

Midocean University

College of Management

Master of Business Administration (MBA)



**The Impact of Strategic Asset Management Practices on Operational
Performance of Baggage Handling Systems at King Abdulaziz
International Airport, Jeddah.**

Prepared by:

Anas Ibrahim Alsulaimani

Student ID : 253001122

Supervised by:

Dr. Al-Faisal Abdulhamid Mohammed Hassan

Dr. Fayez Jarrad

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Contents

1.	Introduction	4
2.	Problem statement	5
3.	Research Objectives	6
4.	Research Questions	6
5.	Research Hypotheses.....	7
6.	Theoretical Frame of Reference for the Study	7
6.1.	ISO 55000 Asset Management Perspective.....	8
6.2.	Resource-Based View (RBV).....	9
7.	Importance of the Research.....	10
8.	Literature Review	11
8.1.	Airport Operations and Infrastructure Performance.....	11
8.2.	Strategic Asset Management in Infrastructure Systems	11
8.3.	Maintenance Strategies and Operational Performance.....	12
8.4.	Complex Operating Systems in Airports - Baggage Handling Systems	13
8.5.	Digital Monitoring and Intelligent Airport Systems.....	14
8.6.	Research Gap.....	14
9.	Research Methodology.....	15
9.1.	Research Design	15
9.2.	Research Approach.....	16
9.3.	Population and Sample	16
9.4.	Data Collection Method	16
9.5.	Data Analysis.....	16
9.6.	Expected Outcomes	17
10.	References	18
11.	Appendix	21

11.1. Research Questionnaire	21
Demographic Information.....	21
Strategic Asset Management Practices	22
Preventive Maintenance.....	22
Predictive Maintenance.....	22
Asset Lifecycle Planning	23
Digital Monitoring Systems.....	23
Resource Allocation	24
Operational Performance of Baggage Handling Systems.....	25
Operational Efficiency	25
System Reliability	25
Reduction in Operational Delays	26
Passenger Service Quality.....	26

1. Introduction

Airports use a variety of technologies designed to optimize passenger flow, aircraft turnaround, and service provision. Passenger movement and aircraft turnaround depend on the synergistic functioning of various technical systems. Any malfunctioning of a component system can lead to delays in flights, movement of passengers, and can paralyze the functioning of the airport (Rubio-Andrada et al., 2023; Sun et al., 2024).

Of the multiple operational systems, the most important, by far, is the baggage handling system (BHS). They are responsible for the movement, sorting, screening and delivery of passenger baggage, and for taking baggage to the aircraft. Any infrastructural failure in the BHS has the potential to cause delays in the processing of passengers, increased aircraft turnaround time, and a reduction in passenger satisfaction (National Academies of Sciences, Engineering, and Medicine, 2023).

Reliability of systems at the airport can be attributed to the effective management of the technological and operational systems over their life cycle. In complex environments, the reliability of systems has been improved and operational downtime reduced using advanced strategic asset management techniques, integrated preventive maintenance, predictive maintenance, life cycle management, and resource management. (Oukacha et al., 2025; Gürsel et al., 2023).

Due to its significance in examining operational challenges across airports in the Middle East, King Abdulaziz International Airport (KAIA) in Jeddah, handles high traffic volumes coupled with complicated logistical scenarios, serving as the main gateway for numerous pilgrims traversing to Makkah annually. The operational pressure on the baggage handling system (BHS) is substantial, necessitating reliability and efficiency. (General Authority of Civil Aviation, 2023).

There is a dearth of literature concerning the operational dimension of the systems and the impact of strategic asset management on the operational performance of the BHS in Saudi airports. Hence, this study seeks to analyze the strategic asset management and operational performance of BHS at King Abdulaziz International Airport in Jeddah. (General Authority of Civil Aviation, 2023).

2. Problem statement

In modern airports, one of the most important pieces of operational infrastructure is the BHS, as it impacts passenger flow, airplane turnaround time, and service reliability. Failures in baggage systems can lead to operational delays, and other issues, which can lead to a significant impact in the operation of the airport and can hurt passenger satisfaction (National Academies of Sciences, Engineering, and Medicine, 2023). While several airports have adopted new technologies to enhance the efficiency of their baggage handling systems, there is still a lack of operational efficiency. Research indicates that the performance of a system's infrastructure is a function of the system's physical assets, including the lifecycle management, maintenance, and operational replacement strategies, as well as the management of the assets. (Oukacha et al, 2025).

In this study, the managerial issue being tackled is the scant empirical evidence regarding the strategic asset management practices, and how they affect the operational performance of baggage handling systems in Saudi airports. This study seeks to explain this relationship by looking into some practices such as preventive maintenance, predictive maintenance, lifecycle planning, digital monitoring, and resource allocation as they relate to the baggage handling systems of King Abdulaziz International Airport in Jeddah.

3. Research Objectives

1) General Objective

Analyze how strategic management of assets impacts the operational performance of the baggage handling systems in King Abdulaziz International Airport.

2) Specific Objectives

- 1- Establish the strategic asset management practices in use in the baggage handling systems in King Abdulaziz International Airport.
- 2- Evaluate the operational performance of the baggage handling systems in the areas of efficiency, reliability, reduction of delays, and quality of services.
- 3- Assess how the application of preventative maintenance impacts the performance of the baggage handling systems.
- 4- Assess the extent to which predictive maintenance and digital monitoring systems impact operational performance.
- 5- Assess the impact of lifecycle asset planning and the allocation of resources on the performance of the system.

4. Research Questions

- 1) What strategic asset management practices are implemented in the baggage handling systems at King Abdulaziz International Airport?
- 2) What is the current level of operational performance of baggage handling systems at the airport?
- 3) What is the effect of preventive maintenance on the operational performance of baggage handling systems?
- 4) What is the effect of predictive maintenance and digital monitoring on the operational performance of baggage handling systems at King Abdulaziz International Airport?

- 5) What is the impact of life's asset planning and resource distribution on the performance of baggage handling systems?

5. Research Hypotheses

Main Hypothesis

H0: Strategic asset management practices do not have an impact on the operational performance of the baggage handling systems at King Abdulaziz International Airport.

H1: Strategic asset management practices do have an impact on the operational performance of the baggage handling systems at King Abdulaziz International Airport.

Sub-Hypotheses

H01: Preventive maintenance practices have no impact on the operational performance of the baggage handling systems.

H02: Predictive maintenance practices have no impact on the operational performance of the baggage handling systems.

H03: Lifecycle asset planning has no impact on the operational performance of the baggage handling systems.

H04: Digital monitoring systems have no impact on the operational performance of the baggage handling systems.

H05: Resource allocation practices have no impact on the operational performance of the baggage handling systems.

6. Theoretical Frame of Reference for the Study

One of the core aspects of this research is the integration of the two theoretical frameworks explaining how management of infrastructure integrates with operational performance within complex systems, namely the ISO 55000 framework for asset management and the Resource-Based View (RBV), within the context of infrastructure and operations management. When combined, these frameworks help in formulating the study of

strategic asset management and its impact on the operational performance of airport baggage handling systems.(Nasser, 2025).

6.1.ISO 55000 Asset Management Perspective

The ISO 55000 framework offers a lifecycle approach to the management of physical assets and infrastructure. The framework characterizes asset management as the coordinated activities of an organization to optimize value from assets while addressing performance, cost, and operational risk. In airports and other complex operational environments, Asset Management Systems (AMS) help ensure that infrastructure and operational assets provide value through effective and reliable performance for an extended period of time.

These practices include the planning and management of maintenance, the use of monitoring technology, and evidence-based decision-making throughout the lifecycle of the asset. For example, the studies involving the airport baggage handling systems have shown that the coupled systems of effective management, monitoring, and control of the system's lifecycle, improve the reliability of the system, and, thus, decrease operational disruptions within the airport environment (National Academies of Sciences, Engineering, and Medicine, 2023).

Also, the baggage handling systems consist of several interconnected technical systems, such as conveyor systems, automated control and sorting systems, and various types of sensors. All of the technical systems must function in a continuous mode to support the passenger processing and aircraft turnaround operations. In this regard, the application of the ISO 55000 standards in the operational management of baggage handling systems demonstrates the importance of implementing maintenance, control and monitoring systems, and planning within the entire lifecycle of the system.(Gürsel, 2023).

Recent studies have pointed out the new digital monitoring systems and predictive maintenance as new and important components of the management of infrastructure assets

and system management in an airport environment. The use of real-time monitoring systems and smart maintenance of systems has provided airport operators with the ability to "detect" operational disruptions in an "inactive" mode (Oukacha et al., 2025).

The analysis allows us to conclude that the ISO 55000 standards can be used to understand the benefits of strategic asset management in the operational management of baggage handling systems.

6.2.Resource-Based View (RBV)

The Resource-Based View (RBV) defines organizational efficiency from the angle of an organization's internal resources and capabilities. In the case of the airline industry, which is highly capital-intensive, organizational resources that affect operational efficiency and quality of service are the possession of physical assets, operational know-how, and technological and maintenance capabilities. (Gürsel, 2023).

In the recent past, a number of studies have emphasized the growing importance of digital technology, predictive analytics, and smart infrastructure integrated systems within the context of improvement of airport management and operations (Sun et al., 2024; Gürsel et al., 2023). These technologies and managerial capabilities provide airport managers with the ability to effectively utilize their infrastructure, operational improve and reduce system-wide downtime.

In airport operations, some strategic asset management (e.g. maintenance and asset reliability, predictive maintenance and monitoring, and lifecycle asset management) are organizational capabilities that sustain operational reliability. A well-defined and well-organized system will minimize equipment failure and operational delays, and sustain service quality.. (Sun et al., 2024; Gürsel et al., 2023).

The RBV analysis, thus, emphasizes that effective management of the assets of the baggage handling system can improve operational efficiency and, hence, better the quality of service offered by the airport.

7. Importance of the Research

This study offers an important contribution to airport management and academic literature, in a number of aspects.

To begin with, the study adds to the literature on the management of airport operations and the management of infrastructure assets. Recent developments in the management of airport operations focus on digital innovations, smart airport technologies, and service enhancements (Rubio-Andrada et al., 2023; Sun et al., 2024). Most of these studies, however, examine the impact of strategic asset management on the operational efficacy of the systems. This study seeks to fill this gap in the literature by investigating the impact of asset management on operational systems of airport infrastructure systems.

Also, the study has value for airport managers and infrastructure planners. Predictive maintenance, digital monitoring, and lifecycle asset management have been shown to enhance the reliability and operational effectiveness of airport systems (Oukacha et al., 2025; Yang et al., 2023). The study, therefore, presents the management and operational elements of an airport baggage handling system.

Third, the study aligns with the strategic development objectives of Saudi Arabia's Vision 2030, particularly the enhancement of transport systems, logistics, and the integration of aviation networks. King Abdulaziz International Airport, as one of the largest international entry points into the Kingdom, supports tourism, pilgrimage, cross-border travel and international connectivity. Thus, learning how operational performance is shaped by strategic asset management will enable effective airport infrastructure management.

Lastly, this study will assist airport authorities in the enhancement of Baggage Handling System (BHS) reliability and patron service. Literature suggests that the combination of predictive maintenance, digital monitoring, and operational intelligence systems can mitigate service disruptions and enhance the operational performance of airports. (Haldar, 2025; Gürsel et al., 2023).

8. Literature Review

8.1. Airport Operations and Infrastructure Performance

An airport needs multiple subsystems to aid with passenger processing, aircraft handling, and baggage handling in a seamless and reliable manner. Airports are increasingly reliant on data-driven decision-making and intelligent airport technologies to improve the digital transformation and operational efficiency of their integrated aviation infrastructure systems. (Sun et al., 2024).

Existing research has focused on airport operations within the context of system planning and system design. Their analyses advanced the knowledge of airport systems, but in the end, most analyses of the airport system focus on planning and design and leave out the operational effectiveness of specific subsystems, such as the baggage handling systems. (Sun et al., 2024).

Recent studies point to the growing impact of emerging technologies on the enhancement of the various operations and service quality at airports. The operational efficiency and customer experience at airports can be improved by the use of smart airports and automated technologies (Rubio-Andrada et al., 2023; Gürsel et al., 2023).

These studies have shown how important it is to have an integrated approach, but not many explain how the management of systems infrastructure assets impacts operational performance at subsystem of the airport system.

8.2.Strategic Asset Management in Infrastructure Systems

Facilitating the transportation, sorting, and delivery of passenger baggage in the multi-terminal environment of an airport, baggage handling systems have become an integral (yet still one of the most complex) operational systems in an airport's infrastructure. Rekiek (2023) states that decision support systems and operational improvement systems have come to rely, in large part, on automation, artificial intelligence, and optimization algorithms. Such systems provide reliability and reduce operational delays. Airports are able to handle significant baggage volumes with improved operational reliability.

Modern airports rely on baggage handling systems to ensure the effective movement, classification, and retrieval of customer baggage throughout airport terminals. National Academies of Sciences, Engineering, and Medicine (2023) notes that the total cost of ownership, including acquisition, maintenance, operational, and long-term performance of handling systems, offers insight into the most effective operational decisions. The longer the systems are in place, the more costs are incurred. With effective planning regarding the systems, operational reliability can be restored, and the integrity of the handling systems can be preserved.

Though strategic asset management has been widely applied in industrial settings, its use in airport operational subsystems is still in its infancy. (Wandelt, 2025).

8.3.Maintenance Strategies and Operational Performance

The various types of strategies for conducting maintenance have an impact on the reliability of critical infrastructures. For instance, one type of strategy is reactive maintenance, which is maintenance that is performed only after an equipment failure occurs. Alternatively, newer strategies include predictive maintenance and preventive maintenance.

The importance of baggage handling systems is of great relevance in today's operational systems in airports as they aid in the movement, sorting, and distribution of passenger luggage within terminals. National Academies of Sciences, Engineering, and

Medicine (2023) states that the most successful systems in baggage handling are those in which decision-makers evaluate the complete cost of ownership, including costs of acquisition, costs of maintenance, operational cost efficiency, and performance of the infrastructure over the operational lifespan. According to the report, the operational reliability and failure of the systems can be improved by the effective maintenance of the baggage system components. However, the majority of available literature on predictive maintenance focuses on the manufacturing and industrial systems, and very few studies touch on airport systems.

8.4. Complex Operating Systems in Airports - Baggage Handling Systems

Baggage Handling Systems (BHS) are examples of very sophisticated systems in an airport. They include the processes for moving, sorting, screening, and delivering passenger luggage from the check-in counters to the aircraft.

The National Academies of Sciences, Engineering, and Medicine, (2023) states that in making decisions regarding systems for handling baggage at airports, the entire life cycle costs, operational efficiency, and the sustainable use of the infrastructure should all be considered. Use of an integrated decision-making process for the selection of suppliers of airport baggage handling systems. The study captures the link between the design of airport infrastructure and the efficiency of the operation of baggage handling systems. However, the study seems to focus more on the selection of suppliers than on the management of operational performance.

Recent studies have focused on the operational efficiency of baggage handling systems. For instance, Rekiek (2023) pinpointed the use of automation, real-time tracking, and digital control systems, as well as their impact on the operational efficiency of baggage handling systems. The study emphasizes the synergistic effect of technology and operational management.

In the same vein, Agarwal et al. (2023) analyzed smart baggage handling systems through the lens of AI-powered logistics optimization. Their study found substantial improvement in the efficiency of baggage handling system and reduction of delays in the system due to the use of advanced data-based technologies. The focal point of the study is on the design and technology of the system as opposed to management of resources.

8.5.Digital Monitoring and Intelligent Airport Systems

The use of digital technology in systems of airport infrastructure to enhance operational efficiency is on the rise. The recent study by Oukacha et al (2025) studied the implementation of real-time monitoring systems at airports and found that use of the digital monitoring tool and data-based control of operational activities helped to optimize the overall efficiency of the system and minimize operational disruptions.

The same conclusion has been reached from different cases of the same industry. Belden (2024) reported that monitoring tools of individual assets, through digital technology, have provided the airport operators with the ability to monitor the operational state of the system components, and from that point on, they have been able to control system failures by operating maintenance services on a schedule. This resulted in the system becoming more reliable and more predictable in operation.

The research carried out has been centered on the incorporation of new digital tools in the operational process of the airports, and the outcomes of the research showcase the value of these digital tools, however, the operational efficiency of these tools with the integrated Strategic Asset Management has not been studied.

8.6.Research Gap

Research has been carried out on diverse components that make up the airport infrastructure, systems of maintenance management and the baggage handling systems, but there are still three substantial gaps in research of these components.

The overall focus of the majority of studies is on the operational systems of the airports, which may include processing of passengers, planning of the airports, and operational activities of the airlines. These studies undoubtedly add value to the management of airports, but they very seldom analyze operational performance of the baggage handling systems as part of the infrastructure assets within the operational activities of the airport.

Research conducted on predictive maintenance and maintenance strategies primarily targets the industrial and manufacturing sectors. Although these studies showcase the benefits of predictive maintenance and lifecycle asset planning for improving the reliability of equipment, the results are still not widely applicable to the systems used to handle baggage at airports.

Most empirical research studies pertaining to the management of operations in the airport sector have been carried out in Europe, North America, and Asia. Within the fast-growing aviation industry in Saudi Arabia, little is known about the management of infrastructure in airports in the Middle East.

Most existing works have looked at airport operations and maintenance approaches in industrial systems; however, there are not many that have attempted to combine the strategic asset management components with operational performance of baggage handling systems in airports in Saudi Arabia.

Thus, this study aims to evaluate strategic asset management components such as preventive maintenance, predictive maintenance, lifecycle planning, digital monitoring, and resource allocation, and their impact on the operational performance of the baggage handling systems at King Abdulaziz International Airport in Jeddah.

9. Research Methodology

9.1. Research Design

The study will utilize a quantitative research design to analyze the correlation between strategic asset management and operational performance.

9.2.Research Approach

A descriptive and analytical approach will be employed to assess the data collected.

9.3.Population and Sample

The study's research population consists of employees involved in the operation, maintenance, and management of baggage handling systems at King Abdulaziz International Airport.

These employees have experience in the operational aspects of the performance of the baggage systems and the management of the associated assets.

The sample will comprise:

- Maintenance engineers
- Operational supervisors
- Airport operations managers
- Technical personnel on the baggage handling systems

A structured questionnaire will be administered to 150–200 people.

9.4.Data Collection Method

The primary data will be collected using a structured questionnaire with a five-point Likert scale.

The secondary data will be collected from:

- Research reports
- Reports on aviation and airport management

9.5.Data Analysis

Data will be analyzed with the aid of the SPSS statistical software using:

- Descriptive statistics

- Correlation analysis
- Regression analysis
- Reliability analysis

9.6.Expected Outcomes

The purpose of this study is to provide evidence that the strategic asset management practices in use have a positive impact on the operational performance of airport baggage handling systems. Additionally, it will be determined if predictive maintenance systems and digitally monitored systems are useful in mitigating system failures and operational performance. The study may also reveal the asset management practices that most positively affect the performance of the baggage handling system.

Timeline

Stage	Duration
Literature Review	Month 1–2
Proposal Approval	Month 2
Data Collection	Month 3
Data Analysis	Month 4
Writing Results	Month 5
Final Thesis Submission	Month 6

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11. Appendix

11.1. Research Questionnaire

“The Impact of Strategic Asset Management Practices on Operational Performance: Baggage Handling Systems at King Abdulaziz International Airport.”

Use a **5-point Likert scale**.

Scale:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

Demographic Information

Question	Options
Gender	Male / Female
Age	Less than 30 / 30–40 / 41–50 / Above 50
Educational Qualification	Diploma / bachelor’s degree / master’s degree / Doctorate
Years of Experience	Less than 5 years / 5–10 years / 11–15 years / More than 15 years
Position	Maintenance Engineer / Operations Supervisor / Airport Manager / Technical Staff
Department	Airport Operations / Maintenance / Engineering / Asset Management

Strategic Asset Management Practices

Preventive Maintenance

Statement	1	2	3	4	5
Preventive maintenance schedules are regularly implemented for baggage handling equipment.	☐	☐	☐	☐	☐
Preventive maintenance helps reduce equipment failures in baggage handling systems.	☐	☐	☐	☐	☐
Maintenance activities are well planned and executed according to operational requirements.	☐	☐	☐	☐	☐

Predictive Maintenance

Statement	1	2	3	4	5
Predictive maintenance technologies are used to monitor baggage handling equipment performance.	☐	☐	☐	☐	☐
Predictive maintenance helps detect potential equipment failures early.	☐	☐	☐	☐	☐

Data analytics tools are used to improve maintenance planning.	☐	☐	☐	☐	☐
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Asset Lifecycle Planning

Statement	1	2	3	4	5
The airport applies lifecycle planning for baggage handling system assets.	☐	☐	☐	☐	☐
Asset replacement decisions are based on performance data and lifecycle analysis.	☐	☐	☐	☐	☐
Long-term asset management strategies are implemented to improve system sustainability.	☐	☐	☐	☐	☐

Digital Monitoring Systems

Statement	1	2	3	4	5
Digital monitoring systems are used to track the performance of baggage handling equipment.	☐	☐	☐	☐	☐

Real-time monitoring improves the efficiency of baggage handling operations.	☐	☐	☐	☐	☐
Automated monitoring systems help identify operational problems quickly.	☐	☐	☐	☐	☐

Resource Allocation

Statement	1	2	3	4	5
Sufficient financial resources are allocated for maintenance and asset management.	☐	☐	☐	☐	☐
Skilled technical staff are available to maintain baggage handling systems.	☐	☐	☐	☐	☐
Training programs are provided to improve asset management practices.	☐	☐	☐	☐	☐

Operational Performance of Baggage Handling Systems

Operational Efficiency

Statement	1	2	3	4	5
Baggage handling operations are completed efficiently without unnecessary delays.	☐	☐	☐	☐	☐
The baggage handling system processes passenger luggage quickly and accurately.	☐	☐	☐	☐	☐
The system helps improve overall airport operational efficiency.	☐	☐	☐	☐	☐

System Reliability

Statement	1	2	3	4	5
The baggage handling system operates reliably during peak passenger periods.	☐	☐	☐	☐	☐
Equipment failures are rare in the baggage handling system.	☐	☐	☐	☐	☐
Maintenance strategies help improve system reliability.	☐	☐	☐	☐	☐

Reduction in Operational Delays

Statement	1	2	3	4	5
Efficient baggage handling reduces flight delays.	☐	☐	☐	☐	☐
Operational disruptions related to baggage handling are minimal.	☐	☐	☐	☐	☐
Maintenance and monitoring systems help prevent operational delays.	☐	☐	☐	☐	☐

Passenger Service Quality

Statement	1	2	3	4	5
Efficient baggage handling improves passenger satisfaction.	☐	☐	☐	☐	☐
Passengers receive their baggage on time.	☐	☐	☐	☐	☐
The airport provides reliable baggage handling services to passengers.					