Design and Implementation of Balanced Scorecard for Maintenance Department at Hajj Terminal, King Abdulaziz Airport

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Abstract: This report is about the design and implementation of a PAX system, PAX system is a Balance Scorecard (BSC) for maintenance department of PPMDC (Port Projects Management & Development Company) at Hajj Terminals, King Abdulaziz Airport. It monitors customer satisfaction, optimum service availability, the compliance of maintenance practice to GACA quality standards, maintenance department expense, spare part management, and enhancement of employees' skills, experience, and knowledge. The research uses a descriptive design surveys and formulas to assess scores, future target and suggests crucial initiatives to attain desired goals. Applying BSC, passenger journey satisfaction score indicator is 94.4% and a two-year projection of 96% and 98%. It achieved total quality standards compliance with General Authority of Civil Aviation Service quality standards (GACA) the indicator for current estimate of 4.55/5 Civil and for two successive years are estimated to be 4.60/5 and 4.65/5. The PAX systems availability indicator is 98.8% and projected 99% (for the second year). While internal process indicator was estimated at 94% and projected at 96 % in the sconed year. Department expenses indicator was 97 % for this year, while expected to be reduced at 95 % in the second year. Spare part inventory management measured at 88.3% and projected 90% for the second year. Lastly, for learning and growth indicator, the team' skills and experience is estimate at 95% and anticipated to grow to 96% in the short term.

Keywords: Data Analysis, Maintenance, Descriptive Design, Balanced Scorecard, Indictors

I. INTRODUCTION

Hajj terminal at king Abdulaziz International Airport is operated by Ports Projects Management & development company (PPMDC). PPMDC is specializing in operating and maintaining airports. This thesis addresses performance indicators in establishing the BSC, adapting the Saudi Arabia General Authority of Civil Aviation perspective. Key performance indicators for financial, customers, internal processes and learning and growth are assessed. The BSC focuses on the maintenance department.

Companies employ a balanced scorecard as a framework for managing and implementing plans. Strategic goals, targets, metrics, objectives, and initiatives are linked together on the scorecard to improve the effectiveness and efficiency of service delivery. To ensure that departmental and corporate goals are aligned, it balances performance indicators with financial objectives from departments of a company. Other advantages include evaluating services, assessing company success, synchronizing daily operations to define goals, and developing methodologies (Quesado et al., 2018). Thus, businesses may improve service flow and accomplish short-term and long-term objectives using a clear, balanced scorecard.

PPMDC and other entities in the aviation sector and related departments are often susceptible to market changes. Kopecka (2015) emphasizes the necessity for BSC, owing to its enhanced capacities in addressing performance-specific aspects. Passenger satisfaction scores are critical as they determine industry competitiveness. BSC helps visualize, conceptualize, and understand the customer, financial, and internal commercial processes and knowledge and growth to enhance internal operations and meet or satisfy external demands. The approach facilitates the assessment of past performance data and offer feedback to the organization to foster improvement. At PPMDC's maintenance department, crucial measures encompass facilities and amenities, ambience, targets, and initiatives. Passenger processes, service quality, and competitiveness are critical aspects that require metrics to assess performance, establish trends, and offer credible solutions to existing challenges.

Problem Statement

Maintenance department at Hajj Terminals at King Abdulaziz Airport will be able to establish better strategic plans with the assistance of the balanced scorecard (BSC). The BSC will enhance communication and execution of strategy, improve service provided to passengers and other stakeholders. It will assist management in aligning processes, focus on passenger satisfaction, visualize, conceptualize, and understand customer needs. It will monitor financial and growth to improve internal operations and meet and satisfy external demands. Moreover, it provides the assessment of past performance data and offer feedback to the organization to foster improvement.

Objectives

The research objectives are:

1.   To identify which maintenance performance metrics of the balanced scorecard need to be improved and improving the performance of maintenance department.
2.   To demonstrate the appropriate viewpoint of incorporating a stable scorecard as an instrument for monitoring.
3.   To determine the limits of employing balanced scorecards in the maintenance department's operations performance measurement.
4.   To compile unprocessed data and render them in a form that can be understood.

Hypotheses

Are the maintenance activities contributing to Hajj terminal operations performance?

About Hajj Terminal

Hajj terminal is the third terminal of King Abdulaziz International Airport located in Jeddah, Saudi Arabia. This terminal is estimated at five thousand square meters (465,000m^2) and is known for its tent-shaped roof. The Hajj terminal was intentionally designed to serve Hajjis (Pilgrimage) during Hajj and Umrah seasons. The Hajj terminal is an enclosed and conditioned facility that occupies five modules, known as Modules A, B, C, D and E. Within the five (5) modules of HT, fourteen functional units are designated as lounges 1 through 14. The HT has ten contact gates: with 27 remote stands for 34 aircraft parking positions. The total processing capacity of HT during arrival is 3800 passengers per hour and 3500 passengers per hour for the departure processes.

About Ports Projects Management & Development Company (PPMDC)

PPMDC was established in 2007 as a partnership between Saudi Binladin Group (SBG) and Airport de Paris (ADPM) to be the first company in Saudi Arabia to manage ports. The vision of PPMDC is to: *"To become the leading airports operator in Saudi Arabia and a key contributor to the Kingdom's vision of establishing itself as a global player in the transportation industry."*.

This was reflected in its mission statement: *"To excel in our operation and development, achieve best practices and set exceptional standards in customer experience. Our main principles of forging strategic alliances, developing our human resources, utilising creative solutions and capitalising on cutting-edge technology are fundamental to accomplishing our goals."*

From that point, the first project PPMDC got was King Abdul-Aziz International Airport-Hajj Terminal on a twenty years BTO contract (more than one billion Saudi Riyals) to run the terminal in two main areas: airport operations and maintenance. Following is a brief description of both sectors and the roles they are playing in the terminal

Hajj Terminal Operations Department

The role of the PPMDC Operation Department in the Hajj terminal is to manage all airport activities, such as:

- Scheduling and apron space allocation, PPMDC shall determine the schedule of HT airlines and passengers.
- Allocation of check-in counters, lounges, and parking stands to HTC airlines and flights.
- Passengers flow management
- Provision of vehicles or other passengers' movement systems to move all arriving & Departing passengers form/to HTC to their aircraft.
- Coordination with government agencies.
- Information provision to all agencies and passengers.
- Retail, food, and other non-aeronautical activities.
- Terminal safety & security

These activities are managed by a specialised and experienced team working to ensure the best performance and utilisation of the terminal's facilities to reach the company's vision and mission.

Hajj Terminal Maintenance Department

The maintenance department in Hajj Terminal was established to be a centre of control for every maintenance activity performed by subcontractors. This includes continuous monitoring & evaluation for the performance of every subcontractor to ensure systems availability and serviceability at high levels for performing its designated operational tasks. The responsibilities of the maintenance department are:

- Setting strategic plans
- Development programs
- Performance monitoring and evaluation
- Statistical analysis
- Routine and random inspection

- Quality control
- Continuous improvements

Beyond these responsibilities, the maintenance department links the operation department and maintenance contractors. They play an essential and significant role in bringing operation department needs and ideas into reality.

Hajj Terminal Maintenance Department Methodology

PPMDC's maintenance department delivers efficiencies by working alongside the operation department and other departments within PPMDC to understand the Hajj and Umrah operational plans, design them, turn them into the real world, and implement and test their results. Knowledge is the driver to facilitate it each part of the plan through the following structured approach:

- Identify Processes – By analysing the operation department plan to understand the complete picture and identify the set of processes within each operation process.
- Review Processes – By organising processes workshops to understand how the contractors operate, the details of the processes and the employees who execute the plan.
- Design Processes – PPMDC team, through the contractors, design the solutions that can manage the complexity of the operational plan. The operation department then reviews these procedures to ensure the proper implementation.
- Implement & Test – Implement and test the change within the setup procedures through the performance of the contractors and processes.

II. LITERATURE REVIEW

The literature review focuses on the BSC's four primary aspects and discusses maintenance's role in airports. Moreover, this section goes through types of KPIs and their types. Also, the operation of airports is explained here since the airport's maintenance is impacting the airport's operation. Subsequently, the first section will address customer satisfaction indicators in all industries, with an emphasis on the aviation sector. In such a case, the focus will be on vision attainment and the steps the organisation should take to obtain a desirable customer perception. The second part will address internal process indicators. The concept addresses customer and shareholder needs and primarily addresses particular business practices that the firm should excel at to meet such requirements.

Moreover, it is essential to establish the link between the internal business processes and external effects, related to profitability, branding, and service quality. The third aspect addresses financial indicators, focusing on how the organisation should appear to stakeholders from a financial performance or perspective. Lastly, the fourth section will analyse learn and growth indicators, including the ability to change and improve. In addition all the other followings sections will go through maintenance, KPIs and Airport' Operation

Customer Satisfaction Indicators

Customer satisfaction is the primary goal of BSC, particularly for industries sensitive to competition and intense rivalry. In this regard, Trung (2019) links BSC with enhanced performance and customer satisfaction. Examples include an assessment of passenger satisfaction in the aviation sector, crucial in enhancing user experiences and service optimisation. Additionally, Farooq and Hussain (2011) identifies the significance of customer assessment in BSC and its usefulness in streamlining

organisational vision with business strategy and activities. Examples include facilities, amenities, environment, hygiene, waiting times, and staff helpfulness, which significantly determine service access and quality. At the same time, Chimtengo et al. (2017) highlights the approach's efficacy in promoting customer-centrism, a vital component in the aviation sector's competitive industry. Examples include compliance with aviation industry standards and optimise the customer's lifetime value. From such a perspective, customer satisfaction indicators are quality oriented and address the essential human component, a critical aspect in a market sensitive industry.

As highlighted, customer satisfaction indicators assess how the customers perceive the organisation and the steps entities can take to ensure progress. In such a case, Chimtengo et al. (2017) highlight the need for subjective customer surveys to identify weak areas to provide service improvements and customisation. Regarding customer lifetime value, obtaining passenger feedback on waiting times, baggage collection, overall satisfaction with airport services, and access to Wi-Fi are vital. Additionally, Trung underlines BSC's importance in providing theoretical and factual data to promote decision-making efficiency. Applying such concepts to the current case, asset supply from customer data analysis, avoiding or fixing delays, and promoting person with reduced mobility (PRM) services are essential in enhancing customer perceptions of the organisation. Farooq and Hussain (2011) advocate for a statistical and data-based approach to improve performance. Using such data to improve arrival and budget services, staff quality, and overall satisfaction data will be helpful.

Internal Process Indicators

Internal process measures are a crucial aspect of BSC focused on enhancing business needs and practices to improve performance and meet shareholder expectations. Sujova et al. (2019) underscore the necessity of such processes, mainly when related to specific customer needs. In such a case, the emphasis is on passenger processes and how such concepts may adversely impact organisational perceptions. Service availability in carusel mobile counters, jetways, and lounges X-rays has relevance to security and customer trust. Additionally, Lundrogen et al. (2020) introduce the smart maintenance concept, emphasising digitalised organisational designs. Subsequently, sustainable systems focused on optimisation apply.

Moreover, Looy and Shafagatova (2016) highlight the need for performance measures to promote objective business improvements. The goal entails optimising supply chain management services to attain efficiency, including risk assessment and compliance with relevant standards. average response time and repair, work quality maintenance and reducing the backlog and the rate of deferred work also apply and play a crucial role in improving internal processes.

Various KPIs related to internal process indicators include maintenance, system availability, and response time. Looy and Shafagatova (2016) identify the need for time optimisation in processes that depend on time and cost, quality, and flexibility enhancement to meet organisational goals. According to Kaplan and Norton (1992), internal process indicators focus on time- and cost-related performances, and interior quality, which also promotes external outcomes, such as shareholder and customer participation. In such a case, Sujova et al. (2019) underline the organisation's capacity to meet end-user and internal requirements. Data collection should focus on time, cost, and performance-related aspects. Examples include the time taken to initiate and complete a repair, response time, and system standby to ensure accessibility when needed. Outcomes include decreased passenger waiting times and enhanced service and customer perceptions. Non-schedule maintenance or on-demand availability is also critical and promotes overall service quality.
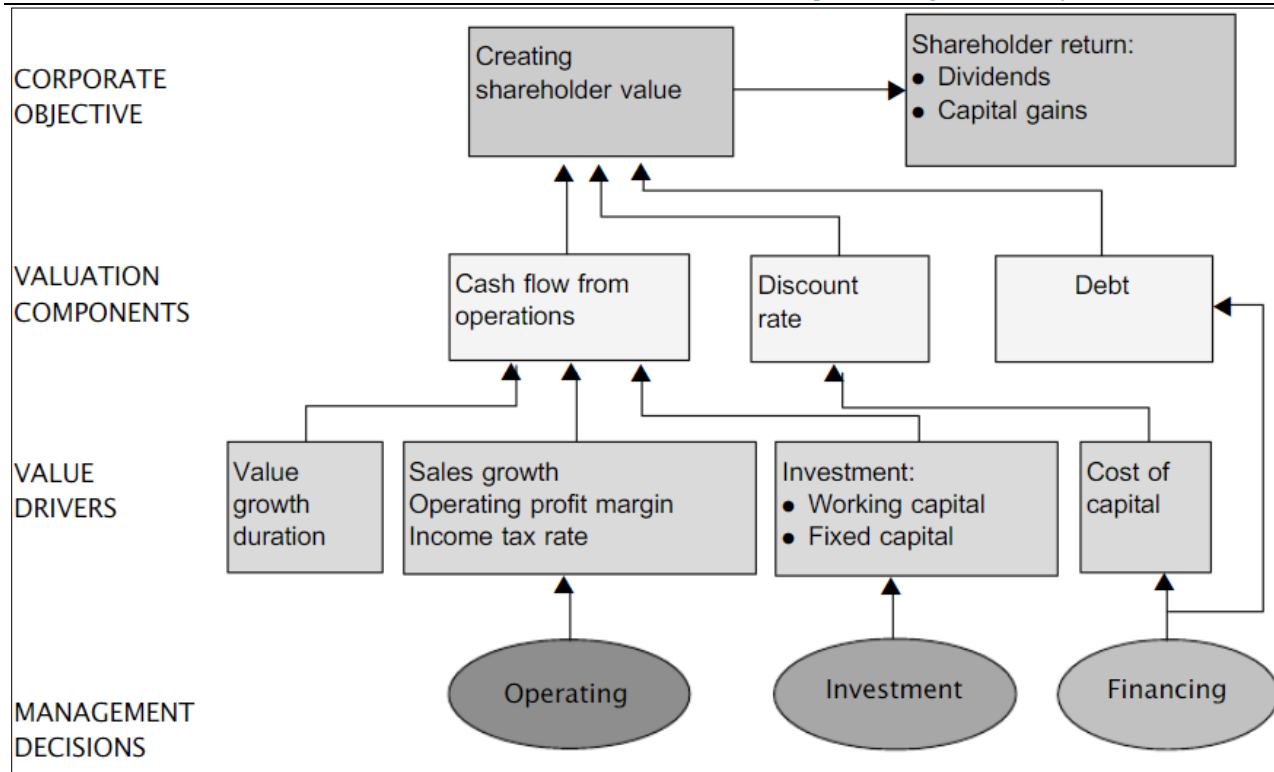
Figure 1. Shareholder value analysis (Wet & Jager, 2007).

Financial Indicators

Financial indicators are a vital driver of business operations and organisational purpose. In such a case, Kefe (2019) identifies various financial components, such as profitability retrieved from sales data. To illustrate, appropriate, satisfactory service will likely translate into higher sales, leading to profitability. Additionally, sustainability is critical, such as a consistent percentage increase in sales, inventory turnover rate, and a firm's liquidity, including current assets and short-term liabilities. Similarly, Wet and Jager (2007) highlight the necessity for shareholder inclusion, ensuring their goals are adequately met through effective value creation. Crucial assessable aspects include cash flow, growth in sales, and operating income. Market share and return on investment (ROI) components are also critical, as they determine shareholder value and returns on dividends and capital gains (Wet & Jager, 2007). As illustrated in fig 1, management decisions, determine and establish value drivers, the valuation of components, and corporate objectives.

The emphasis on shareholder needs is crucial from a financial perspective. As indicated, there is a critical association between economic goals and customer service. Chitu and Opris (2014) identify BSC use in addressing customer-centric needs, translating into service quality and acceptance, and promoting organisational profitability. At the same time, Kaplan and Norton (1992) address the need for strategic financial data to improve financial performance for shareholders and top managers. Moreover, the entity's investment capacity is critical and plays a beneficial role in influencing investor decisions. Kefe (2019) states that the essential aim of the financial perspective is to optimise stakeholder worth using strategic goals and plans. Various approaches to attain such purposes may include optimising operating expenses, such as utility bills and payroll. Optimising consumer needs is critical as it leads to enhanced subscription rates and product or service sales, a vital component of profitability and service optimisation.

Learning and Growth Indicators

Growth is a vital component of organisational performance. From such a perspective, Nazari-Shirkouhi et al. (2019) link the concept to service optimisation, an essential component of service management focused on efficiency and customer needs optimisation. From a progressive and customer-centric approach, addressing a reduction in labor turnover rate, establishing organisational cultures focused on addressing customer needs, and optimising service are critical. At the same time, Utomo et al. (2019) the role of BSC in understanding user needs to encourage growth. A learning-based approach is essential and promotes progression, such as skill and experience development to meet current and future user needs. Employee training, organisational culture changes, and staff motivation apply. Nielsen and Erland (2014) underscore the need for a strategic learning process, where research and development aspects play a vital role in promoting learning. The emphasis is on organisational adaptability to encourage readiness for change and capacity to absorb industry developments.

Performance-related learning and growth have significant correlations with employee performance. Using the Kaplan and Norton (1992) model, various components, such as flexibility in process performance and cost-related cost performance, are critical in promoting organisational sustainability and longevity. Additionally, Looy and Shafagatova (2016) emphasise the need for creativity, innovation, and society results or perceptions. Organisational culture and performance are when applied in the long-term, owing to the emphasis on altering existing traditions to meet developing customer needs. Nielsen and Erland (2015) highlight the need for training and customisation to ensure employees have the right skills aligned with long-term organisational goals. In such a case, indicators address training quality, relevance compared to organisational needs, and assessing the impact of a training or educational approach to employee motivation. Besides, establishing mentorship, employee development plans, and task rotation programs are critical and depend on the learning and growth components. As highlighted, the capacity to meet changing customer needs through employee training and development is vital.

Table 1. Performance perspectives (Looy & Shafagatova, 2016).

Financial perspective	Key results	Financial view	Financial measures Market measures	Financial performance for shareholders and top management
Customer perspective	Customer results	Customer view	Customer satisfaction	Customer performance Supplier performance Society performance
Internal business processes perspective	Enablers (processes/products/services, people, strategy, partnerships/resources, leadership)	Overall process performance based on the other views as driving forces	Flexibility Productivity Quality Delivery Process time Cost	General process performance Time-related process performance Cost-related process performance Process performance related to internal quality Flexibility-related process performance
"Learning and growth" perspective	People results Learning, creativity and innovation	Employee view Innovation view	–	(Digital) innovation performance Employee performance
–	Society results	Societal view	–	Society performance as a sub-perspective of customer performance (see above)

III. RESEARCH METHODOLOGY

The section addresses the methodology used in conducting the research. In this regard, there is an emphasis on the research design adopted, as well as the primary research question guiding the study:

"*Are the maintenance activities improving the performance of Hajj terminal?*". At the same time, addressing the research setting, the participants involved in the study, and data collection tools and approaches employed are included and play a vital role in obtaining the intended goals. Additionally, the data analysis approach used will be helpful. The analysis process included the calculation of various KPIs. Subsequently, a descriptive system was utilised, owing to the nature of the research. Concerning data gathering, a quantitative survey targeted on employees, managers, and shareholders was employed, focusing on the four domains of the BSC. As illustrated in appendix A, the questions were extracted from the literature assessment, although customised to fit the entity's specific needs. Secondary data was also obtained from PPMDC's records, which complemented the surveys.

Research Design

Doyle et al. (2020) identify various benefits, including an in-depth analysis of the problem and obtaining relevant and critical data related to all four perspectives. As highlighted, the emphasis was on the detailed analysis of the PPMDC's maintenance department regarding customer satisfaction and meeting customer needs. In a best-fit approach, assessing the needs, experiences, complaints, and feedback of the main participants, such as the passengers, employees, and shareholders, is vital. The design focuses on obtaining data in such a case. The emphasis is on the what, when, where, and how, instead of the why of the research question, concepts that adequately address the four components of the BSC. The goal is to obtain in-depth and comprehensive data for an enhanced understanding and assessment of the aspects affecting passenger processes at PPMDC's maintenance department.

Performance Measuring Model

This study aims to assess the influence of maintenance performed on the maintenance department; hence, it must be personalised. There must be a custom-tailored performance measurement methodology for the maintenance department. Consequently, the primary goal of this study is to identify the best performance indicators for airport operations and maintenance and the most real relationship between the two to ensure the validity and importance of the findings.

Setting

The setting is PPMDC's maintenance department. The emphasis is on a problem-solving approach focused on enhancing the quality output to meet passenger-specific needs in an industry sensitive to market changes. In such a case, the setting was the maintenance department of the Hajj Terminal, owing to its centrality in passenger process aspects, such as access to service, transit and processing time. As highlighted, various objectives were critical, including optimising operational efficiency at the facility. In such a case, the setting provided an adequate sample to collect relevant data related to task completion, task prioritisation, planning and activity completion, as well as the percentage of system availability. Other vital components encompass backlog, deferred work, and taverage response and maintenance demand times. The emphasis was on customer satisfaction and addressing process aspects and concepts related to passenger satisfaction. In this regard, the Hajj terminal and the maintenance department offered access to relevant individuals, supplying valid input.

Data Collection

Data collection was from two resources. The first one is from maintenance records which are secondary data. The other one is through a survey.

The Set Measures

To achieve the goal of this research, seven indicators were set and defined by the four different perspectives of the BSC as follows:

Customer Satisfaction Indicators

Passenger Journey Satisfaction Score Indicator

In such a case, the assessment focused on five primary measures based on GACA requirements. As highlighted, the facilities and amenities measure consisted of signage or ease of navigation, information availability, locating seats for outbound passengers, preciseness, and finding relevant information related to the flight. Secondly, the ambience and cleanliness category evaluated airport hygiene, cleanliness in the washroom, waiting areas and gate comfort, and the cleanliness of the hygiene room. Thirdly, data collected on departure and arrival services focused on baggage availability, check-in efficiency, passport control in immigration, and customs control efficiency. Data on the staff component encompassed the courtesy and helpfulness of the check-in staff for outbound passengers, respect, and resourcefulness of the employees in the passport and control department, and similar measures for the security department. The fifth category in the data collected was waiting times, which assessed overall satisfaction concerning the total waiting times at the airport.

The objective was to achive passenger journey experience at airport. In such a case, the process entailed identifying the maintenance department, the PAX of Hajj terminal, owing to passenger flow and traffic and how maintenance supervises and controls the facility and services.

Data used for the process was a survey to assess passenger satisfaction. An outsourcing company does the study here.

An allocation of 20% to each indicator, amounting to 100% total

- Arrival & Departure   20%
- Airport Staff   20%
- Ambience and Cleanliness   20%
- Facilities and Amenities   20%
- Waiting Time   20%

Here is a breakdown of the details for each measure

Arrival & Departure

- Availability of baggage trolleys
- Efficiency of check-in (outbound passengers only)
- Efficiency of passport control (immigration)
- Efficiency of customs control (inbound passengers only)

Facilities & Amenities

- 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

Airport Staff

- Courtesy & helpfulness of check-in staff (outbound passengers only)
- Courtesy and helpfulness of passport & customs control staff
- Courtesy & helpfulness of security (outbound passengers only

Ambience & Cleanliness

- Cleanliness of this airport terminal
- Cleanliness of washrooms
- Comfort of waiting/gate areas
- Cleanliness of airport prayer rooms

Waiting Times

- Overall satisfaction with total waiting time at airport

The calculation involved the average of each component and assessing overall means as illustrated by the following equation.

$$Ave = \frac{1}{n} \sum_{i=1}^{n} A\, ai$$

A= arithmetic mean
n= number of values

a_i= data set values

To achieve total quality standards compliance with General Authority of Civil Aviation Service quality standards (GACA)

Waiting time is most important standard. There are five primary measures weighted differently. The first one is waiting time at the facility, which encompassed the waiting times at various points, such as at the check-in phase for passengers, at the security control, and at the outbound and inbound passport control. Additionally, the waiting times at customs control, baggage collection for the first and last bag were assessed. As related to passenger experiences.

The primary objective for the aspect was achive total quality standards compliance with gernaral authority of civil aviation standards (GACA)

The data here was taken by observation. The observation here is done by outsourcing company.

Measures and weight:

An allocation of 16.67% each indicator, amounting to 100% total

- Waiting time at baggage collection   16.67%
- Waiting time at custom   16.67%
- Waiting time at security check   16.67%
- Waiting time at passport control outbound   16.67%
- Waiting time at passport control inbound   16.67%
- Waiting at check-in CUTE   16.67%

Regarding the calculation, times vary for passenger's service waiting at each processing point. The recommended waiting time at for all process is 15 min. A category table is built to convert the time to a 5-point scale as indicate below ensued.

$$
\begin{array}{llll}
5 \ point & & < 15 \ min \\
4 \ points & between & 18 \ to \ 16 \ min \\
3 \ points & between & 20 \ to \ 18 \ min \\
2 \ points & between & 2\,2 \ to \ 20 \ min \\
1 \ points & between & > 22 \ min
\end{array}
$$

The waiting time will be observed, and the average waiting time will be calculated. Then will be apply to the above table.

Internal Process

PAX' System Availability Indicator

In such a case, six prominent systems were weighted at equal percentages and related to direct passenger processes. The implication is that delays at any of the systems could inconvenience passenger processes; hence, the need to assess system readiness. The six measures included jetways, mobile counter, check-in counter, security screening walk-through, BHS X-ray, and lounges X-ray.

The overall objective for the category was to maintain all service unite (during operation).

The data here was taken from maintenance data records.

An allocation of 16.67% each indicator, amounting to 100% total

- Mobile counter availability   16.67%
- Jetways availability   16.67%
- Check-in counter availability   16.67%
- Security screening walk-through availability   16.67%
- BHS X-ray availability   16.67%
- Lounges X-ray availability   16.67%

The formula used to calculate the availability of the systems is

$$Availability = uptime \div (uptime + downtime)$$

After calculating the availability for each system, the average availability time will be calculated through this formula:

$$Ave = \frac{1}{n} \sum_{i=1}^{n} A\,ai$$

A= arithmetic mean
n= number of values
a_i= data set value

Internernal Process Indicator

This indicator was focused on the department's internal process. Process inside the department is measured from different perspectives

The indicator's primary objective was to introduce operational excellence across maintenance operational area through:

- Speed of service
- Automation

The data here were collected from maintenance department records.

An allocation of 20 % each indicator, amounting to 100% total

- PM tasks to be completed from over all require tasks	20%
- CM tasks to be complete on priority	20%
- Percentage of system availability	20%
- Average response time	20%
- Average time to repair	20%

To calculate these indicators different method and formula are used here.

Starting by PM tasks calculation formula:

$$= \frac{Number\ of\ task\ performed}{Numner\ of\ total\ task\ requier} \; X\; 100$$

For CM tasks to be complete on priority the same formula, but only for Priority 1

$$\frac{Number\ of\ task\ performed}{Numner\ of\ total\ task\ requier} \; X\; 100$$

The percentage of system availability is already calculated in another indicator.

The Average response time is taken and converted into a percentage and same for average time to

Financial Indicators

Department Expenses Indicator

In this regard, the maintenance department has numerous expenses, with the general expense category as the main one for the indicator. Subsequently, various fees encompass office stationery, supplies, utility, telephone, insurance, license, and payroll costs. Additionally, the categories of vehicle, travel and other expenses were significant and assessed.

The main goal was to optimize maintenance department expenses

The data here was taken from maintenance data records.

Allocation is equality for each indicator, amounting to 100% total

- Office Stationery and Supplies Expenses   11.11%
- Utility Expenses   11.11%
- Telephone Expenses   11.11%
- Insurance Expenses   11.11%
- License Expenses   11.11%
- Payroll Expenses   11.11%
- Vehicle Expenses   11.11%
- Travel Expenses   11.11%
- Other Expenses   11.11%

The methodology used here is that every element was trucked for 2019 and calculated the total cost.

Then take the highest amount in the last five years and make it 100%.

Current year amount / Highest amount of last 5 years

Measure & Manage Spare Part Inventory Indicator

For the category, the data collected included inventory accuracy weighted, the cash spent on emergency purchases relative to overall purchases. Additionally, the data involved weighted days of inventory at hand, back orders, and vendor performance.

The primary objective to introduce inventory management standards based on best practice

The data here was taken from maintenance data records.

Allocation is different for each indicator, amounting to 100% total

- Inventory accuracy   40%
- Money spent on emergency purchases compared to overall purchases   30%
- Days of inventory on hand   30%

Each indicator has different calculation approach, but here is a breakdown of calculation details:

- *Accuracy of inventory*: determined by comparing the actual count to the on-hand balance supplied by the computer.
- *Money spent on unexpected purchases compared to the entire amount of money spent on all purchases:* Total money spent/ amount of money spent on emergency.

- *Number of days' worth of stock on hand*: The total money spent on the inventory divided by the daily average.

Learning & Growth Indicators

Team's Skills and Experience Indicator

The measures encompassed training hours per employee and employee engagement survey

The overall goal for the indicator is to improve the team's skills and experience

The data here was taken from maintenance data records.

Allocation is 50% for each.

- Training hours per employee
- Employee engagement survey

The calculation for training hours per employee compared the number of hours existing employees spend training divided by the number of employees undergoing training over the same period of times as illustrated in the following formula:

$$= \frac{Number\ of\ exsiting\ hours\ employees\ spend\ traning}{Number\ of\ employees\ undergoung\ traning\ over\ the\ same\ period\ of\ times}$$

The calculation for employee engagement survey has applicable measures for the category encompass the quality of training at the facility, the relevance of training to the current work, and training effectiveness to enhance employee performance. Moreover, the necessity for further training, with the impacts of training on employee motivation.

The data I collected through a survey filled by maintenance team.

Allocation is equal for each indicator, amounting to 100% total

- Quality of the training	20%
- Relevance of training to the current job	20%
- Training effective on improve employee's performance	20%
- Need for further training	20%
- Effects of training on motivation of employee	20%

After calculating the percentage of each indicator, the average will be calculated through this formula:

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

A= arithmetic mean
n= number of values
a_i= data set values

IV. RESULTS AND DISCUSSION

The unit will present the outcomes and discussion of the data gathered and analysed from the previous section. In such a vase, the emphasis is on assessing the BSC and related metrics, assisting companies in identifying and enhancing their internal operations, and improving external outcomes. Moreover, the section will assess current scores and targets, set new short-term goals for the first and second years, and highlight the suggested initiatives to improve performance and attain the goals. The BSC will assist in collecting critical feedback and inform the organisation on how to make better decisions in the future and address competition in the industry.

Customer Satisfaction Indicators

For passenger journey indicator the initiative that should be considered to automate a satisfaction survey. From the outcome, the value for 2019 was 94.5%. The score was applied in projecting first year goal, set at 96%, and the second-year goal, put at least 98%.

For (to achieve total quality standards compliance with General Authority of Civil Aviation Service quality standards indicator) the current score was identified at 4.55/5, with the target goal for the first year set at 4.60/5 and 4.65/5 for the second year. The initiatives for the component included evaluate details program development and develop a check list containing GACA service leve agreement to eliminate non compliance.

Table 2: Passenger Journey Satisfaction Score

Objective	Indicators	Current	Target	Initiatives
To achive passenger journey experience through: -Arrival& Departure -Airport Staff -Ambienceand Cleanliness -Facilities and Amenities -Waiting Time	Survey	2019 score 94.5%	2023 goal 96 % 2024 goal 98%	Automation satisfaction survey

Table 3: To achieve total quality standards compliance with General Authority of Civil Aviation Service quality standards (GACA)

Objective	Indicators	Current	Target	Initiatives
To achieve total quality standards compliance with General Authority of Civil Aviation Service quality standards (GACA).	-Waiting time at baggage collection -Waiting time at custom -Waiting time at security check -Waiting time at passport control outbound -Waiting time at passport control inbound -Waiting at check-in CUTE	2019 score of 5: 4.55	2023 goal: 4.60 2024 goal: 4.65	-Evaluate details program development -To develop a check list containing GACA service leve agreement to eliminate non compliance.

Internal Process Indicators

For PAX' System Availability Indicator the calculations resulted in a current value of 98.8%, which helped in setting the first-year goal at 98.9% and the second-year target at 99.00%. The initiatives involved introducing continuing improving process (kaizen) and developing (Kaizen) based solution

For Intern Process Indicator as indicated, the outcome yielded a current score of 94%, with first and second-year goals set at 95% and 96%, respectively. However, there is adequate room for improvement to optimise performance. In such a case, the suggested initiatives for the indicator's improvement include develop operation maunual. Also, Compliance of maintenance task as per operation and maintenance manual

Table 4: PAX'System Availability

Objective	Indicators	Current	Target	Initiatives
To maintain all service unites (During operation)	- Mobile counter availability - Jetways availability - Check-in counter availability - Security screening walk-through availability - BHS X-ray availability - Lounges X-ray availability	2019 score 98.8%	2023 goal: 98.9% 2024 goal: 99.00%	-To introduce continuing improving process (kaizen) -Develop (Kaizen) based solution

Table 5: Internal Process

Objective	Indicators	Current	Target	Initiatives
To introduce operational excellence across maintenance operational area through: • Speed of service • Automation	-PM tasks to be completed from over all require tasks -CM tasks to be complete on priority. - System availability. -Average response time. -Average time to repair.	2019 score: 94%	2023 goal: 95% 2024 goal: 96%	- Develop operation maunual. -Compliance of maintenance task as per operation and maintenance manual

Financial Indicators

For Department Expenses Indicator the calculation involved trucking every element in 2019 and calculating the total expense. The resulting score for the present year was 97% , and the first-year target set at 96% , while the second-year target was reduced at 95%. The initiatives for the indicator included developing cost optimization program amd introduce wast management. Also, Supplier partnership (win-win approach) to increase overall profitability and optimize cost.

For Spare Part Inventory mangment Indicator the initiatives encompassed introduction to inventory management process to achieve world class practice. Moreover, to introduce inventory item classification. Concerning the calculation, every category was assessed individually. In the inventory accuracy, the formula used was Actual count/Computer reported on-hand balance. Additionally, the second category on money spent on emergency purposes used the formula Emergency money spent on acquisitions/ Total money spent on all procurements. From the calculations, the current score was 88.3%, with the first-year goal set at 89.5%, while the send-year goal was set at 90%.

Table 6: Department Expenses

Objective	Indicators	Current	Target	Initiatives
To optimize maintenance department expenses	-Office Stationery and Supplies Expenses -Utility Expenses -Telephone Expenses -Insurance Expenses -License Expenses -Payroll Expenses -Vehicle Expenses -Travel Expenses -Other Expenses	2019 score: 97%	2023 goal: 96% 2024 goal: 95%	To develop cost optimization program include: -Wast management. Supplier partnership (win-win approach)

Table 7: Inventory management

Objective	Indicators	Current	Target	Initiatives
To introduce inventory management standards based on best practice	-Inventory accuracy -Emergency purchases compared to overall purchases -Days of inventory on hand	2019 score: 88.3%	2023 goal: 89.5% 2024 goal: 90%	-Introduction inventory management process to achieve world class practice. - Introduce inventory item classification.

Learning & Growth Indicators

For team's skills and experience, regarding the target, the 2019 value is at 95%, with the first-year goal set at 96%, while the second-year goal was set at 98%. At the same time, the initiatives focused on develop training program schedule and initiating an introduction of engagement system Although 97% is favourable, there is adequate room for better scores related to the indicator. Calculation process involved multiplying all the answers by 10 and averaging them for the engagement survey. In such a case, the current value was 90%. The goal is attaining the set objective, ensuring the employees have the required knowledge to meet internal and external organisational needs, including dealing with competition in the industry and to improve the team's skills and experience.

Table 8: Team's skills and experience

Objective	Indicators	Current	Target	Initiatives
To improve the team's skills and experience	- Training Hours per Employee. - Employee engagement survey	2019 score: 95%	2023 goal: 96% 2024 goal 98%	-Develop training program schedule -Introduce engagement system

V. CONCLUSION AND FUTURE SCOPE OF WORK

This study created a balanced scorecard for the maintenance department of King Abdulaziz International airport. Eight key performance indicators were invented. Two regarding customer satisfaction. Another two internal process indicators. The last four were financial, learn and growth

indicators. All the indicators calculations were explained. King Abdulaziz International Airport's maintenance department can determine and measure its action to achieve its vision. Despite substantial room for improvement, the BSC at PPMDC's maintenance department illustrates acceptable performance rates. Subsequently, the passenger satisfaction score under customer satisfaction indicators is 94.5%, with a projected 96% and 98% increase for the next two years by automate satisfaction survey.

Additionally, PPMDC has a 4.55/5 score in complying with the Civil Aviation Service Quality standards, a favourable score that can be optimised at 4.65/5 by the second year. The initiatives for the component included evaluate details program development and develop a check list containing GACA service leve agreement to eliminate non compliance. The organisation's PAX system availability indicator was calculated at 98.8% for internal process indicators. It could be extended to 99% in two years by introducing continuing improving process (kaizen) and developing (Kaizen) based solution, while the internal process indicator was estimated at 94%, with a projected improvement to 96% by year two after initiation. Regarding the financial indicator, the department expenditure for 2019 was edstimated at 97%, projected to be reduced to 95% through developing cost optimization program amd introduce wast management. Also, Supplier partnership (win-win approach). A score of 88.3% in spare parts management is dismal, with an anticipated increase of 90% by the second year by optimising efficiency by introduction to inventory management process to achieve world class practice. Moreover, to introduce inventory item classification. The last indicator in learning and growth was team's skills and experience Indicator; Team's skills and exiperience ndicator is estimated to be in the second year at 97%, a 2 % rise from the 2019 value. In future, an emphasis on external metrics to address the competitiveness of PPMDC will be vital in ensuring survivability.

Conflict of interest: We declare that we have no conflict of interest.

Ethical statement: We declare that they have followed ethical responsibilities.

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