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# Factors Determining the Failure of Global Systems in the Air Cargo Community

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**ABSTRACT**

*Air cargo parties are becoming increasingly aware of the importance of Information Technology and, more and more, they are understanding the value which Information Technology could provide for the total value chain performance. However, whereas in other sectors Information Technology has scored big successes, there are no real signs of successful global community systems in the air cargo community. This paper describes the failure of global systems in the air cargo community. It draws on extensive fieldwork in the air cargo community in Europe, in addition to reviews of relevant trade and academic literature. The paper provides interesting data on the IT-related dynamics in this business network. The objective of this research study is to describe the situation in the air cargo community in such a manner that from this the underlying causes for Information Technology systems 'failures' can be extracted. By providing an insight into the existing information systems and the evolving dynamics in the air cargo community, we present a set of determinants for the failure of IT initiatives in the global air cargo industry. The paper will explore the determinants for such failures from a theoretical perspective as well as on the basis of data obtained in exploratory fieldwork conducted in the European Air cargo community. After the most important business dynamics in this network are outlined, the paper describes a set of determinants that might account for the failure of systems in the global air cargo market. It concludes with suggestions for further research.*

## 1. Introduction

Just as in other sectors, there is a growing interest in Information Technology in the air cargo community. Air cargo parties are becoming increasingly aware of the importance of Information Technology and, more and more, they are understanding the value which Information Technology could provide for the total value chain performance. In recent years, many industries have undergone dramatic changes as a result of IT. However, whereas in other sectors Information Technology has scored big successes, there are no real signs of IT successes in the air cargo community. Although a large number of attempts have been made to automate air cargo processes, it has turned out that there is really no system that truly fits the air cargo process structure and the demands of air cargo parties. King [1] observed on this subject:

> ***"Computers are everywhere in the air cargo community but there are no comprehensive systems that tie the business across company lines."***

In the situation as it exists the air cargo community seems to be trapped in its own information technology infrastructure. The web of networks, systems, computers, programs and procedures has weighed heavily on investment capacity without bringing any really positive results. The present information technology does not seem to fit the structure of the air cargo process and the demands of the market, resulting in a sector with 'useless' technology and a deep need for new systems properly adapted to the community as a whole. An important question is:

> ***Which factors are responsible for the fact that existing Information Technology initiatives in the air cargo community can not be considered successful ?***

Therefore, the aim of this research study is to describe the situation in the air cargo community in such a manner as to reveal the underlying causes for information technology systems 'failures'. By providing an insight into the existing information systems and the evolving dynamics in the air

cargo community, we come up with a set of determinants for the failure of IT initiatives in the global air cargo industry. The paper will explore the determinants for such failures from a theoretical perspective as well as on the basis of data obtained in exploratory fieldwork conducted in the European Air cargo community. Some examples of failures and the possible reasons for them will be provided and placed in a future research perspective. The paper will conclude with suggestions for further research in this area.

## 2. The Air Cargo Business Community

Vervaat [2] defined the air cargo market as follows:

> ***"The relationships of buyers and sellers as a whole, directed towards achieving exchanges of money and services concerning air transport of goods from a region of departure to a region of destination".***

Based on weight, air cargo only accounts for 1 per cent of total general cargo transport. However, based on the market value of goods, the share amounts to approximately 25 per cent. Of the total $200 billion in world scheduled airline operating revenues[1], the air cargo industry represents a relatively small share at around $30 billion [3].

As early as 1975, IATA concluded that for 78% of its total travel time, air cargo is at the airport "waiting" for transport and there are no signs that there has been much improvement since [4]. According to IATA, this inefficiency was caused mainly by the lack of communication and integration of administrative processes. It was expected that pre-defined document standards would reduce data-entry and re-keying of information and coupling cargo systems and accounting systems would speed up billing processes and reporting procedures.

The air cargo community is a very complex community. In spite of this complexity, there has been a shortage of research with respect to this mode of transport as compared with other modes of transport such as civil aviation. In particular, passenger air transportation has been one of the most prominent examples of the use of IT for strategic advantage and electronic integration [5,6]. The passenger reservation systems have provided airlines with considerable competitive advantages, because airlines gained considerable influence and control over their distribution channels. It is in fact very surprising that these (community) systems have in fact been mostly failures, not only in Europe but in the US and Asia as well [7,8]. In the air cargo business, there have been numerous examples of initiatives to replicate the success of reservation systems and the implications such systems had on airline performance and marketing practices. However, none of these systems has been able to replicate the success of CRS's in the US in the 1980s [7,1,9].

We will address the fact that it might not be the technology that is wrong and that it is not the fact that the air cargo community is short on talent to produce such systems, and argue that the issue is the *nature of the business* instead of the nature of the technology or available talent, as also indicated by King [1] and Ritz [10]. To gain more insight into the nature of business in this setting, we will discuss the most important dynamics in this business network.

## 3. Dynamics between the Parties in this Business Network

First, the parties in this business network will be described. This will be followed by an outlining of the key characteristics of the air cargo market.

### 3.1 The Parties in this Network

**The Airlines:**

Two important types can be distinguished: scheduled airlines and charter airlines. Scheduled airlines are airlines performing flights based on a fixed schedule. Traditionally, they take care of the airport-to-airport transport of cargo, with the help of combination planes and/or full-freighters. They traditionally sell space through forwarders, who take care of all activities before and after shipment. Besides this, scheduled airlines have been selling space to brokers and consolidators for many years now. Charter airlines perform flights from airport-to-airport on an ad hoc basis, with the help of convertible freight planes. Charter airlines sell space to forwarders, but also to other airlines facing possible shortages. In practice, many air carriers can be considered a combination of these types of airlines.

**The Shippers/Consignees:**

Shippers and consignees together form the parties demanding the air cargo services. The difference between shippers and consignees is that, whereas shippers are the ones sending the shipments, consignees are the ones receiving the shipments.

**The Forwarders:**

Another traditional air cargo party is the forwarders. It is not wholly appropriate to think of forwarders as the travel agents of the air cargo community, although there are some similarities between these parties. Like travel agents, forwarders need to have perfect knowledge of prices, routes and carriers. However, the activities of the forwarders are usually more diverse. They perform many functions on behalf of their shipper clients [11]. The most important activity in terms of its contribution to the forwarder's

[1] Air Transport World Airline Statistics, 1993

profitability is that of consolidation. This activity has become so attractive to carry out that new kinds of parties have emerged in the air cargo market, who concentrate on this activity. These parties are called brokers and consolidators.

**The Brokers/Consolidators:**

Brokers and consolidators buy large amounts of space from airlines and resell this bought space in smaller sizes to shippers and smaller forwarders. Brokers usually buy on an ad hoc basis, while consolidators publish a kind of schedule, in which bought space is specified. Another difference between brokers and consolidators is that consolidators offer additional services to shippers.

**The Integrators:**

The integrators form a relatively new party in the air cargo markets. An integrator can be considered a combination of an air carrier and a forwarder, having all the necessary equipment (for example airplanes, trucks, etc.) at his disposal, for door -to-door services. The integrator business started in the United States, but nowadays there are also an increasing number of integrators operating in the European air cargo market. DHL and Federal Express are examples of very successful integrators.

**The Logistic Service Suppliers:**

Another relatively new party in the air cargo markets is formed by logistic service suppliers. These are hired by shippers to take care of the logistics management of their flows of distribution. Their primary task is to calculate the optimal logistical product route for their clients. By means of the efficient planning and control of their transport and warehousing, shippers expect to achieve a reduction in total logistics costs. When using air cargo transport, logistic service suppliers buy space either through forwarders or directly from carriers. An example of a company offering such services would be Encompass.

**The Customs Authority:**

One party which plays an important part in air cargo transport, although not really part of the air cargo community, is the customs authority. *"Customs activity is part of the distribution system and how it functions will affect the effectiveness of the system as a whole"* [12]. Whereas the parties mentioned above are focused on providing services to shippers, the customs authority has as its primary tasks to examine, tax and control the movement of cargo. Therefore, customs regulations and procedures inevitably act as a restraint on the international air cargo distribution system. The air cargo industry tries to minimize the impact of customs by pressing for simplified procedures.

### 3.2 The Key Characteristics of the Air Cargo Market

**Market Intransparencies:**

The air cargo market is characterized by a high degree of intransparency and information-asymmetry. Transparency concerns the familiarity of prices, production, sales and other market characteristics for market parties. Knowledge of this data decreases the uncertainty and the range of expectations. *"In the traditional air cargo community, data transparency would transform power relations by changing information asymmetries"* [7]. *"Access to or control over information flows and power are two sides of the same coin. Most participants are well aware of it, and those who are not suffer the consequences"* [13]. For example, carriers are increasingly trying to displace forwarders by providing door-to-door services. Insight into the prices charged by forwarders would be very useful in this attempt. This information can help carriers in their presentation to the market and probably more importantly, in setting the prices for this kind of services.

**Multi-Modular Transportation Strategies:**

The most important players in the air cargo community have been listed above. However, nowadays differences between air cargo parties are not so clear any more. This is mainly due to the fact that air cargo parties are expanding their services more and more. Integration (both horizontal and vertical) is becoming increasingly important. Integration can be achieved in two ways. The first way is to co-operate with other parties from the same mode of transport or from other transportation modes. In the air cargo community, many co-operations have been formed. For example, KLM has formed a joint venture with forwarder Frans Maas. The second way of integration is by performing activities that lie outside the scope of the traditional functions of a certain party. This process is familiar under the name 'ALIAS' - effect. In the air cargo community, an enormous 'ALIAS'-effect has taken place since the first air cargo transport activities, because new parties have entered the market and because parties have started to perform activities which lie within the scope of other parties' traditional operations. Airlines, for example, have developed new markets by means of road feeder services (road transport from and to airports, to which airlines do not fly) and more and more parties have started to offer logistical services.

This demonstrates that the main strategy in the air cargo community is one of integration of services and strategies. Both vertical and horizontal integration characterize this market, resulting in parties meeting each other in the market place. Figure 1 below depicts this situation.

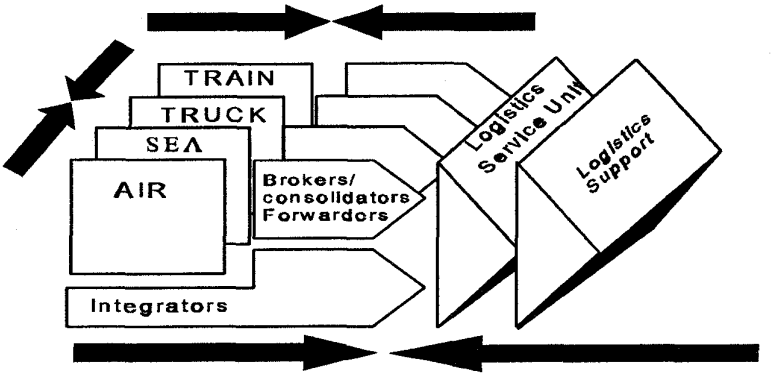


Figure 1: Dynamics in the Aircargo Distribution Chain
(Adapted from B. Grin 1994)

Global strategic initiatives such as multi-modular transportation and value-added logistics need to be supported by IT and require insight into the effects of these new technologies.

**The Gap between Supply of and Demands for Logistic Support:**

Our fieldwork [4,14,15] pointed out that, overall, there is a clear gap between the demands for logistic services and the logistic support that is provided at the moment. Research by the Dutch Ministry of Transportation confirmed this [16] for the Dutch situation. The information asymmetries in the market are a clear disadvantage to those without access to the necessary information; however, all parties require more information then is currently available: Shippers demand tracking and tracing information, road-transporters require optimal route information, carriers want more specific booking information, pre-arrival information and transportation documentation and customs want information on importation requests. Several initiatives in the global air cargo market have recognized this gap and have, in various ways, attempted to provide these additional services. The next section will present three examples of global information systems and discuss their objectives and their achievements.

## 4. Global IT Initiatives in this Network

Based on the description of the strategies of the various parties and the characteristics discussed above, in particular the gap, we will discuss some of the attempts to computerize the air cargo community. We will not focus on the efforts of individual firms to computerize their own *internal* operations but will concentrate on those projects established to create global systems which can be used to co-ordinate air cargo operations across organizational and national boundaries. We will discuss: 1) Cargo Community Systems, presenting Traxon as a case in point. 2) A logistic service supply initiative (Encompass) and 3) An Electronic Market initiative by a third party (Reuters) and show how each of these pre-trade and trade systems is trying to address the demands of the air cargo market, and close the gap between the supply of and demand for logistic support.

**Cargo Community Systems:**

Cargo Community Systems (CCS's) are air cargo information and communication systems designed to integrate the administrative systems of the parties involved with air cargo. CCS's are considered trade systems as opposed to pre-trade systems such as electronic market (EM) initiatives[2]. Trade systems are used for the arrangement of a transaction. Trade systems have become a common feature in the air cargo industry while pre-trade systems are a very new phenomenon. CCS's serve as a clearing house for information. Two basic co-ordinating features of every CCS are a message switching system and an international database of supply and booking information. In the rhetoric of the system designers, this system will span countries and organizations while remaining neutral and unbiased towards any of the many interest groups [7]. However, the reality of CCS's is quite different from the intention. Forwarders look suspiciously upon CCS's as attempts by powerful alliances to either lock them in or to bypass them entirely by placing terminals in the offices of their shippers. A large number of CCS's have been introduced all over the world, but none of these

[2] The most important difference between a CCS and an EM is that a CCS is a *trade* system and an EM is a *pre-trade* system. Pre-trade systems offer pre-trade information and enable buyers and sellers to expand their view of the market and to anticipate possible changes. Pre-trade systems support the processes that can bring together buyers and sellers.

systems has generated the number of subscribers required to create network externalities in the larger community, or the number of transactions needed to achieve economies of scale in [7]. Why are these systems not successful? King and Forster [7] note:

> ***"The difficult part has been getting companies to join the systems on a permanent basis. To succeed, a CCS requires all relevant parties to enter their supply and booking information into the system and make it available for other to use. This creates two problems: First, it is expensive and second, information asymmetries play a role".***

**Traxon as an example[3]:**

In April 1990, Air France, Cathay Pacific, Japan Airlines and Lufthansa set up a joint venture to build a Global Logistic System (GLS) which was to be owned and operated by an independent company. Lufthansa is the world's largest scheduled cargo carrier, second only to Federal Express, the market leader among the integrators. It is commonly estimated that the four airlines jointly invested approximately $500 million in setting up the Cargo distribution system and the GLS company owning it [17]. The system was called Traxon. The heart of Traxon Europe is a message owned and operated by the GLS Europe company, headquartered in Frankfurt, Germany. By the end of March 1994, thirteen carriers were accessible to participating forwarders. At the same time, approximately 210 freight forwarders were connected to Traxon. Table 1 depicts the chronological history of the Traxon project.

Table 1: Chronological History of Traxon Project
(Adapted from Ritz [5])

| | |
|---|---|
| 1983 | Drawing up of a concept for a freight data exchange system by Lufthansa |
| 1984 | Decision to implement the proposed system |
| 1987 | Specification of a concept for a multi airline switch (MOSAIK) |
| 1988 | Issue of a call for tenders to hard and software suppliers |
| 1989 | MOSAIK operational with Lufthansa being the only airline connected |
| 1990 | Signing of a memorandum of understanding between Air France, Cathay Pacific, Japan Airlines and Lufthansa regarding the setup of a Global Logistics System (GLS) |
| April 1990 | Foundation of the GLS project group Europe company as the first of three distribution centers worldwide |
| January 1992 | Commercial Start-up of Traxon |
| 1995 | Traxon links 15 member airlines with 1370 forwarders around the world |

[3] This material is from a case study reported by Ritz [10] and is used with the permission of the author.

In short, the aim of Traxon is to improve the quality of service and the transport opportunities by improving communication between carriers and forwarders in air cargo. According to the initiators of Traxon, in this way carriers and forwarders will be able to compete with integrators more fiercely. To achieve this goal, they need to have the airline office at the point of destination retrieve information from forwarders on the final delivery of the cargo. In Hong Kong, Traxon Asia has invested in TCN (Transportation Community Network), a company which will handle surface shipment information, not only for forwarders, shippers and consignees but also for financial institutions. In the development stage of the system, two other important goals were defined, namely the creation of central databases and the achievement door-to-door functionality, but in 1992 these two goals were abandoned. One of the ways that door-to-door functionality could be achieved is by making the traditional air waybill an "electronic air waybill". Due to problems with implementing an exclusively *electronic* air waybill, this was abandoned. However, as our conclusions will outline, an important aspect of the traditional air cargo chain was that cargo needed to be accompanied *physically* by the air waybill, something that however is questionable and might be one of the reasons why air cargo is spending a significant amount of total travel time waiting at airports.

**Evaluation:**

In general, forwarders are reluctant to adopt systems that might lock them in, and therefore the system is not as successful as was expected. Ritz [10] concludes: *"After almost two and a half years of commercial operation, Traxon is a large network in terms of access connections and messages transmitted. However, despite the size of the network, the average coverage of its target market remains relatively low. Most forwarders are currently making rather low usage of the system despite the fact that the majority of them are host-to-host connected. The volume of message traffic remains lower than previously forecasted. In particular, the number of air waybills transmitted is still substantially below expectations"* [10].

**Logistic Service Systems: Encompass**

An important example of a logistic service system is *Encompass*, which is an initiative of American Airlines, Seaworld and the Dutch PTT and was developed as an answer to the 'failure' of the traditional CCS's in the United States and Europe. This initiative is aimed at providing logistic support for the full distribution chain (sea, road and air cargo transport). In fact, Encompass has tried to create a system similar to the in-house systems of the integrators. Like almost all IT initiatives in the air cargo world, this information method is based on the principles of EDI. This

world-wide system was not meant to replace the cargo reservation systems, but to enhance them. Encompass has been developed to solve the problems of the diversity in modes of communication existing between forwarders, shippers, carriers and so on and to make it possible for international trading partners to communicate electronically through a single, neutral interface, regardless of the type of computer systems the companies use internally or where they are located. It is meant to *"become the new mode of correspondence, replacing telephones and facsimiles, and provide, along with a paperless system, the ability to perform shipment planning, bookings and inventory management and the use of a multi-modal pathfinder"* [18].

**Evaluation:**

The system is not as successful as was expected. From the moment that Encompass became operational to serve air cargo processes, carriers have been playing a waiting game and therefore not enough carriers are connected. In addition, forwarders try to hold up Encompass, because the system is not in their interests. As a result, *"instead of a door-to -door logistical control system, it appears that it will be more an air cargo Official Airlines Guide (OAG)"* [7].

**The Reuters Electronic Market Initiative:**[4]

In 1992 Reuters, the world-wide press agency and supplier of business information services, started developing an electronic information system on behalf of parties in the spot-markets for air cargo space. The so-called Reuters-initiative is an international initiative with terminals in Amsterdam, London, Paris and Frankfurt. It is primarily meant to be placed between the forwarders and the carriers. The fact that prices are now set in the market and not regulated by IATA any longer provides a good opportunity to develop an information system for the spot-market for air cargo space.

The content of the information system consists of a scrolling news page carrying general and specific air cargo news, a summary of all available business information, such as oil prices and exchange rates, and most important, a summary of indicative price quotes input by sellers showing demand.

The Reuters-initiative is aimed at creating a symmetric transparency in the air cargo market. In the situation without the Reuters-initiative the markets for air cargo can be called extremely non-transparent. There are a great number of different market parties, each with its own exploitation problem. Uncertainty about their own capacity situation compared with the market situation and fear of mutual price undercutting cause secrecy and intransparency between airlines. On the other hand, there is much more transparency for buyers in the markets for air cargo. For them there are replaceable alternatives. They gain knowledge of prices and price differences by shopping around. This greater transparency for buyers as for sellers causes a fierce price-competition, because sellers react (too) slowly to changes in market conditions. Greater transparency causes a decrease in uncertainty and because of this a more efficient tuning between supply and demand. The creation of symmetrical transparency makes it possible for the sellers to react to changing circumstances more quickly. In micro-economic terms, this means the sellers are capable of being more flexible in their pricing because they have a better view of the market.

**Evaluation:**

The information system ran on a trial basis at Schiphol airport from August 1993 to January 1994. There was no trade in the system. It was completely filled with *pre-trade* information. The information system was not given much support. In the financial world, the reactions where very positive, but in the industry itself parties were very opposed to the Reuters-initiative. The following objections were raised during field interviews: The *forwarders* had serious doubts because they feared that the forwarder may be eliminated and that margins would decrease as a result of the increasing transparency of the market. In addition, the negative attitude in general towards electronic business played an important role. The reaction of the *carriers* has not been positive either. They are of the opinion that the initiators of the Reuters-EMP have overlooked a few important facts [19]. For instance, air carriers claim that the demand for and supply of air cargo space are quite inseparable. In addition, the 'Alias-effect' is playing a role: according to the carriers, it is not possible to make a clear distinction between different parties in this business network. Some forwarders act as carriers by buying large blocks of capacity and then reselling it. As a result of these conflicting interests, it was concluded that the system cannot be viable if the parties concerned refuse to co-operate.

Figure 2 below depicts the evolution of IT initiatives in this sector. As can be seen, systems were first used for internal purposes only as efficiency tools; later in the 1980's, they were increasingly used as trade support systems, while most recently, in the 1990's, in particular systems which provide pre-trade information such as electronic markets are being developed. Each of the systems described above can be placed in this phase model.

[4] This section is based on an earlier paper describing the failure of this electronic market initiative and was published in the *Proceedings of the European Conference of Information Systems* in Athens May 1995 [15].

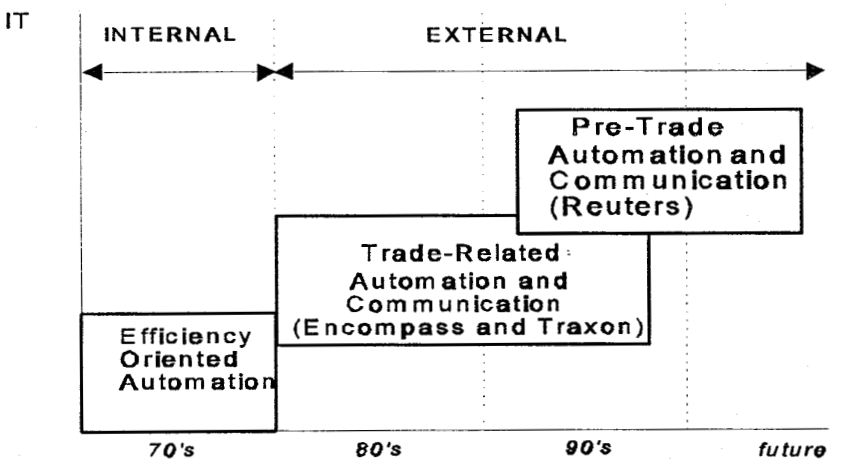


**Figure 2: Automation in the Air Cargo Distribution Chain**

## 5. Determinants of IT Initiatives/ Failures

Summing up the reasons behind the failures, we would argue that in these cases the complex, interdependent institutional and technical choices were not considered by the initiators of the system in terms of their competitive implications. The instability of the social structure in this business network and the dynamics of this particular market were inadequately represented in the design of the systems, each of which was, to a large extent, aiming to derive benefits from the reduction in market intransparency. The systems were inadequately integrated in the social systems they would have to support ,and this is illustrated by the conflicting interests of the various parties involved. The existing competitive structure of the business network which needed to support the development and operation of these global initiatives significantly inhibited the successful operation of these systems. The institutional dimensions of the area of implementation added to the complexity and inertia to make the implementation more complex than the initiators of the systems would have wished. It was not the technical capabilities of the systems which inhibited the co-operation of the parties in the business network, but the competitive environment with its work practices, commitments, and routines which were not taken into account. From our research into the use of Information Technology in the air cargo community, it has become clear that, in the present-day situation, information systems do not really match the structure of the air cargo process and the needs and demands of the air cargo parties. We will now discuss some of the key determinants we believe to underlie these global systems failures.

**Determinant 1: Information Asymmetries Between Air Cargo Parties**

The air cargo market is characterized by a high degree of intransparency which creates substantial market inefficiencies. However, these market intransparencies are, as we discussed, in the interests of some of the parties in this market place. The existence of information asymmetries represents the structure of the power relationships in this industry and implies that some air cargo parties are intent on taking advantage of the information which they have at their disposal and other parties do not. In particular, when it comes to pricing information, the air cargo community is characterized by secrecy. Among air cargo parties, there is a great fear about disclosing prices and this has resulted in a strong refusal of every system designed to provide price information in the air cargo community, such as the Reuters initiative. Forwarders in particular derive their main reason for existence from this lack of transparency and this was one of the reasons for resisting the logistic service system Encompass. In the present-day situation, the forwarders still have a far more extensive knowledge of the distribution process than shippers do. The information asymmetry is in this case clearly in favour of the forwarders.

In the case of the Reuters initiative, we argued, based on previous research [20,21], that electronic markets usually favor the buyers and reduce sellers' profits and market power. From this point of view, it is predictable that sellers would want to stay away from systems that emphasize price information. Besides the objections of the sellers in this case the buyers too had interests which would not be served by the

system. Altogether, there was a lot of uncertainty involved, in particularly regarding the outcomes of the system.

Those responsible for the Reuters-initiative noticed that the carriers were afraid for losing control over the market. Carriers obviously do not want to be pushed back to a homogeneous or commodity market. They are afraid the system will lower their margins even further. In general, theory states that an EMP usually benefits the buyer, because of decreasing total search costs, which was anticipated the carriers as well and the main reason why they refused to cooperate.

**Determinant 2: Conflicting Business Strategies**

A second determinant for global systems' failures can be found in conflicting business strategies. In the course of time, the degree of vertical competition has heavily increased, as a result of the enormous growth in the number of operating parties in the air cargo community and the overcapacity in this industry. Not only has the number of forwarders and carriers grown, but moreover the diversity in parties offering services has greatly increased. Besides the increasing vertical competition, we have also discussed the increasing *horizontal* competition, which means competition between different modes of transport. An important aspect of this is that there is an increasing variation in the transport modes within one transportation process. One example is the increasingly popular sea-air concept. It has already been mentioned that a very important development that has taken place can be found in the integration between different phases in the distribution chain. This means that parties try to gain control over a larger part of the distribution chain and are meeting each other in competition in the market place.

These developments in horizontal and vertical competition and integration are responsible for complicating the "air cargo information process", and therefore for complicating the automation of this process. One important problem is the air waybill. In fact, the electronic air waybill is an exact copy of the traditional paper air waybill and is thus purely focused on the airport-to-airport transport of goods. This conflicts with the clearly observable trend towards door-to-door strategies controlled by one single air cargo party. This means that the (electronic) air waybill is based on an "old" situation in this distribution chain.

It can be concluded that at this moment there is a very complex market structure, which creates market inefficiencies and makes is hard to design systems which support the information flows between parties in this network. This complexity will, in our opinion, continue to increase since parties in the air cargo market will certainly go on adapting their business strategies in the near future, which will intensify competition in this business network. The integration process is a continuing phenomenon and the question of how this can be supported by IT becomes increasingly important.

**Determinant 3: Discrepancy Between Physical Air Cargo Flows And Information Flows**

In our opinion, one of the most important underlying causes for the fact that the information systems in the air cargo community often show functional shortcomings can be found in the discrepancy between the physical flows of air cargo products and the related information flows. This discrepancy is mainly due to the complexity of the structure of the (air) cargo transport related information flows as opposed to the structure of the physical flow of goods. This complexity makes it extremely difficult to develop an information system which functionally suits the air cargo market. In figure 3, both the physical flow of goods and the information flows in the (traditional) air cargo distribution chain are depicted. This figure shows that the physical movement of the goods is (almost) a straightforward process. However, whereas physical goods follow a one way, sequential path, the information flows related to these products have an unstructured, multi-directional character. This complicated nature of the flows of information creates serious obstacles to the automation of the information process with regard to air cargo transport. First, in advance of the development of information systems, it is crucial to have insight into the organization of the information process which has to be automated. The complicated nature of the information flows in the air cargo community hamper any insight into the overall information process related to air cargo transport. An example of this unstructured nature can be found in the absence of standardization of bookings.[5] There is no standard air cargo booking procedure. Even if all different handling possibilities are input into an information system, it is still possible that shippers will come up with different demands.

[5] On the issue of standardization of air cargo services, see also Forster and King [7].

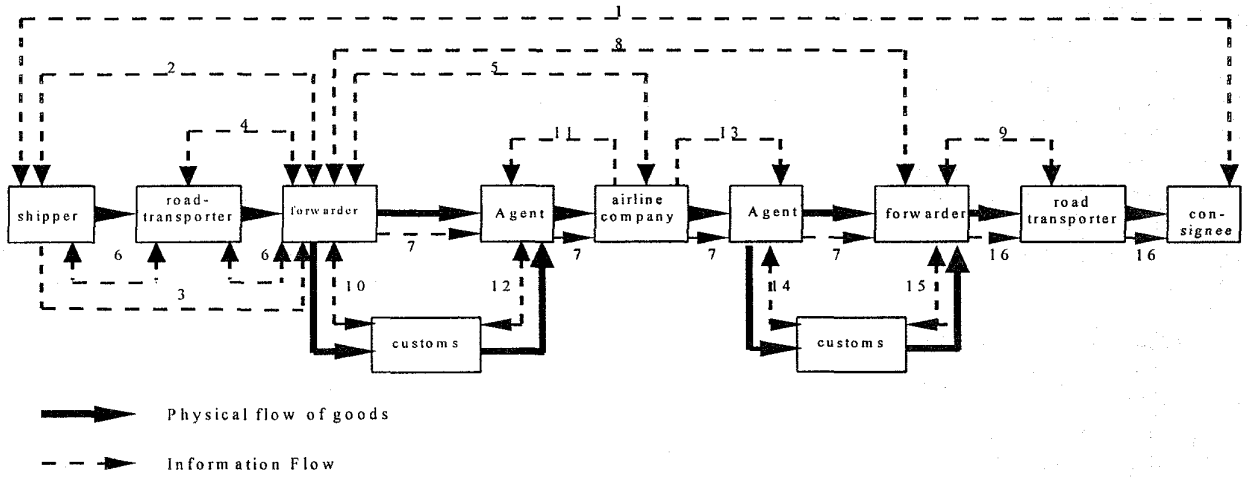


Figure 3: Information Flows in the Traditional Intercontinental Air Cargo Chain Adapted from Zijp (1995) "Telematics in Air Cargo"

1. Consignee places an order with the shipper and he confirms receipt of the order;
2. Shipper places a transport order with the forwarder and the confirms receipt of the order;
3. Shipper passes on shipping instructions to the forwarder;
4. Forwarder reserves and books freight capacity with the road transporter and he confirms the reservation and booking;
5. Forwarder reserves and books freight capacity with the airline company and he confirms the reservation and booking;
6. Forwarder makes up the bill of lading for road transporter and this document goes with the freight during the road transport;
7. Forwarder makes up an Air Waybill and this document goes with the air freight from one airport to the other;
8. Forwarder gives an assignment to the forwarder at the airport of destination, to reserve and book freight capacity with the road transporter and he confirms receipt of this assignment;
9. Foreign forwarder reserves and books freight capacity at the road transporter and he confirms the reservation and booking;
10. Forwarder supplies information about the air freight sending (at 'House air waybill Bill'-level) with the customs and the customs provides the forwarder with the necessary documents;
11. Airline company provides the agent with a booking list for a specific flight;
12. Agent gives information about the load of a specific flight to the customs and the customs gives confirmation to the agent;
13. Airline company provides agent with details about the load of a specific flight at the airport of destination;
14. Agent at the airport of destination gives details about the load of a specific flight to the customs and the customs gives confirmation back;
15. Forwarder at the airport of destination provides the customs there with details about the load and gets information about this from the customs in return;
16. Forwarder at the airport of destination makes up a bill of lading for road transporter there and this document goes with the freight during the road transport.

The black arrows refer to the physical movement of cargo between the parties in this network while the dotted arrows refer to the information flows between members in this network. It should be clear that the movement of cargo is of a sequential nature and that the information flows can be done in parallel. An example might be the clearing of goods at customs, often cited as a bottle neck during fieldwork by parties in the network. The administrative information flows related to customs do not necessarily have to take place in parallel with the physical movement of cargo. In other words there can be a flow of information parallel to the flow of goods within this chain.

## 6. Concluding Remarks and Suggestions for Further Research

Figure 4 below depicts how each of the systems described in this paper attempts to control/ provide a particular part of the information flows in the air cargo distribution chain. An important observation is that increasingly parties outside the direct business network are trying to bridge the gap between supply and demand for information services in this network.

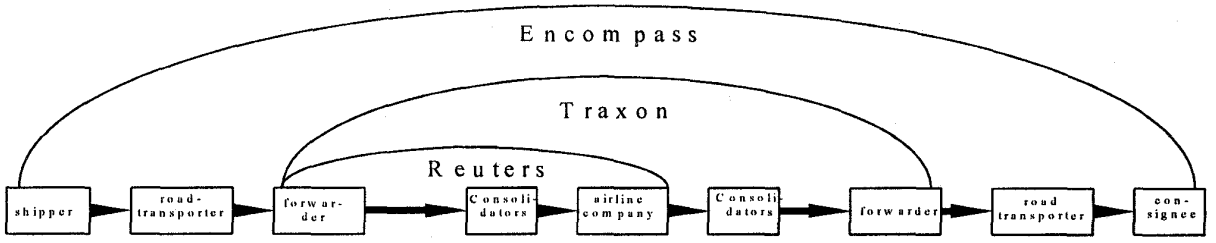


Figure 4: IT Initiatives in the Global Air Cargo Chain

The situation sketched in this paper poses several important questions and provides many opportunities for future research. The following research suggestions we consider to be the most important ones:

The first important issue concerns the possibility of designing a single system for this complex community. The complexity of the community and the competitive environment might make it hard to develop a system that meets all parties' needs and stimulates involvement and disclosure of necessary information. This raises the question: Is it possible to design a system that will support the information flows and that will be supported by the parties in this network? King [22,23,24] notes:

> ***"The air cargo community operates on a manner predicated on a heterogeneous and flexible network of alliances and competitive practices. Any attempt to build an infrastructure that fails to conform those practices that embody the economic rationality of the industry will almost certainly fail".***

The question remains how do you build such a system and what would be the requirements?

Another important issue is: What will be the role of local government in global competition? In global competition in air cargo, a certain airport or region might lose its importance if a relatively nearby community offers cheaper and more efficient cargo handling facilities. This might have far-reaching consequences for a country and/or its competitive position. Should governments introduce standards and enforce co-operation among parties or should this be totally left to the market? Examples such as the Tradenet [24] in Singapore which links together all the 3000 air, land and sea forwarders, carriers and agents doing business in Singapore, used a powerful authoritarian government as an important backer. The system however is strictly local and cannot be compared to globally operating CCS's with several governments involved.

In addition, would there be a difference in obtaining the acceptance of systems which were more oriented towards trade related information instead of pre-trade related systems? Might it be easier to gain acceptance for a trade-related system which, unlike a pre-trade system, does not contain any price information and therefore has fewer competitive implications? A government institution might want to decide to leave pre-trade system initiatives to the market while actively trying to stimulate trade systems that make the distribution of cargo services more efficient and effective.

A last related and important issue is: Who should be in control of the information flows and what could be the consequences? Can the success of the integrators be explained by the fact that they have full control over their own (internal) information flows supporting their door-to-door strategies? Are there hardly any co-ordination or transaction costs and inefficiencies involved since there is full control over internal information flows?

Our exploratory description of the air cargo community and its systems might raise more questions than it solves. We see this exploratory fieldwork however as a necessary towards more rigorous testing of some of the questions and hypotheses raised here. We hope that this paper will stimulate further discussion and empirical research along these lines.

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