Air cargo revenue management
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Executive Summary

The integration of innovative systems in different transport modes is a key factor in order to improve efficiency, save costs and energy, and decrease cargo transport time. Demand is pulling the integration of revenue management (RM) in the air cargo industry.

Intelligent Transport Systems (ITS) are marketed differently depending on the transport mode and sector specificities. The potential of ITS in the integration of revenue management (RM) in air freight transport seems to be strong. Currently, revenue management techniques are applied to air passenger transport. Nevertheless, the adoption of such systems is at an early stage in the air cargo sector. Market trends show an active environment in which new partnerships are being set up, such as those between IT providers, freight forwarders and air cargo carriers.

ITS have a strong potential in the sector, especially for the integration of revenue management, already implemented for passenger transport. There are some important technical and organisational barriers, such as the complexity of RM algorithms and the lack of information transparency, which have to be overcome to succeed in integrating information technologies (IT) in air cargo. However, the potential of optimisation of air cargo operations is very important. Carriers are developing their own RM software, but current practices in the sector and the high negotiation power of freight forwarders are restricting the deployment of these ITS.

In conclusion, the air cargo market represents a high potential of opportunities for the application of revenue management. Alliances with traditional transport sector stakeholders are a viable strategy for improving the deployment of such systems but this integration is only possible if the technological, legal, and organisational environments are prepared prior to the general adoption of innovative ITS in the market.
Air cargo revenue management

Market information

Since the beginning of the 20th century, with the arrival of powered planes, cargo has been transported by air. The very first air vehicle that transported mail was a hot air balloon in 1785, but it was not until 1911 that an airplane was first used for carrying mail. Throughout history many types of air vehicles were used to transport mail and cargo, starting with hot balloons, then dirigibles and finally airplanes due to the evolution of the aeronautics industry.

During the 1980s and 1990s, air cargo traffic had an annual growth rate of approximately 6 to 7%. During the last decade, air cargo traffic has shown an annual average growth rate of 3.7%, reaching today 200 thousand million Revenue Tonne Kilometre (RTKs) (Figure 1).

In Europe the use of air vehicles to transport cargo has been adopted since the early days of the aeronautics industry and continues to be at the heart of the freight and mail transport industry. In the last decade, the amount of cargo transported by air has not changed significantly, as shown in Figure 2.

Today air transport is an essential element in the cargo industry and its evolution is directly dependent on world trade evolution, which in turn, is dependent on the world Gross Domestic Product (GDP) (International Air Transportation Association IATA, 2011).

Figure 1: History of air cargo traffic, including freight and mail. The traffic is measured in RTK which is a ton of goods transported one kilometre. Adapted from (Boeing, 2013)

Figure 2: Air freight and mail transportation in European Union 27. (Eurostat, 2013)
This section aims at characterising the air cargo market in order to assess the feasibility of integrating revenue management techniques. For this, two requirements have to be fulfilled from the air cargo company standpoint and from the customer point of view.

Concerning the air cargo carrier, RM applications have to be justified by an improvement of the company’s revenue or competitiveness. From the customer point of view, it has to fit its needs. It is essential to take into account different market segments and associated needs such as their willingness to pay, product specifications, etc.

In Europe, about 14.5 million tonnes of freight were transported by air via airports within the EU-27 in 2011 (national and international transport). Approximately 4.3 million tonnes of air freight were handled in German airports, considerably more than in any other EU country (see Figure 3). The UK comes in second for the last decade. Italy, France and some smaller countries of the EU-27 have become specialised in air freight (such as Benelux countries) and have reached the top rankings in terms of transported freight.

![Figure 3: Evolution of cargo transported by air in the studied countries in the last 10 years. Information adapted from (Eurostat, 2013)](image)

Figure 4: Total air freight and mail loaded and unloaded in 2011, in tonnes. (Eurostat, 2013)

All of these goods (freight and mail) transported by air represent the current size of the market for this study. However, the application of RM to air cargo is strongly affected by significant market barriers. These barriers are presented and explained in the following section.

**Cargo airlines**

Figure 5 and Figure 6 present the world’s most important air cargo companies, classified by fleet size and transported cargo, regardless of their origin.
Market trends

Experts agree on the following trends for the air cargo sector:

- During the last decade, air cargo traffic has shown an annual average growth rate of 3.7%.
- The world full cargo fleet is growing, as a consequence of the air cargo traffic growth.
- Maritime transport has become a very important competitor on the market, as its price is competitive.
- The EU air cargo market seems very contestable as there are approximately 450 different carriers operating.
- Language seems to be a barrier for concentration of airlines from different countries.
- A concentration process in the EU exists between small and very big air cargo carriers, but remains a small process regarding the market size.
- RM is being widely applied to air passenger transport but not to air cargo. An opportunity from a more efficient use of holds in passenger aircrafts is highlighted by first experiments done by low cost airlines.

Trends concerning the application of revenue management (RM) techniques to air cargo:

- Currently, RM in air cargo is at an experimental stage and only few carriers are using it.
- The growth of e-commerce is fostering the introduction of RM in air cargo due to the following reasons:
  - Customers prefer express shipment to reduce shipment time. Air cargo is better adapted than other modes for e-customers’ needs. RM is more convenient for this type of shipments.
- E-freight is at a development stage. Once paper documents will be replaced by electronic documents, the growth of an internet-based cargo industry will be easier. This will simplify the application of RM.
- RM is not a subject of any actual or future European Commission initiative.
Market barriers and incentives

Technological factors

- **RM algorithms complexity**: They are more difficult to develop for cargo than for passenger, as the transported entity is not clearly delimited. Algorithms for air cargo take into account two dimensions: weight and volume. Moreover, the transported cargo could require a special treatment, such as refrigeration.
- **Lack of GDS in air cargo**: Global distribution systems allow the automated transaction between air cargo carriers and booking agents (usually freight forwarders).
- **Lack of e-platform for direct cargo booking which apply RM algorithms**: These platforms are usually set up by a GDS.
- **Lack of comparison platform**: for prices of different air cargo carriers.
- **Lack of cloud computing environment**: This is a consequence of the absence of GDS.
- **Bureaucracy**: Complexity of air cargo documentation preparation, which difficult the integration of IT in the value chain.
- **Lack of reliable performance allocation tool**: It aims at optimising the space allocation process and overbooking. This is usually developed by carriers but there is a lack of technical solutions in the IT market.
- **Different booking systems**: Airlines have different booking systems, which implies a high complexity in interoperable software development.

Business factors

- **High volatility in bookings**: Cargo space is usually cancelled, re-booked and re-cancelled. This may have an impact in technical complexity.
- **Existing proven revenue model**: This makes the development of new business models difficult. Revenue depends on destination, weight and size of transported objects. Cargo space is offered in three stages: a few months prior to a season, “allotted capacity” is bided by freight forwarders. A part of remaining space is allocated to contracts (with a fixed price for large customers, called block space). The remaining “capacity available for free sale” is open to booking a few days prior to departure.
- **Lack of compatible business models for passenger and cargo**: For this mixed transport, cargo is considered separated from the passenger business model.
- **Constrained RM scope to air cargo**: Intermodal transport scenarios are not considered for the application of RM in an integrated manner.
- **Short booking time window**: Bookings open 10 to 13 days before the flight (depending on the carrier) because of demand’s volatility, while passenger bookings open one year before the flight and are paid during the booking.
- **Logistics market concentration**: Freight forwarders are few, thus they are strongly positioned in the value chain compared to other actors (such as cargo carriers).
- **Volatility of demand**: Even though the space can be allocated in advance, if the cargo is not presented, the carrier cannot invoice the sender, who is not penalised for the cancellation.
- **Implementation investment**: The integration of RM techniques requires high
investments in software development and in adapting activities in the value chain.

**Social factors**

As air cargo is not directly contracted by individuals and most of the activities in which RM is applied have no social influence, social factors do not have a significant impact. Nevertheless, people sending goods by air are used to pay a clearly defined price, and product segmentation is clearly defined. Only certain applications of RM such as online booking coupled with variable pricing customer segmentation, could be influenced positively in its development by the society. Today RM is sometimes perceived negatively by the general public, as aiming only to improve earnings for companies regardless of the customers’ satisfaction.

**Policy factors**

The lack of public policy to create incentives for the application of RM in the air cargo sector is a major barrier. Experts consider other barriers such as:

- **Invoicing process**: it is performed during the flight and not during the space booking. This has a negative influence in the capacity of the cargo carrier to correctly predict the space allocation in a flight, impacting the application of revenue management. It also reinforces demand volatility, as last minute bookings cancellations are not penalised.

- **International standards & interoperability**: that could improve the exchange of information between different carriers, facilitating the implementation of GSD.

**Organisational factors**

- **Value chain stability**: the application of RM in a specific domain or activity would entail the modification of other activities and of the cargo space commercialisation process. This concerns not only the carrier but also other stakeholders in the value chain such as shipping agencies and freight forwarders.

- **Internal organisation**: Not all air cargo companies are involved or acknowledged in RM practices. This is not the case for passenger carriers, where RM is widely applied.

- **Lack of transparency**: Carriers do not always agree to share information on available space, as this would allow consignees to negotiate lower prices for a specific booking. As a consequence, GDSs are currently under-developed, under-exploited and difficult to be deployed in the sector.

- **Lack of RM IT offer in air cargo**: Even though there is a great number of IT developers and providers for the passenger transport sector, this is not the case for cargo. Thus, the few cargo carriers that are starting a full deployment of revenue management, have to do it internally.

- **End of the week problem**: demand rises during the beginning of the weekend due to industrial manufacturing companies and freight forwarders supply chain organisation. As a consequence, the demand is cyclic, showing periods of overcapacity. This makes the application of RM in specific activities difficult.

- **Internal inertia**: Unwillingness to study or to change standard methods, company’s structure and financial stability.
Market potential for 2020

According to experts, world freight traffic is strongly related to GDP and average yield. However, for air mail transport, the correlation with GDP is stronger than for freight (Boeing, 2013). According to Boeing’s forecast (see Figure 7) air cargo traffic (not including mail) will have a 5.3% yearly sustained growth for the next years, in accordance to GDP growth predictions. Then, it is expected that air freight traffic at least doubles in the next 20 years (from 195 billion RTK in 2011 to 550 billion RTS in 2031).

![Figure 7: World air cargo traffic forecast to 2020, including freight and mail. Adapted from (Boeing, 2013)](image)

For air mail, predictions differ. The growth rate is expected to be around 1% per year. Experts consider that this growth could be affected by inroad express competitors, replacement of mail by internet communication, and the entry of traditional postal companies into express air freight industry.

As mail represents only 1% of transported air cargo, total air cargo is predicted to double in the next 20 years (See Figure 8). This growth, as stated above, is highly dependent on economic growth.

Taking into consideration the presented forecasts, the deployment of revenue management in the air freight transport industry can bring many benefits to the industry.
A power-interest matrix shows the most important stakeholders and their implication in the air cargo revenue management market (Figure 9). The “players” are the most influential stakeholders, they are interested in the market and they have the power to influence it. The “context settlers” are unaffected by the conditions of the market, but they are influencers, engaged in the debate. The “subjects” are interested by the issue but have no power to influence the debate in the market.

Figure 9: Power-interest matrix for air cargo revenue management. Power is the ability to influence the behaviour of the market, while interest is the engagement the stakeholder has within this market. Closer the core business of the organisation is in the market, higher will be the interest. A high power or high interest is represented by a higher number (value 5).
The financial scheme for the studied market is presented in the figure below. Before sending goods, the shipper contacts a freight forwarder or integrator through an IT platform to make the space booking. These goods go through a freight forwarder or integrator first, before arriving at the air cargo carrier.

**Figure 10: Financial scheme for the air cargo industry**
General conclusions

The integration of innovative technologies in different transport modes is a key factor in improving the efficiency, saving costs and energy and decreasing transport time. Different intelligent transport systems are available today and many stakeholders are responsible for their implementation. This document presented a general analysis of the most relevant information for the integration of revenue management in air cargo, proposed by the T-TRANS project.

Results show that the market is at an early stage of development. The most important barriers for market development have a technical and organisational origin (information transparency). Nevertheless, the market seems promising and new opportunities may appear with the integration of IT in the sector.

As a conclusion, the ITS sector presents a high potential of opportunities for IT companies. Alliances with traditional companies in the transport sector are a viable strategy for improving the integration of IT. Such integration is only possible if the technological, legal, and organisational environments are prepared prior to the launch of innovative ITS to the market.

Recommendations: marketing strategies and technology diffusion

The identification of the main barriers for the integration of RM techniques in air cargo, presented in the previous section, leads us to the proposal of strategies for improving such integration:

- Lobbying at the EU level to adapt a legal framework that ensures stability in the booking process. Today it is submitted to high volatility due to the possibility of non-presentation of the cargo without penalties for the shipper, who cannot be invoiced in this case. A legal framework that envisages invoicing during the space reservation would allow performing more accurate traffic predictions and optimising the use of cargo space in aircrafts.

- Development of a standard for the interoperability of different actors in the value chain and for different technologies and communication protocols existing in the current air cargo industry. This is necessary in the absence of a GDS in the air cargo industry.

- Vertical cooperation of IT booking systems with freight forwarders, multinational industrial companies and other stakeholders involved in the value chain (through cooperation tools such as think tanks, business clusters and associations).

- Horizontal cooperation between different carriers to develop information transparency without generating a negative impact in their business. Each carrier designs and operates its own booking platform, but there is a lack of horizontal cooperation and integration. This would allow the development of an e-cloud space of information and the development of interoperable booking internet platforms.
Annex: basic notions

Market definition and delimitation

The market for this study is defined as the air cargo market, in which revenue management techniques can be applied. This limits the market to civil air cargo, and does not include any military market segment or elements transported by any other means. The market survey focuses on the current airplane cargo market.

Products in the smart container market

For this study, the product analysed is air cargo and the application of revenue management techniques to different activities involved in the air cargo industry.

Air cargo (AC)

Air cargo (or air freight transport) is the process of transporting commodities and other goods by air. Air cargo is not a physical product but a service. From a general point of view, it comprises freight and mail transportation. In air cargo, big shipments and small shipments are usually considered separately. Specialized cargo aircraft and luggage compartment of passenger aircraft are used for this purpose. Airlines dedicated to transport of cargo are called “cargo airlines”, which are sometimes subsidiaries of larger passenger airlines. Compared to other transport means (ground, ship), air freight transport is generally the fastest mode for long distances, but also the most expensive, due to high fixed and variables costs related to infrastructure and operation of aircraft which has a reduced loading capacity compared to other modes. Thus, 3,5% of worldwide weight is transported by air(Bureau of Transportation Statistics RITA, 2010).

Shipments are usually transported in a standardized pallet or container which allows a certain quantity of cargo to be bundled into a single unit. An airplane can load several units. Numerous types of standardised pallet and container are used, adapted to different aircraft dimensions and cargo volume, as presented in the following table.

Air shipments are booked directly with carriers, through bookers or with online marketplace services. The price depends on the following factors (UPS Air Cargo, 2012):

- Destination (domestic or international)
- Dimension and weight
- Cargo type (mail or freight)
- Service type (express, scheduled, charter)
- Good type (perishable, dry, hazardous)
- Insurance
- Fuel Surcharge
- Security Surcharge
- Accessorial charges (collect fee, terminal fee, agents’ disbursement fee, destination charge, hazardous material fee, proof of delivery, storage charges, etc.)
- Oversized freight (dimensions larger than allowed for a standard container or pallet)
### Table 1: Types of standard intermodal transport units in air cargo

<table>
<thead>
<tr>
<th>PALLLET</th>
<th>CONTAINER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Four types of standardised pallets are used in air cargo, for loading volumes from 6.88 to 11.52m³.</td>
<td>Six types of standardised containers are used in air cargo, with internal volumes from 4.9 to 8.95m³.</td>
</tr>
</tbody>
</table>

### Revenue management (RM)

This analysis aims at assessing the application of revenue management to air cargo. Revenue management is the application of data pattern analysis to predict consumer behaviour and optimise product availability and price, while maximising revenue. Thus, RM is not a product, but a technique.

The application of revenue management techniques requires the measurement of commercial offer performance, pricing strategy definition and demand forecasting. More specifically, for air cargo, RM addresses the following functions (Revenue Technology Services RTS, 2013):

- **Capacity forecasting (CF):** determination of availability of cargo space by flight for future departures.
- **Demand forecasting (DF):** projection of origin/destination demand, based on historical data and current bookings.
- **Overbooking:** determination of the amount of additional capacity to be made available for booking to offset the impact of cancellations.
- **Cancellation rate forecasting:** prediction of behaviour in terms of cancellations.
- **Allotment management (long-term sale):** it concerns long-term agreements (typically 6-12 months) between a freight forwarder and an airline.
- **Free sale space management (short-term sale):** it concerns the decision of selling the capacity when a request comes in, or to save it for a potential later sale at a higher price.
- **Bid pricing:** calculation of minimum acceptable price (bid price) for a shipment taking into account demand and capacity.
- **Routing optimisation:** generation of operationally feasible routes considering shipment, aircraft and network characteristics.
- **Booking evaluation:** evaluation of booking request considering rates, routes, and bid prices.
Management reporting: on flights and customers in terms of usage, load factor, revenue, etc.

A functional description shows the needs that are being satisfied by revenue management techniques (Table 2).

<table>
<thead>
<tr>
<th>Function \ Type of application</th>
<th>Current RM in Air Cargo</th>
<th>RM passenger transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity forecasting</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Demand forecasting</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Overbooking</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Cancellation rate forecasting</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Allotment management</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Free sale space management</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Bid pricing (variable price strategy)</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Management reporting</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Routing optimisation</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Booking evaluation &amp; feedback</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Customer segmentation</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 2: Functional analysis of the different categories of revenue management functions existing in the air transport market

- ✗ function not performed by the product
- ✓ function fully performed by the product
- ~ function may be included by the product for specific needs


Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AC</td>
<td>Air Cargo</td>
</tr>
<tr>
<td>CF</td>
<td>Capacity Forecasting</td>
</tr>
<tr>
<td>DF</td>
<td>Demand Forecasting</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GDS</td>
<td>Global Distribution System</td>
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<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
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<td>IT</td>
<td>Information Technologies</td>
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<tr>
<td>ITU</td>
<td>Intermodal Transport Unit</td>
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<tr>
<td>RM</td>
<td>Revenue Management</td>
</tr>
<tr>
<td>RTK</td>
<td>Revenue Tonne Kilometre</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research &amp; Development</td>
</tr>
</tbody>
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Figure 4: Total air freight and mail loaded and unloaded in 2011, in tonnes

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Figure 6: World top ten air cargo companies

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