Implementation of Standard Operating procedures for unplanned maintenance processes

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Executive Summary

Transnet Freight Rail has always been faced with a challenge of spending much time dealing with maintenance. This has a major adverse impact on how they do their overall business because the delay in maintenance causes a delay in the delivery of the trains carrying customer's goods.

This project addresses a secondary problem which was discovered during the attempt of solving the time delay problem. Thus this project addresses the reasons why the workers who do the manual maintenance work do not follow the Standard Operating Procedures.

A study on best practices on how to map out, manage and improve processes is carried out in the attempt of seeing what may be the other causes to this secondary problem.

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1. Introduction and background

Transnet Freight Rail (TFR), one of five Transnet divisions, specialises in the transportation of goods for other companies from harbours and mines to the specified location. Products transported include the following: Coal, Iron ore, Timber, Fuels, Chemicals, Containers, Non-ferrous metals, Chrome, Automotives, Granite, Cement and Lime, Manganese, Steel as well as other minerals .For the continual success of delivering these products Transnet needs to maintain its infrastructure. One of the most critical Infrastructures is the rail way. Rail way can be, simply put, broken down to Ballast, Rails, Sleepers and Turnout sets. The rail way depends on these four materials to function.

TFR has a total of 21 depots around the country aimed at carrying out its main function of transporting goods from one place to another. Different commodities are assigned to different depots and for this reason depots differ from one another in size and in operation. Some depots are used and temporary hubs where trains come and change locomotives whilst others are used as a consolidation station where different loads are built or consolidated to go to a predetermined destination.

1.2 problem statement

Currently TFR is faced with a problem of spending much time in dealing with unplanned maintenance on the rail way. This delay in maintenance always results in late delivery of customer's goods. There may be many root causes to this problem hence a study on the process of doing unplanned maintenance is going to be carried out from the point a fault is seen until the fault is cleared. In carrying out this task of repairing an identified fault there is more than one division included. These are some of the internal divisions that are involved in making sure that a fault is cleared or resolved:

- Depots
- Supply Chain
- Technical Command Center (TCC)
- Resource Management
- National Command Center (NCC)

In the attempt of solving the current problem another problem was derived of which the success of the solution of the current problem is dependent on. The problem is that the workers who do the actual work of implementing what is written on the Standard Operating Procedures are actually not following the SOP as it is.

1.3 Project Aim

With what has been written on the last part of the problem statement the aim of this project is to find out the reasons why the workers are not following the SOP and give recommendations to the TFR management on how they can implement the SOP's and make sure that they are followed.

1.4 Project Scope

This project only covers those processes that are followed to make sure that a fault is cleared or fixed during unplanned maintenance. This project will be done with correspondence with the Isando depot, one of TFRs depots.

2. Literature Review including selection of Appropriate Methods, tools, and/or Techniques

The main focus of this review is to discuss possible ways which can assist in helping TFR management in implementing the Standard operating Procedures and how to ensure that they are followed. With that in mind this review will predominantly look at business process techniques with the aim of finding a suitable method to apply seeking to address the issue faced by TFR.

The review looks at the commonly used method to tackle business process related problems. These are the likes of Business Process re-engineering, business Process Improvement and business process Management.

2.1 Business process re-engineering (BPR)

2.1.1 What is reengineering?

Re - engineering is "the fundamental rethinking and radical re - design of processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, service, and speed. (Hammer and Champy, 2001).
Grover et al.(1993) state that over the years reengineering has been given many definitions depending on its application. Here are some definitions proposed by leading practitioners:

- ‘‘the analysis and design of work flows and processes within and between organizations’’;
- ‘‘a methodological process that uses information technology to radically overhaul business process and thereby attain major business goals’’;
- ‘‘the reconfiguration of the business using IT as a central lever’’;
- ‘‘overhauling of business processes and organization structures that limit the competitiveness, effectiveness, and efficiency of the organization’’;
- ‘‘the fundamental analysis and radical redesign of business processes to achieve dramatic improvements in critical measures of performance’’

Four elements of these definitions seem to standout and form the nucleus of reengineering:
1. It consists of radical or at least significant change;

2. The unit of analysis is the business process as opposed to departments or functional areas;

3. It tries to achieve major goals or dramatic performance improvements;

4. IT is a critical enabler of this change.

In support of the last statement Hammer defines reengineering as "The use of modern information technology to radically redesign business processes."(Hammer, 1990).
These four elements provide a working definition of reengineering. In other words reengineering is about significant change and a rethinking of why we do things the way we do—and not about tinkering with or speeding up what is already in place (Grover et al, 1993).

2.1.2 What drives reengineering?

Crisis is one the driving factors behind BPR. Dixon at al. (1994) wrote “Crisis" conjures images of impending disaster demanding quick decisions and desperate measures, and for those interested in creating radical change these images can be put to good use. Crises can drive organizational, technical, and cultural changes that dramatically improve a firm's competitive, technological, and administrative capabilities. These crises can be imposed by outside competitive forces, but they can also be "constructed" by top management to stimulate innovative organizational responses. The perception of crisis, it appears, can be created by managers to motivate improvement while it is still a proactive response to changing conditions, rather than a last-gasp attempt to survive.
Here are some few driving factors:

- New product failure
- The need for change
- Current operating capabilities cannot support the newly developed vision by drawn up by management

Reengineering is not always driven by the above listed driving factors and it is not used only to resolve a problem, but a proactive step toward the future. It is also a proactive repositioning strategy for successful companies to compete along new dimensions.

2.1.3 How can BPR be done?

Reengineering requires an out of the box thinking approach, it requires an organization to get out of the normal comfort zone and start pursuing drastic change. It also focuses on the larger cross-functional processes where responsibility is not taken by an individual or any group. Therefore, the impetus, leadership and championship through this endeavor must come from the top of the organization. It requires mobilizing resources across functions, setting up team representatives of the entire organization, and effectively communicating the goals and objectives throughout the organization (Grover et al, 1993).

2.1.4 How Is the Success of a Reengineering Project Measured?

To support their reengineering efforts, companies must be prepared to adopt new measures and eliminate old ones. The objective should be to identify measures consistent with the goals of the reengineering effort and the strategy behind it. In many cases, these measures will be nonfinancial, focusing on the operational characteristics of the process being changed. There are methodologies that might prove useful for developing these new measures in the design phase of engineering project, like the activity analysis phase of Activity Based Management or the Performance Measurement Questionnaire

2.1.5 BPR Principles

These are the business process reengineering that when followed can lead to successful implementation of BPR

- Organize around outcomes, not tasks.
- Have those who use the output of the process perform the process.
- Subsume information-processing work into the real work that produces the information.
- Treat geographically dispersed resources as though they were centralized.
- Link parallel activities instead of integrating their results.
- Put decision points where the work is performed and build controls into the process.
- Capture information once and at the source**.**

2.2 Business process management (BPM)

Before discussing what Business process Management is it is important to first discuss what a process is, then discuss a business process and conclude by discussing a business process management.

Simply put a process is an approach of transforming inputs into outputs or transforming raw materials into usable products.
Zairi (1997) defines a process as the approach in which all the resources of an organization are jointly utilised in a reliable, repeatable and consistent way to achieve its targets.
Essentially, there are four key features to any process .A process has to have:
(1) Predictable and definable inputs;
(2) A linear, logical sequence or flow;
(3) A set of clearly definable tasks or activities;
(4) A predictable and desired outcome or result.

Without processes it would be impossible for business to continually do or perform the activities needed to keep the business running. In other words processes are essential to the running of everyday activities in a business.

Talwar (1993) defines a process as a "sequence of pre-defined activities executed to achieve a pre-specified type or range of outcomes" and Ould (1995) writes that there are two types of processes:
(1) "The type that discrete;
(2) The type that is continuous."
With that definition of a process Lee and Dale (1998) wrote that BPM is intended to align the business processes with strategic objectives and customers' needs but requires a change in a company's emphasis from functional to process orientation.

Moving to a business process, Aguilar-Saven (2004) defines a business process as the integration of a set of activities in an organization with a structure describing their logical order and dependence with the aim of producing a desired result". The success of a company is not only dependent on achieving the desired results once but it is dependent on whether the company can maintain and improve the desired results. Hence DeToro and McCabe (1997) define BPM as an approach that "presents a more comprehensive array of improvement options" and can help organizations "avoid the tendency to fall prey to the hype of a new management fad". In general BPM is a management principle applied by companies to make sure that the company maintains its competitive advantage (Lee and Dale, 1998).

Business process is the combination of activities or tasks with the aim of creating an output of value to a customer. These activities could be value-adding activities which are of importance to the customer or non-value adding which are of no importance to the customer but essential to the functioning of value adding activities.
Lee and Dale (1998) describe Business process management as a systematic approach for solving business problems and helping businesses meet their financial goals. Zairi (1997) describes BPM as: "A structured approach to analyze and continually improve fundamental activities such as manufacturing, marketing, communications and other major elements of a company's operations." Essentially, BPM is concerned with the main aspects of business operations where there is high influence and a big proportion of added value.
He continues and writes that BPM has to be governed by the following rules:

- Major activities have to be properly mapped and documented.
- BPM creates a focus on customers through horizontal linkages between key activities.
- BPM relies on systems and documented procedures to ensure discipline, consistency and repeatability of quality performance.
- BPM relies on measurement activity to assess the performance of each individual process, set targets and deliver output levels which can meet corporate objectives.
- BPM has to be based on a continuous approach of optimization through problem solving and reaping out extra benefits.
- BPM has to be inspired by best practice to ensure that superior competitiveness is achieved.
- BPM is an approach for culture change and does not result simply through having good systems and the right structure in place.

BPM differs in application depending on whether it is applied on a business unit level or on an organization level, but irrespective of which level BPM is applied the following principles are applicable (Zairi, 1997):

1. **Pervasiveness** - an understanding of BPM principles through the whole company.
2. **Ownership** - all processes should have a clearly defined owner who reviews process performance and is responsible for their continuous improvement.
3. **Documentation** - all processes should be modeled from end-to-end to link customers to the process and the standards of documentation are defined and support the needs of the process participants. This includes in-process control measures, document and information usage, management controls and a description of how to complete the process.
4. **Measurement** - process measures are classified into cost, quality and time parameters. All key processes are tracked within process and results measures taken at critical steps in the process to meet customer requirements, prevent errors, reduce variability, improve cycle time and increase productivity.
5. **Inspection** - process owners should monitor performance and identify gaps through regular reviews and then close the gaps. This principle also embraces the need to reduce variability. In the organization's view BPM also includes the identification and understanding of cross functional interdependencies and improvements optimised by: investment in technology; fact-based decision making; simplification; and innovation.

In conclusion it can be seen that BPM is a process focused approach to sustaining and improving business process with the aim of giving companies a competitive advantage.

2.3 Business Process Improvement (BPI)

BPI is simply a method of improving the way a discrete set of business activities is organized and managed, it is an organized approach to study and improve continuously the essential activities of a company's operation by simplifying and streamlining business processes. (Lee and Chuah, 2001)

BPI will lead to the efficient and effective use of resources such as facilities, people, equipment, time and capital (Zairi, 1997). Harrington (1995) further elaborates that making processes more effective means producing the desired results from product or service in comparison to what the customers required; while making processes more efficient means minimizing the resources used such as costs, materials, cycle time, and so on from the internal process operation; and making processes adaptable means being able to meet changing customer and business needs (Lee and Chuah, 2001).

There is a couple of activities and strategies to follow to improve business processes or to do business process improvement, but the commonly adopted ones by organizations are continuous process improvement (CPI), business process reengineering (BPR), and business process benchmarking (BPB). The above mentioned have their own specific purposes and their impact and effects differ (Lee and Chuah, 2001).

Though these three are different they can be combined and used together under a methodology called the SUPER methodology.
Basically, the SUPER methodology is a five-phase BPI framework used to address the improvement problems faced by an organization. It serves as a guide line to help take a process from its current state along a guided path to a desired state (Lee and Chuah, 2001).

These are the five phases of SUPER methodology with SUPER being an acronym for:
(1) Select the process;
(2) Understand the process;
(3) Proceed with the process measurement;
(4) Execute the process improvement; and
(5) Review the improved process.

Phase 1: select the Process
The purpose of this phase is to investigate and select the processes that are problematic and are critical to and essential for meeting customers' requirements and improving the company's competitive position in the industry. There are four activities in this phase (Steps 1 to 4 of Figure 1).
Step 1: Form the process improvement team
Step 2: Identify final output and End customer
Step 3: Realize Customer requirement
Step 4: Identify and select the relevant processes

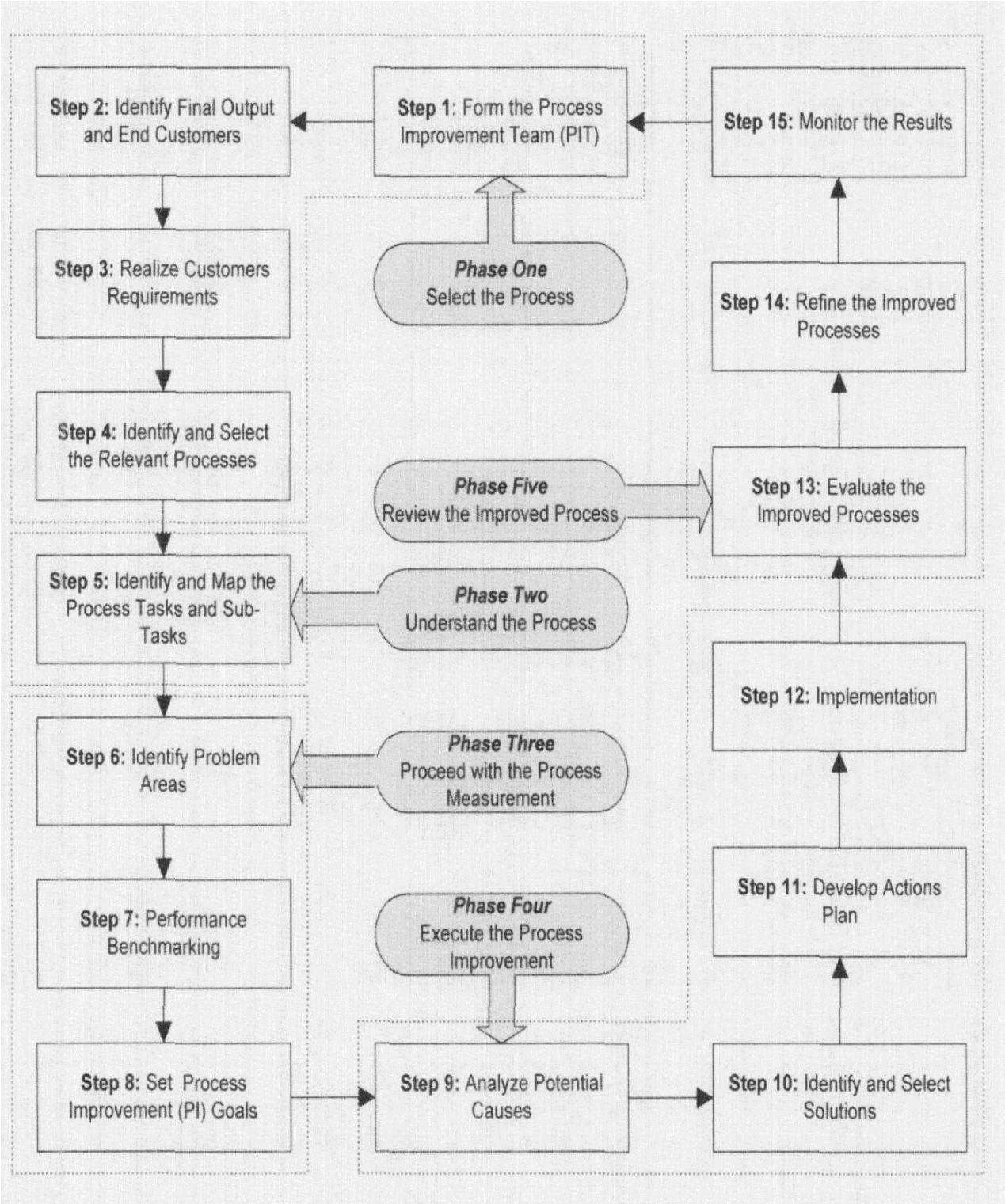
Phase 2: understand the process
In this phase, the PIT is going to study and understand the process flow of the operating activities involved in the selected processes. Tasks and sub-tasks should be included so that the PIT can effectively make changes to the processes. The main activity in this phase is to identify and clearly map out the process tasks and sub-tasks (Step 5 of Figure 1) and their important inter-relationship.

Phase 3: proceed with the process measurement
The purpose of this phase is to define and measure the operation performance of the current activities or tasks and sub-tasks in the processes, and by comparison to the benchmark show the performance gaps with the predetermined goals of each activity/task or sub-task. There are three activities to be followed (Steps 6 to 8 of Figure 1).
Step 6: Identify problem areas
Step 7: Performance benchmarking
Step 8: Set process improvement (PI) goals

Phase 4: Execute the process improvement
This phase seeks to improve the performance of the identified problematic tasks to the level of desired states so that the output of the processes can meet the level required or expected by the customers. This will also increase the company's competitive position in the industry.
There are four activities in this phase (Steps 9 to 12 of Figure 1).
Step 9: Analyze potential causes
Step 10: Identify and select solutions
Step 11: Develop action plan
Step 12: Implementation

Phase 5: review the improved process
The purpose of this phase is to evaluate the improvement against the set targets or check if the process has met the customer's requirement or the desired final output. If the answer is positive, another improvement program may or should continue in the new areas by following the SUPER cycle again.
There are three activities in the final phase of SUPER (Steps 13 to 15 of Figure 1).
Step 13: Evaluate the improved process
Step 14: Refine improved process
Step 15: Monitor the results

Figure 1: SUPER model



2.4 The PDCA Cycle

One of the most important models for continuous improvement used is the PDSA (Plan-Do-Check-Act) model, which encourages a proactive discipline. It is different form the problem solving cycle in that the problem solving cycle is reactive in nature, where the best results are sought for a problem which already exists, whereas the PDSA cycle is proactive in approach. Then aspect of planning demonstrates that is a proactive discipline because planning precedes any execution.

Plan – This is one of the most important steps in the model. Before jumping into action, the process requires thought. Elements to be addressed are shown below in Table

Table 1: Elements involved in the plan phase

What is the purpose	What is to be accomplished	What are the permitted variations
How shall it be done	Who should do it	Who is responsible, authorized
When shall it be done	What are the actions	How long will it take
What is the sequence	Who are the customers	What are the inputs
What shall be measured	How shall it be measured	What equipment is needed

Do: This is the implementation phase of the model. The plan is tested and tried to see how it works.

Check: This phase involves finding out what happened during and after implementation. The idea is to determine if the objective was achieved, and if not, how far are the results from the goal, set in the planning phase, and why did it nit work.

Act: In this stage it is important to make sure that the improvements made are permanent i.e. necessary adjustment are made to assure the improvements stay intact.

2.4 Tools used in this project

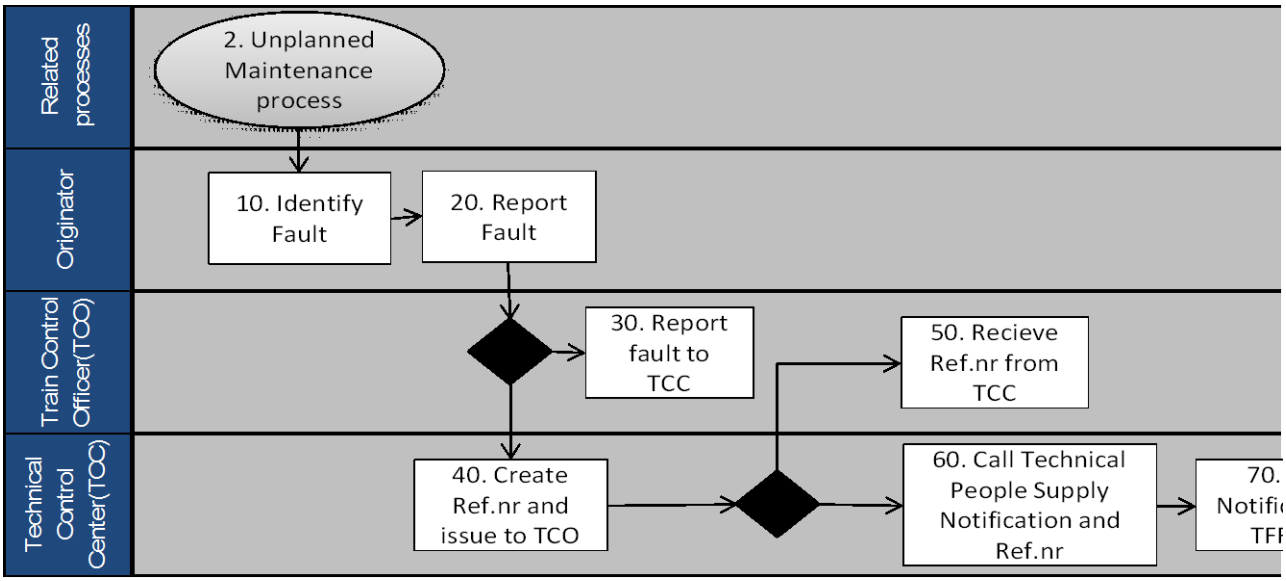
2.4.1 Excel spread sheet

On this project Excel spread sheet will be used to serve two functions. Firstly it will be used as a form where one, in writing, will document all the processes. Secondly it will be used to map out all the processes following the documentation given on the input sheet.

Table 2: Example of an input Excel spread sheet

Main Activity No.	Process Activity Description	Responsible Person
1	Track Master contact TCO as soon as he arrives at the incident location and gives the TCO the reference number.	Track Master
2	The TCO validate the reference number received from the Track Master against reference number/ notification number received from the NCC and simultaneously the TCO grant occupation to the Track Master and complete the Occupation Granting form.	TCO

Figure 2: An example of an Excel process flow diagram



2.5 Conclusion

It is evident on this review that these techniques discussed above have, on a broader sense, one aim. That is to manage and improve business processes to keep the company competitive on the market.

Chapter 3

3. Development of conceptual design/solution

In carrying out the conceptual design the SUPER methodology is going to be used because of the following reasons:

- It caters for both existing processes and those that have to be mapped from scratch.
- It is easy to follow and understand
- It goes more into detail than the PDCA methodology

As discussed in the previous chapter the SUPER methodology will be used as a guide line to follow in analyzing the data.

The SUPER methodology will only be utilized until phase 4, execute the process improvement, and step 11, develop action plan. This is because the project was not implemented and step 12 until step 15 can only be applied if the project was implemented.

In addition to the SUPER methodology the PDCA methodology is going to be used as a guide line to suggest recommendation to the problem faced by TFR, which is how can they implement and make sure that the workers follow the SOPs.

3.1. PHASE 1: Select the process

Step 1: Form the process improvement team

Because of the nature of the project there is only one member on the team

Step 2: Identify final output and end customer

According to the derivative problem the final output will be recommendations on how TFR management can achieve the implementation of the Standard Operating Procedures and the end customer is the TFR management.

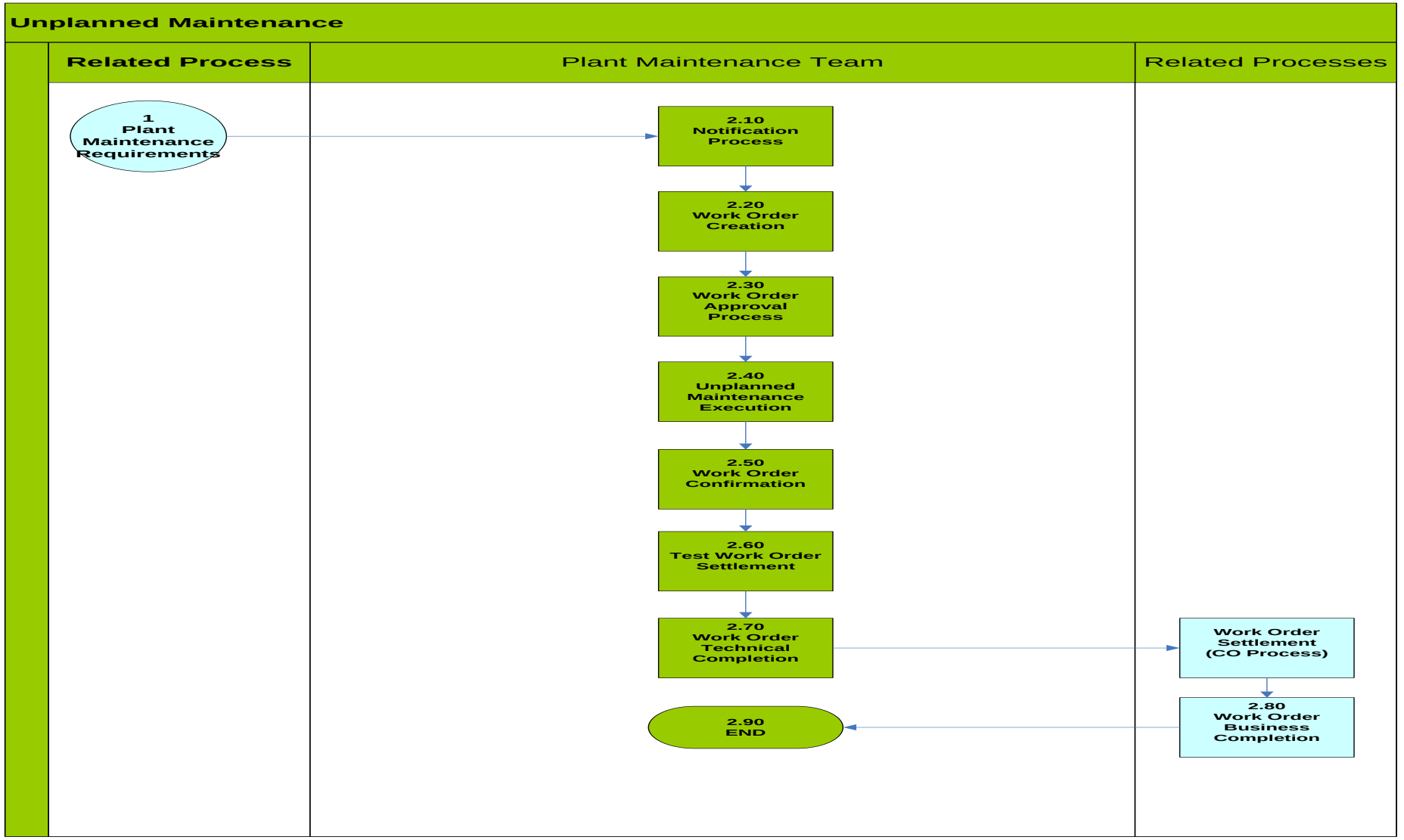
Step 3: Realize Customer requirement

The customer requires that the Standard Operating Procedures be implemented at the depot

Step 4: Identify and select the relevant processes

The relevant process to consider is the process involved in making sure that a problem is identified and cleared during unplanned maintenance as shown on Figure 3

Figure 3: Unplanned Maintenance process flow according to SOP



3.2. PHASE 2 and PHASE 3: Understand the process and proceed with the process measurement

To be able to identify tasks involved in this process an input sheet where one would record the process in words step by step was used.

Step 6: Identify problem areas

The problem is that the workers at the depots who do the manual work of unplanned maintenance do not follow the Standard Operating Procedures.

In order to show the difference in what is done at the depot and what is written on the SOP, two processes were selected randomly. The two processes were:

1. Notification process(2.10 of Figure 3)- process where the person who saw the incident will report the incident as shown in Table 2 and;
2. The occupation granting process or unplanned maintenance execution process (2.40 of Figure 3) – process where an occupation is going to be granted for the maintenance team to start working as shown in Table 3.

Then the two processes were then mapped out using Excel spread sheet as shown in Figure 4 and Figure 5.

Table 3: Notification input sheet

Main Activity No.	Process Activity Description	Responsible Person
1	The train driver/ yard master report fault to TCO	Yard officials and Train Driver
2	TCO manually complete the Incident Report form and also log the reported incident on the Incident Log Book	TCO
3	TCO informs NCC regarding the fault reported and request a reference number.	TCO
4	The NCC generate the incident reference number on the SAP.	NCC
5	The NCC provide fault/ incident reference number to the PerwayTechnician or Maintenance Manager and TCO.	NCC
6	The Maintenance Manager receive notification with numbers and develop a weekly schedule maintenance plan according to priority level.	Maintenance Manager
7	The TCO update and forward incident report to the CTC Coordinator.	TCO
8	The CTC Coordinator capture the incident or fault and close the TOMS system.	CTC Coordinator

Table 4: Occupation granting input sheet

Main Activity No.	Process Activity Description	Responsible Person
1	Track Master contact TCO as soon as he arrives at the incident location and gives the TCO the reference number.	Track Master
2	The TCO validate the reference number received from the Track Master against reference number/ notification number received from the NCC and simultaneously the TCO grant occupation to the Track Master and complete the Occupation Granting form.	TCO
3	The Track Master and Foreman conduct "Green Area" and safety meeting with the Perway team , execute maintenance, complete SAP 01.	Track Master
4	The Track Master complete and sign off SAP 01 form and inform TCO of the cleared fault.	Track Master
5	The Track Master sends signed off copy SAP 01 form to the Perway Maintenance Manager	Track Master
6	The Maintenance Manager review, sign off and send SAP 01 form to the Maintenance Controller and update Perway maintenance report on the system (Excel Spread sheet).	Maintenance Manager
7	The Maintenance Controller update/ capture the SAP 01 on the SAP system and close the PM order and file hard copy of the SAP 01 form (1-5 years).	Maintenance Controller
8	The TCO declare the line to be safe and inform NCC.	TCO
9	The TCO cancels the granted occupation by completing and signing off the occupation granting form with the occupation start and finish times provided by the Track Master, shift handover log book	TCO
10	The TCO handover the signed off occupation cancellation form to the CTC Coordinator	TCO
11	The CTC Coordinator capture the incident or fault and close the TOMS system.	TCO

Figure 4: Notification (AS-IS) process flow diagram

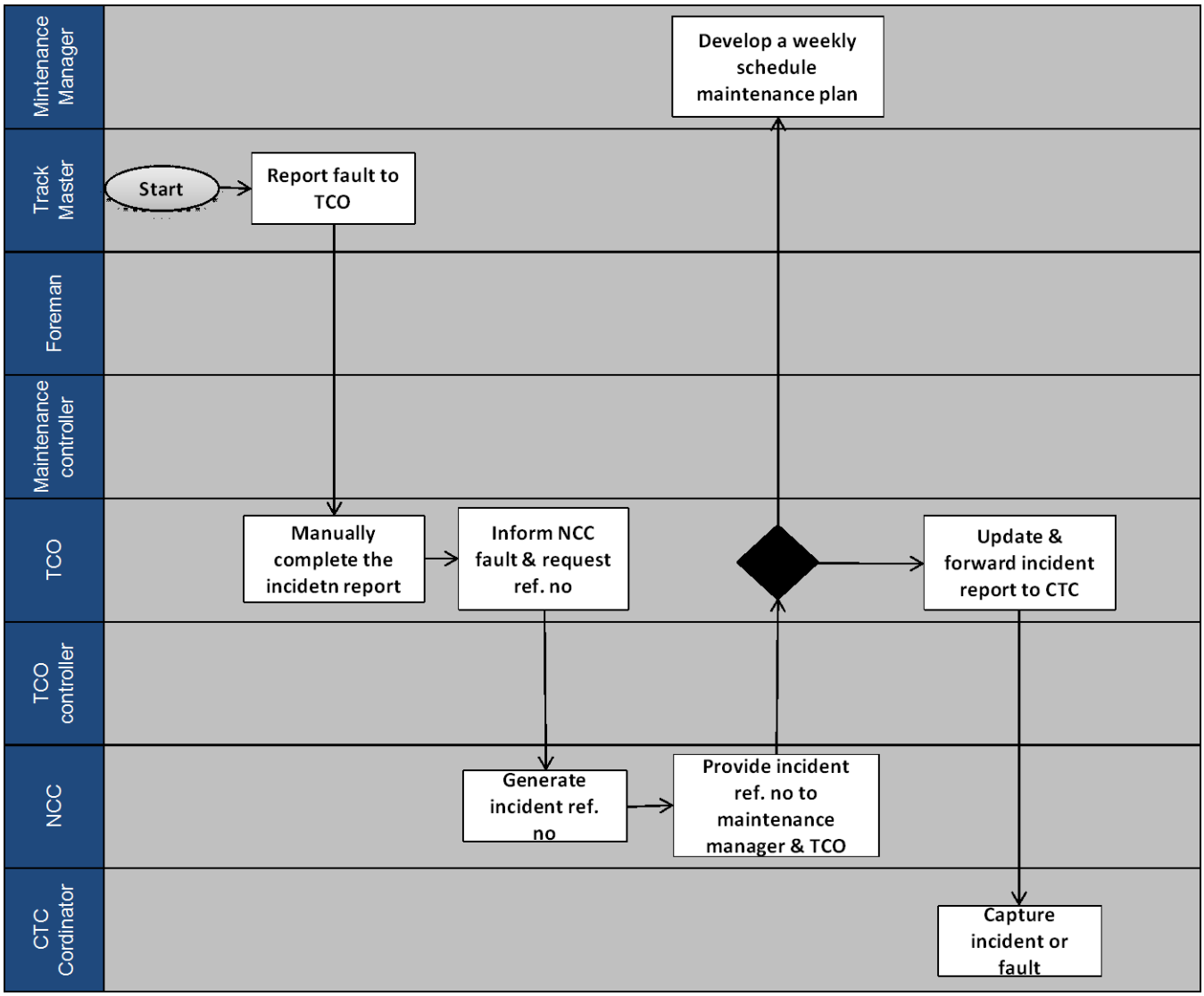
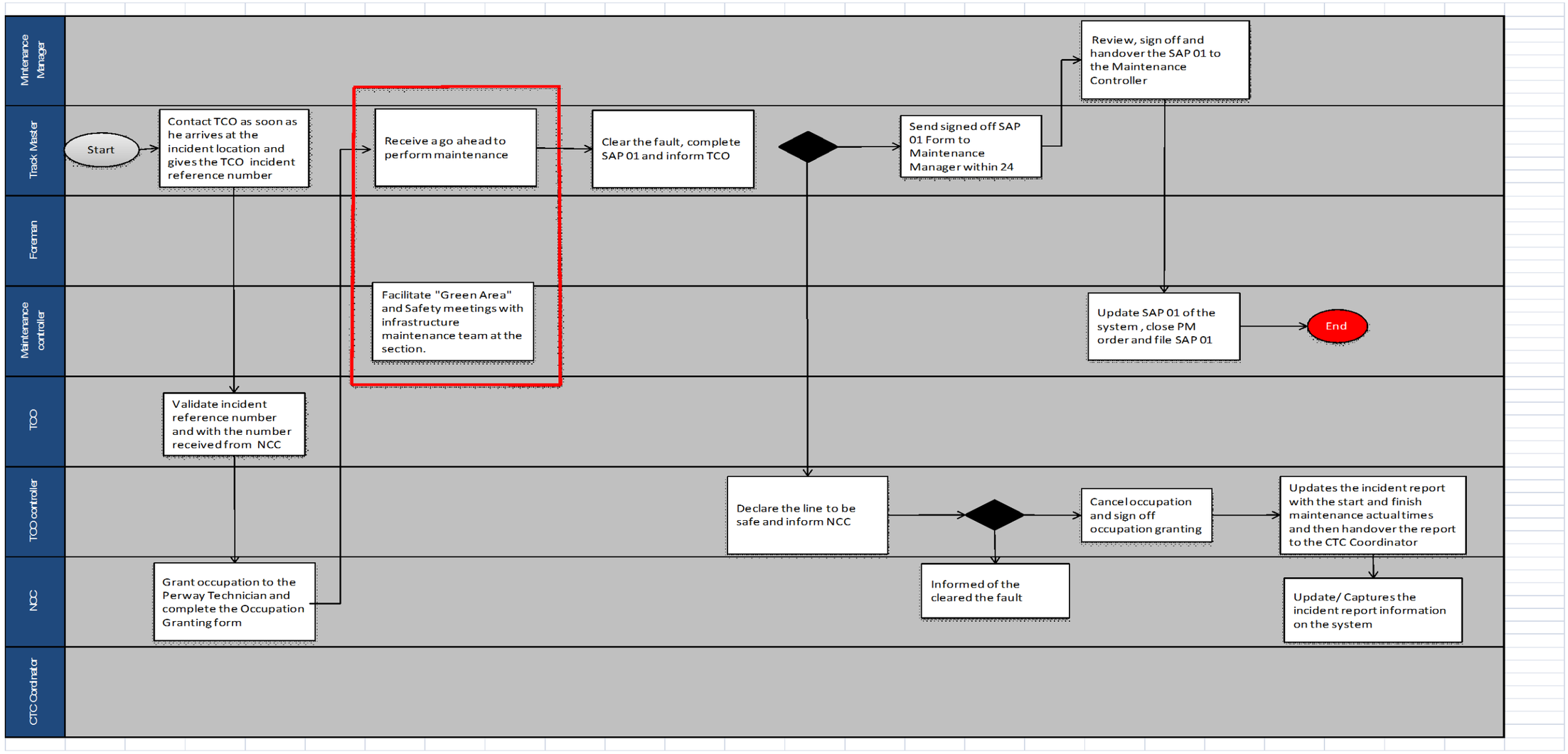


Figure 5: Occupation granting (AS-IS) process flow diagram

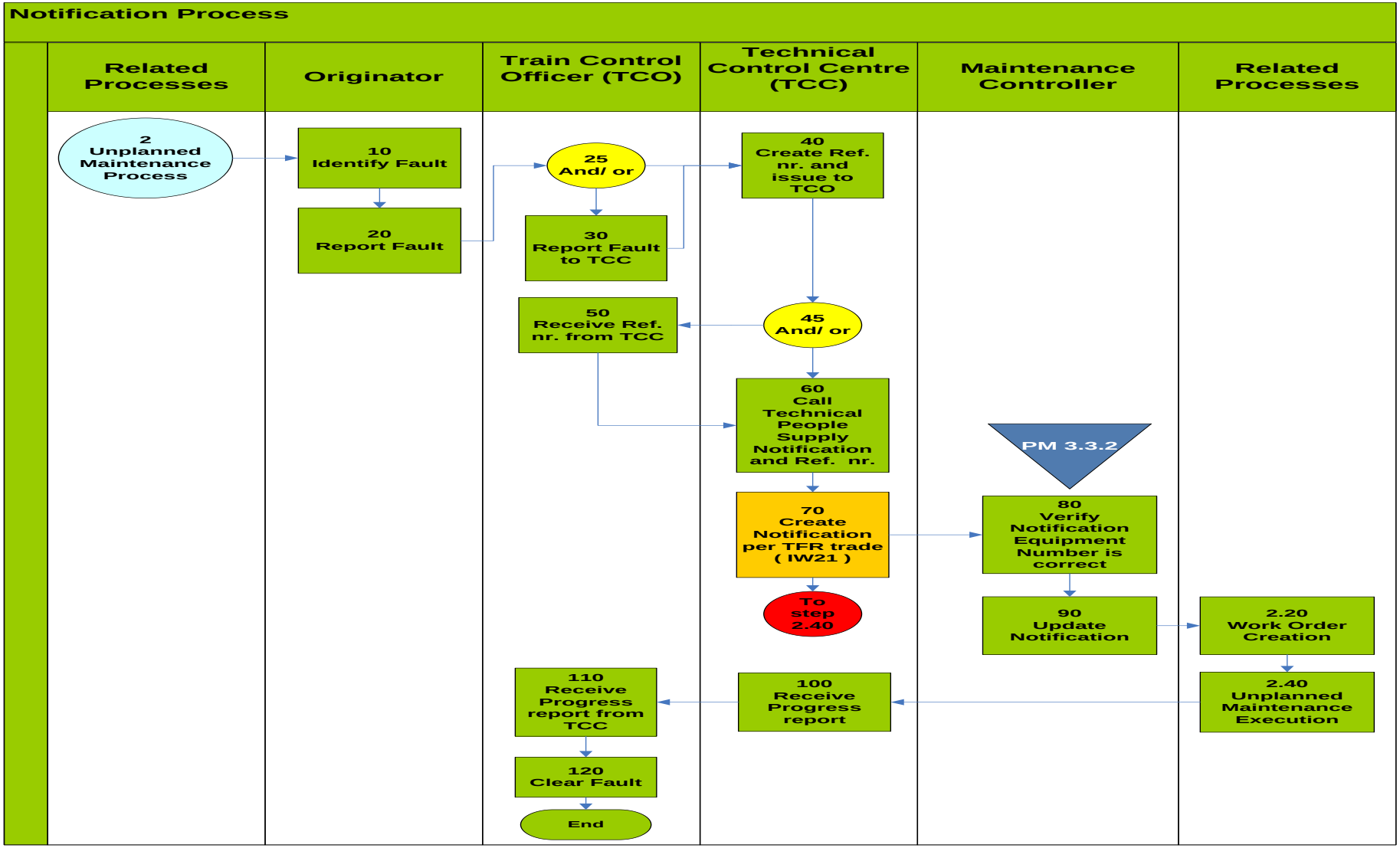


Step 7: Performance benchmarking
The benchmark of these AS-IS processes are the Standard Operating Procedures known as SOP given on Figure 6 and 7. Following the two figures are the detailed process descriptions which serve the same purpose as the input sheet.

Step 8: Set process improvement (PI) goals

1. The AS-IS processes at the depots must be the same as the Standard Operating Procedures and the workers must follow the SOP when executing the unplanned maintenance.

Figure 6: Notification process according to SOP



Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
2	Unplanned Maintenance Process	Process to do maintenance for the plant maintenance infrastructure department and achieving maintenance requirements for unplanned.			No	No	
10	Identify Fault	This is the point where the fault will be Identified due to breakdown on Infra related equipments/ Infrastructure.			No	No	Fault Originator
20	Report Fault to TCO	This is the point where the fault will be reported to TCO as identified.			No	No	Fault Originator
25	And/ or	This means that the Fault can be reported directly to Technical Control Center (TCC) by the Originator can be reported via Train Control Officer (TCO).			No	No	Fault Originator
30	Report Fault to TCC	This is the point where the fault is reported to TCC for capturing after validation by the TCC			No	No	TCO

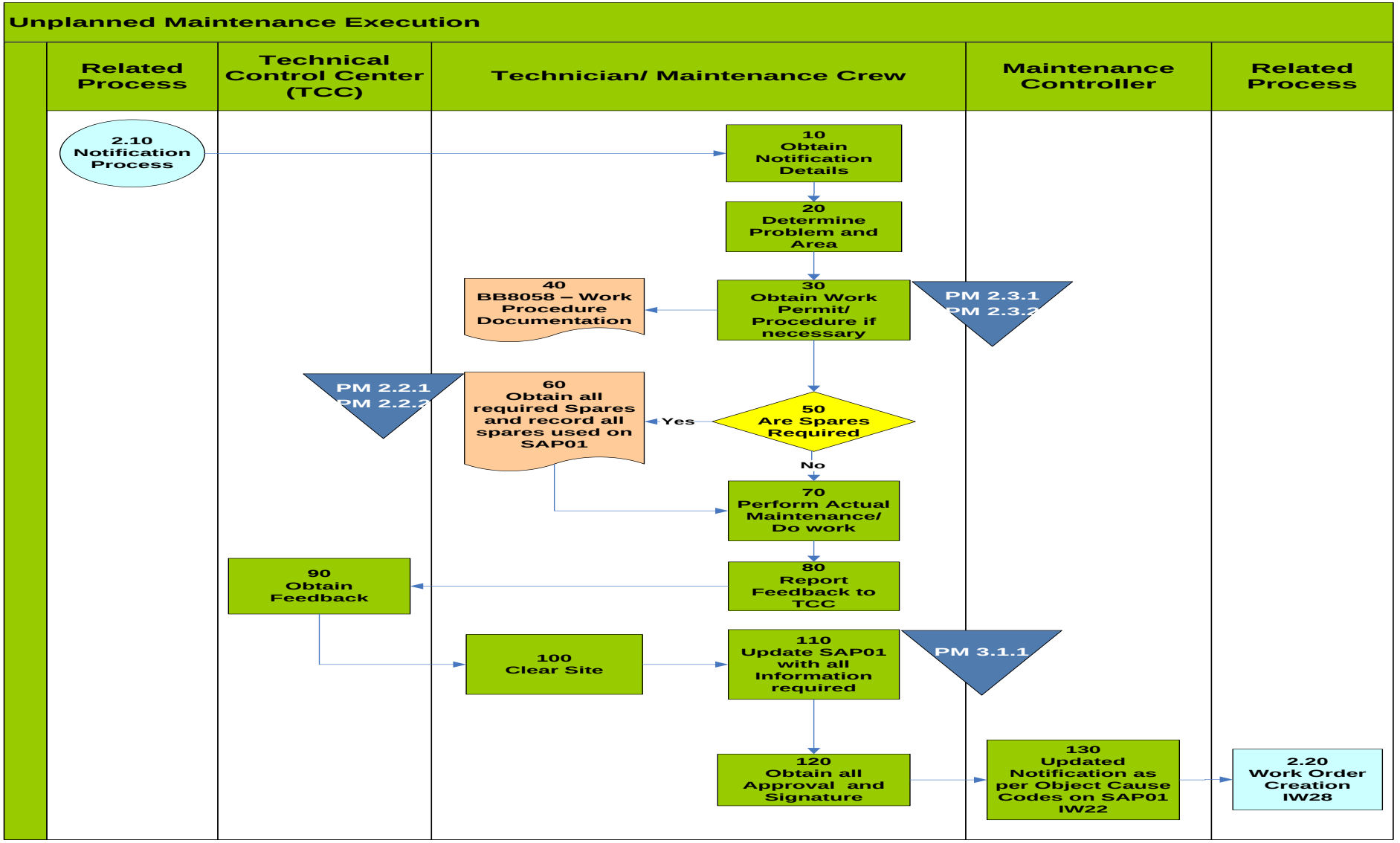
Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
40	Create Ref. nr. and issue to TCO	This is the point where the Reference number with regard to the fault as reported is generated and issued.			No	No	TCC
50	Receive Ref. nr from TCC	This is the point where the reference number will be obtain from TCO			No	No	TCO
60	Call Technical People Supply Notification and Ref. Nr.	This the point where the Technical people must be called in order to attend the emergency work that need to be carried Out.		Output	No	No	TCC
70	Create Notification per TFR trade	This is the point where the Notification number will be generated in SAP with reference to the number issued for tracking purpose.	IW21	Input	No	Sequence Number	TCC

Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
80	Verify Notification Equipment Number is correct	This is the point where the maintenance controller must verify if the equipment number and notification number provided on are correct according to the maintenance request.	IW22	Output	No	SAP001	Maintenance Controller
90	Update Notification	The notification number as given on the form must be updated accordingly as per the feedback Populated.	IW22	Output	No	SAP01	Maintenance Controller
100	Receive Progress Report	This is the point where the maintenance technician/ crew must give progress report to TCC.			No	No	Maintenance Technician/ Crew
110	Receive Progress report from TCC	This is when TCO will receive progress form TCC for further determine if the fault can be cleared.			No	No	TCC

Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
120	Clear Fault	Once TCO receive progress report that the work has been completed as request, the fault will be cleared which will open the line for operation again.			No	No	TCO
2.40	Unplanned Maintenance Execution	Process to do unplanned maintenance process for Infrastructure plant maintenance department and ensuring that maintenance of such nature when occurred is carried out and attended to by the relevant maintenance technician/ crew and document any task/ spares used for the actual execution of the maintenance requirement will be done in adherence to the maintenance standard process for unplanned.			No	No	Maintenance Technician/ Crew

Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
2.20	Work Order Creation	A step in planned /unplanned maintenance whereby a work order is created in SAP.					

Figure 7: Unplanned maintenance execution according to SOP



Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
2.10	Notification Process	Process to ensure that maintenance request (notification) for Infra Plant Maintenance department gets generated, attended to and actioned in the system with all required field for further maintenance analysis and development of maintenance strategies. This will provide Infra with a better overview of maintenance request in order to identify gaps meanwhile ensuring that same standard is followed with Infra irrespective of depot geographical location, and achieving maintenance requirements for unplanned, planned and budget processes.	IW21	Input	No	SAP01 & Sequence Number	Technical Control Center

Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
10	Obtain Notification Details	This is the point where the maintenance technician will be called whenever they is a fault reported depending on the line and region in which the fault has been reported for and then the technician will then be provided with the fault details.			No	No	Maintenance Technician/ Crew
20	Determine Problem Area	This is the point where the maintenance technician/ crew will use the fault details provided to him/ her to determine the area of problem.			No	No	Maintenance Technician/ Crew
30	Obtain Work Permit/ Procedure if necessary	This is the point where the maintenance technician/ crew must obtain permits to go and do maintenance on site if required			No	No	Maintenance Technician/ Crew
40	BB8058 – Work Procedure Documentation	A document that details all information with regard to permits.			No	No	Maintenance Technician/ Crew

Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
50	Are Spares Required?	This is where the maintenance technician/ crew must determine according to the fault information provided that will spares required before travelling to the site to perform the actual work.		Output	No	No	Maintenance Technician/ Crew
60	Obtain all required Spares and record all spares used on SAP01	This is when the maintenance technician/ crew if according to the nature of the fault will obtain spares required from store and record on SAP01.		Output	No	SAP01	Maintenance Technician/ Crew
70	Perform Actual Maintenance/ Do work	This is when the maintenance technician/ crew will be on site and carry out the actual maintenance as per the fault reported.			No	SAP01	Maintenance Technician/ Crew
80	Report Feedback to Train Control Center (TCC)	This is the point where the maintenance technician/ crew must report work progress to TCC.		Input	No	No	Maintenance Technician/ Crew

Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
90	Obtain Feedback	TCC will receive feedback from maintenance technician/ crew as provided to them and further decision will be made depending on the progress report.		Input	No	No	Train Control Center (TCC)
100	Clear Site	This is the point where maintenance technician/ crew will clear site for operation again.			No	No	Maintenance Technician/ Crew
110	Update SAP01 with all Information required	The maintenance technician/ crew upon work completion will fill in the SAP01 form with all required details to ensure correct feedback captured in the system.			No	No	Maintenance Technician/ Crew
120	Obtain all Approval	This is the point where the maintenance technician/ crew must obtain all necessary signatures that are required on SAP01 from all parties.			No	SAP01 Signature	Maintenance Technician/ Crew

Detailed Process Description *The following steps form part of this process:*							
Ref Num	Activity / Task Name	Activity / Task Description	Transaction Code	Input/ Output Reports	Workflow	Control	Roles
130	Updated Notification as per Object Cause Codes on SAP01	Updating SAP01 form information into the notification failure codes in SAP as per feedback captured	IW22	Input	No	SAP01	Maintenance Controller
2.20	Work Order Creation	A step in planned /unplanned maintenance whereby a work order is created in SAP.	IW31	Input	No	SAP01	Maintenance Controller

4. Problem solving and results

In this section potential causes to the secondary problem which is that the workers are not following the SOP as it is are going to be identified and recommendations are going to be given on how TFR management can implement the SOPs and make sure that they are followed.

4.1 PHASE 4: Execute the process improvement

Step 9: Analyze potential causes

The following are the reasons given by the workers who do the manual implementation of the unplanned maintenance as to why they do not follow the SOP as it is.

1. Some of the workers are not aware that SOP are available
2. Those who are aware see no reason to follow them since what they are doing now is working.
3. People are already used to what they are doing and it will be hard to start following the SOP
4. SOPs are generic and workers feel like it cannot work for all depots since depots differ in size and in operation.
5. No formal introduction to SOP is given to newly hired staff since the newly hired staff receive on the job training which might not necessarily be what is required on the SOP

In addition to the problems presented by the workers the following problems were identified on the SOP

1. There are no clear indications of key performance indicators in the SOPs
2. There are no specific times allotted to each process so it makes it hard to measure since there are no numbers to measure
3. The SOP's are not given in detail , the processes that are followed at the depots are more detailed that the SOP

4.2 Recommendations

Step 10: Identify and select solutions

After going through the processes and the issues raised by the workers who do the execution of processes it was evident that there is a gap between management or the people who draw up the processes and the people who do the implementation of the processes.

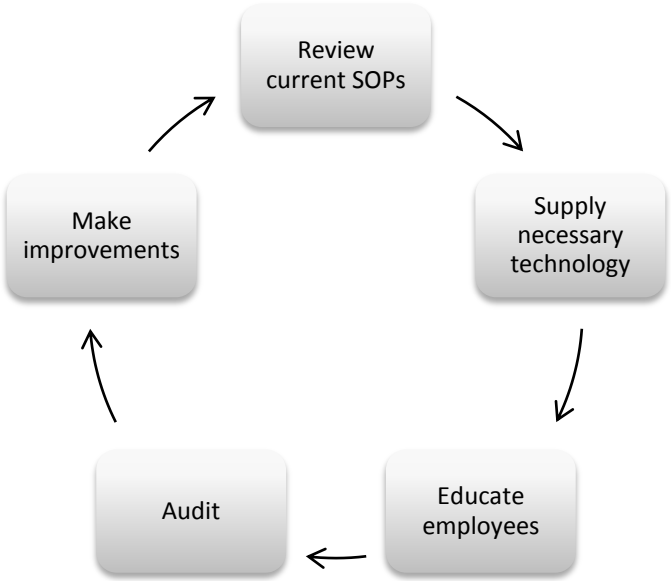
With that in mind it is recommended that:

- Management must try and fill the gap between them and the staff implementing the processes. This can be achieved firstly by understanding what is happening at ground level e.g.
  - What actually takes place and not what the book says what must happen.
  - Understand why employees are not following the SOPs
  - Understand why employees have modified the SOPs

TFR management can achieve what is highlighted above and address the secondary problem by doing the following:

1. Reviewing the current standard Operating procedures with the workers.
2. Supplying the necessary technology for the SOP to be followed
3. Educating the workers about the SOPs
4. Making audits to check progress and results
5. Making improvements or changes if necessary

Figure 8: Steps that can be followed in implementing SOPs

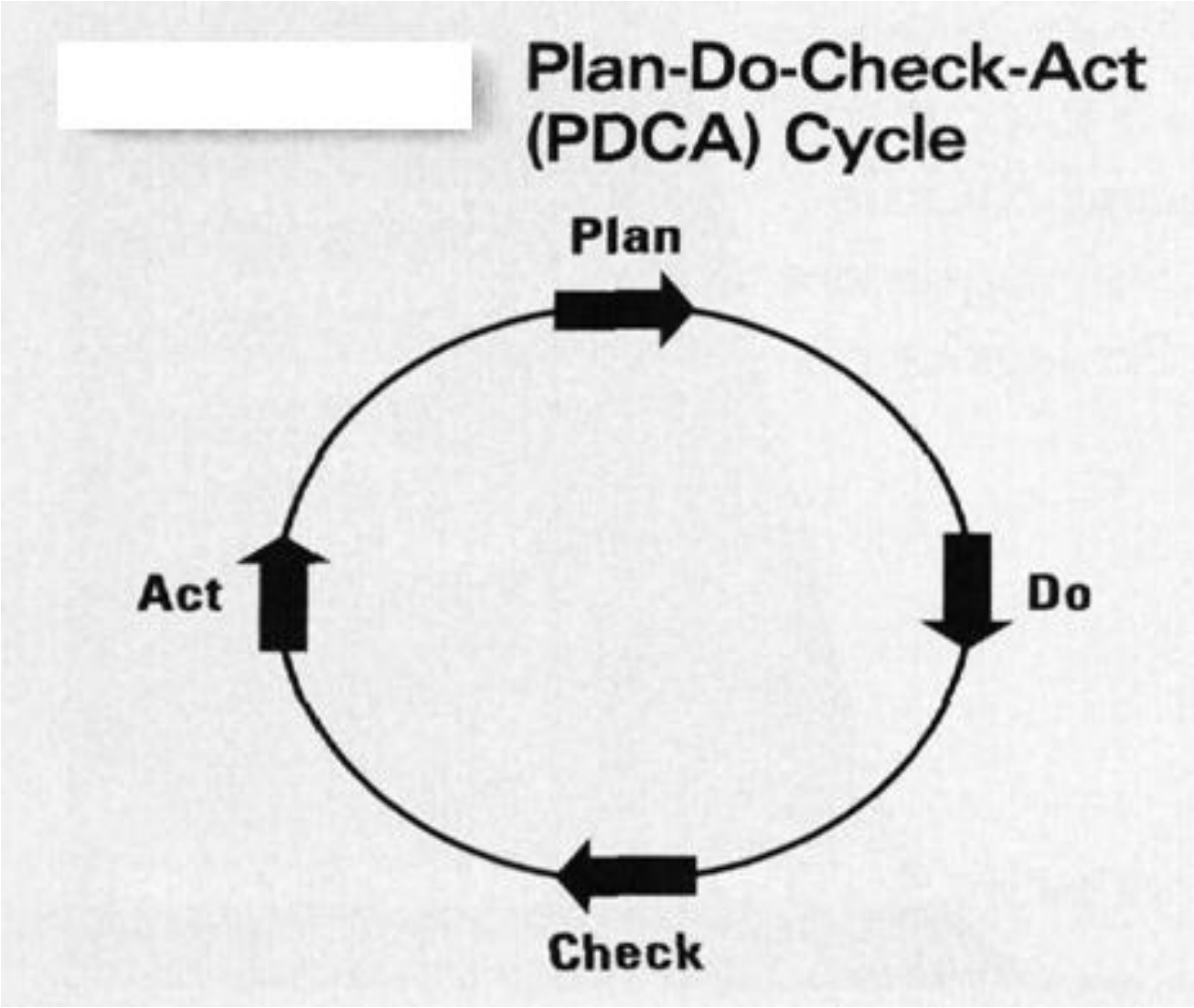


These four steps are elaborated further using the PDCA cycle in step 11.

Step 11: Develop action plan

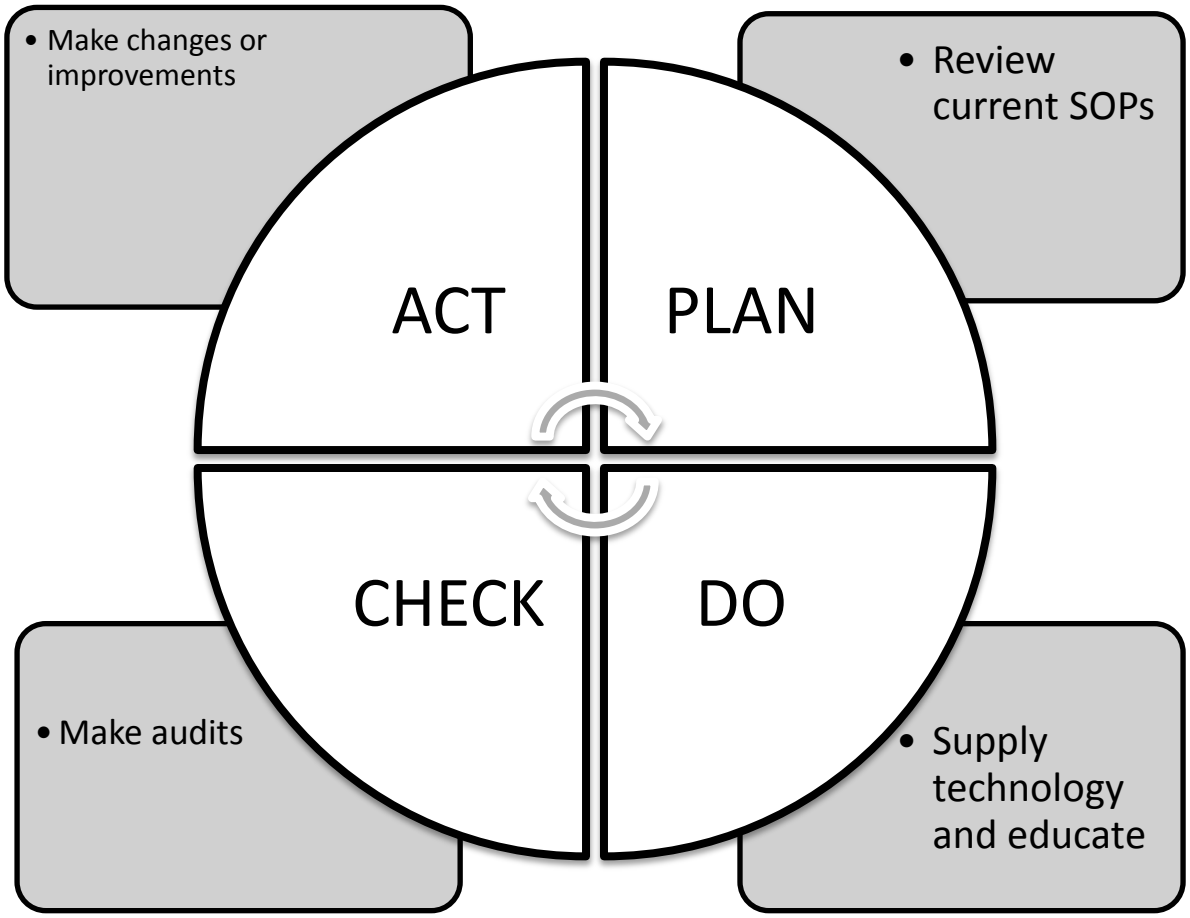
The action plan can be implemented by following the PDCA (Plan-Do-Check-Act) cycle discussed in chapter 2.

Figure 9: The PDCA cycle



In carrying out the implementation of the SOPs the PDCA cycle depicted on figure 9 is going to be fused with figure 8. The fusion of the two processes is shown below on figure 10.

Figure 10: The PDCA cycle to be followed when implementing the SOPs



The combination of the two processes as a way of helping TFR management to implement the SOPs is discussed in detail on the pages that follow.

Plan

This is the phase where all the elements of the project are going to be addressed before they are implemented. Targets are also set in this phase.

1. The management or the people who drew up the Standard Operating procedures must meet up with a pilot team made up of depot engineers from all 21 TFR depots. The two parties, management and the pilot team, must come together and review the SOPs and make changes where necessary. They must work together and develop the first standardized process.

In reviewing the current SOPs the commonly used method to tackle business process related problems listed in the literature review in chapter 2 can be of assistance. That is the likes of BPR, BPI and BPM.

In their planning they must make sure that the agreed standard operating process can be monitored i.e.

a. It must have clear Key Performance Indicators (KPI's)
b. There must be approximate times allotted to how long is a process supposed to take at maximum
c. It must be in clear and in enough detail to be followed as it is.

As a guide line these are some of the questions they can ask themselves

Figure 11: Elements involved in the plan phase

What is the purpose	What is to be accomplished	What are the permitted variations
How shall it be done	Who should do it	Who is responsible, authorized
When shall it be done	What are the actions	How long will it take
What is the sequence	Who are the customers	What are the inputs
What shall be measured	How shall it be measured	What equipment is needed

In addition to this, they must also plan how the process is going to be managed. Business process Management well known as BPM has the following principles to help in process management (Zairi, 1997):

- Pervasiveness
- Ownership
- Documentation
- Measurement
- Inspection

Do

In this phase all that has been planned during the plan phase will be implemented.
This can be achieved by:

2. Supplying the necessary technology needed to fully implement the Standard Operating procedures
3. Offering employer training on the SOP by presenting short refresher courses on the SOP through the whole TFR depots

When offering training on the SOPs, management must highlight the importance of having a standard process to follow. Below are some of the reasons they can state:

- Standardized work was never meant to be used by management as a tool to be imposed coercively on the workers. On the contrary standardized work is the basis for empowering workers and innovation in the work place (Liker, 2004)
- Processes need to be standardized before they are improved. Any improvement made on a process which is not standardized will be another variation that is occasionally used and mostly ignored. One must standardize, and thus stabilize the process, before continuous improvement can be made.
- Standardized work creates repeatable processes that are consistently executed.
- Standardization promotes effective team work by teaching employee's similar terminology, skills, and rules of play.
- When processes are standardized there is less variation to deal with.
- Standard work identifies the most efficient method for a process
- Standard processes simplifies training of new workers
- Standard work improves safety.

Check

In this phase the implemented solution is reviewed with the aim of checking if the targets were met and if not how much was the deviation from the target and the reasons to the deviation. This can be achieved by:

4. Performing a study or an audit after the courses have been presented to record the results, that is whether the workers are following the SOP when executing their work.

The only way for management to be sure that the SOPs are being followed is for them to go see for themselves if they are being followed. This is important because what you see firsthand is not always recorded in the written reports and tables of numbers. Even though tables and numbers measure results, they fail to reveal the details of the actual process being followed on a daily basis (Liker 2004).

Because of the many depots that TFR has, it will be hard for management to audits all depots by themselves. They can call in an external company that does process auditing to do the auditing or alternatively they can form an internal process auditing team that will audit all the 21 depots.

Act

This is the phase where the necessary actions will be taken to address any deviations seen during the check phase. This will be achieved by:

5. Making changes or improvements on the observed results accumulated during the check phase.

4.3 Conclusion

It is important that the current standard operating procedures be fully implemented and followed by workers before trying to address the issue of time delays of unplanned maintenance on the railway. This is important because it is easier for management to deal with a standardized process than to deal with many different processes which are aimed to solve one problem at all TFR depots as TFR has a number of depots around the country.

If a new model was developed as an improvement of the AS-IS process for only the Isando depot, it will be contrary to the goal of Transnet Freight Rail as a whole because they are aiming to standardize all their processes across all depots so developing another model will further deviate from this goal.

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