The systematic returns management to improve customer services in reverse logistics operation

Airbus Defense and Space Oy – Case Study

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Description

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Abstract

The operations of supply chain management has been a topic of interest in the research world for many years. Especially for reverse logistics field – which is also an integral part of supply chain management in specific and in logistics world in general. Besides the large-scale operations, it is also important to pay attention to the Return Management perspective. It plays as an indispensable role in improving customer services and service level agreement.

This study analyzes the current situation at Airbus Defense & Space Oy – Repair Logistics department in terms of activities related to return data system and information management - especially database exchanged between different departments internally and externally for daily activities usage and KPIs and identifies the root causes for the inefficiencies and concentrates on these factors to improve the resources. The study will be conducted through the eye of an interaction analysis which utilizes the systematic-problem solving method. Throughout the research process, the company's resources and operations will also be analyzed in order to support the new practice. This project's goal is to enhance the existing processes and give a better solution in information and data management performances within the Repair Logistics department, in order to improve KPIs measurements as well as customer services.

Keywords/tags (subjects)

Returns management, reverse logistics management, data management, value creation, functional integration, optimized framework.

Miscellaneous (Confidential information)

For example, the confidentiality marking of the thesis appendix. See Project Reporting Instructions, Section 4.1.2.

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Table 1 Glossary

Abbreviation	Meaning	Pages
DS	Defence and Space	34, 36, 38-40
SLC	Secure Land Communication	8-12, 14, 16-24, 26, 32, 34, 36, 38-40, 56, 58, 79, 82
ART	Airbus Repair Ticket	12, 19, 21-23, 27, 29, 31, 34, 39, 40, 50-52, 62, 64, 72, 75, 77
TETRA	Terrestrial Trunked Radio	10, 21, 22, 25, 32, 55
SLA	Service Level Agreement	12, 17, 19, 41, 54, 56, 57, 58
RR	Return Rate	13, 54

3PL	Third-party logistics	15, 23

1 Introduction

1.1 Objectives

The operations and management of supply chain has been a topic of interest in the research world for many years. Since supply chain is considered as 'forward chain', it means that there is 'backward chain' – which is also named as reverse logistics. Similar as supply chain management, reverse logistics management is also an integral part of supply chain in many businesses as well as industries. Besides the large-scale operations, it is also important to pay attention to the Returns management perspective. When a customer finds something about a product to be undesirable or inappropriate in some way, the reverse logistics is referred to as returns management. Products could be in the wrong size, shape or content, for instance. Additionally, defective goods frequently lead to product returns. Last but not least, even when purchases are made and products match expectation, customers often change their minds (Yu & Goh, 2010). In this context, customer value can be created by connecting the marketing and logistics/operations functions to the customer through internal policies and procedures, information sharing and engagement (Robert Frankel et al., 2010). This study analyzes the current situation at Airbus Secure Land Communication (SLC) – Repair Logistics department in terms of activities related to data and information management as well as a new approach or a framework will be created in order to optimize and improve the current practices of returns database reporting system at Repair Operations department, especially it is going to reinforce the collaboration, exchanging, and management of returns data among other departments within the company. The research will be conducted through the eye of an interaction analysis, which is helpful throughout the whole working process.

1.2 Motivation and background circumstance

Nowadays, Secure Land Communication (SLC) has been able to have consistent and reliable means of gathering, measuring and analyzing product maturity data not only on the generic level but also on the reverse logistics foundation. Although there are a number of practices being used across the organization, within Care services (Repair Operations) department, there are different and

specific ways of reporting or working at the end of the day, impacting the quality of products/ services that we provide to our customers. That is to say, there is the existence of difficulties in data managing and exchanging which show the inefficiency and inconsistency. Therefore, it is important to identify the root causes as well as concentrate in these factors to improve the resources. Once the key improvement or innovation is able to trigger this area and to secure the predictability of the department's deliverables to end users as well as to increase compliance to their demands, in doing so Repair Logistics team will positively impact their relationship with the customers and create a much stronger SLC business.

1.3 Airbus Defense and Space at a glance

1.3.1 Worldwide locations

Airbus Defense and Space is one of the divisions belonging to the Airbus Group. It consists of four business lines, which are Military Aircraft, Electronics, Space Systems, Communication, Intelligence and Security (CIS). The distribution of Airbus Defense and Space is located across different continents such as Europe, Asia-Pacific, Americas, Africa and the Middle East. That is to say, the company’s customer and projects are also distributed mostly in every continent. Especially, Airbus France has been one of the four founders – which is now where most of the company’s headquarters being based and the main Airbus Defence and Space locations are Elancourt and Toulouse in France.

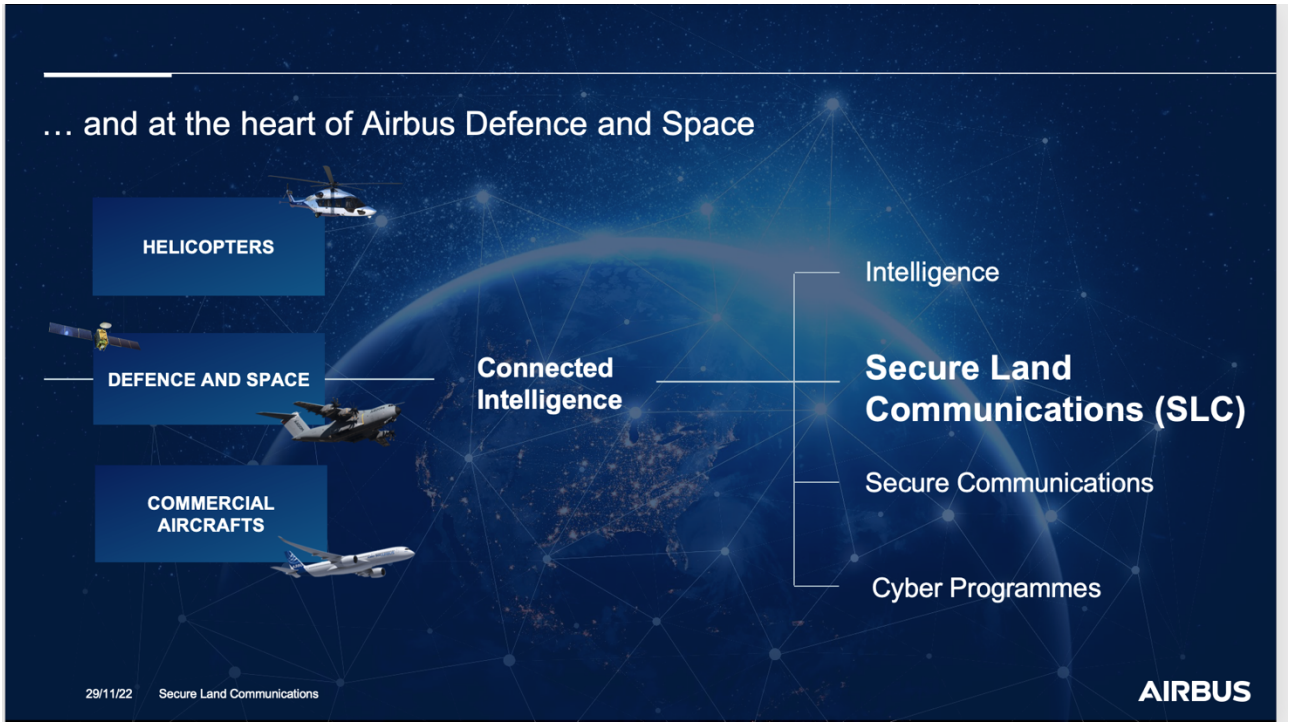


Figure 1 Airbus company structure 2022 (Secure Land Communications)

1.3.2 Organization structure of the company

Airbus Defense and Space Secure Land Communication unit is a Matrix organization for OPERATIONS – which conduct the business procedures in both vertical and horizontal directions. In our OPERATIONS, there are different departments and teams such as Supply Chain, Procurement and Customer Services. As it is shown in the below illustration, all of these departments' tasks and activities always involve all Tetra products and they are contributing and working for the whole business's operations, while at the same time, they support each other for the common goals of the whole corporation's OPERATIONS.

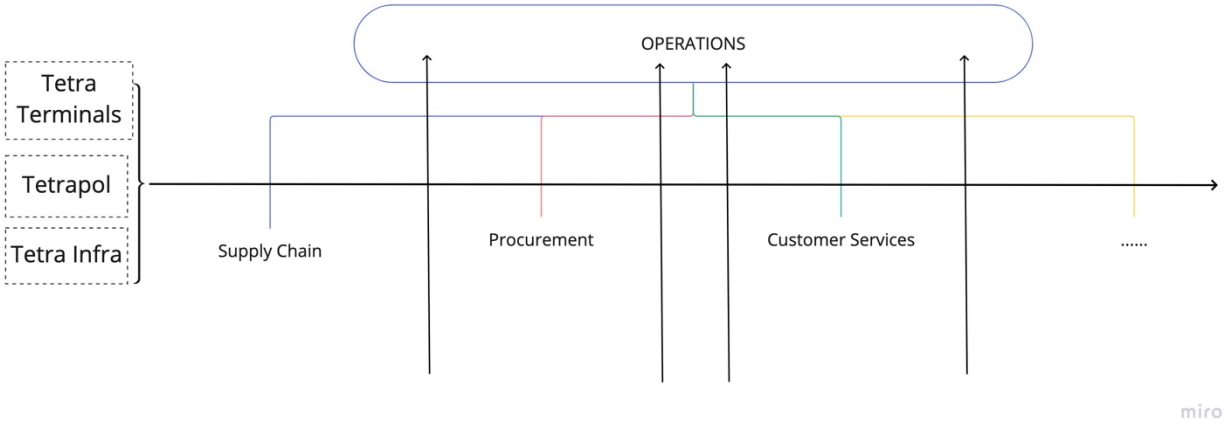


Figure 2 Organization structure

1.3.3 Company products

Airbus Defense and Space is playing a vital role in Secure Land Communication section (SLC), which offers advanced communication solution. The unit develops, installs and maintains professional mobile radio (PMR) networks/terminals based on two different technologies: TETRA and TETRAPOL. For both technologies, SLC is providing terminals and their accessories, servers and switchers, base stations, gateways and so on. They also provide a wide range of integrated, end-to-end solutions and services which aiming for serving users mainly from security and safety forces such as police forces, special forces (military forces), fire brigades, emergency and health services, defense forces, customs. As these customer segments are considered to be critical and have high demands, SLC products have to function flawlessly. In addition, Airbus SLC also covers other customer segments such as event security, airports, public transportation, oil and gas, utilities or site security.

Figure 3 Examples of Airbus SLC product portfolio

1.4 Structure of Repair Logistics department at Airbus Defense and Space

1.4.1 What is this department about?

Repair Logistics belongs to a customer service department within Airbus Secure Land Communications (SLC) units – which belongs to Airbus Defense and Space branch. On a basis level, the business process at Airbus SLC - Repair Operations unit is actually 'reverse logistics' – in which the procedure is related to managing returned goods or products in logistics administrative standpoint. To be specific, when customers have problems or issues regarding Airbus's products – which they are utilizing. There can be faults, misuse or defection when customers send the products back to our Repair Centers. For those types of products which are not anymore manufactured or already obsolete, customers will get newer versions as swaps or they can have the option of scraping the devices/ components. After the defections are fixed or products are swapped, they are shipped back to the customers from Repair Centers. This explains why the business comprises of 'reverse logistics' segment.

1.4.2 Who are the responsible people?

Frequently, the repair services work is managed and executed by Global Repair team. Global Repair team is responsible for handling customer repair orders, first level technical support linked to repair cases and repair logistics.

1.4.3 How does it operate?

In general, the whole department plays a key role in creating a positive customer experience by ensuring the best possible product availability, trainings and repairing. It is operating based on targets which are given and followed by several operative business performances such as Service Level Agreement (SLA) between Airbus and its customers or SLC business performances – operations which include repair services, are also monitored and measured by Turnaround Time (TAT) – which is the lead time starting from the moment when customers send components/ items back for repair, then the time the Repair Centers implement their services or the suppliers offer completely new components until they deliver the devices back to customers. In addition, Return Rate (RR) – which is the amount of repair sent to Airbus divided by the amount of total unit used globally – is also utilized. For Repair Operations department, these Key Performance Indicators (KPIs) aspects are an integral part of their work performances, which determine the process of analyzing customers' returns.

2 Theoretical background

2.1 Reverse Logistics concept

Supply Chain Management is no longer something new for everyone, however, "Reverse Logistics" perhaps is. It is still a young conceptualization which can be simply understood as the opposite "chain" of normal supply chain, as "reverse" means going backwards. According to The Council of Logistics Management, reverse logistics is defined as "the process planning, implementing and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of origin to the point of consumption for the purpose of conforming to customer requirements." (Rogers & Tibben-Lembke, 1999, p. 2).

In other words, "reverse logistics" is also explained as the execution of products or items when they are returned by the customers, they will be repaired or scrapped and depending on the properties of the them, items will be recycled, substituted (or swapped with new one), or disposed and refurbished. Therefore, as Ritchie et al. (2000, Introduction section, para. 6) points out: "logistics does not stop with the delivery of goods to customers, but also offers the opportunity for stock to be returned to suppliers via a feedback loop". This is the reason why it is called as "reverse" logis-

tics operation and its potentials have been explored and brought into practical business operations and industries such as automotive, electrical or food and beverages. Due to the fact that customers only return their items whenever there is faulty and the origin value of them is required by customers, reverse logistics processes are well-considered.

Thus, the process flow will undertake at the moment when customer start to deliver their products back to the manufacturers. As Li and Olunrunniwo (2008) have clarified that in a generic reverse logistics process, when returned products are accepted to initiate all reverse logistics procedures, the company would typically issue a “Return Merchandise Authorization” (RMA) or “Return Material Authorization” (RMA). They acknowledged that products which have been returned and are in less-than-perfect condition are processed to be tested and repaired before being placed in the finished goods inventory and sold to customers. The remaining items with more deterioration will be returned to suppliers, sold on secondary markets, disassembled to recover components or disposed of in landfills. Overall, this process seems to be the most common practice, though there are still existing different procedures implemented in different sectors and enterprises.

2.2 Information and data management within Reverse Logistics services

Reverse logistics management includes the management of all returned products data and information. Up to now, a number of studies indicated that. Apparently, it is proved that as the information system is essential to the operations of any businesses and industries, from the moment of goods manufacturing to the point of delivering and distributing the products (Daugherty et al., 2005). At the same time, investigation and analysis executed by this group of authors (2005) had shown that supporting for information system is made up of three different and major parts: compatibility, technologies and capability. The interconnection and consolidation of these three dimensions are required to construct efficient and cost-effective resource allocation decisions. The performance of whole system will not function properly and effectively if the three parts are not successfully integrated. This principle works correspondingly to information system compatibility within the reverse logistics process. A significant analysis and discussion on the three essential mentioned elements were presented quite well by Daugherty and his group of authors that they affect the information system, as in any flow or procedures of operating management information network, compatibility, technologies and capability would always be needed.

In addition, Daugherty et al. (2005) had been implying one more time that managers and employees must be prepared to arrange and handle the returned items accurately and reliably, even in a state that they are oblivious of when the product will or might be returned. This is a compelling reason to prioritize sharing precise and timely data with partners. Moreover, useful and responsive information and data resources should be delivered by the information system that satisfies all the demands. As well as information should be accessible to all parties involved in the external and internal flow of backwards chain operations in order to accomplish the abovementioned. For reverse logistics efforts to be successful and continue to meet the expectations of customers, this specific level of information provision is essential. In the case of Repair Logistics department at Airbus Defense and Space, the information is mostly regarding reports from the partners such as Repair Centers or suppliers and they are often utilized by the third-party logistics (3PL) unit and Reverse Logistics team.

2.3 The impact of return data management regarding Reverse Logistics services

Every operation of reverse logistics consists of the management of data, especially returns data management. This is one of the most crucial aspect in deciding the effectiveness and efficiency of the whole reverse logistics service process. When items or products have been returned from the customer back to the Repair Centers or the suppliers, a whole logistics process is recorded in the system and the repair reports will be implemented by the reverse logistics service team. Reports or database should be organized in a systematic way by the information system in order to satisfy the customers' demands.

One of the challenges with reverse logistics, as stated by Kaynak et al. (2014), is the lack of insights and technical systems. Separate tracking of returns requires accurate and reliable data and information so that returned products can be distributed according to their condition. Additionally, they also verified that the data collection reveals trends and foundational reasons as well as supports in understanding the rationale behind a customer's return. Indeed, a typical returns database when being exchanged between customers and manufacturers or suppliers normally consists of faulty products and shipment information. Therefore, returns database is seen as a vital role in operating reverse logistics flow.

According to Jayaramana et al. (2008), since reverse logistics involved a number of time-sensitive duties like inspecting returned goods, crediting customer accounts and retailing returned products, it necessitates specialist operations and information technology. That it would be possible to accomplish this, a suitable data information base and infrastructure software are required. (Tao, 2010).

That is to say, the efficiency of reverse logistics could potentially be slowed down and consumers' satisfaction could suffer from a lack of an effective information infrastructure (Jayaramana et al., 2008). Rogers and Tibben-Lembke (2001) have supported this argument by emphasizing that the fact that "poor data collection leads to confusion about return causes". The collection of data is the long-term advantage of effective reverse logistics management. Costs can be reduced by optimizing the return procedure and treating returned goods efficiently. Businesses that effectively handle information also effectively manage their inventories. The same logic applies appropriately to reverse logistics. Companies that do not properly manage the data associated with their logistics processes typically do not manage their inventory. Owing to the fact that logistics flow data system also involves information in terms of spare parts and available items within warehouses such as specific quantity among different stocks as well as plants.

Furthermore, Gu and Liu (2013) insisted that there may be variations in product conditions and other features (for instance, the numerous potential locations and various product arrival states. This phenomenon perhaps results in extremely high expenditures for the product's recovery and re-evaluation (Gu & Liu, 2013).

Moreover, by drawing on the concept of returns data management, Jayaramana et al. (2008) have been able to show that data organization should be supported by the information system. Indeed, at Airbus SLC, the Repair Operations or Repair Logistics department has been performing their work flows with the support of the company's internal information system or networking database – which has been functioning as a web-page system with all necessary returns data, allowing different internal entities to participate and utilize its resources. Hence, the communication and data exchanges between customers and the department has become easier with the access availability to the database. As a result, it gave a sufficient effect on the returns management in general and especially on the services that the company has been providing to its customers.

2.4 The collaboration and exchange of data information

As reverse logistics has always been a highly-demand driven operation, collaboration is not an exception. It demands the cooperation between many parties, including organizations and enterprises, suppliers, customers and so on. This pooling of assets, knowledge, expertise and technology leads to a competitive advantage.

With the focus on substantiating that there is the existence of collaboration and exchange of information within supply chain in general, it is indicated by Simatupang and Sridharan (2003, p.19) that “two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation". This is no exception for reverse logistics operations where members of the reverse logistics teams cooperate to convey information and exchange data in a manner that allows reasonable visibility within and between entities. The information that is most frequently exchanged pertains to the status of the process such as availability of resources such as capacity, costs and supplies, key performance indicators which score and record the level of flexibility, the timeline, amount of costs and the state of quality. They have to do with how a process including forecasting, ordering, delivering, refilling and servicing is progressing. Data associated with these processes can be collected and transmitted in real-time or on demand through advances in information technology such as Internet of Things (IoT). (Simatupang & Sridharan, 2003). When information is maintained and shared throughout departments, there is complete transparency, which enables processes to be tracked, organized and managed (Shah et al., 2020). With mutual communication and harmonizing interactions between members of RL and their customers can help to enhance the customer experience journey (Shah et al., 2020). On top of that, this helps to improve the Service Level Agreement (SLA) between the company and its customers. For Airbus SLC’s case, different departments such as Research and Development (R&D), Quality, Repair Operations, ... are all working on and with the same shared returns database within the same shared network system. Data resources are analyzed, utilized and managed in a strict and rigorous solidarity. The collaboration is guaranteed that information and data resources are available and visible for internal entities in order to perform their tasks at the best as they can. It is also recommended that internal department and entities support each other in gathering, collecting and handling the database and information resources. This is due to the fact that some challenges possibly still exist such as the inefficiency and lost in the processes of utilizing, gathering and analyzing the database.

2.5 Initial situation

Information system support is actually made up of three distinct elements: compatibility, technology and capacity, according to Daugherty et al. (2005). The integration of these elements must be completed in order to make determination about the allocation of technology resources that are effective and economical. Indeed, for the case of Repair Operations department at SLC, it has been a while that there is considerable amount of data which has not been excavated that when the database is analyzed at a deeper level for achieving actual repair data from the Repair Centers and factory. The management of Repair Data in general as well as Service Partner reports in specific has been quite complex and inconsistent, actual repair data has not been treating well – which has led to some problems when implementing returns analysis as well as Key Performance Indicators (KPIs) calculations. Currently, the existing framework of Service Partner reports have not been managed efficiently when there is lack of consistency in the reports' contents, the inputs as well as outputs. As these reports are not only considered to be critical for the returns and KPIs analysis but also to contribute to the process of uncovering trends and causes of the returns, it is urgently necessary to conduct a more optimized and innovative practice or framework in order to gain the most as reliable information and data as possible.

2.6 Research objectives

The research is going to conduct a study and analysis based on a case at Airbus Secure Land Communications with the aim of getting to understand well about the current situation and picking up a better solution or a more optimized practice, which has been quite complicated and causing several difficulties while being managed, in order to improve the repair services as well as the reverse logistics service at SLC.

The expected outcome is a new template or a new framework of Service Partner reporting at the most basic level in order to treat the raw database. This new practice of will allow the entities involved to follow and manage returns data consistently and efficiently. As the database within the tool will be the foundation for data integrating in the company's repair web-page system – Airbus Repair Ticket (ART), KPIs are conducted and play a role as the foundation for the database analysis. Correspondingly, it contributes to the process of clarifying and determining why the new framework and KPIs are systematic and efficient for returns management.

2.7 Planning

The operations within SLC in general and Repair Operations in specific are frequently demanded with orientated thinking based on working agreements, share of responsibility and communication flows among the SLC regions. It is encouraged that having a mindset of creativity, innovation, improvement and non-stop moving forward is an appreciated way of thinking in order to manage and perform operative reverse logistics daily business.

Based on the current situation analysis at Repair Operations department, several meetings and discussions have been executed in order to work on the new practice regarding Repair Data reporting segment. It was decided that the Service Partner reporting should be optimized and improved since it has been generating difficulties and inefficiencies, especially the loss of actual data.

2.8 Research questions

The management of reverse logistics seeks for the most effective returns data management practices, which is capable of providing different departments or entities with information and database – which plays a vital role as the key resources to support and to be utilized for different tasks as well as practices. In the general operative reverse logistics businesses segment and in specific returns management sector, it is highly demanded that analytics, returns data and returns information management be monitored, recorded, maintained and exploited in a lively manner. A practical powerful operation of returns data management activities is expected to the guarantee the achievement of fundamental requirements from customers. Especially, the operation should be committed and collaborative among partners in operative processes in order to accomplish targeted Service Level Agreement (SLA) with customers. Hence, it is crucial to discover what strictly needed to be improved and how to efficiently utilize the database reporting system regarding returns management.

The thesis work is intended to focus on investigating the answers to the following research questions:

1. *What are the reasons for the new practice?*
2. *How is the new solution regarding data reporting structure implemented?*

3. *What are the benefits that the solution brings to returns management generically and specifically in customer service segment?*
4. *Why is this new framework systematic?*

Through initial situation determination, information gathering and final result implementation, the mentioned research questions will be thoroughly studied.

2.9 Informative operation analysis

In this section, resources, observations and generalized findings are collected and analyzed based on basic, daily practices at Airbus SLC will be useful for drawing a big picture about the whole business performances at Repair Operation department in general, as well as playing a role as a foundation for the practical research.

2.9.1 Reverse Logistics physical flow

2.9.3 Repair Data exchange – Database contributors

2.9.4 Customer experience perspective at SLC

At Airbus SLC, the customer experience is segregated into six different perspectives. First of all, employees at Airbus SLC are committed to ensure that **time and effort** are contributed. Customers should be informed of the delay when achieving their expectations. In addition, every step of working and exchanging information with the customers must be crystal clear, especially whenever there are possible related risks. Therefore, it will make the overall process smoother and be able to remove the unnecessary steps.

Secondly, the **personalization** is also considered as an essential aspect in the customer experience journey. It is necessary to understand customer moments of matter and create value on them. In other words, employees need to demonstrate to their customers that they understand these specific circumstances, the advantages and the difficulties, so that in the end, it will be possible to involve customers in designing solutions.

Thirdly, customers' **expectation** should be guaranteed by being able to identify key expectations and irritants during customer journey, as well as provide adapted answers to the customer. That is to say, the **resolution** is to provide detailed, consistent and accurate problems or incidents, firm

decisions and answers whenever being in contact with customers. Besides, it is also proper to provide mechanisms to customers so that they can solve the issues themselves if necessary. Moreover, **empathy** is also an indispensable angle which needs to be considered. Employees should offer to the customer the opportunity to tell their needs, expectations and disappointments.

Lastly, **integrity** is also worth paying attention to. Especially, it is necessary to create good impression at the first sight and identify trust-building events. Accordingly, promises can be delivered on among the relationship with customers.

2.10 Preliminary reporting structure analysis

In this section, an analysis in terms of the preliminary versions which belong to the target repair data reports will be conducted. On the basis of repair data reporting process flow, data validation, structure details, questionnaire's results and the current challenges or difficulties the Repair Operations department is facing with. Throughout the whole analyzing and studying processes, these mentioned areas will be playing a vital role in demonstrating and justifying how the repair data at Repair Operations is normally managed and supervised. Specifically, the types of repair data reports which are going to be investigated within this part are Service Partner reports (Terminal Monthly Reports) and Electrical data Interchange (EDI) reports. In regards of Service Partner reports (Terminal Monthly Reports), the scope is to focus on Terminal segment – both TETRA and TETRAPOL categories. For Electronic Data Interchange (EDI) reports, the scope will be related to all TETRA families.

2.10.1 Repair Data Confidence - Validate data to show the trustworthiness of database

Understanding the product information and its flow through the supply chain in a thorough and excruciating detail is necessary for a successful returns management system. Contributing to the process and workflow of this system is returns data management - which is one of the most critical aspects within the segment relies on product data such as material codes, serial numbers, logistics records, repair service activities, warranty status and so on. With systems like streamlined data reports, Return Merchandise Authorization can be quickly validated. The evaluation metric below is conducted with the aim of validating the trustworthiness and the reliability of the database.

Therefore, this Data Validation scale is implemented for both reporting data base which are 'Service Partner report' and 'EDI report'.

The validation scale consists of five different criteria: Data Owner, Data Update Frequency, Input Status, Data Source and Data Quality. These are the standards which can be seen eligible enough to evaluate and confirm if a database or a data report structure is well-built and reliable. The validation is measured based on a proportion of 100%, with different distribution scope for each criterion. It is clear that Input Status and Data Quality account for the largest proportion of 30% each. Specifically, for Input Status, the scale for benchmark "Automatic" is 30% if the database is built, updated or downloaded with an automatic system or tool; while if the report system is constructed half manually, the database's score will be 15%. In regards of the quality of the data reporting system, if the data is completely accurate, the benchmark will be graded with 30%, meanwhile, 0% will be assigned if it is not correct and lack of necessary entries. The second highest % weight is the Data Source criterion, if the database belongs to Master data (raw data), it will be assigned with 20%, otherwise will be 10%. Lastly, Data Owner and Data Update Frequency are the ones that account for only 10% on the scale level. In terms of a reliable database, it is critical that the Data Owner is identified and known, especially when the person is needed for being charge of and managing as well as organizing the report structure, then the score will be 10%. In addition, the up-to date status of the data report should also be monitored closely. Once it is amended to the newest version in the most adequate way, the reliability reaches 10%.

Table 2 Preliminary SLC Data Evaluation

% Scale	Criteria	Possible Scores
10%	**Data Owner:** Do we know who the data owner is? ● Owner is unknown - 0% ● Owner is known - 100%	0% 10%
10%	**Data Update Frequency:** How often is the data updated? ● Unknown - 0% ● Known and not enough - 50% ● Known and enough - 100%	0% 5% 10%

	Example: If we know that data is only updated every three months but it is actually required to be updated every month, then score will be 5%.	
30%	**<u>Automatic/ Manual Input (Input status):</u>** Is the data being automatically loaded or is there any manual input necessary? ● Manual - 50% (as there is more room for error) ● Automatic - 100% Example: Data entry within ART is partly manual, then score will be 15%.	15% 30%
20%	**<u>Master Data/ Secondary Source:</u>** Is the data coming from a master data (raw) data or is it coming from a secondary source (e.g.: a file that is derived from another data source)? ● Secondary Source: 50% ● Master (raw) data: 100% Example: We making an extract of data directly from SAP, then score will be 20%	10% 20%
30%	**<u>Data Quality:</u>** Is the data complete? Are there any data entries that are blank, don't make sense or incorrectly filled? ● Not accurate & data has a lot of inconsistencies: 0% ● Limited accuracy & some blank entries: 50% ● Accurate: 100% Example: When looking at repair data in ART we have some fields marked as "out of KPI" in sections that should describe our products, then score will be 15%.	0% 15% 30%

The next important task to be executed is to study and get comprehension of the data report contents as well as its structure, how they are handled and managed, what is the flow processes like. First of all, a general work flow of the subjected reports which are Service Partner report and EDI report will be defined and analyzed, in order to gain a better view of how these database reports are going through each section, work tasks and performance.

2.10.2 Repair data reporting flow

For a long time, information assistance has been considered as a vital resource that is able to enhance business performance in the logistics literature (Mentzer & Firman, 1994). The topic of reverse logistics places a special emphasis on information support for returns handling. Information support has been proven to have effects on reverse logistics performance, including performance in terms of economics and service quality (Daugherty et al., 2005). On that account, when handling, managing and utilizing the repair database systems as well as reports and metrics, it is essential that the process flow should be determined and clarified, which can be seen as a guiding flow for internal stakeholders within a department or an entity.

2.10.3 Electronic Data Interchange (EDI) repair report

a. Structure and data contents:

The data fields within this report structure has been researched and the outcome is the description of each data content. As a result of doing this, the data structure will be more comprehensive as well as easier to conduct the new structure and for improvement. The contents which marked as red are mandatory entries, some of them should be fulfilled with special conditions.

b. Purpose and data evaluation:

Table 3 EDI repair data validation

% Weight	Criteria	Possible Scores
10%	**Data owner:** Airbus SLC agent, Service Partners' team • Owner is known – 10%	10%
10%	**Data Update Frequency:** How often is the data updated? Is it enough? • Known and enough – 50%	10%
30%	**Automatic/ Manual Input:** Data entry is partly manual • Manual - 50% (as there is more room for errors)	15%
20%	**Master Data/ Secondary Source:** The data is coming from the Service Partners	10%

	• Secondary Source: 50%	
30%	**<u>Data quality:</u>** The data report is not often fully completed, there are still several blank entries. Data is not always corrected due to manual typing. • Limited accuracy & some blank entries: 15%	15%
100%		**60%**

The overall score for the data validation of EDI repair report is 60% per 100%. As a matter of fact, the data structure only meats the basic requirements but has not been cultivated as effective as possible. To be specific, the first benchmark is assigned with a 10% score for the Data Owner, as far as it is known that there are several owners or data responsible entities which include Authorized Repair Stations or Service Partners as Repair Centers. Data is always assured, updated and its flow is maintained by these participants. In terms of the second standard, as the database report is updated and sent to the Repair Centers twice a day, the frequency is likely to be more regular. Hence, Data Frequency criterion is marked with a 10% score. With this persistence level, this can be seen as a strength for a database structure, for the most part, it is monitored and kept on track easily. On the other hand, the data entries are still partly manual, which is able to lead to wrong typo and false information. Especially, when data fields which their format is free text (alphanumeric or text), there is higher chance of wrong entries, owing to the fact that data once collected from different sources such as serial numbers scanned by the logistics carrier or Repair Centers possibly misunderstand the format of the product's serial number. As a result, in the next benchmark, EDI repair report structure is weighed 10% over 20% since it is a secondary data source. Last but not least, the Data Quality standard is also one of the most important criteria to evaluate a database structure. The total score for an excellent database is 30%, however, for EDI repair report, it is only given a 15% score since as the reliability, the integrality and the efficiency have not been enhanced.

2.10.4 Service Partner reports

a. Structure and data contents:

The Service Partner report structure is formed by five segments: Repair Centers identification, Helpdesk & advanced swap services, Repair services, Logistics and Miscellaneous. The contents

which marked as red (as well as in the data reports) are mandatory entries, there should not be any blank columns. Specifically, most of the fields in Repair Centers Identification and Repair Services are mandatory, which shows the level of importance and necessity to entry data within these fields.

b. Purposes and data evaluation:

The metric below presents the analytic figures for Service Partner report validation.

Table 4 Service Partner data validation

% Weight	Criteria	Possible Scores
10%	**Data owner:** Airbus DS SLC agent, Service Partners' team • Owner is known - 100%	10%
10%	**Data Update Frequency:** The data is updated every month by Service Partners and Airbus agent checks report validity (if report is rejected, it should be corrected and sent again) • Known and enough - 100%	10%
30%	**Automatic/ Manual Input:** Data entry within ART is partly manual • Manual - 50% (as there is more room for error)	15%
20%	**Master Data/ Secondary Source:** The data is coming from the Service Partners • Secondary Source: 50%	10%
30%	**Data quality:** The data report is not often fully completed, there are still several blank entries. Data is not always corrected due to manual typing. • Limited accuracy & some blank entries: 50%	15%
100%		**60%**

The overall score for data validation of Service Partner report is also 60% per 100% comparing to EDI repair report structure. That is to say, the database is as well not completely as well-structured and concise. However, there is a number of fields to be taken into consideration. In particular, the first benchmark is assigned with a 10% score as the data report is often prepared by the Service Partners. Every month, on the first five working days, this team will have to transfer their reports to Airbus DS SLC Database server to be checked for validity, if the data files are accepted, they will

be integrated within the repair system (ART tool). Therefore, if this level of frequency is maintained monthly, the database is validated with a 10% score of the Data Update Frequency standard. However, in terms of the Input, data when being fulfilled can either be free text or manual typing, which there could be rooms for errors and then once it is integrated within ART tool, KPI results or data aimed for repair activities will be falsely utilized. In addition, the data entries are fulfilled by the service partners and customers, such as the fault descriptions is reported by the customers and repair descriptions is recorded by the Repair Centers (service partners), as the fault descriptions are still under free text format based on their device's functioning, hence, when the reports are transferred to Airbus agent to be integrated within the repair servers and utilized as inputs for KPIs metrics and calculation, it is the secondary database. The score for this criterion is 50%. Last but not least, one of the most important benchmarks to decide the essence of a database is the Data Quality. From the above analysis and comparison of the data reports at different time frame, it can be seen that the report entries are not often fulfilled completely as there are still several blank columns, as well as the data is not always corrected due to manual typing. For that reason, the assigned score is only 15%.

2.10.5 Current situation research

The current situation reference was collected and gathered through practical experiences attained by subject-related employees at Airbus Defense and Space Oy. The below repair service and logistics specialists, whose daily duties and responsibilities are directly concerning operational reverse logistics activities, as well as care service management had received and answered a questionnaire form, so that their opinions and insights regarding the interested matter were collected.

The questionnaire was sent out to each of the employees from the above-mentioned parties and they were asked for opinions about their current performance in utilizing and managing the repair data reports when they implement their work tasks. The questionnaire template used is presented as below.

Questionnaire title: *The current performances concerning the management of general Repair Data reports.*

Questionnaire description: The survey is conducted as a part of the thesis work research, with the aim of collecting thoughts, opinions and some insights regarding the management performance of Repair Data reports.

Email address:…

1. Do you use EDI repair reports or Service Partner reports? If not, please specify what kind of repair data report you are using for work?...

2. What do you use Repair Data reports for? What are the purposes when using them?...

3. What are the important characteristics for a Repair data report (possible to choose more than one answer)?
   - Contents are easy to understand
   - Consistency: Removes room for contradictory data
   - Visibility: Framework formatting presents data contents well
   - Accuracy: Data should remain error-free and precise
   - Validity: All data is aligned with the existing formatting rules
   - Uniqueness: No overlapping of data and it should be recorded only
   - Completeness: The data should be completed without any missing data
   - Other:…

4. How frequently do you work with the general Repair Data reports? (Mark only one box)
   - Daily
   - Weekly
   - Monthly
   - Only occasionally
   - Other:…

5. How long is the time interval you spend on treating/ managing/ analyzing the Repair Data report? (Mark only one box)
   - 4-8 hours a day
   - 1 day in a week
   - 1 week in a month
   - Never

- Other:…

6. Are you satisfied with the current Repair Data reports framework? (Mark only one box)
- Yes
- No
- Not applicable
- Other:…

7. How efficient do you think the current structure of Repair Data reports towards data integration and KPIs analysis? (Mark only one box)
- Quite efficient
- Very efficient
- Not quite
- Not at all
- Other:…

8. Please specify your choice for option “Not at all” in question 6:…

9. Which aspects/ difficulties of the general Repair Data reports are you concerning about? (Check all that apply)
- Accuracy
- Consistency
- Visibility
- No concerns
- Other:…

10. What contents do you think Repair Data reports are still missing in their structure?...

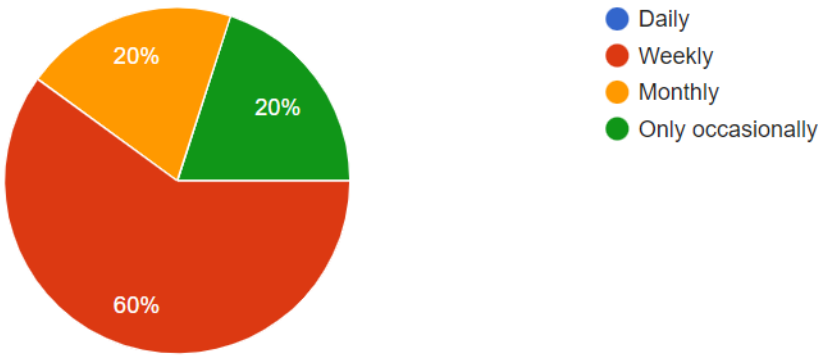
11. Other specific recommendations for general Repair Data reports structure and returns data management:…

Based on the above presented questionnaire which was provided to the employees at Repair Operations department, a variety of opinions regarding the management and performance of treating as well as handling the Repair Database were gathered. Different perspectives, presumptions and judgements were acknowledged as a research methodology. In order to establish the findings and conclusions of the current situation in terms of the existing challenges and difficulties, as well as the insights regarding a reasonable and ideal database structure, all proposals were examined, analyzed and researched, which are presented in the next two chapters (2.10.6 and 2.10.7) of this thesis. Based on this analysis, a set of new practice and new database structure for the field will be constructed later on.

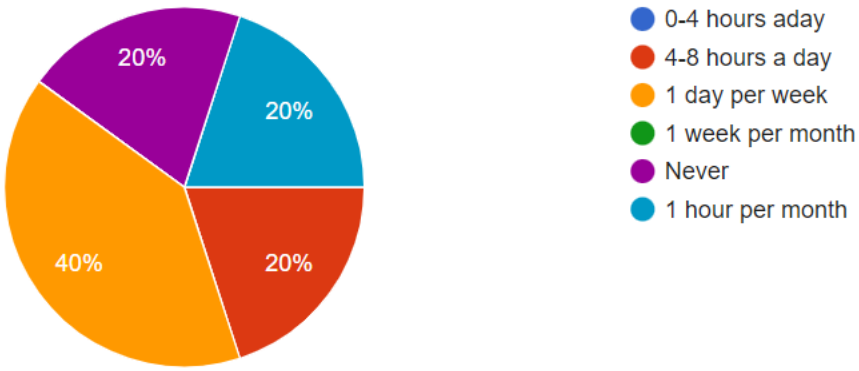
2.10.6 Questionnaire results

Most of the interviewees have confirmed in the answering section for question number two that they have particular purposes to use Repair Data reports such as to understand the fault trends in top five reports regarding different products, to obtain data for calculating Return Rate and component consumption KPIs with the aim of defining changed component per product family or to update central database to build global Repair reporting.

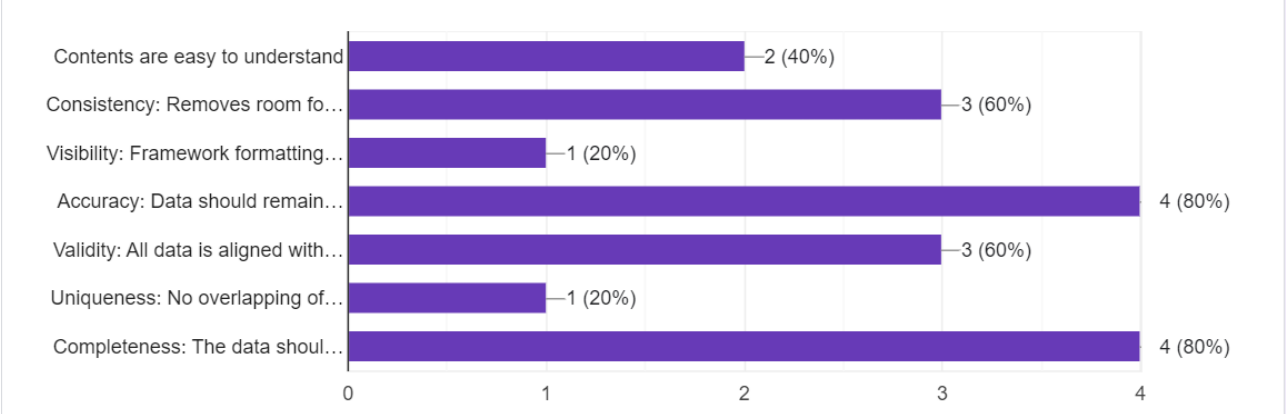
From the answers' result of question number four, 60% of the interviewees claimed that they utilize and manage the Repair Data reports on a weekly-basis. Following is 20% of the answers indicated that the data reports are utilized quite occasionally as well as monthly-basis also took up to 20% of the total proportion.



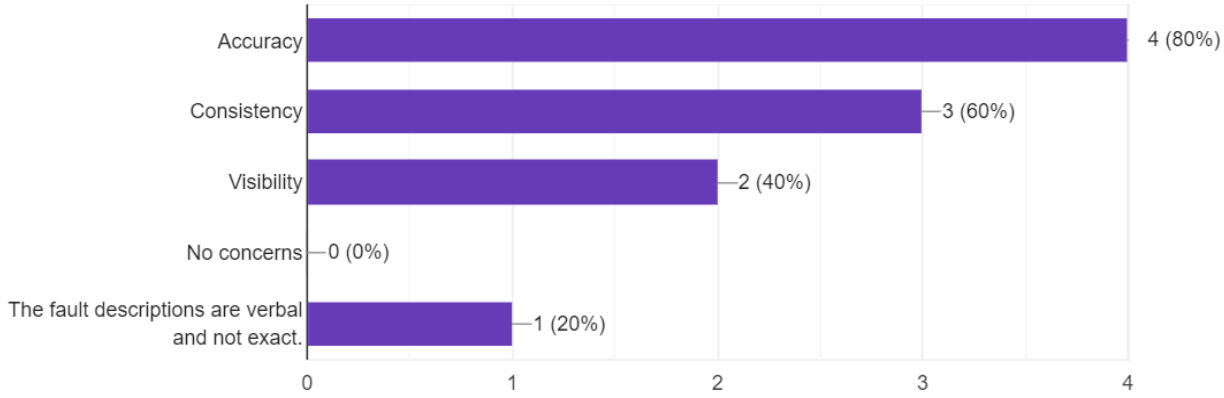
At the same time, the pie chart given below shows the highest percentage of the interviewees who work on the Repair Data reports at least one day per week. Meanwhile, the number of employees who work from four to eight hours per day take up 20% in total as well as there is also 20% of them who only work one hour per month.



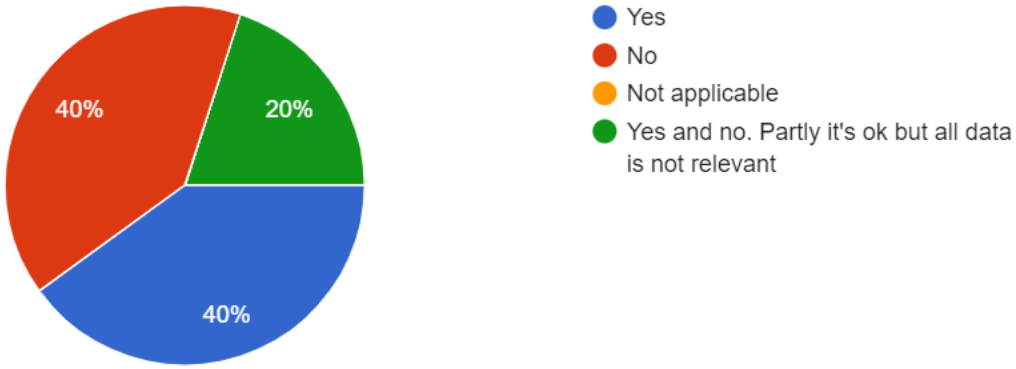
According to the interviewees, when they are asked about the important characteristics for a Repair Data report, 80% of the answers nominated for Accuracy and Completeness, while, 60% of the answers fell on Consistency and Validity as well as 40% voted for the comprehensiveness of data Contents. However, the Visibility aspect only received 20% of consensus.



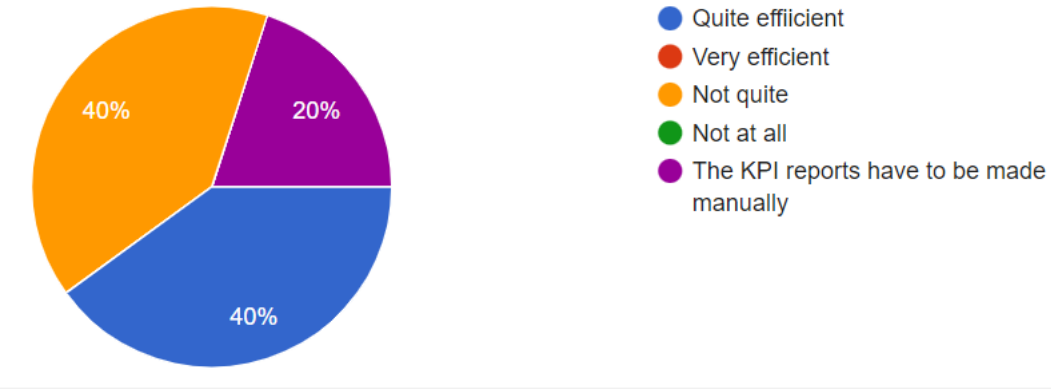
Moreover, up to 80% of the interviewees had concerns regarding Accuracy aspect of a Repair Data report. Besides, Consistency element ranked second with 60% of the total interviewees who considerate about it, while Visibility also played a considerable role in the reporting structure as the figure showed 40% of the interviewees' vote.



In addition, the result of the question number six illustrates that there is 40% of the interviewees who did not agree with that fact that they were satisfied with the current Repair Data reporting structures. Besides, 20% of them declared that the reports structure are partly acceptable but most of the data contents are not quite relevant to their work performances.



In the next question, there was 40% of the interviewees answered that they thought the current structure of Repair Data reports towards data integration and KPIs analysis was not efficient enough, although the same result was applied for the “Quite efficient” option. Additionally, the noticeable opinion which was given by the interviewees was that the KPI metrics which utilized Repair Data should be implemented in a manual way.



On top of the above opinions, interviewees also gave their feedback in regards of missing or information lacking in the structure of the Repair Data reports which they were utilizing for their work. Most of them stated that the components information of the product families were not in the same pattern coming from one Repair Center to another.

The above feedback results from the interviewees at Airbus agent will be playing a vital role in supporting as well as being a reference foundation for the challenges analysis regarding the Repair Data reporting system in the next chapter (2.10.7).

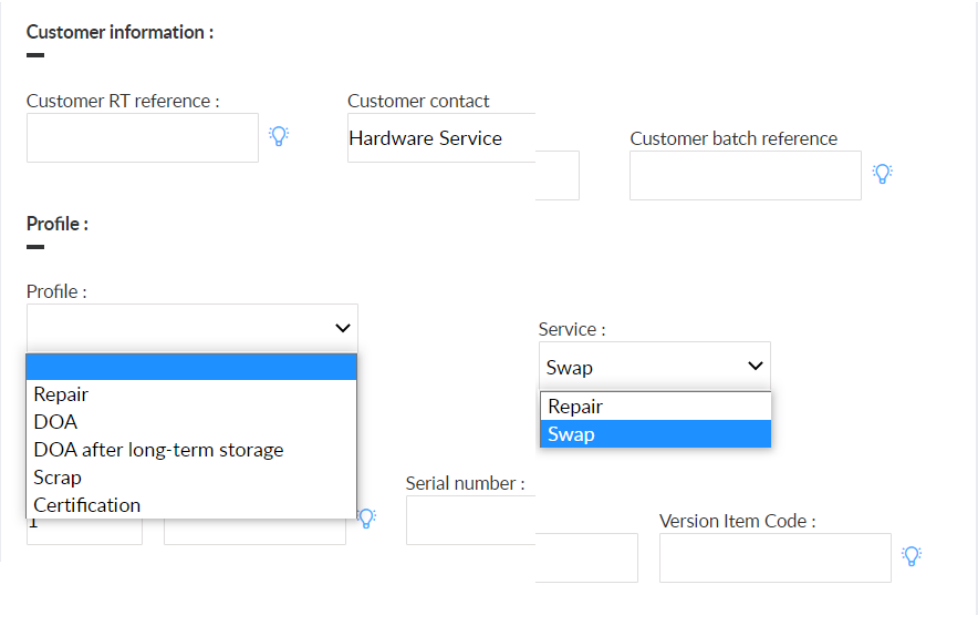


Figure 4 Correct data entries in ART tool

AC	AD	AE
Service	Profile	Garantie
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N
REPARATION	REPARATION	N

Figure 5 Wrong data entries and typing error

Moreover, it is obvious that these reports are having problems regarding their data quality as there are still quite many empty data entries, which means there are existing un-utilized data fields and information (Figure 16). This is due to the fact that there should be better alignments in controlling and keeping the data fields up-to-date. Especially, in the case of the example below, there is a list of data fields which are missing their entries: “MSF Def. Random”, “MSF Def. Continue”, “MSF Def. Reproductible”, “MSF Def. After Upgrade” and so on. Although within ART tool, these data contents belong to the optional details, which means it is completely not mandatory to fulfill the data entries there. However, in order to have a better well-organized and enhanced database, these data fields should be re-constructed in a sophisticated practice on how to optimally utilize the data without making the database size larger or more complex.

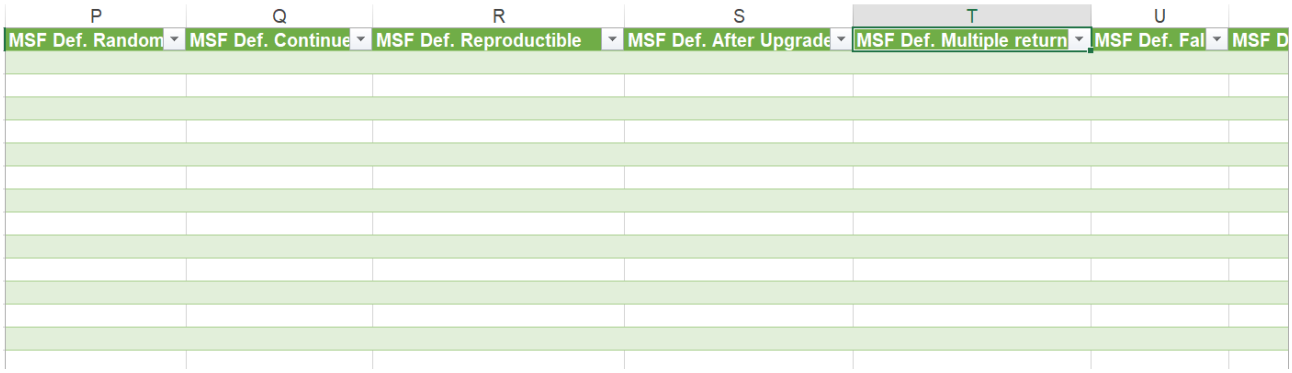


Figure 6 Some empty data fields

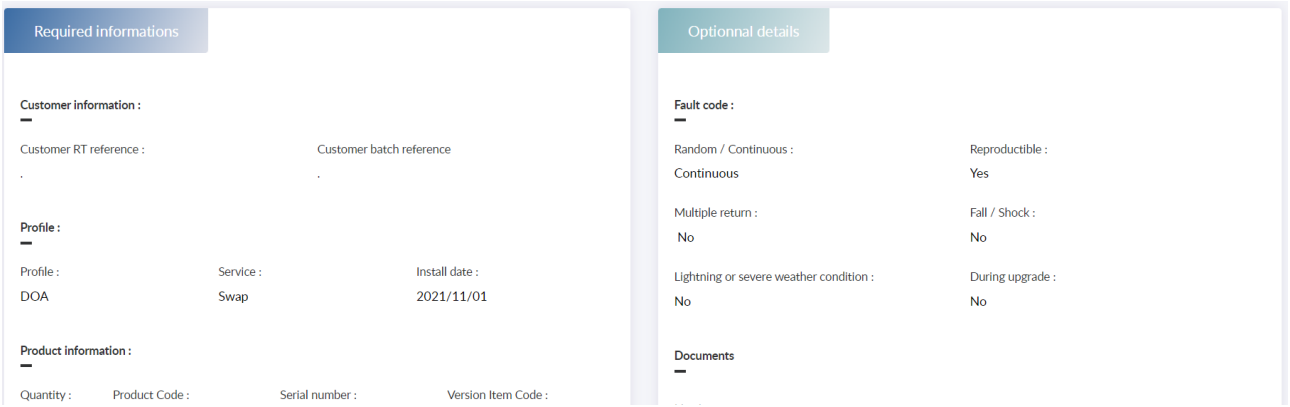


Figure 7 Un-utilized data fields in EDI report – Optional details

Furthermore, EDI repair reports and Service Partner reports are working under the same format which is Microsoft Excel csv format. As these reports all contain entries related to serial number of the products, the purpose for utilizing this format is to retain the “zeros” in front of each number (which can be up to 10-digit long) whenever the report file is opened and treated. Hence, for the reason that the serial number format needs to be preserved, it is quite a complex manual work to open csv file every time it is processed.

By the same token, from the questionnaire’s results, it can be seen that in the operational returns data management processes, it is unavoidable to meet a variety of difficulties and challenges. The responses to the final two survey questions best demonstrate this aspect. The majority of the interviewees had given their opinions in terms of the possible solutions as well as their insights of the current challenges. To be specific, the data content related to the product components were

not frequently in the same pattern when the data report was transferring from one Repair Center to another, in other words, there was the inconsistency in language usage or in the way of their interpretation and choice of words for the addressed issues and the data entries were not compatible with each other, which regularly caused confusion. In addition, there were also some feedback specifying that the data contents should be formulated differently. That is to say, a new data structure should be handled.

Besides these insights, some recommendations were also given by the interviewees. Specifically, it is suggested to conduct alerts or warning on the poor and unacceptable trends of data or to execute a defined selection lists regarding faults for Repair Centers and the data entries should be easy to fulfil for the customers as well. The data structure should minimize the possibility to input "free text" and customers ought to have as much as possible qualified "selections or automatic updates". Besides, a smoother structure and practice when treating database should be aligned among different versions.

Concisely, at Airbus Repair Operations, the most common challenges when treating and controlling the repair database are relevant to data entries inconsistency, manual typing errors and choice of words or data formatting. Hinge on these analyzed challenges and difficulties, solutions will be determined in section 3 (Implementation of data structure performance).

2.10.8 Repair Operations KPI details

2.10.8.1 Return Rate % (RR %) – Repairs

(Confidential data)

2.10.8.2 Turn-Around Time (TAT)

(Confidential data)

2.10.8.3 Repair Lead Time (LT)

(Confidential data)

2.10.8.4 Repair Service Level Agreement (Repair SLA)

(Confidential data)

2.11 Impact of Repair Data reporting system towards customer service as well as Care Services and Service Level Agreement perspective

From the Repair data reporting structure analysis, it is essential that the essential data components including returns management content such as logistics information (shipping date time, tracking numbers, etc.), repair service activities (investigations, fault/ problem descriptions, repair types and level), type of repair (scrap, swap, return, etc.), spare part options and so on. Each of these data field has a capability of having an impact to the partner and the end-customers satisfaction as well as the Service Level Agreement (SLA) due to the fact that they are the valuable resources for measuring the performance of suppliers, Repair Centers and Airbus agent (e.g: KPIs).

Apparently, the general repair database has become the core within different performances among different entities and department at Airbus DS SLC, especially within Repair Operations. Thanks to repair data reports, whenever there are crucial issues related to components or spare parts, faults, Airbus agent is able to react on time, especially for Field Support Engineers or R&D Engineers, to grasp the situation and have capability to figure out and give solutions accordingly. As a result, it is able to avoid customers' escalations and dissatisfaction.

3 Research methods

Throughout the whole thesis work, the primary methods utilized for implementing the practical research are Systematic problem solving and the 6 Bono's Thinking Hats. The research's performances were presented in a way that both of these techniques were applied and implemented optimally and effectively.

3.1 Systematic problem solving

Systematic problem solving is a chain processes of developing, planning and improving. As a matter of fact, systematic problem solving is utilized in a case when there is the need of analyzing the current scenario of an organization or an entity in a particular field, then, from this analysis, the weaknesses and strengths are determined so that in the end, alternative solutions will also be defined. Solving problems is capable of allowing us to follow a logical progression of steps, each of which builds upon the previous one (Hanane, 2022):

- Stating the problem
- Analyzing the problem
- Identifying ideas for problem solving
- Evaluating alternative solutions
- Determining the optimal solution

In this thesis work, these steps were conducted in a systematic principle which started with information gathering and assessing such as facts and figures of the research scope based on the generic knowledge from the real-life working environment at the case company. In fact, the collected data included Airbus's operations at Repair Logistics department, how it worked and its products or services in the chapter 2.9 (Informative operation analysis). Then, the current work flow and performance at Airbus would be interpreted and assessed in details, which was describing from the section 2.10.1 (Repair Data Confidence – Validate data to show the trustworthiness of database) to 2.10.5 (Current situation research). After that, from the problem analysis in chapter 2.10.5, a recognition and assessment were acknowledged, which represented thoroughly in the chapter 2.10.7 (Challenges of data reports management) Data Validation metrics. Later, possible solutions would be identified with an open-minded thinking and thee optimal one would be clarified.

3.2 The six Bono's Thinking Hats

The six Bono's Thinking Hats is a methodology which supports people and teams in observing and assessing issues and circumstances from several angles. The six hats basically tell us "how to think" rather than "what to think", thus they could be applied anywhere. This technique was developed by Dr. Edward de Bono – who stated that the method reduces conflict within a group by keeping the concentration on one aspect at a time and allowing for a change in thinking (Channell, 2023b). In addition, this method also helps an action plan to Reduce, Maintain, Create and Reinforce. Specifically, as explained by GmbH, A. (2020) from *airfocus*, there are six different colors of the hats, which they are:

- The White hat: the object hat, which pays attentions to facts and logic
- The Red hat: Intuitive hat, which focuses on emotion and instinct
- The Black hat: Cautious hat, which is utilized to anticipate the negative outcomes

- The Yellow hat: Optimistic hat, which is utilized to point out positive outcomes
- The Green hat: Creative hat, in which there are various ideas to make the impossible possible
- The Blue hat: Control hat, which is utilized for management and organization

From this thesis report's point of view, the six Bono's hats were applied based on this following simple framework, which had supported the research work quite properly. Derived from this approach, a few questions which need to answered were listed in order to advance the research flow and practices efficiently.

White hat – Facts:

- What information do we have?
- What information do need?
- What information is missing?
- How are we going to get the information we need?

Red hat – Emotions:

- How do we feel about it?
- What are hour hunches?

Black hat – Problems:

- What is wrong with this?
- What do we used to be careful of?

Yellow hat – Benefits:

- What are the good points?
- Why is this one preferable?
- How can we make this work?

Green hat – Ideas:

- What are the suggestions?
- Are there any other ideas or alternatives?
- Could we do this a different way?

Blue hat – Planning:

- What thinking is needed?
- What is our planning?
- What is the next step?

4 Implementation of new data structure performance

4.1 Suggested optimization

There are many aspects which should be taken into consideration in order to improve the data integrity. Derived from the analysis of the current situation and the challenges that the Repair Operations department is having; several suggested solutions have been implemented after the basic researches. For the purpose of limiting and optimizing the inefficiencies in processing and managing database reports, there are some basic practices to be executed within Microsoft Excel. By the reason of an easier approach as well as more convenient adaptation, Airbus agent can quickly get familiar with the usage of these new practices. Especially, the new suggested repair data structures will be conducted in a more efficient way that extra contents or contents which their necessities are no longer needed, as well as the data entries will be cleaned up and cut back down.

4.2 New reporting structure

In this section, new database structures of Service Partner report and EDI repair report will be executed utilizing Microsoft Excel, after the previous analysis of the data contents and the utilization of them. This practical research is going to be presented similarly as a detailed guidance or instruction on the new practices. The reports' structure is summarized with the new modifications using

different functions in Excel tool (table 11). Material support is also included with the participation of data and resources from ART tool.

4.2.1 Service Partner report

The data report is re-constructed in a way that the minor errors can be avoided and eliminated as much as possible. First of all, the "Service Partner Name" (Column B) is adjusted with the *Data Validation* function in Excel. The main purpose is to keep the format of this entry to always be in capital letters – which is the original format of the data. At this point, it is thanks to *Data Validation* that it allows users to customize this function formula to make changes to the data entries (Figure 20):

=AND("EXACT(B:B,UPPER(B:B)),ISTEXT(B:B)")

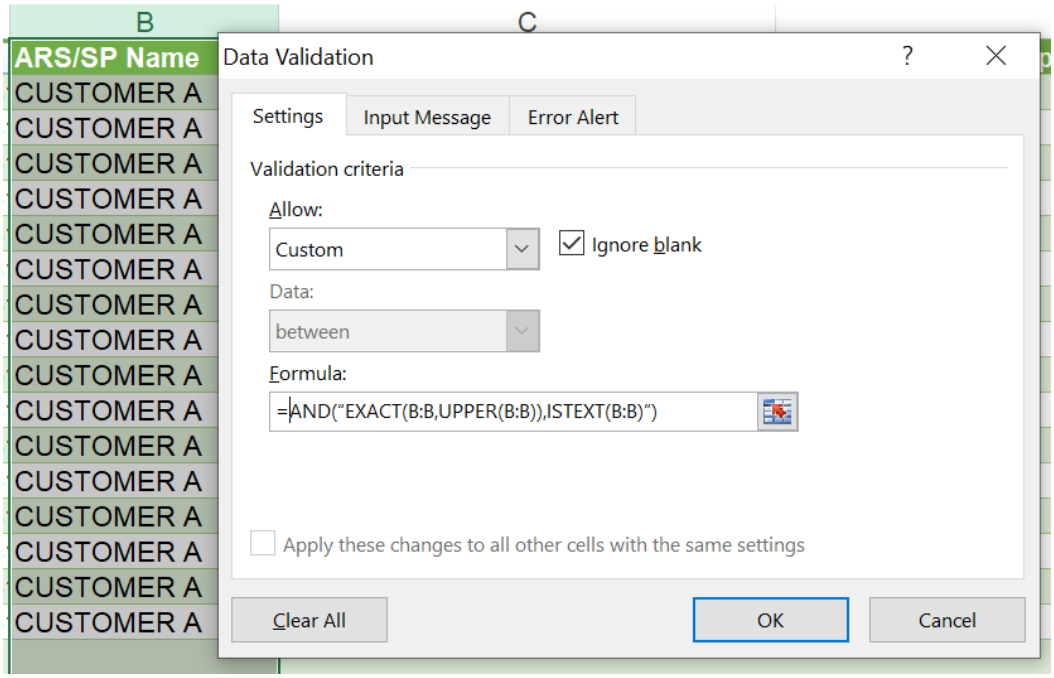


Figure 8 Service Partner Name field modification 1

Once this function is applied, the outcome is that whenever users are trying to type in the data cells with lower case characters, a warning box will appear to stop the action and require users to put the right entry (Figure 21). If the users want the entries to be automatically in capital characters, *Retry* option should be clicked on, otherwise, *Cancel* option will return the entry back to empty cell.

This change will bring an advantage in the future when database is recorded in the data warehouse and ART tool that it will be visibly managed better with data sorting and filtering tasks.

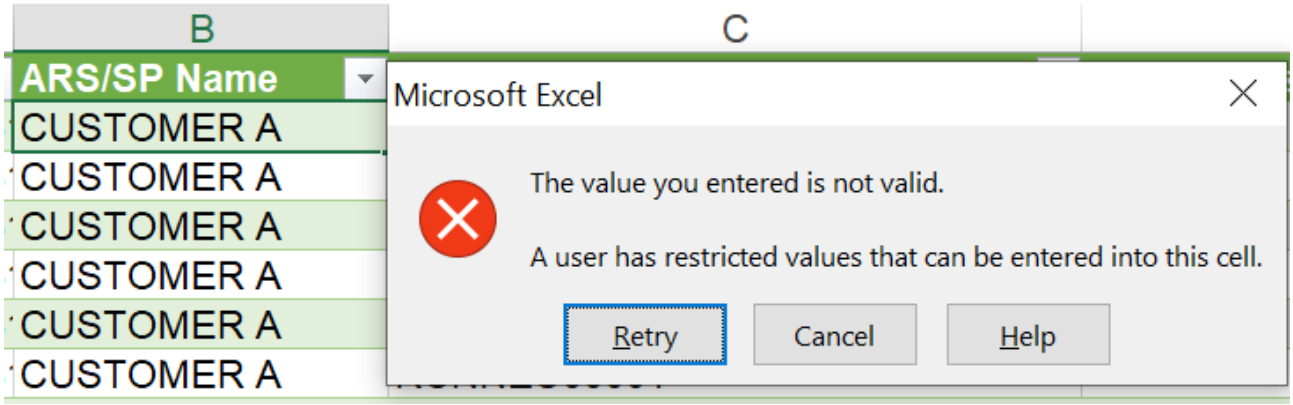


Figure 9 Service Partner Name field modification 2

Secondly, one of the most vital and indispensable data content is Serial numbers. In this report, there two types of serial number entries to be fulfilled: “Original serial number” (Column O) and “New serial number” (Column P). The optimal solution to prevent any minor errors for this type of data is to set the data format as *Text* instead of *General number* and restrict the length of the number string. This is due to the fact that the serial numbers can be entered wrongly with duplicated numbers, extra digits and so on. Besides, by this way, once the data format is in *Text*, it is able to keep the leading “zeros” in front of a serial number string (Figure 22). In addition, data fields in regards of date time format such as “Swap Shipment date” (Column H), “Swap Delivery date” (Column J), “Terminal arrived date” (Column AQ) and “Terminal shipped or Swap stock reintegration date” (Column AU), the entries format should be *Short Date* – which can be found from the *Number* ribbon in Excel. This modification is suggested to be executed by the reason of data related to date or time when having the identical format, mismatches or misinterpretation can be avoided. For example, the format *mm/dd/yyyy* is unique in the United States and sometime utilized in Canada too. However, in most of the European countries, the format is mainly used is *dd/mm/yyyy*. Especially, when fulfilling the database, different responsible people may be accustomed to different kinds of format, thus, this data detail should be taken into consideration, otherwise, confusions can be caused.

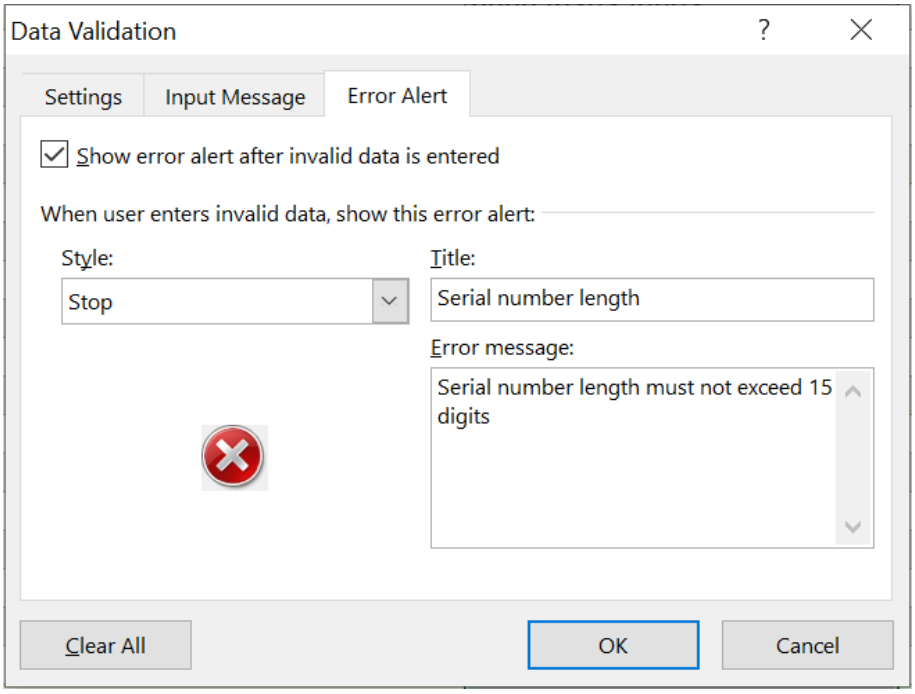


Figure 10 Serial number length restriction

Another function of Excel's *Data Validation* which can be used for most of the data fields: *List* – which allows users to activate a dropdown list within Excel's cells. For the most part, this List function is applicable for data types containing several fixed values. For instance, the "Repair Status" (Column N), "Type/ product reference" (Column Q), "Repair codes" (Columns AD-AI), "Spare part" (Columns AJ-AO) and "Warranty" (Column AP) fields. This function keeps all these data entries to be identical and reduce the possibility of typing mistakes. Specifically, in this case, it is recommended to use INDIRECT() function to the *Source* function formula in the *Validation criteria* section of *Data Validation* (Figure 25), by this way, it will be more time-saving as the data list will automatically be added as the dropdown values, instead of typing each value in the *Source* field manually:

=INDIRECT("Table 5[Repair Status]")

This INDIRECT() function allows users to complete the date values before the dropdown list is created so that is possible to avoid the lack of information. In order to get the syntax inside this function work, firstly, a preliminary list of data values should be established by constructing a separate worksheet (Figure 24). Next, put the "=" sign in any cell and place the curser on the table's header

to make a black down arrow appear. Once it is clicked on, the entire column heading will be highlighted, then, the right syntax for referencing the table is in the empty cell. After that, when every data entry has been built out, the spreadsheet including this table can be hidden so that the database is ready for distribution.

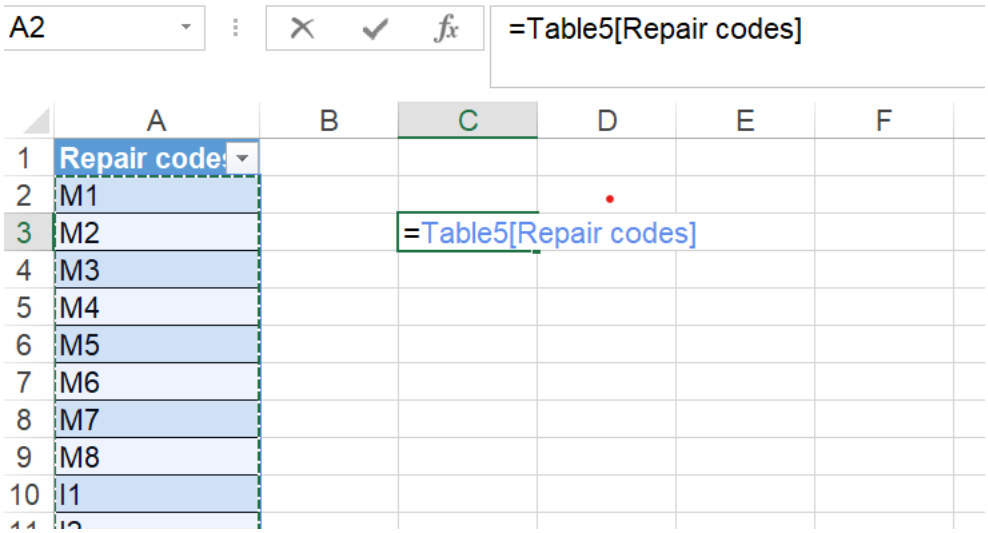


Figure 11 Data list table

For instance, in the “Repair status” column, the fixed data values are “Repair closed”, “Quote issue”, “Repair in progress”, “Spare ordered”, “Dispute in progress” (Figure 26). By this way, users can easily control and update the repair status, particularly, in which stage the repair service is at. Besides, although this data field can be left as free text format, whenever the database is updated, different participants or data managers can have different ways of interpreting their understandings regarding the repair process, hence, there is higher capability of inconsistent data entries which can lead to difficulty in database integration. The similar principle also works for data columns such as “Type/ product reference”, “Repair codes” and “Spare part”. Product types, repair codes or spare part codes are also categories that have fixed values so it is easier to conduct the data list (Figure 27, 28). In terms of the “Warranty” data content, the fixed values consist of only “Y” or “N” as “Yes” or “No”. When *Data Validation* is utilized in these cases, it is also more convenient to treat the data and save more time for data fulfilling.

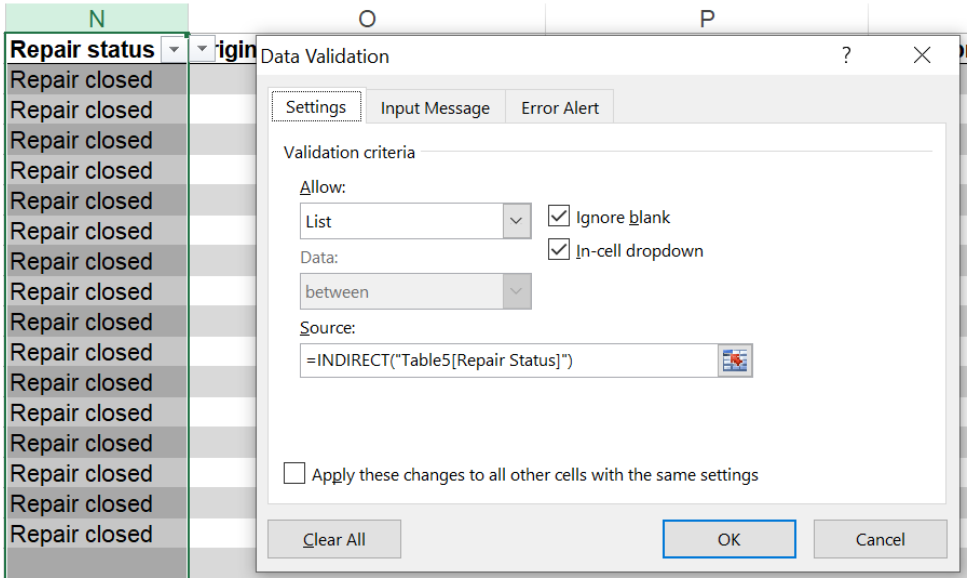


Figure 12 Repair Status listing function

Figure 13 Type/ product reference data list (Confidential data)

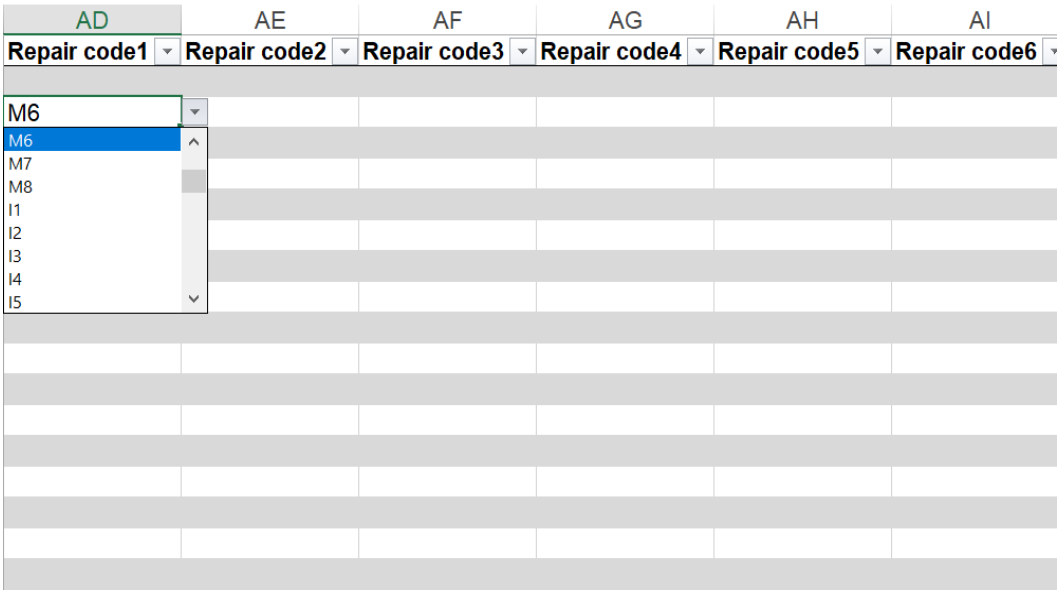
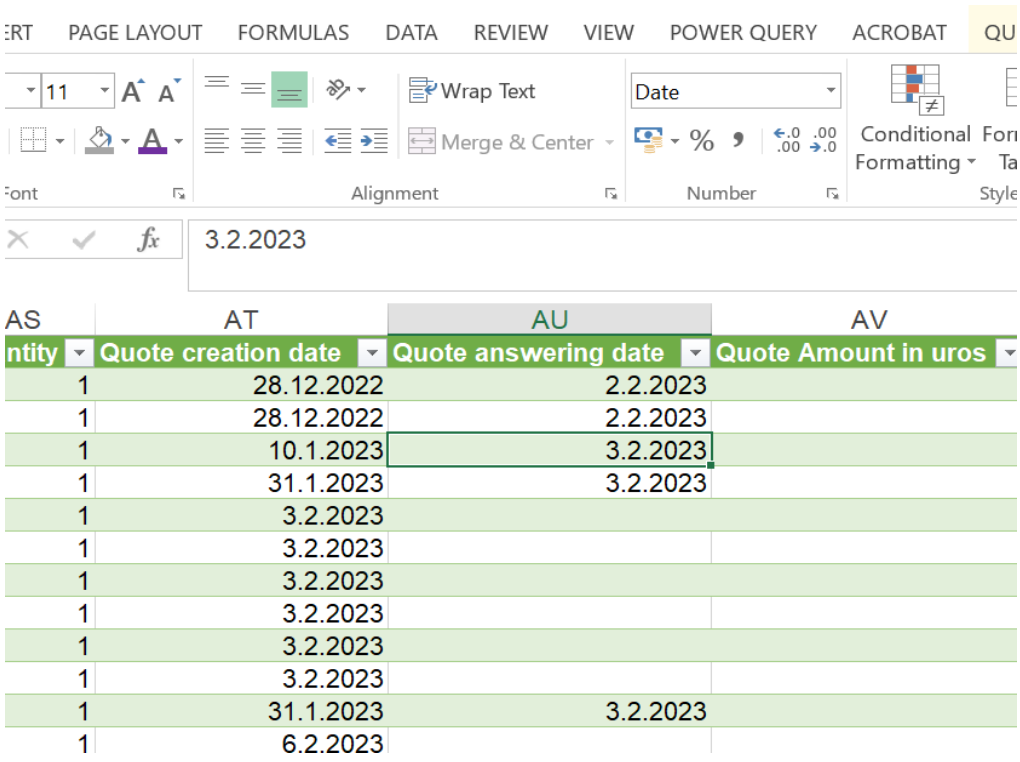


Figure 14 Repair code data list

Finally, another data field which is able to use *Data Validation – List* function is "Currency" column. Although the mostly-used type of currency is EUR, it is recommended to have a list of other type of currency such as USD and AUD. Hence, the data entries in this field are EUR, USD and AUD, which are the most common used currencies, especially for international logistics processes.

4.2.2 EDI repair report

Additionally, owing to the fact both Service Partner and EDI repair are returns data management reports, they have quite similar data category structure such as logistics and repair services, which are the most important pieces of information in regards of reverse logistics processes. To be specific, the data which is relevant to the delivering or service date time such as “HUB sending date” (Column AF), “Repair Date” (Column AH), “Shipment Date to Hub” (Column CM), “Shipment Date to Customer” (Column CO), “Shipment Date” (Column CU), “Investigation Start Date” (Column CY) and so on. The optimal improvement is to put the entries format as *Short Date* according to the standard European date format which is *dd/mm/yyyy* (Figure 31). These data entries are important and necessary to be recorded as they are the basic information regarding logistics processes and normally shown within the repair tickets in ART system and data warehouse in general.



AS	AT	AU	AV
ntity	Quote creation date	Quote answering date	Quote Amount in uros
1	28.12.2022	2.2.2023	
1	28.12.2022	2.2.2023	
1	10.1.2023	3.2.2023	
1	31.1.2023	3.2.2023	
1	3.2.2023		
1	3.2.2023		
1	3.2.2023		
1	3.2.2023		
1	3.2.2023		
1	3.2.2023		
1	31.1.2023	3.2.2023	
1	6.2.2023		

Figure 15 Short Date format

On top of this, the report consists of a variety of binary data entries, which require the confirmation answers such as “Yes” and “No”. For instance, “Warranty” (Column AE), “Quote answer” (Column AW), “Send to hub” (Column CL) and “Send to customer” (Column CN). Since there are only two values in the data list, it is not necessary to add a formula within *Source* field (Figure 34).

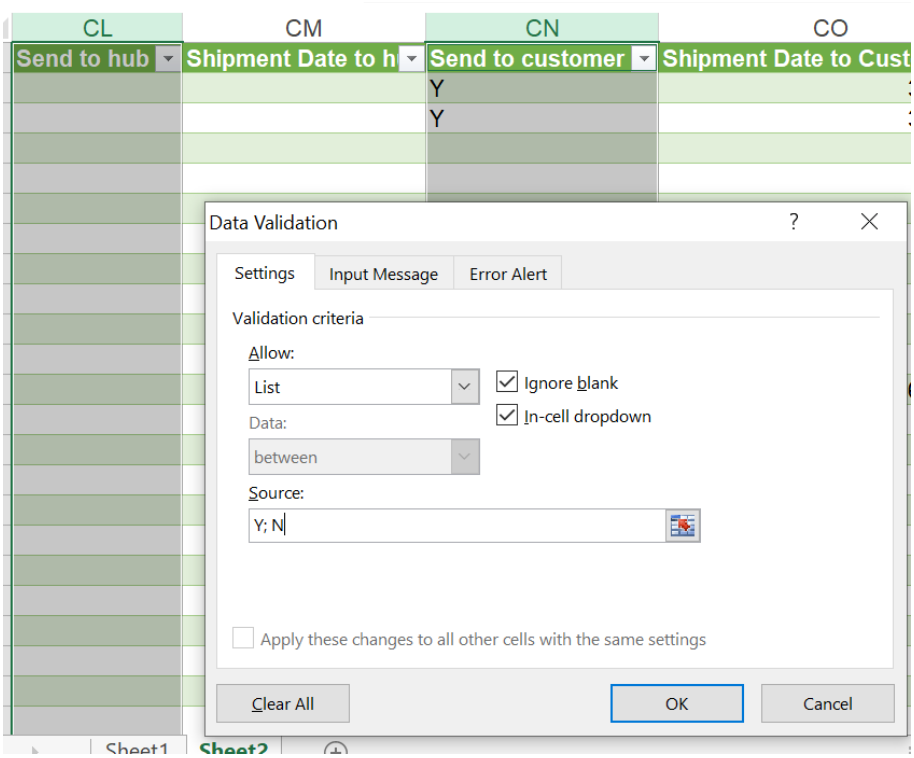


Figure 16 Binary entries using Data Validation

Besides these kinds of warranty information, there are several data fields within this report which are more technical-oriented and there values also consist of “Yes” or “No” options. Although they are all optional details, however, since they are related to the repair service and repair characteristics of the products (Column P-V) as well as visible and recorded within ART system, an improvement should also be suggested. It is highly-recommended to implement the same practice as the “Warranty” content. Another issue to be paid attention to is that these data fields are not frequently fulfilled due to the fact that they are optional details, however, their necessity and importance need to be defined internally and carefully so that these data fields can be utilized ultimately.

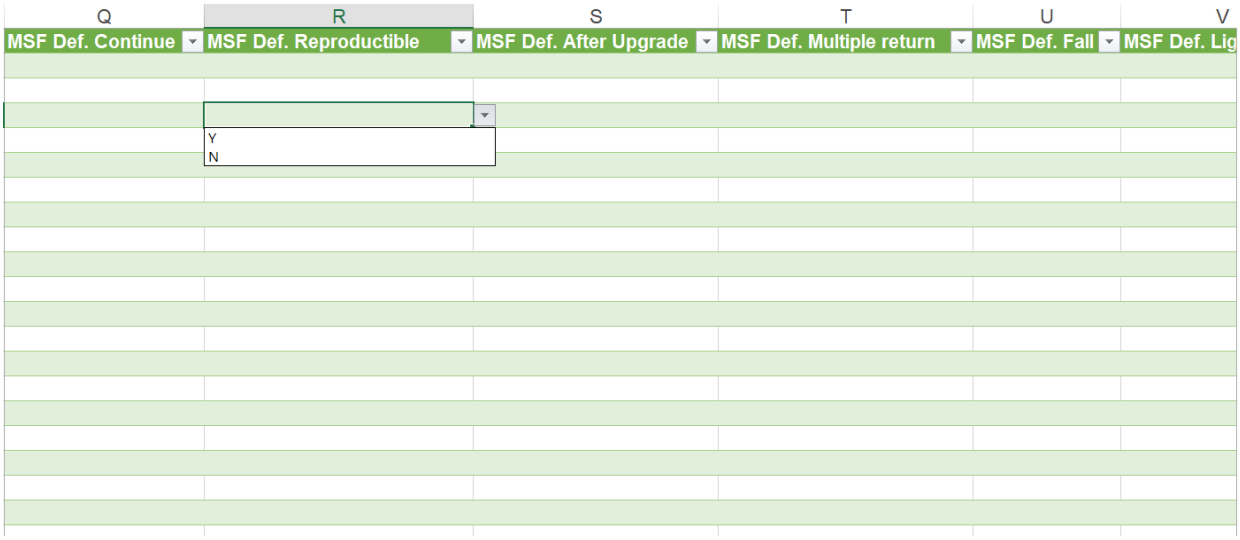


Figure 17 Binary values of data column O-V

Generally, *Data Validation* is likely to be quite functional when it is applied for most of the data contents whose entries are more than two values. In section 2.10.6, the "Profile" (Column AD) and "Service" (Column AC) were taken into account due to the reason that their entries were inaccurate and incompatible with the entries in ART system (Figure 14). This function is also possible to apply for data contents such as "Repair Status" (Column AJ) and "Repair Type" (Column AO). Since these data entries are essential to be updated and monitored, especially within ART tool, so that customers as well as Airbus agent and Repair Centers are able to conduct effective communications regarding repair service processes (Figure 37).

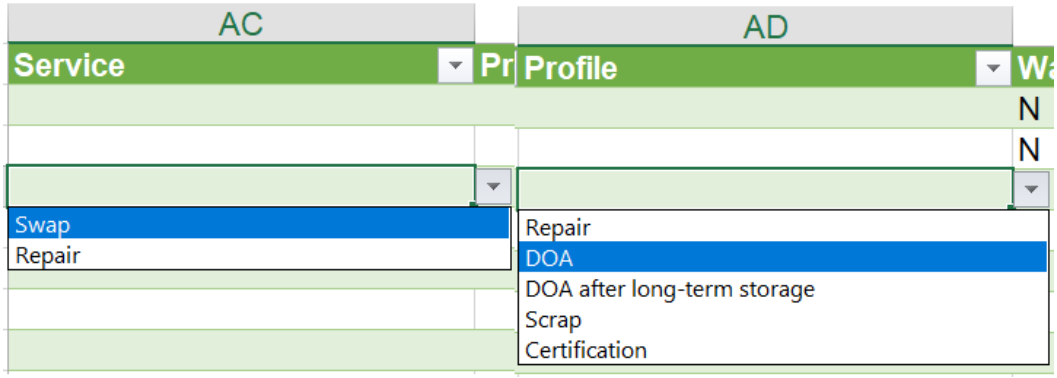


Figure 18 Data entries to be corrected

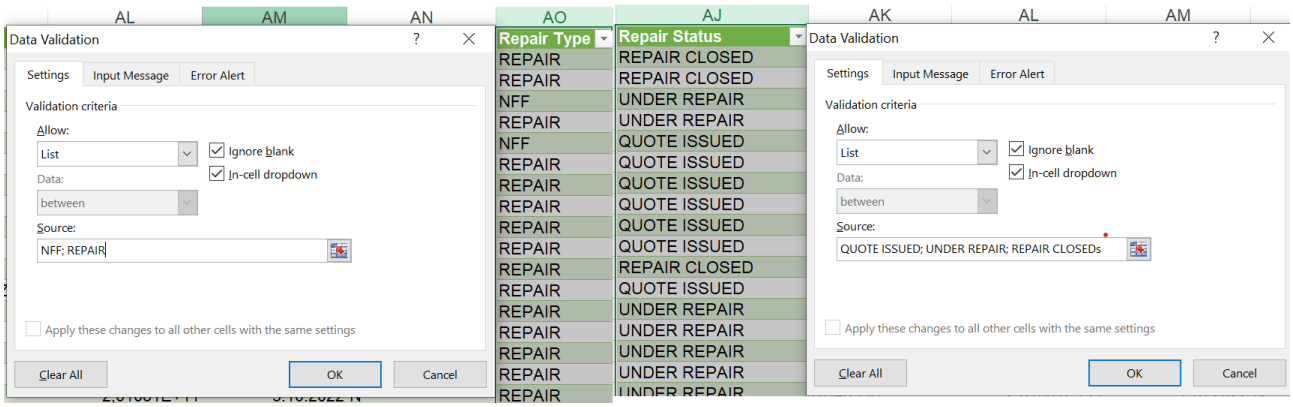


Figure 19 Repair Type and Repair Status data entries

4.2.3 Database upload with Power Query

One of the easiest methods to get the data report structure always uploaded and synced to each other is through Power Query function within Microsoft Excel. In this way, whenever the repair data reports are up-to-date and new versions after fulfillment can be added into only one official folder, the report will be automatically synced to each other, especially the data structure is maintained and connected.

Principle: *Power Query -> From File -> From Folder -> Browse ->* choose the desired folder -> OK -> *Combine & Load.*

First of all, go to Power Query tab in Microsoft Excel, then choose *From File* and *From Folder,* a Folder Path box will appear (Figure 38). Once the desired folder is picked from *Browse*, the folder path is shown within the box, by that time, *OK* command should be chosen and the database review will pop-up to give announcement regarding the size limits (if available). Finally, the last option to choose is *Combine & Load.* The complete data report will be launched in a new worksheet with Workbook Queries panel (Figure 39).

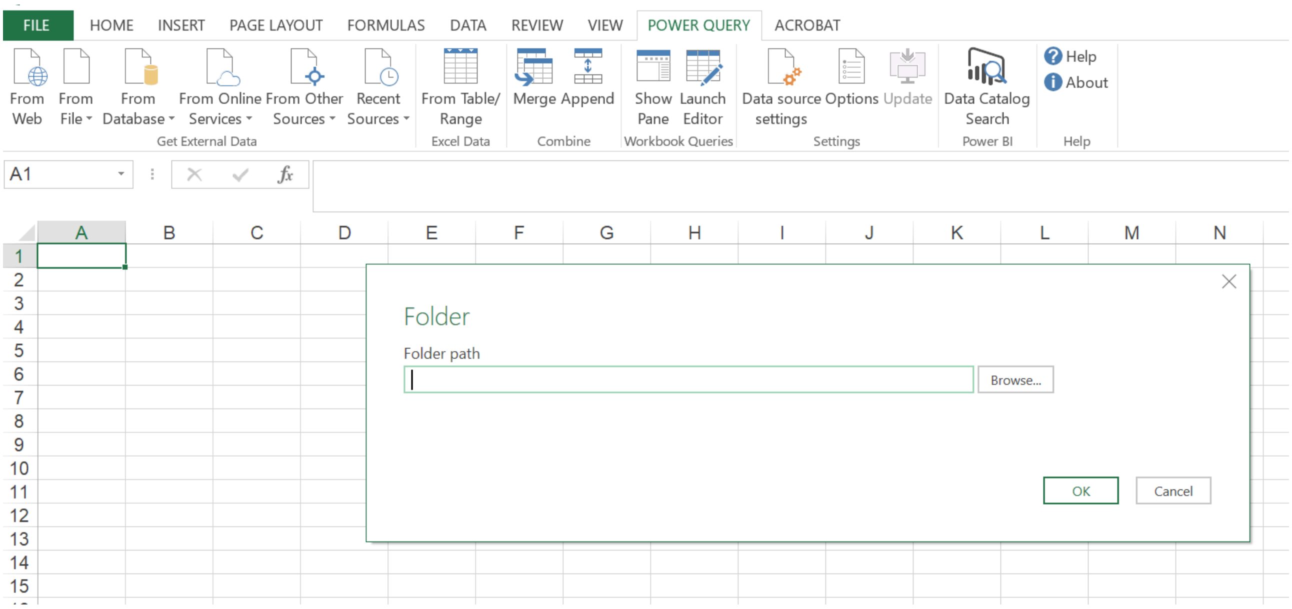
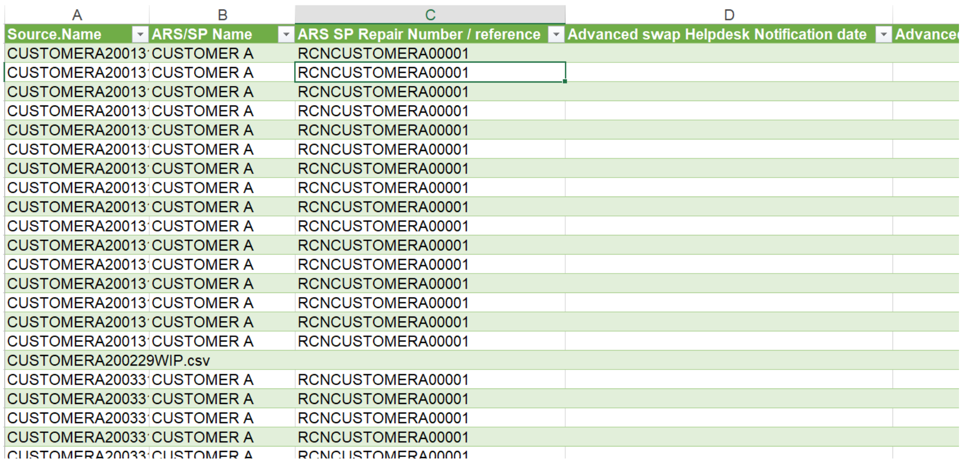


Figure 20 Database folder path activation by Power Query



Source.Name	ARS/SP Name	ARS SP Repair Number / reference	Advanced swap Helpdesk Notification date	Advance
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20013	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA200229WIP.csv				
CUSTOMERA20033	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20033	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20033	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20033	CUSTOMER A	RCNCUSTOMERA00001		
CUSTOMERA20033	CUSTOMER A	RCNCUSTOMERA00001		

Figure 21 Database folder loaded by Power Query

5 Discussions

5.1 Research results

The development of an operational returns data management system is essential and necessary for constructing a company's reverse logistics strategy and maintain effective reverse logistics operations management. During the course of this thesis work, the research was conducted based on the existing circumstances at Airbus Defense and Space Oy, to determine and enhance the processes of managing and fulfilling returns database practices. After the research was brought into a hands-on performance, based on the preliminary Repair Data Validation metrics of both reports, the new structures and practices of the Service Partner report and EDI repair report were constructed and suggestions regarding the data treatment performances were also given. Subsequently, these new data structures are validated in order to assess their quality and reliability. The following Data Validation framework below has analyzed and concluded the final results of the primary Repair Data reports which are Service Partner and EDI repair reports (Table 13).

Table 5 Final SLC Data Validation

% Weight	Criteria	Possible Scores
10 %	Data Owner: Do we know who the data owner is? Owner is known - 100%	**10 %**
10 %	Data Update Frequency: How often is the data updated? Known and enough - 100%	**10 %**
30 %	Automatic / Manual Input: Is the data being automatically loaded or is there any manual input necessary? Automatic - 100%	**30 %**
20 %	Master Data / Secondary Source: Is the data coming from a master data (raw) data or is it coming from a secondary source (e.g. a file that is derived from another data source)? Master (raw) data: 100%	**20 %**
30 %	Data Quality: Is the data complete? Are there any data entries that are blank, don't make sense or incorrectly filled? Limited accuracy & some blank entries: 50%	**20 %**
100 %		**90 %**

The metric shows a total score of 90% - which is 30% higher comparing to the preliminary Data Validation metric. This final figure has demonstrated the significant transformation and advancement of the new structures applied for both Service Partner and EDI repair reports. Of all the assessed benchmarks, the one whose score has improved remarkably is Automatic/ Manual Input. After the research and new structure is conducted, this criterion is graded with 30%, that is to say, the data reporting structures have been enhanced quite sufficiently. Particularly, there are more data fields which can be automated, in other words, instead of fulfilling those entries by manual typing, *Data Validation* function in Microsoft Excel has supported and allowed database users to pick and make their choice thanks to the dropdown list in each cell. Another benchmark which its score has increased comparing to the preliminary Data Evaluation is Data Quality – which was assigned with a score of 20%. Although the original scale only includes 15% or 30% scores, this criterion still gets its grade 5% higher than the scale of 15%. This is because of the basic quality of the database structures has increased after the implementation of new data templates. However, the score also verifies that the data entries are not always 100% accurate. Therefore, as there was a sign of improvement, Data Quality was exceptionally assigned with a score of 20% instead of 15% to demonstrate the veracity in the effect of the new data structures.

5.2 Advantages of the research

Through the research, it is advantageous for all stakeholders such as Airbus agent, Repair Centers and customers, whose work performance includes the involvement of Returns Data – Repair Data management to uncover new knowledge and gain a deeper understanding of the existing challenges. This knowledge can then be utilized to inform decision-making and improve the current practices in Repair Database management. Specifically, the research has been focusing quite carefully on the data contents and their essence of existence and purposes.

Once the data contents are comprehensive, it is a plus point for the database structures as well as their users. Besides, the database has been having quite several deficiencies regarding the contradictory data contents. In other words, data fields which contain the same purposes but with different ways of interpretation have also been an obstacle for the data users in general. Hence, the new practices have given better recommendations for optimizing the database consistency. There are considerable amount of advantages and benefits which can be indicated. The data structure formatting is now presenting data contents better as well as the accuracy level has increased

which means fewer errors have been made. Besides, the new data template allows all data to be aligned with the existing formatting rules, that is to say, with the help of Excel Power Query tool, once the original data template is up-to-date, the newer versions once fulfilled will also be synced and connected with the determined data template, thus, it will not be necessary to adjust and format the database again. Additionally, since the abundant data fields have been limited, the data structure has become more unique and complete, in other words, there will be no overlapping data and the data entries will also be fulfilled quite completely.

Overall, the research not only points out the drawbacks and challenges that the stakeholders at Airbus have met but also finds out what can be done for further development. This new analyzed database structure is not the final frontier for Repair Data management as there will always be rooms for better improvement. Particularly, it can be implemented in more automatic and valid practice of data treatment as well as data contents can be optimized to limit the excessive ones, reduce the opportunity of contradictory data entries and language inconsistency.

5.3 Application and reflections

5.3.1 How is it going to be applied?

At Airbus SLC, whenever a new practice or solution is proposed, the company will thoroughly consider, review, asses, examine and consult with experienced experts in the field internally before deciding on the set of the new practices for the returns database structures. Specifically, each Repair Operations department organizes weekly shop-floor meetings for each of its teams on a regular basis. Shop-floor meetings are intended to serve the purpose of internal performance or work tasks updates and reviews of the current state of the business. This is particularly crucial for the management to rapidly capture the whole picture of the team's operation. The Repair team, R&D, Quality and Reverse Logistics divisions are able to gain the advantage from the new Repair data structures. After the evaluation process is implemented within this meeting, it is likely that consents should be received and votes should be gathered in order to proceed with putting the proposed database structures into actions as the new data templates for the general repair data framework in a particular amount of time. In such a way, the effects of the new database templates can be defined. In other words, this principle will work similarly as a preliminary test for the returns database system. Based on the new practices conducted in this thesis work's research, it is

completely possible to make adjustments in order to observe and monitor the returns management system. As long as the data entries and information in the reports are still operating on a master-data basis.

In addition, it is not only the reworked process or practice to be considered internally but also externally. A plan and a back-up one should always be prepared in advance in order to get external stakeholders or partners on board from the start. To be specific, for all stakeholders, the firstly primary step is to explain clearly the need for the change or the proposed database framework. For a smooth transition to be executed, communication is the key. Explanations should consist of reasons of the change, the necessity, the expected goals to achieve when utilizing new data templates and implementing new practices and values gained for all parties and employees. Especially, when their daily workflows get affected by the change. Secondly, in order to make the proposed process become practical and likely to follow, it should be sponsored and reinforced by leadership and management. Once it is supported to be put into actions, a training should be adapted in order to fulfill employees' needs such as a tutoring or mentoring program. As a new solution is applied, mistakes are unavoidable. Stakeholders should have time to train, practice, fail and try again until they are all confident with it. As long as the database systems are visible and accessible for them, especially with the segments of Repair Data which are visible and shared to Airbus's customers and partners.

5.3.2 Why is the new practice preferable and systematic?

The recommended enhanced and developed practices and data structures are considered relevant and deliberate not only for Repair management, but also for Logistics processes management in general. With the new database upload practice using Excel Power Query, the newly suggested database templates are able to be downloaded, treated and assessed directly without the need of manually creating time-consuming reports. This is also one of the reasons why the new practice is considered to be systematic, as the database report is existing with the support of the new practice to keep the data in sync in multiple places, further possibility is the division of the data workloads among various instances. It also guarantees that all data administrators and analysts are able to navigate to the correct archive address of the database files. Notably, they have more time to analyze and understand what the data is describing instead of spending tome to get access and combine data. In addition, as the database is re-organized in a more enhanced practice and the

essence of this data report is to involve the review, updates and collaboration among Repair Operations teams and stakeholders, it is considered to be systematic. Based on the research conducted in this thesis work as well as the database reorganization, the new practice plays a vital role as a solid foundation which reflects positively on the returns management performance at Airbus and the challenges of it. Overall, a methodical approach helps the wider team feel more at ease with using the business's effective technology, systems and tools within the business to streamline workflow, automate operations, save time and effort on daily duties.

5.4 Limitations and future development

5.4.1 Possible challenges and difficulties if the new practice is conducted

Once a new suggestion of changes or modification is conducted, it is considered that the work will not be easy to bring the modifications into practice. Especially at a large-scale firm that defined processes and practices have been quite well-comprehended and utilized occasionally. Particularly, executive support and active consensus among different entities, partners or internal departments may be absent, which can lead to inhibition and progress delay due to the importance of the initiative is perceived by the staffs as being reflected in the inactive agreement. Besides, there can be the lack of effective communication, visibility and transparency within the organization, which leads to misalignment due to the inconsistency in exchanging conversation such as mixed languages between different entities or the loss of the database structure after every modification at each department. In addition, participants at all organizational levels can acknowledge little understanding of what change management is and the benefits it offers. This factor makes it harder to obtain the resources and funding for success. As they may not comprehend the benefits or values of the change in these situations, hence, managers and leaders may be hesitant to allocate budget or employees to the new framework. Moreover, it is not an exception to consider the change resistant culture and attitude – which is one of the largest obstacles when there are individuals who show little engagement and reluctance to accept new procedures and more likely to reject the change since they do not comprehend it and might be afraid of the "unknown". Such staff members feel at ease with their current practices and do not generally have desire to implement the adjustments. Another possibility is that it can be a challenge for employees to adapt with the change without proper assistance and orientation.

As a result, resolutions are needed in order to avoid the above challenges. Leaderships and managing-level employees should indeed be aware of their responsibilities in managing the change, the resources needed and the objectives that the new practice brings back – in which the necessity needs to be defined. Proper projects, guidance or support's preparation such as workshops, discussions, meetings for training sessions carried out by the management level to keep attentive and overcome misconceptions and conflicts regarding the new solution or practice. It takes the collaborative efforts of many people to change and adapt to a new practice. Especially the size and scope should be taken into account in a respectable and practical manner. Additionally, the impact of the solution must also be demonstrated by leaders. They must be able to outline what will and will not be included in the framework, how is the timeline going to be, who is primarily in charge for which roles in terms of database management and compliance, what kinds of guidance or trainings are required and so on (Apty Staff, 2020). Since the role of leaders and managers is vital, they are eligible enough to support their employees when necessary and commit them to responsibilities through efficient communication.

5.4.2 Is it worthy of investment?

Through the research, it is possible to consider that the new practice is applicable in the most as cost-saving way as possible. The worthiness of the adjustments will be dependable on the alignment with the goals of the company. As the practice is conducted with the aim of limiting the existing difficulties, it should only focus on improving, optimizing, serving the need is to get the necessary and correct data from the reporting system, so that the output can be implemented accurately. Furthermore, the solution needs to guarantee specific added values in order to be convincible and worthy of the change. There are several aspects which needs to be taken into account and evaluated before deciding to invest in such as knowledge and resources, objectives the solution can deliver. It is also important to adequately explain and demonstrate during skill-training sessions how the answer will ease the company's burden and struggles. Internal and external partners consisting of customers' trusts are also need to be ensured before devoting in the change. Likewise, it is also suggested that experts or specialized staffs should be invited in to validate the trustworthiness of the solution, with the aim of clarifying the quality of it. That is to say, the solution should be guaranteed that it is measurable, how it will affect the work of partners and various involved departments. Accordingly, it should reflect the need and desire of the partners: do they seem enthusiastic about the proposed solution or not.

5.4.3 Future development

In spite of the consistent and flexible application of the implemented data structures and practices in fulfilling and managing the Repair Data entries of Repair Operations in reverse logistics service, as well as all the consents or confusions, pushbacks or agreements, frustration or satisfaction, there are always rooms for improvement. When a new work process or practice is proposed and taken into consideration, expectations from other employees at Repair Operations department are indispensable. If a change is implemented, stakeholders should be allowed to know about the continuously improvement as well as they should be invites to participate in providing feedback and enhance methods regularly. With the background of the current research, there is a possibility in the near future that the Repair Data structures will be developed to be more automatic, consistent and accurate. Since the total data validation score for the final data structure version is 85%, it means that there are still criteria to be paid attention to and better improvements should be conducted. The next step for improvement can be executed in a way that the internal collaboration and communication will still be needed. Larger scale of stakeholders can be expanded and more opinions can be gathered. As in logistics world, especially Reverse Logistics, the returns data management is crucial to paid attention to. Hence, database should always be monitored and up-to-date. Furthermore, future improvement for these Repair Database structures is that they may be equipped with more advanced protection from un-quality data information, preferably with minimal effort and risk. That is to say, there can be the capability of back and necessary recovery of restoring database access without affecting user productivity, especially affecting customer experiences and services.

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