# Summary


## *Introduction*

Air France-KLM Cargo (AFKL) uses a hub-and-spokes freight network; freight from approximately 70 cities in Europe is trucked daily to one of the hubs, from where it is flown mostly to intercontinental destinations. In each of these cities a third party ground handling agent is providing handling services for AFKL. Part of these services is checking upon acceptance if the shipment and its airway bill are in accordance and *ready for carriage*. The airway bill is a document that states all kinds of information on the shipment like the shipper, the consignee, the weight, the volume and special handling prescriptions. Once the ground handling agent has accepted the shipment on behalf of AFKL, the airway bill has become a non-negotiable contract between the customer and AFKL.

## *Problem*

Every now and then a shipment has some issues upon acceptance; the customer has stated the weight and volume of the shipment on the airway bill, but on a check by the ground handler it turns out that the actual shipment is heavier or bigger. There is than a discrepancy between the actual shipment and the information flow as this is processed in AFKL systems. This is detrimental for AFKL in two ways:

i) Big discrepancies may give loading issues at the hub; not all the freight fits in the aircraft. Consequently one or more shipments cannot be flown as planned. Moreover this shipment(s) needs to be rebooked on the next flight which may also be full.

ii) The invoicing is done according to the weight and volume on the airway bill. When the weight and volume on the airway bill are lower than that of the actual shipment, the customer pays for less freight than what is being shipped.

A pilot of weighing and measuring shipments shows that more than 3,5% of shipments has a weight on the airway bill that deviates more than 10% from the actual weight of the shipment. Rough estimations show that around 6% of shipments is not flown as planned due to capacity issues, another calculation indicated that the yearly missed revenue due to weight and volume discrepancies on the airway bill comes to € 1.000.000.

At this moment, given the current situation, it is not feasible to check all shipment on weight and volume; there simply is not enough measuring capacity given the available time. Ground handling agents currently are able (and contracted) to check 10% of all shipments on weight and volume. Many

of them inspect the 'easy' shipments (light and small) and do not find many discrepancies. Others check random 10% of shipments and are somewhat more successful. In one city (Segrate) the ground handler daily receives a carefully selected list of shipments for checking from the AFKL customer service. In Segrate the number of found shipments is approximately three times higher than in other cities.

## *Research Question*

Based on the described issues and findings the following research question has been formulated:

*"How can AFKL find more weight and volume discrepancies using spot checks upon acceptance at all ground handling agents in Europe, taking into account their existing process and constraints?"*

## *Options*

Three possible projects have been identified for finding more discrepancies:

i) Invest in measuring equipment; automated volume scanners and weighing equipment on forklifts will increase the measuring capacity.

ii) Adjust ground handling procedures; by changing rules regarding the time between delivery of a shipment and formal acceptance, more time becomes available for measuring with the given capacity.

iii) Use smart freight selection; use expert knowledge in combination with historical data in a fuzzy rule-base for automated risk assessment. The assessed risk can be used to select a subset of risky shipment for measurements. More discrepancies will be found given the limited time and capacity.

## *Fuzzy risk assessment*

Fuzzy logic is a technique that can combine the knowledge of cargo-experts with results from data analysis into a rule-base of 'if-then' rules. The idea of fuzzy logic is that a given logic implication (rule) can be applicable to a certain degree; if the 'if-part' of a rule (input) is valid *to a certain degree*, then the 'then-part' (output) is also valid to the same degree. All individual outcomes of many rules can be aggregated, and translated to a crisp output.

A fuzzy rule-base has been developed for reasoning for booked shipments on the chance of weight and volume discrepancies. The obtained model can assess the risk of discrepancies based on booking records, so prior to the physical delivery and formal shipments acceptance. This way the predicted risk can be used in the selection of shipments that is going to be spot-checked by the ground handling agent.

The rules in the rule-base have been obtained via interviews with several experts on the business and markets. The derived rules-base is endorsed, augmented or adjusted based on data analysis on an available dataset from Segrate.

## *Results*

It has been shown that smart freight selection is an interesting option that will find more discrepancies than a random selection of freight. Furthermore it has been shown that smart freight selection can be automated using a fuzzy model, reducing the workload and the subjectivity of manual selection. The model is validated on the dataset that was used to develop the model. Furthermore experts have assessed the freight selection of the model and endorse its findings. Moreover the system has been tested for one week in Segrate; for each day the model selected approximately the same shipments as experts would have done, and the found number of discrepancies is similar to that of other weeks.

## *Conclusions & Recommendations*

Air France KLM cargo is advised to:

- ***Develop the fuzzy model further***
  - Adjust and validate the model for other cities than Segrate
  - Improve selection performance by iterative adjustments over months
- ***Select shipments for sport-checks at all Ground Handling Agents by themselves.***
  - Implement a customized version of the model in each city
- ***Start collecting the check results***
  - Standardize measurements and processing
  - Develop a customer-performance dashboard
- ***Aim for change in customer behavior***
  - Initiate review meetings with the customer on his performance
  - Evaluate the change in behavior one year from now