BUSINESS PROCESS ANALYSIS AND IMPROVEMENT AT AIRBUS HELICOPTERS

AIRBUS HELICOPTERS

BPJ 420: FINAL PROJECT REPORT

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EXECUTIVE SUMMARY

The aim of this document is to showcase the final year student's industrial engineering knowledge and skills gained throughout the course of her studies. This document contains a literature review, problem investigation, conceptual design, solution selection and the solution construct as well as the implementation and evaluation thereof.

Airbus Helicopters Southern Africa (Pty) Ltd was formed in 1994 and has its headquarters at Grand Central Airport (Gauteng). AHZA operates as an accredited maintenance repair organization (MRO) to maintain and repair the aircraft of key customers in Southern Africa, but also assemble and test new aircraft and supply spare parts to other customers. AHZA implemented one of the most widely used ERP Software systems SAP in 1996 to integrate business functions. The CS order process captures the activity steps required to perform a maintenance inspection on an aircraft, from forecasting, planning the maintenance inspection, compiling the work-pack, issuing the work-pack and performing the aircraft runs, invoicing the customer, releasing the aircraft, to closing the aircraft maintenance inspection. Documented detailed workflows or business process procedures and guidelines of the CS order process do not exist at AHZA which means there are no instructions or guidelines in place for employees to use when executing their day-to-day tasks. This project aims to address the inefficiencies, lack of documented and standardized processes and recurring problems of the process and setting a baseline for process improvement and standardization.

An initial investigation was conducted to understand the AHZA environment, the CS order process and the key concepts of process improvement. Research indicated that the concept of business process improvement (BPI) was an appropriate approach to use to drive and structure the project. The BPI methodology emphasizes the importance of mapping processes, measuring performance and facilitating the implementation of the new process by means of a change management plan. The as-is process documentation success depended on the support and buy-in from the business process owners, various joint application design (JAD) sessions established that the current *CS order process* had numerous inefficiencies and communication gaps. All problem statements were analyzed and the problems that fell within the scope of the project provided as key inputs to defining all functional and non-functional requirements of the conceptual design.

Documentation was developed for the to-be CS order process including detailed hierarchical models of all the relevant sub-processes and detailed design documents (DDD) per activity. These to-be process maps were created with Microsoft Visio which was selected as the best software alternative after careful consideration and weighing of all options available by means of software comparison. Process performance measures were defined to enable managers to monitor the performance of the new processes and a KPI performance tracking spreadsheet was created to help quantify the KPI's results.

An informal implementation strategy including a change management plan was formulated to guide AHZA through the final phases of the project. The next step of the project was to validate the final solution against the functional and non-functional requirements initially formulated while also ensuring that AHZA management and key-users were satisfied with the project outcome. The latter was done by quantifying and qualifying the opinions and recommendations of all relevant employees by means of stakeholder interviews and short questionnaires focused on the new CS order process.

Addressing the gaps and challenges identified helped achieve the project goals of having documented processes, defined employee roles and responsibilities and performance measures for the CS order process ultimately resulting in an effective and transparent process.

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LIST OF ACRONYMS

AD – Airworthiness Directives
AOG – Aircraft on Ground
BP – Business Process
BPMN – Business Process Model and Notation
BPO – Business Process Owner
BPR – Business Process Re-engineering
CS – Customer Service
DAW – Data Accumulation Worksheet
DDD - Detailed Design Document
EADS - European Aeronautic Defense and Space Company
EMS – Emergency Medical Services
FICO – Financial Accounting Control
KPI – Key Performance Indicator
MS – Microsoft
MM – Materials Management
MRO – Maintenance and Repairs
OS – Operating System
SB – Service Bulletin
SD – Sales & Distribution
SIPOC – Supplier Input Process Output Customer
TECO – Technically Complete

1. Introduction

"The helicopter comes closest to fulfilling mankind's ancient dream of the flying horse and the magic carpet." ~Igor Sikorsky

1.1 AHZA Background

The Airbus Group unifies the capacities of three market leaders: Airbus, Airbus Helicopters and Airbus Defence & Space (Airbus Group, 2016) as seen in Figure 1. The majority of the company's customers operate in very dangerous and demanding environments, thus only the most efficient military and civil helicopter solutions are acceptable. The company's in-service fleet, around 12,000 helicopters, flies about 3 million hours per year. The in-service fleet is operated by about 3,000 customers in more than 153 countries (Airbus Helicopters Southern Africa, 2014).

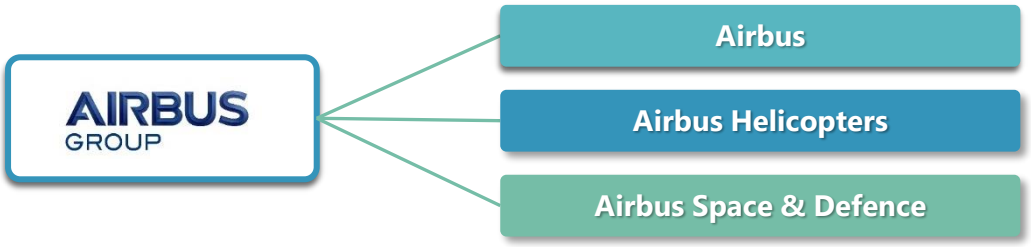


Figure 1: Airbus Group Structure

Approximately 23,000 people worldwide are currently employed by Airbus Helicopters, the company generated revenues of €6.5 billion in 2014 alone. After the company's integration into the Airbus Group, it was decided upon to rename the product range with an "H" instead of the original "EC" designation (Airbus Helicopters Southern Africa, 2014). The rebranding was a result of the restructuring of the Airbus Group formerly known as EADS, which became Airbus Helicopters (EngineeringNews, 2014).

Airbus Helicopters Southern Africa (AHZA) was founded in 1994 and currently has its headquarters at Grand Central Airport in Midrand. AHZA is a fully owned subsidiary of its parent company, Airbus Helicopters S.A.S. (Airbus Helicopters Southern Africa, 2014). AHZA formed part of the restructuring of the Airbus Group and CEO, Arnaud Montalvo's take on the restructuring is: "Airbus is known worldwide for the safety, quality and reliability of its products, it makes really modern, safe and cost-effective aircraft. These three axes – safety, quality and competitiveness – are the axes around which we are transforming. We want to deliver more than good products. We want to deliver customer satisfaction." (EngineeringNews, 2014). Providing quality products and services to customers is of great importance, which is why AHZA owns a ISO 9001 certificate and boast with the highest quality management systems.

AHZA currently has around 89 employees and the company generated a turnover of 533 million rand in 2014. AHZA receives new helicopters from its parent company in Europe and then paints them, modifies them and equips them as required by customers. AHZA also undertakes maintenance, repair and overhaul of Airbus Helicopter models. In addition, they have training facilities for mechanics, technicians and pilots, including a Super Puma simulator (EngineeringNews, 2014). Figure 2 shows the organizational structure of AHZA. In South Africa the Airbus Helicopter fleet contains 150 turbine helicopters, and in the last

few years, the latest products have successfully been introduced by the company to the South African market. These products include the smooth and quiet H120, the H125 "workhorse", the spacious H130, the twin engine H145, the world's first choice in emergency medical services (EMS) and police missions (Airbus Helicopters Southern Africa, 2014).

The South African Police Services (SAPS) and the South African Air Force (SAAF) act as AHZA's main customers; the majority of their fleets consists of Airbus helicopters, and more recently the Namibian, Botswana, and Kenyan Police Forces have all acquired H125's for their air-based police operations. AHZA has the capacity to support its customers at the Cape Town International Airport Satellite Station and at its Kenya Line Maintenance Station based at Nairobi's Wilson Airport (Airbus Helicopters Southern Africa, 2014).

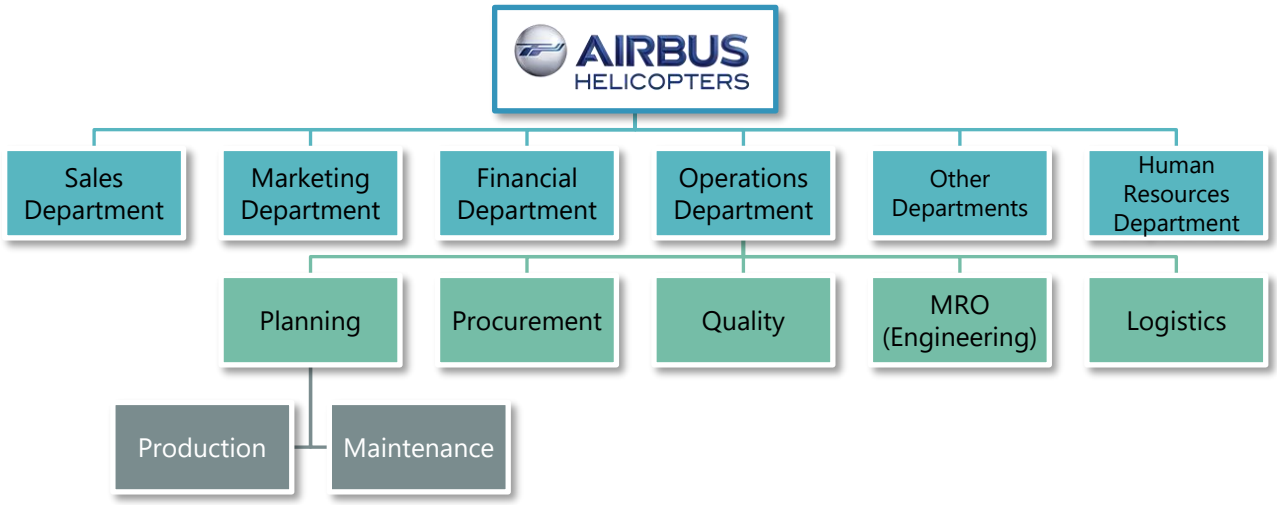


Figure 2: Organizational structure of AHZA (Obtained via interview)

AHZA's sales department is one of the key business functions, as it acts as the interface between AHZA and its customers. The operations department consists of inbound logistics, outbound logistics, warehousing activities, maintenance and repairs as well as local assemblies who works closely with the sales department to maintain high aircraft availability and committed service and part delivery lead times.

AHZA implemented SAP, one of the most widely used ERP Software systems, in 1996 to integrate business functions. The primary SAP modules used at AHZA are:

- CS – Customer Service
- SD – Sales & Distribution
- MRO – Maintenance and Repairs
- MM – Materials Management
- FICO – Financial Accounting Control

A recent review and visualization of the *CS order process* resulted in improved integrity, but significant gaps still exist, especially with regard to financial control and accurate reporting of gross margins.

1.2 Problem Statement

The implementation of SAP at AHZA resulted in numerous changes in how the system functions, considering that AHZA's operations proved to be smaller than originally thought. Thus a few key people at AHZA had to customize the system to fit the needs and capabilities of the company and due to limited knowledge concerning SAP and its functionalities this proved to be difficult.

The current business processes required for a customer service (CS) order often involves known and unknown defects and repairs, sometimes required offsite. This results in intricate planning and repairs, involving numerous decisions, approvals, interruptions and delays. The result is significant operational challenges to deliver aircraft on committed delivery lead times and to maintain contractually agreed service levels. In addition, many judgement calls made by personnel in order to expedite the work, results in aircraft being released without being technically completed (TECO'd) and fully invoiced. The relevant information associated with each step in the process are thus not always processed in the correct order. Data or documents have been known to end up out of sequence at different sales representatives or planner's desks. This causes lags and errors in the system, as the SAP system requires information to be entered into the system in the same logical sequence as the relevant business process. The conclusion is thus that the business processes and the SAP system are not accurately aligned thus the system and resulting transactions are not foolproof and lacks some essential controls, which are crucial to ensure that the correct process procedures are followed.

The most significant consequence is unallocated costs and insufficient financial control and effective and timely margin analysis. Due to the ineffective and untimely capturing of information on the SAP system significant effort is required to ensure that all revenue and costs are accurately accounted in financial records. Tracking all of these transactions through a manual system (or data dumps) has proven to be extremely labor intensive and time consuming. Basic human errors and a lack of in-time data capturing occur due to the manual capturing of data.

If these financial control deficiencies are not addressed, AHZA will continue to struggle with gross marginal analysis which consists of reconciling revenues with the associated costs. Currently revenue amounts are available however due to inaccurate and ineffective invoicing the associated costs are missing. The result of not managing gross margin leads to problems with breakeven and profit reporting and the margin may ultimately slowly deteriorate and lead to cash flow problems.

An opportunity or need arises for documenting the *CS order* or Aircraft Maintenance Process is one of AHZA's primary business processes. The process maps can be used by management to control processes (against a benchmark standard) and supervise employees, employees seen that the documents can act as a guide to perform their jobs, internal training and lastly, but most importantly, to provide the basis for continuous improvement. These documented processes can address and resolve any existing gaps or challenges in the end-to-end processes and highlight failure points in process integration and communication between role players. The documents should be in a visual format and employees at all organizational levels should be able to understand it.

1.3 Project Aim

The aim of this project is to analyse the current *Customer Service (CS) process* as defined in the SAP system, to identify the gaps and challenges in the process with specific focus on financial control and to accurately record all activities/tasks with potential financial implications. The documentation of

detailed workflow or business process procedures and guidelines is envisaged as a major deliverable of this project and all processes will need to be documented in a visual format and presented in a referenced, user-friendly and accessible electronic repository as the basis for management control, training and continuous improvement. Project objectives include increasing financial control, closing communication gaps and standardizing the processes thus ensuring that process tasks are always performed in the same manner.

1.4 Project Scope

The project scope consists of end-to-end business process mapping of the *CS order process* which is aligned with the ERP system. The overall project involves an in-depth investigation of business processes, identifying and closing of gaps between the SAP system and all processes, generating electronic repository alternatives, and providing training to increase employee awareness of the importance of accurate, timely information, adherence to correct procedures when capturing information on SAP.

The current process was analysed during numerous work sessions with management and the employees involved in the process. These sessions consisted of knowledge transfers, identifying challenges/issues, gaining information and knowledge on all relevant activities/tasks and clarifying business rules and internal controls. A team of SAP consultants from Britehouse was responsible for aligning the SAP system with business processes, developing certain detailed design documents or system manuals and training and supporting AHZA system users. The industrial engineers from Institute for Business Efficiency, acting as the industry sponsor, supervised and supported the student during the project execution as seen in Figure 3.

The student's project supports the review and documentation of the as-is processes, identification of gaps and failure points and the development of selective to-be processes.

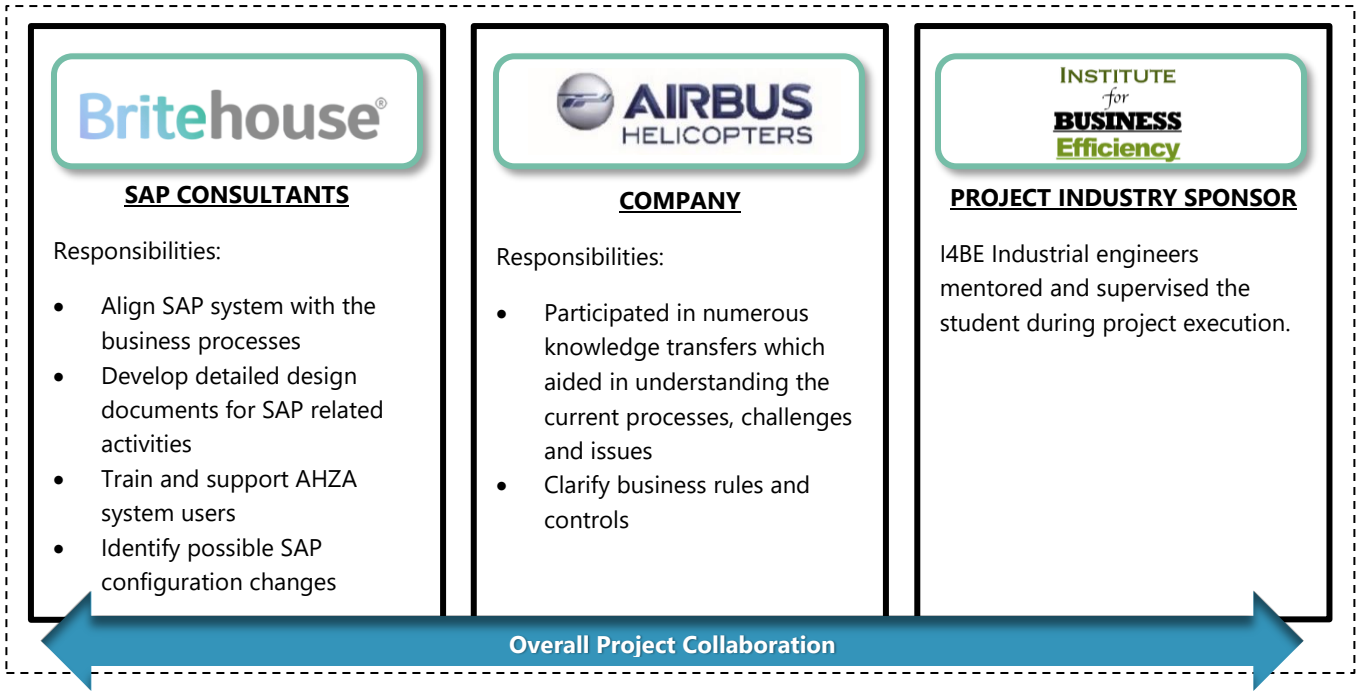


Figure 3: Project Collaboration

1.5 Project Approach

The Generic Project Approach, based on the Design Science Approach (Peffers, 2007), was integrated with the BPI methodology, discussed in Chapter 2, to create a new project approach. The customized approach (Table 1) ensures that only the most appropriate and relevant steps are pursued and the correct IE tools are considered to ultimately lead to the successful execution of the project.

An outline of the Generic Project Approach is provided below (Figure 4). This document addresses each of these approach steps, the detail of step 1 and 2 can be found in the indicated chapter sections. Steps 3-5 are incorporated in the BPI approach as seen in Table 1 and the detail of these steps can be found in the chapter sections listed.

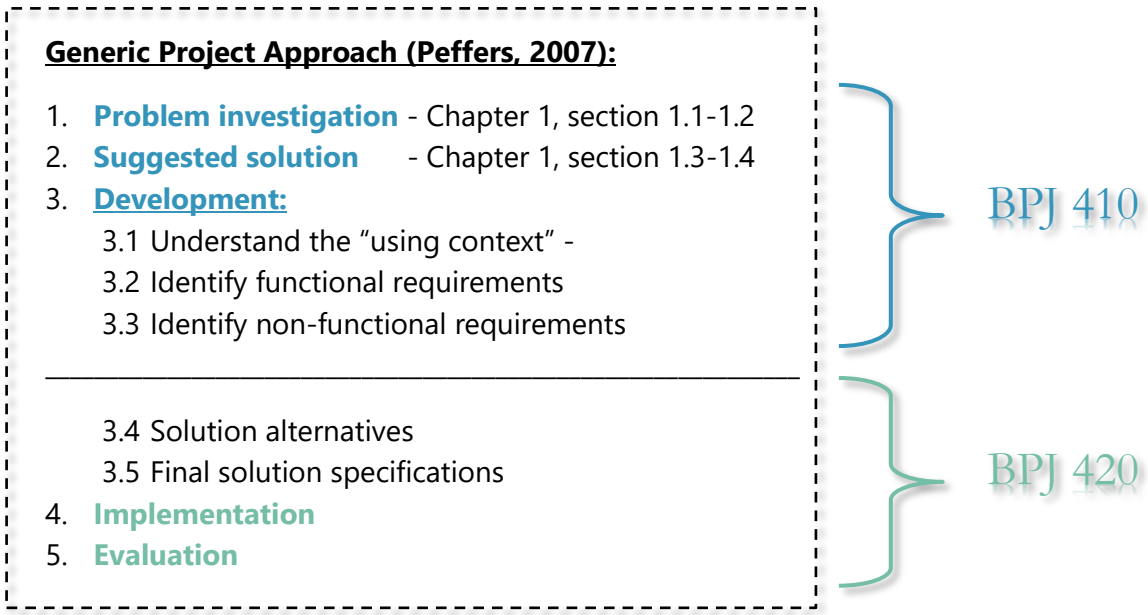


Figure 4: Generic Project Approach

Project deliverables

This project provides a literature study on the business process improvement (BPI) methodology, performance measures, process maturity as well as a change management model. The document delivers process maps of the current *CS order process* as well as an analysis of these maps. Possible changes and improvements to the as-is processes, detailed design documents and to-be process designs form part of the project deliverables. A change management plan, informal implementation plan and a solution evaluation strategy was also formulated to guide AHZA through the final phases of the project.

Table 1: Custom BPI project approach

Model-based and integrated process improvement (MIPI) methodology				
	Step description:	Technique/tool:	Methodology, refer to:	Application, refer to:
BPJ 410 Project Proposal	**Step 1: Understand the business needs**			
	• Identify the opportunity/problem • Develop vision and strategic objectives • Develop organizational model • Evaluate current practices, prioritize objectives • Determine project scope • Decide on measurable targets	a. Organizational model b. JAD sessions & interviews	a. N/A b. Ch.2 sec. 2.5	a. Ch. 1 sec.1.1 b. Ch. 3 sec 3.4.2 ***3.1 "Using" context***
BPJ 410 Preliminary Project Report	**Step 2: Understand the current process**			
	• Identify the business process components • Scope and define the process • Capture and model as-is process information • Model the as-is process	a. SIPOC diagram b. As-is analysis (process flowchart) c. Capability maturity model (CMM)	a. Ch. 2 sec. 2.1 b. Ch. 2 sec. 2.3 c. Ch. 2 sec. 2.2	a. Ch. 3 sec. 3.2 b. Ch. 3 sec. 3.3.2 c. Ch. 2 sec. 2.2 ***3.1 "Using" context***
	Step 3: Model and analyze the process			
	• Verify and validate the model • Analyze the business process • Identify process gaps • Define functional and non-functional requirements	a. Cause and effect analysis b. JAD sessions & interviews c. JAD sessions & interviews	a. Ch. 2 sec. 2.4 b. Ch. 2 sec. 2.5 c. Ch. 2 sec. 2.5	a. Ch. 3 sec. 3.4.1 b. Ch. 3 sec. 3.4.2 c. Ch. 4 ***3.2 – 3.3 Requirements analysis***
BPJ 420	**Step 4: Consider solution alternative and select final solution**			
	• Compare software and storage solution alternatives based on defined requirements and select the most feasible alternatives • Model new to-be process and create DDD's for all processes • Formulate KPI's for the process	a. Decision Matrix Analysis b. To-be maps & detailed design documents (DDD) c. Process Performance Measurement	a. Ch. 2 sec. 2.7 b. Ch. 2 sec. 2.3 c. Ch. 2 sec. 2.6	a. Ch. 5 b. Ch. 6 sec. 6.1 c. Ch. 6 sec. 6.2 ***3.4 – 3.5 Alternatives, solution specifications & construction***
	Step 5: Implement the new process			
	• Plan the implementation • Obtain approval for implementation • Review the change management plan • Communicate the change • Make the new process operational • Roll-out changes	a. Kotter's change model	a. Ch. 2 sec. 2.8	a. Ch. 7 ***4. Implementation***

	Step 6: Assess the new process			
	• Verify whether stakeholders are satisfied with the final deliverables • Revise whether failure points were addressed • Measure the new process performance against defined requirements	a. Stakeholder interviews	a. N/A	Ch. 8 ***5. Evaluation***

2. Business Process Improvement Principles

"You should not ask questions without knowledge." ~ W.E. Deming

A process consists of numerous activities that use resources (systems, people, tools) to transform inputs into value-added outputs. A process is a sequential set of tasks or sub-processes performed in order to achieve business objectives or to manufacture a specific product, service, good or piece of information (Boutros & Purdie, 2013). The *CS order process* of AHZA can be seen as one big business process that stretches across numerous departments.

What makes process change and improvement worthwhile? -
Andersen emphasizes the repetitiveness of a business process as an important characteristic. He feels that the fact that the process will be repeated for years to come is what makes investing in further improvements worthwhile, and that all the repetitions provide a framework for experimentations and process stabilization (Andersen, 2007). After consideration of Andersen's words, it is justified that changing and improving the *CS order process* is worthwhile seen that AHZA can expect immediate improvements as well as numerous benefits in the long-run.

AHZA requires change and improvements to stay competitive and improve customer satisfaction. Firstly, the importance of having a value chain perspective was studied by referring to and understanding the concept of Porter's value chain. The capability maturity model (CMM) and its application follows in the subsequent section, this concept aided in assessing the maturity of the processes and in determining the extent of improvements applied to the processes. The concept of Business Process Improvement (BPI) as well as concepts imbedded in the process change like process mapping, performance measures and change management was also investigated.

Business Process Improvement Approach

A variety of methodologies exists for process improvement. Six Sigma, Lean Management, Lean Six Sigma, Re-engineering, Total Quality Management, Just-In-Time, Kaizen, Poka-Yoka, Design of Experiments, and Process Excellence are all examples of popular improvement initiatives. Gershon states that the large number of available improvement approaches, all claiming to be the best way to achieve a similar goal, makes it very difficult for a company to decide which one will work for them (2010). The massive development caused by information and communication technology in all life aspects results in organizations being subjected to instant and regular changes in all aspects such as technical, organization, and operational aspects. These changes need systems, regulations, and procedures to increase the efficiency and performance of the business processes in order to achieve set goals and to ensure that the organization remains competitive. Business process improvement (BPI) is an approach that aims to improve business process in a way that makes improved product and service available to the consumer (Rashid & Ahmad, 2013).

Model-based and integrated process improvement (MIPI)

The BPI methodology was selected to structure and drive this project. It is an appropriate tool seen that the model-based and integrated process improvement (MIPI) methodology provides a step-by-step map to make knowledgeable, consistent and sufficient changes to business processes (Adesola

& Baines, 2005). MIPI is an approach that brings about significant improvement ofthe effectiveness and efficiency of any business process whilst ensuring that improvements are maintainable in the future. The primary components required to improve business processes are: management support, development of a measurement system and focusing on the process (Harrington, 1991). The MIPI approach recommends numerous IE tools to aid in executing each of the approach steps (Table 1), these tools and techniques are listed and discussed in the subsequent sections and form part of the MIPI toolbox (Figure 5).

As seen in Table 1, the first step of the MIPI methodology is to identify the problematic business processes and select the process to be improved. The second step consists of mapping the sequence of the activities by creating the as-is model, these maps and models aid in understanding the process. The process is improved and all the changes to the process is documented by creating a to-be model. The new process is implemented and performance measures are developed to analyse the new improved process. Finally, the last step of the methodology consists of reviewing the new process to determine if any further improvements can be made.

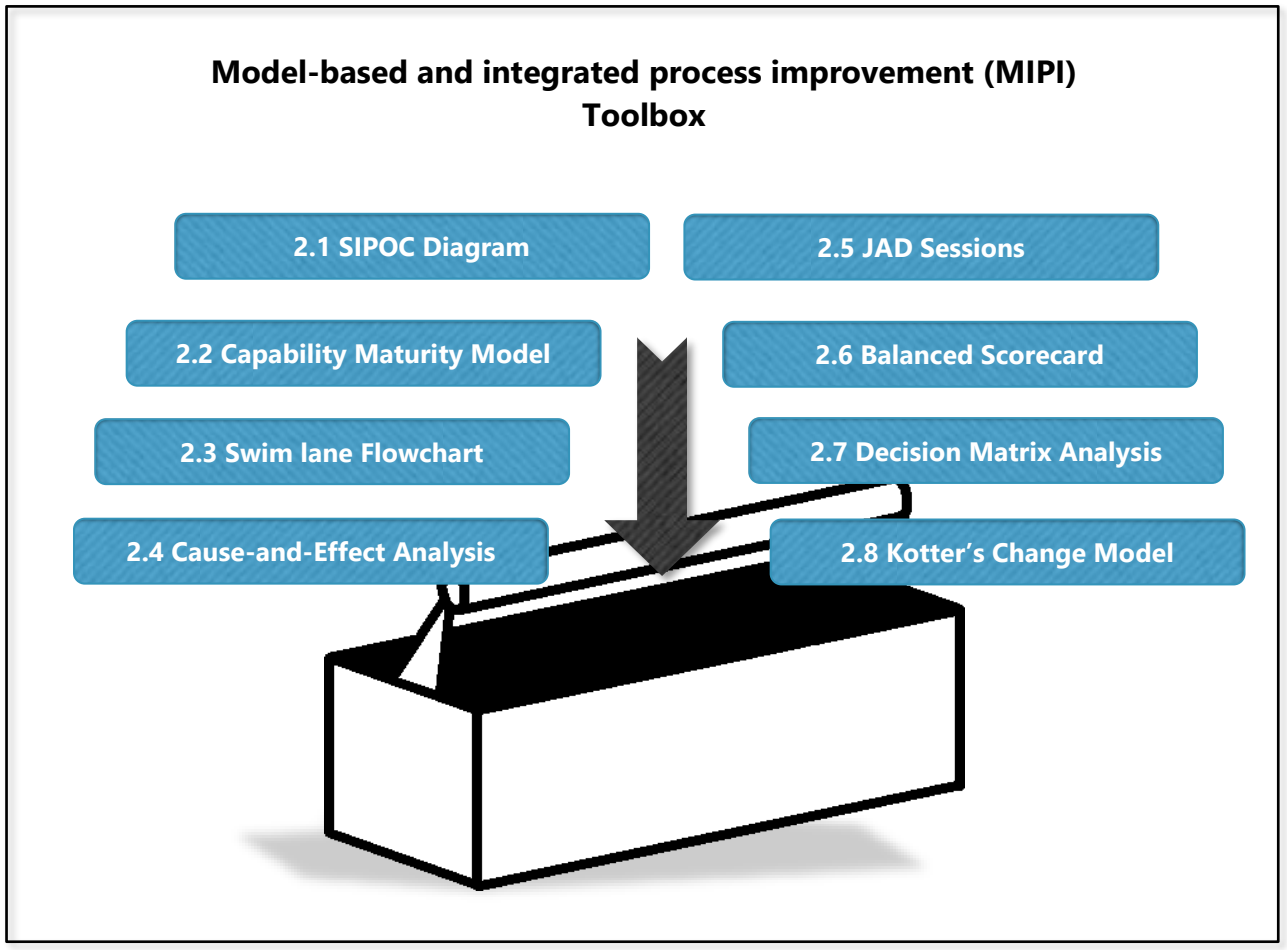


Figure 5: Business process improvement toolkit

2.1 SIPOC Diagram

A SIPOC diagram (supplier-input-process-output-customer) is a very useful tool seen that it facilitates gathering appropriate data, which is affecting the process, in a systematic way. The diagram aids in identifying and understanding all of the influences that affect the behavior and performance of the process (Raynus, 2016).

Montgomery recommends using a SIPOC diagram as part of the first steps towards a problem solving process for quality and process improvement (Montgomery, 2013). The diagram helps to identify and measure the current business activities (as-is) while defining the process scope and what it involves before starting to construct process maps (ISConsulting, 2008). This tool was selected as part of the project improvement toolbox seen that it was the first step towards getting a clear high-level view of the *CS order process*. The steps of creating a SIPO process definition is shown in Figure 9.

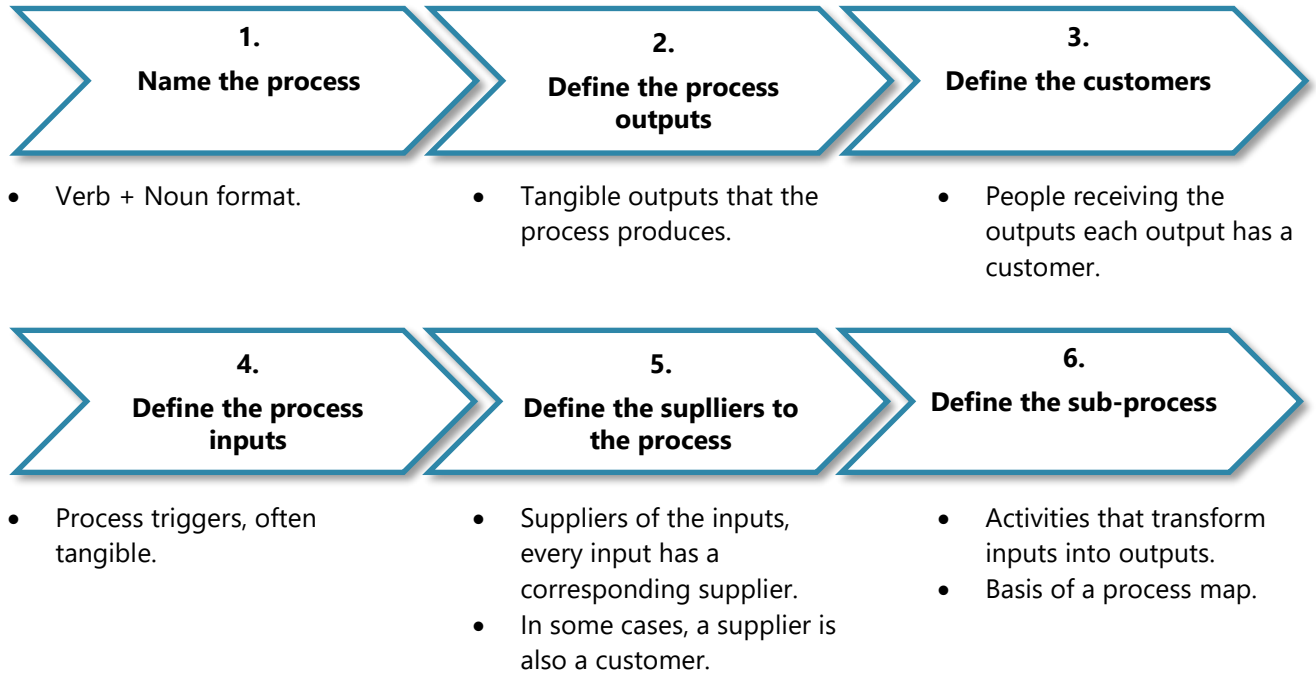


Figure 6: SIPOC diagram steps

A SIPOC diagram template, containing possible process definition pitfalls and good practice remarks, is attached as Appendix A.

2.2 Business Process Maturity

Process maturity can be defined as an indicator of how close a process is to being complete and capable of continual improvement through numerous measures and feedback. A process is considered to be mature when it is complete in its usefulness, automated, reliable in information and continuously improving (Srinivasan, 2013).

Various models/approaches have been developed to assist organizations with improving the quality and performance of their processes while moving towards business excellence. One of the most

popular maturity models is known as a capability maturity model (CMM) (Paulk, 1995) which is discussed in the following section.

2.2.1 Capability Maturity Model (CMM)

The Software Engineering Institute (SEI) originally developed CMM to measure the maturity of software development processes. However, at a later stage models were developed for other disciplines as well. A high level indicates a better software development process, thus reaching each level is a time-consuming and expensive process (Tutorialspoint, 2013).

The SEI software CMM defines five maturity states or levels. Harmon's evaluation (2004) uses the same levels however he recommends an informal and less time-consuming method of determining a company's maturity level. The models consists of the following 5 maturity levels; initial, repeatable, defined, managed and optimising (Tutorialspoint, 2013). A level 1 maturity level is associated with an organisation that has immature control over their business processes, while a level 5 maturity company exhibits fully mature business processes. Figure 10 is a visual representation of the different levels while Table 2 gives an overview of each level, the associated characteristics and possible examples.

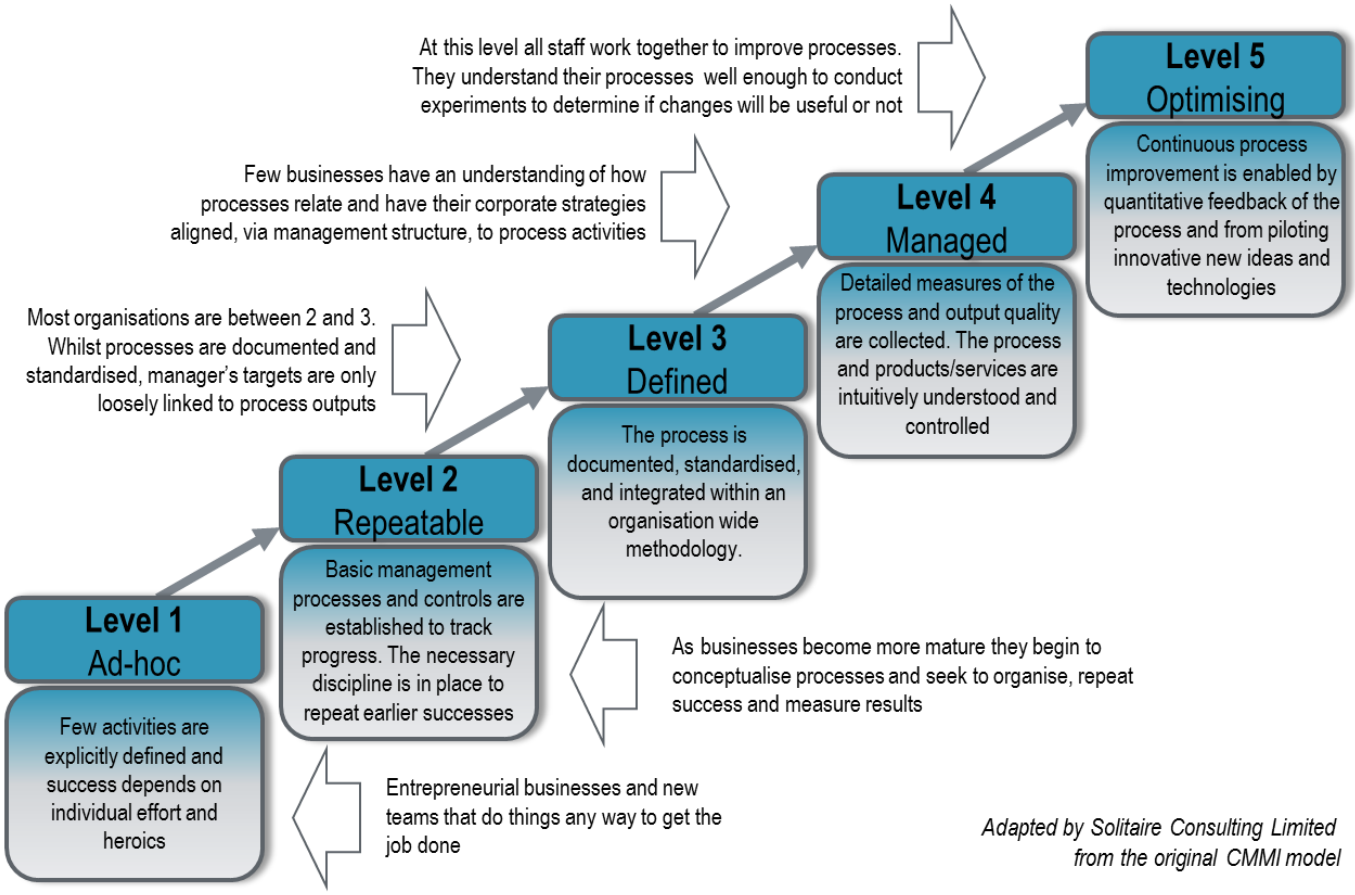


Figure 7: Process maturity levels of the CMM model (Every, 2012)

Table 2: Maturity level descriptions (Harmon, 2004)

Maturity levels, characteristics and descriptions	
Level 1: Initial	The organization is considered immature. Their processes are ad hoc, undefined, and their projects are unpredictable.
Level 2: Repeatable	Organizations have started to focus on processes and have defined some of their major processes. They can repeat some processes with predictable results, while other processes are not yet well controlled. i.e. Process modelling tools are being used and the company is investing in the process redesign methodology.
Level 3: Defined	All basic processes have been defined by the organization and they have some degree of control over them. The company has started to emphasize the collection of data and use measures to help manage their processes. i.e. Company maintains processes in a repository.
Level 4: Managed	Emphasis has been put on the organisations processes by the management team. They have gather data consistently and have well defined process measures. The managers depend on measures and data when planning projects and establishing goals. There is a hierarchical alignment among project managers, so that the achievement of sub process goals reliably contributes to the achievement of super process goals, and all work to achieve the organization's overall goals. i.e. SCOR models are used by companies to organize their supply chain process.
Level 5: Optimizing	Organizations have informed their employees on the processes and encourage them to take part in the continuous effort of refining and improving the processes. i.e. The company has a Six Sigma program and the process has trained Green or Black Belt's the on team.

CMM is an effective and informal methodology and a simple approach for managers to determine the business process maturities. The main goal of the maturity analysis was to determine the current state of the *CS order process* as well as the next target level AHZA is capable of reaching while shifting the focus of employees towards a process-orientated perspective (Harmon, 2004).

CMM Conclusion

The CS order process was classified to be in the middle of maturity level 1 *ad hoc* and maturity level 2 *repeatable*. The majority of the processes were classified as *initial* maturity processes seen that few activities are clearly defined and the existing process documentation is out-of-date and incomplete. Each employee is completing tasks in a different manner and no processes are enforced. Due to employees doing anything in order to get the job done, it is difficult to define appropriate process measures. The main goal of this project was to deliver the necessary process documentation to ensure process maturity improvement from level 1 *initial* to level 2 *repeatable*. The documented processes helped to define and integrate each of the processes in the CS order process to ultimately provide AHZA with a steady foundation to progress to a level 2 maturity.

2.3 Process Mapping Technique

According to the MIPI methodology an understanding of the current state and defining the weak points of the process is important before being able to improve the process. It is crucial to gain a detailed and precise picture of how it is actually working, involving the strengths and weaknesses of the process (Rashid & Ahmad, 2013). Not only is it important to understand the process, it is required to document the process as well. Process documentation, also known as process mapping, provides important tools for evaluating, understanding, improving and redesigning a process (Hunt, 1996). According to Hunt process mapping is a method to visually identify and analyse the current as-is business processes, identify improvement opportunities and ultimately develop to-be processes (1996).

The methodologies and notations commonly used include flowcharts, the Integrated Definition (IDEF) modelling languages, Event Driven Process Chains (EPC) and the Business Process Modelling Notation (BPMN) (Ingram, 2013). These process mapping alternatives were considered to model the process however swim lane flowcharts were ultimately used due to their simple and easy-to-understand nature (MindToolTeam, 2016). This concept is discussed in the following section.

2.3.1 Flowcharts

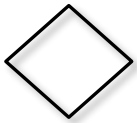
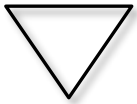
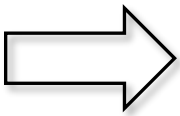
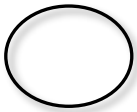
Frank Gilbreth introduced the concept of flowcharts in 1921, which quickly became an industrial engineering tool to visually present all process-related information. Flowcharts are easy-to-understand diagrams that show how process steps fit together. The charts consist of a variety of symbols representing different activities as well as the sequence of events (MindToolTeam, 2016).
According to Hebb the majority of flowcharts consist mainly of only a few process-related symbols, these are usually the: terminator, process, decision, document and the connector symbols (2010). He states that if you use other flowcharting shapes, many people won't know what they represent, so you may want to add a symbol key to the flowchart (Hebb, 2010). Table 3 depicts and describes the most frequently used symbols in flow charts.

The following guidelines can be used to construct a flow chart (MindToolTeam, 2016):

1. Identify tasks and decisions that are made during the process.
2. Organize and document the tasks in the correct order.
3. Test each of the steps within the process sequence.
4. Challenge the process steps to identify improvement opportunities, efficiency and bottlenecks.
5. Finally, test your flow chart to ensure that it realistically and accurately represents the process, and that it shows the most efficient way of doing the job.

Most process mapping concepts are valid for the majority of notations. Process hierarchy and swim lanes are important principles that help improve the usability and readability of process maps.

Table 3: Flow chart symbols (Hebb, 2010)

Symbol	Name	Explanation
	Activity or process	A Process or action step. Description includes a verb.
	Terminator or terminal	Terminators indicate the start and stop triggers/points in a process. When a start symbol is used, it represents a trigger action that sets the process flow into motion.
	Decision or conditional	Indicates a question or fork in the process flow. A typical decision flowchart shape is used when there are 2 options.
	Storage	Most commonly indicates storage of raw materials. Usually a noun.
	Movement or transportation	Indicates that goods are being transported.
	Inspection	The symbol shows that the process output is being evaluated for quality purposes.
	Delay	The symbol depicts any waiting period that is part of a process.
	Data	The shape indicates inputs to and outputs from a process.
	Connector	A Connector indicates a shift from one point in the process flow to another, they are used to indicate jumping to and from a sub-processes defined in a separate area than the main flowchart.
	Document	The document flowchart symbol represents a process step that delivers a document.
	Direction or flow	Flow line connectors indicate the process flow direction.

Process Hierarchy

Functional decomposition consists of decomposing a complex system into smaller pieces which can be more easily managed. "… in its most basic form … is a simple hierarchical decomposition of the functions with associated performance requirements." (Berklich, 2011). A complex problem is decomposed into layers of more manageable and understandable pieces, resulting in a structured function chart that presents the problem and/or solution in levels of increasing detail.

Why use this method? According to Berklich the following points make functional decomposition worthwhile (2011):

• Functional decomposition aids in understanding the system and its components, it's interactions and interfaces are useful tools in providing requirements insights for both analysis and design.

• It will also allow satisfying the users' needs both stated and unstated by providing direct traceability to capabilities and on requirements.

As seen in Figure 11, the lower level functions/processes completely describe the parent, a lower level cannot exist unless it is included within its parent function/process (Berklich, 2011). The following levels describe the process hierarchy, ranging from the highest-level, the value chain to the lowest level or the execution steps;

Level 1: Value chain
Level 2: Process
Level 3: Sub-processes
Level 4: Activity
Level 5: Task
Level 6: Steps

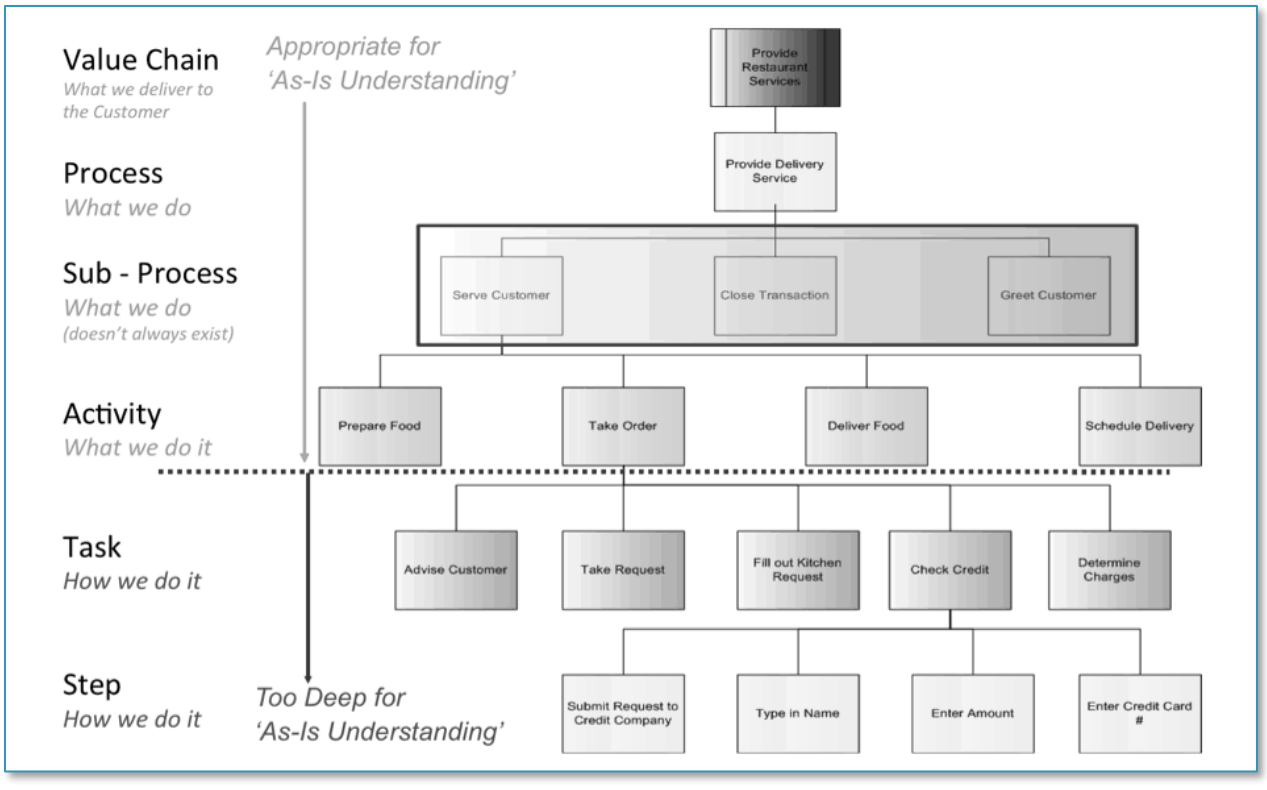


Figure 8: Process hierarchy example (BRCommunity, 2008)

Swim Lanes

A swim lane diagram also known as a cross-functional diagram, is a process flowchart that provides more information on who does what (Niat, 2005). The diagram as seen in Figure 12, shows columns and rows, each considered as a lane, representing a specific functional area or department. A functional area may represent a department or individual who is responsible for executing the step. Each lane represents a different area of responsibility while each step of the process, or block on your workflow, is listed in chronological order in the appropriate lane (Richards, 2010).

According Niat the following steps can be followed to create a swim lane diagram (2005);

1. Identify the lanes and assign the departments you need represented by them and label them.
2. Start your chart by defining the starting point of the process. Add a rounded rectangle to the top of the appropriate swim lane to indicate its starting point and label it.
3. Add steps. Each step should be connected to the previous one with a connector. When constructing the steps in the same swim lane, always draw from top to bottom. To add a step in another department, go from left to right. With each step, describe what it represents until you reach the end of the process. The arrows in-between the steps refer to the transfer of flow or information.

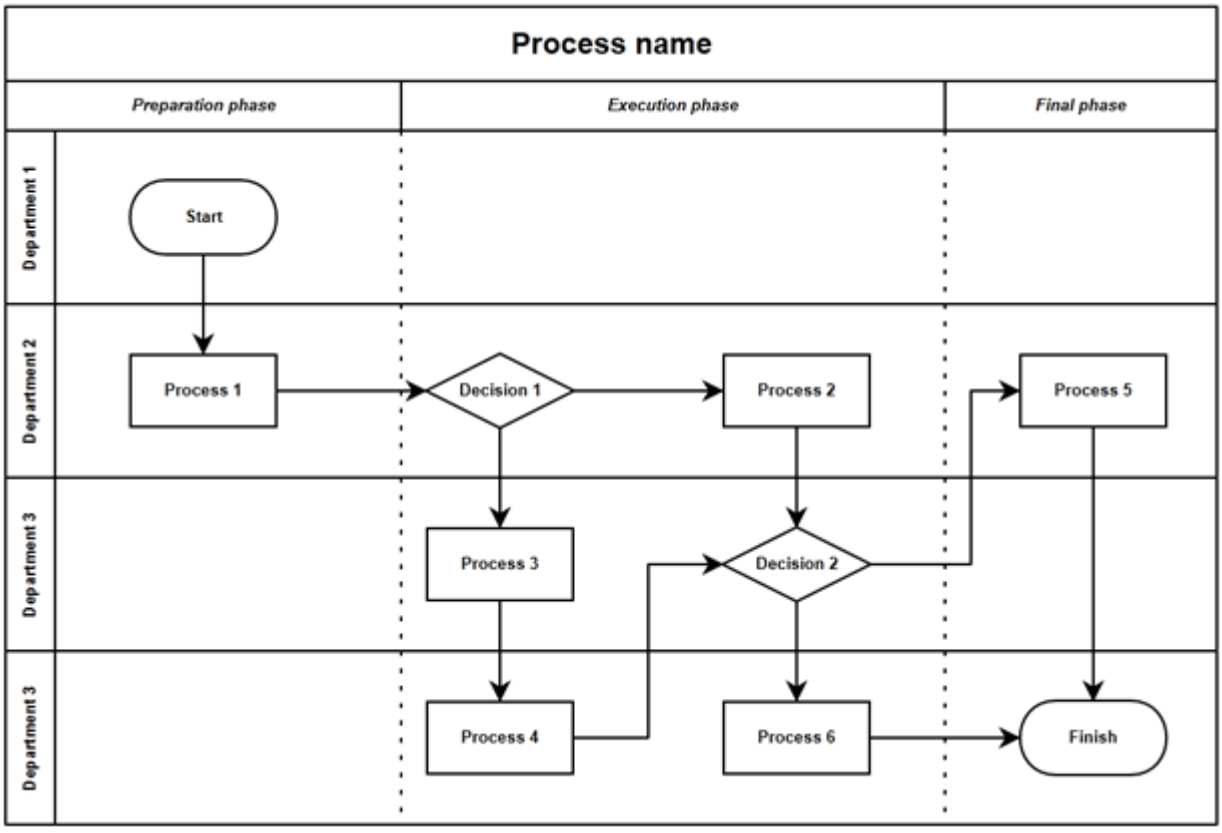


Figure 9: Swim lane diagram template (Grapholite, 2010)

Flow charts are tools that aid in understanding business processes. The primary purpose of the diagram is to document the process while identifying possible improvement opportunities

(Harrington, 1991). According to Harrington it is crucial to realize that improvement doesn't come from constructing flow charts, but by analyzing them (1991).

2.4 Cause-and-Effect Analysis

Root cause analysis, also known as cause-and-effect analysis, is a structured team activity that assists in identifying hidden factors or causes of an unfavorable event. Understanding the contributing factors or causes of failures within business processes can help develop actions that sustain the corrections thereof (API, 2014).

A cause-and-effect diagram, often called a "fishbone" diagram (see Figure 13), consists of brainstorming to identify possible causes of a problem and in sorting ideas into relevant categories. A fishbone diagram is a visual method of looking at cause and effect. The problem or effect is displayed at the head or mouth of the fish. Possible contributing causes are listed on the smaller "bones" under various generic cause categories like man, machine, method, environmental, measures and materials. A fishbone diagram is helpful in identifying possible causes for a problem that might not otherwise be considered by directing the team to look at the categories and think of alternative causes (API, 2014).

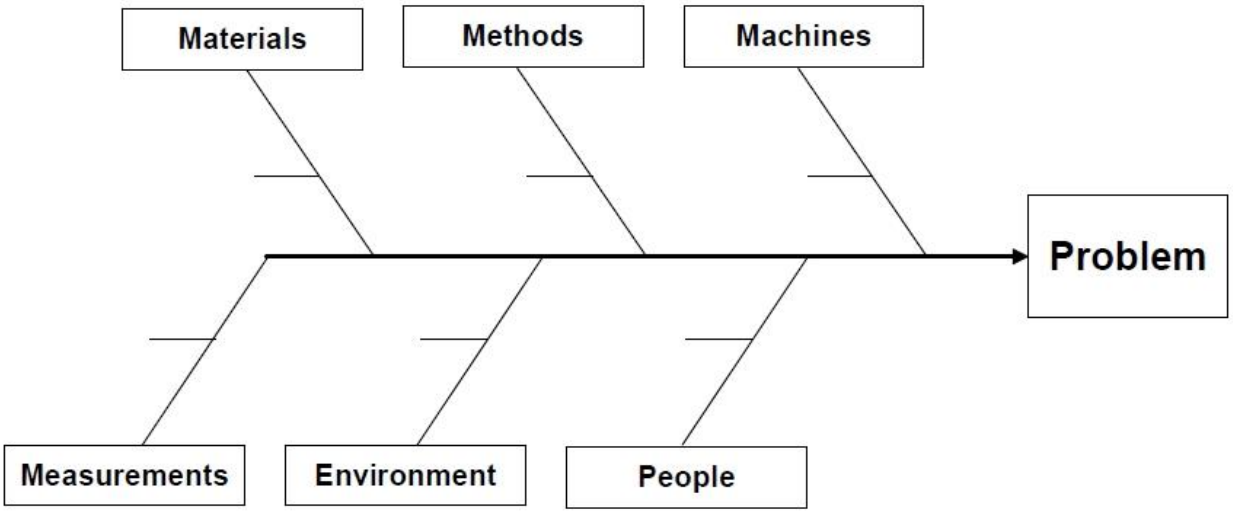


Figure 10: Cause-and-effect diagram template

The cause and effect diagram is an appropriate tool in the context of this project seen that it served as primary analysis to determine the potential causes of ineffective CS order process at AHZA.

2.5 JAD Sessions

A JAD session is a technique used to rapidly reach an agreement between a group of individuals. The technique mainly applies to software development however it can also be applied to numerous other areas. The primary concept of a JAD session is to get all of the major decision makers, system users and stakeholders together. Such a get-together dramatically reduces the time required to gather information seen that the flow of information and knowledge across the different departments occur

at once thus person to person information sessions are eliminated (Mochal, 2002). Without the quick start that a JAD session provides, the early project initiation and specification work on a project cannot be finished in a short enough time frame (Knowledge Structures, 1998).

The following 6 points summarise exactly what the execution of JAD sessions do/aim to achieve (Knowledge Structures, 1998):

1. **Simplify** – integrate months of meeting and one-on-one sessions into a structured work session.
2. **Unify** – the output from one phase of development is input to the next.
3. **Identify** – problems and participants.
4. **Quantify** – processing as well as information needs.
5. **Satisfy** – the customer defines the system thus it is "their" system. Shared participation brings a shared outcome. Everyone becomes committed to the systems success.
6. **Clarify** –all requirements agreed upon in the session.

Due to the versatility and effectiveness of this tool it greatly contributed to the successful and timely execution of this project.

2.6 Process Performance Measurement

Measuring performance is another crucial component of the MIPI methodology. Process measurement before and after it has been altered is crucial to be able to determine if improvements have been achieved. Companies need to make a shift from monitoring to management; from measurement to management and from management to direction setting (Nair, 2004).

A performance measure is a quantifiable indicator used to assess how well a company is achieving its objectives. Many businesses routinely review various performance measure types to assess results, production, demand and operating efficiency in order to obtain a more objective sense of how their business is operating and whether improvement is required (WebFinance, 2013). Figure 11 gives an explanation of the measures classed as either a key result indicator, a performance indicator, or a key performance indicator (Parmenter, 2010).

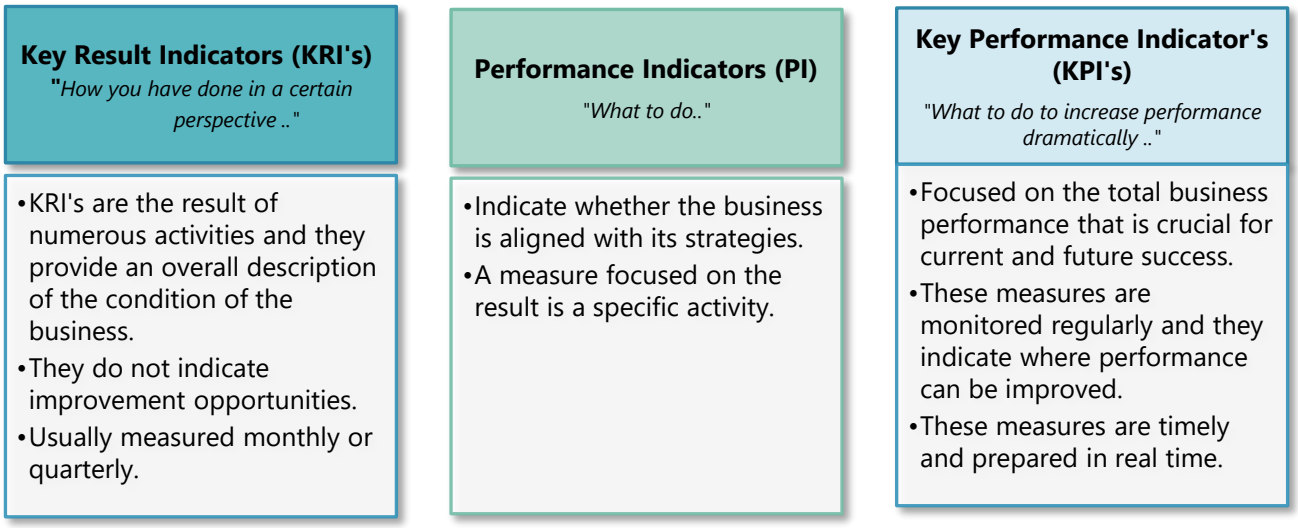


Figure 11: Types of performance measures (Parmenter, 2010)

Kaplan and Norton recommend no more than 20 KPIs while Parmenter (2010) recommends the 10/80/10 rule as a guide. The rules states that that about 10 KRIs, up to 80 PIs, and 10 KPIs in an organization is sufficient (Parmenter, 2010). It is crucial for a company to develop the right performance measures that will make a difference to their performance (Parmenter, 2010). Parmenter suggests using the Balanced Scorecard as an approach to align the company's strategies with the performance measures (2010). The discussion of the concept of a Balanced Scorecard follows in the next section.

Balanced scorecard

According to Niven a balanced scorecard is not about a strategy; it is about making strategy possible (2010). A balanced scorecard can be defined as a set of measures that gives top management a fast but comprehensive view of the business. Kaplan & Norton explain that the balanced scorecard should be seen as the dials and indicators in an airplane cockpit. For the pilots to be able to fly the airplane they need detailed information concerning many aspects of the flight, focusing on only one aspect can be fatal. Similarly, the complexity of managing a company requires that managers view performance in several areas simultaneously (Kaplan & Norton, 1996).

The balanced scorecard gives managers a snapshot view of the four most important aspects of their business and answers to the following four basic questions (Kaplan & Norton, 1996):

- How does customer see the company? (customer perspective)
- What must the business excel at? (internal perspective)
- Can the company continue to improve and create value? (innovation and learning perspective)
- How does the company look to the stakeholders? (financial perspective)

The financial measures indicate whether the financial objectives were achieved and what the economic consequences are of the decisions made. The customer perspective identifies the market segments and measures the outcomes that indicate whether the business strategy is well-defined. The innovation and learning perspective identifies the gaps between an organization's people, systems and procedures, including the measures that show how to close these gaps in order to achieve and maintain growth and improvement in the long-run. Finally the internal business process measures focus on the processes that affect customer service and they highlight new processes that need attention in order to meet organizational objectives (Kaplan & Norton, 1996).

Parmenter recommends including two more perspectives to the balanced scorecard: employee satisfaction and the environment/community. He states that the satisfaction of the employees and staff should be closely monitored, because the happiness and morale of employees directly impact customer service. The environment/community consists of implementing green initiatives, minimizing waste and having a positive impact on the surrounding community. Figure 15 displays the six perspectives of the balanced scorecard as defined by Parmenter.

Performance measurement is crucial to effectively manage processes and the organization as a whole. Creating the correct and relevant KPI's to measure the performance of the *CS order process* was an important deliverable to ensure future monitoring, management and control of the processes. The

balanced scorecard concept was applied, but it will measure the primary processes instead of the standard four areas as defined by Kaplan and Norton.

Figure 12: Parmenter's balanced scorecard (2010)

2.7 Decision Matrix Analysis

BusinessDictionary.com defines a decision matrix as "a table used in evaluating possible alternatives to a course of action". Its purpose is to help management weigh and arrange all alternative options, especially when relevant options do not differ significantly in terms of performance, cost and complexity to only name a few. The matrix guides the user toward deciding between several options, where you need to take a number of different factors and attributes into account (Martin, 2016).

In short, the Decision Matrix consists of listing your options as rows on a table, and the factors you need consider as columns. Each option/factor combination should be scored after which you weight this score by the relative importance of the factor, and add these scores up to give an overall score for each option (MindToolsTeam, 2012). Although this might seem complex, the technique is actually quite easy to use, a simple template of a Decision Matrix is shown in Figure 13.

A more comprehensive discussion of the tool follows (MindToolsTeam, 2012):

- **Step 1:** List all of your options as the row labels on the table, and list the factors that you need to consider as the column headings. For example, factors to consider might include cost, compatibility, and reliability etc.
- **Step 2:** Next, work your way down the columns of the table, scoring each option for each of the factors in your decision. Score each option from 0 (poor) to 5 (very good). Note that you do not have to have a different score for each option – if none of them are good for a particular factor in your decision, then all options should score 0.
- **Step 3:** The next step is to work out the relative importance of the factors in your decision which is referred to as the criterion weight. Show these as numbers from, say, 0 to 5, where 0 means that the factor is absolutely unimportant in the final decision, and 5 means that it is very important.

- **Step 4:** Multiply each of your scores from step 2 by the values for relative importance of the factor that you chose in step 3. This will give you weighted scores for each option/factor combination.
- **Step 5:** Finally, add up these weighted scores for each of your options. The option that scores the highest wins and is ultimately selected as the final solution seen that it satisfies all required needs and outperforms or outweighs the other options it competed against.

Decision Matrix

	Criterion A	Criterion B	Criterion C	Criterion D	Criterion D	Criterion E
Option 1						
Option 2						
Option 3						
Criterion weight						

Figure 13: Decision Matrix Template (MindToolsTeam, 2012)

It is however important to note that this decision making tool is partly subjective seen that the person using it uses their instinct when allocating the various weights and points per alternative. Seen that the main objective of this project was not to conduct detailed and elaborative software comparisons, this tool was sufficient for selecting the appropriate mapping software as well as a storage solution for the to-be maps and DDD's of the CS order process.

2.8 Change Management

The MIPI methodology includes a phase where the improved process is implemented. The phase requires proper planning of the implementation strategy and the involvement of the people affected by the change. It's common for a company to feel uneasy and intimidated by the scale of the challenge when considering a small change or system wide change to their organization. The majority of businesses know that the change needs to happen, but they don't really know how to go about delivering it (MindToolsTeam, 2010).

Where does one start? Who do you involve? How do you see it through to the end? Numerous theories exist on how to incorporate change. Most of the change theories were introduced by John Kotter, a professor at Harvard Business School and world-renowned change expert (MindToolsTeam, 2010). A discussion of Kotter's model follows in the section below.

Kotter's Change Model

Kotter states that organizations have made various errors during change implementation, which have disappointing results and leave employees frustrated. Kotter based his model on the identified errors that undermine transformation and change efforts of organizations (Kotter, 1996).

The methods used in successful change implementation are all based on the insight that major change does not occur easily. Numerous barriers like inwardly focused cultures, politics, low levels of trust,

lack of teamwork and the general human fear of the unknown hinder the rate and effectiveness at which change occurs. To ensure that a change initiative is effective, a method designed to alter strategies, re-engineer processes, or improve quality must address these barriers and address them sufficiently (Kotter, 1996).

Kotter introduced the eight-step change process. Figure 16 gives a summary of these steps:

Figure 14: Kotter's change model (Paull, 2012)

These eight steps ensure the successful implementation of a change initiative. The first four steps are seen as the defrosting or warm-up activities that consists of communicating the need for change and receiving buy-in from management and employees. Kotter states that if these activities aren't executed the implementation of the initiative will be unsuccessful due to no solid base established to proceed further. The new practices are introduced during step five to seven while step eight stabilizes the change in the corporate culture of the organization (Kotter, 1996). Table 4 elaborates and describes the steps of Kotter's model.

Table 4: Kotter's change model (MindToolsTeam, 2010)

Step		Step Description
1	**Create urgency**	Change occurs easier when the whole company really wants it. A sense of urgency around the need for change has to be developed. Initial motivation to get things moving is created during this step.
2	**Form a strong partnership**	It is crucial for strong leadership and key people within the organization to convince everyone that change is necessary. Managing change isn't sufficient, it has to be led by a strong team who is responsible for building urgency and momentum around the need for change.
3	**Create a change vision**	The vision for change has to be one people can easily grasp and remember. A clear vision aids in explaining to everyone why you're asking them to do something. The vision must be focused, flexible, feasible and easy to communicate.

4	**Communicate the vision**	The vision has to be communicated frequently and powerfully to ensure the majority of people accept it. Special meetings to communicate your vision isn't enough, use the vision daily to make decisions and solve problems. A crucial tip is to demonstrate the kind of behavior that you want from others rather than just talking about it.
5	**Remove barriers**	This steps consists of identifying and eliminating the obstacles and barriers that cause change resistance.
6	**Create short-term wins**	Short-term targets with visible results should be created. Achieving these targets will motivate employees and build momentum for the change.
7	**Build on the change**	Building and improving on previous successes is emphasized in this step. It is crucial to continue making changes even after a few successes, early declaration of victory can be detrimental.
8	**Anchor the changes in corporate culture**	During the final step the change is integrate into the company culture and significant efforts are made to ensure that the change becomes part of the organization's core.

Kotter's model has set a solid foundation to be able to define the implementation strategy to guide AHZA with the future implementation of the new design for the *CS order process*.

3 Problem Investigation

"A bad system will beat a good person every time." ~ W.E. Deming

Business activities forming part of the CS-process are currently ineffective and gaps exist in the process due to a lack of:

- up-to-date documentation of business processes;
- training and training material;
- process alignment with SAP (SAP Integration);
- communication between departments; and
- performance measures

The first step was to analyse all CS-process activities on a high-level basis to understand how these activities interact and influence each other. The failure points within the process were identified by using a fishbone diagram in section 3.4.1, followed by numerous knowledge transfers, meetings and interviews with key system users and the various business process owners. Figure 17 gives a high-level visual representation of the content and structure of Chapter 3.

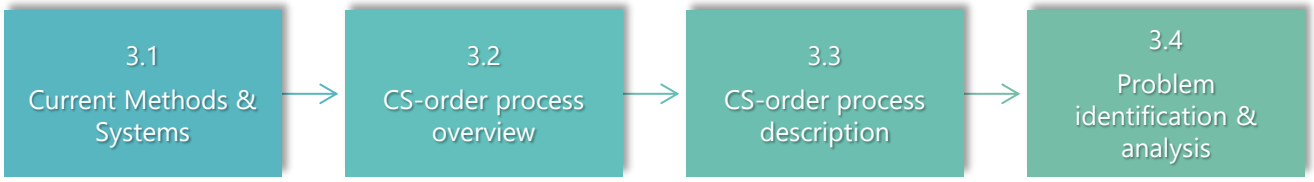


Figure 15: Problem investigation activities

3.1 Current methods and systems

AHZA uses LTB400 Aviation Software as their maintenance management and forecasting system, the software is ideal for small to medium sized aviation companies involved in the repair and overhaul (MRO) business (LTB400, 2008). SAP P20 R3 is currently used by AHZA to manage all their sales and purchasing functions. Although high-level documentation of the *CS order process* exists, it is outdated, incomplete and not representative of the actual process taking place. The business processes are ineffective and full of gaps due to these outdated documents, these documents can't be used as guidelines to help employees with their day-to-day tasks. Due to the lack of up-to-date documentation there is no way of enforcing processes seen that there are no methods/tools in place to control and manage AHZA's business processes.

3.2 CS-order process overview

One of the first steps toward business process improvement is determining the process scope. A SIPOC (supplier, input, process, output, customer) diagram allowed the student to easily identify improvement opportunities by gaining a detailed and shared visual understanding of how the process actually works (Carey, 2016). Refer to Chapter 2, section 2.1 for a detailed discussion of the SIPOC diagram. The diagram in Figure 18 was used to gain a high-level view of the *CS order process* at AHZA.

SIPOC Diagram for the CS-Order Process				
Supplier	**Input**	**Process**	**Output**	**Customer**
• AHZA Stores • External customer	• Customer information • Aircraft information (flight folio) • SAP system inputs • Components and finished goods	***CS order process***	• SAP system outputs • Documentation (detailed discussion in section 3.3.2) • Purchase orders	• Private customer/civil aircrafts • Contractual customers, mostly military aircrafts • Financial department

Figure 16: SIPOC diagram for the CS-Order process

As seen in Figure 16, the primary suppliers of inputs to the *CS order process* are external customers and AHZA's stores. Personal, order and delivery details and information is provided by the external customers while stores supplies off-the-shelf components or parts as required. The SAP system is populated with the required information to process and load the *CS order*. Once the CS order process is complete and the customer has been invoiced, the aircraft is delivered to the customer. Finally, all the *CS order process* documentation is sent to the financial department to perform marginal analysis and ensure payments have been received by all the customers.

3.3 Current process description

An as-is map of the *CS order process* aided in representing the departments, resources, activities, third parties, handoffs and decision points of the process graphically; deconstructing a process in this manner facilitates problem identification and analysis (Berg, 2008). The *CS order process* consists of numerous key activities and tasks within different departments that interact in order to complete each activity. A large communication gap exists within the *CS order process* seen that the majority of employees have no clear understanding of where the transfer points within the process are. The main process activities and transfer points became apparent after multiple knowledge transfers, interviews and constructing the preliminary process models.

The as-is process maps present the sequence of key activities as well as their interactions with one another. The as-is analysis helped identify the employees involved in the process as well as their associated roles and responsibilities.

3.3.1 Employees responsibilities & roles

According to Rever any business process is "owned" by the individuals involved in the process (2007). The *CS order process* extends across multiple departments, meaning that numerous employees from different departments influence and ultimately determine the effectiveness of the process. However, the roles of the certain employees involved in the process are not clearly defined which leads too incomplete, pending tasks which ultimately result in late deliveries.

The key stakeholders involved in the *CS order process* were identified. The stakeholders within each department have different responsibilities, see Appendix B.

Communication between departments is crucial due to the sequential and inter-connected flow of activities in the process. The effectiveness of the entire process depends on how the key activities interact and where they have cross-functional boundaries. Defining each of the roles and their interactions with each other provided a clear understanding of critical handover points as well as the individuals involved in executing the process.

3.3.2 As-is high-level map & process description

Functional decomposition, discussed in Chapter 2, section 2.3.1 was used to decompose the entire CS order process into smaller, more manageable parts. The various levels the CS order process consists of are as follow:

- Level 1: AHZA value chain
- Level 2: *CS order process*
- Level 3: *CS order* sub-processes
- Level 4: Sub-process activities
- Level 5: Tasks
- Level 6: Steps

} Sufficient for an as-is understanding

The *CS order process* itself represents the level 2 decomposition. There are 4 sub-processes within the *CS order process* as illustrated in Figure 17, the sub-process map can be seen as the level 3 breakdown. Each of the 4 sub-processes were decomposed into sub-process activities which provides the level 4 detail. These activities indicate where information and product flows occur as well as the different interactions between departments. See Figures 18 to 21 for each of the sub-process swim lane diagrams which supply the level 4 detail as well as the process failure points which will be discussed in the subsequent section 3.4.3. Each diagram has numerous lanes representing the role/department responsible for executing the task. Mapping the process in this manner, according to (Berg, 2008). also gives a sense of timing with respect to the flow of the process, as activities flow downstream to the right as time passes and the process is completed. Levels 5 and 6 were not addressed nor required for understanding the as-is process, these levels are addressed during the later phases of the project.

Numerous documents form part of the *CS order process*, these documents are briefly discussed below:

1. **Flight folio:**
   The details of each flight has to be recorded in the flight folio. The flight details include the flight hours, cycles and engine times of the aircraft.
2. **SB list:**
   The SB list contains information regarding the aircraft and its components which may be faulty or need to be replaced during the aircraft's lifetime. SB lists are sent to AHZA by the aircraft manufacturer on a frequent basis.
3. **AD lists:** Airworthiness Directives are regulations that are legally enforceable and are issued by the FAA correct an unsafe condition in a product.

4. **Component due list:**
   The due list contains all the aircrafts scheduled maintenance events, component lifetimes in months and hours, component removal date cumulative actual flight hours and the component installation dates. The events are listed/displayed according to their due dates; the most recent due events appear first; the due list is generated on LTB 400 per aircraft.
5. **Aircraft overview report:**
   This report provides a summary of all the aircrafts in the system with inspections coming up soon the report is generated on Microsoft Excel; thus it is a manual process. This report mainly covers inspections, due components and the relevant dates which influence hangar prediction planning and the hangar workload of each aircraft.
6. **Operations planning schedule:**
   Contains the maintenance sequence and forecasted schedule for an aircraft which has arrived at the hangar.
7. **DAW sheet:**
   A sheet containing all the work to be done, during the service, on the aircraft. The sheet also resembles all the information required to create a *CS order*.
8. **Work-pack:**
   A work-pack contains the following documents;
   - ✓ CS orders
   - ✓ DAW sheets
   - ✓ AD/SB list
   - ✓ Aircraft time overview report
   - ✓ Copy of model status - for both aircraft and engine
   - ✓ Test flight and ground run data
   - ✓ CA043 form
   - ✓ Company authorisation signature form
   - ✓ Aircraft inspection reminder decal (if job is performed away from bay)
   - ✓ Maintenance inspection task cards

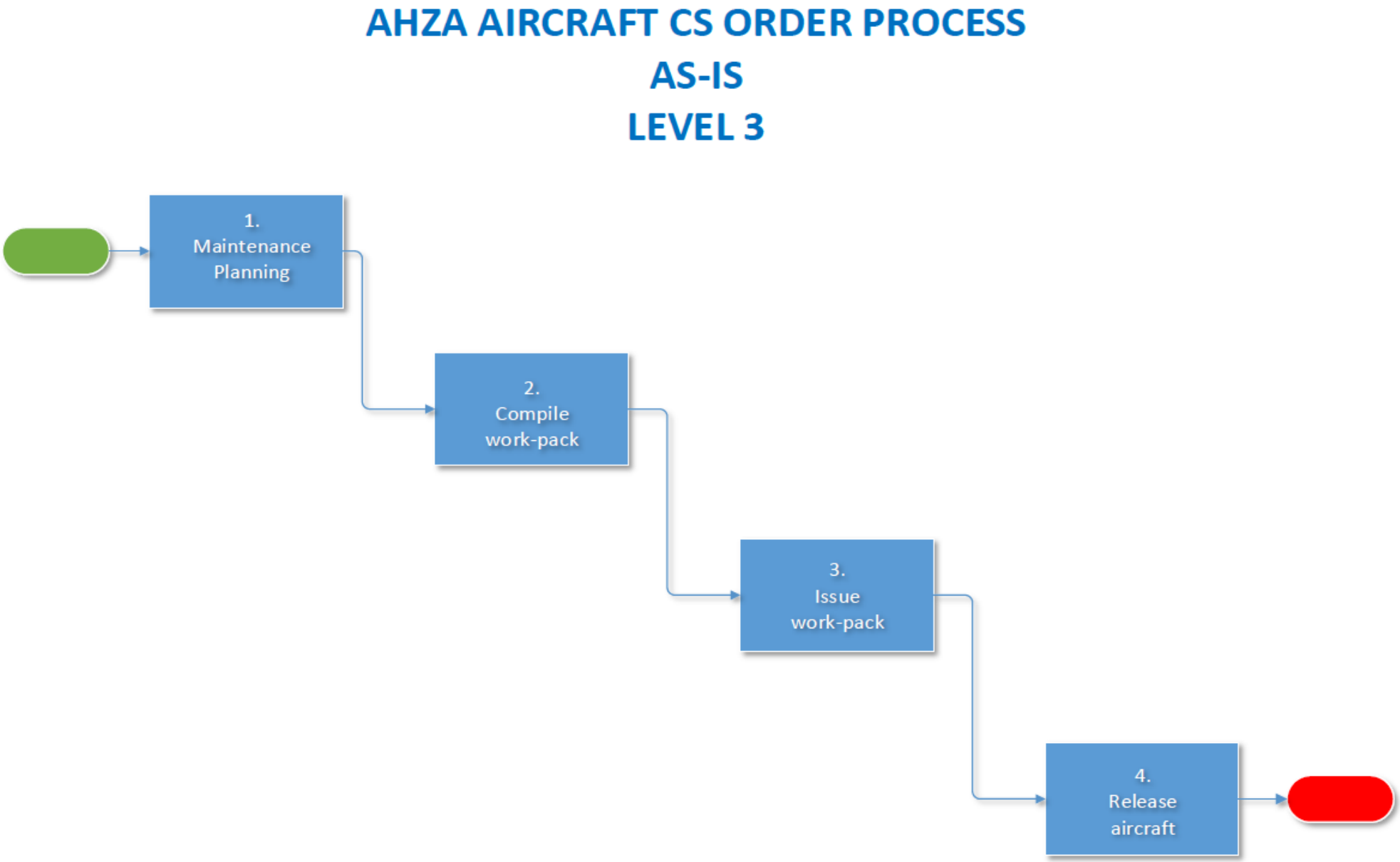


Figure 17: Level 3 process map of the CS-order process

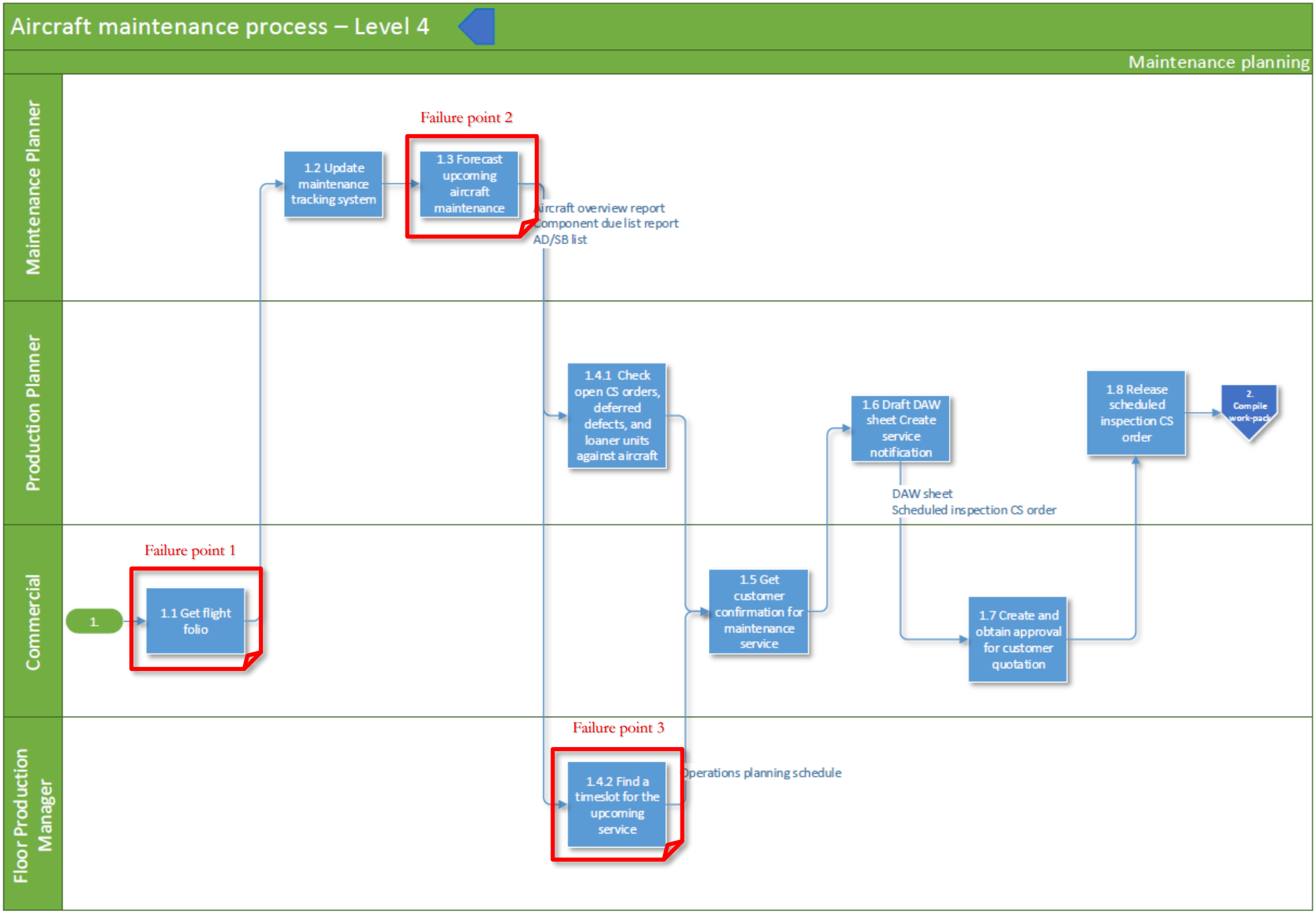


Figure 18: Level 4 process map of maintenance planning

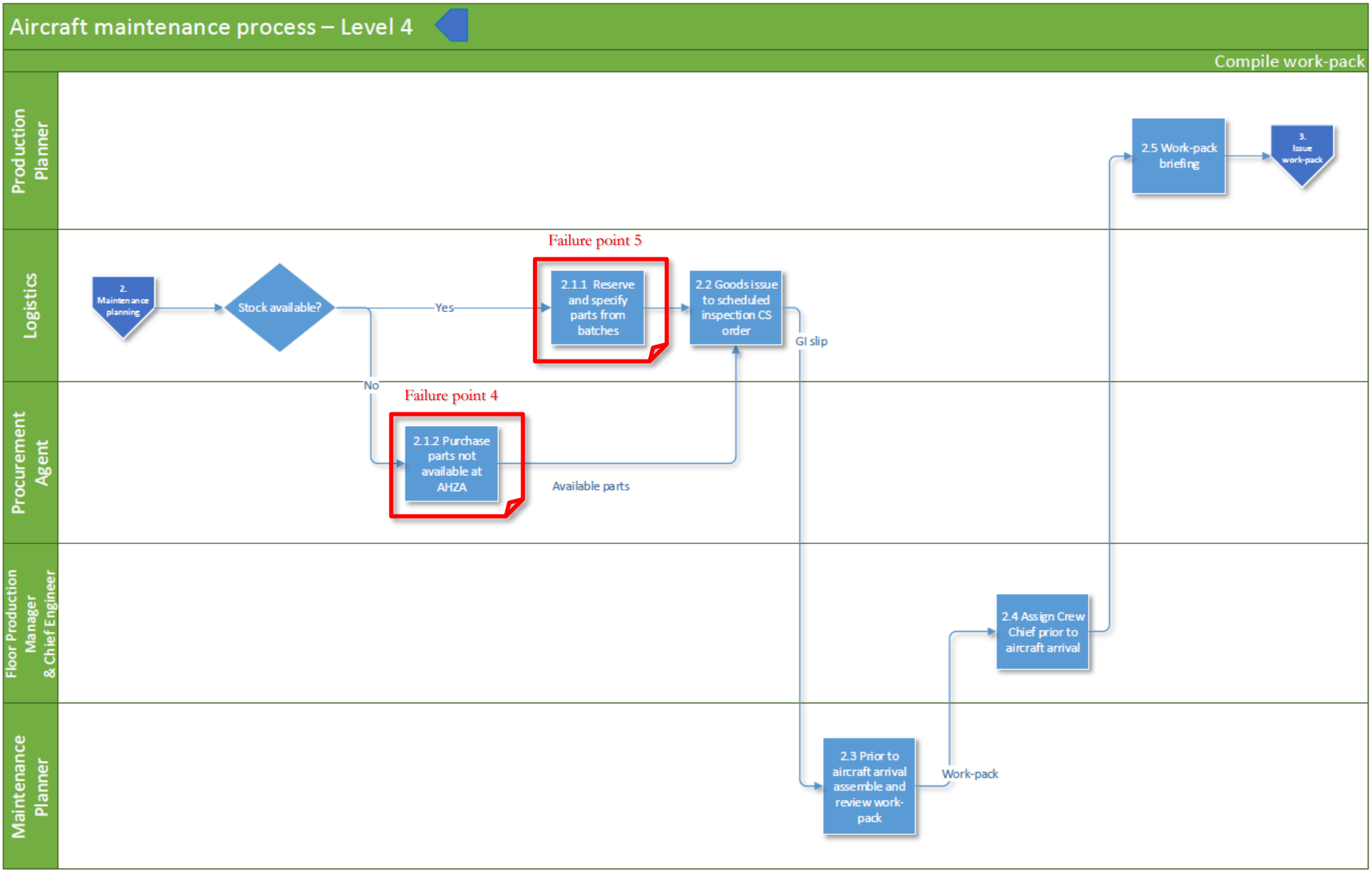


Figure 19: Level 4 process map of compile work-pack

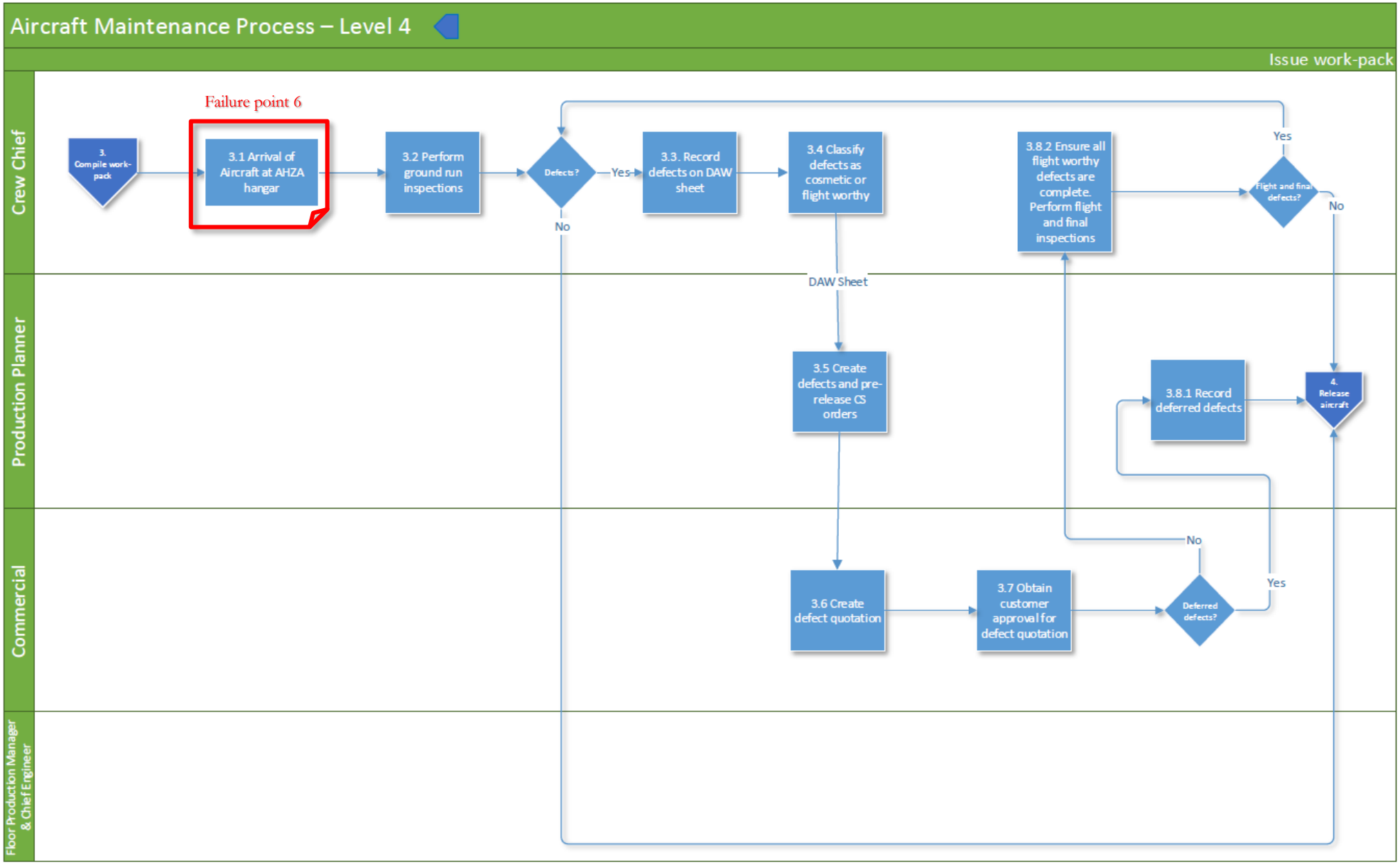


Figure 20: Level 4 process map of issue work-pack

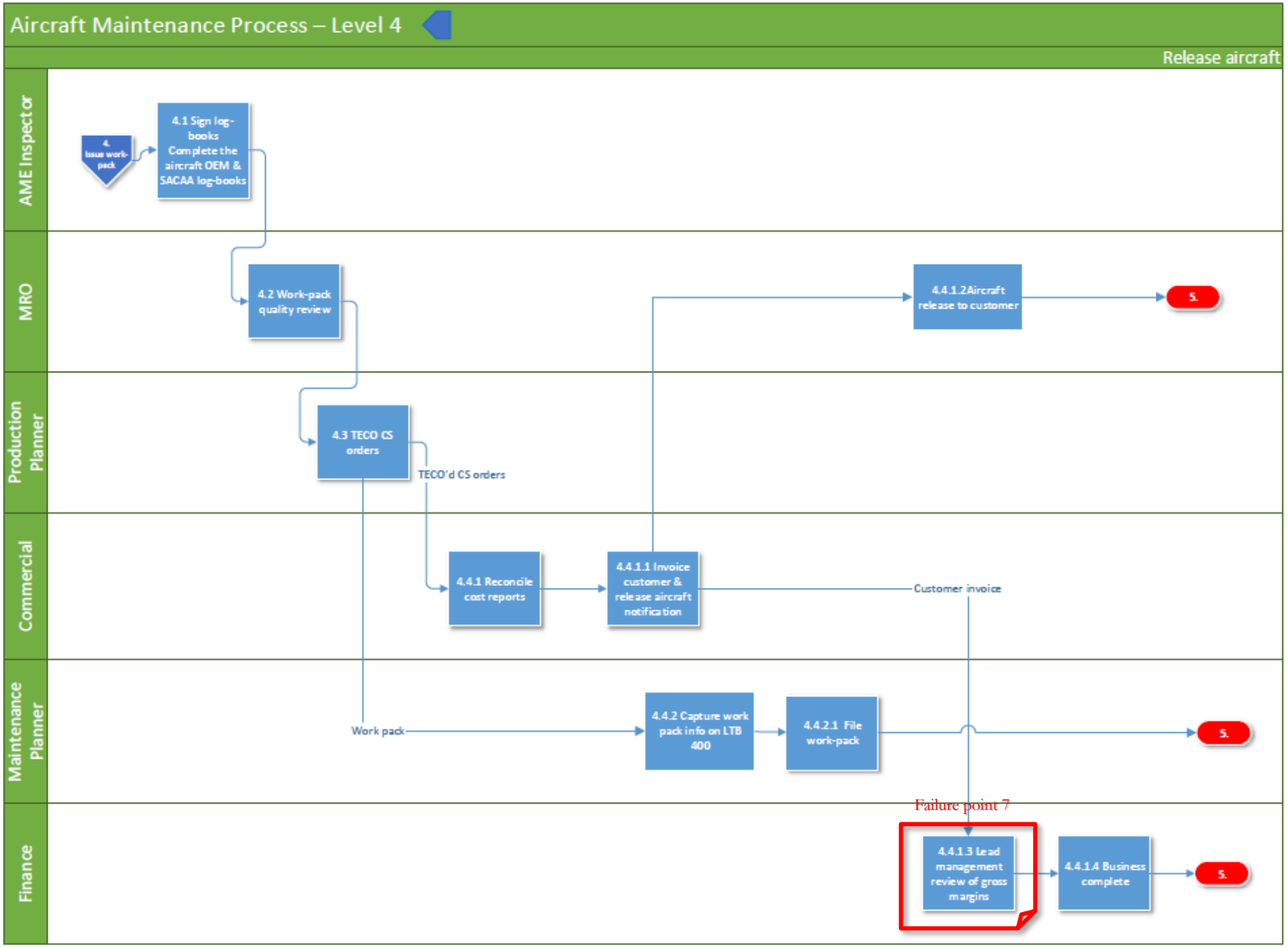


Figure 21: Level 4 process map of release aircraft

Each of the sub-processes illustrated in Figures 20 to 23, take place over numerous departments and deliver different outputs. A brief description, process deliverables and process stakeholders are listed below.

Sub-process 1: Aircraft maintenance planning (See Figure 18 for process map)

The key deliverables for maintenance planning procedure are to obtain an operations planning schedule, a scheduled inspection superior *CS order*, and a signed customer quotation.

STAKEHOLDERS:	KEY DELIVERABLES:
• **Maintenance planner** • **Production planner** • **Sales** • **Floor production manager** • **Chief engineer**	• Scheduled inspection *CS order* • DAW sheet • Operations planning schedule • Signed customer quotation

Sub-process 2: Compile work-pack (See Figure 19 for process map)

The compile work-pack procedure includes all the activities that lead up to the maintenance inspection after the customer has signed the quotation. These activities take place before the aircraft arrives at the hangar. The key deliverables of this process are a complete work-pack and a briefing session to inform the crew chief of the work-pack content.

STAKEHOLDERS:	KEY DELIVERABLES:
• **Production planner** • **Stores agent** • **Procurement agent** • **Floor production manager** • **Crew chief** • **Chief engineer**	• Purchase order • Good issued (GI) slip • Work-pack

Sub-process 3: Issue work-pack (See Figure 20 for process map)

The issuing of work-pack procedure captures the activities of performing the scheduled inspection according to the work-pack, raising defects, issuing a CS order for defects, and quoting the customer for defects. The main focus of the issue work-pack procedure is to guide the production planner to accurately raise *CS orders* for defects and to record them accordingly.

STAKEHOLDERS:	KEY DELIVERABLES:
• **Production planner** • **Floor production manager** • **Chief engineer** • **Crew chief** • **Sales**	• DAW sheet • Defect CS order • Pre-release CS order • Defect GI slip • List of deferred defects • Open deferred defects CS orders

Sub-process 4: Release aircraft (See Figure 21 for process map)

The release aircraft, invoice customer, and file work-pack process captures the last activities of the customer maintenance inspection process. The key deliverables are to ensure that the aircraft is airworthy, to ensure that the customer is invoiced accurately, to safely store the work-pack, and to reconcile the work done to eliminate errors creeping through to the next customer service.

STAKEHOLDERS:	KEY DELIVERABLES:
• **Production planner** • **AME inspector** • **Sales** • **Chief engineer** • **Crew chief** • **Maintenance planner** • **Finance** • **Floor production manager**	• TECO'd CS orders • Client invoice • Reporting

The high level process maps were only used to visually present the processes and to explain and indicate the basic flow of the *CS order process*. These as-is maps were primarily used to identify the failure points and problems within the *CS order process*.

3.4 Problem identification & analysis

The following section contains the problem identification procedure, problems identified and the problem analysis.

3.4.1 Cause & Effect Analysis

A fishbone diagram is helpful in identifying possible causes for a problem that might not otherwise be considered by directing the project team to look at the categories and think of alternative causes (API, 2014). Refer to Chapter 2, section 2.4 for a detailed discussion of the fishbone diagram. The fishbone diagram in Figure 22, was used as an analysis tool to identify the possible causes of the poor financial control experienced at AHZA. The possible causes were categorized in 6 categories, all of these causes affect the financial control. The 6 categories were derived from the generic diagram categories defined as the 6 M's: Mother Nature, measures, man, methods, materials and machines.

The cause-and-effect analysis, not only indicated that numerous causes contribute to poor and untimely financial control, it helped identify problematic categories. This project will not address all of the identified causes however; the "Process" category will be the focus of this project. Possible causes of the poor financial control, as seen in Figure 22, were generated by the student. The possible causes aren't validated they merely provide a broad perspective of the issues experienced at AHZA. The possible causes had to be validated and other causes were identified during various JAD sessions. An in-depth analysis helped identify specific problems and errors within the process, see the subsequent section for the analysis.

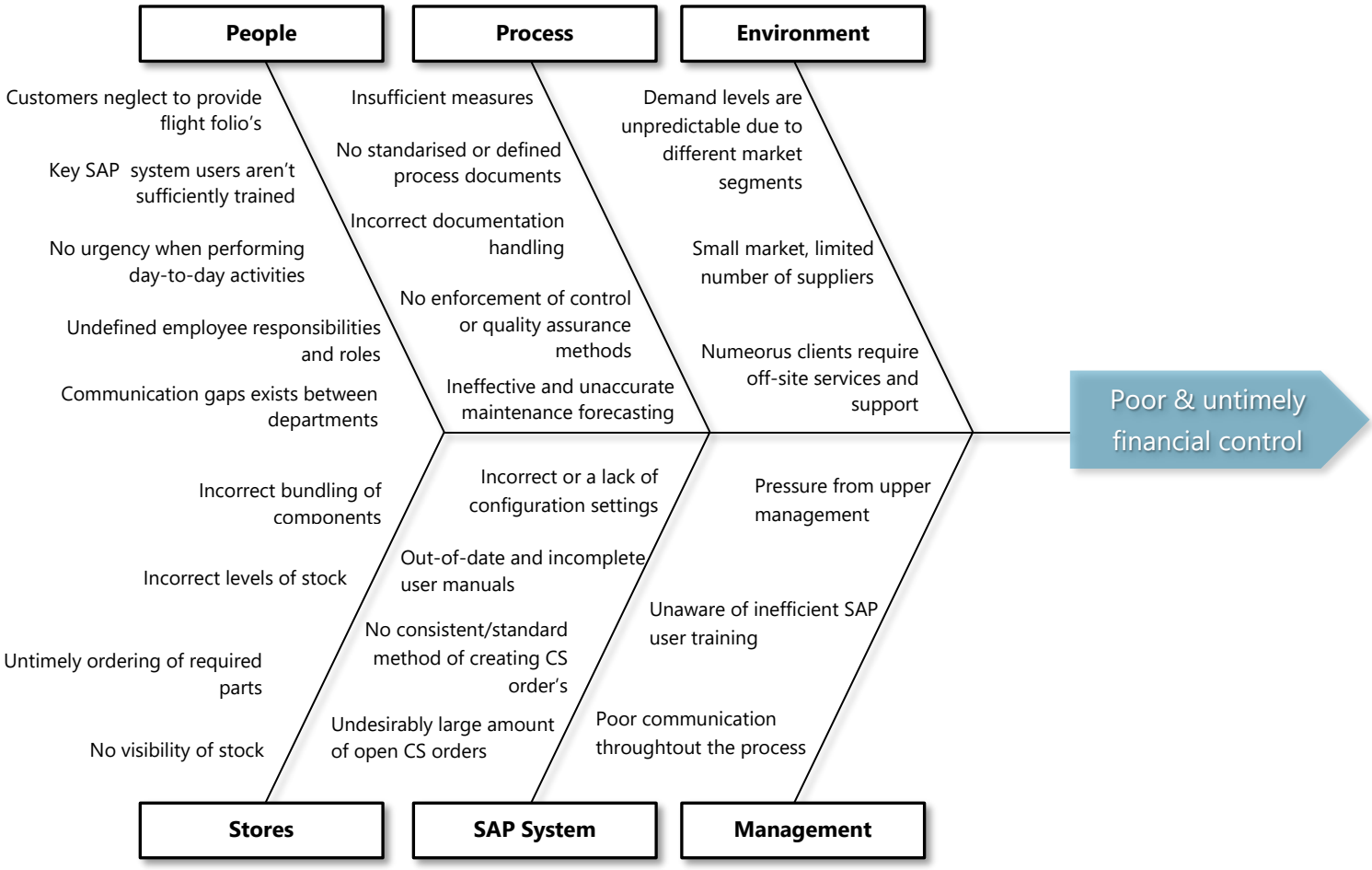


Figure 22: AHZA fishbone diagram for poor financial control

3.4.2 JAD sessions

The success of a business process improvement initiative is greatly determined by the involvement and input of the business process owners (BPO's) as well as the employees performing the tasks in the process (Al-Mashari & Zairi, 1999). The process documentation success depended on the support and buy-in from the BPO's and the employees of AHZA, their knowledge of the process and its cross-functional implications were crucial inputs to the documentation process. It was important to accurately identify the current problems and failure points as experienced by the individuals involved in the process, meaning that the input of employees from numerous departments and organisational levels was required.

Numerous meetings based on the principle of Joint Application Development (JAD) sessions were held to obtain the inputs and opinions of the individuals involved in the *CS order process*. The JAD sessions started off with a kick-off meeting at which the project sponsor made his project outcome expectations clear to the student and the project team consisting of all employees and management involved in the process. It was made clear that each team member had to commit and attend all the relevant sessions while being actively involved and participating in each session.

The entire *CS order process* could not be discussed during a single JAD session due to the limited availability of the required employees and BPO's. It was decided upon to conduct 4 separate JAD sessions, with the following topics; aircraft maintenance planning, compile work-pack, issue work-pack and release aircraft. These sessions consisted of the employees and managers involved in the relevant processes as indicated in the as-is swim lane maps (Figures 18-21). Each of these sessions started with a brief discussion of the project background and the meeting objectives followed by a high-level description of the relevant process. The process was discussed from start-to-finish during the sessions while the present individuals identified and explained the current problems and failures within the process. These problems were documented throughout each of the discussions.

The JAD sessions revealed the majority of the problems experienced within the *CS order process*. The distribution of these problems were unevenly scattered across the 4 processes, as well as across areas outside the scope of the project. Managing and analyzing the problems was crucial in order to prioritize the identified problems as well as identify their root causes.

3.4.3 Problems identified

The JAD sessions established that the current *CS order process* has numerous inefficiencies and communication gaps. All the problems identified during the JAD sessions were categorized and analysed. The majority of problems identified were categorized as either process or SAP related.

SAP related problems

The implementation of SAP at AHZA resulted in numerous changes in how the system functions, considering that AHZA's operations proved to be smaller than originally thought. Thus a few key people at AHZA had to customize the system to fit the needs and capabilities of the company and due to limited knowledge concerning SAP and its functionalities this proved to be difficult.

SAP related issues were amongst the biggest contributors to poor and untimely financial control. The main issue affecting the performance of the sub-processes is insufficiently trained employees, who are unsure of their roles and responsibilities, ultimately leading to a dysfunctional process. Other issues and problems identified during numerous JAD sessions are listed below:

- Many judgement calls are made by personnel in order to expedite the work and to deliver aircraft on committed delivery lead times and to maintain contractually agreed service levels. This results in aircraft being released without being technically completed (TECO'd) and fully invoiced.
- There are currently hundreds of open CS orders on the system, a legacy data clean-up or data archiving initiative is required to improve the slow processing of the system.
- SAP configuration settings need to be reviewed, numerous system users mentioned that the SAP system isn't customized to fit the business needs of AHZA.
- Key users aren't using the SAP system with the necessary discipline, numerous instances have occurred where the system users don't follow the correct procedures and neglect to allocate costs on SAP.
- Management has no knowledge of the reports their SAP system is capable of generating; thus they are unaware of system functionalities they could potentially benefit from.

- The relevant information associated with each step in the process isn't always processed in the correct order. Data or documents have been known to end up out of sequence at different sales representatives or planner's desks. This causes lags and errors in the system, as the SAP system requires information to be entered into the system in the same logical sequence as the relevant business process.

When the incorrect data is populated into SAP the outputs of the system is undesirable and of no use. These issues are outside the student's project scope however the Britehouse consultants, as mention in Chapter 1 section 1.4, are responsible for rectifying these issues and training the key users to ensure the SAP system is used with the necessary discipline and skill. The Britehouse consultants will help to improve the *CS order process* performance by fulfilling their roles within the overall project.

Process problems

Various process related problems were identified during the JAD sessions. These problems were mainly the result of miscommunication between departments, undefined processes and employees forgetting/ignoring quality controls and business rules. The identified problems were categorized per sub-process (see Tables 5-8) and indicated on the corresponding as-is maps. Numerous problems were common to all four sub-processes; these mutual problems are listed below.

Most-common process failure points:

- Documented detailed workflows or business process procedures and guidelines do not exist, this leads to protracted training of new employees seen that no resources exist to standardize and speed-up the training process. The lack of documentation also means that there are no instructions or guidelines in place for employees to use when executing their day-to-day tasks. Employees have no resources/guidelines to refer to when they are uncertain of what to do or who to work with.
- Undefined roles and responsibilities of the employees involved in the process. Employees are unsure of what they should and should not do, this results in late deliveries due to numerous pending tasks and interrupted workflows.
- Undefined business rules within the *CS order process* lead to unstructured processes and activities resulting in limited control over the behavior of the business.
- Numerous quality procedures (QP's) exists at AHZA, however the QP's aren't enforced by management and only a few individuals are aware of them. Neglecting or ignoring these quality controls lead to dissatisfied customers whose product requirements aren't met.
- AHZA doesn't perform delay analysis to record the duration and reasons for delays within the sub-processes. Thus they aren't able to use the identified delays as the basis for problem solving, corrective action and preventative action.

Table 5: Aircraft maintenance planning failure points

Sub-process 1: Aircraft maintenance planning (See Figure 20)		
Activity Failure point	**Description**	**Effect**
1.1 Get the flight folio	This is the most important activity in the maintenance planning sub-process seen that no subsequent activities can take place without the flight hours. Employees don't know who is responsible for obtaining the flight folios from the customers. However, the sales department has lately been performing this activity, they indicated that obtaining the flight folios is a very difficult task due to customers neglecting to supply the folios on time and in general.	Unable to update the maintenance tracking system, perform maintenance forecasting and do hangar loading.
1.3 Maintenance forecasting	The flight folio data is used to determine the number of hours remaining until the next inspection. Forecasting currently consists of compiling a basic bar chart that contains the actual flight hours per aircraft, per month. The history data of each aircraft is used to calculate an average utilization rate per month. This has to be done to estimate the aircraft arrival date for any given service. However, the average rate is very inaccurate seen that the utilization of an aircraft can differ significantly from month to month and from customer to customer. The maintenance planners describe the forecasting process as follow: Produce a component due list, in essence it says exactly what has to be done but only if the flight folio is regularly obtained. Thus no standardized and accurate forecasting method exists which results in a lack of companywide clarity on "what is coming" and early triggers for preparation work, approvals and orders for long lead items aren't formalised in the processes.	Untimely placement of purchase orders and numerous service delays
1.4.2 Find a timeslot for the upcoming service	AHZA currently has a weekly updated Capacity Profile based on the forecast (expected demand) and the bay capacity, however it's format has to be reviewed and refined according to the employees. It was established that the current Microsoft Excel capacity profile template is outdated and ineffective.	Ineffective bay loading

Table 6: Compile work-pack failure points

Sub-process 2: Compile work-pack (See Figure 21)		
Activity Failure point	**Description**	**Effect**
2.1.1 Reserve and specify parts from batches	MRO receives incomplete service kits and usually wait for the correct parts before being able to start servicing the aircrafts. The primary failure is that employees loose traceability of specified and reserved parts, and experience various planning troubles.	Frustrated MRO personnel, they are available but the required parts aren't.
2.1.2 Purchase parts not available at AHZA	The main cause of these problems is a lack of downstream communication to ensure kits contain the correct components and are delivered on time. In some instances, parts arrive after the aircraft has already been released.	Late deliveries to customers

Table 7: Issue the work-pack failure points

Sub-process 3: Issue work-pack (See Figure 22)		
Activity Failure point	Description	Effect
3.1 Aircraft arrival at AHZA	No aircraft tracking dashboard exists to monitor the status of each aircraft in the hangar. The aircraft status refers to the aircraft arrival date, inspections due, inspections completed and aircraft release date. The different departments don't have quick and easy access to this information, thus uncertainty arises over the whereabouts of the aircrafts in the hangar as well as the sequence of aircraft inspection activities. There is no urgency amongst the employees to get the job done on time, due to a lack of a visual tracking system, available to all, that displays the scheduled aircraft release dates.	No urgency amongst the employees. No aircraft monitoring, causing delays between activities.

Table 8: Release the aircraft failure points

Sub-process 4: Release the aircraft (See Figure 23)		
Activity Failure point	Description	Effect
4.4.1.3 Gross margin analysis	The most significant problem experienced is unallocated costs and insufficient financial control and effective and timely margin analysis. Due to the ineffective and untimely capturing of information on the SAP system significant effort is required to ensure that all revenue and costs are accurately accounted in financial records. Tracking all of these transactions through a manual system (or data dumps) has proven to be extremely labor intensive and time consuming. Basic human errors and a lack of in-time data capturing occur due to the manual capturing of data. If these financial control deficiencies are not addressed, AHZA will continue to struggle with gross marginal analysis which consists of reconciling revenues with the associated costs. Currently revenue amounts are available however due to inaccurate and ineffective invoicing the associated costs are missing. The result of not managing gross margin leads to problems with breakeven and profit reporting and the margin may ultimately slowly deteriorate and lead to cash flow problems.	Ineffective and untimely margin analysis. No basis for improvement based on profits, costs and revenues.

The aim of the project was to address the identified process problems by firstly defining the as-is processes clearly with process maps to ensure that the issues and failure point are effectively identified and addressed. The as-is maps in Chapter 3, section 3.3.2 were sufficient to gain understanding of the current situation and processes at AHZA. However, the JAD session participants indicated that numerous activities are more complex and may require level 5 and level 6 maps to accurately capture all the detail, these lower level maps form part of the to-be models included in the subsequent sections of the report.

4 Conceptual Design

"Design is a plan for arranging elements in such a way as best to accomplish a particular purpose."
~ Charles Eames

4.1 Functional requirements

"Conventional business process modeling includes the capture of functional tasks and steps that form discrete processes and sub-processes also known as the functional requirements" (Pavlovski & Zou, 2008). Functional requirements define how the final solution should function from the end-user's point-of-view and describe the functions and features with which the end-user will interact directly (MindToolsTeam, 2016). The most appropriate and relevant IE methods to identify the functional requirements were stakeholder interviews used in conjunction with numerous JAD sessions as discussed in Chapter 3 section 3.4.2.

The new design of the *CS order process* must effectively address all the identified process failure points and improve the process as much as possible by using the selected IE tools and techniques. The construction of the conceptual solution is visually represented in Figure 23; the solution consists of numerous components. If these components realize, the entire CS process will improve in various areas. The final solution consists of the following **components/elements** that the solution "must-have":

1. **Documented to-be process maps** of all 4 sub-processes. The process mapping software has to satisfy certain functional requirements.

The process mapping software should:

- ✓ Have an extensive collection of **example templates**: The mapping software should streamline the diagram-creation process. A variety of templates and examples aid in getting a quick start when it comes to mapping the processes.
- ✓ House a **storage database** of all created documents.
- ✓ Support **multiple pages**: Multiple page process flow diagrams give you the ability to include several diagrams in a single project and link between them. To have expandable canvases that automatically grow to fit the content so that you're not constrained to a pre-set page size greatly simplifies the mapping process.
- ✓ Enable the user to **export diagrams** in different formats and have different viewing capabilities. Presentation capabilities of the software or maps is very important seen that it enables you to present all diagrams in front of your staff and clients as easily and elegantly as possible. Being able to export your files to sharable formats such as JPG, PNG, PDF files or to a website in HDML that can be emailed or printed is another important consideration.
- ✓ Enable the user to **link diagrams to data** from any resource.
- ✓ Supply the user with a **variety of mapping tools and features**: The software has to have the functionality to be able to map in particular, swim-lane diagrams. An extensive library of shapes that can be customized to fit your diagrams makes it easy to transform the process information into neat and organised flowcharts.

2. A **DDD** for each process activity. A DDD includes applicable business rules, minimum control, the procedure steps and more. These documents are discussed in greater detail in Chapter 6 section 6.1.3.
3. A **repository** containing the mapped to-be processes as well as the DDD per activity corresponding to the process maps. The document storage solution requires the following functional requirements.

The storage solution should:

- ✓ **Store documents** of different formats while also being able to display the document details/properties like last modified date, size and owner.
- ✓ **Open/display documents** of different formats and programs/resources.
- ✓ When off-line changes or additions are made the storage solution should **sync/refresh** all data once it is connected to a network again.
- ✓ **Display history and revisions** activity to the user as changes or updates to the data is made as well as by whom.
- ✓ **Email/notify** the storage solution owner when changes are made or updates are available for the software. Preferably an icon on the desktop screen should also indicate the status of the storage solution.
- ✓ Allow the user to use a **search functionality,** the system has to have a search engine to enable the user to easily find any required document without wasting time searching the entire data library.
- ✓ Include a **user authorisation** procedure where users must identify themselves using a login name and password. Only users who are authorised in this way may access the system data.

4. Define **process performance measures** to regulate the new process design and to determine whether gradual improvement is achieved.
5. **KPI tracking dashboards** to track the status of every defined KPI on a dashboard visible to all, on a weekly and monthly basis.
6. **Change management plan** to ensure all stakeholders are on-board with the new and improved process and to ensure successful transformation.

4.2 Non-functional requirements

In almost every process operational constraints and behavior exist. This may include the following properties; performance expectations, policy constraints and security controls. These characteristics can also be defined as the non-functional requirements of a process, which is generally identified at some stage after the as-is business process modeling (Pavlovski & Zou, 2008). At the business process modeling stage the constraints, system qualities, and soft goals contribute to the definition of the non-functional requirements (Pavlovski & Zou, 2008).

4.2.1 Process mapping software non-functional requirements

In the context of this project, the following non-functional requirements were identified for the mapping software:

- **Compatible**: The software must be compatible with AHZA's Windows operating system.
- **Usability:** The software should be user friendly and easy to navigate, while the interface should be graphically well-formed and feel up-to-date. The software should also make the users experience effortless and informative by means of displaying informative error messages and having help facilities.
- **Supportability:** The solution provider must be reachable and preferably close to the user in terms of geographical location in the event of any issues or problems. Making changes to the system after deployment mustn't be complex and the software should be cost-effective in the long-run.

4.2.2 Storage solution non-functional requirements

The following non-functional requirements were identified for the storage solution:

- **Performance** – for example response time, throughput, uploading, downloading, opening and sharing all need to happen as quickly as possible. When it comes to getting information, AHZA employees want it fast. Speed is important, especially when trying to save a file to the cloud or trying to restore data from online.
- **Capacity:** The storage solution must have sufficient space for all the process documentation and reserved space for any further documentation or document updates is also crucial.
- **Reliability:** It is of great importance that the storage solution performs its required functions under all possible conditions all the time. Thus the information stored should always be available when requested by end-users.
- **Security:** Security features are one of the most important requirements of the final solution. AHZA wants to make sure that all their documents and files are safe without having to worry about someone stealing any data.
- **Environmental:** The solution should be environmentally friendly and strive towards being sustainable.
- **Usability:** The storage solution should be user friendly and easy to navigate, while the interface should be graphically well-formed and feel up-to-date. The software should also make the users experience effortless and informative by means of displaying informative error messages and having help facilities.
- **Accessible:** (multiple devices): The software should allow the user to install and use it on multiple devices anywhere, anytime.
- **Supportability:** The solution provider must be reachable and preferably close to the user in terms of geographical location in the event of any issues or problems. Making changes to the system after deployment mustn't be complex and the software should be cost-effective in the long-run.
- **Interoperability:** The solution should have the ability to connect and integrate with different apps. I.e. Google accounts to allow the storage solution to gain user information like the user

name, surname and an account picture thus the storage solution feels more personal when users use it and no communications barriers exist.

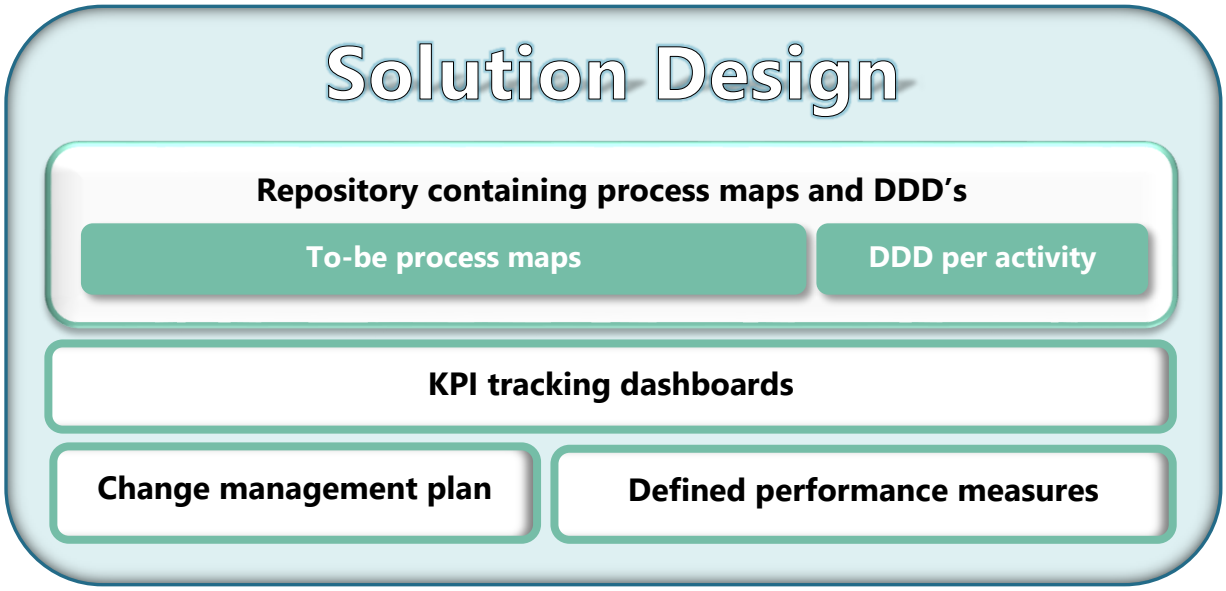


Figure 23: Conceptual design solution components

5 Solution selection

In the preceding sections of this report it has been established that a need exists for documenting the detailed workflow of the CS order process and storing these documents in a referenced electronic repository. Although the final solution and its requirements have been defined in the previous chapter, the detail and specifications thereof is still very vague seen that a variety of options and approaches exist to map and store the process documentation. Numerous factors and solution requirements was used as decision criteria on which software comparison was based, section 5.1 and 5.2 contain these comparisons as well as the reasoning behind the final solution selections.

5.1 Process mapping software selection

Before starting to map the relevant processes, it was important to consider different software alternatives. Various process mapping software solutions exists however it was important to select the most feasible and appropriate solution in order to effectively address the task at hand.

The following process mapping software alternatives were identified and their functionalities are briefly described below:

1. MICROSOFT VISIO

	One of the most popular and widely used mapping software in the market is Microsoft Visio. The software helps to simplify and communicate complex and detailed information with data-linked diagrams that you can create in just a few seconds. Visio makes diagramming simple and easy, whether you want to quickly capture a flowchart that you brainstormed on a whiteboard, map an IT network, build an organizational chart, document a business process, or draw a floor plan (Sullivan, 2015).
Paid plans	Visio Standard Package: From R8,562.00 (PriceCheck, 2016)
Operating Systems supported	The software only works on Windows OS, it is not compatible with tablets or Mac computers (Sullivan, 2015).
Usability	With Visio, you can enter text directly into shapes on your flowchart. You can also replace shapes without first needing to delete an object, which is very helpful since it saves time and frustration. Spellcheck is also available in this software, which makes it easier to present a professional flowchart to your clients or team members. Symbols automatically resize to fit your text, and you can add extra connector points to them, though there are already multiple connector points available. Junction jogs are also available, which creates bumps in a connector when it crosses another connector line. Visio's clipart gallery includes hundreds of shapes, symbols and decorative objects, most of which you can apply colors, fills and styles to. Visio's library boasts with 70 diagram templates and 20 process templates as well as starter diagrams color schemes and

	design themes available for the user to use and customize (Microsoft, 2016).
Multiple page support	You can create a multiple-page diagram to be able to fit more information than would be able to comfortably fit on a single chart. The canvas expands as you add content to your diagram and layers are also available (Microsoft, 2016).
Real-time Collaboration	If you need to collaborate with one or more people while you create your presentation, this software offers real-time collaboration so that you can see what changes your cohorts are making as they edit the diagram.
Exporting capabilities	This software allows the user to connect data to the visualization of an organizational structure, IT network, manufacturing plant, or complex business processes to grasp performance in one glance. Visio shapes can be linked to multiple data sources including Microsoft Excel, Microsoft Excel Services, Active Directory, Microsoft SQL Server, Microsoft SQL Azure, and Microsoft SharePoint Lists and Business Connectivity Services. Or, alternatively, you can export your presentation to PDF or HTML documents (Microsoft, 2016).
Security	You can password protect your diagrams and presentations, which can help keep your company's proprietary information secure. Additionally, you can assign authorized users to help you control who sees and edits the document. (Microsoft, 2016).
Support Plan	Support via: Initial tutorial, phone, forum and a blog (TopTenReviews, 2016).

2. BIZAGI (Bizagi, 2016)

	Bizagi is considered as one of the easiest and quickest tools to create process maps. The software can be used to automate processes and has made a set of executable process templates available which can be downloaded from their website.
Paid plans	This software gives its user the ability to create cutting-edge flowcharts for free.
Operating Systems supported	The software works on Windows OS and Mac computers (Sullivan, 2015).
Usability	Bizagi Modeler's efficient and crisply rendered user interface borrows the Ribbon toolbar and other elements from Office, giving it a familiar look and feel that integrates equally well with corporate environments and personal desktops. Bizagi's visual drag & drop process modeling encourages business and IT interaction, makes requirements quick to capture and business

	processes easy to visualize. Joining Bizagi's user community enables access to more free resources, like templates.
Multiple page support	Bizagi has this functionality.
Real-time collaboration	This software allows the user to collaborate with other team members during process definition, run discussions and to collaborate in the cloud or on premise.
Exporting capabilities	Bizagi allows the user to export the whole or part of process in Word, PDF, HTML and Sharepoint format.
Security	Bizagi allows you to restrict access to different areas of your processes during execution to ensure that the correct people have the necessary privileges and prevent unauthorized actions
Support Plan	A User Guide, video tutorials, and online forums and training deliver support that few other tools of Bizagi Modeler's type can match, let alone for free.

3. SCREENSTEPS (Screensteps, 2016)

	ScreenSteps helps companies create better process documentation by either creating a new online knowledge base or improving the knowledge base they are already using. ScreenSteps is not just another screen capture application it helps the user answer questions by automatically creating image-based documents as you capture screenshots. Using the integrated authoring tools, you can quickly annotate images and add text.
Paid plans	Business version: R1500/month (PriceCheck, 2016).
Operating Systems supported	The software works on Windows, Mac, Android, iOS.
Usability	The creation and maintenance of user documentation becomes a simple process with ScreenSteps. In turn these assets enhance enablement tools and speed customer and employee onboarding. ScreenSteps enables you to create visual user documentation, including articles, how-to guides and manuals. Further, it allows you to build a knowledge base for easy organization and maintenance. This way, you're encouraging self-service among your customers and improving efficiency on both sides with the incredibly easy and organised interface.
Real-time Collaboration	ScreenSteps takes the complexity out of collaboration by means of its web-based application. Its cloud-based back end is designed to allow for simple, productive and efficient collaboration in authoring visual documentation, allowing the user to focus on the content itself.

Exporting capabilities	Once you create your documents in ScreenSteps a wide variety of export options are available including HTML, PDF, Microsoft Word and WordPress.
Security	Built-in tools manage author permission, assign author ownership and update the workflow status, so you know who is working on which article and when it is ready for the next pair of eyes.
Support Plan	Support via: Forum, Knowledge Base, Online Support, Video Tutorials

A decision matrix (see Table 9) was used to compare the process mapping software. The requirement weighting was subjectively allocated based on a scale of 0 to 5. The weight which indicates the importance of the specific software solution requirements as seen below, was prioritized based on stakeholders and key-users' recommendations and requirements as established in Chapter 3 section 3.4.

1. Not at all important
2. Somewhat important
3. Important
4. Very important
5. Extremely important (Critical)

Table 9: Process mapping software comparison

		WEIGHT:	MS Visio	Bizagi	Screensteps
Functional requirements	1. Example templates	2	4	4	2
	2. Storage database	3	9	9	9
	3. Multiple page support	2	4	4	2
	4. Exporting capabilities	5	25	25	20
	5. Link diagrams to data	5	25	20	10
	6. Mapping features	3	9	9	3
Non-functional requirements	1. Compatibility	3	9	6	6
	2. Usability	5	25	20	15
	3. Supportability	2	4	4	2
Total			114	101	69

Software selection conclusion:

After careful consideration it is clear that Microsoft Visio outweighs the other software options. This is especially due to the compatibility and user-friendliness of the software. The projected cost of the selected Visio Standard Package will amount to R8,562.00 (PriceCheck, 2016).

5.2 Data storage selection

The mapped to-be processes and the relevant DDD's have to be stored seen that these documents will be used for both training and continuous improvements purposes.

The following storage software alternatives were identified and their functionalities are briefly described below:

1. GOOGLE DRIVE (Drive, 2016)

	Google Drive offers the user a place to store and share files, videos, and photos. With an average of 240 million active users each month, world-wide, this cloud storage platform has the right to claim top status as well. In addition to being a storage platform, Google Drive offers users a host of office tools, allowing them to edit and collaborate on stored files without leaving the cloud site, even with recent changes (GoogleDrive, 2016).
File size restrictions	5TB
Free storage	15GB
Features	• Google Drive for Individuals • Google Drive for Work • Document management • File sharing and collaboration • Integration with Google Apps • Administration console
Paid plans	1TB for R110/month
Operating Systems supported	Windows, Mac, Android, iOS Computers per subscription: Unlimited
Security	Protected by AES 256-bit encryption – However numerous internal security issues have taken place. History of customer's files being lost on their servers
Support plan	Server location: US Support available via: phone, e-mail, tutorials, forum, FAQ's (TopTenReviews, 2016)

2. DROPBOX (Dropbox, 2015)

Dropbox is probably one of the best known cloud storage and sharing providers. With over 300 million active users worldwide, it's easy to see why some would consider it the number one platform. In addition to offering personal space to share and save files and photos, Dropbox also offers a business level platform. This package gives users additional features to help their company grow (Mitroff, 2015).

File size restrictions	10GB
Free storage	2GB
Features	• Automatic device synchronicity • File recovery and backup options • Comprehensive administrative tools • Speedy multi-device file sharing • Extensive offline capabilities
Paid plans	R540/month for 500GB
Operating Systems supported	Windows, Mac, Linux, Android, iOS, Windows Phone, BlackBerry, Kindle Fire. Computers per subscription: Unlimited
Security	Protected by AES-256bit encryption, has password-protected, expiring shared links and view-only sharing permissions. However, the service has been the victim of several phishing scams.
Support plan	Server location: UK Support available via: e-mail, tutorials, forum, FAQ's

3. ONEDRIVE (OneDrive, 2015)

OneDrive offers a secure solution for dependable storage for your employees. Each individual can receive 1 TB of space for a small monthly fee. Files and documents are saved to the Cloud so that employees can access them from anywhere and from any of their devices, even when offline. OneDrive for Business also helps teams share files and collaborate, and keeps everyone working on and saving the same version of a file

File size restrictions	10GB
Free storage	5GB
Features	• Cloud storage • Cross-platform syncing • Mobile application • Data loss protection • Business collaboration

	• Excellent photo presentation with slideshows and tagging
Paid plans	R200/month for 50GB
Operating Systems supported	Windows, Mac, Android, iOS and Windows Phones. Computers per subscription: 5
Security	The Cloud is also backed with industry-leading security, using advanced encryption technology to ensure your company's files and sensitive data is safe and secured
Support plan	Server location: US Support available via: phone, tutorials, forum, FAQ's

Comparison of the above discussed storage software follows, a decision matrix (see Table 10) was used as a framework for the software comparison. The factor weighting was allocated based on a scale of 0 to 5. The weight which indicates the importance of the specific software solution requirements as seen below, was subjectively prioritized based on stakeholders and key-users' recommendations and requirements as established in Chapter 3 section 3.4.

1. Not at all important
2. Somewhat important
3. Important
4. Very important
5. Extremely important (Critical)

Table 10: Storage software comparison

		WEIGHT:	Google Drive	Dropbox	OneDrive
Functional requirements	1. Store documents	4	16	16	16
	2. Open/display documents	4	16	16	16
	3. Display history and revision activity	3	9	9	6
	4. Sync/refresh	3	9	9	6
	5. Notifications	2	4	4	2
	6. Search functionality	2	4	4	4
	7. Authorisation process	3	9	9	9
Non-functional requirements	1. Performance	3	9	6	6
	2. Capacity	2	4	2	2
	3. Reliability	4	16	12	12
	4. Security	5	25	25	20
	5. Environmental	1	1	1	1
	6. Usability	4	12	16	8
	7. Accessible	4	16	16	16
	8. Supportability	2	4	2	2
	9. Interoperability	2	4	4	2
Total			158	151	128

Data storage selection conclusion:

After careful consideration it is clear that Google Drive outweighs the other software options. This is especially due to the performance speed and the reliability of the software. The projected cost of Google drive will amount to R110/month for 1TB which is sufficient storage space for the process documentation.

6 Solution construct

The main purpose of this project was to document the entire CS order process while also suggesting possible improvements to the process design. The process document library as discussed in Chapter 4 will enable AHZA to improve the CS order process, however improvement will only take place once the suggested process designs are implemented and managed correctly. The solution to be discussed in the upcoming sections aim to address all process-related problems as defined by all AHZA employees by explicitly and clearly defining tasks, roles and procedures to reduce or eliminate any errors whilst improving the process efficiency.

The subsequent section discusses the Visio to-be process maps and DDD's of the CS order process which will be stored in a Google Drive cloud as motivated in Chapter 5. The details of the to-be process maps are also included in this section; it consists of the process hierarchy design as well as the process model notation and the key changes made to the process.

Section 6.2 elaborates on Performance measures and KPI dashboards of the solution. To ensure that the process is continually measured various KPI's related to the CS order process were defined and to be able to quantify the performance of the CS order process, KPI tracking dashboards were created. (Please note that the CS order process is referred to as the Aircraft maintenance process in the documented process seen that it describes the process better).

6.1 Process Documentation Library

The Aircraft Maintenance process captures the activity steps required to perform a maintenance inspection on an aircraft, from forecasting, planning the maintenance inspection, compiling the work-pack, issuing the work-pack and performing the aircraft runs, invoicing the customer, releasing the aircraft, to closing the aircraft maintenance inspection.

Documented detailed workflows or business process procedures and guidelines do not exist at AHZA as mentioned in Chapter 4 section 4.2. The lack of documentation also means that there are no instructions or guidelines in place for employees to use when executing their day-to-day tasks. Employees have no resources/guidelines to refer to when they are uncertain of what to do or who to work with.

The purpose of the process documentation library is to guide the reader on how to perform day-to-day activities relating to the Aircraft Maintenance process and to ensure stable SAP related business processes and integrity of financial postings. The library consists of two main components namely the to-be process maps and the relevant DDD's which will be discussed in the subsequent sections but first a comprehensive summary of all the key changes that were made to the process is discussed in section 6.1.1.

6.1.1 Key changes to the CS order process

The significant changes/enhancements to the Aircraft Maintenance process (also referred to as the CS Order process) during the review and development of this document are indicated in Table 11 below. During the review and development phase *additional* performance criteria was also identified and embedded in the new processes as seen below.

Table 11: Key changes to the CS order process

Aircraft Maintenance Process Phase			
1. Maintenance Planning	**2. Compile work-pack**	**3. Issue work-pack**	**4. Release aircraft, invoice customer & file work-pack**
1. The process has been expanded to include the procedure of obtaining flight folio from the customer. 2. A request for quotation procedure has been added to the maintenance planning phase to improve the aircraft maintenance lead time. 3. The MRO Scheduler has been added to the process to manage the operations planning schedule, and to prepare the maintenance inspection information to be communicated to the customer prior to loading a service order and drafting a quotation. 4. The process includes the detailed execution steps on how to create and load a service order.	1. The purchasing process has been expanded into detailed execution steps. 2. A procedure to identify and escalate physical part shortages in stores has been added to the process to include the preparation of inspection kits. 3. A procedure step has been added to for the Key Accounts Manager to list the spares per aircraft that is under warranty. Improving the visibility and control of warranty requests.	1. The aircraft incoming inspection procedure has been added to the aircraft maintenance process. 2. The responsibility to classify defects as cosmetic or flight worthy has been assigned to the Crew Chief and has been moved earlier in the process to improve maintenance inspection lead time. 3. If defects are deferred by the customer, it is included in the process that the Sales Administrators has to update the quotation to only reflect the work that has to be done in the current maintenance inspection on the quotation, for improved financial control.	1. The release aircraft, invoice customer, and file work-pack process has been expanded with the following processes: 2. Capture work-pack on maintenance inspection tracking system. 3. An aircraft release to customer procedure. 4. Hangar clean-up. 5. File work-pack

6.1.2 To-be process maps

The final solution contains numerous to-be maps as shown in Figures 25-36, which were created with Microsoft Visio as decided upon in Chapter 5.

The Aircraft Maintenance process comprises three process levels. The first level (Level 1) provides a breakdown of the high level Aircraft Maintenance processes. This level divides the Aircraft Maintenance process into four phases (see Figure 24):

1. Maintenance planning (Color code: Dark blue)
2. Compile work-pack (Color code: Green)
3. Issue work-pack (Color code: Orange)
4. Release aircraft (Color code: Light blue)

Each phase of the Aircraft Maintenance process, is expanded into Level 2, and where necessary a Level 3 process. For each lowest level process (block or decision in the process flow), a process guideline or detailed procedure is presented. These detailed documents are presented and described in section 6.1.3.

High Level CS order Process

The Aircraft Maintenance process captures the activity steps that should be taken to perform a maintenance inspection on an aircraft, from planning the maintenance inspection, compiling the work-pack, issuing the work-pack and performing the aircraft runs, to releasing the aircraft, invoicing the customer, and closing the aircraft maintenance inspection.

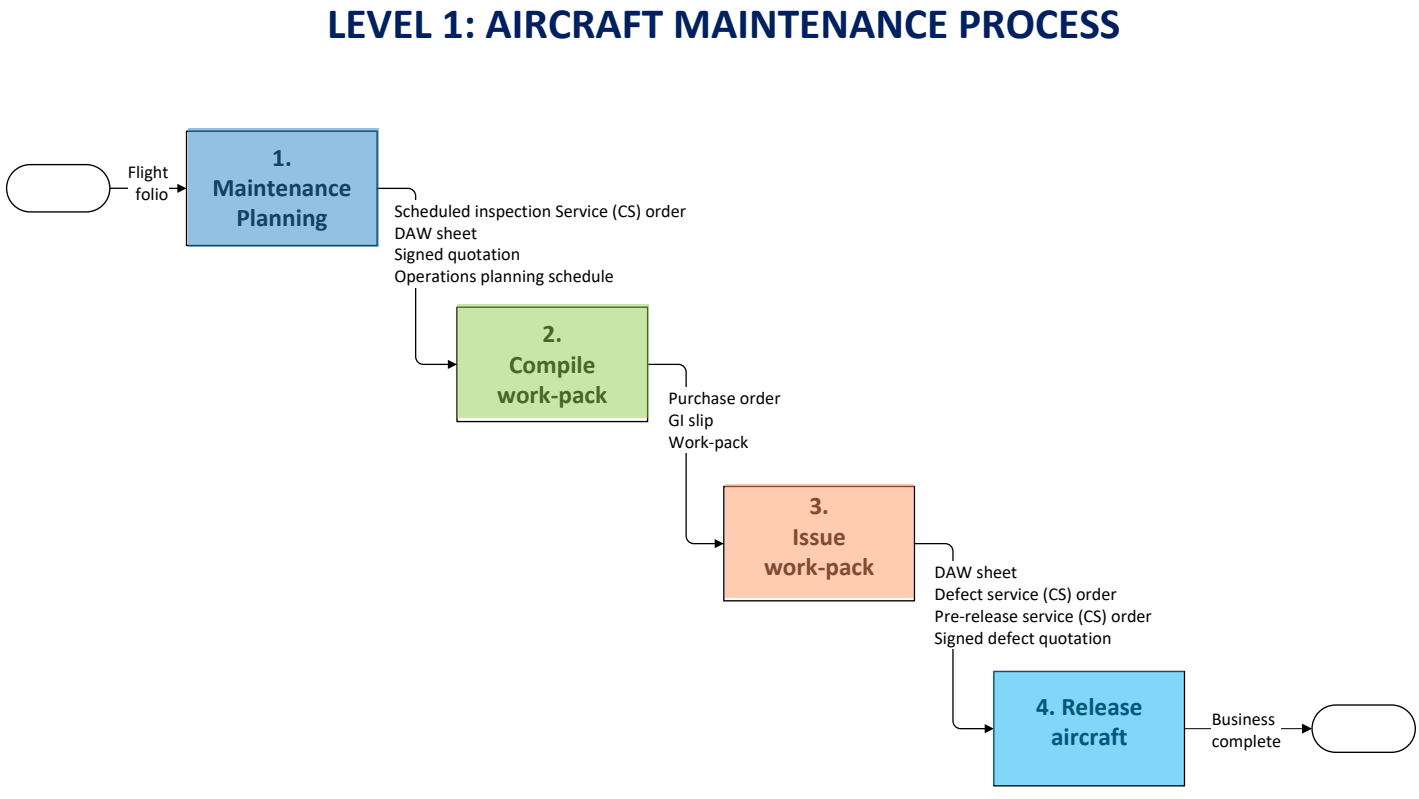
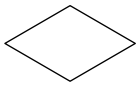
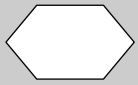
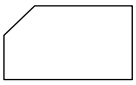


Figure 24: Level 1 Aircraft Maintenance Process Map

Process Notation

The following descriptive process shapes presented in Table 12, were used in the to-be mapping of business processes:

Table 12: To-be process map notation

Process start & end		This shape indicates where the flowchart begins and ends. It shows the entry point of the flowchart and the exit point.
Process		This shape is used to show a process and or operation. It shows something that has to be done or an action that has to be taken. – A process marked in white is a non-related to SAP. These action steps are not performed in SAP and thus most often indicates a manual process. – A process marked in blue is SAP related, therefore the action steps are performed in SAP.
Decision		A decision asks a question. The answer to the question determines which direction the process should follow.
Level three process		A process block with double lines, marked in yellow, indicates a process that will expand to a level three process.
Off page reference		This shapes indicates that the process continues on a new page.
Reference		The reference shape, marked in grey, indicates where in the level three process, a level four process integrates.
System step		This shape represents an activity that is automatically performed by SAP.

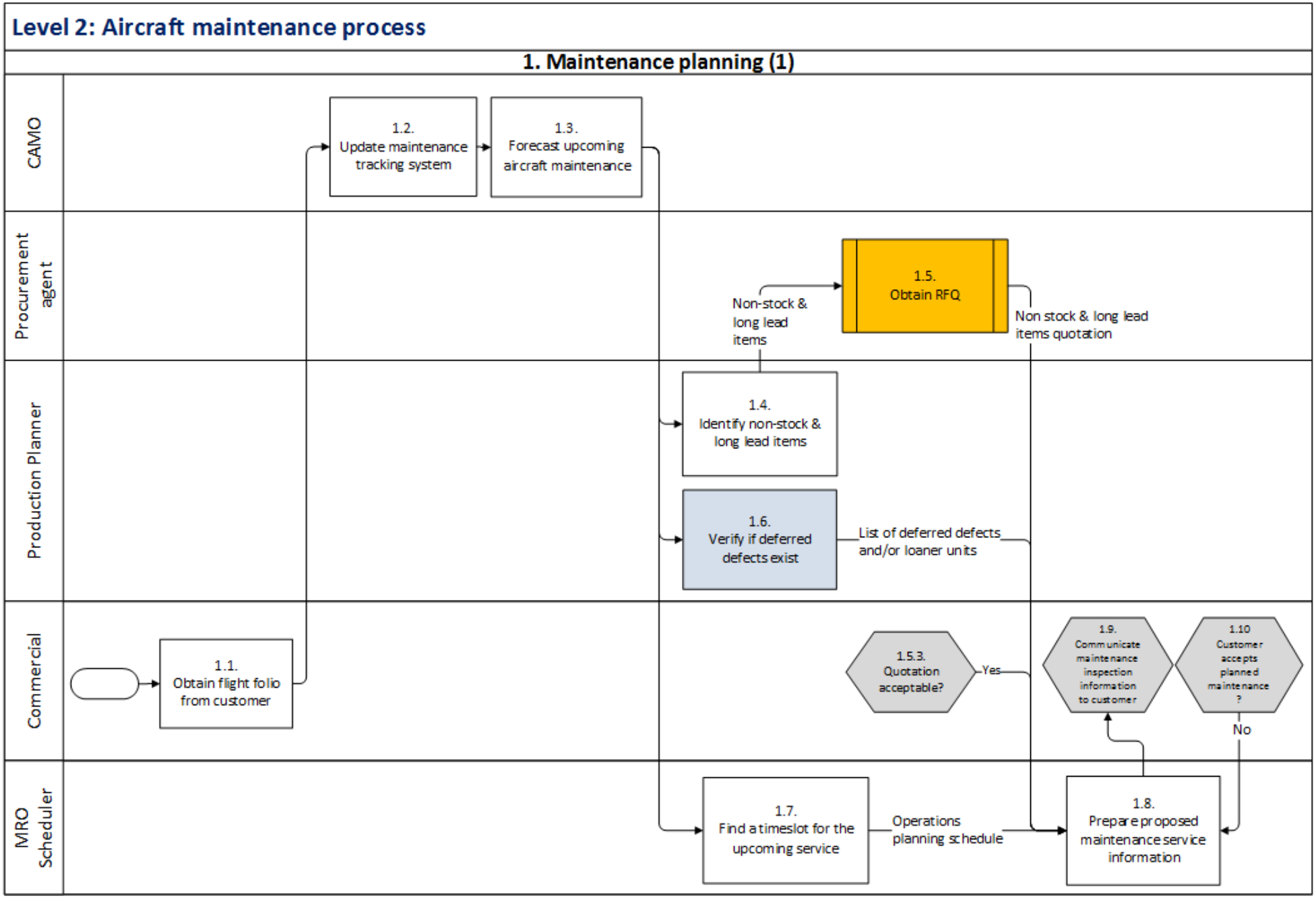


Figure 25: Maintenance Planning To-Be Process Map

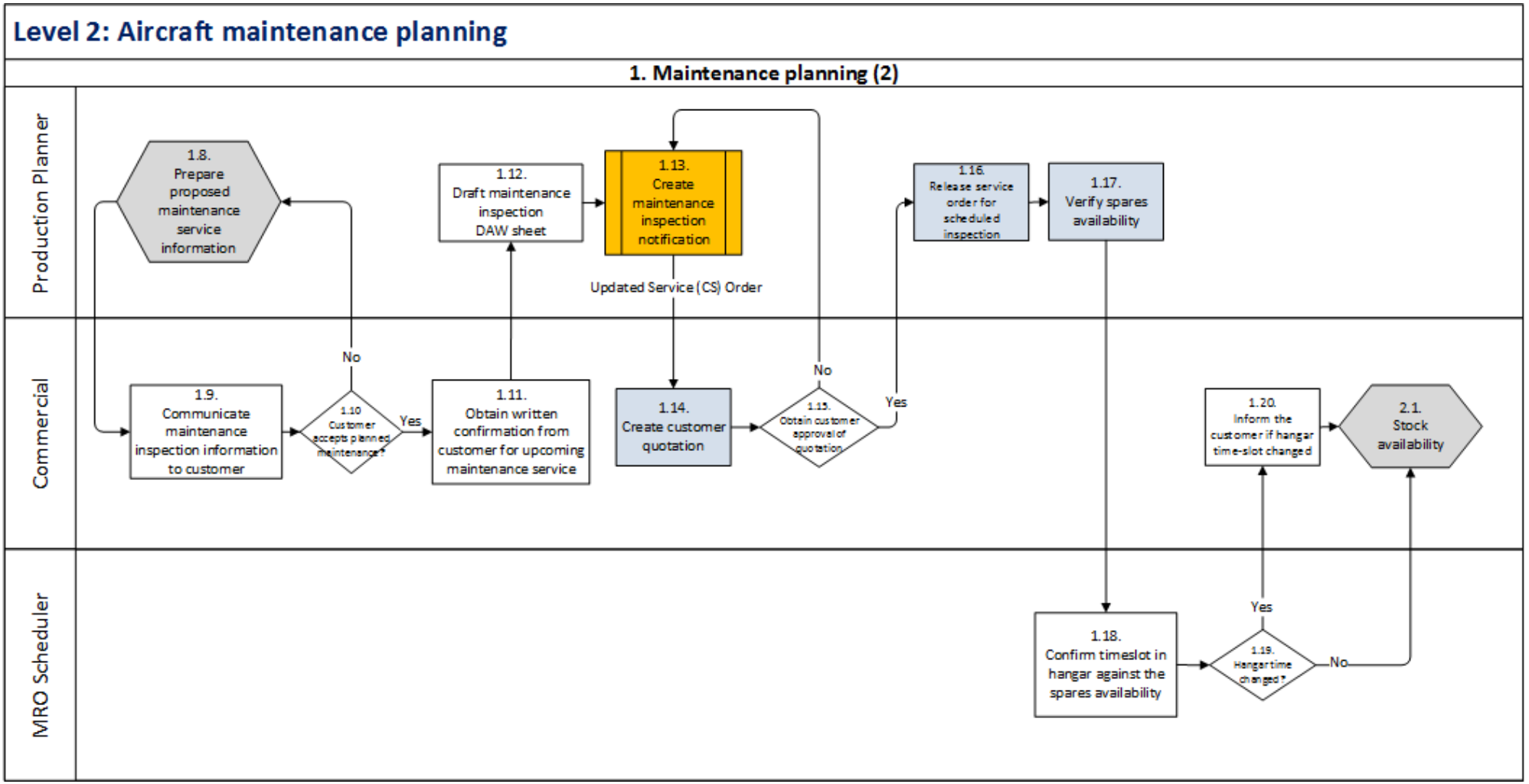


Figure 26: Maintenance Planning To-Be process Map

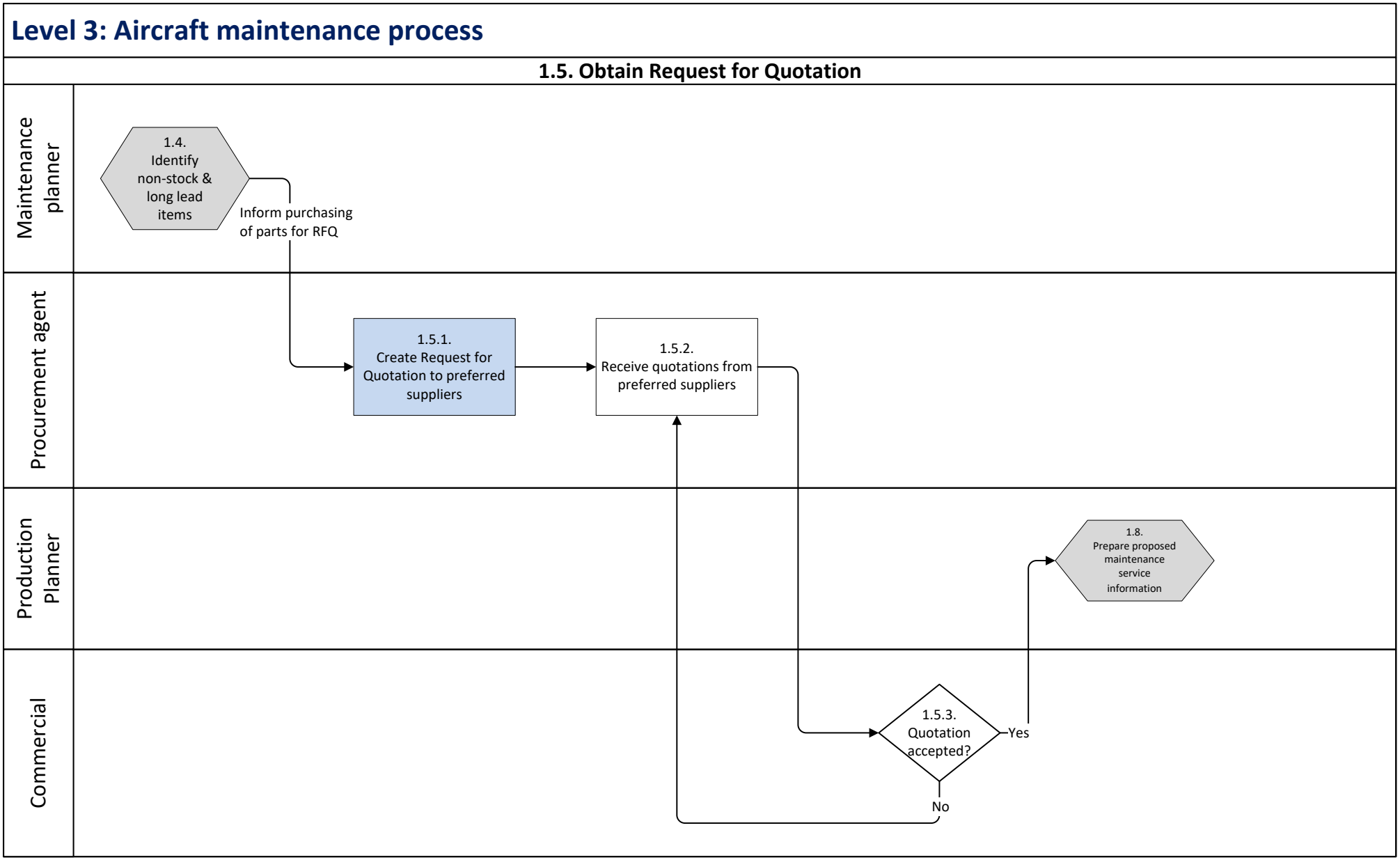


Figure 27: Maintenance Planning To-Be process Map

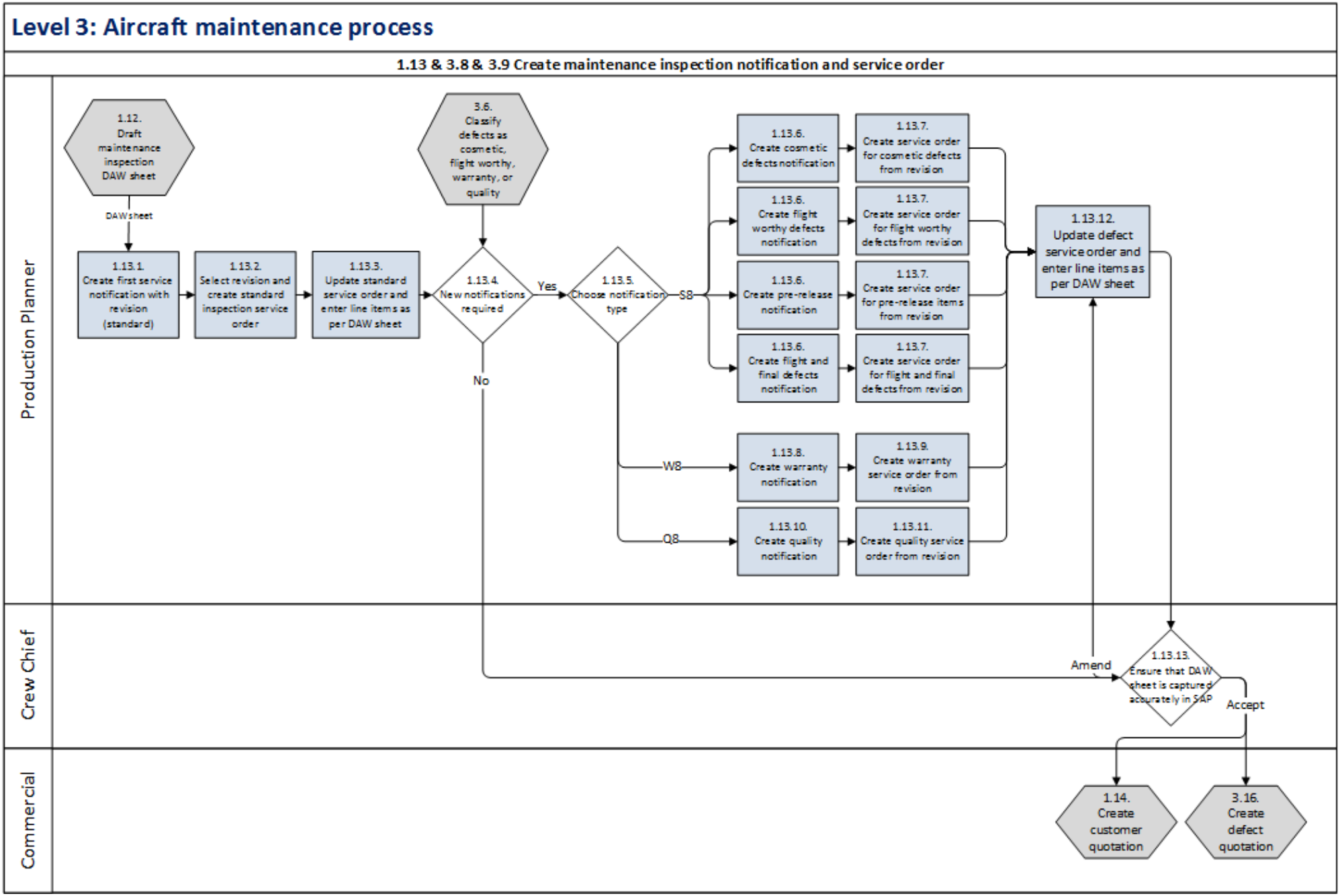


Figure 28: Maintenance Planning To-Be process Map

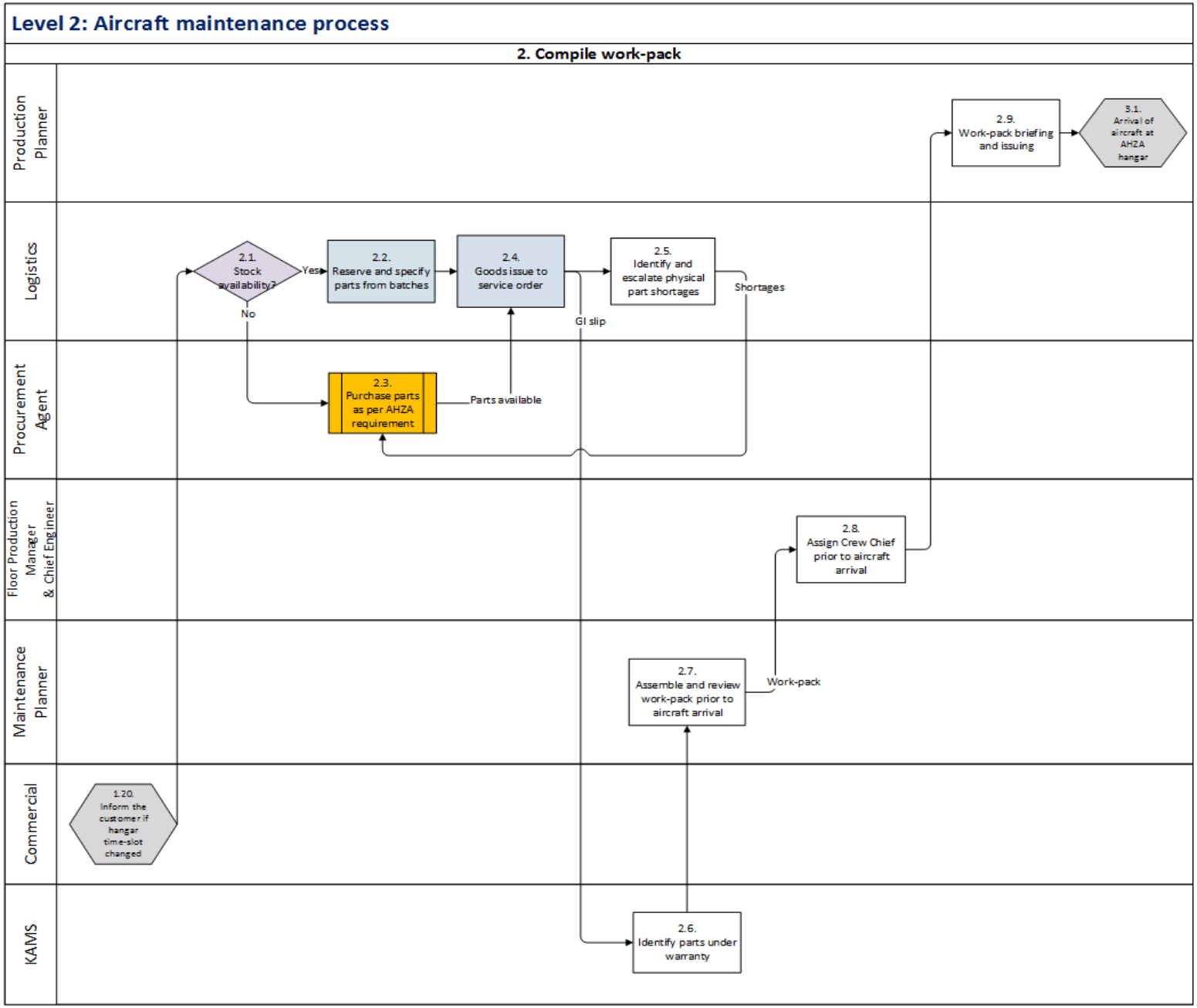


Figure 29: Compile work-pack to-be map

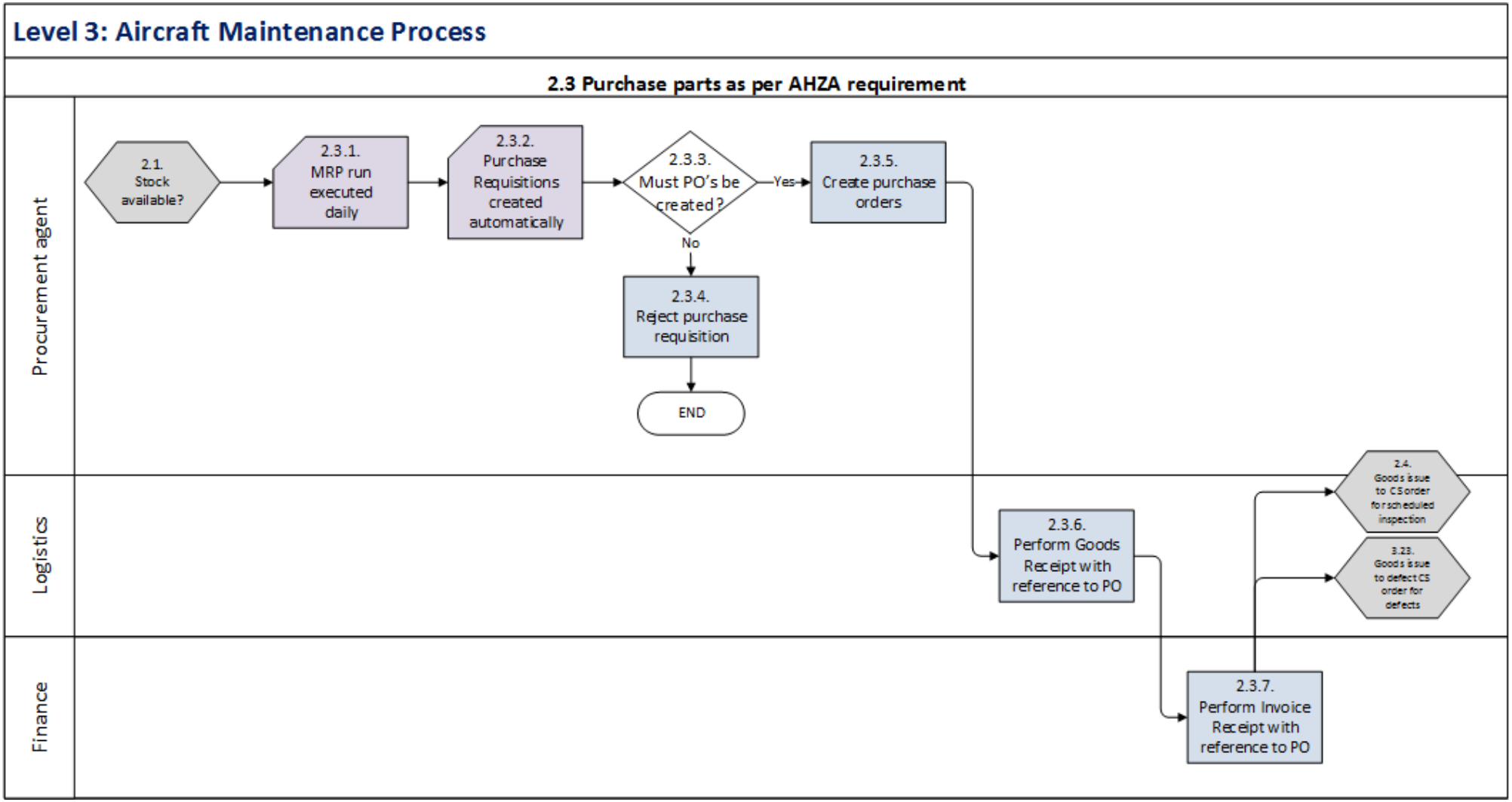


Figure 30: Compile work-pack to-be map

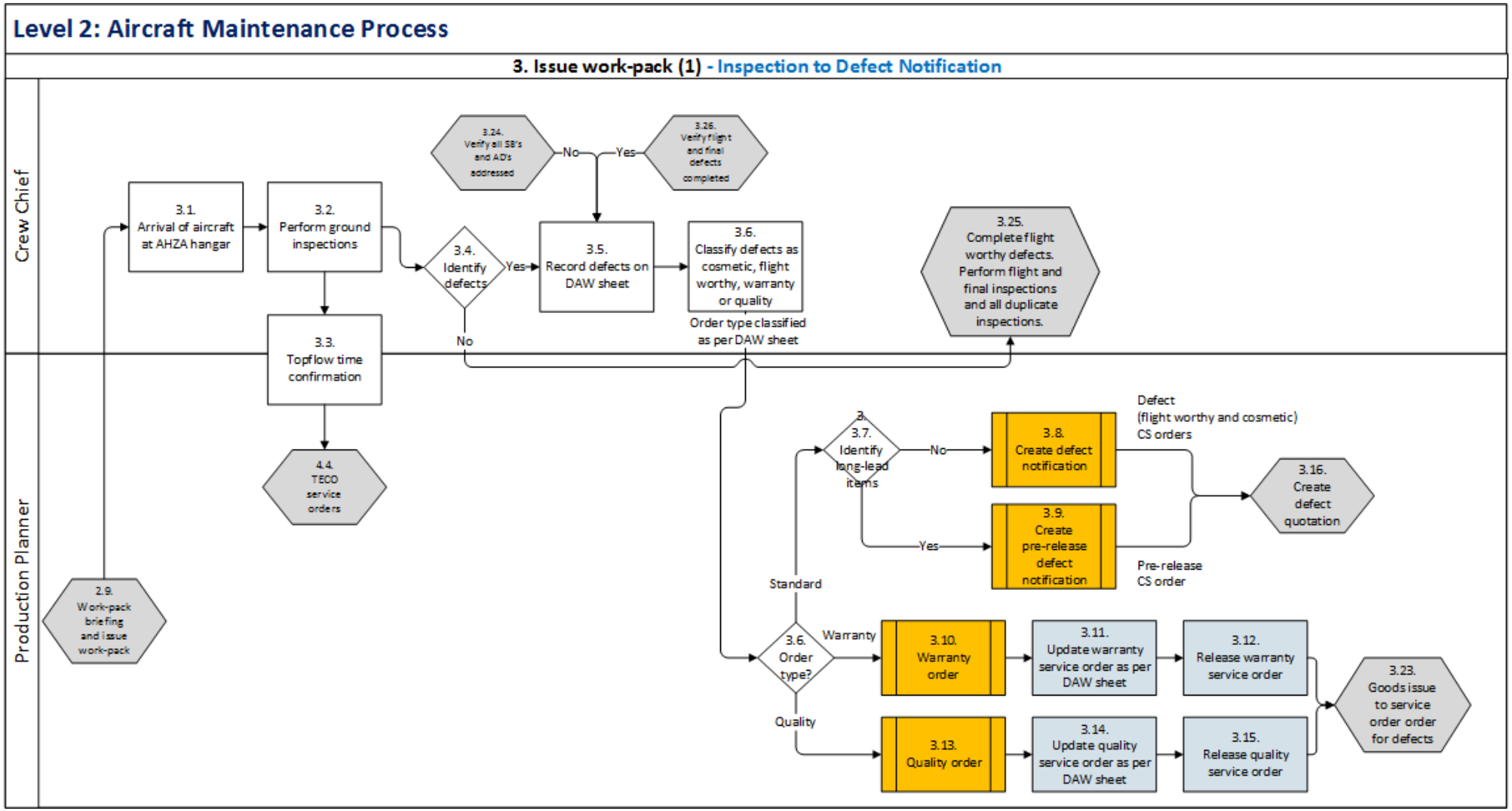


Figure 31: Issue work-pack to-be process map

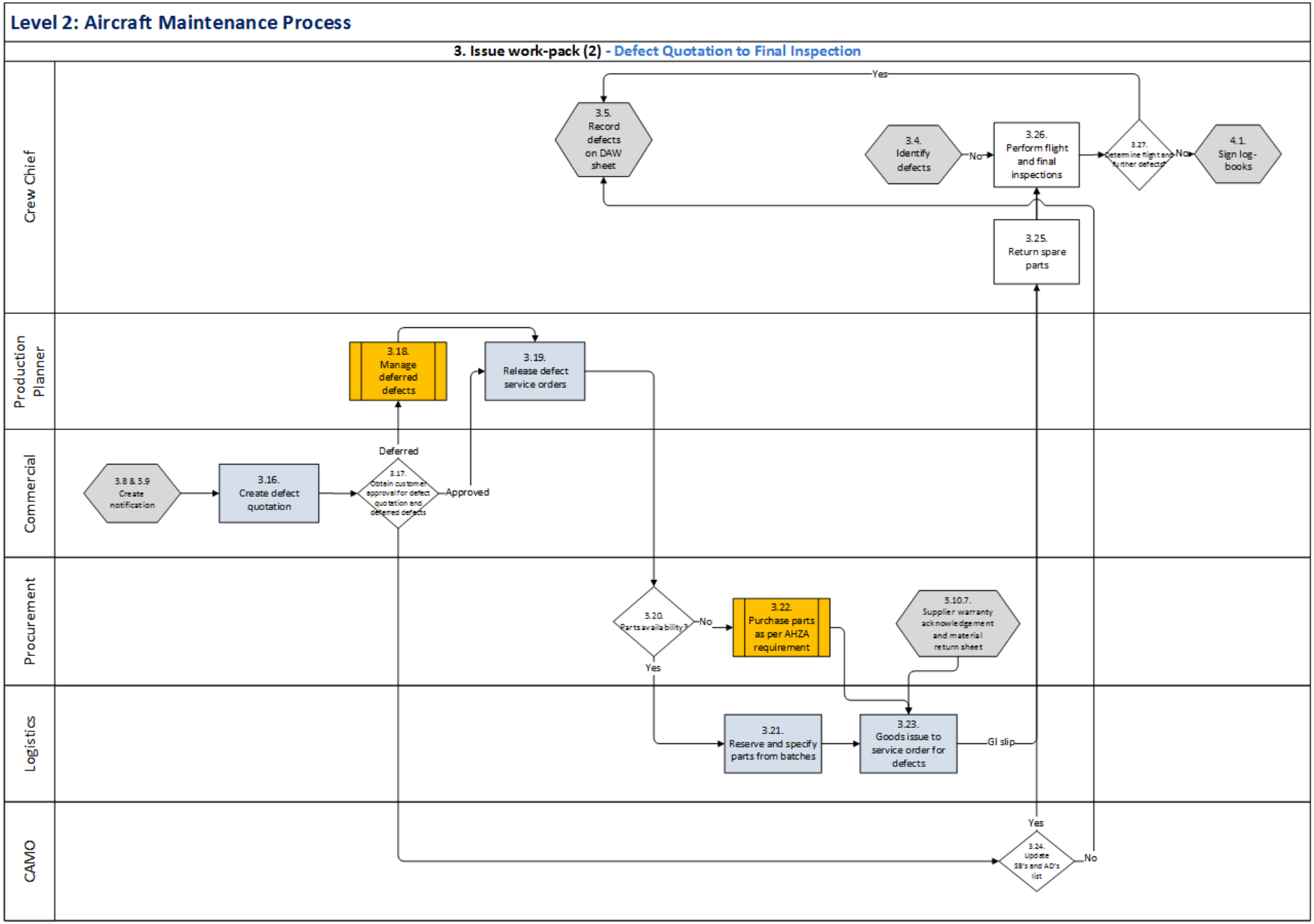


Figure 32: Issue work-pack to-be process map

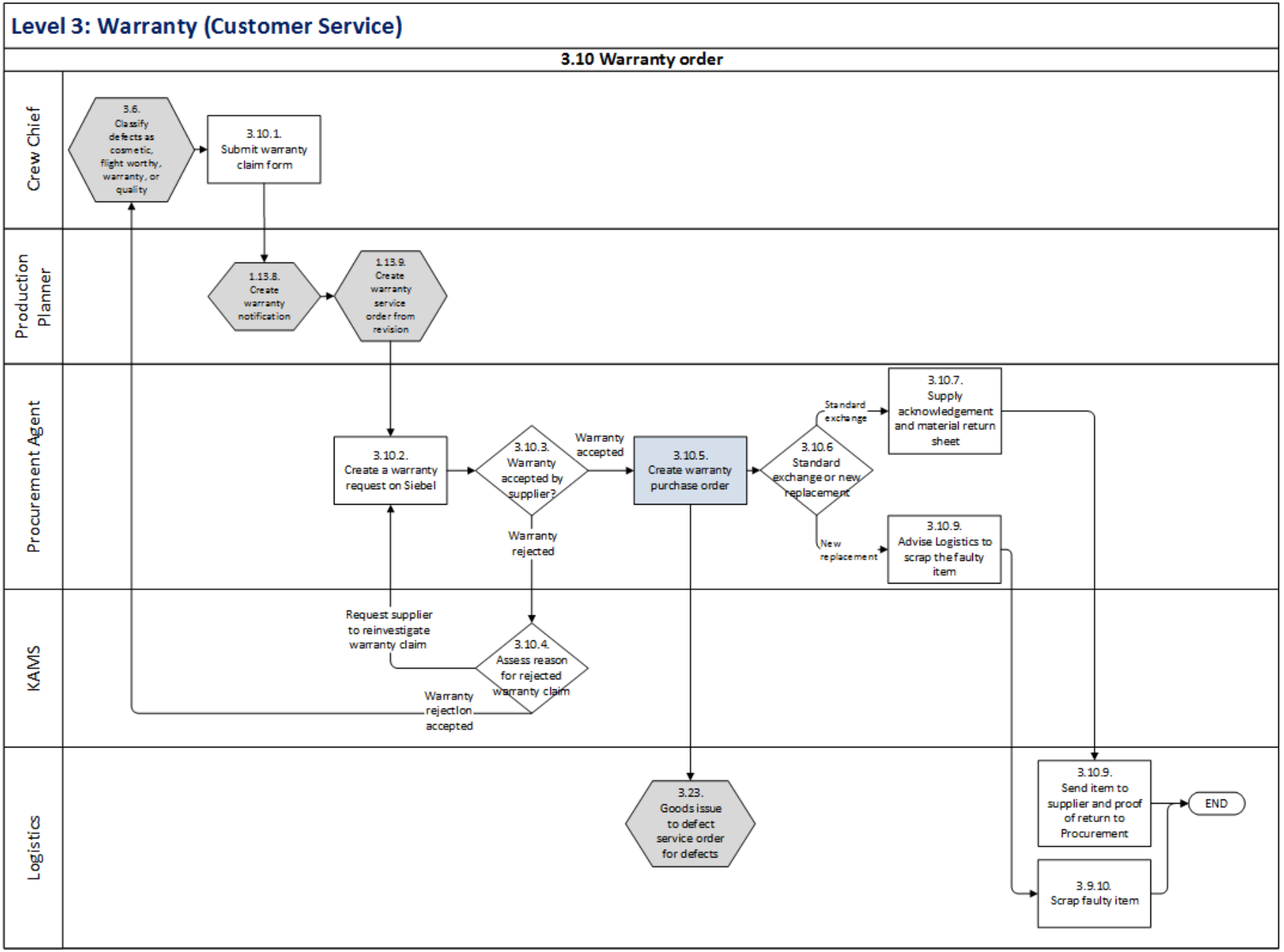


Figure 33: Issue work-pack to-be process map

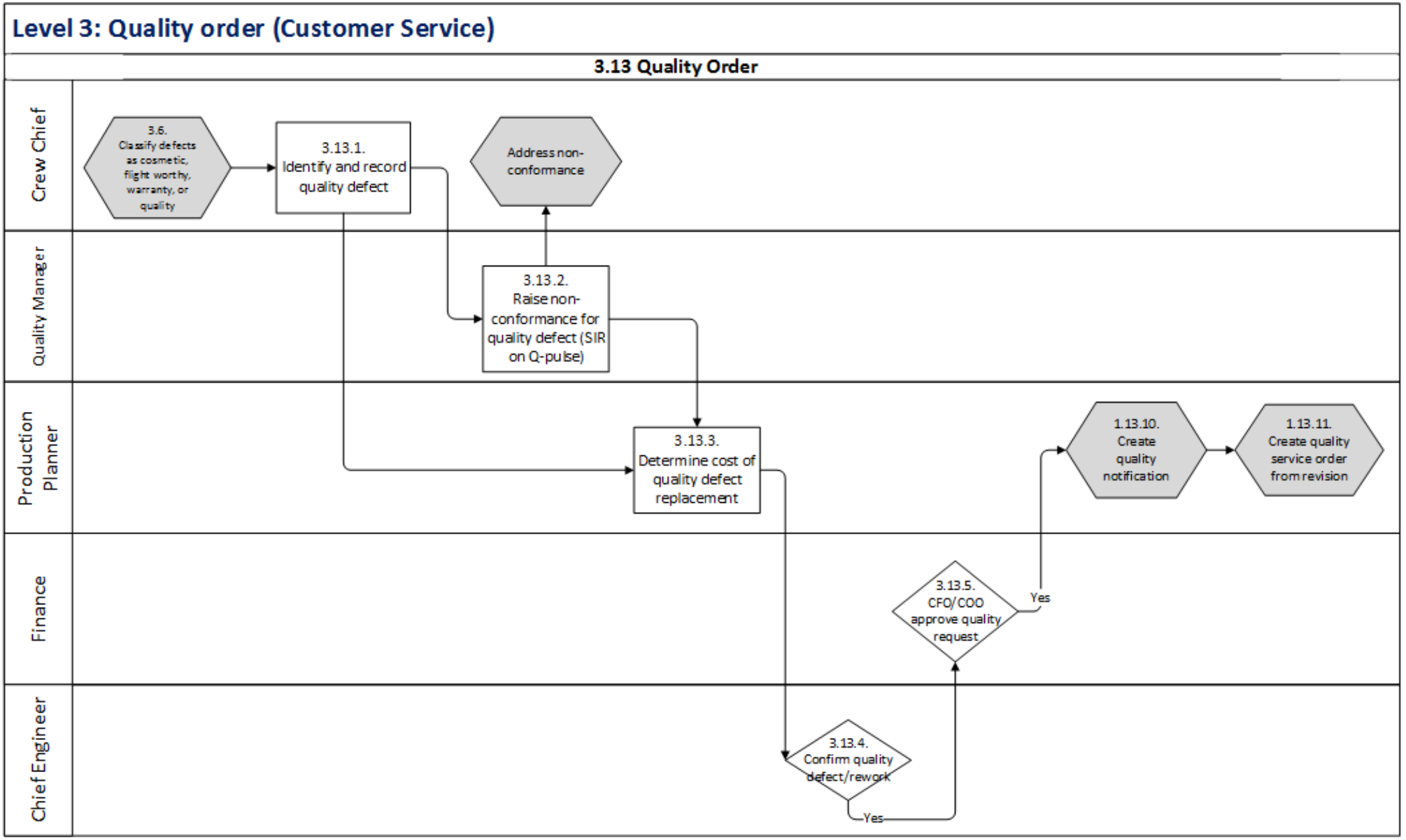


Figure 34: Issue work-pack to-be process map

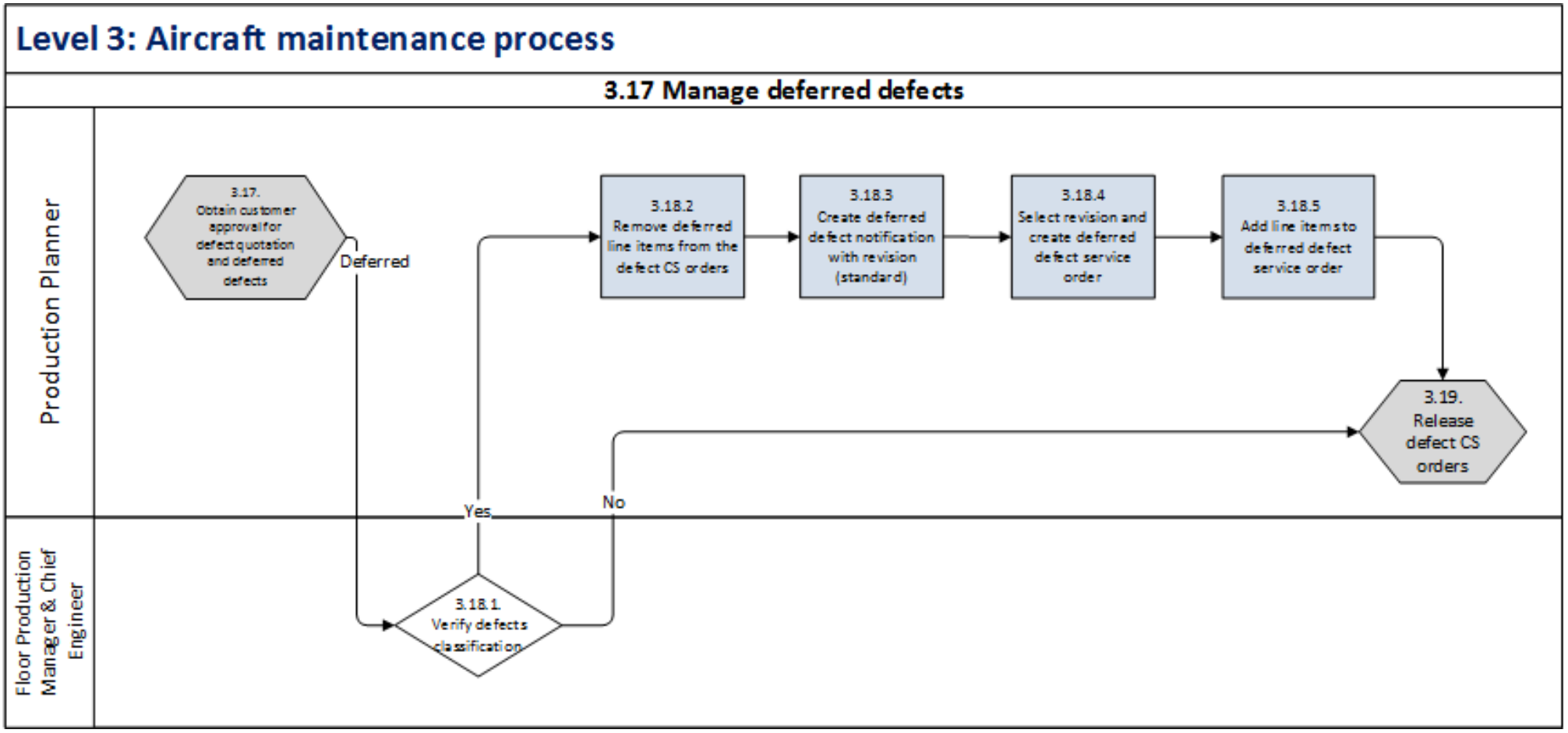


Figure 35: Issue work-pack to-be process map

4. RELEASE AIRCRAFT, INVOICE CUSTOMER AND FILE WORK-PACK

Level 2: Process 4.1 – 4.15

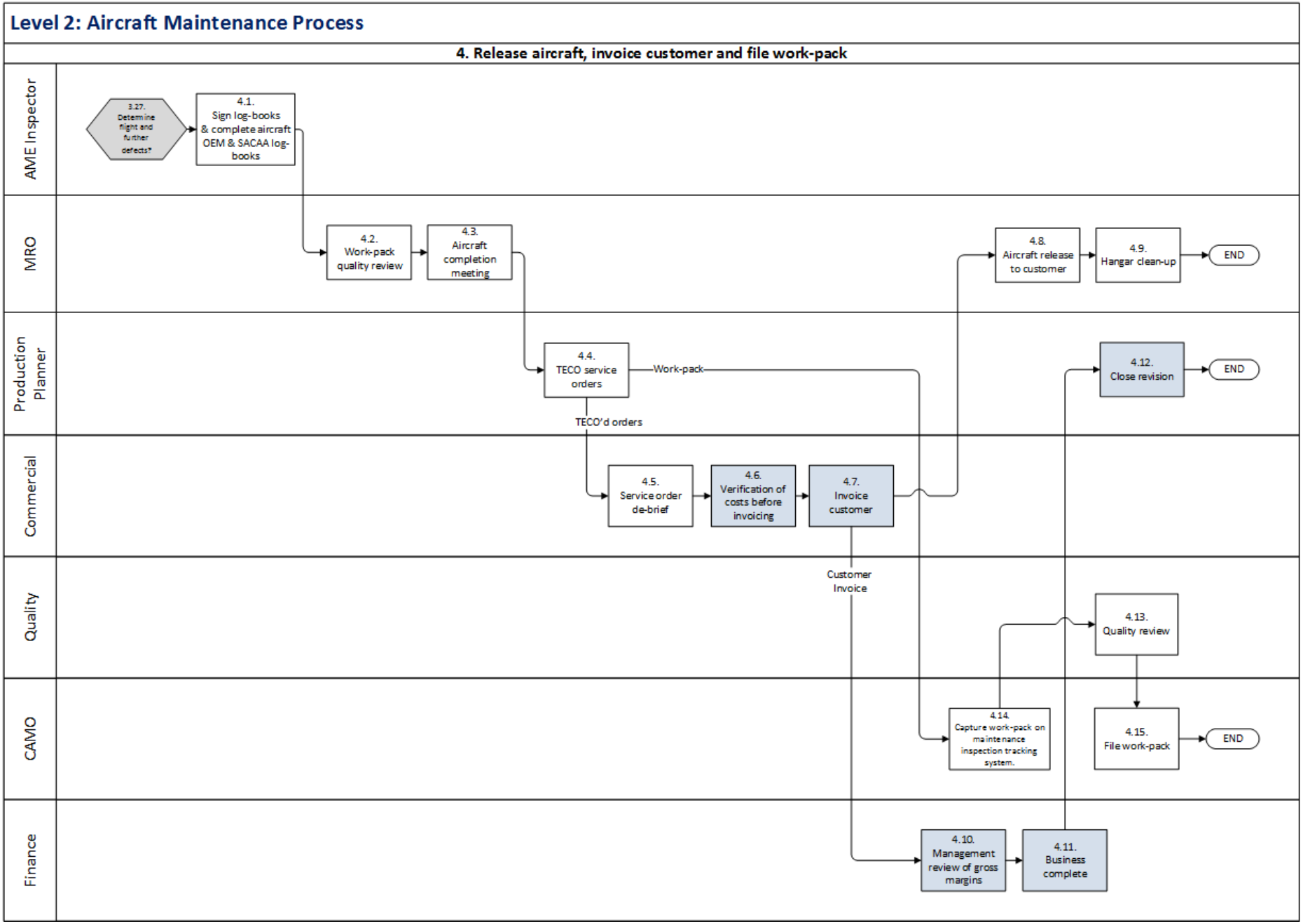


Figure 36: Release aircraft to-be process map

6.1.3 Detailed Design Documents

The Detailed Design Documents (DDD) per to-be map activity were created on Microsoft Word seen that these documents merely contain the relevant process activity data and no complex functionalities from the software is required. The DDD per activity outlines the process flow and detailed procedure steps for the Aircraft Maintenance process and is intended to optimise and simplify the process. The detailed procedure or process guideline provided for each process step captures the process description, information input, output, business rule, SAP transaction (if applicable), process responsibility, minimum control, exception handling, possible templates or examples and execution steps, including screen prints. Reference are made to related AHZA Quality Procedures. For an example of a DDD for each of the four processes refer to Figures 37-40.

The entire list of DDD's created are listed below and were made available in a CD format for assessment.

1 MAINTENANCE PLANNING

1.1 Obtain flight folio from customer
1.2 Update maintenance tracking system
1.3 Forecast upcoming aircraft maintenance
1.4 Identify non-stock & long lead items
1.5 Obtain Request for Quotation
  1.5.1 Create Request for Quotation to preferred suppliers
  1.5.2 Receive quotations from preferred suppliers
  1.5.3 Quotation accepted
1.6 Verify if deferred defects exists
1.7 Find a timeslot for the upcoming service
1.8 Prepare proposed maintenance service information
1.9 Communicate maintenance inspection information to customer
1.10 Customer accepts planned maintenance
1.11 Obtain written confirmation from customer for upcoming maintenance service
1.12 Draft maintenance inspection DAW sheet
1.13 Create maintenance inspection notification and service order
  1.13.1 Create first service notification with revision
  1.13.2 Select revision and create standard inspection service order
  1.13.3 Update standard service order and enter line items as per DAW sheet
  1.13.4 New notifications required
  1.13.5 Choose notification type
  1.13.6 Create additional defects notification
  1.13.7 Create service order from revision
  1.13.8 Create warranty notification
  1.13.9 Create warranty order from revision
  1.13.10 Create quality notification
  1.13.11 Create quality service order from revision

1.13.12 Update defect service order as per DAW sheet
1.13.13 Update deferred defects service order as per DAW sheet
1.13.14 Ensure that DAW sheet is captured accurately in SAP
1.14 Create customer quotation
1.15 Obtain customer approval of quotation
1.16 Release service order for scheduled inspection
1.17 Verify spares availability
1.18 Confirm timeslot in hangar against the spares availability
1.19 Hangar time changed
1.20 Inform the customer if hangar time-slot changed

2 COMPILE WORK-PACK

2.1 Stock availability
2.2 Reserve and specify parts from batches
2.3 Purchase parts as per AHZA requirement
2.3.1 MRP run executed daily
2.3.2 Purchase requisitions created automatically
2.3.3 Review purchase requisitions
2.3.4 Close purchase requisition
2.3.5 Create purchase orders
2.3.6 Perform goods receipt
2.3.7 Perform invoice receipt
2.4 Goods issue to service order
2.5 Identify and escalate physical part shortages
2.6 Identify parts under warranty
2.7 Assemble and review work-pack prior to aircraft arrival
2.8 Assign Crew Chief prior to aircraft arrival
2.9 Work-pack briefing and issuing

3 ISSUE WORK-PACK

3.1 Arrival of aircraft at AHZA hangar
3.2 Perform ground inspections
3.3 Topflow time confirmation
3.4 Identify defects
3.5 Record defects on DAW sheet
3.6 Classify defects as cosmetic, flight worthy, warranty or quality
3.7 Identify long lead items
3.8 Create defect notification
3.9 Create pre-release defect notification
3.10 Warranty order
3.10.1 Submit warranty claim form
3.10.2 Create a warranty request on Siebel
3.10.3 Warranty accepted by supplier
3.10.4 Assessment reason for rejected warranty

4.9 Hangar clean-up
4.10 Management review of gross margins
4.11 Business complete
4.12 Close revision
4.13 Quality Review
4.14 Capture work-pack on aircraft maintenance tracking system
4.15 File work-pack

Similar to the AHZA Quality Procedures, this library should become an essential part of the standard AHZA way of doing business and the embedded best practices and disciplines. The aim of the DDD is to formally document the SAP and related processes and procedures and to establish the basis for continuous improvement and training. As such, the DDD should be continuously reviewed and updated by business owners as processes and procedures are challenged and streamlined. Business owners should be invited to suggest process improvements and the resulting process reviews and updates should be supported. This should be augmented by regular formal process reviews, at least once per year.

1. MAINTENANCE PLANNING

1.1 Obtain flight folio from customer	
	PROCESS DESCRIPTION
	Flight folios are received regularly from customers as per CAA requirements. The aircraft maintenance forecast is used to reflect the latest status of recorded flight hours and forwarded weekly by the maintenance planners to remind sales representatives to request the necessary flight folios from customers.
	PROCESS OBJECTIVE
	To request and obtain timely flight folios updates from the customer.

Information / Documentation	*Input:* - Flight folio template - Aircraft Maintenance Forecast - E-mail & call reminders to customers to submit flight hours	*Output:* - Updated flight folio per aircraft - Updated flight hours in Maintenance Forecast
Application System: Type and Transactions:	N/A	
Business Rule	Aircraft flight folio record to be maintained and communicated by customers as per CAA requirements	
Role / Position	Sales Representative	
Quality procedure reference	N/A	
Minimum control	Any Flight Folio (for a/c currently serviced by AHZA) not updated for more than one month to be escalated to the Commercial Manager	
Exceptional handling, Alerts, Notifications	N/A	
Templates / Examples	***Aircraft Maintenance Forecast*** example	***Flight Folio and Defect Report*** example

Detail Execution steps (Procedure)

1. Maintenance Planner distributes the Aircraft Maintenance Schedule to Sales Representatives, indicating flight folios to be updated
2. Sales Representatives request customers to provides updated Flight Folio and Defect Reports for all Aircraft per e-mail or telephone call
3. If no response to provide the updated flight folio is received within one week from a specific customer, the Sales Representative follow up with reminder via e-mail or telephone
4. If no response within a further two working days from a specific customer, the Sales Representative escalates the delay in flight folio update to the Sales Administration Manager
5. Sales Representatives receive electronic copies of Flight Folio and Defect Reports from customers
6. Sales Representatives forward the updated Flight Folio Reports if available

***Note:** An electronic system, Fleetkeeper, which will enable customers to capture the flight folio data will be piloted with Sanparks. Flight hours and defects will be captured electronically by the customer and forwarded automatically to the responsible AHZA representative. This 'Obtain Flight Folio' process will need to be updated as soon as the system is fully operational.*

Figure 37: Maintenance Planning DDD example

2. COMPILE WORK-PACK

2.2 Reserve and specify parts from batches

PROCESS DESCRIPTION

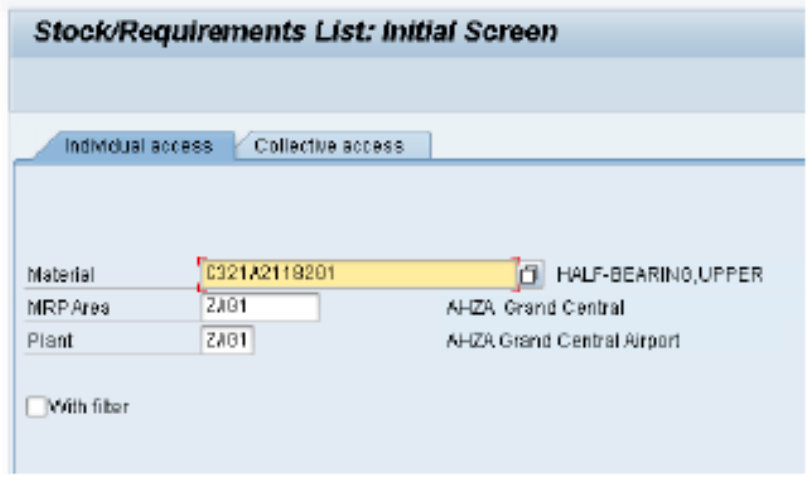
Available parts must be reserved for specific service orders.

PROCESS OBJECTIVE

To ensure that available parts are allocated to the correct service/sales orders as per the relevant priority.

Information / Documentation	*Input:* - Available stock *Output:* - Parts reserved to service (CS) order for scheduled inspection
Application System: Type and Transactions:	SAP MD04 – Stock / Requirements list
Business Rule	Ensure that both service and sales orders are considered before stock is reserved.
Role / Position	Logistics
Quality procedure reference	N/A
Minimum control	Service and sales orders must be taken into account before stock is reserved.
Exceptional handling, Alerts, Notifications	N/A
Templates / Examples	N/A

Detail Execution steps (Procedure)

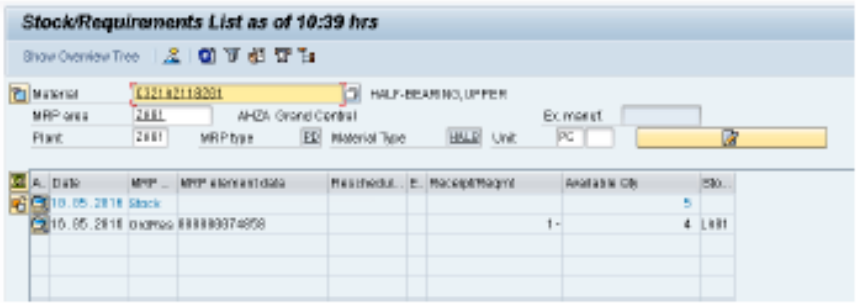


Transaction MD04

Enter the relevant material, MRP area and plant.
Click on Enter.

Figure 38: Compile work-pack DDD example

AIRBUS HELICOPTERS



The service and sales orders relating to the material are shown.

3. ISSUE WORK-PACK

3.3 Topflow time confirmation

PROCESS DESCRIPTION
Record and confirm labour resource time allocation to service orders and other activities
PROCESS OBJECTIVE
To record and ensure accountability of labour hours

Information / Documentation	*Input:* - Service Orders - Work-pack	*Output:* - Confirmed service time
Application System Type and Transactions	TOPFLOW/OO_T02_HYB - Clock time	
Business Rule	Before any service task and after the has been completed the following steps has to be followed: - Scan the bar code on the access card - Scan the bar code in the printed job card (shop paper)	
Role / Position	Crew Chief & Production Scheduler	
Quality procedure reference	N/A	
Minimum Control	No resource labour can perform a service task without clocking to a specific job or service order	
Exceptional handling, Alerts, Notifications	N/A	
Templates / Examples	N/A	

Detail Execution steps (Procedure)	
	Enter User Name and Password

Figure 39: Issue work-pack DDD example

AIRBUS HELICOPTERS

4. RELEASE AIRCRAFT INVOICE CUSTOMER AND FILE WORK-PACK

4.1 Sign log-books and complete aircraft OEM & SACAA log-books

PROCESS DESCRIPTION

Perform the OEM inspection and complete the OEM & SACAA log-books

PROCESS OBJECTIVE

To complete the aircraft OEM and SACAA log-books

Information / Documentation	*Input:* - Flight worthy aircraft - Updated work-pack - Signed flight folio	*Output:* - OEM logbook - SACAA logbook - Release to service form
Application System: Type and Transactions:	N/A	
Business Rule	The release to service form has to be completed.	
Role / Position	Crew Chief, supported by Chief Engineer AME	
Quality procedure reference	QP 7.17	
Minimum control	The release to service form has to be reviewed by the Chief Engineer.	
Exceptional handling, Alerts, Notifications	N/A	
Templates / Examples	N/A	

Detail Execution steps (Procedure)

1. Ensure that the Crew Chief completed the work-pack with all the relevant serial and part numbers.
2. Record all the work performed in the SACAA log-book
3. Complete the log cards
4. Complete the flight folio
5. Complete the release to service from
6. Dual inspection by another (different to the AME overseeing the current service) AME

Figure 40: Release aircraft DDD example

AIRBUS HELICOPTERS

6.2 Performance Measurement

Performance measurement is crucial to effectively manage processes and the organization as a whole. As mentioned in Chapter 2 section 2.6, AHZA has no performance measures in place. Processes cannot be managed effectively and employees have no performance targets to aim for. Defining performance measures was a crucial component of the final solution seen that the process document library aids in defining process procedures and roles but performance measures help to optimize the final outcome of the project. This optimization is ensured by measuring current performance, identifying failure points, making improvements and finally measuring process performance again until improvement within the process is recognized. Thus the defined KPI's in the following sections should be used in an iterative process of continual monitoring and improvement of the CS order process.

6.2.1 Process KPI's

Creating the correct and relevant KPI's to measure the performance of the *CS order process* was an important deliverable to ensure future monitoring, management and control of the processes. AHZA's end goal is to gain full and timely financial control, by improving the CS order process. All dimensions in the CS order process namely; Purchasing, Customer Service, Goods Binning and Receipt, Goods issued and Stock Control contribute towards achieving this goal.

The concept of the Balanced Scorecard was used to develop the process KPI's across the dimensions mentioned earlier. Different goals were defined for each dimension which link with the strategy of the CS order process. The goals guided the development of the performance measures to ensure that they reflect how well the dimension is achieving and working towards the strategy. Figure 41 displays the Balanced Scorecard outline of the five dimensions to be measured.

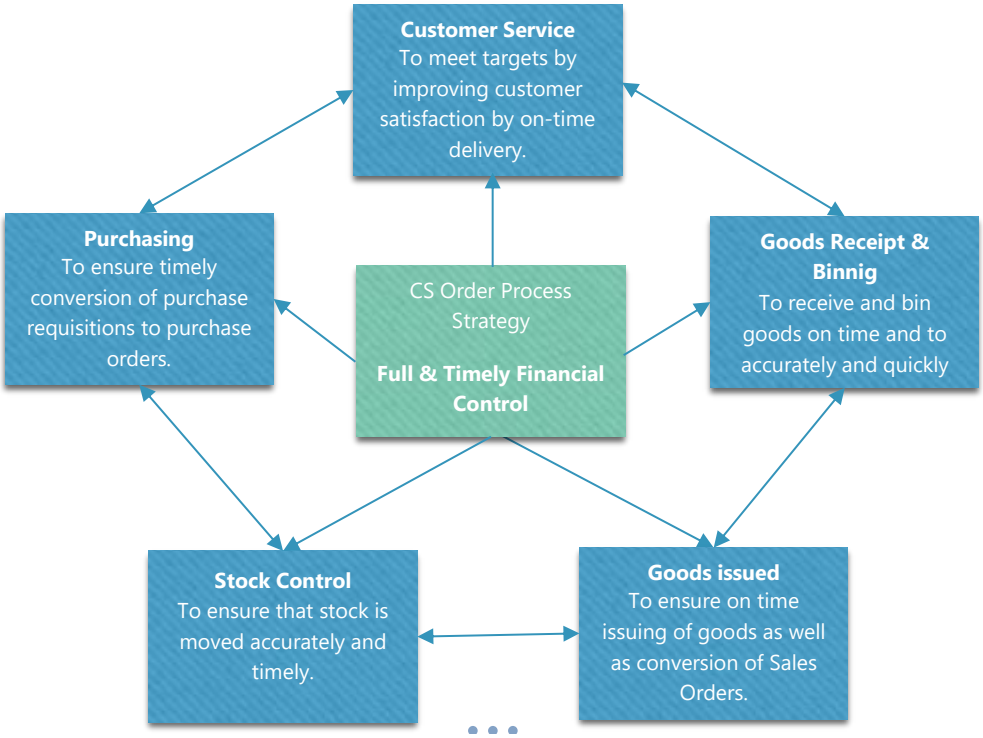


Figure 41: CS order process performance measurement dimensions

The KPI's for the CS order process are listed in Table 13. The KPI's for *Customer Service* determines whether all parts where delivered to customers on time. Satisfied customers are of great importance to AHZA thus these KPI's have to be monitored closely. The KPI's for *Procurement* focus on the supplier performance. Suppliers are measured in terms of timely conversion of purchase requisitions to purchase orders and material shortages. This will provide a baseline for supplier management, to determine which suppliers contribute towards the strategy of the CS order process. The *Stock Control* KPI's focus on the accuracy of the daily stock as well as measuring the slow moving stock as a percentage of the total value thereof. Slow moving stock leads to a delays which may lead to late delivery to customers thus numerous KPI's are integrated amongst each other and it is important for AHZA to realize that all KPI's influence each other and are thus equally important. The *Goods Receipt & Binning* measures whether goods required for the maintenance job are received on time at the workshop each day and whether the binning thereof is completed within 24 hours by means of regular spot checks. Finally, the *Goods Issued* KPI's whether the Goods Issued by MRO are received on time as well as well as the conversion time of a sales order to a delivery note as defined on SAP.

Each KPI is linked to the goal for the specific dimension. A description of each KPI is given and realistic targets for all KPI's have to be defined by the top management of AHZA.

Table 13: Key Performance Measurements of the CS Order process

KPI		Description	Target
Stock Control	Stock accuracy	Stock Accuracy as per daily cycle count (# of parts)	TBD
		(Based on # of parts as per available SAP Cycling Counting)	TBD
	Slow moving stock	Slow Moving Stock as % of Total Value	TBD
Goods Receipt & Binning	Goods received on time	% of Deliveries receipted within 24 hours	TBD
	Parts binning on time	% of Binning completed in 24 hours	TBD
		(Measured by regular spot checks)	TBD
Customer Service	On time delivery of parts	On Time Delivery	TBD
	AOG Spare part prioritisation	AOG Spare Part Supply Lead Time	TBD
Purchasing	Purchase request to purchase order time spent	Timely Conversion of Purchase Requisitions to Purchase Orders	TBD
		(Measured as per system time)	TBD
	Material shortages	Supply Shortages - MRO Productive Hours Lost	TBD
Goods Issued	MRO requests to goods issued	MRO Requisitions to Goods Issue	TBD
		Target on Time as per SAP Report1	TBD
	Sales order to delivery note	Sales Order to Delivery Note	TBD
		Target on Time as per SAP Report2	TBD

6.2.2 Process KPI tracker

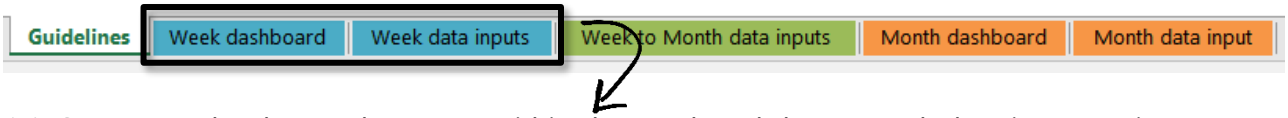
The Process KPI Tracker discussed in this section will help to efficiently implement and monitor all the KPI's defined for the process in section 6.2.1. The KPI tracker provides a platform to capture the KPI data, and visually allows employees to communicate the KPI's to the relevant stakeholders by using an Excel Spreadsheet Template. The template consists of the following spread sheets:

- Guidelines – Refer to Figure 43
- Weekly dashboard – Refer to Figure 45
- Weekly data inputs – Refer to Figure 44
- Week-to-month data inputs – Refer to Figure 46
- Monthly dashboard – Refer to Figure 48
- Monthly data inputs – Refer to Figure 47

KPI tracking tool guidelines:

The tool should be implemented in the following manner (also see Figure 43):

1. Weekly data capturing, reporting, and implementation



1.1. Capture each relevant data entry within the Excel worksheet "Week data inputs" (Figure 44) marked in blue.
1.2. Ensure that the data is captured as accurately as possible.
1.3. Compare the measurement captured within each data entry against the target value, and against the data history or trend line.
1.4. Review the weekly dashboard on the worksheet "Week dashboard" (Figure 45). If a major deviation is noted from the target, and or present trend, investigate the root cause of the deviation.
1.4.1. First, make sure that the data entry is entered correctly.
1.4.2. If the data entry is entered correctly, and the deviation still occur, mark the deviation with an oval callout marker, please see example below (Figure 42), and describe the problem in a few words.

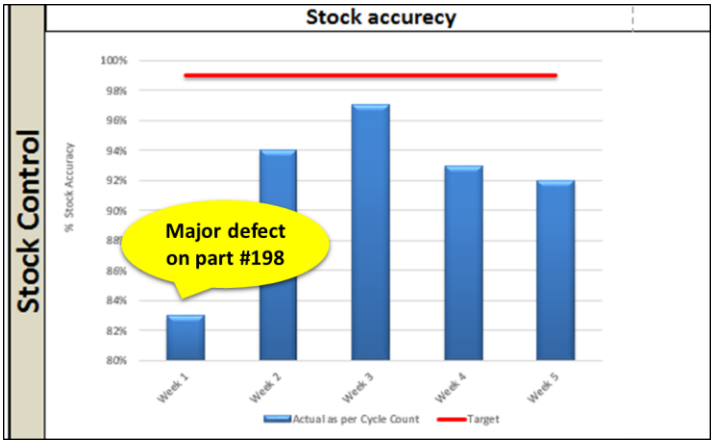
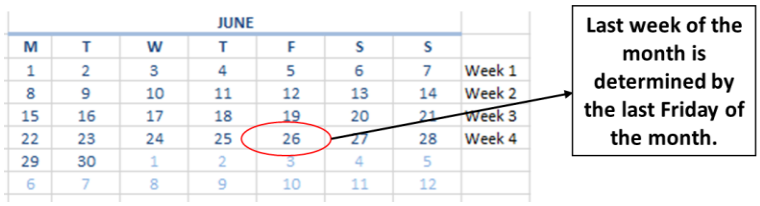


Figure 42: Dashboard deviation indication

1.5. Update all KPI's and callout explanations in graphs, and print to display during weekly operations meeting.
1.6. During weekly team meetings, discuss performance, explain problems/route causes, and brainstorm appropriate actions, responsibility and time line.
1.7. Record the brainstorming session information manually within the meeting, and update the electronic report version.
1.8. At the end of each month, use the KPI report, and communicate the results back to management.

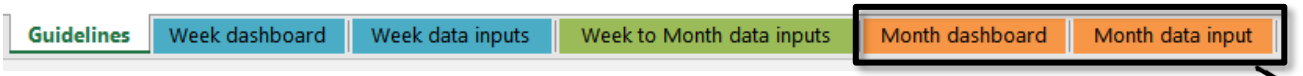
2. Week to month data storage

2.1 Note that the last week of a month is determined by the last Friday of the month. To look at the week schedule within a month. See the example below on how to determine when the last week of a month should be captured.



2.2 Once the entire month's data is captured, copy the data captured during that month to the worksheet "Week to Month data inputs" (Figure 46) and paste the data under the month's relevant column.
Please note: the weekly data capturing sheet makes prevision for a five-week month. If the month only had four weeks, just copy the four weeks' data into the relevant column.

3. Monthly capturing, reporting, and implementation



3.1. The monthly report's structure is similar to the weekly report's structure. If the data was copied correctly in step 2, the monthly report's graphs will be updated automatically.
3.2. Follow the guidelines set out in step 1.4 and 1.5 and apply it to the entire year. Report on the major issues and improvements
3.3. Identify any trends in problems and causes throughout the year, report back on improvement, review the relevancy of the KPI, and make improvement decisions the following year.

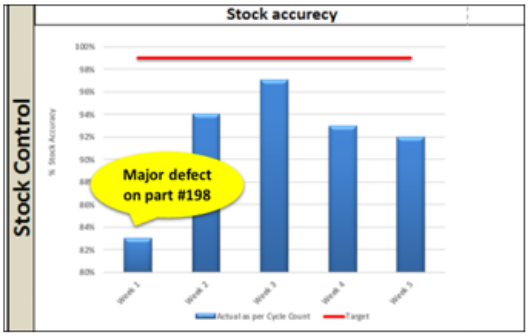
AIRBUS HELICOPTERS KPI data capturing and reporting guidelines

This report is a tool to ensure efficient implementation of Airbus warehouse key performance indicator (KPI's) analysis. The KPI report provides a platform to capture the KPI data, and visually allows the warehouse manager to communicate the KPI's to the relevant stakeholders.

The KPI reporting tool should be implemented in the following manner:

1. Weekly data capturing, reporting, and implementation.

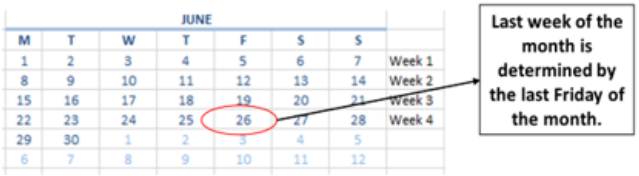
1.1. Capture each relevant data entry within worksheet "Week KPI's & Actions" marked in blue.
1.2. Ensure that the data is captured as accurately as possible.
1.3. Compare the measurement captured within each data entry against the target value, and against the data history or trend line .
1.4. Review the weekly KPI report on the worksheet "Week KPI's & actions". If a major deviation is noted from the target, and or present trend, investigate the root cause of the deviation.
1.4.1. First, make sure that the data entry is entered correctly.
1.4.2. If the data entry is entered correctly, and the deviation still occur, mark the deviation with a oval callout marker, please see example below, and describe the problem in a few words.



1.5. Update all KPI's and callout explanations in graphs, and print to display during weekly operations meeting.
1.6. During weekly team meetings, discuss performance, explain problems/route causes, and brainstorm appropriate actions, responsibility and time line.
1.7. Record the brainstorming session information manually within the meeting, and update the electronic report version.
1.8. At the end of each month, use the KPI report, and communicate the results back to management

2. Week to month data storage.

2.1. Note that the last week of a month is determined by the last Friday of the month. To look at the week schedule within a month, go to the worksheet "calendar". See the example below on how to determine when the last week of a month should be captured.



2.2. Once the entire month's data is captured, copy the data captured during that month to the worksheet "Week to Month" and paste the data under the month's relevant column.
Please note: the weekly data capturing sheet makes prevision for a five week month. If the month only had four weeks, just copy the four weeks' data into the relevant column.

3. Monthly reporting

3.1. The monthly report's structure is similar to the weekly report's structure. If the data was copied correctly in step 2, the monthly report's graphs will be updated automatically.
3.2. Follow the guidelines setout in step 1.4 and 1.5 and apply it to the entire year. Report on the major issues and improvements
3.3. Identify any trends in problems and causes throughout the year, report back on improvement, review the relevancy of the KPI, and make improvement decisions the following year.

Figure 43: KPI tracker guidelines sheet

Weekly data capturing

	KPI	Description	Measurement	Jan-16 Week 1	Week 2	Week 3	Week 4	Week 5
Stock Control	Stock accuracy	Stock Accuracy as per daily cycle count (# of parts)	Target	99%	99%	99%	99%	99%
		(Based on # of parts as per available SAP Cycling Counting)	Actual as per Cycle Count	83%	94,00%	97,00%	93,00%	92,00%
	Slow moving stock	Slow Moving Stock as % of Total Value	Target	20%	20%	20%	20%	20%
			Actual as per % of Value	19%	18,00%	19,50%	17,80%	16,90%
Goods Receipt & Binning	Goods received on time	% of Deliveries receipted within 24 hours	Target	95%	95%	95%	95%	95%
			% Same Day	90,00%	89,00%	88,00%	91,00%	83,00%
			% Within 24h	92,00%	91,00%	93,00%	90,00%	89,00%
			% Exceed 24h	40,00%	59,00%	63,00%	41,00%	58,00%
	Parts binning on time	% of Binning completed in 24 hours	Target	80%	80%	80%	80%	80%
		(Measured by regular spot checks)	% Binned in 24h	75,00%	74,00%	69,00%	76,00%	72,00%
Customer Service	On time delivery of parts	On Time Delivery OTR5b	Target	100,0%	100,0%	100,0%	100,0%	100,0%
			Actual	85,00%	83,00%	88,00%	91,00%	87,00%
	AOG Spare part prioritisation	AOG Spare Part Supply Lead Time	Target	12	12	12	12	12
			Actual	15				
Purchasing	Purchase request to purchase order time spent	Timely Conversion of Purchase Requisitions to Purchase Orders	Target (h)	24	24	24	24	24
			Tolerance (h)	36	36	36	36	36
		(Measured as per system time)	Actual Average	12	16	18	22	15
	Material shortages	Supply Shortages - MRO Productive Hours Lost	Target	4	4	4	4	4
			Actual	8	4	2	1	0
Goods Issue	MRO requests to goods issued	MRO Requisitions to Goods Issue	Target	8	8	8	8	8
		Target on Time as per SAP Report1	Actual	6,5	9,2	6,0	4,0	3,0
	Sales order to delivery note	Sales Order to Delivery Note	Target	12	12	12	12	12
		Target on Time as per SAP Report2	Actual	5,2	10,6	10,0	8,0	7,0

Figure 44: Weekly data capturing spreadsheet

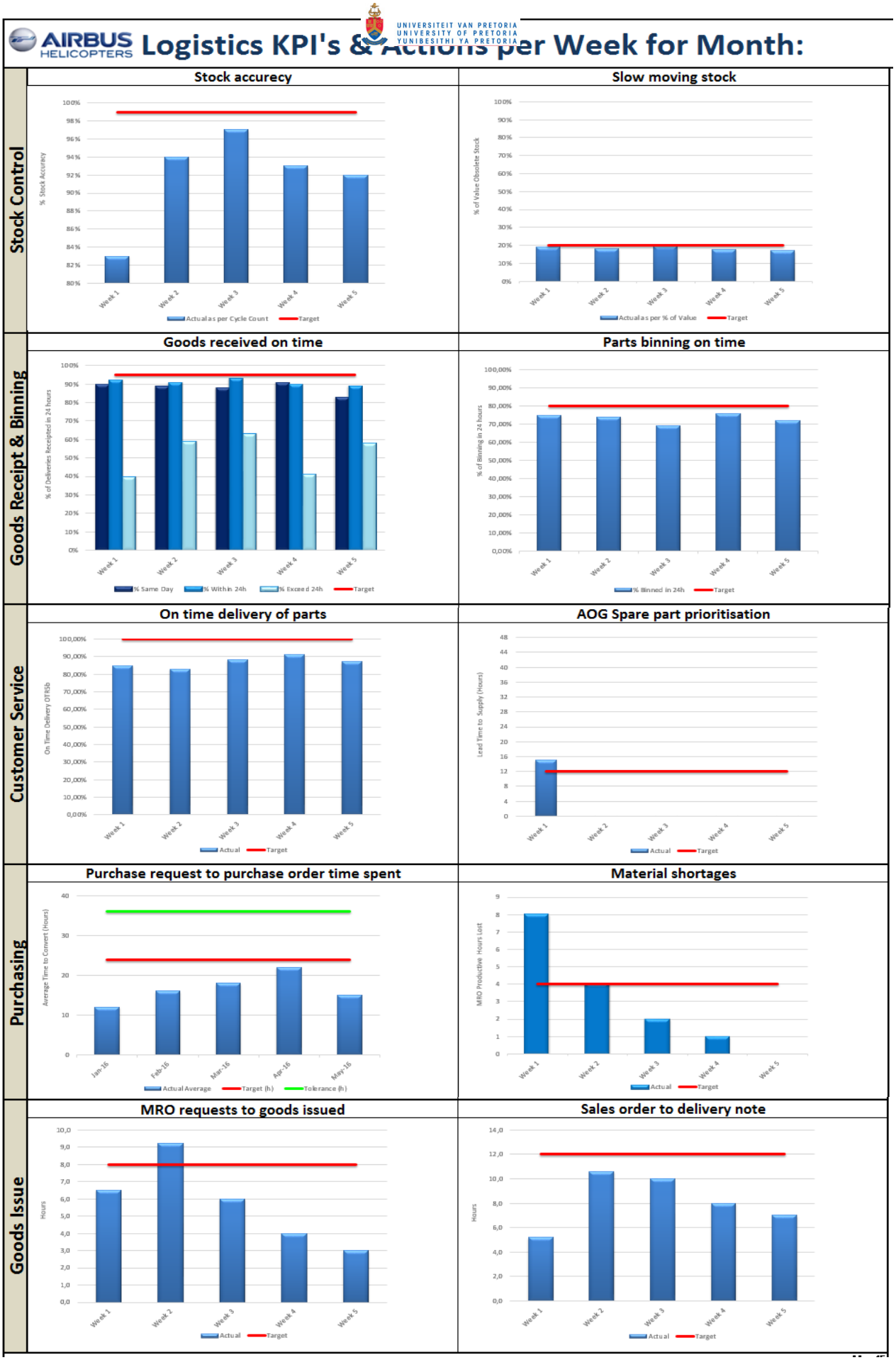


Figure 45: Weekly KPI dashboard

Week-to-month data capturing

	KPI	Description	Measurement	May-15 Week 1	2	3	4	Average	Jun-15 Week 1	2	3	4	Avera
Stock Control	Stock accuracy	Stock Accuracy as per daily cycle count (# of parts)	Target	99%	99%	99%	99%	99.00%	99%	99%	99%	99%	99.00
		(Based on # of parts as per available SAP Cycling Counting)	Actual as per Cycle Count					0.00%					0.00
	Slow moving stock	Slow Moving Stock as % of Total Value	Target	20%	20%	20%	20%	20.00%	18%	18%	18%	18%	18.00
			Actual as per % of Value					0.00%					0.00
Goods Receipt & Binning	Goods received on time	% of Deliveries receipted within 24 hours	Target	95%	95%	95%	95%	95.00%	95%	95%	95%	95%	95.00
			% Same Day					0.00%					0.00
			% Within 24h					0.00%					0.00
			% Exceed 24h					0.00%					0.00
	Parts binning on time	% of Binning completed in 24 hours	Target	80%	80%	80%	80%	80.00%	80%	80%	80%	80%	80.00
		(Measured by regular spot checks)	% Binned in 24h					0.00%					0.00
Customer Service	On time delivery of parts	On Time Delivery OTR5b	Target	100.0%	100.0%	100.0%	100.0%	100.00%	100.0%	100.0%	100.0%	100.0%	100.00
			Actual					0.00%					0.00
	AOG Spare part prioritisation	AOG Spare Part Supply Lead Time	Target	12	12	12	12	12	12	12	12	12	12
			Actual					0					0
Purchasing	Purchase request to purchase order time spent	Timely Conversion of Purchase Requisitions to Purchase Orders	Target (h)	24	24	24	24	24	24	24	24	24	24
			Tolerance (h)	36	36	36	36	36	36	36	36	36	36
		(Measured as per system time)	Actual Average					0					0
	Material shortages	Supply Shortages - MRO Productive Hours Lost	Target	4	4	4	4	4	4	4	4	4	4
			Actual					0					0
Goods Issue	MRO requests to goods issued	MRO Requisitions to Goods Issue	Target	8	8	8	8	8	8	8	8	8	8
		Target on Time as per SAP Report1	Actual					0					0
	Sales order to delivery note	Sales Order to Delivery Note	Target	12	12	12	12	12	12	12	12	12	12
		Target on Time as per SAP Report2	Actual					0					0

Figure 46: Week-to-month data capturing spreadsheet

Monthly data capturing

	KPI	Description	Measurement	Jan-16	Feb-16	Mar-16	Apr-16
Stock Control	Stock accurecy	Stock Accuracy as per daily cycle count (# of parts)	Target	99%	99%	99%	99%
		(Based on # of parts as per available SAP Cycling Counting)	Actual as per Cycle Count	80,0%	78,0%	85,0%	70,0%
	Slow moving stock	Slow Moving Stock as % of Total Value	Target	20%	18%	15%	15%
			Actual as per % of Value	10%	8,00%	7,00%	0,00%
Goods Receipt & Binning	Goods received on time	% of Deliveries receipted within 24 hours	Target	95%	95,00%	95,00%	95,00%
			% Same Day	80%	80,0%	78,0%	85,0%
			% Within 24h	70%	70,00%	60,00%	80,0%
			% Exceed 24h	80%	80,0%	78,0%	85,0%
	Parts binning on time	% of Binning completed in 24 hours	Target	80%	80,00%	80,00%	80,00%
		(Measured by regular spot checks)	% Binned in 24h	70%	70,00%	60,00%	80,0%
Customer Service	On time delivery of parts	On Time Delivery OTR5b	Target	100%	100%	100%	100%
			Actual	80,0%	78,0%	85,0%	70,0%
	AOG Spare part prioritisation	AOG Spare Part Supply Lead Time	Target	12	12	12	12
			Actual	5	8	0	6
Purchasing	Purchase request to purchase order time spent	Timely Conversion of Purchase Requisitions to Purchase Orders	Target (h)	24	24	24	24
			Tolerance (h)	36	36	36	36
		(Measured as per system time)	Actual Average	5	8	0	6
	Material shortages	Supply Shortages - MRO Productive Hours Lost	Target	4	4	4	4
			Actual	1	4	0	0
Goods Issue	MRO requests to goods issued	MRO Reqeusts to Goods Issue	Target	8	8	8	8
		Target on Time as per SAP Report1	Actual	5	8	0	6
	Sales order to delivery note	Sales Order to Delivery Note	Target	12	12	12	12
		Target on Time as per SAP Report2	Actual	5	8	0	6

Figure 47: Monthly data capturing spreadsheet

Figure 48: Monthly KPI dashboard

A KPI dashboard report is a powerful tool which can help AHZA meet its business objectives and it gives all stakeholders a snapshot view of all vital process data. AHZA can save precious time by not having to produce multiple reports, and the consolidated metrics can easily be shared between the relevant departments. One of the main benefits of the KPI dashboard is the visual element it brings to the table; employees can easily identify whether they are performing on target and it creates accountability amongst the individuals involved in the process.

Performance measurement is important for this project, because the KPI's will be used to evaluate the new processes after they have been implemented. The KPI's will indicate whether the new processes lead to improvement of the CS order process. It is important that the KPI's have to be reviewed and improved to ensure continual improvement.

7 Implementation

The implementation phase consists of executing the structured project plan defined earlier in this document. Successful implementation of the entire project is greatly affected by the implementation strategy thereof. The effect of all process improvements will only be realized once the process documentation has been embedded into the day-to-day activities and culture of AHZA employees. As stated earlier the current business processes of AHZA are ad hoc and undefined, thus the process documentation created will serve as baseline to enable the company to move to level 2 maturity. It is crucial to acknowledge that the existence of the documentation alone does not guarantee any improvements, only once employees utilize these guidelines the effects will come into play.

Change management was a crucial component to include in the implementation phase of the project seen that human factors and behavior affect the business processes to a large extent. The employees of AHZA have always been doing their jobs and conducting their day-to-day activities without any enforced structure or process guidelines, thus numerous employees may be reluctant to step out of their comfort zones. AHZA employees may not be aware of the potential benefits and convenience provided by detailed guidelines and structured processes, thus by using Kotter's change model the reluctance to accept change could be dealt with.

A structured implementation plan had to be developed to provide clear guidelines for actual implementation by the selected team. The implementation plan serves as a communication channel between the project team and the relevant stakeholders, it translates the solution design into the necessary required activities, schedules and costs to ultimately meet the project objectives (Willis, 2014). The latter plan has no fixed and formalized format, however it has to include and address the following:

- Project background and description
- Project outcomes and vision
- Project team and their responsibilities
- Progress and performance monitoring

An *informal* implementation strategy was formulated for AHZA seen that a detailed implementation plan falls outside the project scope. The *informal* implementation strategy addresses the key elements of project implementation mainly focusing on change management. The strategy will act as a useful guideline to help AHZA implement the final solution successfully.

7.1 Implementation Strategy

The implementation strategy addresses the project vision, team structure and the suggested activities required to meet the vision.

7.1.1 Project Vision and Objectives

The project vision is to create an efficient CS order process with the focus on improving financial control and customer satisfaction. This improvement consists of standardization and optimization of the process through implementing the process documentation. The objectives of the project are listed below:

- Enhance customer satisfaction and service
- Reduce errors and system issues
- Efficient and transparent processes
- Improved and defined communication channels throughout the process

7.1.2 Implementation Team

The implementation team has to be formed with special care and consideration seen that they will govern the planning and most importantly the management of this phase. Carefully selected team members will ensure that all established team roles and responsibilities are adhered to and executed by competent employees.

The team will be lead and monitored by a project owner and manager as well as five project leaders to each represent a department involved in the CS order process. These project leaders will be responsible for managing and physically implementing the process relevant and applicable to their area/department. Five additional team members will assist the project leaders with the implementation activities within their department. Table 14 defines the role, responsibility and job title associated with each team member.

Table 14: Implementation Team

Role	Job Title	Responsibility
Project Owner	Operations Director	Facilitate and oversee the implementation process.
Project Manager	Financial Manager	Oversee implementation while ensuring that all milestones are met and schedules are followed.
Process Manager	Quality Coordinator	Make modifications to process models when required.
Leader: Operations	MRO Manager	Manage implementation within their department. Ensure employees in their department follow process documentation.
Leader: Sales	Sales Manager	
Leader: Warehouse	Warehouse Supervisor	
Leader: Procurement	Supply Planner	
Member: Operations	Production planner	Assist the leader with implementation and guide and support other employees in their department. Initiate change within the department.
Member: Sales	Sales representative	
Member: Warehouse	Quality Controller	
Member: Procurement	Supply Planner	

7.1.3 Implementation Actions

The implementation actions define, on a high-level, the activities required to implement the newly defined processes. The implementation team defined in the previous section is responsible for reviewing and elaborating on the detail of each activity regarding tasks and responsibilities. Kotter's change model was used as a framework to ensure change management issues are also addressed accordingly throughout the phase. Table 15 summarizes the key activities suggested to implement the new processes.

Table 15: Implementation activities

Action 1: Implementation kick-off
Activity 1: Project kick-off meeting Project management should communicate the project to the stakeholders while creating urgency amongst them to accept the much-needed change and improvements. **Activity 2:** Construct implementation team It is crucial for AHZA to put a change management team together to ensure that the change associated with the project is monitored and executed successfully. The team will also have to act as a living example of what the project aims to achieve; trust, teamwork and pursuing of a common goal amongst them. With the latter being said numerous teambuilding activities can be coordinated to ensure trust amongst team members while informative sessions should be held regarding what is expected from each member. The team should consist of Change Champions which refers to individuals committed to change regardless of forces of inertia. The team of Champions should represent employees with different organizational titles, expertise, departments, relationships and reputations seen that without that kind of cooperative coalition, it can be difficult to confront resistance and to eliminate reluctance. The diversity within the team will ensure that all employees feel represented in some or other form and it will encourage them to interact with the team members. High risks of project failure can arise when change is led by a group of people who are not seen as powerful or influential by the employees. Thus if the wrong people are included in the team the project will most probably fail based on the employees' opinion of the team alone. With the latter being said it will be most effective to allow the company's employees to democratically select the coalition team to ensure that their opinions are valued and to ensure that they trust the team they are led by, however logic and mindfulness should be used in creating the final team. **Activity 3:** Finalize process models All final process models should be communicated and explained to the employees during this step while final changes can be made after which management approval is required. **Activity 4:** Approve process models The final process models should be communicated to top management for approval. After the necessary changes, the processes should be formally and finally documented as stated in the following activity.

Activity 5: Formally document the process
The models will form part of the final documents and each will require a process narrative to provide detail regarding the process.

Action 2: Prepare for implementation

Activity 6: Develop and communicate the vision
AHZA should create a vision that acts as a compass to guide the workforce towards the desired destination which is an integrated, diverse and fully functioning company. An effective approach to define the vision would be to involve the entire coalition team in defining it after which they are responsible for knowing and being able to explain the vision in detail. Thus the vision makes it clear to the employees that support, respect and unity is required amongst them before being able to become a more respected and successful company. This will motivate employees seen that they benefit from better personal work relationships as well as possible increases or incentives while ultimately being able to boast about being part of a successful and growing company. Once a clear and easy to understand vision has been defined it is important to get it out there. Initially it is very important to clearly, and in sufficient detail, explain the different components of and the ultimate meaning of the vision. To reach as many employees as possible, all possible channels have to be used to promote and broadcast the vision and future goals of the project. Firstly, the vision will be greatly emphasized in the first project kick-off meeting in which the executive will ensure it is effectively communicated however the vision can be communicated using various mediums like vision "logos" included in newsletters, presentations, posters on common walls, stickers or it can be included in the footer of company emails. With the rise and growing popularity of social media the vision can be communicated by means of informal platforms like tweets, Facebook posts or even a hashtag can work. Using the different communication mediums and channels will ensure that the vision is repeated and seen everywhere which causes employees to remember it by heart. Actions speak louder than words, these words apply specifically to the leaders of the change initiative. Although repetition and rehearsing the vision guides employees it is the behavior of their leaders which will ultimately motivate and encourage them to do the same. Usually leaders are seen as people who give orders and boss employees around, however if they earn the trust and respect of the employees they can speed up the entire process of getting buy-in and cooperation.

Activity 7: Identify and eliminate barriers
All change management efforts inherently run the risk of being undermined by someone from a team, supervisor or even an executive. It is crucial to recognize these employees early on to ensure that the whole project is not led to a disaster. The first step toward removing barriers is for the Coalition Team to identify, discuss and eliminate any barriers they can think of like employees refusing to; leave their comfort zones, respect different cultures and stop discrimination. The coalition team members may require additional skills and knowledge applicable to change management, thus they should attend relevant courses and preferable be tested on their knowledge to ensure that there are competent and qualified to do the job. After these barriers are removed the next step is to implement the change after which further barriers should continually be identified and eliminated to empower the people you require buy-in from. In the case of stubborn and unwilling employees it is crucial for the Change Leaders to immediately and personally try to persuade, enlighten and inform them in the *context of their position* in the company of the benefits and contribution that personally can make when they accept the changes. When

employees accept and make change happen it is crucial to ensure that they feel acknowledged and appreciated for their contribution toward achieving the vision, this may also lead to employees talking amongst each other and influencing one another to join the change train.

Activity 8: Generate short-term wins
Maintaining project momentum is one of the most important success factors of the change implementation. During change efforts short-term wins are life savers for teams and they can help AHZA's employees stay motivated and on track during the change journey. These wins can include the company's management organizing; company dinners, sponsored gift-cards or award ceremonies for employees who are embracing and promoting the change and the change vision. The previously mentioned award ceremony can prove to create healthy competition within the company seen that a number of employees may want to work harder in order to be awarded and acknowledged publicly. Monitoring and setting KPI targets will give employees something to work, seen that their performance is measured it creates some form of positive pressure to push them a bit harder than they usually would work.

Activity 9: Plan and prepare for training
The team should identify the best method of training employees, while structuring a training schedule to ensure that all employees are trained and informed on how to use the process documentation.

Action 3: Actual implementation

Activity 10: Run a pilot process
This activity consists of testing whether the process is working correctly and to ensure that all errors are addressed and adjustments to the process are made.

Activity 11: Train employees
This activity entails physically training the employees according to the training plans. The training should be split according to departments and suitable and appropriate dates.

Activity 12: Roll-out new process
After testing and piloting results are desirable the new processes can be implemented in a 'live' environment.

Activity 13: Review and build on change
Step 8 should be seen as the short term milestones however the real victory comes into play when long-term change can be achieved, it is important to communicate the difference between the two to all stakeholders and eliminate any impressions that the work is done. It is important to celebrate small victories but AHZA should never settle when they can build on whatever they have already achieved. The moment the company recognizes that the change initiative is successful and maintainable they should realize that the door has been opened to new projects. These new projects may include improvements on current ones seen that after every win, AHZA should analyse the situation and what made it successful and which constraints existed during implementation. Thus goals and new targets should be set by, preferably new and untapped change agents to ensure continual improvement and maintainability of positive changes. When the employees recognize

the change, benefits and improvements they may even start contributing more than required from them seen that they are motivated and innovative in their area of work and they feel they have the ability to influence any future changes. It is however always important to keep a watchful eye on the individuals who tried or may try to undermine the current success of the project thus some positive pressure and monitoring can keep them in line and out of trouble.

Action 4: Implementation close-out

Activity 14: Embed the change in the company culture
It is important to revisit the entire journey which lead the company to this stage, a lot of time and effort went into achieving the change and keeping the vision. Cultural change only comes into play now seen that for the changes to be anchored, they have to become part of the day-to-day activities. Thus management is greatly responsible for continually supporting change and ensuring that new employees are informed and kindly forced to accept and support the change ideals and values. It is clear that the success stories have to be told amongst employees which allows them to form deep roots and ties to the change process, this leads to the changes becoming a real and solid part of the company's culture. An annual Remembrance Day can be held to celebrate the change project's success and the people who made it happen, especially the coalition team, whilst new goals and project can be discussed which are relevant or improvements of the one being celebrated. This day can ensure that all contributors feel valued and acknowledged whilst new employees can be motivated by the success and cooperation of the employees of the company. It is important to recognize the fact that time is the enemy when it comes to change management as the 'change generation' employees decrease in numbers, it is crucial to replace key leaders and members to ensure that the success achieved is not left there and forgotten. Continued improvements and new ideas are dependent on new and creative leaders who are fully committed to successfully achieving change and vision, like contributors before them.

The defined implementation activities and actions will assist and guide the team while giving the entire initiative a much needed structure. The activities are defined on a high-level which means it is the team's responsibility to define what is required in more detail.

7.1.4 Implementation Conclusion

Careful planning and consideration is required when planning a project's implementation. Numerous elements have to be addressed to ensure all aspects of implementation are taken into account like costs, risks and key activities. The informal implementation strategy discussed in the previous sections has to be translated into a formal implementation plan by the AHZA implementation team.

Change is required to implement the new processes at AHZA and it is a known fact that an employee will always resist changing his known and convenient ways of doing his job. It is crucial for the implementation team to create urgency and motivation amongst employees to strive towards the improvement and greatness that comes with effective change. The team needs a framework and guidelines to do the latter which is why Kotter's change model should be carefully followed.

8 Process Design Evaluation

Evaluating and determining whether the new process design is an improvement on the previous process, is crucial. Generally, the current process would be measured with the defined KPI's after which the new process would be implemented and after implementation the process would be measured again to identify any improvements.

The evaluation of the solution required a different approach seen that the *current* process is not formally and completely documented. According to the CMMI process maturity model, AHZA's process are merely level 1 maturity processes and thus undefined and ad hoc. It was decided by AHZA that it will be ineffective to measure the current as-is performance of the process in quantifiable terms. The decision was made to implement the new processes and strive toward reaching a level 2 maturity. The performance of the new processes will then be measured regularly to ultimately achieve continuous improvement.

Due to the scale and complexity of the CS order process, the implementation of the project does not fall within the project scope. This means that the new processes cannot be evaluated by measuring the actual physical performance of the new processes and an alternative approach had to be followed. The new approach consisted of the following two phases, which focused on the stakeholders and process performance respectively:

The new/initial process models were developed with the help of employees, but these initial inputs were based on redundant and incomplete processes. Firstly, it was necessary that all process models were reviewed and checked by management to ensure that they were satisfied with the results while also providing possible alternative activities and solutions. The evaluation method was focused on solution validation. The validation was based on whether the solution's functional and non-functional requirements, defined in Chapter 4, were met by means of numerous stakeholder interviews and a simple questionnaire. To further qualify the evaluation of the final solution, a suggestion box was placed in a communal area to enable stakeholders to suggest any possible further improvements or additions to the new process. The knowledge and experience of the key-users proved to be invaluable to the full and continual optimisation of the project.

The proposed modifications and improvements were made according to management's specifications. The final versions of the process models were validated by employees and management to ensure that the final documentation is accurate and will provide useful and relevant guidance. The entire process modelling process is an iterative process which ensures continual improvement and increased accuracy. Figure 49 depicts the validation process followed, the iterative process came to an end when the relevant manager and operations director approved the final process models.

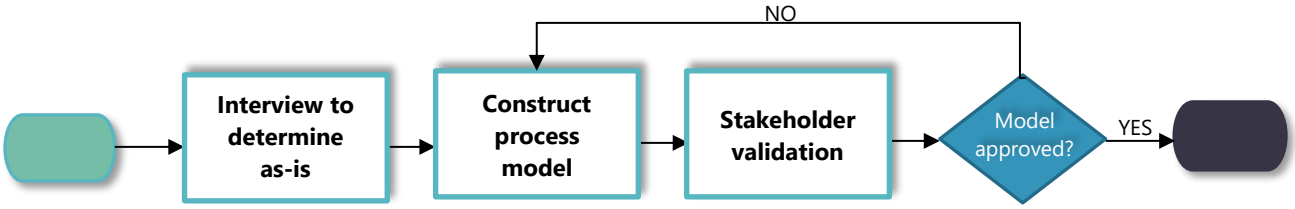


Figure 49: Solution validation process

The second part of the evaluation phase was focused on measuring the process performance after implementation. As stated earlier project implementation does not fall within the project scope, however this method of evaluation can be used by AHZA after process implementation in the future. By measuring the process performance, AHZA will be able to identify any overall improvements. AHZA can use the KPI's developed for the process in Chapter 6 to measure and quantify the CS order process performance. It is however crucial to continually review the processes and metrics in order to identify improvement opportunities, after which process models should be adjusted accordingly. The latter will ensure the continuous improvement of the CS order process while the process becomes more mature and standardized.

After re-visiting the Problem Statement in Chapter 1 section 1.2, it became evident that AHZA is in desperate need of proper process documentation which satisfies the following requirements:

- The process documentation has to be easy to use and employees at all levels of the organization should be able to understand it.
- The process documentation has to ensure process consistency by guiding employees through day-to-day activities.
- Managers have to be able to monitor and control their employees by using the process documentation.
- The documentation has to successfully address current issues and problems experienced by suggesting process improvements or additions.
- Relevant performance measure should accompany the process documentation to assist AHZA management with managing the process as well as identifying possible improvements.

Throughout the first phase of evaluation, all stakeholders were regularly consulted to ensure that the process models satisfy all the defined requirements. The final process documentation and the defined KPI's were approved and validated by the relevant managers. It can be concluded that the project satisfied all of AHZA's needs while all solution requirements were met.

9 Conclusion

"A conclusion is the place where you get tired of thinking." ~ Arthur Bloch

Arthur Bloch's words are very relatable; however, it is crucial to reflect on the findings/results and purpose of this document. Business activities forming part of the CS-process are currently ineffective and gaps exist in the process due to a lack of up-to-date documentation of business processes and communication between departments. The most significant consequence is unallocated costs and insufficient financial control and effective and timely margin analysis.

Determining the maturity level of AHZA's processes was a crucial first step before being able to decide on the project improvement objectives. The majority of the processes at AHZA were classified as level 1 maturity seen that the processes are undefined and the existing process documentation is out-of-date and incomplete. An opportunity exists to help AHZA move to a level 2 maturity where they can achieve consistent results, this can be done by means of documenting the CS order process and defining all the components and activities it consists of.

Research indicated that the concept of business process improvement (BPI) was an appropriate approach to use to drive and structure the project. The BPI methodology emphasizes the importance of mapping processes, measuring performance and facilitating the implementation of the new process by means of a change management plan. The as-is process documentation success depended on the support and buy-in from the BPO's and the employees of AHZA, their knowledge of the process and its cross-functional implications were crucial inputs to the as-is documentation process. The various JAD sessions established that the current *CS order process* has numerous inefficiencies and communication gaps. All the problems identified during the JAD sessions were categorized and analysed. The aim of the project is to address the identified process problems by clearly documenting the to-be process up to procedure level.

Early on in the report it was established that a need exists for firstly improving then documenting the detailed workflow of the CS order to-be process and storing these documents in a referenced electronic repository. However, a variety of options and approaches exist to map and store the process documentation. Numerous factors and solution requirements were used as decision criteria on which software comparison was based and after careful consideration it was clear that Microsoft Visio and Google Drive outweighed the other software options.

A process documentation library was created using the selected software to guide the user on how to perform day-to-day activities relating to the Aircraft Maintenance Process and to ensure stable SAP related business processes and integrity of financial postings. The library consists of two main components namely the to-be process maps and the relevant DDD's per process.

To ensure that the process is continually measured various KPI related to the CS order process were established to be able to quantify the performance of the CS order process. The Process KPI Tracker will help to efficiently implement and monitor all the KPI's defined for the process while capturing the KPI data, and visually allowing employees to communicate the KPI's to the relevant stakeholders by using the Excel spreadsheet template.

The full effect of all process improvements will only be realized once the process documentation has been embedded into the day-to-day activities and culture of AHZA employees. It is crucial to acknowledge that the existence of the documentation alone does not guarantee any improvements, only once employees utilize these guidelines the effects will come into play.

An informal implementation strategy was formulated for AHZA which addresses the key elements of project implementation mainly focusing on change management. Change management is a crucial component to include in the implementation phase of the project seen that human factors and behavior affect the business processes to a large extent. AHZA employees may not be aware of the potential benefits and convenience provided by detailed guidelines and structured process and way of operating, thus by using Kotter's change model the reluctance to accept change was dealt with. The implementation strategy will act as a useful guideline to help AHZA implement the final solution successfully.

AHZA wants to improve their customer service and financial control by improving the current CS order process. To achieve this improvement, the entire process had to be defined and documented. The process models will provide the baseline for improvement however it is important that the processes are implemented and managed to ensure that employees follow the documented to-be processes. This will lead to process standardization if all employees conduct the process in the same way. The processes should be measured and reviewed regularly to identify opportunities for further improvement. This project will contribute significantly to AHZA's understanding of their processes and it will set the foundation for improvement of their other business processes.

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APPENDIX A: SIPOC diagram template

Process Name

Pitfall:

- Names that use the "past tense".
- Names that describe what the process output is.
- Process names should not define performance requirements or improvement objectives.
- Names should not indicate improvement aims or the performance needs.

Good practice:

- Use Verb + Noun format.
- Improvement objectives can be identified by using the Process Purpose Statement, this statement describes why the process exists.

Supplier	Input	Process	Output	Customer
	Inputs define what the process triggers are as well as what gets transformed by the process. *Good practice:* The suppliers provide the inputs or "things" to the process. *Pitfall:* The staff as well as other resources are seen as inputs, however they do not get transformed by the process nor do they trigger it. Rules and Policies guide the process however they do not get transformed indicating that they are not inputs.		Process deliverables are seen as outputs, what the process achieves isn't seen as a output, *Good practice:* Outputs are tangible things, these items/things may have defects and errors. Outputs may lead to a satisfied customer or not. *Pitfall:* Defining outputs that are actually outcomes	

APPENDIX B: Departments and employee roles

ROLE	DESCRIPTION
Sales Department	
Sales representative	The core aspect of this role is customer interaction. The sales rep is responsible for receiving enquiries, creating quotations, obtaining flight folio's, placing purchase orders on SAP and ultimately reconciling cost reports and creating customer invoices.
Operations Department	
Planning	
Maintenance planner	Responsible for updating the maintenance tracking system as well as forecasting upcoming aircraft maintenance. Has to assemble and review the work-packs and finally file it.
Production planner	Responsible for checking for any open CS-orders, drafting the DAW sheet, creating service notifications and leading the work-pack briefing. Ultimately TECO's CS-orders.
Execution	
Floor production manager	Responsible for finding a timeslot for any upcoming aircraft service.
Chief engineer	Responsible for physically working and performing the maintenance on the aircraft.
Crew chief	Responsible for performing ground run inspections and recording defects. Has to ensure all aircrafts are airworthy after inspection.
AME inspector	Responsible for signing all log-books and completing the aircraft OEM & SACAA log-books.
Logistics (Warehouse)	
Stores agent	This individual has to reserve and specify parts from batches as well as issue goods to scheduled inspection CS-orders.
Procurement agent	This role refers to an employee who is responsible for purchasing any parts not available at AHZA.
Finance	
Financial representative	Responsible for ensuring business complete by checking all the relevant requirements. Finally leads the management review of gross margins.

APPENDIX C: Maintenance planning process description

ACTIVITY/TASK	ACTIVITY/TASK DESCRIPTION
1.	**CS order process starts, Aircraft maintenance planning process starts**
1.1 Get flight folio	Flight folios are received regularly from customers as per CAA requirements. The aircraft maintenance forecast is used to reflect the latest status of recorded flight hours and forwarded weekly by the maintenance planners to remind sales representatives to request the necessary flight folios from customers.
1.2 Update maintenance tracking system	This flight folio information is transferred to the maintenance planner who updates the maintenance tracking system (LTB 400) with its content and draws the Service-Bulletin (SB) list. The SB list which is compiled by the aircraft manufacturer contains information regarding the aircraft and its components which may be faulty or need to be replaced during the aircraft's lifetime.
1.3 Forecast upcoming aircraft maintenance	After the component due lists (see Appendix X) of the aircrafts have been drawn and printed the content is summarized in an aircraft overview report (see Appendix X) which mainly covers inspections, due components and the relevant dates which influence hangar prediction planning and the hangar workload.
1.4.1 Check open CS orders, deferred defects, and loaner units against aircraft	The production planner opens a *CS order* and checks the aircraft for any open *CS order*s, deferred defects or loaner units on SAP. Finding a time slot for the upcoming service occurs in parallel with the former mentioned task as seen in Figure 4.
1.4.2 Find a timeslot for the upcoming service	Consider current and projected allocation of A/C and available certified capacity in terms of bays and resources to determine a feasible time slot for the required upcoming service
1.5 Get customer confirmation for maintenance service	The sales representative then has the following responsibilities; 1. Inform the customer of his/her upcoming aircraft inspection 2. Inform customer of possible time slot for the aircraft inspection within the hangar 3. Inform the customer of any deferred defects and loaner units. The following information has to be obtained by the sales representative; 1. The customer's approval to bring aircraft in on the available day and time, according to the operations planning schedule 2. Confirmation on which deferred defects he/she want to address in this scheduled maintenance, and list the deferred defects to be addressed. 3. Confirmation on the removal of loaner units. 4. Any other known defects or modifications that the customer wants fixed. 5. Written confirmation to commence with the quotation.
1.6 Draft DAW sheet Create service notification	After the customer has agreed to the upcoming maintenance inspection, draft the DAW sheets for the inspection according to the maintenance inspection information.
1.7 Create and obtain approval for customer quotation	Obtain approval on the maintenance inspection quotation, either a customer signature on the quotation or a purchase order, from the customer.
1.8 Release scheduled inspection CS order	Once the signed customer quotation has been received the scheduled inspection *CS order* can be released.
2.	**Aircraft maintenance planning process ends, Compile work-pack process starts**

APPENDIX D: Compile work-pack process description

ACTIVITY/TASK	ACTIVITY/TASK DESCRIPTION
2.	**Compile work-pack process starts**
2.1 Purchase parts not available at AHZA	Firstly, stocks are reviewed after which any items not available at AHZA are procured by the procurement agent by releasing a purchase order.
2.2 Reserve and specify parts from batches	However, the parts available at AHZA are specified and reserved from batches by the stores agent.
2.3 Goods issue to scheduled inspection CS order	The stores agent then issues the goods to the scheduled inspection *CS order* by means of a good-issued (GI) slip.
2.4 Prior to aircraft arrival assemble and review work-pack	The maintenance planner is responsible for assembling and reviewing the work-pack prior to the aircraft's arrival at AHZA. A work-pack contains the following documents; 1. CS orders 2. DAW sheets 3. AD/SB list 4. Aircraft time overview report 5. Copy of model status - for both aircraft and engine 6. Test flight and ground run data 7. CA043 form 8. Company authorisation signature form 9. Aircraft inspection reminder decal (if job is performed away from bay) 10. Maintenance inspection task cards
2.5 Assign Crew Chief prior to aircraft arrival	After the completion of the work-pack and prior to aircraft arrival it is issued to the assigned crew chief.
2.6 Lead work-pack briefing	Prior to the arrival of the aircraft at AHZA, conduct a work-pack briefing, which is a knowledge share and work-pack quality check between the Maintenance Planner, Production Planner, the Crew Chief, and the Floor Production Manager. The production planner leads the work-pack briefing where the following is discussed; 1. Work-pack content 2. Defects target date 3. Planned man hours 4. Daily time sheets 5. Maintenance inspection turnaround time.
3.	**Compile work-pack process ends, Issue work-pack process starts**

APPENDIX E: Issue work-pack process description

ACTIVITY/TASK	ACTIVITY/TASK DESCRIPTION
3.	**Issue work-pack process starts**
3.1 Perform ground run inspections	The issuing of work-pack procedure commences when the crew chief performs the ground run inspections and services as indicated in the work-pack.
3.2. Record defects	While the aircraft is being serviced it is the responsibility of the crew chief to identify and record any defects on the DAW sheet until the defect due date has been reached.
3.3 Create defects and pre-release CS orders	The production planner is responsible for creating defect and pre-release *CS orders*. A prelease order is created for a part which has been known to have a long lead time and has to be ordered in advance.
3.4 Classify defects as cosmetic or flight worthy	The floor production manager as well as the chief engineer have to classify the defects as either flight worthy or cosmetic. In the case of a flight worthy defect the aircraft isn't allowed to fly thus it is grounded until the defect is fixed and when a cosmetic defect is noted the defect can be deferred to be fixed later and the aircraft is allowed to fly.
3.5 Create defect quotation	Sales can create the customer defect quotation after all the defects have been classified. The quote is then sent to the customer after which Sales is responsible for the following; • Discussing the defect quotation with the customer, explain which defects are flight worthy and which defects are cosmetic. The flight worthy defects have to be addressed before the aircraft leaves the hangar however cosmetic defects can be addressed in three ways: 1. Either the customer wants the defect to be fixed in the scheduled inspection 2. The customer can defer the defect to the next inspection 3. Or the customer can leave the defect as is and never address it. • Ask the customer if the cosmetic defects can be addressed in this scheduled inspection and whether any defects have to be deferred or ignored.
3.6 Obtain customer approval for defect quotation	Obtain a customer signature on the defects quotation within 3 working days.
3.7.1 Ensure all flight worthy defects are complete. Perform flight and final inspections	When no defects are deferred the crew chief has to ensure all flight worthy defects are fixed and ultimately do the flight and final inspections. However, there is still a chance of identifying unnoticed defects during the final inspections, in the case of finding defects the process of recording the defects as mentioned earlier has to be performed while stock availability has to be checked by the stores agent and in some cases items have to be procured by the procurement agent. If no defects are identified, the aircraft release process can start.
3.7.2 Record deferred defects	When cosmetic defects are deferred the production manager has to create a new *CS order* for the deferred defects, which will be left open at the end of the scheduled aircraft inspection. The open deferred defect *CS order* will be reviewed prior to the aircraft's next scheduled inspection, and the line-items to be addressed in the following inspection, will be moved to that scheduled inspection's superior *CS order*. After recording all of the defects, the aircraft can be released.
4.	**Issue work-pack process ends, Release aircraft process starts**

APPENDIX F: Release aircraft process description

ACTIVITY/TASK	ACTIVITY/TASK DESCRIPTION
4.	**Release aircraft process starts**
4.1 **Sign log-books** **Complete the aircraft OEM & SACAA log-books**	The process starts with the AME inspector signing the log-books and completing the aircraft OEM and SACAA log books.
4.2 **Work-pack quality review**	MRO is then responsible for reviewing the work-pack quality as well as conducting an aircraft completion meeting. During this meeting the scheduled inspection has to be technically authorized as complete after which the aircraft is permitted to leave the hangar.
4.3 **TECO CS orders**	The production planner is responsible for TECO'ing the *CS orders* within 24 hours from technical authorization.
4.4 **Reconcile cost reports**	Sales reconcile the cost reports, invoice the customer and creates an aircraft release notification on SAP.
4.5 **Invoice customer & release aircraft notification**	
4.6 **File work-pack**	After the aircraft maintenance inspection is complete and the work-pack has been captured on LTB400, file the work-pack.
4.7 **Business complete**	Finally, Finance concludes the *CS order process* as business complete after which the aircraft is released. The business complete check-list consists of the following questions; 1. Are the CS orders TECO'd? 2. Is the customer invoiced? 3. Are all deferred defects recorded? - consult with the Production Planner 4. Are there any additional open *CS orders* that should be invoiced?
4.8 **Lead management review of gross margins**	Once the job is marked business complete, no alteration can be made to the CS orders. During the month-end meeting between Commercial, Planning, Finance, and Operations the following is reconciled; • Invoice vs. gross margin • Planned vs. actual costs
5.	**Release aircraft process ends,** **Cs order process complete**

APPENDIX G: Industry Sponsorship Form

Department of Industrial & Systems Engineering
Final Year Projects
Identification and Responsibility of Project Sponsors

Final Year Projects may be published by the University of Pretoria on *UPSpace* and may thus be freely available on the Internet. These publications portray the quality of education at the University, but they have the potential of exposing sensitive company information. It is important that both students and company representatives or sponsors are aware of such implications.

Key responsibilities of Project Sponsors:

A project sponsor is the key contact person within the company. This person should thus be able to provide guidance to the student throughout the project. The sponsor is also very likely to gain from the success of the project. The project sponsor has the following important responsibilities:

1. Confirm his/her role as project sponsor, duly authorised by the company. Multiple sponsors can be appointed, but this is not advised. The duly completed form will considered as acceptance of sponsor role.
2. Review and approve the Project Proposal, ensuring that it clearly defines the problem to be investigated by the student and that the project aim, scope, deliverables and approach is acceptable from the company's perspective.
3. Review the Final Project Report (delivered during the second semester), ensuring that information is accurate and that the solution addresses the problems and/or design requirements of the defined project.
4. Acknowledges the intended publication of the Project Report on UP Space.
5. Ensures that any sensitive, confidential information or intellectual property of the company is not disclosed in the Final Project Report.

Project Sponsor Details:

Company:	Airbus Helicopters South Africa (AHZA)
Project Description:	Business processes analysis and improvement to improve operational efficiency and financial control at Airbus Helicopters
Student Name:	Elrize Prins
Student number:	u13018044
Student Signature:	**E. Prins**
Sponsor Name:	Dr Chris van Schoor
Designation:	i4BE Partner: Supply Chain & Manufacturing
E-mail:	chris.vanschoor@i4be.co.za
Tel No:	-
Cell No:	083 287 4436
Fax No:	-
Sponsor Signature:	

APPENDIX H: Ethical Clearance

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Engineering,
Built Environment and Information Technology

1956 – 2016
60
years of
Engineering Education

Reference number: EBIT/32/2016 27 July 2016

Ms E Prins
Department of Industrial Engineering
University of Pretoria
Pretoria
0028

Dear Ms Prins,

FACULTY COMMITTEE FOR RESEARCH ETHICS AND INTEGRITY

Your recent application to the EBIT Research Ethics Committee refers.

Approval is granted for the application with reference number that appears above.

1. This means that the research project entitled "Business process improvement at Airbus Helicopters South Africa" has been approved as submitted. It is important to note what approval implies. This is expanded on in the points that follow.

2. This approval does not imply that the researcher, student or lecturer is relieved of any accountability in terms of the Code of Ethics for Scholarly Activities of the University of Pretoria, or the Policy and Procedures for Responsible Research of the University of Pretoria. These documents are available on the website of the EBIT Research Ethics Committee.

3. If action is taken beyond the approved application, approval is withdrawn automatically.

4. According to the regulations, any relevant problem arising from the study or research methodology as well as any amendments or changes, must be brought to the attention of the EBIT Research Ethics Office.

5. The Committee must be notified on completion of the project.

The Committee wishes you every success with the research project.

Prof JJ Hanekom
Chair: Faculty Committee for Research Ethics and Integrity
FACULTY OF ENGINEERING, BUILT ENVIRONMENT AND INFORMATION TECHNOLOGY

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