



**‘Design Balanced Scorecard for Maintenance Department
in King Abd-ulziz Airport Hajj Terminals’**

Eng. Mohammed Nizar Salem

Maintenance Supervisor

Abstract

Since Kaplan and Norton introduced the Balanced scorecard (BSC) it had the attention of the whole world. This research aims to measure the effect of maintenance practices and activities on King Abd-AlAziz airport – Hajj Terminal operation process. Recently, the role of maintenance doesn't end at repairing or fixing a machine or system, the maintenance these days playing an important strategic role in achieving business goals. This can be in terms of money (Financial), Process performance (Internal Perspective) Agents satisfaction (Customer Perspective), and Organizational capacity (Learning & Growth Perspective).

The Hajj terminal maintenance department aims to reach the maximum efficiency in terms of clients' satisfactions, staff performance developments, cost reduction, and quality assurance. This research is trying to help the Hajj Terminal maintenance department ensure efficiency of processes and systems by improving KPIs to measure the effect of maintenance activities on its current operation processes.

The value of Balanced Scorecard is the main driver of getting the desired results that helps in exploring the effect of maintenance on terminal's operations. The study creates a Balanced

Scorecard to measure the performance of general maintenance practices, and establish KPIs to measure the department performance in all four parts of the Balanced Scorecard from row data.

Key Words: Balanced Scorecard, Maintenance Department, Airport, Hajj Terminals, Quality.

1.1. Introduction

A balanced scorecard is a framework used by organizations to manage and implement strategies. The scorecard links an organization's vision to strategic goals, targets, measures, objectives, and initiatives to enhance an effective and efficient service delivery process. Additionally, it balances the performance measures with financial objectives relating to other sectors of an entity to facilitate the coherence of departmental and organizational goals. Other benefits of a balanced scorecard include prioritizing services, monitoring business progress, aligning daily operations to set strategies, and communication development strategies (Quesado et al., 2018). Therefore, organizations can enhance a smooth flow of services and achieve short-term and long-term goals by implementing a well-defined balanced scorecard.

PPMDC operating Jeddah Airport maintenance department can effectively enhance service delivery using a balanced scorecard that leads to increased customer satisfaction, low operational costs, increased customer satisfaction, and development of department staff. The airport maintenance team performs skilled and unskilled duties necessitating a framework that ensures PPMDC hires the best talent. The right choice of skills will also ensure that there is efficiency in output and unnecessary delays. Some of the duties of PPMDC include response to airport emergencies, maintenance of necessary tools and equipment and accompanying records, the performance of repairs and preventive maintenance of the control tower, hangars, and conducting daily operations that ensures that the airport environment is safe for aircraft and other users. Due to the complexity of the duties, the corporation should adopt a balanced scorecard to implement and revise existing strategies.

1.2. The Problem of the Study

This research will design and examine the applications of a balanced scorecard (BSC) as a tool for measuring and improving maintenance performance in King Abdulaziz Airport Hajj Terminals. Specifically, a balanced scorecard will be designed by the maintenance department and propose the appropriate approach for making performance improvements. A balanced scorecard of the department that the airport aims to improve the four key performance indicators which are financial, customer satisfaction, internal process, and organizational capacity. In this view, it aims to reduce financial costs relating to maintenance, increase customer satisfaction, increase safety and optimize all related internal processes, and improve team capacity and identify the appropriate technology for advancing organizational capacity. Balanced scorecard measurements are important for any organization. However, it has been established that aligning the performance indicators with the organizational or departmental goals is very important in integrating the use of a balanced scorecard. This perspective will be the primary guideline for developing a balanced scorecard for the maintenance department of King Abdulaziz Airport Hajj Terminals. Overall, this research will design that for the maintenance department of King Abdulaziz Airport Hajj Terminals to meet its performance targets, its balanced scorecard should be aligned with the goals of the department.

1.3. Objectives of the Study

The research objectives are:

- 1) To identify maintenance performance indicators of the balanced scorecard that require improvement in the related airport department.
- 2) To illustrate the proper perspective of integrating balanced scorecard as a tool for measuring and improving performance for the airport maintenance department.
- 3) To identify limitations of using balanced scorecards in measuring maintenance performance in the concerned airport department.

- 4) To gather raw data and make them understandable.

1.4. Importance of the Study

Designing the balanced scorecard will help the maintenance department of King Abdulaziz Airport Hajj Terminals to create better strategic plans. Also, designing (BSC) will improve strategy communication and execution inside the department which will lead to improvement in the service applied to PAX and stakeholders. When gathering raw data and converting to do indicators, the management of the department will have better alignment of process. This study will make it easier to illustrate to the head office the improvement of the maintenance department. It will make the efforts shine. Performance reporting will be way faster. By the end of this research the maintenance department of King Abdulaziz Airport will have better alignment in the process.

1.5. Limitaion of the Study

The maintenance department of King Abdulaziz Airport Hajj Terminals aims to improve key performance areas. To achieve this objective, it is necessary to understand the activities and processes that affect maintenance efficiency. A balanced scorecard of the department reveals that it falls short in meeting its performance targets. There is a need to align the desired objectives of the balanced scorecard with the department goals.

2. Theoretical Framework

2.1. Maintenance Management

In today's world, managing maintenance of systems efficiently is not only the matter of saving Money; it is the concept that having well-structured maintenance management is a source of generating profit. Maintenance is no longer a source of loss (if it is well managed), it is in contrast the complement of success for any organizational strategy. Maintenance management is defined as "All the activities of the management that determine the maintenance objectives or priorities (defined as targets assigned and accepted by the management and maintenance department), strategies (defined as a management method in order to achieve maintenance objectives), and

responsibilities and implement them by means such as maintenance planning, maintenance control and supervision, and several improving methods including economical aspects in the organization.”

The maintenance as a management approach should have (as any management activity) a definite strategy to help achieving its own goals resulting in organization’s goals as well. This is going to “conditions the success of maintenance in an organization, and determines the effectiveness of the subsequent implementation of the maintenance plans, schedules, controls and improvements”.

From this perspective, setting a maintenance strategy that ensures efficiency of each task being performed is the key success of any maintenance department. The efficiency in maintenance means “providing the same or better maintenance for the same cost”.

In order to develop or implement a specific maintenance strategy, it is important to set the objectives of maintenance then start formulating the strategy. Following is an appraisal of setting maintenance department strategy.

2.1 Maintenance Objectives

The objective of the maintenance department must be driven from the organization’s objective and support it. However, any maintenance department objectives typically are based on the following:

- **Management objectives:** to ensure that all the resources need to perform maintenance task are well allocated and coordinated to work together with its priorities
- **Technical objectives:** to guarantee having equipment/system available when it is needed and ensuring its reliability over lifetime
- **Regulatory Objectives:** to make sure that all maintenance work are following the regulatory standards in each sector such as electrical, mechanical, or safety regulations
- **Financial objectives:** to perform all the maintenance works at an excellent level with the minimum costs.

These four key points are the core objective of any maintenance department. It needs to be adjusted to support the organization’s ones and bear with it to achieve the general goal.

After setting these objectives, it's the time to develop the strategies needed to achieve these objectives.

2.2. Maintenance Types & Categories

Maintenance Terminologies

As any field, maintenance has its own jargons that are used to describe and define a state or a process. Following is definitions for some of maintenance terminologies that are been widely used in this field (Campbell et al., 2015):

- **Scheduled Maintenance:** is the maintenance work that is executed according to predefined schedule
- **Break-in Work:** work that is been added to a schedule for execution after it has been finalized
- **Corrective Maintenance:** usually known as repairs which means work done to correct or restore a defect back to normal condition
- **Detective Maintenance:** form of predictive maintenance, it is the work done to detect failures that have already occurred but remain undetected because the functionality that has been lost is normally not used or is dormant. This often related to back up or stand by systems
- **Planned Maintenance:** work that is planned in detail in-advance of being scheduled and assigned to work crews for execution. Planning is used to increase effectiveness, and ensuring that the right job is done
- **Predictive Maintenance:** known as Condition based monitoring, is looking for signs of impending failure so a corrective action can be taken before equipment completely breaks down
- **Preventive Maintenance:** is the work done to replace a component or restore a system to its original condition regardless of its apparent condition at that time
- **Emergency Maintenance:** is the work that treated as if it were a truly emergency. Emergency maintenance gets the top priority regardless of any work is being executed

2.3. Key Performance Indicators

“Managing without KPIs gives one the feeling of being lost with no hope” (Smith et al., 2008). The Key Performance Indicators (KPI) is a measure for a business to show how successful it is.

KPIs are used within maintenance to know the status of systems and equipment for a short and long period of time. It highlights the strengths and weaknesses to help rectifying a problem or appreciating excellence. In setting the performance measures, it is important to know exactly what will be measured and how often it will be measured.

As previously mentioned, the goal of this research is to measure the impact of maintenance activities on the airport operations. For this reason, this literature review is going to focus on various maintenance and airport operation performance measures then link these measures together to study the effect of maintenance performance on airport operations performance. The following text will discuss the types of KPIs with various examples, and airport operation and maintenance performance measures with more focus on maintenance KPIs and its benefits to both operation and maintenance department.

2.3.1.Types of KPIs

There are two types of KPIs, Leading and Lagging. “Leading KPIs lead to results, such as schedule compliance; lagging KPIs are the results, such as maintenance cost (affected if scheduling is not working)” . The leading KPIs are used to find out how well a part of the maintenance has been done while lagging KPIs show how well it was handled. Moreover, leading KPIs are only indicating the performance of a single action while lagging KPIs can be a result of different leading KPIs. For example, a maintenance cost is lagging KPI; it could be resulted from several leading KPIs such as schedule compliance, or failure rate (figure 2.2).

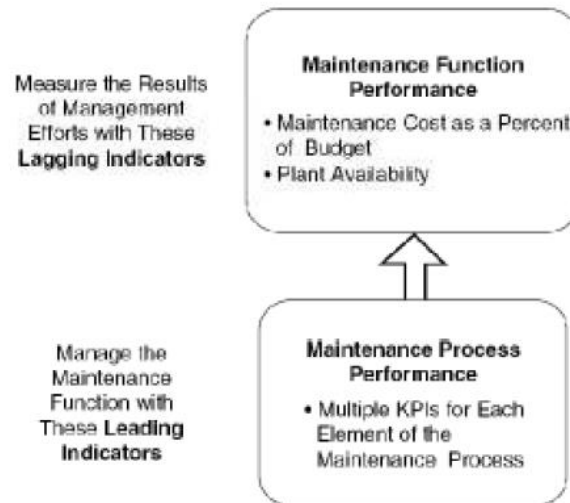


Figure 2.2: Leading & Lagging KPI

Source: Rules of Thumb for Maintenance and Reliability Engineers, by Smith & Mobley

Many maintenance KPIs can be generated according to the needs, an example of general maintenance leading and lagging KPIs with its world class standards are found in table 2.1

Table 2.1: General Maintenance Leading & Lagging KPIs

Source: Rules of Thumb for Maintenance and Reliability Engineers, by Smith & Mobley

KPI Type	Measure	Key Performance Indicator	World Class Target Level
Result/lagging	Cost	Maintenance cost	Context specific
Result/lagging	Cost	Maintenance cost/replacement asset value of plant and equipment	2-3%
Result/lagging	Cost	Maintenance cost/manufacturing cost	<10-15%
Result/lagging	Cost	Maintenance cost/unit output	Context specific
Result/lagging	Cost	Maintenance cost/total sales	6-8%
Result/lagging	Failures	Mean time between failure	Context specific
Result/lagging	Failures	Failure frequency	Context specific
Result/lagging	Downtime	Unscheduled maintenance related downtime (hours)	Context specific
Result/lagging	Downtime	Scheduled maintenance related downtime (hours)	Context specific
Result/lagging	Downtime	Maintenance related shutdown overrun (hours)	Context specific
Process/leading	Maintenance strategy	Percentage of work requests in "request" status for less than 5 days, over the specified time period	80% of all work requests should be processed in 5 days or less
Process/leading Planning element/lagging	Planning	Percentage of work orders with work-hour estimates within 10% of actual, over the specified time period.	Accuracy of greater than 90%
Process/leading	Planning	Percentage of work orders, over the specified time period, with all planning fields completed	95% +
Process/leading	Planning	Percentage of work orders assigned "rework" status (due to a need for additional planning) over the last month.	Should not exceed 2-3%
Process/leading	Planning	Percentage of work orders in "new" or "planning" status less than 5 days, over the last month	80% of all work orders should be possible to process in 5 days or less; some work orders require more time to plan but attention must be paid to late finish c
Process/leading Scheduling element/lagging	Scheduling	Percentage of work orders, over the specified time period, having a scheduled date earlier or equal to the late finish or required by date	95%+ should be expected to ensure the majority of work orders are complete before their late finish date
Process/leading	Scheduling	Percentage of scheduled available work hours to total available over the specified time period	Target 80% of work hours applied to scheduled work
Process/leading	Scheduling	Percentage of work orders assigned "delay" status due to unavailability of personnel, equipment, space, or services over the specified time period	Number should not exceed 3-5%
Process/leading	Execution	Percentage of work orders completed during the schedule period before the late finish or required-by date	Schedule compliance of 90%+ should be achieved
Process/leading Execution element/lagging	Execution	Percentage of maintenance work orders requiring rework	Rework should be less than 3%
Process/leading	Follow up	Percentage of work orders closed within 3 days, over the specified time period	Should achieve 95%+; expectation is that work orders are reviewed and closed promptly

2.3.2. Process for Developing Maintenance KPIs

To start developing an efficient and effective key performance indicators for a maintenance activities, here are some steps that worth looking before establishing the process:

1. Start with higher management. Set up a learning session for showing the value

- of KPIs, how leading & lagging KPIs differ, and how it could affect a Department' future. Conduct similar session for lower level involved employees
2. Compare the existing situation of maintenance activities and results against available best practices in similar field
 3. Start making a plan for establishing KPIs that includes:
 - Identification of all the maintenance activities
 - Work flow during each single activity
 - Prosperities of each leading and lagging KPI
 - Final targets and world class standards for each KPI
 4. Implement the process and start acting through leading KPIs. Involve other people to review the result.

2.4. Airport Maintenance Performance Measures

As in any business, maintenance plays a fatal role in success and reaching goals. In addition, maintenance undertakes high responsibility for customer's safety and convenience especially at public services places such as airports and hospitals. For these reasons, airport maintenance must maintain a high level of performance to guarantee passengers and airport users with outstanding degree of safety and convenience. In order to do so, airport maintenance must have its own performance measures that show how well things are going on and help rectify any troubles if occurred. In this research, a number of maintenance performance measures will be presented in order to assess the performance of the maintenance and its impact on airport operations.

2.5. The Airport Maintenance Department

Maintenance became a major player in the success of any organization. The airport maintenance department undertakes the responsibility of keeping the airport a live at its full load whenever needed. Airports are mainly divided into two areas, landside and airside. The airside includes all the area beyond the terminal's building including jetways, taxiways, runways, etc. The landside area consists of terminal building, transportation stations, and parking areas.

2.6 Balanced Scorecard (BSC)

There is a significant amount of literature that is dedicated to the concept of a balanced scorecard which is a tool for measuring performance. Kaplan (2010) indicates that the principle concept that underpins the use of BSC is the realization that measurement precedes understanding. In this view, Kaplan argued that one cannot comprehend something without first measuring it. Initially, the BSC was only adopted as a tool for measuring tangible aspects of performance. In this view, the tangible assets of an organization are solely used to measure organizational performance. However, research that was done indicated that intangible assets also play an important role in determining organizational performance. These findings emphasized that performance measurement should include value created through both the tangible as well as the intangible assets of a firm (Kaplan, 2010). According to Kaplan et al., (2001), BSC aims to measure four key performance metrics which are the financial, internal processes, the customer, and growth. Madsen & Steiheim (2014) state that the financial metrics are vital for ascertaining whether the organizational strategy is being implemented in a manner that is consistent with the overall mission of the business. In respect to Private or profit-driven organizations, the financial metrics aim at measuring profits and the existing market share. Conversely, in non-profit organizations, financial metrics are about outcome-oriented processes (Madsen & Steiheim, 2014). BSC also determines the customer perception of the service provided. Casey & Peck (2004) observe that understanding Customers' perception is important as it affects sales and revenue. In this view, high positive perception is associated with an increase in sales and generated revenue. In relation to the customer, therefore, BSC examines metrics such as quality and service performance. Internal processes with respect to BSC focus on aspects that improve innovation and staff skills (Kaplan, 2010). According to Marntinsonet et al. (1999), BSC is a tool for making more informed strategic decisions. In this view, BSC acts as an instrument for transforming strategy to actual performance measures and aligning it with the wider mission of the organization. It also performs as a tool for goal setting and allocating organizational resources. BSC also identifies activities that are lurking in execution and areas that need more resources or lack enough skills or knowledge (Basu et al, 2009). However, while the adoption of BSC is wider, studies show that not all organizations are successful in employing the performance measurement tool (Casey & Peck, 2004). It is within this

perspective that Parida, Ahren, and Kumar et al., (2013) say that the proper way of adopting BSC is to align it with the goals of the organization or the department.

3. Methodology

3.1. The Performance Measuring Model

The performance measuring model needs to be especially designed to match the situation in the maintenance department. In addition, it needs to be customized in a way that help meeting this research goal's to measure the impact of maintenance performance on maintenance department. For these reasons, the core step of this research is to find the best match performance measures for both airport operation and maintenance then find the most accurate link between both types to ensure the accuracy and significance of the results.

3.1.2. Maintenance Performance Measures

The steps for preparing the model are to choose the most suitable performance indicators for the maintenance department that can be used to evaluate the maintenance activities during the peak season. The indicators that are going to be used in this research for maintenance activities will cover preventive and corrective maintenance measures, and various terminal processes systems indicators. The following table is showing the indicators that could be used in this research:

Table 3.1: Maintenance Performance Indicator

<i>Indicator</i>	<i>Type</i>
Total Service calls received during the season	GM
Avg. service calls per day	GM
% of Technical complains	GM
% of Operational complains	GM
Average time taken to respond to a maintenance call	GM
Work orders	GM
Total issued work orders	GM
PM WO/ total maintenance WO	GM
CM WO/ total maintenance WO	GM
Total issued work orders	PM & CM
Total approved WOs	PM & CM
% of completed WOs	PM & CM
% of non-completed WOs	PM & CM
% of non-completed WOs due to unavailability of spare parts	PM & CM
% of non-completed WOs due to unavailability of equipment	PM & CM
% of PMs work order open after 6 days	PM & CM
% of Pending WOs	PM & CM
Avg. WOs downtime for each system	PM & CM
% of satisfactory WOs	PM & CM
% of WOs require rework	PM & CM
% of completed CMs during - 10 min - 20 min - 45 min - > 1 hr	CM
% of major breakdowns	CM
% of minor breakdowns	CM
Average time taken to clear minor breakdown	CM
Average time taken to clear major breakdown	CM

3.1.3. Hajj Terminal Operation Processes Performance Measures

In measuring the HT operations performance, many factors are involved within these areas. These factors can include passengers' movements, safety procedures, availability of staff, and availability of equipment and systems. To be more focused, specific terminal operation processes will be selected in order to measure its performance during the season of 2019. The processes that will be examined in this research are:

1. Baggage Claim
2. Passport Control
3. Check-in
4. Security Checks & Inspections

For the above mentioned processes, the factors that may affect each one of them including maintenance performance must be listed and weighted in order to study the actual effect of maintenance on terminal operations. This task is going to be done using a questionnaire that will be answered by Hajj terminal management.

3.2. Data Collection

The core of any successful research project is the type and the way that data being collected. Inaccurate data can easily mislead people, cause the research to fail, or even it may lead to a disaster. For this reason, the data collection plan for this research is divided into three elements: time, methods, and sources.

3.2.1. Collection Time

As Hajj Terminal is an extraordinary airport terminal in terms of design, operation and load distribution, the data needed in this research will be collected only during the season 2019.

3.2.2. Collection Methods

The methods used in collecting data for this research are qualitative and quantitative. The quantitative ones are mainly used in gathering data for performance indicators while the qualitative tools were used in the questionnaire filled by terminal management.

4. results

4.1 Introduction

In this chapter, the data collected during the research will be presented. This first section will be for the maintenance performance indicators for establishing the BSC from customer perspective, and the second section will be performance indicators for BSC from the internal process. The third section will present the financial perspective, and finally the fourth section will be the indicators measured for the learning and growth.

4.2 Customer Satisfaction Indicators

4.2.1 Passenger Satisfaction Score

In order to collect the data for these indicators first the customer of the maintenance department needs to be identified. PAX of hajj terminal is considered a major customer for the maintenance department at hajj terminal. A survey was conducted to measure the satisfaction of passengers by a specialized company.

Objective

To reach optimum standard for passengers journey

Measures

Facilities & Amenities (20%)

- Ease of finding your way through airport (signage) •
- Availability of information desks •
- Ease of finding seats in the departure lounge (outbound passengers only) •
- Accuracy and ease of finding information about your flight? •

Ambience & cleanliness (20%)

- Cleanliness of this airport terminal •
- Cleanliness of washrooms •

Comfort of waiting/gate areas •

Cleanliness of airport prayer rooms •

Arrival / departure services (20%)

Availability of baggage trolleys •

Efficiency of check-in(outbound passengers only) •

Efficiency of passport control (immigration) •

Efficiency of customs control (inbound passengers only) •

Staff (20%)

Courtesy & helpfulness of check-in staff (outbound passengers only) •

Courtesy and helpfulness of passport & customs control staff •

Courtesy & helpfulness of security (outbound passengers only) •

Waiting Times (20%)

Overall Satisfaction with total waiting time at airport •

Calculation

The calculation is done by taking the average of each question and then calculate the overall average through this formula:

$$Ave = \frac{1}{n} \sum_{i=1}^n a_i$$

A= arithmetic mean

= number of vaules n

= data set values a_i

Target

The score of 2019 is 88.4%

First year goal is to reach at least 92%

Second year goal is to reach at least 95%

Initiatives

The initiatives were taking in consieration is

To develop and create complete inspection process -

4.2.2 To meet General Authority of Civil Aviation Service quality standards

Another important indicator for the maintenance department is the General Authority of Civil Aviation Service quality standards. This will help to see if the maintenance department is following the standard made by the General Authority of Civil aviation in the BTO (Build to operate) contract.

Objective

To achieve customer lifetime value

Measures

Processing Facility (30%)

- Waiting time at check- in for passengers •
- Waiting time at security control for passengers •
- Waiting time at outbound passport control •
- Waiting time at customs control •
- Waiting time at baggage collection (first bag) •
- Waiting time at baggage collection (last bag) •

Passengers Experiences (30%)

- Overall passenger satisfaction with airport services •
- Satisfaction with airport cleanliness •
- Satisfaction with airport information •
- Satisfaction with airport seating •
- Satisfaction with airport baggage carts •
- Satisfaction with airport Wi-Fi •
- Satisfaction with vehicle parking •

Asset Availability (15%)

- Availability of passenger sensitivity equipments •
- Availability of baggage handling system •

Other Key Areas (15%)

Delays caused by airport operator •

PRM (Persons with Reduced Mobility) (10%)

PRM assistance time - departures •

PRM assistance time - arrivals •

Calculation

First for **Processing Facility**

The observer monitors passengers approaching each processing facility and starts by taking out start time and end time. After taking the times, calculate the average wait time for each factor.

Then create a category table so the time can be converted to a 5 points scale

1 point	< 20 min
2 points	between 20 to 16min
3 points	between 15 to 11 min
4 points	between 11 to 6 min
5 points	between 6 to 0.1 min

For all the other elements. A 5 points scale survey conducted by the supervisor to evaluate the situation of the site.

Target

Current 4.17 points out of 5 points

First year goal is 4.5 points out 5 points

Second year goal is 4.7 out of 5 points

Initiatives

Evaluate the check in counter productivity in order to recommend add or decrease -
number of counters

To create automatic (resource supply) -

Introduction of total productive maintenance -

4.3 Internal Process Indicators

4.3.1 PAX' System Availability indicator

There are 6 major systems that can affect passengers' processes directly. Any delay at any of the systems can cause delay in passengers' process. checking the availability of these systems can help to measure how ready the systems are.

Objective

To obtain Service Availability

Measures

- Jetways (16%) •
- Carousel mobile counter (16%) •
- Check-in counter (20%) •
- Carousel X-ray(16%) •
- BHS X-ray (16%) •
- Lounges X-ray(16%) •

Calculation

The formula used to calculate the availability of the systems is

$$\text{Availability} = \text{uptime} \div (\text{uptime} + \text{downtime})$$

Target

Current 94.1%

First year goal is 97%

Second year goal is 98 %

Initiatives

- Evaluate The current supply chain and develop a proper system and procedure to apply best practices in passenger journey
- Restructuring employee sites and increasing their numbers

4.3.2 Overall intern process indicator

In this indicator, it was focused on the department's internal process. Every process inside the department is measured through different perspective,

Objective

To optimize operational efficiency

Measures

- PM task to be completed •
- CM to be completed on priority task •

- Submit Maintenance Activity Plan
- % of system availability
- Initiate maintenance activity without approved WO
- Completion of WO within approved time
- Backlog of Deferred Work
- % of completion complain within approved time
- Maintenance Work Quality
- Avg. response time
- Avg. time to repair
- Risk Assessment Compliance.
- Availability of Spares and Consumables
- Compliance of maintenance tasks as per Operation and Maintenance Manual and or in a
- Good Industry practices

Calculation

In the following table there is the method used to calculate the score of each KPI

Ite m#	KPIs	Description	Indicator	Target	Measurem ent
1	Maintenance	PM Program Reactive Maintenance Technical Library Maintain Emergency System Spare Parts Availability Uniforms	PM task to be - completed CM to be - completed on priority task	Exceptional Performance = 95% Good Performance = 80-94% Poor Performance = 75-79%	Rating / Scoring

				Unacceptable Performance = <74%	
2	System Availability	The Contractor shall confirm the availability and readiness of the systems as per the scope of work.	% of system availability	>95% - 5 90% < 95% - 4 85% < 90% - 3 80% < 85% - 2 75% < 80% - 1 <60% - 0	Rating / Scoring
3	Response Time	Response time starts from Maintenance Dept. first call to the technician presence at the specified equipment.	Avg. response time	Avg. Min/call (per call type)	Rating / Scoring
4	Time to Repair	The time required to complete the work and need to be within the time frame.	Avg. time to repair	Avg. Min/incident (per maintenance Level required)	Rating / Scoring
5	HSE	Risk Management Health & Safety Plan Energy Management Plan Comply with HSE Operational	Risk Assessment Compliance. Compliance with HSE regulation. Monthly Report for Energy Management Compliance with HSE	Exceptional Performance = 95% Good Performance = 80-94%	Rating / Scoring

				Poor Performance = 75-79% Unacceptable Performance = <74%	
6	Non Schedule Maintenance	Corrective Maintenance	Compliance of maintenance tasks as per Operation and Maintenance Manual and or in a Good Industry practices	Exceptional Performance = 95% Good Performance = 80-94% Poor Performance = 75-79% Unacceptable Performance = <74%	Rating / Scoring

Target

- Current 3.7 out of 5
- First year Goal 4.2 out of 5
- Second year Goal 4.5 out of 5

Initiatives

- Communication program
- weekly monitoring

4.4 Financial Indicators

4.4.1 General Department Expenses

Maintenance department has many expenses. One of the most important expenses is the general expenses. General expenses cost a significant amount each year.

Objective

To optimize operating expenses

Measures

- Office Stationery and Supplies Expenses •
- Utility Expenses •
- Telephone Expenses •
- Insurance Expenses •
- License Expenses •
- Payroll Expenses •
- Vehicle Expenses •
- Travel Expenses •
- Other Expenses •

Calculation

Every element was trucked for the year 2019 and Calculated the total of cost.

Target

Current 3,450,388 SAR

First year Goal 3,350,388 SAR

Second year Goal 3,250,988 SAR

Initiatives

- Go Paperless -
- Compare providers -
- Eliminate unnecessary expenditure -

4.4.2 Measure & Manage Spare Parts Inventory

Objective

To increase the efficacy of spare part managements

Measures

- Inventory accuracy (45%) •
- Money spent on emergency purchases compared to overall purchases (20%) •
- Days of inventory on hand (20%) •
- Back orders and vendor performance (15%) •

Calculation

- Inventory accuracy: *Actual count/Computer reported on-hand balance.* •
- Money spent on emergency purchases compared to overall purchases: •
- Emergency money spent on purchases / Total money spent on all purchases*
- Days of inventory on hand: *Total inventory valuation/Average daily money used* •
- Slow-moving parts: Number of parts identified as slow or no movement/ Total parts in •
- inventory.

Target

- Current 2.87
- First year Goal 2.5 out of 5
- Second year Goal 2.25 out of 5

Initiatives

- To go paperless & computerized all the transaction.
- To focus on the disposal of unused parts
- To double check by outsourcing auditor

4.5 Learn & Growth Indicators

4.5.1 Team's efficiency Indicator

Objective

To improve team' skills and experience

Measures

- Time for task completion •
- Number of times performed •



Calculation

$$= \frac{\text{Total time to complete the same task (across set timeframe)}}{\text{number of times performed}} \times 10$$

Target

Current 75 %

First year Goal 80%

Second year Goal 85 %

Initiatives

- Develop the recruitment strategy and increase the efficiency of staff selection
- Coaching program

4.5.2 Employee training Indicator

Objective

To have extremely knowledgeable team

Measures

- Quality of the Training (20%) •
- Relevance of Training to the current Job (20%) •
- Training effective on improve employee' performance (20%) •
- Need for Further Training (20%) •
- Effects of Training on Motivation of Employees (20%) •

Calculation

Taking the average of all answers after multiplied them in 10

Target

Current 85 %

First year Goal 90%

Second year Goal 95%

Initiatives

- Employee's development plan
- Task Rotation program

5. Conclusion

Finally, The balanced scorecard shows the company how well it's managing its strategies. In this thesis, it was shown indicators of airports. This study created the balanced scorecard for the maintenance department of King Abdulaziz International airport. 8 key performance indicators were invented. Two regarding customer satisfaction. Another two internal process indicators. Last four were financial, learn and growth indicators. All the indicators calculation were explained. Now the maintenance department of King Abdulaziz International airport is able to determine and measure its action to achieve its vision.

References

- Basu, R., Little, C., & Millard, C. (2009). Case study: A fresh approach of the Balanced Scorecard in the Heathrow Terminal 5 project. Measuring Business Excellence.
- Campbell, J. D., Reyes-Picknell, J. V., & Kim, H. S. (2015). Uptime: Strategies for excellence in maintenance management. CRC Press.
- Casey, W., & Peck, W. (2004). A balanced view of balanced scorecard. Executive Leadership Group, White Paper: The Leadership Lighthouse Series.
- Dhillon, B. S. (2002). Engineering maintenance: a modern approach. cRc press.
- Kaplan, R. S. (2010). Conceptual foundations of the balanced scorecard, Harvard Business School. Harvard University.



Journal of University Studies for inclusive Research (USRIJ)
مجلة الدراسات الجامعية للبحوث الشاملة

Kaplan, R. S., Robert, N. P. D. K. S., Kaplan, R. S., & Norton, D. P. (2001). The strategy-focused organization: How balanced scorecard companies thrive in the new business environment. Harvard Business Press.

Kumar, U., Galar, D., Parida, A., Stenström, C., & Berges, L. (2013). Maintenance performance metrics: a state-of-the-art review. Journal of Quality in Maintenance Engineering.

Madsen, D. Ø., & Stenheim, T. (2014). Perceived benefits of balanced scorecard implementation: Some preliminary evidence. Problems and Perspectives in management, 12(3), 81-90.