FREIGHT TRANSPORT FOR DEVELOPMENT

TOOLKIT:

Air Freight
The Transport Research Support program is a joint World Bank/ DFID initiative focusing on emerging issues in the transport sector. Its goal is to generate knowledge in high priority areas of the transport sector and to disseminate to practitioners and decision-makers in developing countries.
Air Freight

A Sector Navigating a Multitude of Challenges
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The paper is a sub-sector contribution to a major World Bank Flagship publication focusing on the contribution of freight transport as a whole to economic and social development.

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EXECUTIVE SUMMARY

Air Freight: A Sector Navigating a Multitude of Challenges

The air transport industry is in a state of change that comes both from the technological developments in the supply chain and external challenges from the current global business climate.

Specifically, the industry faces a host of challenges including:

- High sensitivity to fuel prices, as proven in the crude oil price spike between 2007 and 2008.
- The high sensitivity of demand regarding economic growth, as seen in the global economic crisis beginning in 2008. An estimated 75 Boeing 747 freighters have been parked between 2008 and 2009.
- The overall infrastructure, both air side (aprons and other cargo installations) and land side (road access).
- Dwell time at airports and related air bill paperwork, in an industry that is highly dependent on speedy delivery.
- Amongst the more traditional suppliers of capacity, potential inefficiencies in the structure of the industry, both in terms of accounting for costs (and therefore exhibiting economically inefficient pricing) and in the relationship between the actual providers of capacity (airlines) and the intermediaries that fill this space (freight forwarders).
- Changes in the perception of air transport’s current and future role in climate change, where greenhouse emissions are going to be a particular challenge to the industry.

Overview of the Industry and its Markets

The industry globally is estimated at 124.6 billion kilometer/tons, with a 15 year annual geometric growth rate of almost 7 percent, compared to 3.6 percent growth in GDP. As seen in Figure 1-1 below, China’s portion of air transport amongst developing countries is significant, as is its growth. Unfortunately low income countries have not benefitted as much.

The largest international trade flows are east to West, with the most traffic originating out of Southeast Asia and going to the U.S. and Europe. Both in revenue tonne kilometers (RTK) and in actual tonnage these markets dominate globally, with the U.S. domestic market being a close runner-up in RTKs. Growth is closely linked to global GDP, with an estimated 1 percent growth in GDP resulting in roughly 2 percent growth in freight traffic.

Service providers can be grouped into roughly five categories, namely:

- Scheduled passenger airlines (bellies account for as much as 50 percent of all air cargo, and some scheduled airlines also operate dedicated freighters),
- Scheduled cargo-only carriers,
- Integrated express carriers such as DHL and Federal Express, providing door-to-door services,
- Dedicated charter operators, and
- Special operations such as military, humanitarian relief, and aircraft production parts transport
Most of the scheduled air transport that is non-express (i.e. not involving integrators) has freight forwarders as the direct client, who purchase freight capacity ahead of time and schedule the space of their client's shipments. This arrangement can at times cause delays for smaller packages, and also presents a challenge since the forwarder is a relatively low risk, less capital intensive operation than the actual freight operations of the airlines. By tonnage, about 90 percent of all air freight is handled by combination and dedicated services using freight forwarders.

Tariffs today are generally set by the market, though non-enforced international rules on tariffs have been formulated and are published in IATA’s The Air Cargo Tariffs (TACT).

Air freight is by necessity highly dependent on road access to the departing and arriving airport, and is thus multi-modal. In addition, other multi-modal operations have existed since the 1960’s, specifically the sea-air linkage, originally developed by Air Canada to bridge the distances between the West and East coast, and now also implemented in the recent cargo city development in Dubai.

The market in general consists of high-value goods with an element of time sensitivity. In order to make economic sense, the minimum value of a good to be shipped over a 5,000km distance by air is about US 4.00 per kilogram.

The infrastructure and technology required for air cargo is, except for highly specialized cargo operations and hubs, very similar to passenger services, sharing the same navigation and air traffic control needs and runway needs. Dedicated apron areas for cargo are a minimum requirement for cargo-only operations. As with passenger transport, good road access to the airport is important.

The aircraft used for air cargo services depend on the type of services:

- Dedicated air cargo services use dedicated freighters, as do integrated express carriers. Here one can find many aircraft that have been removed from passenger services and converted to cargo services after having lived out their economically useful lives as airliners.
- Scheduled airlines: Typically scheduled airlines use passenger airline belly capacity, though Lufthansa, Alitalia, Malaysian Airlines, and others also have dedicated freighters. In addition, some scheduled airlines may use "combis" - aircraft that are part passenger and part cargo configured.
- Special operations: The widest variety of aircraft can be found in this category, including the Antonov AN-255 Mriya, which is the largest fixed-wing aircraft flying today.

The four main manufacturers of dedicated cargo aircraft are Antonov, Airbus, Boeing, and Illushin. In addition, there are several companies specializing in freighter conversions. According to Boeing, dedicated medium and larger widebody aircraft today already present nearly 95 percent of available capacity in ton-kilometers, with the very large aircraft (larger than 80 tons) holding a substantial 75 percent of the overall market capacity. Before the height of the financial crisis there was a backlog of an estimated 300 new and converted freighter aircraft. Given the amount of parked freighter aircraft accumulating between 2008 and 2009, this figure may no longer current.
Potential for New Markets and Related Case Studies

Air cargo is often discussed as an unexploited opportunity in the developing world warranting further study. Asymmetric capacities occur often when aircrafts arrive with imports and leave with unused capacity on to the next leg. Though it is out of proportion to say that these capacities alone have spurred new industries, some examples, such as the Mauritius garment industry, are mentioned to show how a capacity analysis may help. In addition, air cargo has been explored as an alternative means of exports for land-locked countries, circumventing expensive border crossings and additional hub operations.

Cut flowers present one of the most visible and rapidly growing industries coming out of the developing world. Two main market pairs are Colombia and North America (U.S.), and Kenya and the E.U. Many other countries are now exploring or actually developing the industry, including China, Ethiopia, Uganda, and Malawi. The industry is highly dependent on air cargo, since cut flowers have a finite shelf life as soon as they are harvested. In the U.S., this has led to an extensive market for flowers from Colombia, with Miami International Airport having become an important gateway. In Europe, Kenya has developed as a major supplier. Though the carbon footprint of air cargo is often mentioned when discussing the Kenya - Amsterdam flower exports, the carbon footprint of greenhouses in the Netherlands compared to the lack of climatization required in Kenya needs to be balanced against air transport emissions.

Source: World Bank World Development Indicators, with underlying contributions by ICAO.
Fresh seafood is interesting to study in terms of air transport and the logistics of bringing the product to the table. However, salt water fish and shrimp obviously not only require a shoreline, but also geographic proximity to the right currents. In this case the example of Ecuador, which has extensive salt-water fish exports, is unique and does not create an easily replicable model. However, fresh tilapia – a farmable freshwater fish, is a potential. Freshwater fish farming could have potential in both coastal and land-locked countries with lakes and reservoirs (e.g. Ethiopia). Tanzania, which exports West Nile Perch from Lake Victoria, is not necessarily a model to be followed directly (the introduction of the West Nile Perch is now generally considered an ecological calamity), but does show how the right combination of demand for a perishable product and its unique abundance at another location allow an industry to flourish. In Tanzania’s fish exports logistics and air transport play a crucial role in delivering the product.

Though initially attractive, the climate for manufactured clothing has changed significantly since the expiration of the Multi Fiber Agreement (MFA) on December 31, 2004. Countries that had been developing the industry, such as Mongolia and Mauritius, have seen their markets swamped by less expensive Chinese products. Factories are closing, and unemployment is on the rise. In Mauritius, an industry that has pushed a small island nation out of poverty is contracting. The wealth the industry created raised labor rates as full employment came near, yet at the same time made itself vulnerable to lower cost competitors. However, the development of the garment industry was not able without air cargo capacity, and Mauritius is another example where an industry had developed, along with other favorable conditions, with the availability of fast cargo capacity.

The electronics manufacturing industry can be segmented into the following five general groups:

- manufacture of semiconductors
- computer and peripherals,
- consumer electronics
- wires and cables, and
- precision equipment.

In addition, the industry can also be grouped into three general categories:

- assemblers,
- manufacturing of core components, and
- sales/service.

Not only is air cargo important in bringing products to the end consumer – in fact, air cargo seems to be playing an even more essential role in the actual manufacturing process. Intel sends its processors and other chips through different continents in the manufacturing process. Semiconductors are shipped from manufacturing centers to assemblers. Assembled products are redistributed by sales centers. The interrelationship between the vertical elements of the industry is complex, and, with just-in-time inventory, requires precise logistics.
INTRODUCTION

This report is part of a series of reports on different modes of freight transport, commissioned by the Department for International Development (DFID) of the United Kingdom.

During the inception of these reports the global logistics community was facing a dramatic spike in fuel prices; there were discussions of modal shifts in transport, and debates on how the global supply chain may develop and change.

Since then, much has changed. Oil prices have fallen, and the current global crisis is financial in nature, lowering demand and consumption. On one hand this has also lowered the demand of fossil fuels. However, as growth returns, pressures will not only rise from the supply and demand of energy per se, but also the environmental impact of greenhouse gas emissions.

For the air transport sector, including air freight, this has been a turbulent time. After the industry turned briefly profitable, the new pressures of 2008 and 2009 have again shifted the basis for strategic planning.

This report provides a brief overview of the air cargo sector, starting with a description of the challenges facing the industry, followed by an overview of the industry, and ending with several specific case studies relating to economic development and the use of air transport. There are several excellent sources on the overall industry. One source is the Air Cargo Management Group's International Air Freight and Express Industry Performance Analysis, which is published annually, and provides much detailed insights to the readers. The focus of this report, however, in addition to providing an overview, is also to present an exploration of the industry in a development context.
1. AIR CARGO: ITS ROLES AND ITS CHALLENGES

1.1. THE ROLE OF AIR CARGO AS A MODE OF TRANSPORT

Intercontinental air cargo, as a mode, fills the need for time-sensitive deliveries over larger distances, especially where the alternative modes are considerably slower, such as ships on transcontinental routes. Since air cargo is the most energy-intensive mode of transport (see Error! Reference source not found. below), goods being shipped are non-bulk. In almost all cases air freight is multi-modal in the sense that whatever is being shipped is brought to the airport/aircraft by truck, and, at the arrival airport, is taken away by truck for delivery¹. Since with the exception of perishables almost all goods that can be transported by air cargo could be transported with less energy costs by slower modes, the value of the timing of the delivery needs to be larger than the savings in the costs of shipping by alternate modes to justify transport by air. Conversely perishables, that are often the exports of developing countries, are entirely dependent on readily available air cargo capacity for shipping.

In addition to time sensitivity, air transport also has a role where excessive border crossings and/or modal switches come into play. This is especially the case for land-locked countries: Bringing goods to usually distant markets would require trucking the goods through border crossings with associated customs costs, and then perhaps several additional nodes such as feeder container shipping to a main port for transcontinental shipping.

In the overall economic context air transport can be seen as indispensable. In the case of perishables such as cut flowers, the production centers (usually along the equator) have air transport as the only means of getting their exports to the distant client markets without spoilage. Also, in certain production systems the ready availability of components being manufactured in other countries, such as semiconductors used in consumer electronics assembly, air transport is the vital mode. In addition, in the fully developed economies the added value of time makes the fast delivery of small packages and documents dependent on the air transport capacity as provided by the integrated express carriers.

1.1.1. AIR FREIGHT: A SECTOR NAVIGATING A MULTITUDE OF CHALLENGES

For the industry, the following broad challenges have appeared. More detail is provided in subsequent topics of this report:

- The spike in fuel prices in 2007-2008 has made fuel become generally half of all operating costs during that period. Since air transport is the least fuel-efficient mode of freight movement, the economic feasibility of shipping by air shifts with the rises and falls of the price of oil. The spike in fuel prices has now been mitigated, but prices may rise again during an economic recovery.
- Fuel prices have since become more reasonable, but in part due to the global economic crisis, which has a significant impact on trade. For the carriers this means that just after recovering from the oil shock they are now hit with an economic storm. In addition, for shippers this has

¹ There are special exceptions: Larger aircraft components, for example, are transported by a super-sized specialized freighter for assembly at airbus. Other exceptions are special cases where an airstrip is the only form of transportation infrastructure, such as mining operations in some regions of Sub-Saharan Africa.
meant a reduction of scheduled capacity in the bellies of passenger aircraft as passenger services are being reduced.

- In developing countries, the overall infrastructure is often blamed in hindering the development of an active air cargo sector, especially with respect to express carriers. Since all goods must be brought to the airport by some means, the road infrastructure to the airport, and in the case of express carrier, the overall road and transport infrastructure, is essential.

- The ultimate economic justification for the expense of shipping by air is the monetary value of time. This means that dwell times at airports, usually associated with customs services and other trans-border regulations, are a vital issue. In many countries express carriers in particular have to carefully form relationships with customs officials to assure expedient processing. This creates a new set of complex issues regarding governance, and may also be limiting competition.

- Potential inefficiencies in the structure of the conventional portion of the industry, including the inability for true cost accounting for mixed carriers

- Globally, and related to the fuel issue, there is a growing sense of awareness of the environmental impact of air transport. Initially this was limited to mainly noise pollution, however, now the emission of greenhouse gases is getting more scrutiny.

### 1.2. Fuel Supply and Costs

Air transport in general is highly sensitive to changes in fuel prices. During the 2003-2008 spike in crude oil prices, Jet-A, the principal fuel in air transport today used by nearly all turbine-powered aircraft, rose from US $.26 cents per liter (US$ 1 per gallon) to over US$ 1 per liter (US$ 4 per gallon) globally (see Error! Reference source not found.-1 below). For passenger operators, the cost of fuel jumped from 25 percent of operations to nearly 50 percent of operations. Dedicated air cargo operators also saw such a hike. CargoLux’s annual reports show that fuel costs jump from 35 percent of overall revenues in 2005 to 47 percent in 2008. Martinair’s annual report for 2008 is not available as of the time of writing of this report; however, there has been consistent growth of the proportion of fuel costs as to revenue from 2005 through 2007.

*Figure 1-1: Average Jet-A spot prices, FOB, from fourth quarter 1990 until June 2009.*

Source: US Department of Energy. The price represents an average from the New York, U.S. Gulf Coast, Los Angeles, Rotterdam (ARA), and Singapore markets.
The aviation fuel issue is directly linked to crude oil prices, which are dependent on reserves and the infrastructure for extraction. As the economy slowed down during the global recession, so has overall oil consumption, which may have been the cause of the general fall in commodity prices, including oil, and therefore fuel. However, if the supply of fuel dwindles as the global economy expands, prices could spike again, hurting not only the air transport sector, but economic growth overall. The costs of fuel in aviation are also tightly linked to environmental concerns, since any form of regulating carbon emissions would in effect raise the costs of burning fossil fuels.

1.3. THE SLOWING ECONOMY

The global slowdown of the economy has created some capacity shifts in the air cargo industry. In general, it can be said that the U.S. markets were in decline, especially at the local level, as other smaller regional markets were faltering as well. Though for a while it seemed that the Asia-Pacific carriers might not be so badly hit, as steep decline has been noted in actual freight traffic beginning in November 2008. However, since July 2009 there has been a strong recovery overall.

The severity of the economic decline has caused the freighter conversion market, which specializes in converting older passenger airliners into freighters, to come to an almost standstill, especially with regard to wide-bodied aircraft. An estimated 75 Boeing 747 freighters have been parked between 2008 and 2009, with no guarantee of their future return to service.2

The consensus now seems to be that globally freight has bottomed out in the first quarter of 2009, with freight tonne kilometers showing a climb as of June 2009, though still with little very yield (see Error! Reference source not found. below). Even though demand has picked up again, profitability has not returned to the sector.

Figure 1-2: Air freight yields and tonne kilometers flown on international markets.

Source: Financial Forecast September 2009, IATA, p.2

2 Slumbering Conversions- Freighter converters hope the market will awake soon but brace for extensive dry spell, Aaron Karp, Air Transport World, Volume 46 Number 12, December 2009, p. 41-44
1.4. **OVERALL INFRASTRUCTURE**

A common complaint amongst air cargo operators in developing countries is the lack of overall infrastructure. This is not related as much to airports per se, where the main complaint is often lack of apron space (cargo aircraft sit on the tarmac for loading much longer than passenger aircraft), but particularly a country’s road network. By necessity, air transport is multi-modal, since whatever is being shipped has to come to the airport somehow. Except for the very rare exception of true cargo cities like the one being built in Dubai today, the dominant mode of access to an airport is by road, meaning that all cargo has to be brought by truck.

The challenge, however, is not only the road access to the airport itself, though this is critical, but all the other logistics that complements this. For integrated express carriers (such as FedEx or UPS), the overall road network in a country is of essence. Arriving packages and letters need to be brought to their final destination quickly, and cargo has to be able to get to the airport in an efficient manner.

1.5. **DWELL TIME**

Dwell times include not just the time waiting for the aircraft, but also the time needed to clear through customs, and the time needed for security-related procedures. A common complaint from operators in the developing world is that customs and security procedures add too much time to deliveries and are choking the industry. Part of the solution is technical – electronic air bills are being implemented by IATA as a solution for speedier transfer through customs, as are other efforts, such as IATA's "Cargo 2000" program for making the overall industry performance better. Some security-related policies are hard to mitigate, however. In India there is a 24-hour “cool down” period for any cargo boarding aircraft, in order to prevent explosives from being planted. The United States in the post 9/11 rulemaking has set a goal for having all air cargo going into the bellies of passenger aircraft be x-rayed by June 2010, up from 50 percent of all cargo since February 2009. Though generally air cargo has much more manageable proportions than a 40-foot container, and therefore is easier to x-ray, this still requires the queuing of cargo before an x-ray machine prior to loading onto aircraft.

1.5.1. **Industry structure**

The traditional (non-express) service providers depend heavily on freight forwarders for the retail side of providing cargo clients. There have been some attempts, though not very successful, in providing more integrated services by combination carriers, in general mixed carriers prefer to be responsible only for the airport to airport delivery, with the freight forwarder managing the rest of the logistics chain. The relationship between airlines and forwarders is complex. Airlines operate with intensive capital (aircraft and facilities) and operating costs, while depending on freight forwarders that in essence carry a low risk, office-infrastructure only operation. The freight forwarder, on the other hand, is completely dependent on an airline to provide previously agreed-upon capacity, and, since not all airlines operate in all regions
of the world, the freight forwarder needs to establish relationships with several, often competing, airlines in order to get full global coverage for its clients.  

In addition, accurate cost-accounting for flying freight in bellies of passenger aircraft is virtually impossible, making the setting of truly economically efficient tariffs very difficult. Since belly traffic accounts for a large portion of all air freight, rates set by this traffic affect the overall air cargo market. This places pressure on dedicated freighter-only operators, who need to fill their aircraft in order to be profitable, yet have to compete with randomly available and perhaps arbitrarily priced belly capacity as competition. In addition, the economic cost of carrying cargo is dependent on the load factor of the aircraft both flying to a destination and then returning. In developing countries with little exports this raised the costs of importing goods by air, since the return flight may carry substantially less paying cargo.

The speed of smaller air cargo shipments is also affected by the role of the freight forwarder. One reason dwell times may go up is because forwarders hold up shipments of smaller packets in order to consolidate a larger pallet sized shipment to fill a given capacity purchased from an airline.

As mentioned above, IATA’s Cargo 2000 is a program designed to streamline the interactions between the airlines, airports, and freight forwarders. In addition, new web-based software systems have been implemented, such as Global Freight Exchange (GF-X), Cargo Portal Services, and Ezycargo.

### 1.6. Environmental Concerns

Aviation in general has several environmental areas that are currently under examination: greenhouse gas emissions and particulates, noise pollution, land and infrastructure concerns, and the not yet much understood climate effect of contrails.

Figure 1-3: Energy Intensity by Freight Mode, 1985, 1988, 1991, in thousand BTU per Ton Kilometer, in the United States.

![Energy Intensity by Freight Mode](image)

Source: Adapted from Measuring Energy Efficiency in the United States, Energy Information Administration, U.S. Department of Energy

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3 See the Air Cargo Management Group’s International Air Freight Performance Analysis 2008 for an in-depth discussion of the delicate balance between forwarders and service providers.
Since the cost of fuel is directly interlinked with operational profitability, airlines and air cargo carriers by nature want to reduce fuel consumption, and therefore also emit less greenhouse gases. However, the drive for the ever increasing efficiency in jet engines leads towards a tradeoff between emitting CO\textsubscript{2} or NO\textsubscript{x} – both of which are greenhouse gases.\(^5\)

Though aviation is estimated to contribute only 2 percent of all man-made emissions, the sector is the second most intense emitter in the transport sector after roads, with a total of 14 percent of all of transport (see Figure 1-4). In terms of energy consumption per ton kilometer, air transport is the least efficient, as seen in Figure 1-2 above. More importantly, the historic growth rate of aviation had many worried about its future contribution. In estimates projecting the future growth in emissions by the overall aviation sector developed for the IPCC working groups in 1999, the annual rate of 3 percent had already been adjusted for expected gains in efficiency from the expected traffic growth rate of 5 percent, meaning that the continued expected growth in emissions is already discounted for expected increased efficiency gains in technology.\(^6\) Unless the aviation sector is able to move into non-fossil fuels, environmental pressures will mount. For example, in Europe there is a proposal to charge for carbon emissions from aircraft flying into, out of, or within Europe, for the total, not just European portion, of the flight.

**Figure 1-4: Transport CO\textsubscript{2} emissions by mode in 2000.**

![Diagram showing transportation modes and CO\textsubscript{2} emissions](http://example.com/figure14)

Source: *The Economics of Climate Change, The Stern Review, Annex 7.*

\(^4\) The original chart can be found at [http://www.eia.doe.gov/emeu/efficiency/eefig_ch5.htm#Figure%205.21](http://www.eia.doe.gov/emeu/efficiency/eefig_ch5.htm#Figure%205.21). The data relates to domestic freight, however, similar analysis not just limited to air freight but also to air transport in general have been made. The decrease in efficiency from 1985 to 1991 may be explained by the increased growth in freight traffic being served by older aircraft as the latter are being pulled out of passenger services, though this has not been confirmed by the author.

\(^5\) NO\textsubscript{x} is a collective term that includes N\textsubscript{2}O

2. OVERVIEW OF THE INDUSTRY

2.1. OVERALL SIZE OF AIR TRANSPORT

The air cargo industry, though roughly 1 percent of the overall freight industry if measured by weight, presents an overall crucial component in the supply chain, on many different layers and in many different segments. Unlike other modes of transport, because of its cost structures based on technological constraints, air transport fills a niche in mostly time-sensitive deliveries, though the cause of this time sensitivity may vary greatly. Air freight is tightly linked to trade and overall economic growth. IATA published an economic briefing as of April 2009 stating that air freight has been a timely indicator in overall global trade volume, and has in fact been a leading indicator in turning points in global trade, signaling changes as far as four to five months ahead in time. The relationship can be seen in 2-1 below.

The industry globally is estimated at 124.6 billion kilometer/tons, with a 15 year geometric growth rate of almost 7 percent, compared to 3.6 percent growth in GDP, prompting a common conclusion that a 1 percent rise in global GDP results in a 2 percent rise in air freight demand. This growth, however, has slowed as the time span measured gets closer to 2007, with the 5 year rate being only 1.2 percent, as compared to overall adjusted global GDP of 3.9 percent. The most rapid growth globally in the sector was between 1990 and 1998. The growth in tonnage in the developing world has been more consistent, fluctuating between 3.5 and 3.9 percent over the same period. Figure 2-1 below shows the growth for both GDP (in 2000 constant US$) and the related growth in air cargo. The U.S. is the largest market, in part because of its size and therefore domestic demand.

In Figure 2-6, found on page 21, the proportion of the traffic related to developing countries is estimated to be between 20 and 25 percent. Of particular interest is the rapid growth that countries in the upper middle income and the lower middle income have enjoyed. Interestingly, the lower middle income countries seem to have had more growth and more traffic overall then the upper middle income countries. One would suspect that this defies logic; however, China is included in the lower income country grouping. If one separated out all traffic related to China, then the lower middle income group would have had about half the freight-ton kilometers as the upper middle income group, and growth would not have seemed so dramatic in the last two years shown. As it stood at the end of year 2007, this suggests that China represented above one third of all global air cargo traffic for the entire developing world. Since the lower middle income countries also contain other important exporters, such as Thailand and the Philippines, it becomes clear that the traffic flows, as shown in Figure 2-3 and Figure 2-4 below, clearly involve massive trade with Southeast Asia, and that flows are East-West more than North-South. China’s role in, for example, the express markets, is becoming such a powerful magnet that UPS is moving its regional base of operations from Manila’s former Clark Air Force Base in the Philippines to Shenzhen, China, with the construction of a US$ 180 million terminal. Worrisome is the fact that the poorest

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7 “Air Freight Timely Indicator of Economic Turning Point”, IATA ECONOMIC BRIEFING, The International Air Transport Association, Geneva, Switzerland, April 2009, p. 1
8 World Development Indicators, The World Bank. Using other ICAO estimates the figure is 156.6 billion RTK in 2007.
9 International Air Freight and Express Industry Performance Analysis 2008, Air Cargo Management Group, December 2008, p. 22 (from now on cited as “ACMG”)
countries, those in the low income group (defined as having $905 or less per capita GNI in 2006), have not participated in the rapid global rise, and have remained stagnant.

Figure 2-1: Ton kilometers of air cargo according to per capita GNI.

Data source: World Bank World Development Indicators, with underlying contributions by ICAO.

Projected growth rates show domestic and within-region freight transport to have the highest potential growth between 2008 and 2027, while the Intra-North American markets may act as the most saturated. Boeing’s forecasts can be found in Table 2-1 below.

The U.S. domestic air cargo use is such a high phenomena that it distorts all other global data. In fact, for Figure 2-4 below, the U.S. numbers had to be omitted to make the diagram more readable. The size of the market is also related to its maturity – the dedicated cargo carriers are in decline, and as fuel prices rise, movement of goods by truck is gaining wider-spread use. The express industry (Fed EX and UPS predominantly) is feeling the current economic decline, and Fed Ex, as of June 2009, is suffering significant losses.11

Because of the higher fuel costs versus other modes of transport, the concept behind air transport for freight is that whatever commodity is being shipped is in a sense perishable. The time sensitivity of the shipping, as well as the final market value, is what provides the necessary economic justification to send by air. Of particular interest, though, especially to the development community, is the development of “alternate exports”, such as livestock, edibles, and flowers. In the major routes this sector of the economies is not much represented. However, 60 percent of the air cargo routes from Latin America to the United States are such perishable exports, especially fish and flowers. 16 percent of the cargo being flown from Latin America to Europe consists of the same commodities, and nearly 20 percent of the flows from Africa to Asia consist of food and live animals. 12

Values of goods being flown is usually a minimum of roughly $4.00 per kilogram for a distance of about 5,000 kilometers. Figure 2-2 shows a breakdown of the types of commodities being shipped according to major shipping routes.

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12 Analysis based on data found in World Air Cargo Forecast 2008-2009, Boeing Commercial Airplanes

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<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>4.1%</td>
<td>5.1%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Intra-North America</td>
<td>0.5%</td>
<td>-1.2%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Latin America – North America</td>
<td>1.5%</td>
<td>7.7%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Latin America – Europe</td>
<td>3.5%</td>
<td>6.7%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Europe – North America</td>
<td>3.1%</td>
<td>7.0%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Intra-Europe</td>
<td>2.1%</td>
<td>3.7%</td>
<td>3.6%</td>
</tr>
<tr>
<td>Middle East – Europe</td>
<td>6.5%</td>
<td>5.7%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Africa – Europe</td>
<td>4.0%</td>
<td>3.4%</td>
<td>6.2%</td>
</tr>
<tr>
<td>Asia – North America</td>
<td>4.8%</td>
<td>5.7%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Europe – Asia</td>
<td>9.7%</td>
<td>8.4%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Intra-Asia</td>
<td>7.0%</td>
<td>3.7%</td>
<td>8.1%</td>
</tr>
<tr>
<td>Southwest Asia – Europe</td>
<td>5.4%</td>
<td>3.6%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Domestic China</td>
<td>15.6%</td>
<td>11.9%</td>
<td>9.9%</td>
</tr>
</tbody>
</table>

Figure 2.2: Air Cargo by Commodity.

There are many other routes (such as between Latin America and North America), however, they are too thin in volume to display in this chart. The shown routes account for over 96 percent of estimated ton/kilometer traffic.

**Figure 2-3: Global Routes in Air Cargo, as Estimated in RTKs**

Data Source: Analysis from data found in *World Air Cargo Forecast 2008-2009*, Boeing Commercial Airplanes
Figure 2-4: The flow of estimated tonnage (not RTK).

Data Source: Analysis from data found in *World Air Cargo Forecast 2008-2009*, Boeing Commercial Airplanes

Traffic flow within the United States has been omitted. Had flows within the United States been included, the line would be twice as thick as the line from the U.S. to Asia.
Figure 2-5: World Trade and Air Freight Growth.

Source: IATA, using data from IATA and the Netherlands Bureau for Economic Policy Analysis. The chart is originally published in Air Freight Timely Indicator of Economic Turning Point”, IATA ECONOMIC BRIEFING, The International Air Transport Association, Geneva, Switzerland, April 2009, p. 1

Figure 2-6: Global and developing world GDP compared to air freight volume as measured in ton/kilometers.

Data source: World Bank World Development Indicators, with underlying contributions by ICAO.
2.2. **INDUSTRY STRUCTURE**

The industry is segmented into several groups:

- **Scheduled passenger airline**: As much as 50 percent of all cargo is transported in the bellies of passenger airlines.\(^\text{13}\) This has important implications in terms of market prices and offered capacity, as is discussed in more detail later in the paper. Passenger airlines may also operate dedicated freighters, such as Lufthansa and Air France, though this is generally not the case in the U.S. Passenger airlines carrying cargo are referred to as "combination carriers", and are considered the traditional mainstay of the industry, along with the scheduled cargo-only carriers. The combination carriers work hand-in-hand with freight forwarders.

- **Scheduled cargo only**: Carriers such as Cargolux and Martinair (now owned by KLM/Air France) provided regularly scheduled cargo-only flights. These carriers traditionally also operate with the participation of freight forwarders. Combination carriers and dedicated carriers, along with their freight forwarders, together account for 90 percent of all air freight tonnage.\(^\text{14}\)

- **Integrated express carriers**: These carriers provide full service, and compete with the more traditional freight forwarder/scheduled carrier combination. The cargo carried consists mostly of small packages. Though most developed in the U.S. and Europe, networks of express carriers, though not necessarily globally integrated yet, are developing even in the poorer regions of the world. According to Boeing, the integrated carriers, though globally not a dominating segment, is gaining in market share (see Figure 2-7 below.) In the U.S. passenger carriers and their forwarders have lost most of their belly traffic to the integrated carriers in the 1980s, which then lost most of their coast-to-coast traffic flown in their dedicated freighters to rail.

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**Figure 2-7: International Express Traffic compared to other air freight and mail, 1991-2007.**


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\(^{13}\) The History of Air Cargo and Airmail from the 18th Century, Camille Allaz, Christopher Foyle Publishing & TIACA, 2004 p. 308 (from now on cited as "Allaz")

\(^{14}\) ACMG p. 8
Dedicated charter operators: These are operators that are hired for specific delivery and do not carry a regular schedule. Providers of complex services would be included here, such as extra-heavy lifting capabilities. The dedicated charter operations only account for about 25 percent of total charter operations, with the bulk of charter operations actually being carried out by scheduled carriers.\textsuperscript{15}

Special operations: Beyond the military, these include humanitarian relief, and also within-production transport, such as the carriage of assembled aircraft sections between various assembly plants.

The majority of the “retail” work of non-express cargo capacity is a function of freight forwarders. The freight forwarder buys a large amount of capacity from a service provider, often much ahead of time (even as far as two years ahead), and then fills the capacity over time as the client demand arrives.

The dedicated cargo industry has a high cost basis both in investment (aircraft) and in operations (labor and fuel), which makes the industry highly competitive and therefore, understandably, secretive about its routes, clients, goods shipped, and future plans. The competitive nature of air cargo is further exaggerated by the provision of cargo capacity of regularly scheduled passenger airlines. The cost and revenue structure of passenger airlines is generally based on revenue passenger kilometers (RPK), and cargo capacity sold is a bonus source of revenue. Passenger airlines, therefore, can sell excess cargo capacity at extremely low prices compared to operations whose returns on investments are completely dependent on air cargo. Obtaining comprehensive sets of data, therefore, is not easy.\textsuperscript{16}

Fares used to be regulated, following rules laid down in IATA’s The Air Cargo Tariff (TACT) manual. However, these are not enforced, and pricing now seems to be based on supply and demand. In addition, IATA serves as an intermediary clearinghouse via its Cargo Accounts Settlements System (CASS).

2.3. Types of Routes and Competing Modes

In general, the highest activity in air cargo, as would be expected, is between the consuming economies of the West and the larger export centers. The lines of movements are in general east-west, in basically the northern hemisphere, less north-south, and are virtually non-existent east-west in the Southern hemisphere. High income countries in general have many cargo facilities and hubs, while in the developing world these activities are centered more on a set of fewer, but large, regional hubs. For obvious reasons much of the flow is dependent on better quality road access – items to be shipped need to somehow get to the airport, and the ability to do so quickly and efficiently is an important element in nearly all air cargo, and especially perishable cargo. Mixed modality, however, emerged even more strongly in the 1960’s, when Air Canada developed a service that allowed coast-to-coast air transport increase the delivery efficiency of consumer goods manufactured in Japan: The goods arrived on the West Coast by sea, were transferred to aircraft flying them to the East Coast, and then either found their distribution there or were again, by sea, shipped to European consumer markets. The notion of sea - air transport, though facing some skepticism as to its long term survival, is evident in the cargo-city concepts currently being implemented in Dubai and elsewhere.

\textsuperscript{15} Allaz p. 302
\textsuperscript{16} One data provider, when contacted regarding research for this report, replied that its services were reserved for airline-only clientele.
Air cargo is generally competitive on long-distance hauls with time-sensitive products, where other infrastructure, such as roads between the origin and destination, do not exist. Therefore, domestic air cargo operations only made up 16 percent of total global air cargo as measured in kilometer/tons in 2002.\(^{17}\) The three alternative modes, truck, rail, and ship, are considerably less costly and energy intensive (see Figure 1-3), though often pose higher risk of delivery for perishables such as flowers and fresh meat-based products. In one multi-modal example, the export of fish from Lake Victoria in Tanzania, the inability to secure direct air cargo services from Mwanza to Europe results in trucking the fish to Nairobi, it is then loaded onto an aircraft bound for the final destination. Though the risk of spoilage in the shipment is higher using road transport, the cost of air cargo from Mwanza to Nairobi is economically too uncompetitive to be an alternative to roads.

All air freight needs road transport to complete the supply chain from the airport to the user. In some markets such as Europe, airlines have been competing by trucking air cargo from user/producer locations to major airports where they were shipped to/from their intercontinental destinations/origins. This was caused by existing regulations disallowing fifth and sixth freedom flights (direct flights by third country carriers in other countries). Overall air cargo is liberalizing more quickly than air passenger services, making the overall supply chain more efficient.

### 2.4. Infrastructure, Equipment, and Technology

Air cargo infrastructure overall involves airports and their accessibility, in-flight navigation and communication systems (including access to weather services), and the aircraft itself. In air transport discussions in general infrastructure, especially regarding airports, is divided into air-side and land-side components. In general, with a few pioneering exceptions, such as UPS’s Louisville hub, the air side of infrastructure is very much the same as that for passenger transport overall. Aircraft fly using the same ground-based or satellite-based navigational systems as passenger airlines, thought often with somewhat older aircraft. A description of the overall infrastructure, however, is still useful for understanding this mode of transport.

#### 2.4.1. Airports

Airports mostly consist of several parts and include: movement surfaces (runways, taxiways, and aprons), terminal buildings (passenger terminals and in many cases freight facilities), navigational aids and approaches to the airport that allows flying into the airport in less than optimal visibility and other weather conditions, air traffic control facilities, fuel facilities, security installations, and some form of road access. Fuel facilities, air traffic control facilities, runways, and taxiways are generally shared with all traffic at the airport. The most minimal installation, however, for dedicated cargo flights is a dedicated cargo apron, allowing for the efficient loading and unloading of aircraft, with dedicated customs facilities close by for international cargo.

#### 2.4.2. Navigation Systems and Air Traffic Control

In general, navigational aids today consist of radio transmitters sending homing signals to aircrafts, identifying for the aircraft from exactly what direction it is approaching the sending station or airport, and

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\(^{17}\) Circular 292AT/124: Economic Contribution of Civil Aviation, ICAO, page 1-13
helping determine the proper angle for landing on the correct spot of the runway if approaching an airport. These instrument landing systems (ILSs) are the same used for passenger aircraft, and elements of these systems are slowly being supplanted by newer, satellite-based technologies. Newer all-cargo aircraft will generally have the latest navigation and communications equipment on board, but older aircraft, as are often found in the air cargo industry, may still depend entirely on the older ground-based technologies.

In the U.S. UPS has been one of the pioneers in installing an aircraft monitoring system called ADS-B, using satellite technology. This system allows close tracking of aircraft, even on the ground, without radar technology. It is now generally accepted that ADS-B will be the air traffic control system of the future, with the U.S. building its "NextGen" air traffic controls system around the technology. One of the key long-term benefits will not only be improved safety, but the ability for more fuel efficient operations, and, if globally adopted, more fuel efficient great circle routes.

2.4.3. The Aircraft

The aircraft used in the industry globally can be generally categorized directly by the type of air cargo services being provided:

- Dedicated cargo services, both scheduled and non-scheduled: The operators use dedicated freight aircraft. In most cases, these are aircraft built by Boeing and Airbus that are, or have been, in passenger service. Often, instead of being aircraft that have been purchased new as freighters, they are aircraft that have been in service as passenger aircraft and then converted to cargo-only operations. The integrated express carriers use similar equipment. Combination carriers may also be operating dedicated freighters, though this is not the case in the U.S. The economic crises may have caused combination carriers to shift away from freighters.

- Scheduled airlines: The aircrafts are passenger airlines with belly space being sold for cargo. Exceptions are combination freighters ("combis") that have only a section reserved for passengers and the rest allocated for cargo. Examples would be the Boeing 737 combi aircraft being operated by Alaskan Airlines, or the 747 400M combis operated by KLM.

- Special operations: the widest variety of aircraft can be found in these services. Airbus, for example, operates an Airbus A300-600ST "Beluga" sized specifically to fly aircraft fuselage sections from one assembly point to another. Heavy-lift aircraft include the Russian-built Antonov AN-124 and the super-sized AN-225 Mriya, the world's largest fixed-wing aircraft.

The cost structure of operating cargo airliners is somewhat different than that of passenger jets. This leads to the “recycling” of some specific airliners by conversion into cargo aircraft. For example, as the Boeing 767 ages, it may become economically more costly to operate because of increased maintenance schedule needed for passenger service, and the much higher number of landing and take-off cycles over time than in cargo operations. At the same time, newer, more fuel efficient aircraft enter the passenger market. The older aircraft, then, become much more economical to operate as cargo aircraft, and replace even older, less fuel efficient aircraft. This is why one can still find very old aircraft, such as the Boeing 727 and the DC10 (modified and upgraded to the designations MD-10 in some cases) fully operational in fleets such as FedEx Express. Charter operators can be found with fleets that go even further back in time, such as the four-engine DC-8. Though these aircraft may be much less fuel efficient, these aircraft are much less costly to acquire, and the overall flying time is much reduced, lowering the overall cost.
A summary of operating expenses of cargo airline in the U.S. for 2007 can be found in Table 2-2 below.

Table 2-2: Cargo operating costs per block hour for 2007 in the United States, summarized and averaged with input from ten airlines.

<table>
<thead>
<tr>
<th>Cost Type</th>
<th>Twin Aisle (widebody)</th>
<th>Single Aisle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flying Costs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crew</td>
<td>1,649</td>
<td>2,039</td>
</tr>
<tr>
<td>Fuel</td>
<td>4,517</td>
<td>2,720</td>
</tr>
<tr>
<td>Other</td>
<td>401</td>
<td>480</td>
</tr>
<tr>
<td><strong>Total Flying Costs</strong></td>
<td><strong>6,567</strong></td>
<td><strong>5,239</strong></td>
</tr>
<tr>
<td>Maintenance Costs</td>
<td>2,415</td>
<td>2,352</td>
</tr>
<tr>
<td>Degreciation</td>
<td>685</td>
<td>695</td>
</tr>
<tr>
<td>Aircraft Rent</td>
<td>859</td>
<td>157</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>10,525</td>
<td>8,444</td>
</tr>
</tbody>
</table>

Source: The Airline Monitor, August 2008, p. 50

These costs reflect the beginning of the oil price spike of 2007-2008. Furthermore, these costs vary widely from airline to airline. For example, Amerijet reports operating costs of $5,295 per hour for a 727-200F, while DHL reports $7,294 for the same aircraft, with different maintenance and flight crew costs.

The four main manufacturers of aircrafts in use in cargo operations are Boeing, Airbus, Illushin, and Antonov. The types of dedicated freighters can be divided into several categories as shown in Table 2-3 below. Both Boeing and Airbus predict an increased long-term shift towards larger, dedicated freighters, including more dedicated freighters in airlines that primarily operate as passenger airlines, but also have large cargo operations. According to Boeing, dedicated medium and larger widebody aircraft today already present nearly 95 percent of available capacity in ton-kilometers, with the very large aircraft (larger than 80 tons) holding a substantial 75 percent of the overall market capacity. The industry sees no significant production of dedicated freighters that would classify as single-aisle in the passenger market, except cargo aircraft of this size coming mainly from passenger jet conversions.

Up until the global financial crisis there had been a production backlog of almost 300 freighters. Figure 2-8 shows the historic backlog from 1982 to 2007, according to Airbus's Global Market Forecast 2007-2026. Interestingly, this graph is no longer being reproduced in the just-published 2009-2028 forecast, perhaps because the economic slowdown has resulted in too many order cancellations. As mentioned earlier in this report, an estimated 75 Boeing 747 freighters have been parked between 2008 and 2009 due to the global financial crisis.

18 World Air Cargo Forecast 2008-2009, Boeing Commercial Airplanes, p. 117
Figure 2-8: Backlog of new-built and conversion freighters, 1982 - 2007. This backlog does not yet reflect the global financial crisis.

Source: Global Market Forecast 2007-2026, Airbus, p. 123

Table 2-2: Cargo operating costs per block hour for 2007 in the United States, summarized and averaged with input from ten airlines.

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<th>Cost Type</th>
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<td>10,525</td>
<td>8,444</td>
</tr>
</tbody>
</table>

Source: The Airline Monitor, August 2008, p. 50
Table 2-3: Types of Dedicated Cargo Aircraft in the Global Cargo Fleet.

<table>
<thead>
<tr>
<th>Payload</th>
<th>Size</th>
<th>Typical Aircraft</th>
<th>Global Count</th>
<th>Percent New vs. Converted</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 80 tons</td>
<td>Wide-bodied large</td>
<td>B747, B777, MD-11, new: Airbus 380, Airbus A350</td>
<td>426</td>
<td>57%</td>
<td></td>
</tr>
<tr>
<td>Between 40 and 80 tons</td>
<td>Wide-bodied medium sized long-range</td>
<td>DC-10-30/40, MD 10 (modified DC 10), A330 series, A340 series, B 747 Combi, B 767</td>
<td>148</td>
<td>76%</td>
<td></td>
</tr>
<tr>
<td>Between 30 and 60 tons (overlaps with previous category)</td>
<td>Standard-bodied regional freighters</td>
<td>Boeing 757 (less common), 767, older Dc8's, older 707s, A300 series, A310 series, A321 series, A330 series</td>
<td>589</td>
<td>46%</td>
<td>The DC 8 in general is too noisy to be flown in Europe without modifications to the engines (adding so-called “hush kits”), which unfortunately increase the fuel burn considerably. Often these aircraft are found in Africa, but their operators are limited by either noise or fuel consumption as to where they may practically operate. Largest portion of the global freighter fleet</td>
</tr>
<tr>
<td>Between 10 and 30 tons</td>
<td>Narrow-bodied smaller</td>
<td>Older Boeing 727s, 737s, DC 9, BAe 146m TU204, A320P2F</td>
<td>533</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>Less than 10 tons</td>
<td>Commuter-sized or General Aviation</td>
<td>ATR 42 &amp; 72, Cessna Caravan, Beech 1900</td>
<td></td>
<td></td>
<td>Complicated market to quantify</td>
</tr>
<tr>
<td>CIS aircraft</td>
<td>Various, generally turbo-prop</td>
<td>Antonov AN 225 (the largest freighter in the world), AN25, AN 32, AN 12, AN 124, Illushin Il76-TD</td>
<td></td>
<td></td>
<td>Mostly former military design, includes some very large and unique aircraft used for special purposes</td>
</tr>
<tr>
<td>Older types of aircraft not found</td>
<td>Generally smaller in size</td>
<td>DC 3 and the DC 6</td>
<td></td>
<td></td>
<td>Still in service routes with some interesting geography – not only in Africa, but also in the more remote regions of North America, such as northern Canada</td>
</tr>
</tbody>
</table>

Source: Adapted from Allaz, p. 308-319, and Flying by nature Global Market Forecast 2007 – 2026, Airbus Corporation, p. 122-123
3. POTENTIAL FOR NEW MARKETS AND RELATED CASE STUDIES

Air cargo is often discussed as an unexploited opportunity in the developing world warranting further study. Recently, for example, air cargo became the focal point in discussing methods of export for land-locked countries. Market mechanisms either already exist calling for air transport (i.e. the demand is there, and there is a "pull" effect on services), or there are proposed or existing capacities that are not being fully utilized and looking for new markets (presenting a "push" opportunity).

Established carriers are most likely to go with "pull" opportunities. For example, one dedicated European freight carrier has stated it will only enter a given market when there are enough freight forwarders showing solid demand. Much of formal freight capacity is already sold months ahead of time in informal meetings between airline executives and forwarders, with as much as 90% of a capacity for a given carrier already accounted for as much as six months ahead of time. The risk for filling the capacity, then, is left with the forwarder.

However, there have been, and may be, overcapacity opportunities that could present new export opportunities. Historically, these cases have been anecdotal, and it cannot clearly be stated that capacity alone presented the opportunity. Typical examples quoted include the garment industry in Mauritius, which according to some unverified accounts came about by excess belly capacity of Air France airliners departing Mauritius, and the development of an electronics industry in South America, which resulted from extensive airport air cargo infrastructure.

In this report, several examples are briefly outlined, using producer/export market pairs that may be of interest to countries looking for new markets. In one example – Ecuador’s seafood exports to North America – the interest is more on the ability to farm tilapia, a freshwater fish. Most markets, except for the electronics market in Southeast Asia, are considered alternative exports.

The final example involving the Southeast Asian electronics industry portrays air cargo as an essential element in the production supply chain. The economic use and justification of the use of air freight on a larger scale seems empirically not just related to the weight/value ratio of the product being shipped, but also the “cycle time”, i.e. the actual timing of the delivery. In effect, the notion of “perishable” is in this case related to just-in-time delivery in the production process.

3.1. CUT FLOWERS

Cut flowers present one of the most visible and rapidly growing industries coming out of the developing world. Two main market pairs are Colombia and North America (U.S.), and Kenya and the E.U. Many other countries are now exploring or actually developing the industry, including China, Ethiopia, Uganda, and Malawi; however, the discussion below is focused mainly on the Colombian – U.S. and Kenya – European markets.

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Prime resources needed for production, beyond inexpensive labor, are location relative to the equator (allowing for a longer, if not year-around, growing season), fresh water, fertile soil, and a temperate climate. The cut flower industry in the northern hemisphere usually requires air-tight greenhouses with heating, irrigation, and artificial sunlight. The industry had originally flourished in the Netherlands because of an abundance of natural gas, making the climate control of greenhouses relatively cheap. With the higher carbon footprint of heating and lighting in traditionally producing regions such as Europe and the West Coast of the United States, and the decline of the availability of cheap energy to those regions, countries such as Colombia and Kenya can compete rather well with greenhouses that require no heating, are of much cheaper construction, and require no isolation from the outdoors. In addition, labor costs are much less, though they are higher and increasing more quickly in Colombia as compared to Sub-Saharan Africa.

Another key element in the export is the logistics of bringing cut flowers to market. In general this industry could not exist without air transport. In contrast to the export of fresh fruit and herbs, for example, the entire logistics chain, from the instant the flower is cut, to the point it arrives at the end consumer, has strong time constraints (see Figure 3-1), moisture requirements, and temperature control necessities. In Ethiopia, a country which is just now expanding its flower production, the challenge lies in bringing flowers from the greenhouses to the international airport in Addis Ababa – long distances, rough roads, and open trucks carrying the flowers bring a high spoilage rate. In fact, the care of cut flowers immediately after cutting affects the overall lifespan of the product. By the same token, the distances traveled also add to the costs of distribution - Table 3-1 above shows distances from major world-wide producing centers to final destinations, clearly indicating that continental proximity should be part of the decision-making in finding new targets for investment. The table illustrates, for example, that though Kunming, China, is a major producing center, it would strategically not be as much of an efficient competitor to Colombia in the U.S. (a distance of 14,373 km between Kunming and Miami versus a distance of 2,430 km between Bogota and Miami), but would very well compete in Europe with a shorter distance to Amsterdam than Bogota.

With natural resources for climate control in enclosed greenhouses running out, and the overall carbon footprint of transporting flowers by air being considerably less than the energy used to heat and light greenhouses, the remainder of the industry is poised to move further into regions where the climate is right, water and labor are available, and foreign investment is allowed.

The movement of the industry into less expensive and more suitable countries must not be confused with overall market growth. Indications are that the purchasing of flowers in the U.S. is on the decline for the time
being, and the EU may well also be approaching a saturation point if consumer sentiment shifts against low-cost producers. In addition, the most traditional channel of distribution, the Dutch flower auctions, are being challenged by direct imports into EU member countries, and by new flower auction markets being developed in places such as Dubai. As such, the market seems to be going through significant restructuring.

**Figure 3-1: Vase Life of Rose Compared to Time in Transit to Point of Sale**

<table>
<thead>
<tr>
<th>Days in Transit to POS</th>
<th>Loss of Value</th>
<th>Remaining Vase Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Days in Transit to POS</td>
<td>71%</td>
<td>4 Days 29%</td>
</tr>
<tr>
<td>8 Days in Transit to POS</td>
<td>57%</td>
<td>6 Days 43%</td>
</tr>
<tr>
<td>6 Days in Transit to POS</td>
<td>43%</td>
<td>8 Days 57%</td>
</tr>
<tr>
<td>4 Days in Transit to POS</td>
<td>29%</td>
<td>10 Days 71%</td>
</tr>
</tbody>
</table>

Days

1 2 3 4 5 6 7 8 9 10 11 12 13 14

^ Rose cut fresh (Day 1) Rose life over (Day 14) ^

Source: USA Floral Products Inc. Form 10K for 1999

### 3.1.1. Colombia Cut Flower Exports to the U.S.

**Figure 3-2: Value of Colombia Flower Exports to the United States.**

Data Source: International Trade Center. The dollar value represents, here and in subsequent graphs and tables, the import price paid for all ITC data, not wholesale or retail value. Final retail value is five to ten times higher.

The United States consumes a retail value of roughly US$ 6 billion in cut flowers per year, of which roughly 66 percent are imported. Per capita consumption by one estimate is at US$ 25.9.20 Colombia exported almost US$ 1 billion of cut flowers in 2005, with the U.S. buying 82 percent (US$ 742 million). 75 percent of the flowers are grown in Bogota – the remaining in Cali and Medellin. The most critical export route is Bogota-Miami.

The beginnings of Colombia’s flower exports to the U.S. date

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back to the mid 1960s, spawned by deregulation within Colombia, and the availability of air transport. By the
1980s Colombia had become the highest volume exporter of cut flowers to the U.S., and continues to lead,
much ahead of Ecuador, the Netherlands, and Mexico. According to the USDA Economic Research Service 21,
40 percent of flower imports from Colombia are roses, and 10 percent each carnations and chrysanthemums,
with the rest falling to other varieties. Several sources state that the labor force in Colombia’s cut flower
industry consists of about 80,000, workers, most of whom are women. 22

Growth has been significant since the beginning, but has fluctuated in recent years. From 2004 to 2005,
exports to the U.S. had a 28 percent growth rate, though more recent anecdotal evidence suggests a decline in
overall cut flower purchases by American consumers, prompting more aggressive marketing techniques by the
Colombian Association of Flower Exporters.

Growing of cut flowers shifted to Latin America in the 1980s and 1990s due to the advantageous climate,
requiring no energy use and allowing year-around production. 23 Though controversial, the low cost of labor
plays into the producer’s favor. Colombia experienced a 13.7 percent unemployment rate in 2004 24, and a
labor force of 21.75 million. However, the unemployment rate in Colombia is slowly declining, with wages
slowly rising. 25

Another favorable change is that Colombia’s business development climate has been steadily improving. In
fact the growth of the flower industry is the direct result of deregulation in the mid 1960s. A summary of a
Price-Waterhouse-Coopers report on Colombia reads:

“The business climate in Colombia is nowadays very attractive for investors, given factors such as the
stability and steady growth of the economy, healthy management of its foreign debt and the
Government attitude, prone to grant always more and more guarantees and benefits to foreign
investors, as well as the ongoing negotiation of Free Trade Agreements with the U.S. and other Latin
American and European countries.” 26

The World Bank’s Doing Business 2007 places Colombia at 79th place out of 175, with relatively high scores in
the ease of registering property, protecting investors, and allowing businesses to close. The country still scores
poorly on trading across borders, at 128th place out of 175, with exporting being a bit more favorably treated
than importing. 27

A recent development has been the signing of a new free trade agreement between the U.S. and Colombia in
November 2006, with the intention of significantly lowering tariffs on cross-border trade. The agreement

21 http://www.ers.usda.gov/Briefing/Floriculture/Trade.htm
22 Several sources had the same number, though no date was attached to them. For example, see
http://www.ebfarm.com/OurFarmStand/PrettyPoison.aspx and http://www.american.edu/ted/ROSE.HTM.
23 An extensive history of the development of the Colombian export market can be found in the 1991 World Bank Working Paper titled
The Development of the Colombian Cut Flower Industry by José A. Mendez.
24 World Development Indicators, The World Bank (WDI)
25 See the IADB’s “Labor Compass” at http://www.iadb.org/res/CompasaLaboral/varCantidad.cfm?coulID=CO&language=english?language=en&parid=6&item1id=4
26 http://www.pwc.com/extweb/pwcpublications.nsf/docid/53C3B25B38B72CFE8525721E00626592. The citation is part of a summary of
Doing Business and Investing in Colombia, Price Waterhouse Coopers, 2006
though will face a tough challenge getting ratified in the U.S. Congress, in part due to resistance by U.S. sugar manufacturers.

**Importance of Air Freight**

Though it is difficult to establish a causal link between availability of air transport and the development of the cut flower market in Colombia, a clearly dependent relationship is readily visible. Of the 247,421 tons of air cargo going into the U.S. from Colombia in 2005, 84 percent were cut flowers. Alternative transport is virtually impossible because of terrain, road conditions, and security concerns. Clearly the case can be built that without air transport, the industry would have no chance of existing. Cut flowers require a cold chain in transport – generally on arrival they go into refrigerated holds at the airport, and once released by customs and USDA they arrive at the importer, where they are re-cooled to 32-38 degrees Fahrenheit. During transit in aircraft, the flowers are in general kept cold through insulated packaging, with no active refrigeration.

The elasticity of the shipping price relies on how much a buyer is willing to pay for freight on board, and how much room there is for adjusting the final retail price of the flower. Markups are high as flowers go through various distribution channels – from the import price to the final retail purchase the value increases five to ten times. A general rule of thumb has been a wholesale price of about US$ 3.60 per kilogram of flowers, though this depends on the type of flower shipped. With an average price of US$ 0.25 per stem, the value of a kilogram of roses (19 stems) would come to $4.75, carnations (37 stems) $ 9.25, and chrysanthemums (15 stems) $3.75. Assuming an air freight rate of US$ 0.56 per tonne kilometer, and a distance of 2,430 km between Bogota and Miami, flowers would cost roughly US$ 1,360 per ton, or US$ 1.30 per kilogram, to ship, roughly 30 – 40 percent of their value. Since fuel now nearly comprises a quarter of airline operating expenses, a doubling of fuel costs would theoretically increase shipping costs by 25 percent.

**Prospects for Growth**

Beyond rising fuel costs and shrinking demand, Colombia’s flower growers now also face a devaluing dollar. Costs for some growers have gone up about forty percent in the last four years, while the Colombian Peso had risen by the same amount. In addition, competition has heated up from Ecuador, China, Kenya, and Mexico. The effects are already becoming apparent as 12,000 jobs have been cut since 2005, and the industry now is pushing for a fixed exchange rate floor of 2,500 pesos per dollar. The danger of too much success lies in oversupply – once the flower trade took off, other markets noticed, and now countries such as China, Tanzania, and Ethiopia are entering, while Kenya is expanding. The competitive advantage for Colombia will be in the proximity to the U.S. markets, meaning that most likely exports to countries other than the U.S. and Canada may decline as Kenya and new entrants take advantage of their proximity to the E.U. It would seem, however, that investing in the cut flower industry in other Latin American countries in order to export into the U.S. would at this point not be advisable, given the decline in purchases by U.S. consumers.

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28 Steward, p. 291
29 The assumptions in this rate are complex and prone to error. A much better value could be obtained by asking the producers or the Colombian Association of Flower Exporters what they actually pay for shipping.
30 Passenger airline fuel costs are 25 percent of operating costs. Flowers go both in dedicated cargo carriers and passenger bellies of aircraft. Since other costs are lower, it could well be that fuel costs are a higher percentage of operating costs for dedicated cargo carriers.
### 3.1.2. Kenya Cut Flower Exports to the European Union

With a 31 percent market share, Kenya is the largest single supplier in the European flower market, the largest competitor and dominating producer being the Netherlands. Other competitors, though minor, include Colombia, Ecuador, and Israel. 69 percent of Kenya’s flowers are shipped to the wholesale markets in the Netherlands \(^\text{32}\), with the UK and Germany having the next largest shares (19 percent and 6 percent). Over 70 percent of flowers exported in 2005 were roses.

“Others” includes France, Spain, and Portugal combined.

Source: International Trade Centre

The cost of the Dutch greenhouses with their required climatization and heating, combined with the increased scarcity of natural gas, has created the context in which the Kenyan cut flower industry emerged, now up to approximately 120 different growers.

Advantages for Kenya include lower labor costs, a much better climactic position near the equator, less environmental regulation, and lower trade barriers. Kenya proclaims itself to be the first low-cost high-volume exporter of flowers, having started in the 1960’s. An estimated 70 percent of the flowers are grown at the rim of Lake Naivasha, northwest of Nairobi. \(^\text{33}\)

**Figure 3-3: Summary of Kenya’s Cut Flower Exports to Europe.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Europe</th>
<th>Netherlands</th>
<th>UK</th>
<th>Germany</th>
<th>Switzerland</th>
<th>France</th>
<th>Spain</th>
<th>Portugal</th>
<th>Israel</th>
<th>Free Zones</th>
<th>Chile</th>
<th>Total:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>144,648</td>
<td>89,790</td>
<td>30,581</td>
<td>14,634</td>
<td>6,336</td>
<td>2,932</td>
<td>363</td>
<td>12</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>144,648</td>
</tr>
<tr>
<td>2002</td>
<td>113,943</td>
<td>69,537</td>
<td>27,190</td>
<td>11,765</td>
<td>3,109</td>
<td>2,112</td>
<td>209</td>
<td>10</td>
<td>11</td>
<td>0</td>
<td>0</td>
<td>113,943</td>
</tr>
<tr>
<td>2003</td>
<td>202,618</td>
<td>128,597</td>
<td>42,175</td>
<td>21,497</td>
<td>4,626</td>
<td>151</td>
<td>549</td>
<td>20</td>
<td>12</td>
<td>4,991</td>
<td>0</td>
<td>202,618</td>
</tr>
<tr>
<td>2004</td>
<td>253,989</td>
<td>156,813</td>
<td>69,619</td>
<td>17,465</td>
<td>5,497</td>
<td>420</td>
<td>336</td>
<td>20</td>
<td>13</td>
<td>0</td>
<td>0</td>
<td>253,989</td>
</tr>
<tr>
<td>2005</td>
<td>369,655</td>
<td>223,957</td>
<td>96,125</td>
<td>25,034</td>
<td>16,322</td>
<td>4,213</td>
<td>7737</td>
<td>24</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>369,655</td>
</tr>
</tbody>
</table>

**Growth Rate**

- 21.23%  
- 73.45%  
- 28.52%  
- 45.54%

Source: International Trade Centre

\(^{32}\) Though Kenya supplies directly to markets in the UK and other countries, the shipments to the Netherlands may appear elsewhere – Dutch flower auction houses present the largest flower market in the world.

\(^{33}\) An excellent draft paper summarizing the Kenyan flower industry can be found in Knowledge, Technology and Growth: The Case Study of Lake Naivasha Cut Flower Cluster in Kenya, April 2006, by Maurice Bolo of the World Bank Institute. The no final version of the paper could be found, so it is only minimally cited. However, this paper is worth a read for further understanding of Kenyan cut flower production around Lake Naivasha.
The flower industry in Kenya directly employs about 500,000, and is estimated to have created 1 million indirect jobs.  

An interesting recent development in Kenya’s export is the signing of an agreement with Germany in 2005 encouraging direct exports, sidestepping the Netherlands’ auction houses. Before the agreement, Germany received 87 percent of its flowers from Holland, 5.5 percent from other growers in Europe, and 7.5 percent from countries such as Kenya, Italy, Israel and Colombia.  

The World Bank’s Doing Business 2007 places Kenya at the 83rd place out of 175, with relatively high scores in the dealing with licenses and getting credit. Though the country still scores poorly on trading across borders at 145th place out of 175, its ranking has approved from the previous year. The overall mid-place ranking must be taken into context for the region – Kenya is one of the most advanced countries in Sub-Saharan Africa next to South Africa, and continues to, albeit timidly, adopt market reforms. In addition, Kenya is a regional hub in transport, and, with its international airline being one of the three most important in Africa, has extensive airport infrastructure at Nairobi.

Importance of Air Freight

Key to cut flower production is the transportation from growing centers to final markets. Schipol International Airport in Amsterdam has become one of the most important cut flower transport nodes in the world, and helped bring about a logistics chain that allows a cut flower from the Netherlands to be on sale in New York City within 48 hours.

In Kenya, good road networks connect growing centers with Nairobi’s Jomo Kenyatta International Airport. Lake Naivasha is only about 80 -100 km away from the airport.

Statistics as to who ships what and where were not as easy to come by as the overall summarized export figures. Two main routes clearly are Nairobi-Amsterdam and Nairobi-UK. Of exports from Kenya to the U.K., anecdotaly over 90 percent arrive via Kenyan Airways. The airline does not have any dedicated freighters, so the flowers are shipped as freight in passenger aircraft to both the U.K. and Amsterdam. Other carriers, such as Lufthansa Cargo and Cargolux, provide dedicated cargo space from Nairobi to Frankfurt and Maastricht. Since sales to the Netherland wholesalers are resold outside the Netherlands, it is reasonable to assume that part of the shipments’ final retail destination may be over other modes of transport.

One of the more visible debates in Europe is the carbon footprint of the industry. Critics claim that since air transport adds to global warming, Kenya is a driver in CO2 emissions. However, others point out that greenhouses with artificial climate control, typical in Europe, result in greater pollution, and that Kenya,

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34 http://environment.guardian.co.uk/conservation/story/0,,2012674,00.html
37 Distance as measured via Google Earth is 82 km straight line, 100 km following road.
because greenhouses there do not require climate control, actually reduces the carbon footprint of the industry notwithstanding the contribution of the related transport flights. 38

The average value of Kenya’s cut flowers has varied and is now approaching $4 per kilogram, though there are wide variations in the statistics. 39 Unlike the fate Colombian growers have been encountering, the industry seems to be strong, and demand for Kenyan flowers in Europe is still increasing. Despite the price fluctuations shown in Figure 3-5, the almost linear growth in exports as seen in Figure 3-6 has not been affected.

Figure 3-5: Average Value per Kilogram of Kenya’s Cut Flowers.  
Figure 3-6: Kilograms of Flowers Shipped Worldwide from Kenya.  

Source: HCDA. Year-end exchange rates were applied.  

Table 3-2: Top Selling Products Worldwide from Kenya’s Greenhouses in 2005.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>US $</th>
<th>Volume (kg)</th>
<th>Value US$ per Kg</th>
<th>% of Value Sold</th>
<th>% of Volume Sold</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROSES</td>
<td>199,013,978</td>
<td>61,072,186</td>
<td>3.26</td>
<td>70.61%</td>
<td>75.20%</td>
</tr>
<tr>
<td>MIXEDFLOWERS</td>
<td>29,000,622</td>
<td>7,043,248</td>
<td>4.12</td>
<td>10.29%</td>
<td>8.67%</td>
</tr>
<tr>
<td>CARNATIONS, STD</td>
<td>9,715,395</td>
<td>2,603,142</td>
<td>3.73</td>
<td>3.45%</td>
<td>3.21%</td>
</tr>
<tr>
<td>CUTTINGS</td>
<td>9,065,415</td>
<td>469,078</td>
<td>19.33</td>
<td>3.22%</td>
<td>0.58%</td>
</tr>
<tr>
<td>HYPERICUM</td>
<td>5,940,285</td>
<td>1,781,429</td>
<td>3.33</td>
<td>2.11%</td>
<td>2.19%</td>
</tr>
<tr>
<td>LISIANTHUS</td>
<td>4,592,782</td>
<td>408,167</td>
<td>11.25</td>
<td>1.63%</td>
<td>0.50%</td>
</tr>
<tr>
<td>CAR.CUTTINGTJNROOTED</td>
<td>3,519,058</td>
<td>170,703</td>
<td>20.62</td>
<td>1.25%</td>
<td>0.21%</td>
</tr>
<tr>
<td>GYPSOPHILLA</td>
<td>3,177,624</td>
<td>792,878</td>
<td>4.01</td>
<td>1.13%</td>
<td>0.98%</td>
</tr>
</tbody>
</table>

Source: HCDA. A breakdown for Europe alone was not available. However, 94 percent of shipments went to Europe. International Trade Center data in Table 3-2 above lists only Israel, Chile, and the Free Zones as additional destinations, with minimal values.

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38 Catherine Riungu, “Kenya: Flower Exports Flourish Despite Odds”, The East African (Nairobi), 1 May 2007. The article in part refers to a study conducted by the International Institute for Environment and Development
39 The HCDA’s data tables do not tie precisely.
Prospects for Growth

Kenya’s flower trade has seen no recent decline in volumes, and European demand for cut flowers looks strong. Due to air transport, Kenya is able to compete effectively and efficiently with the more established growers further north. On the demand side, a saturation point does not yet seem to appear.

However, this must be taken into consideration with new environmental concerns about the impact of the industry in Kenya itself. Horticulture is resource intensive both in labor and in irrigation – Lake Naivasha is showing strains from the consumption of water, the increase of population brought about by the growth of the industry, and the horticultural runoffs caused by fertilizers and pesticides. Unlike in Colombia, natural resources are more finite.

The flower industry is seen in Europe as a two-sided issue: One the one hand, supporting developing countries by purchasing a benign commodity such as flowers can be seen favorably. However, concerns about the treatment of labor (which are being addressed in various ways) and the long-term environmental consequences may in time lead to a dampening of demand for cut flowers.

Given that the demand for flowers in Europe seems to be holding strong compared to the United States, it would seem feasible if not advisable to have new entrants appear in areas of less finite water supply. Attempts are now appearing in Rwanda, and Uganda, the latter which, with its rich and fertile soils, and its cargo capacity both in terms of freighter (DAS Cargo) and the airport in Entebbe, could be an excellent prospect.
3.2. **SEAFOOD AND FRESH FISH**

Fresh seafood is interesting to study in terms of air transport and the logistics of bringing the product to the table. However, salt water fish and shrimp obviously not only require a shoreline, but also geographic proximity to the right currents. In this case the example of Ecuador is unique and does not create a replicable model. However, in the brief description of the Ecuadorian exports of seafood to the U.S. below there is also a discussion on fresh tilapia – a farmable freshwater fish.

Freshwater fish farming is of interest and could have potential in land-locked countries with lakes and reservoirs (e.g. Ethiopia). The example of Tanzania is described below not because it is a model to be followed directly (the introduction of the West Nile Perch is now generally considered an ecological calamity), but because it does show how the right combination of demand for a perishable product and its unique abundance at another location allow for an industry to flourish. Again, here logistics and air transport play a crucial role in delivering the product.

3.2.1. **Ecuador Seafood Exports to the United States**

The United States’ seafood market had reached a consumption value of US$ 62.5 billion in 2005\(^{40}\), of which roughly two thirds was spent in restaurants. In spite of the dollar value increase of five percent over the previous years, per capita consumption as measured in pounds has dropped about two percent to 16.2.

NOAA estimates a total import of US$ 13.4 billion for 2006 (International Trade Centre statistics note slightly below 10 billion for the previous year, which NOAA has at US$ 12.1 billion), up nearly 11 percent over the previous year. Of these imports, Ecuador has 4.3 percent market share of US$ 571 million. Over 55 percent of export by value were shrimp (see Table 3-3 below.)

The Ecuadorian seafood trade is old and established. The location has always been suited for fishing – the corner at the north-western tip of South America is ideal for taking advantage of the meeting of the cold Humboldt with the warmer El Nino currents – the colder currents bring the larger fish feeding on the plankton and the food chain of the warmer currents. Skipjack, Albacore, and Yellow Fin Tuna were common catches,

with Yellow Fin being the biggest export. In the late 1980s Ecuador modernized its fleets and nets. However, it is not only the ideal geographic location of Ecuador that has driven its exports – Tilapia, another export, is actually a farmed fish, with producers all over the world, and the majority imports to the U.S. coming from China. In addition, the warm waters of the Bay of Guayaquil are home to many shrimp farms, which form the most dominant export, and have made Ecuador the world’s biggest shrimp exporter after overtaking Mexico in 1986.

Role of Air Freight

When initially looking at Ecuador’s exports, one would assume only the fresh catch would have the value of being exported by air. For the purpose of looking at the importance of temperature controlled and fast shipping via air transport, the products that stand out are primarily fresh tilapia (most tuna is processed or in some form of oil), other salt-water fish of various kinds, and snappers. Tilapia, however, makes up over 12 percent of Ecuadorian seafood imports into the U.S., with a value of US$ 70.8 million in 2006, and over 14 percent of the total US tilapia import market of $ 482.7 million (China exports about 70 percent.)

Figure 3-8 above shows a breakdown and history of fresh fish imports. With the value of over $6 per kilo in fresh tilapia, air transport makes economic sense, given the about US$ 3.0 threshold commonly discussed in the industry. The leveling of the overall sales show some market saturation, as do the fluctuation of per-kilo prices (see Figure 3-9 below).

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41 http://www.mongabay.com/reference/country_studies/ecuador/ECONOMY.html
42 Ibid.
43 http://www.agmrc.org/agmrc/commodity/aquaculture/tilapia/tilapiaprofile.htm, the numbers on this web citation are derived from the Aquaculture Outlook, USDA-ERS, October 5, 2006
However, further research shows that Miami International Airport (MIA) plays a key role, and that air transportation seems to play a role in all types of seafood exports into the U.S., including frozen shrimp.

An overview at the NTSB Bureau of Transport Statistics states that:

“…MIA is a major hub for trade with Latin American countries—the only air gateway of the top 25 gateways that has major partners in countries other than Pacific-Rim countries. The other key origin countries for imports through MIA are Ecuador and Chile. Along with Colombia, these three countries are origin points for 50 percent of import tonnage through MIA. ... The majority of MIA’s air cargo imports are perishable products, including flowers, fruits, vegetables, and seafood plus some assembled clothing...”

Table 3-3: Ecuadorian Seafood Product Groups Exported to the US in 2006.

<table>
<thead>
<tr>
<th>Product Type</th>
<th>Kg</th>
<th>% of Shipped</th>
<th>US$</th>
<th>US$ %</th>
<th>Avg Value $/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shrimp (mostly frozen)</td>
<td>59,362,672</td>
<td>53.09%</td>
<td>324,240,865</td>
<td>56.74%</td>
<td>5.46</td>
</tr>
<tr>
<td>Tuna (mostly processed or in oil)</td>
<td>24,788,280</td>
<td>22.17%</td>
<td>112,818,623</td>
<td>19.74%</td>
<td>4.55</td>
</tr>
<tr>
<td>Talapia (mostly fresh)</td>
<td>11,118,894</td>
<td>9.94%</td>
<td>70,827,473</td>
<td>12.40%</td>
<td>6.37</td>
</tr>
<tr>
<td>Marine Fish (mostly fresh)</td>
<td>6,727,457</td>
<td>6.02%</td>
<td>31,238,347</td>
<td>5.47%</td>
<td>4.64</td>
</tr>
<tr>
<td>Dolphin (frozen)</td>
<td>2,801,607</td>
<td>2.51%</td>
<td>15,604,773</td>
<td>2.73%</td>
<td>5.57</td>
</tr>
<tr>
<td>Sardines (mostly canned)</td>
<td>2,747,085</td>
<td>2.46%</td>
<td>3,451,651</td>
<td>0.60%</td>
<td>1.26</td>
</tr>
<tr>
<td>Swordfish (mostly fresh)</td>
<td>481,012</td>
<td>0.43%</td>
<td>3,410,602</td>
<td>0.60%</td>
<td>7.09</td>
</tr>
<tr>
<td>Crabmeat products</td>
<td>154,436</td>
<td>0.14%</td>
<td>2,124,086</td>
<td>0.37%</td>
<td>13.75</td>
</tr>
<tr>
<td>Lobster (frozen)</td>
<td>92,687</td>
<td>0.08%</td>
<td>1,328,259</td>
<td>0.23%</td>
<td>14.33</td>
</tr>
<tr>
<td>Snappers (mostly fresh)</td>
<td>178,907</td>
<td>0.16%</td>
<td>1,022,568</td>
<td>0.18%</td>
<td>5.72</td>
</tr>
<tr>
<td>Fish stick products</td>
<td>119,898</td>
<td>0.11%</td>
<td>757,781</td>
<td>0.13%</td>
<td>6.32</td>
</tr>
<tr>
<td>Freshwater fish</td>
<td>213,236</td>
<td>0.19%</td>
<td>539,972</td>
<td>0.09%</td>
<td>2.53</td>
</tr>
<tr>
<td>All Others (also products not for human consumption)</td>
<td>3,035,824</td>
<td>2.71%</td>
<td>4,046,412</td>
<td>0.71%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>111,821,995</td>
<td>100.00%</td>
<td>571,411,412</td>
<td>100.00%</td>
<td></td>
</tr>
</tbody>
</table>

Source: Table compiled from NOAA data.

Another source states that 65 percent of all fish consumed in the United States in 2001 arrived via Miami International, making this the airport’s biggest import.  

**Prospects for Growth**

Error! Reference source not found. above indicates that at least temporarily there may be a saturation point in fresh fish. Exports, as shown in Figure 3-8, have gone down in growth and somewhat leveled off. However, the overall export in seafood is climbing steeply, driven by shrimp. Though the price per kilo of shrimp has somewhat leveled off, the volumes are up astounding – the most drastic figure is the increase of shrimp sales to the U.S. not by dollar value, but by volume (see Figure 3-10 for prices, dollar value, and exports by weight below). The U.S. market for Ecuadorian shrimp, measured in weight, has grown 32 percent in 2005, and 20 percent in 2006. This would indicate that though supply has increased to the point that the price of shrimp has fallen, there is still much unmet or even growing demand – perhaps not just in the U.S., but worldwide. In countries with warmer waters shrimp farming could be of value.

In terms of the business climate within Ecuador, there are fears of nationalizing parts of the industry.  

Ecuador ranks as 123 out of 175, with high firing costs, not the best in investor protection, and complications in starting a business. Ecuador’s politics currently prefer state controlled industries, and there is concern about the future of U.S. trade agreements and foreign investment.  

**Figure 3-10: Shrimp Exports to the U.S. by Value, and Price per Kilogram of Exported Shrimp.**

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45 USAID/GEO Guyana Economic Opportunities - Rapid Reconnaissance Survey of the Export Potential of Guyanese Products to Miami, Bettina Balmer, Mat 2004, p. 18. This report is an interesting read in the sense that, if valid, it provides evidence on p. 19 that prepared foods also arrive via Miami from Ecuador. The report can be found at http://www.newgmc.com/downloads/MiamiReport.pdf.


Nile Perch from Lake Victoria. The West Nile Perch is a freshwater fish artificially introduced into the lake in the 1950s and 1960’s. Some estimates of the Tanzanian market in Europe are at € 100 million (ITC’s statistics portray the market at a more moderate US$ 68 million in 2005.) The exact distribution of the fish within Europe is hard to measure since much of the fish is sent to the airports in Brussels, Liege, and Ostend for immediate reshipping. The largest exports seem to be going to Italy, the Netherlands, and Spain. The other two export competitors are the lake neighbors – Uganda and Kenya. Tanzania has about 60 percent of the market.

The history of the introduction of the West Nile Perch into Lake Victoria is widely known, much discussed, and today much criticized. Locals preferred a form of tilapia native to the lake, now completely consumed by the perch. The disequilibrium caused by the introduction of the perch resulted in the killing of close to all other species of fish, and in the end started harming the perch’s own food supply, lowering its own stock and resulting in fishing quotas set by the Tanzanian Government. In addition, a cholera outbreak led to the fish being banned in Europe in 1991, causing a sharp, though temporary, drop in sales. The ban was lifted after the Europeans were convinced that measures were taken to prevent future occurrences of this sort, and health certificates were attached to each shipment of fish from Tanzania. However, similar outbreaks have occurred since, with Kenyan exports having been banned in 1998.

In spite of these setbacks, the industry surrounding the fish has flourished, and seven large-scale fish factories have been established, buying fish from both individual fisherman and larger, more commercially run fishing operations. The entire fishing industry has changed, drawing labor from barely sustainable subsidence farming into the catching and processing of fish. Statistics are not readily available on how many are employed directly

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48 http://www.globefish.org/index.php?id=2405&easystestatid=87650286. This site has an extensive analysis of East African exports of West Nile Perch to Europe, and is used widely in this summary.
49 Interestingly the U.K has not adopted a taste for the fish.
50 A very thorough analysis of the E.U. market can be found at globefish.org at http://www.globefish.org/index.php?id=2405&easystestatid=87650286. Interestingly, the biggest entry points of West Nile Perch are Belgium and the Netherlands. There is very little consumption in the Netherlands, and the Belgium imports do not appear in the ITC statistics.
or indirectly; however, indications are that in fishing alone there were 22,000 “registered anglers”, with estimates of above 77,000 in all for 2004\textsuperscript{51}, and 30 percent annual increases.

The Mwanza City Council describes the impact of the fishing industry as follows:

“...Fishing in Lake Victoria has a long historical background. However, the introduction of Nile perch or lattes niloticus to the Lake has changed both the social and economic nature of the sector. Today fishing is done mainly for commercial purposes, contrary to the traditional fishing which focused to household consumptions...

According to available statistics from the fish processing plants in Mwanza and Musoma towns, the fish industry has created direct employment for over 8,000 locals and outsiders and indirectly employed about 300,000 others.

At the same time, an estimated three million people living around Lake Victoria in Mwanza, Mara and Kagera regions have been also benefiting from the Nile perch trade (popularly known as marine gold) in one way or another, causing the rapid growth of social and economic activities in the region.

There are also about 52,000 fishermen on the Tanzanian side of Lake Victoria who benefit directly from Nile perch. ...

Tanzania produces about 220,000 tones of fresh and frozen fillets for export annually worth Tshs 77 billion ($77 million).

About 80 percent of the total production of Nile perch fillets is exported to Europe, while the rest is sold to the Asian market.\textsuperscript{52}

The quote above shows the significant impact on of the fishery trade on the local population, and the kind of employment it has created.

\textit{The Role of Air Freight}

West Nile Perch exports in Mwanza are a very good example of the benefits of using air transport for cargo, as well as the potential pitfalls due to lack of infrastructure. The international market for Tanzania’s fresh perch would not exist without the availability of air cargo. When all is as it should be, exports are driven by truck to waiting aircraft at Mwanza’s airport at night, loaded, and sent off to Europe. Interviews at Mwanza’s airport reveal that about 400,000 kilograms of fish go through the airport a month at a declared value of about US$ 3.20 per kilogram\textsuperscript{53}. The estimated overall cost of transport as value added to the product, including subsequent transport cost beyond arrival at the main distribution point, is about US$ 1 per kilogram.\textsuperscript{54}

\textsuperscript{51} Mwanza fishery stakeholders given ultimatum, Pati Magubira in the Daly News, June 12 2007, at the web address http://www.dailynews-tsn.com/page.php?id=7232
\textsuperscript{52} General Overview 2004/2005. Mwanza City Council, at http://www.mwanza.de/mwanza/Mwanza%20CITY%20PROFILE%202004%20en.html
\textsuperscript{53} The figures provided by the airport customs officials, and those by the airport cargo handler, appear to be even larger than those quoted by the Mwanza City Council above. During interviews, samples of the custom delcarstion forms were offered, though a thorough count on site could not be completed at the time.
\textsuperscript{54} Globefish.org http://www.globefish.org/index.php?id=2405&easystatid=87650286
However, new constraints in the ability of moving product out as quickly as possible have emerged. Air cargo aircraft are usually charted for specific shipments by the purchaser. Due to the limitations of the runway, only older single-aisle type cargo airplanes are able to arrive — those that are either too fuel inefficient to be economical, or too noisy to land in Europe. In addition, new surcharges on air freight imposed by the Tanzanian Government has made direct air shipments out of Mwanza economically unfeasible. This causes all products now to be shipped via truck to Nairobi, to be placed on waiting planes at Kenyatta International Airport. The trucking aspect of the operation poses a higher risk to the producer than air freight. However, flying a shorter “feeder” distance between Mwanza and Nairobi is too costly given the value of the product. A solid investment would be the lengthening of the runway in Mwanza to accommodate larger aircraft such as Boeing 767 being converted to freighter operations as they leave passenger service. Also, removing charges that make direct air freight too costly would be helpful.

Future prospects of this market

The biggest concern today about West Nile perch is that its strong demand yet limited supply are pricing the product out of the market. This would infer that new producers (perhaps fish farms) would be welcome, as long as the mistakes of Lake Victoria were avoided. Uncontrolled introduction has had disastrous ecological consequences, controlled farming may not.

Essential though for this type of product, where 65 percent is delivered as fresh, is air transport. West Nile Perch is a freshwater fish, meaning that as a product, as long as air transport is available, the fish could be harvested in any land-locked country with adequate freshwater reservoirs.

The Globefish article mentioned beforehand summarizes the market outlook as bleak for now, with some recommendations:

“...The EU is already now the main market for Nile perch taking about 80 percent of total production. The market is still growing, but various issues have to be taken into account.

Vietnamese catfish is rapidly entering the market, which will have a major impact on the price-conscious Northern European market. Furthermore, logistics provide another bottleneck. There are still few companies (around 10) involved in the direct import of Nile perch from Africa and most of them are based in the Netherlands. Most of them are either specialized in Nile perch trade or have at least one department entirely covering trade in Nile perch.

The air space is the main issue. The mixed (passengers/cargo) regular lines from Nairobi airport are not so frequent and from Tanzania/Uganda the cargo charters still remain the main possibility to deliver fish to Europe. This means that it is very difficult to find room from Nairobi to transport to Europe small quantities of product (500-1000 boxes * 6 kg) and only few companies that sell fish all over Europe can afford to fill up a charter (7500 boxes* 6 kg).

The competition from other goods in the high season (mainly flowers) and the problem to find a south bound in the low season makes even more difficult to book regular air space for companies which are not specialized. These bottlenecks do not attract new Nile perch importers. Companies, who try to enter the market when it is buoyant, by trying to import Nile Perch directly, give up their attempts once they face such an array of bottlenecks.
The trans-shipment of the product through the Netherlands and Belgium to Spain, Italy and Germany represents an additional step and creates additional transport costs. The direct imports of Nile perch from the producing countries should be promoted. A meeting between Nile perch producers and European importers from Spain, Italy and Germany should be encouraged. Annex 2 provides a list of main EU importers of freshwater fish that supply or could be interested in supplying the EU market with Nile perch (3).

Many of the considerations to be applied to the Asian markets could easily be applied to the European market. As a recommendation which is linked to the own nature of the European market, it is worth mentioning the opportunity of eco-labeling. In fact, the European market is extremely environmentally conscious, especially in the northern part of the continent. The option of eco-labeling should hence be taken into consideration: a product which is labeled as “sustainable” or “eco-friendly” (e.g. through the Marine Stewardship Council, MSC certification process) has the potential to attract more purchasers in developed countries, where it may be marketed at a high price. Clearly, this could be done once achieved an acceptable level of sustainability of the fishery.  

3.3. **CLOTHING EXPORTS**

Though initially attractive, the climate for manufactured clothing has changed significantly since the expiration of the Multi Fiber Agreement (MFA) on December 31, 2004. Countries that have been developing the industry, such as Mongolia and Mauritius, have seen their markets swamped by less expensive Chinese products. Factories are closing, and unemployment is on the rise.

In the Mauritius example below, an industry that has pushed a small island nation out of poverty is contracting. The wealth the industry created raised labor rates as full employment came near, yet at the same time made itself vulnerable to lower cost competitors.

3.3.1. **Mauritius Exports of Apparel to the European Union**

*Figure 3-12: Mauritius Clothing Exports to the EU.*

Source: ITC

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One overall summary of the apparel market in the EU reads as follows:

“Clothing imports by EU countries during year 2004 were US$122 billion, of which US$56 billion was supplied by other EU countries. The other major supplying countries were China, Turkey, Romania, Bangladesh and India.

Germany is still the most important country in clothing consumption in the EU, despite continuing decreases. Five EU countries — namely Germany, the United Kingdom, Italy, France and Spain — account for 76 percent of EU clothing consumption.”

The Mauritius exports of apparel are a small portion of the clothing imports entering the EU, and are declining. Chinese imports into Mauritius’s client countries have nearly tripled between 2001 and 2005. Nevertheless, the country did export about US$ 421 million into France, the U.K., Italy, and Germany in 2005. By far the largest markets are France and the U.K., with roughly US$ 180 million each in imports of Mauritius goods. The direct employment in the textiles industry in Mauritius is roughly 75,000, of a total workforce of 549,000, with about 257 enterprises involved.

Originally started in the 1980s by Hong Kong investors taking advantage of the Mauritian export processing zone, the industry has flourished under the now abolished quota system in the EU, and wages slowly rose to above $ 150 a month, much above comparable wages in Asian or other African countries. Today the industry is facing layoffs due to competition not only from Asia but also from lower-income African countries.

Air Freight

Research for this report did not find a direct link between air cargo and the apparel industry. The development of the sector in Mauritius is generally attributed to the creation of free zones, allowing foreign investments and imports without taxation as long as the resulting product is exported. In fact, the Joint Economics Council of Mauritius calls the air transport infrastructure and environment (i.e. bi-lateral agreements allowing foreign access to the main airport, Mauritius International) weak, and blames the lack of more aggressive liberalization and infrastructure for having only 20 percent of exports go out via air. This would still imply, however, that about US$ 80 million of exports to the EU do in fact go by air.

Any analysis of the air transport implications would require knowledge of the value per kilogram of what is being shipped. Research would require on-site interviews, since the product basket being produced in Mauritius is of wide variety, and changing with consumer demand and competitive pressures.

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57 “Disaster looms in Mauritius textile industry”, afrol news, at http://www.afrol.com/articles/14858
59 http://www.jec-mauritius.org/
3.4. **Electronics Exports**

The electronics manufacturing industry can be segmented into the following five general groups:

- manufacture of semiconductors
- computer and peripherals,
- consumer electronics
- wires and cables, and
- precision equipment.

In addition, the industry can also be grouped into three general categories:

- assemblers,
- manufacturing of core components, and
- sales/service.

Not only is air cargo important in bringing product to the end consumer – in fact, air cargo seems to be playing an even more essential role in the actual manufacturing process. Intel sends its processors and other chips through different continents in the manufacturing process. Semiconductors are shipped from manufacturing centers to assemblers. Assembled products are redistributed by sales centers. The interrelationship between the vertical elements of the industry is complex, and, with just-in-time inventory, requires precise logistics.

3.4.1. **Philippines and Malaysia Exports of Electronic Goods**

The Philippine export market in electronics has grown 11 percent in 2006, and may yet grow another 10 percent in 2007. In 2002, about 70 percent of the industry’s income came from semiconductor manufacturing. Total exports in 2005 came to roughly US$ 20 billion, of which the United States had a smaller 9.2 percent share at a little under US$ 1.9 billion. The largest customers were Japan and China – both


61 [http://findarticles.com/p/articles/mi_qn4175/is_20030727/ai_n12930700](http://findarticles.com/p/articles/mi_qn4175/is_20030727/ai_n12930700).
countries highly active in electronics manufacturing. However, the final end point of Philippine semiconductors depends on the product being produced – with the U.S. being a heavy electronic goods consumer, the actually percentage of semiconductors somehow finding their way into the U.S. may be much higher. About 900 firms, dominated by multi-national corporations, are active in electronics production, and the sector employs nearly 400,000. Main players include companies such as Amkor Philippines, Fujitsu, Intel, Philips, Rohm Electronics, Texas Instruments, and Toshiba. 62

Similarly, the Malaysian electronics industry is dominated by semiconductor manufacturing, followed by some component manufacturing and computers, computer parts, and peripherals (NEC and DELL, for example, are two leading computer manufacturers with operations in Malaysia, as is Western Digital). Many of the now established companies went to Malaysia in the 1970s to take advantage of a low-wage labor force that proved to be adept at working at small electronic devices.

| Table 3-4: Share of Philippine Exports According to Trading Partner. |
|-------------------------|-----------------|-----------------|
| Country                 | 2005 Exports    | Share of Exports |
| World                   | 20,162,909      |                 |
| Japan                   | 3,831,854       | 19.00%          |
| Netherlands             | 3,100,354       | 15.38%          |
| Hong Kong, SAR China    | 2,372,599       | 11.77%          |
| China                   | 2,144,797       | 10.64%          |
| United States of America| 1,855,743       | 9.20%           |
| Singapore               | 1,853,711       | 9.19%           |
| Malaysia                | 1,649,979       | 8.18%           |
| Taiwan (Province of China)| 1,110,004  | 5.51%           |
| Korea, Republic of      | 791,434         | 3.93%           |
| Others                  | 1,452,434       | 7.20%           |

The data shows exports to other producing countries, such as Japan and China.
Source: ITC

Air Freight

The ASEAN region has developed into an interacting industrial group in the electronics industry. Singapore, once a manufacturing nation itself, grew into a postindustrial role of sales, distribution, and service. Though no longer considered a manufacturer nation per se, air cargo plays an important role in the collection of manufactured components from the various producer nations, and of course in the final distribution. 63

63 The complexity of air cargo services in the electronics industry has been academically researched. Of note is an article written for the Journal of Economic Geography in 2002 by Thomas R. Leinbach of the University of Kentucky and John T. Brown, Jr. of University of
In the Journal of Economic Geography Leinbach & Bowen write:

“...The geography of internationalization has created an ‘archipelago economy’ (Veltz, 1996, cited in Coe et al., 2003) in which places well integrated into the global economy are surrounded by less privileged places that are not. Air cargo services, like other dimensions of the distributive infrastructure (Martenelli, 1991) of the international economy, reflect and reinforce that geography....In Asia-Pacific, for instance, the density of global production networks and the density of transport networks...augment one another.”64

On the role of Singapore, the authors write

“Supply chains embedded in the Pacific Rim are particularly reliant on air cargo services. Though air cargo has grown rapidly in markets worldwide, its expansion in Asia has been stunning. ... In the computer industry, for instance, Singapore, Taiwan, Malaysia, and Thailand occupy different niches with a constant flow of components among them. Much of this traffic is inter-firm, reflecting the empowerment of the transitional corporation as manager of the new international division of labor.”65

On the role of Singapore, the authors write

“Singapore, which was a key player in the semiconductor industry in the 1960s and the 1970s, has now lost much of its business, particularly the lower value-added assembly operations. It remains, however, an important center in the fabrication of valuable silicon wafers from which semiconductors chips are cut. Malaysia occupies an intermediate position in which both high-end (wafer fabrication) and low-end (cutting and processing of chips) functions are undertaken. And the Philippines’ semiconductor industry remains concentrated in labor-intensive operations.”66

The key element in the intensity of usage of air cargo relates to a common theme throughout this report – air cargo is used in time sensitive circumstances (see Figure 3-15 below.) In Leinbach & Bowen’s study the key

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64 Leinbach & Bowen, p. 305
65 Ibid, p. 302
66 Ibid, p. 309

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<table>
<thead>
<tr>
<th>Country</th>
<th>Kg (2005)</th>
<th>Share of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>48,159,452</td>
<td>100.00%</td>
</tr>
<tr>
<td>United States of America</td>
<td>11,351,661</td>
<td>23.57%</td>
</tr>
<tr>
<td>Singapore</td>
<td>9,207,422</td>
<td>19.12%</td>
</tr>
<tr>
<td>Hong Kong , SAR China</td>
<td>5,918,635</td>
<td>12.29%</td>
</tr>
<tr>
<td>Japan</td>
<td>3,591,240</td>
<td>7.46%</td>
</tr>
<tr>
<td>China</td>
<td>3,101,251</td>
<td>6.44%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1,538,778</td>
<td>3.20%</td>
</tr>
<tr>
<td>Taiwan (Province of China)</td>
<td>1,384,101</td>
<td>2.87%</td>
</tr>
<tr>
<td>Korea, Republic of</td>
<td>836,765</td>
<td>1.74%</td>
</tr>
<tr>
<td>Philippines</td>
<td>587,586</td>
<td>1.22%</td>
</tr>
<tr>
<td>Others</td>
<td>10,642,013</td>
<td>22.10%</td>
</tr>
</tbody>
</table>

Source: ITC
element does not just seem to be the weight/value relationship, but the timing for delivery. Of least intensity of usage is the actual delivery of consumer electronics—the segment using air transport most intensely relates to semiconductors and computers.

Figure 3-15: Intensity of Air Cargo Use vs. Product Cycle Time.

Source: Leinbach & Bowen, p. 311

The importance of the air transport to the industry can be described with the example of the Philippines–Taiwan air services conflict. The owner of Philippines airlines lobbied government officials for a rollback from liberalization, in order to prevent USA traffic from flying to the Philippines via Taipei using Taiwanese carriers. In 1999 the Philippines suspended direct flights from Taipei, forcing notebook computer manufacturer Acer to reroute its product, manufactured in Subic, via Hong Kong. The crisis manifested itself directly in the output—before the restrictions, 84,000 units left the factory; however, during the crisis output dropped to 30,000, with Acer planning to move production to China in search of a more favorable business environment.67

67 Air Cargo: Growth and Issues, Thomas R. Leinbach, Department of Geography, University of Kentucky (PowerPoint presentation)
Prospects for Growth

The semiconductor and electronics industry is cyclical, and another downturn is expected. However, beyond the industry overall growth rates vary widely from country to country and market to market, depending on the type of specialization. A decline is seen when growth rates do not quite meet expected or forecast rates (e.g. there is speculation whether the Philippines will achieve 10 percent in 2007, and what the implications are if growth falls short). In the long term electronics would seem to have very good market prospects. Texas Instruments, for example, has announced in May 2007 plans to invest another US$ 1 billion in plant expansion at the Clark Free Economic Zone in the Philippines, employing an addition 3,000 when completed.\(^6\)

The competitive advantages of the Southeast Asian countries in the electronics manufacturing industry lie in the large quantity of low cost labor, and a business-friendly environment. Just as with Mauritius, growth in the Philippines came from the creation of free commercial zones that allowed direct foreign investment with hardly any strings attached. By the same token, organized labor is kept in check throughout the Southeast

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Asian countries, at times with government interference. Surprisingly, the education level of the labor force seems of little significance – many factory workers in the industry are recruited from the countryside.

The replication of such a model would be possible within a regional context – economically, through free enterprise, different countries in Southeast Asia assume different roles in the overall manufacture and distribution of electronics goods. One could, perhaps, look at geographically close regions such as the CIS to start a similar structure, with different countries specializing in different processes during manufacture, using free enterprise zones.
### Table 3-6: Top 50 Cargo Airports Worldwide.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Airport</th>
<th>Tons</th>
<th>% Change</th>
<th>Rank</th>
<th>Airport</th>
<th>Tons</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Memphis, TN, USA (MEM)</td>
<td>3,695,438</td>
<td>-3.8</td>
<td>26</td>
<td>Guangzhou, China (CAN)</td>
<td>685,868</td>
<td>-1.3</td>
</tr>
<tr>
<td>2</td>
<td>Hong Kong, Chine (HKG)</td>
<td>3,660,901</td>
<td>-3.0</td>
<td>27</td>
<td>Kuala Lumpur, Malaysia (KUL)</td>
<td>667,495</td>
<td>2.2</td>
</tr>
<tr>
<td>3</td>
<td>Shanghai, China (PVG)</td>
<td>2,602,916</td>
<td>1.7</td>
<td>28</td>
<td>Dallas/Ft. Worth, TX, USA (DFW)</td>
<td>660,036</td>
<td>-8.7</td>
</tr>
<tr>
<td>4</td>
<td>Seoul, South Korea (ICN)</td>
<td>2,423,717</td>
<td>-5.2</td>
<td>29</td>
<td>Brussels, Belgium (BRU)</td>
<td>659,054</td>
<td>-11.8</td>
</tr>
<tr>
<td>5</td>
<td>Anchorage, AK, USA (ANC)</td>
<td>2,339,831</td>
<td>17.2</td>
<td>30</td>
<td>Atlanta, GA, USA (ATL)</td>
<td>655,277</td>
<td>-9.0</td>
</tr>
<tr>
<td>6</td>
<td>Paris, France (CDG)</td>
<td>2,280,050</td>
<td>-0.1</td>
<td>31</td>
<td>Oakland, CA, USA (OAK)</td>
<td>622,009</td>
<td>-4.0</td>
</tr>
<tr>
<td>7</td>
<td>Frankfurt, Germany (FRA)</td>
<td>2,111,031</td>
<td>2.7</td>
<td>32</td>
<td>Shenzhen, China (SZX)</td>
<td>598,036</td>
<td>-2.9</td>
</tr>
<tr>
<td>8</td>
<td>Tokyo, Japan (NRT)</td>
<td>2,100,448</td>
<td>-6.8</td>
<td>33</td>
<td>Cologne, Germany (CGN)</td>
<td>578,161</td>
<td>-18.6</td>
</tr>
<tr>
<td>9</td>
<td>Louisville, KY, USA (SDF)</td>
<td>1,974,276</td>
<td>-5.0</td>
<td>34</td>
<td>Mumbai, India (BOM)</td>
<td>559,106</td>
<td>4.2</td>
</tr>
<tr>
<td>10</td>
<td>Singapore, Singapore (SIN)</td>
<td>1,883,894</td>
<td>-1.8</td>
<td>35</td>
<td>Bogota, Colombia (BOG)</td>
<td>547,928</td>
<td>-1.8</td>
</tr>
<tr>
<td>11</td>
<td>Dubai, UAE (DXB)</td>
<td>1,824,992</td>
<td>9.4</td>
<td>36</td>
<td>Liege, Belgium (LGG)</td>
<td>518,389</td>
<td>5.9</td>
</tr>
<tr>
<td>12</td>
<td>Miami Fl, USA (MIA)</td>
<td>1,806,770</td>
<td>-6.0</td>
<td>37</td>
<td>Philadelphia, PA, USA (PHL)</td>
<td>506,680</td>
<td>-6.8</td>
</tr>
<tr>
<td>13</td>
<td>Los Angeles, CA, USA (LAX)</td>
<td>1,629,525</td>
<td>-11.9</td>
<td>38</td>
<td>San Francisco, CA, USA (SFO)</td>
<td>493,628</td>
<td>-12.3</td>
</tr>
<tr>
<td>14</td>
<td>Amsterdam, Netherlands (AMS)</td>
<td>1,602,585</td>
<td>-3.0</td>
<td>39</td>
<td>Jakarta, Indonesia (CGK)</td>
<td>492,308</td>
<td>4.0</td>
</tr>
<tr>
<td>15</td>
<td>Taipei, Taiwan (TPE)</td>
<td>1,493,120</td>
<td>-7.0</td>
<td>40</td>
<td>Toronto, Canada (YYZ)</td>
<td>483,975</td>
<td>-3.7</td>
</tr>
<tr>
<td>16</td>
<td>London, United Kingdom (LHR)</td>
<td>1,486,260</td>
<td>6.5</td>
<td>41</td>
<td>Sao Paulo, Brazil (GRU)</td>
<td>470,404</td>
<td>-3.7</td>
</tr>
<tr>
<td>17</td>
<td>New York, NY, USA (JFK)</td>
<td>1,450,605</td>
<td>-9.8</td>
<td>42</td>
<td>New Delhi, India (DEL)</td>
<td>449,558</td>
<td>4.2</td>
</tr>
<tr>
<td>18</td>
<td>Beijing, China (PEK)</td>
<td>1,365,768</td>
<td>14.5</td>
<td>43</td>
<td>Ontario, CA, USA (ONT)</td>
<td>436,525</td>
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</tr>
<tr>
<td>19</td>
<td>Chicago, IL, USA (ORD)</td>
<td>1,332,123</td>
<td>-13.1</td>
<td>44</td>
<td>Leipzig, Germany (LEJ)</td>
<td>429,915</td>
<td>403.1</td>
</tr>
<tr>
<td>20</td>
<td>Bangkok, Thailand (BKK)</td>
<td>1,173,084</td>
<td>-3.9</td>
<td>45</td>
<td>Milan, Italy (MXP)</td>
<td>415,952</td>
<td>-14.5</td>
</tr>
<tr>
<td>21</td>
<td>Indianapolis, IN, USA (IND)</td>
<td>1,039,993</td>
<td>-5.6</td>
<td>46</td>
<td>Shanghai, China (SHA)</td>
<td>415,726</td>
<td>6.9</td>
</tr>
<tr>
<td>22</td>
<td>Newark, NJ, USA (EWR)</td>
<td>887,053</td>
<td>-8.0</td>
<td>47</td>
<td>Houston, TX, USA (IAH)</td>
<td>412,217</td>
<td>-0.4</td>
</tr>
<tr>
<td>23</td>
<td>Tokyo, Japan (HND)</td>
<td>852,444</td>
<td>-0.1</td>
<td>48</td>
<td>Honolulu, Hawaii, USA (HNL)</td>
<td>410,725</td>
<td>-7.2</td>
</tr>
<tr>
<td>24</td>
<td>Osaka, Japan (KIX)</td>
<td>845,497</td>
<td>-0.1</td>
<td>49</td>
<td>Mexico City, Mexico (MEX)</td>
<td>382,417</td>
<td>-7.0</td>
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<tr>
<td>25</td>
<td>Luxembourg, Luxembourg (LUX)</td>
<td>788,224</td>
<td>-8.0</td>
<td>50</td>
<td>Chengdu, China (CTU)</td>
<td>374,196</td>
<td>13.9</td>
</tr>
</tbody>
</table>

Note: Anchorage data includes transit freight.

Table 7: Top 50 IATA Airlines with Cargo Service World-Wide

<table>
<thead>
<tr>
<th>Rank</th>
<th>Airline</th>
<th>Country</th>
<th>FTKs 07-08</th>
<th>FTKs ’08-09</th>
<th>% Ch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FedEx Express</td>
<td>United States</td>
<td>15,710</td>
<td>15,122</td>
<td>-3.7</td>
</tr>
<tr>
<td>2</td>
<td>UPS</td>
<td>United States</td>
<td>10,961</td>
<td>10,977</td>
<td>0.1</td>
</tr>
<tr>
<td>3</td>
<td>Korean Air</td>
<td>South Korea</td>
<td>9,568</td>
<td>8,890</td>
<td>-7.1</td>
</tr>
<tr>
<td>4</td>
<td>Cathay Pacific</td>
<td>Hong Kong</td>
<td>8,225</td>
<td>8,245</td>
<td>0.2</td>
</tr>
<tr>
<td>5</td>
<td>Lufthansa</td>
<td>Germany</td>
<td>8,348</td>
<td>8,206</td>
<td>-1.7</td>
</tr>
<tr>
<td>6</td>
<td>Singapore Airlines</td>
<td>Singapore</td>
<td>7,945</td>
<td>7,486</td>
<td>-5.8</td>
</tr>
<tr>
<td>7</td>
<td>Emirates</td>
<td>UAE</td>
<td>5,497</td>
<td>6,013</td>
<td>9.4</td>
</tr>
<tr>
<td>8</td>
<td>Air France</td>
<td>France</td>
<td>6,126</td>
<td>5,820</td>
<td>-5.0</td>
</tr>
<tr>
<td>9</td>
<td>Cargolux</td>
<td>Luxembourg</td>
<td>5,482</td>
<td>5,334</td>
<td>-2.7</td>
</tr>
<tr>
<td>10</td>
<td>China Airlines</td>
<td>Taiwan</td>
<td>6,301</td>
<td>5,261</td>
<td>-16.5</td>
</tr>
<tr>
<td>11</td>
<td>British Airways</td>
<td>United Kingdom</td>
<td>4,626</td>
<td>4,702</td>
<td>1.6</td>
</tr>
<tr>
<td>12</td>
<td>KLM</td>
<td>Netherlands</td>
<td>4,745</td>
<td>4,646</td>
<td>-2.1</td>
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<tr>
<td>13</td>
<td>Japan Airlines</td>
<td>Japan</td>
<td>4,669</td>
<td>4,286</td>
<td>-8.2</td>
</tr>
<tr>
<td>14</td>
<td>Eva Air</td>
<td>Taiwan</td>
<td>4,774</td>
<td>4,076</td>
<td>-14.6</td>
</tr>
<tr>
<td>15</td>
<td>Air China</td>
<td>China</td>
<td>3,586</td>
<td>3,396</td>
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</tr>
<tr>
<td>16</td>
<td>Asiana Airlines</td>
<td>South Korea</td>
<td>3,113</td>
<td>3,326</td>
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<tr>
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<td>American Airlines</td>
<td>United States</td>
<td>2,726</td>
<td>2,557</td>
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<tr>
<td>18</td>
<td>Malaysia Airlines</td>
<td>Malaysia</td>
<td>2,622</td>
<td>2,444</td>
<td>-6.8</td>
</tr>
<tr>
<td>19</td>
<td>United Airlines</td>
<td>United States</td>
<td>2,959</td>
<td>2,404</td>
<td>-18.8</td>
</tr>
<tr>
<td>20</td>
<td>China Eastern</td>
<td>China</td>
<td>2,473</td>
<td>2,379</td>
<td>-3.8</td>
</tr>
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<td>21</td>
<td>Lan Airlines</td>
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<td>2,473</td>
<td>2,346</td>
<td>-5.1</td>
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<tr>
<td>22</td>
<td>Northwest Airlines</td>
<td>United States</td>
<td>2,943</td>
<td>2,330</td>
<td>-20.8</td>
</tr>
<tr>
<td>23</td>
<td>Thai Airways</td>
<td>Thailand</td>
<td>2,454</td>
<td>2,289</td>
<td>-6.7</td>
</tr>
<tr>
<td>24</td>
<td>Qantas</td>
<td>Australia</td>
<td>2,345</td>
<td>2,206</td>
<td>-5.9</td>
</tr>
<tr>
<td>25</td>
<td>All Nippon Airways</td>
<td>Japan</td>
<td>1,884</td>
<td>2,068</td>
<td>9.8</td>
</tr>
<tr>
<td>26</td>
<td>Nippon Cargo Airlines</td>
<td>Japan</td>
<td>1,836</td>
<td>1,796</td>
<td>-2.2</td>
</tr>
<tr>
<td>27</td>
<td>China Southern</td>
<td>China</td>
<td>1,905</td>
<td>1,709</td>
<td>-10.3</td>
</tr>
<tr>
<td>28</td>
<td>Delta Air Lines</td>
<td>United States</td>
<td>1,560</td>
<td>1,675</td>
<td>7.4</td>
</tr>
<tr>
<td>29</td>
<td>Qatar Airways</td>
<td>Qatar</td>
<td>1,307</td>
<td>1,653</td>
<td>26.5</td>
</tr>
<tr>
<td>30</td>
<td>Virgin Atlantic</td>
<td>United Kingdom</td>
<td>1,490</td>
<td>1,518</td>
<td>1.9</td>
</tr>
<tr>
<td>31</td>
<td>China Cargo Airlines</td>
<td>China</td>
<td>1,451</td>
<td>1,450</td>
<td>-0.1</td>
</tr>
<tr>
<td>32</td>
<td>Saudi Arabian</td>
<td>Saudi Arabia</td>
<td>1,230</td>
<td>1,383</td>
<td>12.4</td>
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<tr>
<td>33</td>
<td>Etihad Airways</td>
<td>UAE</td>
<td>1,041</td>
<td>1,277</td>
<td>22.7</td>
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<tr>
<td>34</td>
<td>Continental Airlines</td>
<td>United States</td>
<td>1,240</td>
<td>1,191</td>
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<tr>
<td>35</td>
<td>Air Canada</td>
<td>Canada</td>
<td>1,185</td>
<td>1,157</td>
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</tr>
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<td>36</td>
<td>Swiss International Airlines</td>
<td>Switzerland</td>
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<td>3.7</td>
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<td>37</td>
<td>Iberia</td>
<td>Spain</td>
<td>1,156</td>
<td>1,091</td>
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</tr>
<tr>
<td>38</td>
<td>Volga-Dnepr</td>
<td>Russia</td>
<td>n/a</td>
<td>1,047</td>
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<tr>
<td>39</td>
<td>Air New Zealand</td>
<td>New Zealand</td>
<td>906</td>
<td>851</td>
<td>-6.1</td>
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<tr>
<td>40</td>
<td>South African Airways</td>
<td>South Africa</td>
<td>928</td>
<td>739</td>
<td>-20.4</td>
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<tr>
<td>41</td>
<td>Jet Airways</td>
<td>India</td>
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<td>42</td>
<td>El Al</td>
<td>Israel</td>
<td>878</td>
<td>590</td>
<td>-32.8</td>
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<tr>
<td>43</td>
<td>EAT-European Air Transport</td>
<td>Belgium</td>
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<td>587</td>
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<td>44</td>
<td>Finnair</td>
<td>Finland</td>
<td>490</td>
<td>543</td>
<td>10.8</td>
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<tr>
<td>45</td>
<td>Turkish Airlines</td>
<td>Turkey</td>
<td>478</td>
<td>533</td>
<td>11.5</td>
</tr>
<tr>
<td>46</td>
<td>Air India</td>
<td>Air India</td>
<td>508</td>
<td>527</td>
<td>3.7</td>
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<tr>
<td>47</td>
<td>SAS</td>
<td>Scandinavia</td>
<td>546</td>
<td>519</td>
<td>-4.9</td>
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<tr>
<td>48</td>
<td>TNT Airways</td>
<td>Belgium</td>
<td>n/a</td>
<td>487</td>
<td></td>
</tr>
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<td>49</td>
<td>Austrian</td>
<td>Austria</td>
<td>n/a</td>
<td>432</td>
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<tr>
<td>50</td>
<td>Gulf Air</td>
<td>Bahrain</td>
<td>n/a</td>
<td>421</td>
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</table>

Source: Air Cargo World, Volume 98, Number 9, September 2008, p 24-29, and Volume 99, Number 9, September 2009, p. 27. Air Cargo World credits IATA for the compilation.
### Table 8: Top IATA freight forwarders ranked by global forwarding revenues, 2005

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>2005 US $ million</th>
<th>2005 Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DHL Danzas</td>
<td>2,097</td>
<td>7.92%</td>
</tr>
<tr>
<td>2</td>
<td>Nippon Express</td>
<td>1,263</td>
<td>4.96%</td>
</tr>
<tr>
<td>3</td>
<td>Exel</td>
<td>1,086</td>
<td>4.27%</td>
</tr>
<tr>
<td>4</td>
<td>BAX Global</td>
<td>887</td>
<td>3.49%</td>
</tr>
<tr>
<td>5</td>
<td>Kuehne &amp; Nagel</td>
<td>814</td>
<td>3.20%</td>
</tr>
<tr>
<td>6</td>
<td>Schenker</td>
<td>767</td>
<td>3.01%</td>
</tr>
<tr>
<td>7</td>
<td>Expeditors</td>
<td>753</td>
<td>2.96%</td>
</tr>
<tr>
<td>8</td>
<td>Panalpina</td>
<td>666</td>
<td>2.62%</td>
</tr>
<tr>
<td>9</td>
<td>Kintetsu</td>
<td>649</td>
<td>2.55%</td>
</tr>
<tr>
<td>10</td>
<td>Yusen</td>
<td>631</td>
<td>2.48%</td>
</tr>
<tr>
<td>11</td>
<td>EGL Eagle</td>
<td>538</td>
<td>2.11%</td>
</tr>
<tr>
<td>12</td>
<td>UPS</td>
<td>457</td>
<td>1.80%</td>
</tr>
<tr>
<td>13</td>
<td>UT</td>
<td>336</td>
<td>1.32%</td>
</tr>
<tr>
<td>14</td>
<td>Hellmann</td>
<td>298</td>
<td>1.17%</td>
</tr>
<tr>
<td>15</td>
<td>Geologistics</td>
<td>277</td>
<td>1.09%</td>
</tr>
<tr>
<td>16</td>
<td>Shanghai Jin Hai Jet Air</td>
<td>264</td>
<td>1.04%</td>
</tr>
<tr>
<td>17</td>
<td>Hankyu</td>
<td>262</td>
<td>1.03%</td>
</tr>
<tr>
<td>18</td>
<td>Speedmark</td>
<td>211</td>
<td>0.83%</td>
</tr>
<tr>
<td>19</td>
<td>SDV</td>
<td>208</td>
<td>0.82%</td>
</tr>
<tr>
<td>20</td>
<td>Nishi Nippon Railroad</td>
<td>198</td>
<td>0.78%</td>
</tr>
<tr>
<td>21</td>
<td>United China Airfreight</td>
<td>190</td>
<td>0.75%</td>
</tr>
<tr>
<td>22</td>
<td>ABX Logistics</td>
<td>160</td>
<td>0.63%</td>
</tr>
</tbody>
</table>

Source: IATA, also as published in Air Freight: A Market Study with Implications for Landlocked Countries, Arvis, Arnold, Webber, and Bofinger, The World Bank Group, November 2009, p. 81

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69 Ranking is based solely on UPS’ forwarding revenues. IATA has registered its belief that its revenue and consequent market shares have been undercounted – especially as it ranked #10 in the previous year.
APPENDIX 2: POLICY RECOMMENDATIONS

The policy recommendations below to governments derive both out of the discussion of the air cargo sector itself as well as the case studies presented. There are five general recommendations:

1. Adequate infrastructure for preferred equipment: Cargo facilities need not be expansive, but the runways must be able to accommodate the kinds of aircraft that can legally and efficiently be brought into, for example, the EU. Other infrastructure concerns are access to the airport - Kenya's success in the flower business can also be attributed to the excellent road access the growing center has to the Nairobi International. Ethiopia loses a relatively high percentage of it perishables during the road travel from remote regions to Addis. The development of integrated services such as express couriers requires an overall country-wide infrastructure that goes beyond the air side and allows speedy delivery to the final location.

2. Customs and dwell time: One of the most common complaints in the developing world concerns too long dwell times for air cargo. There are many reasons for this, such as security (in India there is a 24 hour “cool-down” period for air cargo to assure no explosive devices are being shipped), however, a common complaint are custom services. Proper governance of customs services are an important part of an effective air cargo network.

3. Legal framework – liberalization: Though not much discussed in this paper, the free flow of traffic between countries is vital. In air freight, 5th and 6th freedoms can play an important role. Under true 5th and 6th freedom operations n air cargo carrier, based in one country, would be allowed to pick up goods in another country, fly to a third country, unload some of the goods while pickup up additional cargo, and fly to a fourth country. Liberalization of air freight services has generally been in a more advanced state than that of passenger services. However, the opponents of liberalization are generally country flag carriers, and many of them have extensive cargo operations. Since 50 percent of all air cargo goes via passenger aircraft bellies, capacity may be limited in countries following a more restrictive policy on passenger services.

4. Safety oversight: Safety oversight is an issue particularly in Sub-Saharan Africa and the newly independent states of the former Soviet Union. A solid safety oversight system within each country assures a safe global network that insures all nodes are accessible. Real examples of breakdowns in those systems are cargo carriers not allowed to fly into Europe (i.e. on the European blacklist). One example would be DAS Air Cargo in Uganda. The airline was blacklisted in the EU, and when the blacklist was removed, the airline had lost so much business it collapsed. Solid safety oversight can also have a bearing on the cost of operating, since the costs of the leasing aircraft for freight are higher if loss rates are higher. Also affects who is allowed to fly where - typical 5. The role of free enterprise zones – common thread in some of the success stories of the case studies in this report. Though markets are claimed to have sprung from excess capacity, the development of free enterprise zones, in at least two high-success cases, has also been a vital catalyst. However, free enterprise zones needs to be carefully constructed, as there have been many cases where their development by themselves yielded little results. Free enterprise zones should be seen as only one tool for development available amongst many.
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