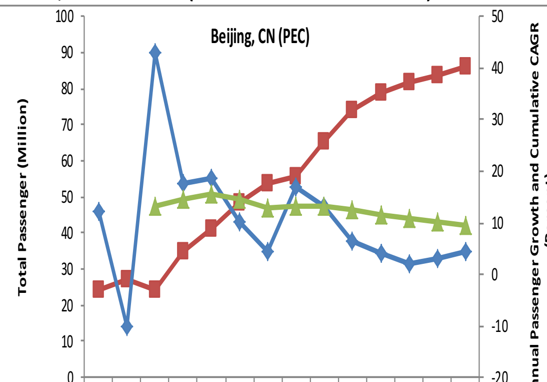
Source (basic data): Airbus Global market forecast 2016-35 and various citations therein.

[23] http://www.airbus.com/company/market/global-market-forecast-2016-2035/.
[24] Households with yearly income between $20000 and $150000 at PPP in constant 2015 prices.

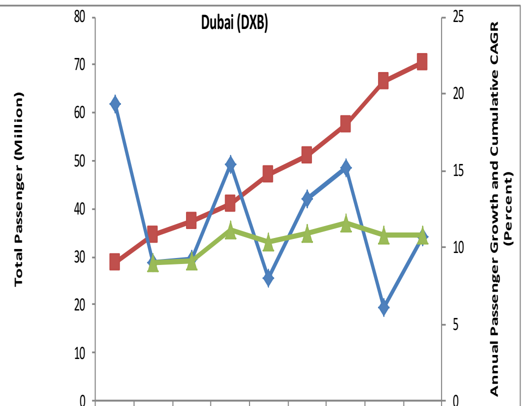
6.2.3 Progression of Selected Large Airports: Non-linearity in the Growth Pattern

Before forecasting traffic for the IGIA, Delhi, it may also be useful and insightful to look at the growth history of large airports of the World. For this purpose, data for four airports namely Atlanta, Beijing, Dubai, and London has been presented in Figure 6.2. Two of these airports namely Atlanta and London belong to developed countries; these can be termed as matured airports and further growth in air transport from these airports are likely to be limited by growth in local population. The other two airports, namely Beijing and Dubai are also large airports but these are still growing at high rates. Figure 6.2 presents data on (1) PAX for the previous year (base year) on which growth is recorded, (2) annual year-over-year growth (Gr), and (3) cumulative CAGR since earliest year of data availability. One of the purposes of examining these data is to see how growth rate change when an airport achieves certain reasonable level of PAX or to find out how high growth rate is possible after achieving (say) 50 million PAX.

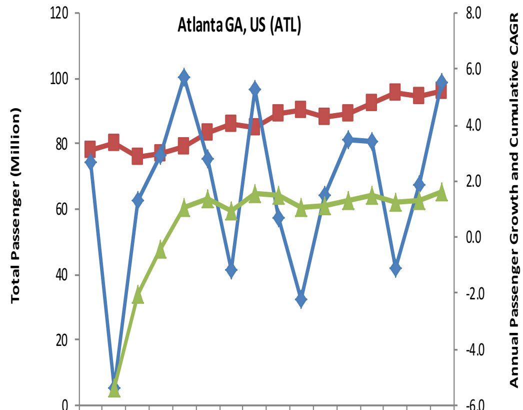
FIGURE 6.2: GROWTH PATTERNS OF LARGE AIRPORT: BEIJING, DUBAI (GROWING AIRPORTS); AND ATLANTA, LONDON (MATURE AIRPORTS)



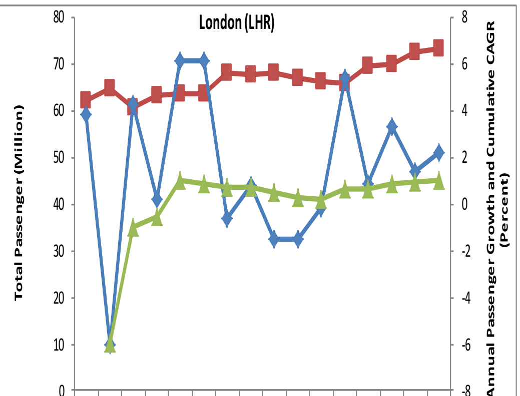
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
PEC_PAX_T-1	24	27	24	35	41	49	54	56	65	74	79	82	84	86
PEC_Gr	12.3	-10.	43.2	17.5	18.7	10.1	4.4	16.9	13.1	6.4	4.1	2.2	2.9	4.4
Cum_CAGR			13.3	14.7	15.7	14.6	12.8	13.4	13.3	12.5	11.7	10.8	10.1	9.6



	2007	2008	2009	2010	2011	2012	2013	2014	2015
DXB_PAX_Mn_T-1	29	34	37	41	47	51	58	66	70
DXB_Gr	19.3	9	9.2	15.4	8	13.2	15.2	6.1	10.7
Cum_CAGR		9.0	9.1	11.2	10.4	10.9	11.6	10.8	10.8



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
ATL_PAX_T-1	78	80	76	77	79	84	86	85	89	90	88	89	92	95	94	96
ATL_Gr	2.7	-5.	1.3	2.9	5.7	2.8	-1.	5.3	0.7	-2.	1.5	3.5	3.4	-1.	1.9	5.5
Cum_CAGR		-5.	-2.	-0.	1.1	1.4	1.0	1.6	1.5	1.0	1.1	1.3	1.5	1.3	1.3	1.6



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
LHR_PAX_T-1	62	65	61	63	63	63	68	68	68	67	66	66	69	70	72	73
LHR_Gr	3.8	-6	4.3	0.2	6.1	6.1	-0.6	0.8	-1.5	-1.5	-0.2	5.4	0.9	3.3	1.4	2.2
Cum_CAGR		-6.0	-1.0	-0.6	1.0	0.8	0.7	0.7	0.5	0.2	0.2	0.7	0.7	0.9	0.9	1.0

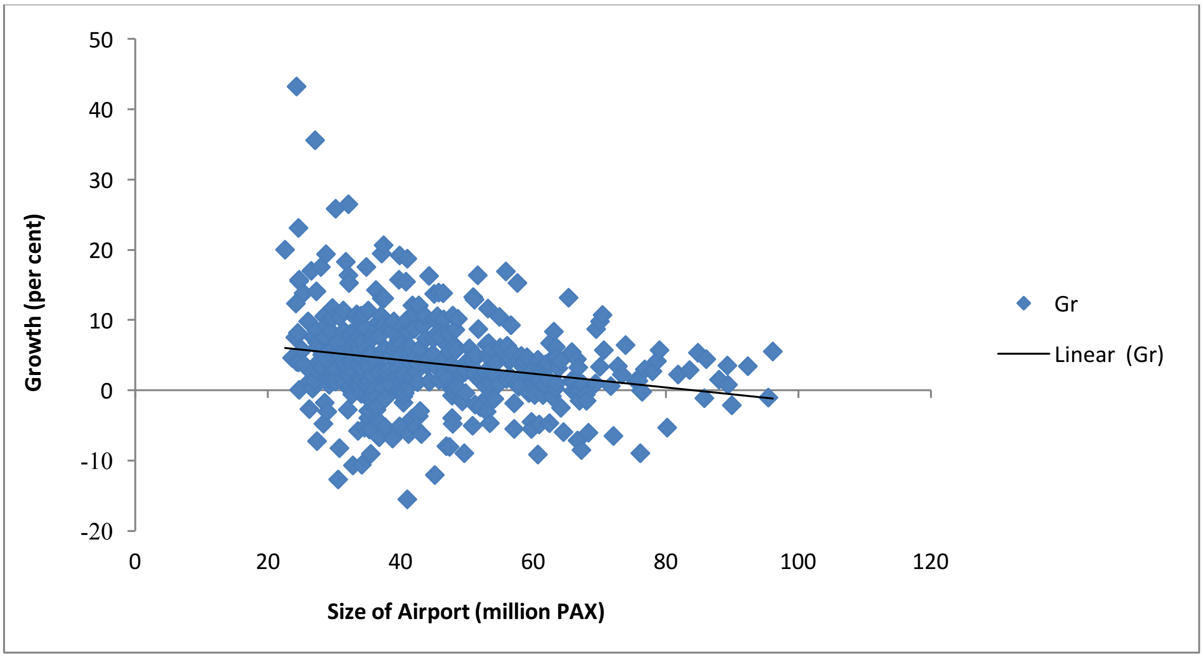
Source (basic data): Airports Council International.

Following inferences can be drawn:

- Large airports in developed countries are likely to grow at much slower rate.
- In developing economy, even large airport with PAX of the order of 70-80 million could experience a CAGR of 10-11 per cent.
- Beijing airport has more than doubled its passenger traffic from 41 million to 86 million in just nine years (2006 to 2015).
- Dubai has grown from 41 million to 70 million in just five years between 2010 and 2015.
- There is tendency for growth to tapper down with increasing size of passenger load.

Using 15 year data for top 30 airports (450 observations) a scatter plot between annual growth and size of the airport indicates that there is significant negative relationship between growth and size (Figure 6.3). Growth falls with increasing size. Therefore, some moderation is required in projecting growth with linear models.

FIGURE 6.3: SCATTER PLOT BETWEEN SIZE OF AIRPORT AND GROWTH



Source (basic data): NCAER Research.

6.3 METHODOLOGY FOR PROJECTION

As discussed earlier, projection of economic impact of IGIA, Delhi for the period 2025-26 requires projection of traffic demand at IGIA, Delhi in 2025-26, which can be used to project the likely impact on the economy.

For projecting air traffic demand, econometric models have been used but due consideration has also been given to the evidences and trends observed globally. Therefore, the results obtained from reasonably well fitted linear econometric models are adjusted to incorporate non-linearity in demand. Typically such adjustment is done in growths as demonstrated in Figure 6.3. Domestic PAX, International PAX, Domestic Freight, and International freight are projected using separate econometric models for each of them. The basic econometric model is multivariate dynamic regression based forecast in vector error correction framework. After experimenting with several variable sets, econometrically consistent models were selected to present the results. For each model a subset of variables have been chosen from a longer list of relevant variables which include, National GDP, world GDP, world crude price index, domestic oil price index, services sector GDP, wholesale price index etc. The theoretical part and equations are abstracted from discussion to avoid clumsiness.

Once forecast for key variables are obtained the expected output for each of the activity discussed in previous chapter is estimated using ratios and then the I-O framework is applied to obtain the impact in nominal terms for the forecasted period. The entire exercise is complex and requires several assumptions which are listed below.

Assumptions

(1) IGIA, Delhi will remain the only international airport in the national capital region during next ten years.

(2) IGIA, Delhi would therefore have to cater to the demand of NCR as well as neighboring states arising out of growth in population and average income.

(3) New policy of the government to promote air travel for common citizen would create additional demand. However, the recent withdrawal of high value currency from the circulation might dent economic growth for a brief period during second half of 2016-17 and first half of 2017-18.

(4) Increasing price of premier class in rail transport would motivate several passengers to move to air travel.

(5) With increasing size of PAX, the growth may slow down due to supply constraints, base effects, and congestion.

(6) Nominal gross value added is assumed to grow at 12 per cent, which is average of last three years (2011-12 to 2014-15). The GDP deflator is assumed to grow at five per cent and nominal wage is assumed to grow at seven per cent per annum.

(7) It is assumed that the current I-O table would remain valid for the next ten years.

(8) The ratios of physical performance of airport and the revenue generation would remain stable for the forecasted period.

6.4 PROJECTION/ ESTIMATES OF PASSENGER AND FREIGHT DEMAND FOR IGIA, DELHI (THE 2025-26 HORIZON)

Two sets of air traffic projections are used for estimating economic impact of IGIA, Delhi at 2025-26 horizons. Section 6.4.1 presents NCAER projection made for this study and Section 6.4.2 presents air traffic projections made in the 2016 Review of the Master Plan. It may be noted that air traffic forecast is not the primary mandate of this study. The primary mandate is to estimate plausible economic impact of the IGIA Delhi at reasonably distant future time period. Therefore, the traffic forecasts used here are intermediate variables needed for the impact analysis. Two sets of traffic projection would show how economic impact may change if air traffic changes. It may also be noted that the IGIA, Delhi is yet to mature and therefore, any forecast of traffic is would at best be a guiding trajectory.

However, looking at the two projections indicates that the projections for passenger load in the 2016 Review of Master Plan are slightly at the lower side, 83.95 million in 2025-26 compared to NCAER projection, which is 96.63 million. Therefore, it may be better to have a higher capacity in advance than to face a situation of capacity constraints after full development of the airport.

The results of NCAER forecast for passenger traffic are presented in Table 6.2 and Figure 6.4, while forecasts for freight are presented in Table 6.3 and Figure 6.5. Projections made in 2016 Review of Master Plan are presented in Sections 6.4.2.

6.4.1 Air Traffic Projections: NCAER

As discussed earlier the air traffic forecasts are based on econometric models. However, in all cases the model growths are sequentially moderated to account for non-linearity due to base effects.

6.4.1.1 Passenger Movement (NCAER projection)

The projections made in this study for the terminal year 2025-26 work out to be 96.63 million with share of domestic passengers to be 72.99 million (Table 6.2 and Figure 6.4).

Thus, for the forecasted period of 2014/15-2025/26, the CAGR for passenger growth comes out to be 8.20 for domestic passengers and 6.78 for international passengers leading to overall CAGR for passenger to be 7.83 per cent. This is less than the CAGR obtained by China while growing from 41 million PAX to 86 million PAX (Figure 6.2). This is also less than the projection of Airbus (Table 6.1) and the projection made by the working group for 12th Plan period. The 12th Plan period (2012-17) projection had assumed a passenger growth of 12 per cent per year. Therefore, the economic impact estimated for the terminal year 2025-26 may be a conservative estimate.

TABLE 6.2: DEMAND FORECAST FOR PASSENGER MOVEMENT (2014/15-2025/26): NCAER

Forecast for Passenger Movement (NCAER) (million)						
Year	**Domestic**		**International**		**Total**	
	Actual	Forecast	Actual	Forecast	Actual	Forecast
2013-14	24.20	27.08	12.68	10.71	36.88	37.79
2014-15	27.45	30.66	13.53	11.48	40.99	42.15
2015-16	34.27	34.72	14.15	12.30	48.42	47.03
2016-17		39.32		13.19		52.51
2017-18		44.02		14.13		58.15
2018-19		48.70		15.12		63.83
2019-20		53.25		16.17		69.42
2020-21		57.53		17.28		74.81
2021-22		61.48		18.44		79.91
2022-23		65.01		19.65		84.66
2023-24		68.10		20.93		89.03

(Contd.)

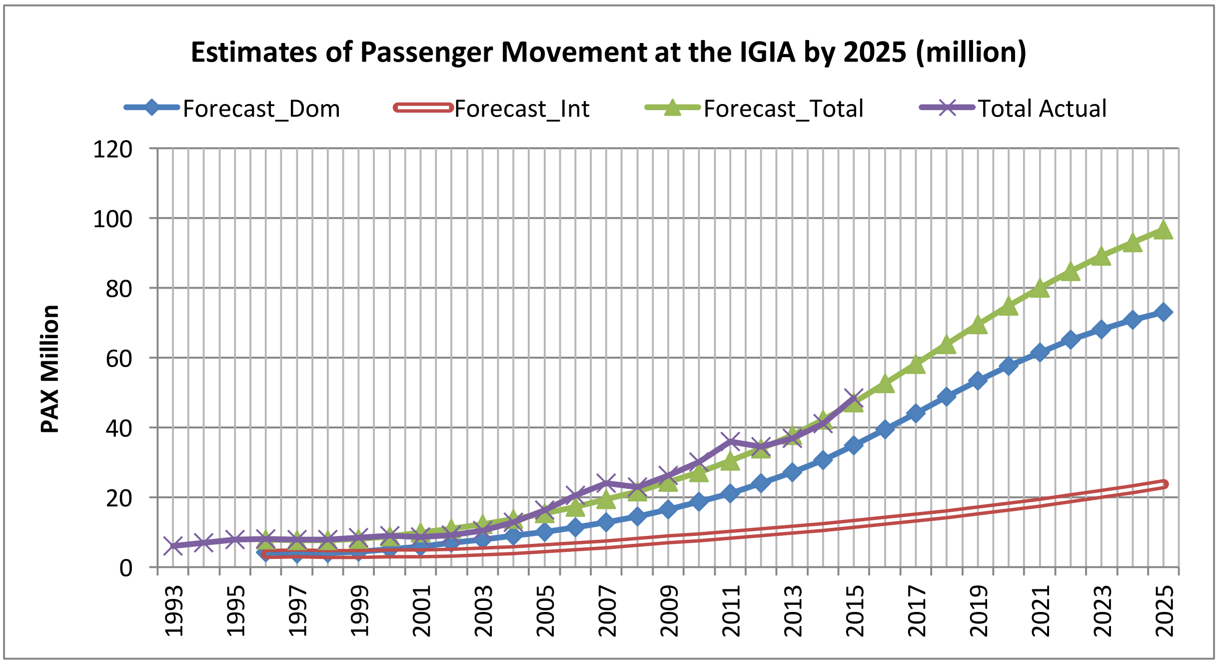
TABLE 6.2: DEMAND FORECAST FOR PASSENGER MOVEMENT (2014/15-2025/26): NCAER (Contd.)

Forecast for Passenger Movement (NCAER) (million)						
Year	**Domestic**		**International**		**Total**	
	Actual	Forecast	Actual	Forecast	Actual	Forecast
2024-25		70.76		22.26		93.01
2025-26		72.99		23.64		96.63
CAGR (Per cent)						
2014-25		8.20		6.78		7.83
2010-15	10.65		8.82		10.09	
2005-15	12.59		9.39		11.55	
2000-15	13.72		8.88		11.93	

Source (basic data): NCAER Research.

Given the prospects of high growth in air traffic at the IGIA, Delhi, it may lead to congestion at the IGIA, Delhi calling for expansion plan. DIAL's 2016 Review of the Master Plan 2006 highlights elaborate development strategy to meet such demand. However, it may also be suggested that the expansion should be tailored to meet possibly a higher demand given the fact that government has already launched the UDDAN scheme where maximum price for one hour domestic flight will be limited to INR 2500 (including all taxes) and 50 per cent seats of planes would be reserved for UDAN (Ude Desh Ka Aam Naagrik) scheme. To fructify this scheme, 50 airports will be upgraded, which when done, the connectivity of IGIA, Delhi would increase leading to higher air traffic demand. As per recent information the regional connectivity scheme has got off well and the bidding under UDAN has already seen as many as 20 registrations from operators.[25]

FIGURE 6.4: ESTIMATES OF PASSENGER MOVEMENT AT THE IGIA, DELHI (2014/15-2025/26): NCAER



Source (basic data): NCAER Research.

[25] http://www.businesstoday.in/sectors/aviation/20-registrations-so-far-under-udan-bidding-govt/story/240454.html.

6.4.1.2 Freight Movement (NCAER Projection)

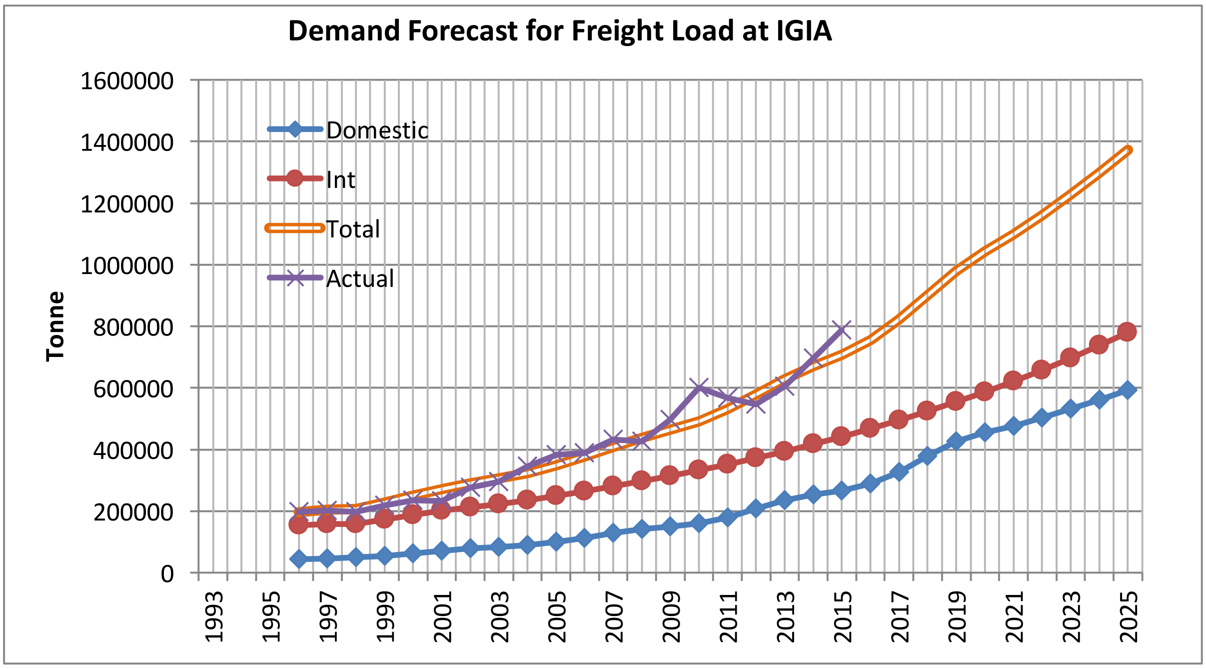
In terms of freight, the overall CAGR for 2014/15-2025/26 works out to be 6.74 per cent leading to demand for freight capacity of 1373.1 thousand tons in terminal year 2025-26 (Table 6.3 and Figure 6.5). CAGR for domestic movement is 8.03 per cent as compared to 5.86 per cent for the international movements. It may be noted that these forecasts are obtained after systematic moderation to take into account supply constraints and slowdown in average annual growth with increasing base (see CAGR for various sub-periods in Table 6.3).

TABLE 6.3: DEMAND FORECAST FOR FREIGHT LOAD AT IGIA, DELHI (2014/15-2025/26): NCAER

Forecast for Freight Movement (NCAER) (000 tonne)						
Year	**Domestic**		**International**		**Total**	
	Actual	Forecast	Actual	Forecast	Actual	Forecast
2013-14	215.8	235.5	389.85	394.0	605.7	629.5
2014-15	271.8	253.3	424.78	417.0	696.5	670.4
2015-16	295.1	266.9	492.06	441.5	787.2	708.4
2016-17		289.0		467.3		756.3
2017-18		327.2		494.7		821.9
2018-19		378.1		523.7		901.9
2019-20		425.7		554.5		980.2
2020-21		455.1		587.0		1042.0
2021-22		476.6		621.4		1098.0
2022-23		503.3		657.8		1161.1
2023-24		531.5		696.4		1227.9
2024-25		561.3		737.2		1298.5
2025-26		592.7		780.4		1373.1
CAGR (Per cent)						
2014-25		8.03		5.86		6.74
2010-15	7.13		4.71		5.58	
2005-15	10.41		6.05		7.47	
2000-15	11.03		7.19		8.39	

Source (basic data): NCAER Research.

FIGURE 6.5: DEMAND FORECAST FOR FREIGHT LOAD AT IGIA, DELHI (2014/15-2025/26): NCAER



Source (basic data): NCAER Research.

6.4.2 Air Traffic Projections: Master Plan

The 2016 Review of the Master Plan for the IGIA, Delhi has given projections for air traffic for a longer period ending 2033-34. However, for the purpose of estimating the economic impact, projections up to 2025-26 have been used and the same is presented below.

6.4.2.1 Passenger movement (Master Plan)

These projections made in the 2016 Review of the Master Plan are presented in Tables 6.4 and 6.5. A comparison of NCAER projections and that of master plan indicate broad similarity except growth in domestic passengers. In case of domestic passengers, the master plan has estimated volume of passengers for the year 2015-16 as 28.73 million as against the actual of 34.27 million leaving a difference of the order of about 5.54 million. When a reducing growth is applied at lower base, the domestic passenger load for the year 2025-26 is obtained as 57.25 million. With 26.70 million international passenger load the total works out to be 83.95 million.

6.4.2.2 Freight movement (master Plan)

Projection for freight load as indicated in the 2016 Review of Master Plan is presented in Tables 6.5. The total freight load for year 2015-16 is projected as 690.10 thousand tonnes as against actual of 787.20 thousand tonnes. For the same year NCAER has estimated total freight of 708.4 thousand tonnes. The forecasts for 2025-26 in the master plan is 1228.6 thousand tonne as against the estimates of 1373.1 thousand tonne by NCAER.

TABLE 6.4: DEMAND FORECAST FOR PASSENGER LOAD AT IGIA, DELHI (2014/15-2025/26): MASTER PLAN – 2016

Master Plan Review 2015-16 Forecast for Passenger Movement (million)						
Year	**Domestic**		**International**		**Total**	
	Actual	Forecast	Actual	Forecast	Actual	Forecast
2013-14	24.20	24.20	12.68	12.68	36.88	36.88
2014-15	27.45	26.63	13.53	13.31	40.99	39.94
2015-16	34.27	28.73	14.15	14.33	48.42	43.05
2016-17		31.29		15.85		47.15
2017-18		33.88		16.81		50.69
2018-19		36.68		18.03		54.70
2019-20		39.58		19.24		58.82
2020-21		42.59		20.50		63.10
2021-22		45.64		21.79		67.43
2022-23		48.66		23.07		71.73
2023-24		51.63		24.34		75.97
2024-25		54.51		25.55		80.06
2025-26		57.25		26.70		83.95
CAGR						
2014-25		7.20		6.53		6.99
2010-15	10.65		8.82		10.09	
2005-15	12.59		9.39		11.55	
2000-15	13.72		8.88		11.93	

Source (basic data): Master Plan-2016.

TABLE 6.5: DEMAND FORECAST FOR FREIGHT LOAD AT IGIA, DELHI (2014/15-2025/26): MASTER PLAN – 2016

Master Plan Review 2015-16 Forecast for Freight Movement (000 tonne)						
Year	**Domestic**		**International**		**Total**	
	Actual	Forecast	Actual	Forecast	Actual	Forecast
2013-14	215.8	215.8	389.85	389.9	605.7	605.7
2014-15	271.8	229.3	424.78	414.0	696.5	643.3
2015-16	295.1	245.8	492.06	444.3	787.2	690.1
2016-17		266.1		473.6		739.7
2017-18		286.5		502.5		789.0
2018-19		308.6		530.9		839.5
2019-20		331.6		559.5		891.1
2020-21		355.7		589.1		944.8
2021-22		380.3		619.7		1000.0
2022-23		404.8		650.8		1055.6
2023-24		429.1		682.4		1111.5
2024-25		454.1		715.1		1169.2
2025-26		479.9		748.7		1228.6
CAGR						
2014-25		6.94		5.53		6.06
2010-15	7.13		4.71		5.58	
2005-15	10.41		6.05		7.47	
2000-15	11.03		7.19		8.39	

Source (basic data): Master Plan-2016.

6.5 PROJECTED IMPACT ASSESSMENT: THE 2025-26 HORIZON

Applying the growth rates of passenger and freight movements with appropriate inflation and macroeconomic assumptions the economic impact has been assessed for the period 2014-2025. The impact is assessed in terms of value added and employment generation using air traffic projections of this study as well as that of 2016 Review of the Master Plan.

6.5.1 Projected Economic Impact based on NCAER Projections of Air Traffic

The economic impact of IGIA, Delhi in terms of value added and employment for the year 2025-26 is summarized in Table 6.6, while year wise impact from 2014-15 to 2025-26 is presented in Figures 6.6 to 6.8. The broad figures for the terminal year 2025-26 are the following:

• The direct impact on value added is estimated as	:	INR 23,743 crore, 0.06% of estimated national GVA
• The impact on value added after taking into account direct and indirect effects as described by impact models Type-I is estimated as	:	INR 93,392 crore, 0.23% of estimated national GVA
• The impact on value added after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be	**:**	**INR 2,40,356 crore,** **0.60% of estimated national GVA**

• The direct impact on employment is estimated as	:	1.52 lakh, 0.02% of total estimated workers
• The impact on employment after taking into account direct and indirect effects as described by impact models Type-I	:	8.67 lakh, 0.12% of total estimated workers
• The impact on employment after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be	**:**	**40.22 lakh,** **0.58% of total estimated workers**

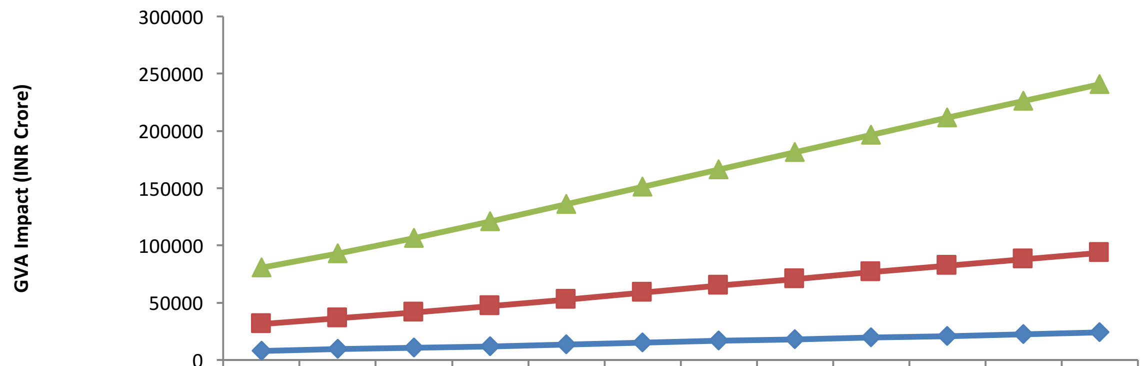
The Type-II Impact on value added for 2025-26, when converted in US$ terms (@INR65/US$), works out to be US$ 36.98 billion. This effect is similar to that of Atlanta Airport where traffic volume is also of the similar order (about 100 million) as projected for IGIA, Delhi.

TABLE 6.6: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI (2025-26) BASED ON AIR TRAFFIC PROJECTION OF NCAER

Projected Impact 2025-26			
Details	Direct Impact	Type-I Impact Model (Direct + Indirect)	Type-II Impact Model (Direct + Indirect + Induced)
Value Added (INR Crore)	23743	93392	240356
Employment (Lakh)	1.52	8.67	40.22
Value Added (US$ billion) @ INR65	3.65	14.37	36.98
Value Added as Percentage of National Gross Value Added (GVA) (%)	0.06	0.23	0.60
Employment/Job Creation as Percentage of Total Workers (%)	0.02	0.12	0.58

Source (basic data): NCAER Research.

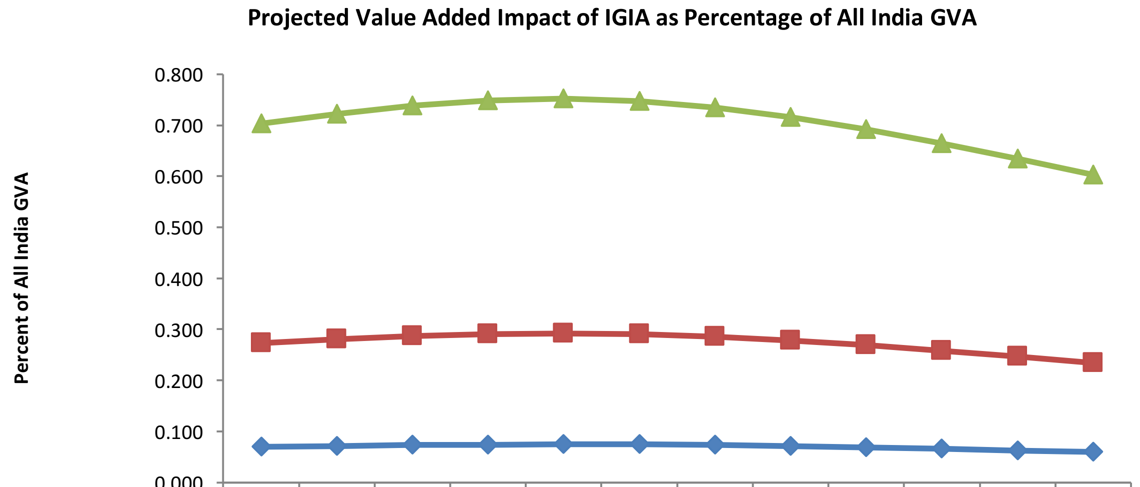
FIGURE 6.6: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI ON VALUE ADDED (BASED ON AIR TRAFFIC PROJECTION OF NCAER)



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Direct Impact	7979	9159	10486	11922	13443	14987	16492	17969	19444	20899	22332	23743
Type-I Impact	31366	36045	41277	46872	52750	58737	64664	70529	76370	82132	87805	93392
Type-II Impact	80724	92766	106230	120631	135757	151167	166420	181515	196547	211377	225977	240356

Source (basic data): NCAER Research.

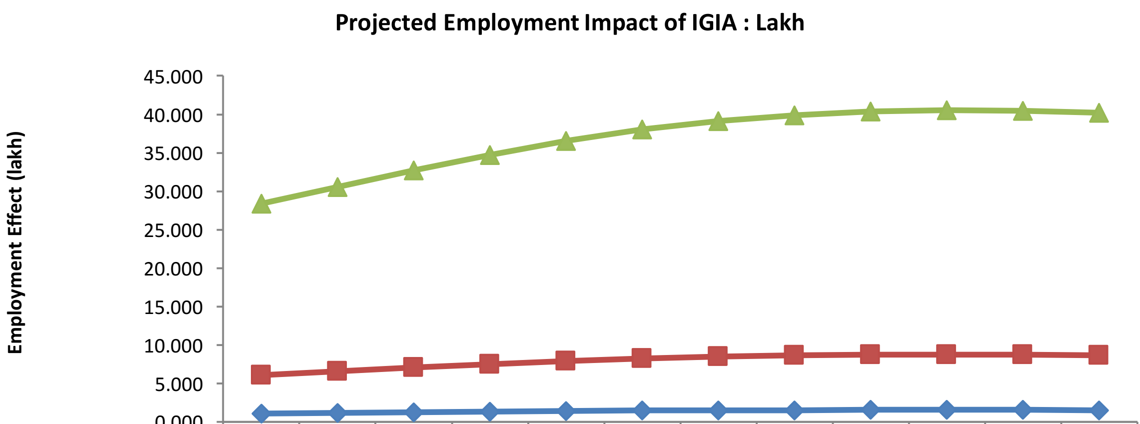
FIGURE 6.7: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI ON VALUE ADDED AS PERCENTAGE OF PROJECTED TOTAL GROSS VALUE ADDED OF INDIA (BASED ON AIR TRAFFIC PROJECTION OF NCAER)



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Direct Impact	0.070	0.071	0.073	0.074	0.074	0.074	0.073	0.071	0.068	0.066	0.063	0.059
Type-I Impact	0.273	0.281	0.287	0.291	0.292	0.291	0.286	0.278	0.269	0.258	0.246	0.234
Type-II Impact	0.704	0.722	0.738	0.748	0.752	0.748	0.735	0.716	0.692	0.664	0.634	0.602

Source (basic data): NCAER Research.

FIGURE 6.8: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI ON EMPLOYMENT (BASED ON AIR TRAFFIC PROJECTION OF NCAER)



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Direct Impact	1.065	1.148	1.235	1.318	1.393	1.455	1.497	1.523	1.539	1.542	1.536	1.521
Type-I Impact	6.088	6.558	7.041	7.494	7.902	8.235	8.475	8.635	8.729	8.761	8.738	8.667
Type-II Impact	28.393	30.514	32.679	34.703	36.519	38.016	39.116	39.868	40.337	40.530	40.479	40.220

Source (basic data): NCAER Research.

6.5.2 Projected Economic Impact Based on air Traffic Projections of the 2016 Review of the Master Plan

When air traffic load projected in master plan is used for the impact assessment, the terminal year (2025-26) estimates of economic impact are at slightly lower side as summarized in Table 6.7. Year-wise trend of impacts on value added and employment are presented in Figures 6.9 to 6.11. The broad figures for the terminal year 2025-26 are the following:

• The direct impact on value added is estimated as	:	INR 22398 crore, 0.06% of estimated national GVA
• The impact on value added after taking into account direct and indirect effects as described by impact models Type-I is estimated as	:	INR 88399 crore, 0.22% of estimated national GVA
• **The impact on value added after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	**:**	**INR 227506 crore,** **0.57% of estimated national GVA**

• The direct impact on employment is estimated as	:	1.43 lakh, 0.02% of total estimated workers
• The impact on employment after taking into account direct and indirect effects as described by impact models Type-I	:	8.17 lakh, 0.11% of total estimated workers
• **The impact on employment after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	**:**	**38.04 lakh,** **0.53% of total estimated workers**

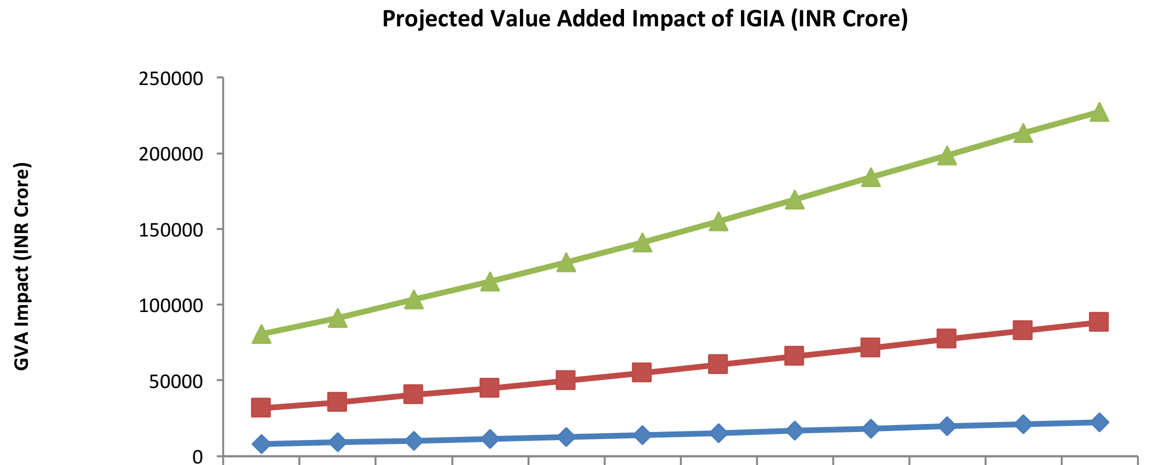
Type-II Impact on value added for 2015-26, when converted in US$ terms (@INR65/US$), works out to be US$ 35.00 billion.

TABLE 6.7: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI (2025-26) BASED ON AIR TRAFFIC PROJECTION IN MASTER PLAN

Details	Direct Impact	Type-I Impact Model (Direct + Indirect)	Type-II Impact Model (Direct + Indirect + Induced)
Value Added (INR Crore)	22398	88399	227506
Employment (Lakh)	1.43	8.17	38.04
Value Added (US$ billion) @ INR65	3.45	13.60	35.00
Value Added as Percentage of National Gross Value Added (GVA) (%)	0.06	0.22	0.57
Employment/Job Creation as Percentage of Total Workers (%)	0.02	0.11	0.53

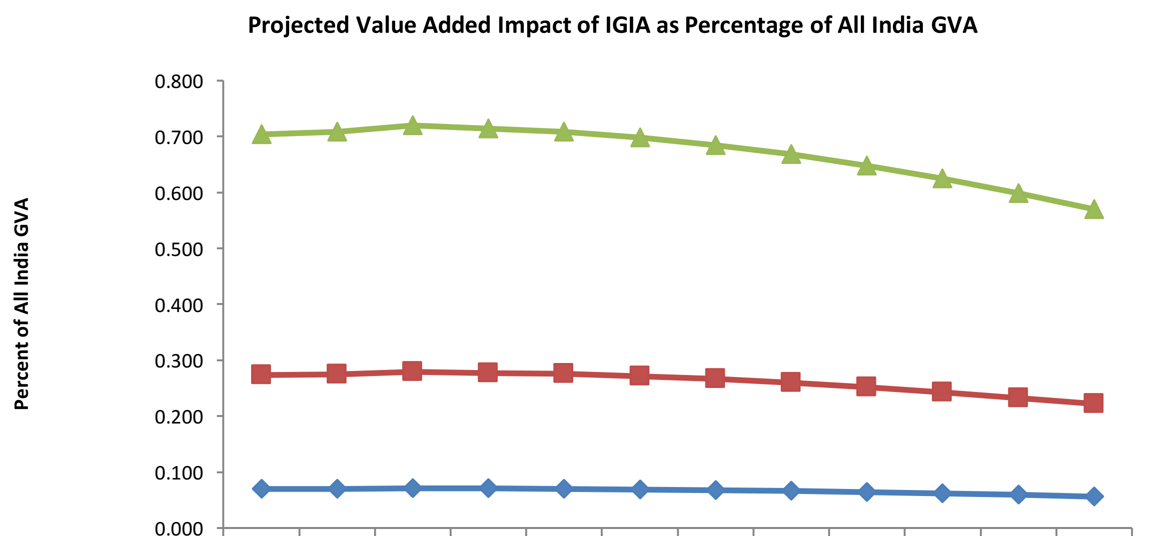
Source (basic data): NCAER Research.

FIGURE 6.9: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI ON VALUE ADDED (BASED ON AIR TRAFFIC PROJECTION IN MASTER PLAN)



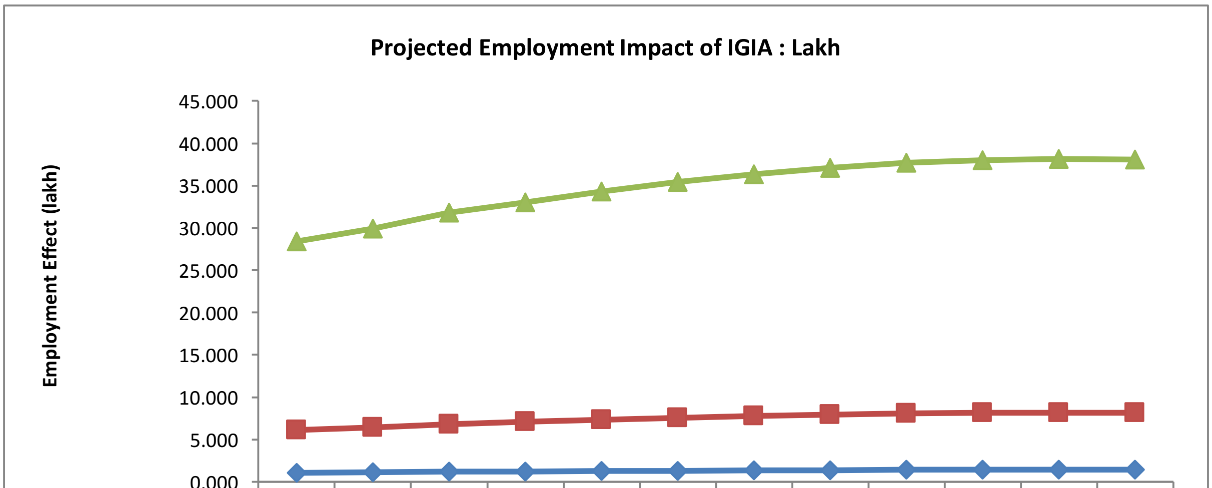
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Direct Impact	7979	8989	10213	11346	12600	13904	15268	16676	18104	19543	20979	22398
Type-I Impact	31366	35349	40257	44711	49684	54851	60260	65838	71488	77181	82839	88399
Type-II Impact	80724	90975	103606	115068	127868	141164	155085	169441	183983	198635	213195	227506

FIGURE 6.10: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI ON VALUE ADDED AS PERCENTAGE OF PROJECTED TOTAL GROSS VALUE ADDED OF INDIA (BASED ON AIR TRAFFIC PROJECTION IN MASTER PLAN)



	1	2	3	4	5	6	7	8	9	10	11	12
Direct Impact	0.070	0.070	0.071	0.070	0.070	0.069	0.067	0.066	0.064	0.061	0.059	0.056
Type-I Impact	0.273	0.275	0.280	0.277	0.275	0.271	0.266	0.260	0.252	0.243	0.232	0.222
Type-II Impact	0.704	0.708	0.720	0.714	0.708	0.698	0.685	0.668	0.648	0.624	0.598	0.570

FIGURE 6.11: PROJECTED ECONOMY-WIDE IMPACT OF IGIA, DELHI ON EMPLOYMENT (BASED ON AIR TRAFFIC PROJECTION IN MASTER PLAN)



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Direct Impact	1.065	1.121	1.188	1.236	1.284	1.325	1.361	1.390	1.411	1.424	1.429	1.427
Type-I Impact	6.088	6.413	6.813	7.081	7.357	7.594	7.800	7.968	8.088	8.163	8.191	8.172
Type-II Impact	28.393	29.905	31.817	33.035	34.311	35.404	36.354	37.124	37.675	38.016	38.136	38.037

6.6. FUTURE DEVELOPMENT STRATEGY FOR IGI AIRPORT[26]

The foregoing discussion amply makes it clear that IGIA, Delhi needs to expand its capacity in order to meet the growing demand of passenger and freight movements. Accordingly, the management of IGIA, Delhi has undertaken an exhaustive Review of the initial master plan. A range of runway and terminal development, and high quality airport infrastructure management systems have been proposed in the revised master plan to build capacities ahead of traffic demand in a timely and phased manner in order to avoid congestion. The new strategy includes synchronised development of Airside, Terminals, Landside, and support facilities.

6.6.1 Airside Developments

The Airside capacity has to increase from the present 75 busy hour movements to 110 movements and this increase has to be achieved without exceeding the delay times specified in the operations management and development agreement (OMDA).

The proposed developments fall in two categories, namely improvement of existing taxiways and addition of runways. It is proposed to optimize the Runway Occupancy Time (ROT) to less than 50 seconds, in line with international best practices through reconfiguration of existing rapid exit runways (RETs) and addition

[26] This section is based on the executive summary of the Review of the Master plan undertaken 2016.

of new RETs to improve efficiency of taxiways. With these improvements alone, the capacity of the existing runway system is expected to increase to 86 busy hour movements from existing 75 busy hour movements.

However, for more substantial improvement, it is proposed to add a fourth runway, 11L29R in the southern part of the airfield parallel to the existing 11-29. With the addition of the fourth parallel runway and improvements in Air Traffic Control (ATC) and airfield improvements, the IGIA, Delhi would be able to accommodate an annual passenger demand of 109-110 MAP.

The new, closely spaced, parallel runway will be Code F compliant and located 380 m to the north of Runway 11-29. Runway 11L will have a take-off length of 3661 m and a landing length of 3515 m. Runway 29 R will have a take-off length of 3830 m and a landing length of 3661 m. The existing Runway 11-29 (future Runway 11 R-29) is proposed to be upgraded to provide Cat IIIC capability.

6.6.2 Terminal Developments

The terminal capacity has to be developed to meet the anticipated demand of about 109-110 MAP. In order to achieve this objective three pronged strategy is proposed, which includes (1) sweating of Terminal 3 to increase its capacity to 45 MAP, (2) expansion of Terminal 1 to a capacity of 30 MAP, and (3) a new Terminal 4 with a capacity of about 34 MAP. These developments are proposed to be taken up in three phases spread over about 15 years depending on the expected traffic demand.

Sweating terminal 3 would involve increasing the counters of immigration and security & immigration counters, building up additional terminal space of 13,000 m2 of infill area, and construction of additional pier E (for domestic services). With these developments, the capacity of the Terminal 3 can be increased to 45 MAP, of which 35 MAP would be for international and 10 MAP for domestic.

Terminal 1 is proposed to be expanded by filling the void over old Udaan Bhawan to expand departure capacity. The expanded Terminal 1 will have a pier building with 10 contact stands allowing about 2178 bus operations per day, and 10 additional gates with passenger boarding bridge (PBB). Thus, the capacity of Terminal 1 is expected to increase to 30 MAP, which could generate 252,000 annual ATMs or about 726 daily ATMs. In order to maximize the capacity of this terminal, it would be a domestic terminal for low cost carriers (LCC) using Code C aircraft. Terminal 1 will have metro connectivity with the city and an automated people mover system (APM) for inter terminal connectivity.

The new Terminal 4 with a capacity of 34 MAP is proposed in the south terminal precinct to be used as domestic terminal. This terminal will have a core building and two piers with 34 Code C + Code E MARS contact stands and it will be connected to Terminal 3 by corridors with wide mechanized travellators on airside & landside. These two terminals would thus for all intent and purpose function as one large integrated terminal with reasonably minimum connecting times for transfer passengers. Adequate capacity road network and multilevel car park have been proposed to meet the additional demand.

All the terminals will be equipped with technology driven processors and self service solutions for check in, bag drops and security checks. Advanced biometric techniques would be explored for hassle free immigration and security controls.

6.6.3 Landside Developments

The landside connectivity is critical element of the development strategy. With growing international and domestic air traffic and rising number of passengers and escorts, the transport link and traffic management at the arrivals and departures, and cargo handling would require enormous development work to avoid congestion and pressure on infrastructure. It is expected that airport wide peak traffic demand would mean about 82 million origin destination passengers. Therefore, development is required within and across terminal precinct in terms of parking, and access roads.

It is proposed to introduce Delhi Metro Rail to connect domestic passengers and employees to Terminal 1 precinct as a major strategic development. The idea is to shift as many passengers, employees and escorts of the airport roadway and onto mass transit options such as rail, APM and buses.

Within the airport, it is proposed to widen the Northern Access Road and tunnel, the Central Spine Road, and to build a new dedicated cargo zone access road from NH-8.

The landside development plan also includes construction of a 3000 space car park, with entry and exit plazas; 62 space bus parking and staging facility with kerbs for loading and unloading passengers; 150 space employee parking lot; underground APM/metro station with line to connect to STP; and 200 space flexible use car park over the APM/Metro Station.

6.6.4 Green Development

All future development are proposed by leveraging green technologies, making effective use of day light thereby conserving energy, reducing water consumption, recycling of waste water, solid waste management, rain water conservation etc. Solar energy potential of the site is proposed to be explored to the maximum extent.

Chapter 7

Passenger Survey

The passenger profile provides important information about the characteristics of users of the air transport and their views about the service quality provided at the airports. In order to profile passengers a survey was undertaken at the airport during March-April, 2016. The survey concentrated on the departing passengers to capture their expenditure patterns at the airport.

About 3500 passengers were interviewed using structured questionnaire. The questionnaire was designed to capture (1) personal particulars of passengers; (2) travel details of arriving and departing passengers including purpose of travel and mode of city transport; and (3) expenditure details including air ticket, food and beverages, shopping and accommodation at the airport.

The sample includes 85.3 per cent departing passengers and 14.7 per cent arriving passengers (Table 7.1). Of the total respondents surveyed 72.5 per cent are international passengers and 27.5 per cent are domestic passengers. In terms of gender distribution, sample contains 32.1 per cent females and 67.8 per cent male (Table 7.2).

In terms of citizenship of respondents, 61 per cent are Indians; about 8 per cent belonged to United Kingdom; four per cent each from United States and Nepal; three per cent each from France and Germany; about two per cent each from Afghanistan, Russia and Australia; and one per cent each from Thailand, Japan and China (Figure 7.1).

TABLE 7.1: SAMPLE DISTRIBUTION: DEPARTING AND ARRIVAL PASSENGERS

Sample Distribution of Passengers Surveyed			
Departure/Arrival	International	Domestic	Total
	Column Percentage		
Departure	78.9	21.1	100.0
Arrival	35.9	64.1	100.0
Total	72.5	27.5	100.0
	Row Percentage		
Departure	92.7	65.6	85.3
Arrival	7.3	34.4	14.7
Total	100	100	100

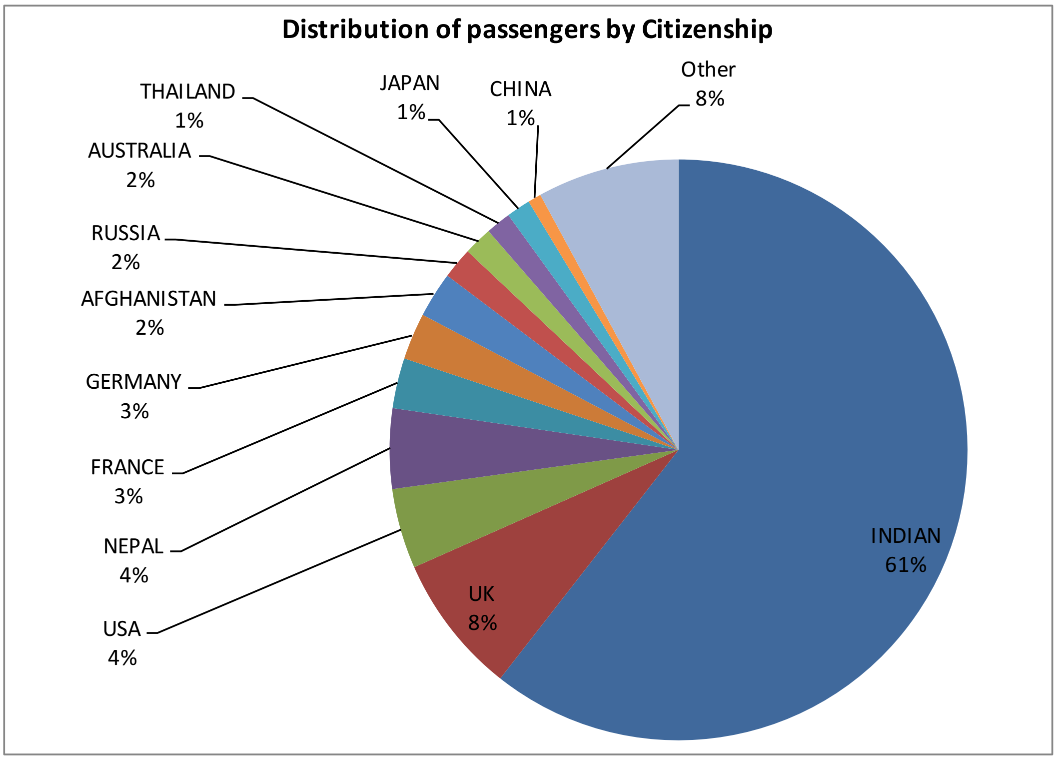
Source (basic data): NCAER Survey 2016.

TABLE 7.2: DISTRIBUTION OF SAMPLE PASSENGERS BY GENDER

Percentage distribution by type and gender			
Type	Female	Male	Total
International	32.5	67.4	100
Domestic	31.2	68.6	100
Total	32.1	67.8	100

Source (basic data): NCAER Survey 2016.

FIGURE 7.1: DISTRIBUTION OF SAMPLE BY CITIZENSHIP



Source (basic data): NCAER Survey 2016.

7.1 PASSENGER PROFILE

Distribution of passengers by age-group, qualification, profession etc. is presentenced in following tables.

7.1.1 Age Group

About 42.6 per cent of the passengers belong to age group of 26-35 years followed by 25.9 per cent being in the age group of 36-45 years (Table 7.3). This indicates that around 68 per cent of the surveyed passengers were in the age group of 26-45 years. It may also be noted that there are more female passengers in the age group of 26-35 years compared to male passengers in the same group.

TABLE 7.3: PERCENTAGE DISTRIBUTION BY AGE GROUP AND GENDER

Percentage distribution by age group and gender			
Age Group (years)	Female	Male	Total
0_15	0.11	0.30	0.24
16_25	20.44	11.93	14.56
26_35	44.97	41.53	42.60
36_45	18.56	29.21	25.91
46_55	9.61	11.09	10.63
56_65	4.09	4.21	4.17
above_65	2.21	1.73	1.88
Total	100.00	100.00	100.00

Source (basic data): NCAER Survey 2016.

7.1.2 Qualifications

Table 7.4 presents the distribution of passengers by their educational attainment. Clearly, a large majority of passengers are graduates and above. Only about 16.2 per cent of them are non-graduates or illiterates. It also appears that female passengers are more qualified than male passengers.

TABLE 7.4: PERCENTAGE DISTRIBUTION BY QUALIFICATION AND GENDER

Percentage distribution by qualification and gender			
Qualification	Female	Male	Total
Professional & higher research degree	11.27	12.89	12.37
Post graduate	24.16	26.83	25.96
Graduate	51.19	42.69	45.45
Non graduate	10.60	15.31	13.78
Illiterate	2.77	2.28	2.44
Total	100.00	100.00	100.00

Source (basic data): NCAER Survey 2016.

7.1.3 Professions

Distribution of passengers according to broad professional grouping is presented in Table 7.5. It emerges that about 34 per cent of them are employed with government or the corporate sector. Own business and self-employed passengers together constitute about 38 per cent of the total passengers.

TABLE 7.5: PERCENTAGE DISTRIBUTION BY PROFESSION AND GENDER

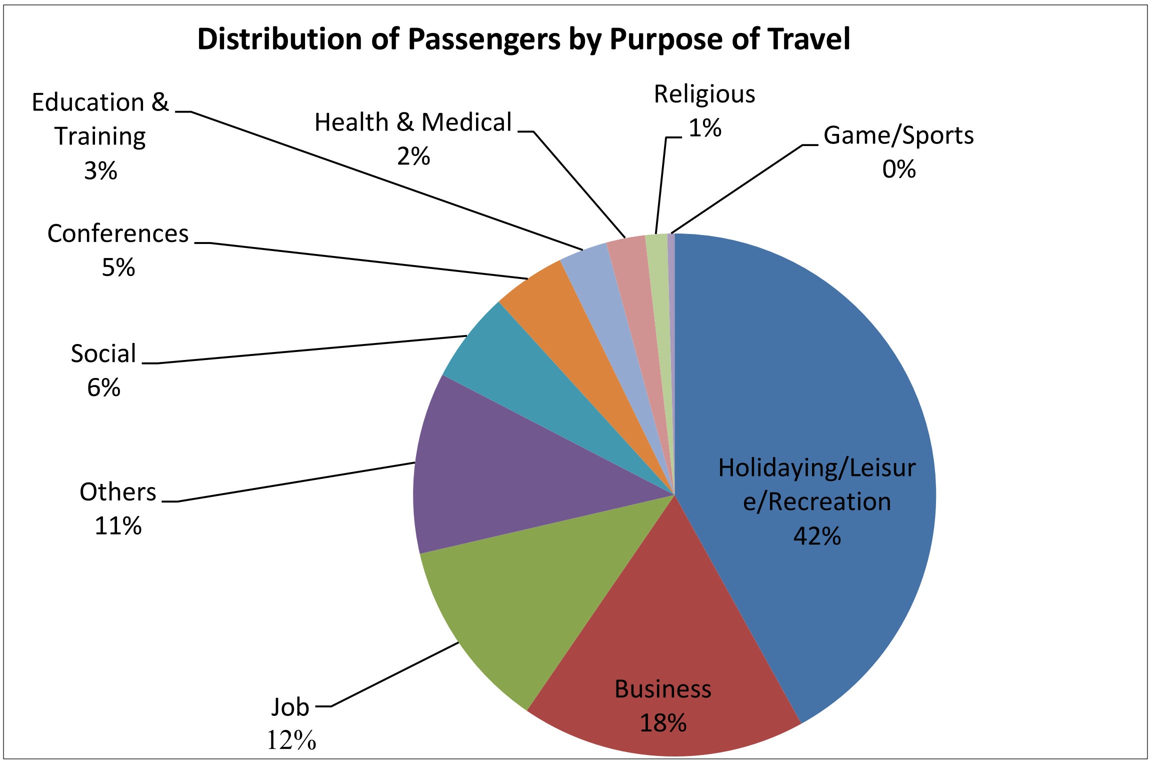
Percentage distribution by profession and gender			
Profession	Female	Male	Total
Own business	12.26	25.32	21.30
Government service	9.67	12.75	11.79
Corporate employee	17.15	24.61	22.28
Self-employed professional	18.34	16.06	16.76
Student	9.17	4.74	6.11
Others	33.40	16.51	21.76
Total	100.00	100.00	100.00

Source (basic data): NCAER Survey 2016

7.1.4 Purpose of Travel

Purpose of travel is another important criterion to analyse the passenger movement. Accordingly, distribution of passengers by purpose of travel is presented in Figure 7.2. Clearly, a big chunk of 42 per cent of the passengers surveyed indicated holidaying/leisure/recreation as the purpose of travel to Delhi/India. Another 18 per cent indicated business as the purposes of travel. About 12 per cent of surveyed passengers travelled in connection with their jobs.

FIGURE 7.2: DISTRIBUTION OF PASSENGERS BY PURPOSE OF TRAVEL

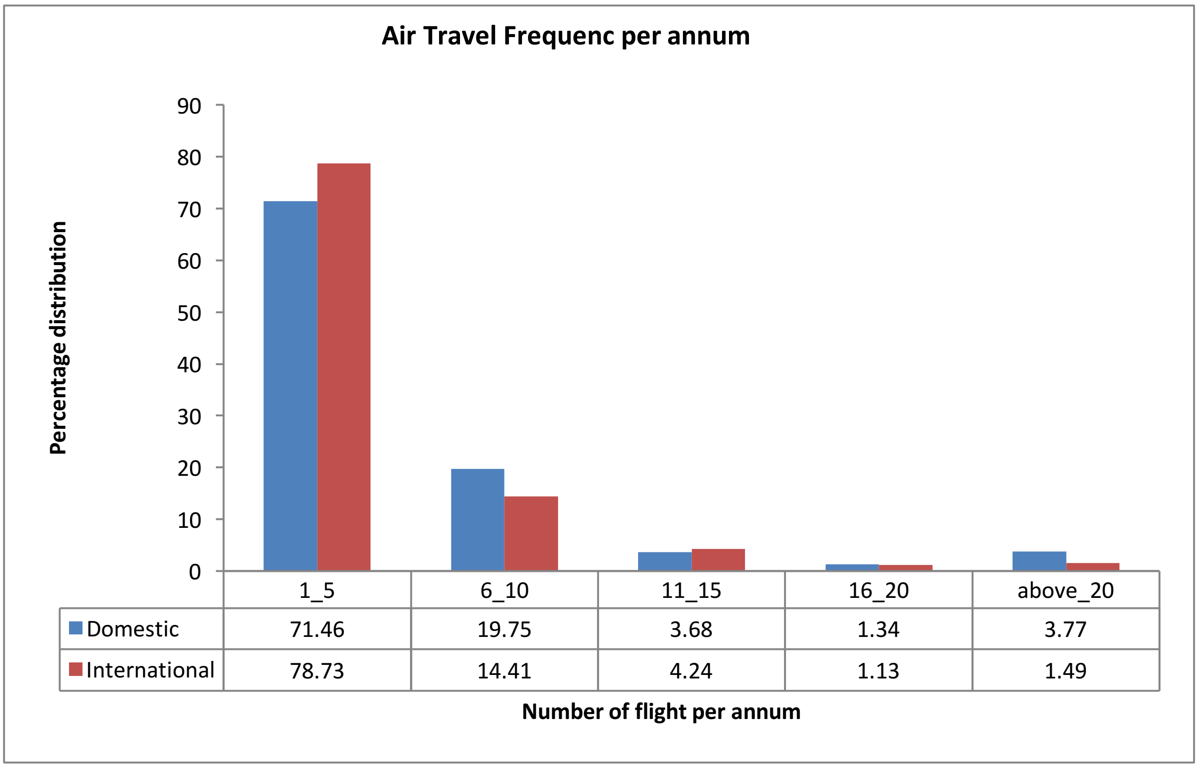


Source (basic data): NCAER Survey 2016.

7.1.5 Frequency of Travel

In response to the question about frequency of air travel, 71-78 per cent of passengers indicated that they undertook less than five flights per annum as shown in Figure 7.3. Frequency of flying is more with regards to domestic traveller as compared to international travellers.

FIGURE 7.3: DISTRIBUTION OF PASSENGERS BY AIR TRAVEL FREQUENCY

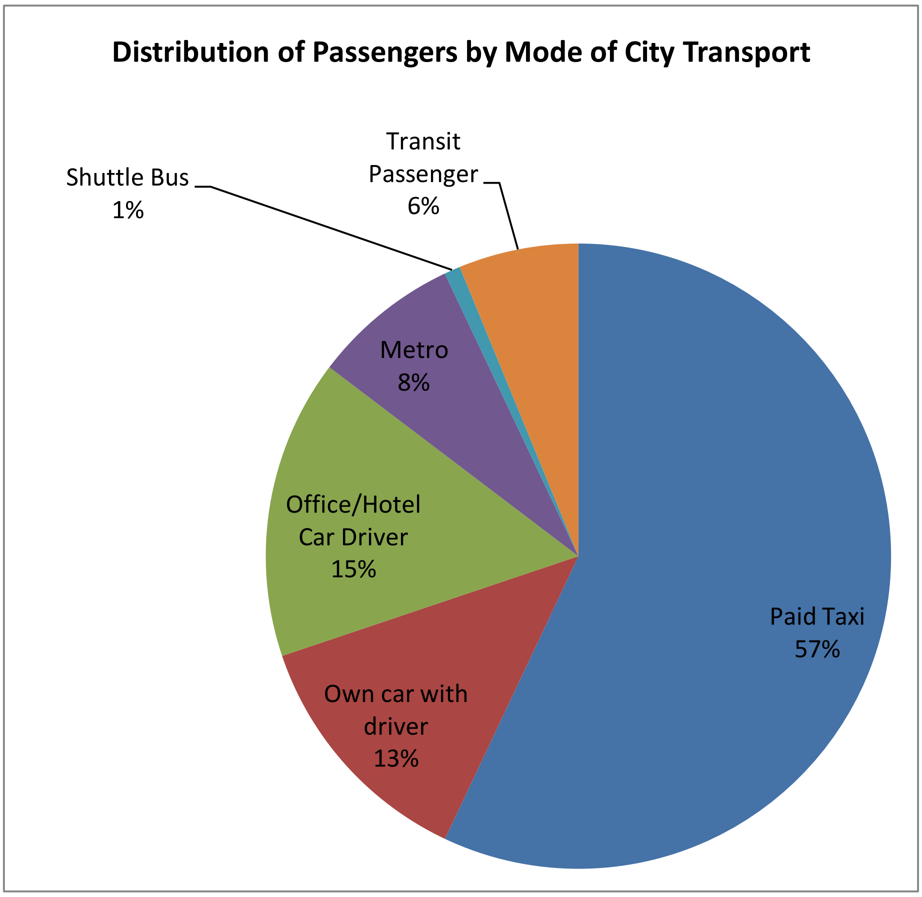


Source (basic data): NCAER Survey 2016.

7.2 MODE OF CITY TRANSPORT

Connectivity of the airport with city is an important element of air transport system. Accordingly question was asked to the passengers about the mode they used to arrive to or depart from the airport. The response to this question is summarised in Figure 7.4. About 57 per cent of the passengers indicated that they used paid taxi to arrive at the airport or departed from the airport. About 28 per cent of them used office/ hotel/own car for transport. Metro has been used by about eight per cent of the passengers.

FIGURE 7.4: DISTRIBUTION OF PASSENGERS BY MODE OF CITY TRANSPORT USED BY THEM



Source (basic data): NCAER Survey 2016.

7.3 EXPENDITURE PATTERN

In the survey instrument questions were included to capture the expenditure pattern of passenger Table 7.6 provides distribution of passengers by total expenditure category and purpose of travel. It may be noted that total expenditure includes expenditure on accommodation at the airport, travel expenses in terms of air tickets and local transport, food and beverages, and shopping at the airport. Data covers all passengers including domestic and international passengers both departing and arriving. Care has been taken to include only those respondents who have at least responded to the question on expenditure on travel and transport to avoid skewed distribution of expenditure.

Table 7.6 shows that 9.8 per cent passengers spend in the expenditure category of less than five thousand. About 56.8 per cent passengers spend in the total expenditure category of INR 5001 to 30000. Percentage of passengers spending above INR 30001 is about 33.4 per cent. Looking at the distribution by purpose of travel, it indicates that the purpose of travel of majority of passengers spending in expenditure group of less than INR 5000 included religious, sports, and conference. Those belonging to expenditure group of INR 5001 to 30000 travelled for social purpose, health and medical purpose, and job. Expenditure of above INR 30001 is incurred by those travelling for holidaying/leisure/recreation and business.

TABLE 7.6: DISTRIBUTION OF PASSENGERS BY TOTAL EXPENDITURE CATEGORY AND PURPOSE OF TRAVEL (INR)

Purpose of Travel	Expenditure Category (INR)						
	0_5000	5001_10000	10001_20000	20001_30000	30001_50000	above_50000	Total
Business	8.7	23.3	18.7	17.3	16.0	16.0	100
Holidaying/Leisure/Recreation	8.3	17.4	17.7	12.1	19.0	25.5	100
Social	10.4	47.9	27.1	8.3	6.3	0.0	100
Education & Training	15.2	27.3	9.1	30.3	18.2	0.0	100
Conferences	20.7	24.1	27.6	6.9	3.4	17.2	100
Health & Medical	16.7	50.0	11.1	16.7	5.6	0.0	100
Game/Sports	100	0.0	0.0	0.0	0.0	0.0	100
Job	11.9	31.2	31.2	11.0	3.7	11.0	100
Religious	50.0	25.0	12.5	12.5	0.0	0.0	100
Others	4.3	17.4	24.3	10.4	19.1	24.3	100
Total	9.8	23.1	20.7	13.0	14.9	18.5	100

Source (basic data): NCAER Survey 2016.

7.3.1 Distribution of Passengers by the Category of Expenditure and Head of Expenditure

Table 7.7 presents percentage distribution of passengers according to expenditure head and expenditure category for each expenditure head. Expenditure heads include air ticket and related cost; accommodation; food and beverages; and shopping. Similarly, expenditure categories include INR 0-5000; INR 5001-10000; INR 10001-20000; and above INR 20000.

It is observed that for expenditure head 'air ticket and other related travel cost', about 49 per cent of the passenger spend more than INR 20000 while 23.5 per cent spend in the range of INR 10001 to 20000; and 27.8 per cent spend below INR 10000.

In case of accommodation at or near the airport, 53.3 per cent of the passengers fall in the expenditure category of below INR 5000, while a small percentage of 3.3 per cent spend more than INR 20000.

In terms of expenditure on food and beverages at the airport, nearly 90 per cent of passengers spend less than INR 1000.

Pattern of expenditure on shopping indicates that about 67 per cent of the passengers spend less than INR 5000 on shopping at the airport. However, a good percentage of 13.1 per cent of the passengers spends more than INR 10000 on shopping at the airport.

TABLE 7.7: DISTRIBUTION OF PASSENGERS ACCORDING TO EXPENDITURE HEAD AND EXPENDITURE CATEGORY

Percentage distribution of passengers according to expenditure head and expenditure category						
Expenditure Head	Expenditure Head-wise expenditure Category (INR)					
Air Ticket and other related travel Cost	category	0_5000	5001_10000	10001_20000	above_20000	Total
	Distribution	9.3	18.5	23.5	48.8	100.0
Accommodation	category	0_5000	5001_10000	10001_20000	above_20000	
	Distribution	53.3	26.7	16.7	3.3	100.0
Food and Beverages	category	0_500	501_1000	1001_2000	Above 2000	
	Distribution	62.4	27.6	7.7	2.2	100.0
Shopping	category	0_1000	1001_5000	5001_10000	Above 10000	
	Distribution	25.3	41.7	19.9	13.1	100.0

Source (basic data): NCAER Survey 2016.

7.3.2 Average Expenditure by Passengers under Different Expenditure Categories on Different Heads of Expenditure at the Airport

Average expenditure on different heads by passengers belonging to different expenditure groups has been estimated taking the expenditures reported by sample passengers and the number of respondent passengers. The result is presented in Table 7.8. Thus, the figures in Table 7.8 indicate average expenditure by those who have incurred expenditure.

It comes out that average expenditure on accommodation, food and beverages, travel and transport and shopping is in the range of INR 12721, 546, 30546, and 5580 respectively.

Thus, those who are spending on food and beverages, their average expenditure varies from INR 267 in the expenditure group of less than INR 5000 to INR 751 in the expenditure group of above INR 50000.

Those who are spending on shopping their average expenditure varies from INR 547 falling under expenditure group of less than INR 5000 to INR 9669 falling under expenditure group of above INR 50000.

TABLE 7.8: AVERAGE EXPENDITURE ON DIFFERENT HEADS OF EXPENDITURE

Total Expenditure Category	Mean Expenditure at Airport (INR)			
	Accommodation	Food and Beverage	Travel and Transport	Shopping
0_5000	1400	267	3776	547
5001_10000	1667	364	6879	1304
10001_20000	3582	463	13471	2619
20001_30000	5440	604	21597	4195
30001_50000	15000	590	35826	5609
above_50000	28030	751	72323	9669
Total	12721	546	30546	5580

Source (basic data): NCAER Survey 2016.

7.4 FEEDBACK ON QUALITY OF SERVICE

Passengers were asked questions regarding their perception and experience about the services available at the airport. Specifically, they were asked to give marks out of ten to each service such as transport link to airport, check-in, immigration/custom, security, waiting room, facilities and overall ambience. In another question, they were asked to give overall satisfaction with respect to IGIA, Delhi and travel experience in India on a five point likert scale of very satisfied, satisfied, neutral, unsatisfied, and very unsatisfied. The results of the responses are discussed here.

7.4.1 Rating of Services in Terms of Marks out of Ten

Table 7.9 provides distribution of passengers by marks (out of ten) they gave to each of the services mentioned earlier. Higher the marks, better the rating is. The table has also summarised percentage of passengers giving more than 8 marks (i.e. More than 80 per cent marks) for each service. The following is the highlight of this exercise:

- Most passengers are happy with the ambience of the airport; more than 80 per cent marks are given by about 87.2 per cent of the passengers for ambience.
- Lowest percentage of passengers giving more than 80 per cent of marks is 73.97, which pertains to immigration/custom.
- People are also less satisfied with the transport links with the city where only 75.09 per cent passengers gave more than 8 marks.

TABLE 7.9: DISTRIBUTION OF MARKS OUT OF TEN FOR SELECTED SERVICES AT THE AIRPORT

Marks out of ten	Service Detail						
	Transport Links	Check-in	Immigration/customs	Security	Waiting rooms	Facilities	Ambience
Five and below	3.02	2.46	4.41	2.75	2.29	2.71	1.92
6	4.29	3.45	4.51	3.01	2.87	2.96	2.13
7	17.6	14.44	17.09	12.82	12.13	10.51	8.74
8	31.15	33.79	29.14	27.54	27.13	24.74	22.6
9	28.47	29.72	28.24	30.4	31.57	32.83	34.04
10	15.47	16.14	16.59	23.49	24.02	26.25	30.56
8 and above marks	75.09	79.65	73.97	81.43	82.72	83.82	87.2

Source (basic data): NCAER Survey 2016.

7.4.2 Overall Satisfaction with the Airport and Visit to Delhi

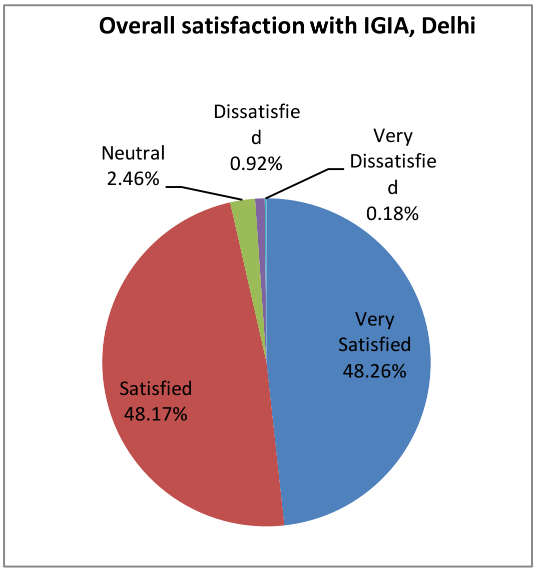
The overall satisfaction with the IGIA, Delhi and their current visit is presented in Figure 7.5. It comes out that:

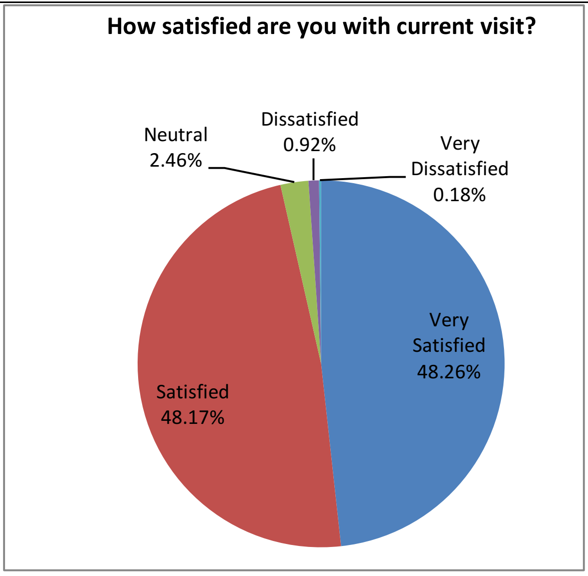
- About 48 per cent of the passengers are very satisfied.
- Another 48 per cent are satisfied.

- Thus, overall satisfaction can be termed as satisfactory by about 96 per cent of the passengers.

This means there is scope of improvement, which may be more demanding given the rate of expansion of passenger traffic at the IGIA, Delhi.

FIGURE 7.5: DISTRIBUTION OF OVERALL SATISFACTION OF THE PASSENGERS





Source (basic data): NCAER Survey 2016.

7.5 LIMITATIONS OF THE SURVEY

The passenger survey was conducted under an environment of restricted permissions, strict security compliance, and acute time constraint. Therefore, the survey is not completely balanced in terms of responses to various questions. All respondents did not answer all questions. Therefore, respondent passengers may be different in case of replying distinct parameters. Therefore, analysis has been presented with maximum available data and to that extent the survey may not be treated as perfectly representative of the entire population of passengers during the year. It has also been experienced that international passengers were more forth coming in giving details of the expenditure as compared to domestic passengers. This may have given and upward bias towards passengers in higher expenditure category. Similarly, out bond passenger were more cooperative in answering the question relating to their expenditure as compared to inbound passengers. This may also lead to upward bias in the expenditure pattern.

Chapter 8

Summary and Conclusions

During the last 10 years, India has recorded robust growth in air traffic. The passenger movement has grown at an annual rate of more than 13 per cent, which is one of the highest in the world. Airbus Global Market Forecast (2016-35) has estimated that the domestic traffic of India would grow more than five-fold over the next 20 years. At the global level, the number of total passengers transported by air increased from 1.97 billion to 3.44 billion between 2005 and 2015. Such heavy air traffic underscores the need for creating modern and efficient airports. During the year 2015, the world's busiest airport of Atlanta GA, USA, handled about 101.5 million passengers while IGIA, Delhi, ranked at the 25th place, handled about 46 million passengers. India's ranking for the year 2015 was 13th in terms of revenue passenger kilometre while it was 19th in terms of the revenue freight kilometre, thus leading to an overall ranking of 16th in terms of freight tonne-kilometres.

Airports have a complex and interdependent interaction with the rest of the city/region. They also have multi-faceted impact on the economy in terms of direct, indirect, and induced effects on production, income, and employment. However, all airports may not have the same level of interaction with the city. For this reason, there is a growing incidence of conducting economic impact studies for airports to enable them to provide quantitative and qualitative evidence with regard to their importance for the economy.

The key objective of this study is to assess the current and future economy-wide impacts of the activities and developments at the 'Indira Gandhi International Airport' (IGIA) in terms of output, employment and value added.

8.1 NATIONAL CAPITAL REGION AND IGIA, DELHI

The development and growth of NCR and the growth of IGIA, Delhi, are interdependent and produce a synergy of development. The international and national connectivity provided by IGIA, Delhi, has helped the region in assuming centre-stage as regards business development in North India. On the other hand, the prosperous population of the region has ensured sufficient demand for air travel to enable the airport to undertake its expansion and modernisation plans and take it on the road to becoming a truly world class airport.

With an estimated population of 18.4 million in 2016, Delhi was the fifth most populous city in the world and the largest city in India. Delhi is also one of the richest cities of India and is home to the second largest number of high net worth individuals (HNWI- individuals with net assets of USD 1 million or more) of India. According to a study jointly conducted by 'Foreign Policy' and the 'McKinsey Global Institute' on 'the Most Dynamic City of 2025', Delhi has been ranked as the 39th most dynamic city of the world.

Further, it is not Delhi alone that influences the demand for air travel at IGIA, Delhi, but the entire NCR as also other northern states. The 33 districts falling under NCR constitute just about 4.8 per cent of the total number of districts of India, but they account for 8.35 per cent of the urban population and 7.75 per cent of the urban workers of India. Estimates for 2013-14 indicate that NCR contributes about 7.9 per cent to the national income. NCR is also one of the fasted urbanising regions of India; it is projected that the population of NCR would cross 64 million by 2021. This points to the enormity of population and worker density of NCR, which is dependent on IGIA, Delhi for air travel.

On the other hand, the growth and development of Delhi and NCR has greatly benefited from modernisation of the IGIA, Delhi. The passenger flow at the airport is more than three times the population of the National Capital Territory (NCT).

After modernisation, IGIA, Delhi has become the busiest airport of India in terms of passenger and freight movement. It handled 48.42 million passengers and 787 thousand tonnes of freight during 2015-16, recording impressive annual growth rates of 18.1 per cent and 13 per cent, respectively, for these two categories of traffic.

During 2015-16, IGIA, Delhi provided air connectivity to more than 14.15 million international passengers (in terms of both arrivals and departures), involving travellers from 68 countries and 34.27 million domestic passengers from 57 Indian cities.

IGIA, Delhi contributes about 34.5 per cent of the total trade transacted through all major airports of India. In terms of trade connectivity, IGIA, Delhi facilitated export to 218 countries and import from 164 countries during 2015-16. During 2014-15, Delhi customs collected INR 10,000 crore, which accounts for about 5 per cent of the total customs duty collected by the government at the all-India level.

Since its modernisation, IGIA, Delhi has bagged several awards for its overall performance, as delineated below:

- IGIA, Delhi won the best airport award from the Airports Council International in the 25–40 million annual passengers category during two consecutive years of 2014 and 2015.
- In 2015, IGIA, Delhi bagged two awards for being the best airport in Central Asia/India and having the best airport staff in Central Asia/India at the prestigious Skytrax World airport awards.
- In 2015, it won the prestigious Golden Peacock National Quality Award given by the Institute of Directors (India). On September 27, 2016, IGIA, Delhi became the only airport in the Asia-Pacific region and one of the world's few airports to achieve a Level 3+ carbon neutral status.
- In addition, IGIA, Delhi became the first airport in India to achieve Platinum rating for its 'Green' Terminal 3 by Indian Green Building Council (IGBC).

The passengers' survey indicates that 96 per cent of the passengers are satisfied with the services at the airport and more than 80 per cent of the passengers gave more than 80 per cent marks for almost all services.

The airport registered a strong current financial performance in terms of gross profitability ratios and its PAT to revenue ratio is comparable to international standards for the industry. An examination of the distribution of sources of revenue shows that for the year 2015-16, about 68.66 per cent of revenue has been obtained from Aero income, while 26.67 per cent has been obtained from non-aero income. The remaining 4.67 per cent has been obtained from other sources. It is desirable to reduce dependence on regulated sources of revenue, and therefore attempts are being made to vigorously develop other sources of revenue. Out of the total revenue collected at the airport, 45.99 per cent is transferred to the Airport Authority of India, which is used inter-alia for infrastructure development.

8.2 ECONOMIC IMPACT ASSESSMENT

The economic impact assessment of the IGIA, Delhi, has been carried out using Input-Output (I-O) framework. While undertaking this exercise, due care has been taken to avoid double counting of outputs and indirect effects of flows. Applications of appropriate multipliers for output, income and employment lead to economy-wide direct effects, indirect effects and induced effects classified as Type-I impact (direct effect + indirect effect) and Type – II impact (direct effect + indirect effect + induced effect). Independently estimated multipliers have been applied on directly accounted output to assess Type-I and Type-II impacts. The base year for analysis is 2014-15. The overall assessment has been detailed below.

8.2.1 Directly Accounted Output and Employment

- The direct output due to various activities at the airport for the year 2014-15 has been estimated at INR 33,139 crore.
- The direct employment associated with various activities at the airport for the year 2014-15 has been accounted as 93,971, which is less than the model estimated direct employment of 1.06 lakh.

8.2.2 Model (I-O Framework) Results

Once direct outputs from different activities have been obtained, these outputs are mapped with the Input-Output sectors of India, which are spread over 28 sectors of the I-O Table.

OUTPUT

- The economic impact on output using Type-I impact model (direct effect + indirect effect) is estimated as INR 91.054 crore.
- The economic impact on output using Type-II impact model (direct effect + indirect effect + induced effect) is estimated as INR 1,89,831 crore.
- Thus, about INR 98,775 crore can be attributed to induced effect on economic output due to circulation of consumption from the factor income.

VALUE ADDED

- The direct effect of the accounted output on economy-wide value added is estimated as INR 7979 crore, which is 0.07 per cent of the national gross value added (GVA).
- The economic impact on value added using Type-I impact model is estimated as INR 31,366 crore, which is 0.273 per cent of the national GVA.
- The economic impact on value added using Type-II impact model is estimated as INR 80,724 crore, which is 0.70 per cent of the national GVA.

- In terms of US$, the Type-II impact is about US$ 12.42 billion (@INR65/US$), which compares well with estimates of other international airports.

EMPLOYMENT

Using sector outputs and employment linkages of respective sectors, the total employment can be estimated independently of the accounted employment.

- Direct employment is estimated as 1.06 lakh, which is close to the accounted employment, at about 0.02 per cent of the estimated number of total workers in the economy.
- Impact on employment corresponding to Type-I Impact Model is estimated as 6.09 lakh, at about 0.12 per cent of the estimated number of total workers in the economy.
- Impact on employment corresponding to Type-II Impact Model is estimated as 28.39 lakh, at 0.56 per cent of the estimated number of total workers in the economy.

8.2.3 Distribution of Overall Impact on Broad Sectors of the Economy (2014-15)

The distribution of the overall impact of the activities related to IGIA, Delhi, on the agriculture, industry and services sectors is presented below. The Type-II impact model clearly brings out the considerable hidden impact on the agriculture sector due to the circulatory effect of income and consumption.

8.2.3.1 AGRICULTURE SECTOR

Type-I Impact:

- Value added: INR 621 crore (2.0%)
- Employment creation: 1.01 lakh (16.5%)

Type-II Impact:

- Value added: INR 8149 crore (10.1%)
- Employment creation: 11.63 lakh (41.0%)

8.2.3.2 INDUSTRY SECTOR

Type-I Impact:

- Value added: INR 14,206 crore (45.3%)
- Employment creation: 0.93 lakh (15.2%)

Type-II Impact:

- Value added: INR 29,965 crore (37.1%)
- Employment creation: 5.01 lakh (17.6%)

8.2.3.3 Services Sector

Type-I Impact:

- Value added: INR 16,539 crore (52.7%)
- Employment creation: 4.16 lakh (68.3%)

Type-II Impact:

- Value added: INR 42,610 crore (52.8%)
- Employment creation: 11.75 lakh (41.4%)

8.2.4 Distribution of Impact by the Contributing Sectors (2014-15)

The distribution of impact by the contributing sectors is presented here for all the three impact models, viz., the direct impact, Type-I impact and the Type-II impact models, with respect to the major contributors.

8.2.4.1 Petroleum products (sale to foreign airlines)

Direct Impact:

- Value added: INR 1622 crore (20.3%)
- Employment creation: 845 (0.8%)

Type-I Impact:

- Value added: INR 10,976 crore (35.0%)
- Employment creation: 1.4 lakh (22.9%)

Type-II Impact:

- Value added: INR 28,248 crore (35.0%)
- Employment creation: 9.2 lakh (32.41%)

8.2.4.2 Air transport (domestic)

Direct Impact:

- Value added: INR 1476 crore (18.5%)
- Employment creation: 11,948 (11.2%)

Type-I Impact:

- Value added: INR 10,854 crore (34.6%)
- Employment creation: 2.1 lakh (34.4%)

Type-II Impact:

- Value added: INR 27,934 crore (34.6%)
- Employment creation: 9.8 lakh (34.6%)

8.2.4.3 Land transport

Direct Impact:

- Value added: INR 924 crore (11.6%)
- Employment creation: 33,369 (31.3%)

Type-I Impact:

- Value added: INR 1992 crore (6.4%)
- Employment creation: 0.6 lakh (9.1%)

Type-II Impact:

- Value added: INR 5127 crore (6.4%)
- Employment creation: 2.0 lakh (6.7%)

8.2.4.4 Supporting and Auxiliary Transport activities

Direct Impact:

- Value added: INR 1601 crore (20.06%)
- Employment creation: 24173 (22.7%)

Type-I Impact:

- Value added: INR 3607 crore (11.5%)
- Employment creation: 0.9 lakh (14.6%)

Type-II Impact:

- Value added: INR 9283 crore (11.5%)
- Employment creation: 3.5 lakh (12.2%)

8.2.4.5 Others

Direct Impact:

- Value added: INR 2355 crore (29.5%)
- Employment creation: 36144 (33.9%)

Type-I Impact:

- Value added: INR 3938 crore (12.6%)
- Employment creation: 1.2 lakh (18.9%)

Type-II Impact:

- Value added: INR 10,132 crore (12.6%)
- Employment creation: 3.9 lakh (13.9%)

8.3 FUTURE PROJECTIONS AND ECONOMIC IMPACT AT 2025-26 HORIZON

The long-term impact has been estimated on the basis of a traffic forecast carried out by NCAER as well as a 2016 review of the Master Plan.

8.3.1 Traffic Forecast (2025-26)

Passenger growth (CAGR) for 2014/15-2025/26:

Agency	Domestic (Per cent)	International (per cent)	Total (per cent)
NCAER	8.20	6.78	7.83
Master Plan	7.20	6.53	6.99

Terminal year 2025-26 passenger demand

Agency	Domestic (million)	International (million)	Total (million)
NCAER	72.99	23.64	96.63

Master Plan	57.25	26.70	83.95

FREIGHT GROWTH (CAGR) FOR 2014/15-2025/26:

Agency	Domestic (Per cent)	International (per cent)	Total (per cent)
NCAER	8.03	5.86	6.74
Master Plan	6.94	5.53	6.06

FREIGHT DEMAND FOR TERMINAL YEAR 2025-26

Agency	Domestic (000 tonne)	International (000 tonne)	Total (000 tonne)
NCAER	592.70	780.40	1373.10
Master Plan	479.90	748.70	1228.60

8.3.2 Economic Impact (2025-26)

The assessment has been done on the basis of the air traffic projection of NCAER estimates as well as that of the Master Plan and the final impact model of assessment, which considers the direct + indirect + induced effects (Type-II), has been summarised below.

The terminal year impact in terms of the value added as a percentage of the national GVA would be 0.60 per cent if the growth projects of NCAER are considered, while it would be 0.57 per cent if the Master Plan Projections are considered. The impact on income in terms of US$ (converted @ INR65/US$) works out to be 36.98 billion and 35.00 billion.

In terms of employment generation, the impact would be 40.22 lakh and 38.04 lakh, respectively. It may be noted that employment generation covers the entire stream of economic activity including both the formal as well as informal sectors as also the agriculture sector.

Summary of Direct, Type-I, and Type – II impact (2025-26)						
parameter	According to NCAER Projections of Air Traffic			According to projections of 2016 Review of Master Plan		
	Direct Effect	Type-I Effect	Type-II Effect	Direct Effect	Type-I Effect	Type-II Effect
Value added (INR crore)	23743	93392	240356	22398	88399	227506
Value added (billion US$)	3.65	14.37	36.98	3.45	13.6	35.00
Employment Creation (lakh)	1.52	8.67	40.22	1.43	8.17	38.04
Value Added as percentage of National GVA	0.06	0.23	0.60	0.06	0.22	0.57
Employment/Job Creation as Percentage of Total Workers (%)	0.02	0.12	0.58	0.02	0.11	0.53

8.3.2.1 Details Based on NCAER air traffic projections

The projected impact of IGIA, Delhi for the terminal year 2025-26 based on NCAER air traffic projections is as follows:

• The direct impact on value added is estimated as	:	INR 23,743 crore, 0.06% of estimated national GVA
• The impact on value added after taking into account direct and indirect effects as described by impact models Type-I is estimated as	:	INR 93,392 crore, 0.23% of estimated national GVA
• **The impact on value added after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	**:**	**INR 2,40,356 crore, 0.60% of estimated national GVA**

• The direct impact on employment is estimated as	:	1.52 lakh, 0.02% of total estimated workers
• The impact on employment after taking into account direct and indirect effects as described by impact models Type-I	:	8.67 lakh, 0.12% of total estimated workers
• **The impact on employment after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	**:**	**40.22 lakh, 0.58% of total estimated workers**

The Type-II Impact on value added for 2025-26, when converted in US$ terms (@INR65/US$), works out to be US$ 36.98 billion.

8.3.2.2 Details Based on air traffic projections of 2016 Review of The Master Plan

The projected impact of IGIA, Delhi for the terminal year 2025-26 based on air traffic projections given in Master Plan is as follows:

• The direct impact on value added is estimated as	:	INR 22,398 crore, 0.06% of estimated national GVA
• The impact on value added after taking into account direct and indirect effects as described by impact models Type-I is estimated as	:	INR 88,399 crore, 0.22% of estimated national GVA
• **The impact on value added after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	**:**	**INR 2,27,506 crore, 0.57% of estimated national GVA**

• The direct impact on employment is estimated as	:	1.43 lakh, 0.02% of total estimated workers
• The impact on employment after taking into account direct and indirect effects as described by impact models Type-I	:	8.17 lakh, 0.12% of total estimated workers

• **The impact on employment after taking into account direct, indirect and induced effects as described by impact models Type-II works out to be**	**:**	**38.04 lakh,** **0.53% of total estimated workers**

Type-II Impact on value added 2025-26, when converted in US$ terms, works out to be US$ 35.00 billion.

8.4 CONCLUSION

In our increasingly globalised world, airports represent not just the simple points of departure and arrival of passengers but go much beyond that. The growth of a city is significantly impacted by the improvement and expansion of airport services, better regulation of air traffic, and upgradation of infrastructure, which also foster dynamic linkages in city. This impact is, in essence, reciprocal, that is, a strong growth impetus in the development of a city or region leads to further expansion of airport activities. The catalytic effect of IGIA, Delhi is obviously reflected in huge investments made in Gurugram and other districts in close proximity of the airport. Thus, IGIA, Delhi and the industrial/institutional development around it present an excellent example of a synergetic two-way development process.

The economic contribution of IGIA, Delhi is substantially high in terms of both employment and value addition. This contribution is likely to increase further in absolute terms with the growth of air traffic.

The aggregate economic impact of IGIA, Delhi, including the direct, indirect, and induced effects for the base year 2014-15, is estimated as INR 80,724 crore in terms of value added, accounting for about 0.70 per cent of the national GVA; and 28.39 lakh in terms of employment, accounting for about 0.56 per cent of the total estimated workers.

The air traffic projection figures for the future years clearly points to the need for expanding the capacity of IGI airport to enable it to meet the growing demand of passenger and freight movements for avoiding congestion. Accordingly, the management of IGI airport has undertaken an exhaustive review of the initial Master Plan to increase the capacity of the airport. It has been proposed to build a range of runway and terminal development and high-quality infrastructure airport management systems to augment the airport capacity ahead of the increase in the traffic demand. The new strategy includes synchronised development of airside, terminals, landside, and support facilities.

On the basis of air traffic projections for the year 2025-26, the economic impact of the IGIA, including the direct, indirect, and induced effects, is estimated to be INR 2,40,356 crore, or about 0.60 per cent of the estimated national GVA. The impact on employment, on the other hand, is estimated to be 40.22 lakh, or about 0.58 per cent of the total estimated workers. The impact on value added for the terminal year 2025-26, when converted in US$ terms (@INR65/US$), works out to be US$ 36.98 billion.

APPENDIX A1: LIST OF I-O SECTOR USED FOR MAPPING ACCOUNTED OUTPUT, AND ESTIMATES OF VALUE ADDED AND EMPLOYMENT AS PER I-O SECTORS

I-O Sector Code	Sector Description	Output (INR crore)	Value Added (INR crore)	Employment (Number)
20	Other crops	0.44	0.34	45
55	Furniture and fixtures-wooden	4.58	1.65	169
56	Wood and wood products	1.42	0.52	77
63	Petroleum products	11501.24	1622.23	845
87	Other non-electrical machinery	68.89	15.00	258
91	Electrical appliances	3.29	0.97	92
92	Communication equipment	16.37	4.84	245
93	Other electrical Machinery	30.00	6.30	836
94	Electronic equipment (incl.TV)	16.44	8.12	258
97	Motor vehicles	2.70	0.91	19
106	Construction	493.58	172.02	9598
107	Electricity	78.02	16.45	120
109	Railway transport services	37.52	24.01	523
110	Land Transport including via pipeline	2101.18	924.20	33369
112	Air transport	11819.90	1476.39	11948
113	Supporting and Auxiliary Transport activities	3723.22	1600.93	24173
115	Communication	6.34	2.62	34
116	Trade	932.39	663.74	1990
117	Hotels and restaurants	1180.18	626.35	10293
118	Banking	45.55	35.38	227
119	Insurance	0.79	0.50	13
121	Education and research	2.71	2.09	102
123	Business services	186.22	114.52	159
125	Legal services	1.21	0.33	6
126	Real estate activities	1.48	0.81	10
127	Renting of machinery & equipment	4.57	2.70	124
128	O.com, social & personal services	9.98	5.77	472
130	Public administration	868.64	649.07	10473
	Total	33138.86	7978.72	106479