

Research Title

The Impact of Business Continuity Planning on Operational Resilience and Risk Management in Airports in Saudi Arabia

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Academic Year:

2025-2026

Abstract

This study investigates the impact of Business Continuity Planning (BCP) implementation on Operational Resilience and Risk Management Effectiveness within Saudi airports. Airports represent complex and interdependent operational systems, where any disruption can significantly affect service continuity, passenger safety, and national reputation. In the context of Saudi Arabia's Vision 2030, ensuring operational efficiency and resilience in aviation is critical, making BCP a strategic tool for mitigating risks and enhancing organizational performance.

A quantitative research approach was adopted, and data were collected from 60 employees occupying diverse managerial and operational roles across Saudi airports. The study utilized a structured questionnaire measured on a five-point Likert scale, covering three main constructs: BCP implementation, operational resilience, and risk management effectiveness. Descriptive statistics, Pearson correlation, and simple linear regression analysis were conducted using SPSS to examine relationships between the study variables and test the research hypotheses.

The findings reveal that the overall level of BCP implementation in Saudi airports is high, particularly in governance and operational integration, while training and testing dimensions show moderate maturity. Operational resilience and risk management effectiveness were also found to be high, indicating that airports are capable of maintaining service continuity, adapting to unexpected events, and managing operational risks effectively. Correlation and regression analyses indicate a significant positive relationship between BCP implementation and both operational resilience ($\beta = 0.61, p < 0.001$) and risk management effectiveness ($\beta = 0.66, p < 0.001$), highlighting the predictive role of structured continuity planning in enhancing airport performance and mitigating disruptions.

The study concludes that the implementation of robust BCP frameworks is crucial for strengthening operational resilience and risk management in airports, supporting continuity of critical services, and minimizing potential financial, operational, and reputational losses. Practical implications suggest that airport authorities should focus on continuous improvement, employee training, and regular testing of BCP procedures to ensure alignment between strategic intent and operational effectiveness.

Keywords: Business Continuity Planning, Operational Resilience, Risk Management, Saudi Airports, Aviation Infrastructure, Crisis Preparedness

حقوق الطباعة

حقوق الطباعة تمتلكها جامعة "ميدأوشن". حيث إن جميع المواد والمحتويات الواردة في هذا البحث هي ملك للجامعة، ولا يجوز استخدامها أو إعادة نشرها أو توزيعها بدون إذن مسبق من الجامعة.

شكر و تقدير

الحمد لله، الحمد لله، الحمد لله الذي بنعمته تتم الصالحات، فله الحمد أولاً و آخراً على توفيقه لإتمام هذه العمل.

أتقدم بوافر الشكر و التقدير إلى جامعة “ميدأوشن” التي وفرت لي البيئة العلمية الداعمة و الموارد اللازمة لتحقيق

هذا الإنجاز. كما أخص بالذكر المشرفين القديرين: د. الفيصـل عبدالحـميد، و د. فايز جراد على التوجيهات السديدة

التي ساهمت بشكل أساسي في البحث و اضافت لجودته العلمية.

كما أتقدم بالشكر لوالديّ و عائلتي و أصدقائي على الدعم و التحفيز الدائم. كما أشكر المحكم و المشاركين في

الاستبيان الذين منحوني وقتهم و علمهم لإثراء هذه الدراسة.

إن هذا البحث هو نتيجة جهود جماعية أقدرها حق تقدير، و أسأل الله أن ينفع بها و يجعلها في ميزان الحسنات.

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Chapter one: Introduction

1.1 Introduction

Airports around the world are critical infrastructure as they are used as central points of global movement, commerce, and tourism and central facilitators of economic development in countries. The contemporary airports are complex, intertwined systems that combine various operational domains, technological platforms, and networks of stakeholders, all of which have to work together to ensure safety, efficiency, and continuity of services. To a passenger, the first and last point of contact with the aviation system is the airport, which forms perceptions of the competence of operations in a country, its safety, and general hospitality. Therefore, airport continuity is crucial to passenger satisfaction as well as maintaining national connectivity, image, and strategic economic purposes (IATA, 2020; ICAO, 2021). In the situation of Saudi Arabia, airports and the aviation industry in general are at the centre of the goals of Vision 2030 which focus on diversifying the economy and developing the Kingdom as a worldwide logistical centre, capitalizing on its strategic geographic positioning (Saudi Vision 2030, 2016). General Authority of Civil Aviation (GACA) has established the following pillars to ensure sustainable expansion in the aviation industry: operational efficiency, safety management, and resilience. However, it is also true that airports are susceptible to a variety of different and dynamic threats, such as cyberattacks, natural disasters, pandemics, geopolitical instability, technical failures, and supply chain disruptions. These incidents may harm the important operational procedures,

endanger the safety of passengers, interfere with the management of air traffic, and have a negative impact on the reputation of the country (Sheffi, 2021; GWEH, 2021). Due to this, the aviation sector in Saudi Arabia has been embracing Business Continuity Planning (BCP) as a formal and proactive model to predict, cope and overcome operational interruptions. BCP is considered an invaluable management tool enhancing the preparedness of the organization in the global environment, but in the Saudi airport scenario, the modernity of the implementation, involvement of the employees, and the correspondence between the strategic goals and organizational practice is still developing (Herbane, 2010; HWANGSUPHAKITKOSON & Siriwong, 2024; Kanaan et al., 2023). The extensive influence of BCP on the resilience of operations and risk management is thus important in strengthening the stability and sustainability of the aviation infrastructure in the Kingdom. Airports are operating in much-intertwined operational settings, which entails real-time coordination of the operations of airlines, the ground handling services, fuel service providers, air navigation services, regulatory bodies, and other service providers. As these systems are interdependent, the effects of disruptions can be multiplied because a single part may spread into several different layers of operation (O'Rourke, 2018; Lee and Harrald, 2003). This complication explains why a strong and responsive BCP should be considered to reduce operational, financial, and reputational risks by a significant margin. Moreover, the global air traffic has been growing rapidly, whereas digitalization and exposure to cyber threats are increasing, which has compelled the implementation of resilience models in the

operation of airports (Syed, 2025; Wong and Brooks, 2020). The COVID-19 pandemic also demonstrated how essential proactive continuity planning is in terms of reducing operational and financial losses as well as maintaining the organization at its core. In Saudi Arabia, the necessity of the widespread use of BCP is reinforced by the current airport development and modernization programs under Vision 2030 to predict the emergence of new threats and ensure that the operational capacity is ensured at all rates to facilitate the sustainable increase in aviation (ICAO, 2021; IATA, 2020). To conclude, this paper has highlighted the fact that Saudi airports are not just passenger service providers but intricate systems of operation with dependent processes, technological systems, and stakeholder relationships that ought to operate in harmony. A well-organized and developed BCP system is thus necessary in order to boost operational resilience, streamline risk management, and make sure that aviation infrastructure in the Kingdom is capable of responding to routine disruptions, as well as unexpected crises. The current study will serve to measure the strategic and operational value of BCP in Saudi airports and present practical findings which can be translated into practical uses of theoretical knowledge to ensure the management of the airports is resilient.

1.2 Research Problem:

The world is increasingly becoming concerned about resilience and risk management in any industry. There are already companies which have made a great step to introduce methodology that guarantees effective resilience and risk management. Nevertheless, there are a limited number of studies which have empirically evaluated the use of business continuity planning (BCP) in the Saudi Arabian airports.

Business continuity management is fully guided at the international regulatory bodies like the International Civil Aviation Organization (ICAO) and Airports Council International (ACI). Nonetheless, there is an early stage in local implementations and contextualization of these frameworks within the cultural setting. Though it might be true that many of the airports might have formal BCP structures, there are a number of areas that have not been covered in the structure, such as the integration of the practices into day-to-day processes, testing of the practices, their corporate integration, practice implementation, and effectiveness of the practice, among others.

Although it is very strategic to have a BCP to enable the perpetuation of operations without compromising on the needed standards, it remains a fact that many airports, both locally and internationally, are mostly reactive, instead of proactive. Saudi Arabia has differing degrees of maturity in the continuity planning in different airports based on the size of their operations, organizational culture, and resource base. Although BCP has been developed by some airports, in most instances, the plans are not more than a case of

documentation, but not deployment. This indicates that there is a crucial difference between a policy on paper and a fully functional BCP on paper.

The other issue is associated with a lack of awareness of frontline and mid-level personnel on their roles and duties. These loopholes can prove to be disastrous in the face of crisis where decision-making is necessary and at the right moment. Airports are very dynamic environments and any delay or misunderstanding between the personnel can worsen the disruptions. Consequently, one must put into consideration the relevance of training programs, communication skills, and drill exercises whenever analyzing the contribution of these factors towards the correct implementation of a BCP in an airport scenario.

1.3 Central Research Problem:

How much does Business Continuity Planning (BCP) influence operational resilience and risk management performance in airports in Saudi Arabia? Furthermore, although there are regulations, for instance the GACA, focused on preparedness and safety, the institutionalization of BCP at all operational layers is difficult.

Barriers to adoption include limited stakeholder awareness, resource constraints, and differences in commitment at different management levels. This regional novelty has also led to variances in stakeholders' interpretation of its scope, which often conflates BCP with emergency response, crisis management, and other broad and general concepts. This research fills the gap by integrating empirical evidence with managerial insight in examining the concrete impact of BCP, as well as the organizational mechanics that impact its effectiveness.

Reviewing these observations, the problem of this research can extend beyond determining whether BCP exists in Saudi airports, it can also support in understanding the degree to which these plans are actually integrated in the operation and how to enhance resilience and implementation while measuring them. There should be also consideration of different factor that can affect the to identify external or internal factors to support a proper integration of continuity planning in Saudi Airports daily operation. This will magnify the importance of assessing the alignment between regulatory expectations, operators readiness, and the actual realty of how the disruptions are managed in a complex aviation environment.

1.4 Importance

The scientific importance of this study stems from its focus on a critical infrastructure sector—airports—within the Kingdom of Saudi Arabia, which play a pivotal role in achieving the objectives of Saudi Vision 2030. Saudi airports, operating under the supervision of the General Authority of Civil Aviation (GACA), represent strategic gateways that support tourism, logistics, international trade, and global connectivity.

From an academic perspective, this study contributes to the existing body of knowledge in Business Continuity Management (BCM), operational resilience, and risk management by addressing a contextual gap in the Middle Eastern region. While extensive research has been conducted in Western and Asian contexts, limited empirical studies examine the integrated relationship between Business Continuity Planning (BCP), operational resilience, and risk governance within Saudi airports.

Theoretical Importance

The study further contributes theoretically by integrating concepts from business continuity management, organizational resilience theory, and risk governance frameworks. It provides a conceptual and empirical model explaining how structured BCP implementation enhances airports' ability to absorb disruptions, maintain operational integrity, and recover efficiently from crises.

Additionally, the study supports alignment with international standards and best practices, particularly ISO 22301 and the resilience guidelines of Airports Council International (ACI). This integration strengthens the academic rigor of the study and promotes the development of measurable indicators for assessing BCP maturity and its impact on operational performance and safety outcomes.

Practical Importance

The practical importance of this study lies in its direct applicability to airport authorities, policymakers, and operational managers in Saudi Arabia. The findings are expected to provide evidence-based insights that can be utilized to enhance strategic and operational decision-making.

Specifically, the results of this study can help:

- Assess the current level of BCP implementation in Saudi airports and identify performance gaps.
- Improve disruption response strategies and reduce operational downtime.
- Strengthen risk anticipation and mitigation mechanisms.
- Enhance staff preparedness through structured training and communication systems.
- Support the integration of BCP into airport management systems and governance frameworks.
- Improve compliance with national and international regulatory standards.

Moreover, by demonstrating the measurable impact of BCP on operational resilience and risk management, the study can assist Saudi airports in enhancing investor confidence, passenger trust, and international competitiveness. Ultimately, the practical outcomes support sustainable growth in tourism, logistics, and aviation services in alignment with national economic diversification goals.

1.5 Objectives

Main Objective

The main objective of this study is:

To examine the impact of Business Continuity Planning on operational resilience and risk management in airports in Saudi Arabia.

Sub-Objectives

1. To assess the current level of Business Continuity Planning implementation in Saudi airports.
2. To analyze the relationship between BCP implementation and key operational resilience indicators.
3. To examine the impact of BCP implementation on the effectiveness of risk management practices in airports.
4. To identify the key organizational factors (e.g., leadership commitment, communication, training, and organizational culture) influencing the effectiveness of BCP implementation.
5. To propose evidence-based recommendations for strengthening BCP frameworks and integrating them into airport management systems.

1.6 Study Questions

Main Research Question

What is the impact of Business Continuity Planning on operational resilience and risk management in airports in Saudi Arabia?

Sub-Questions

1. What is the current level of BCP implementation in Saudi airports?
2. Is there a statistically significant relationship between BCP implementation and operational resilience?
3. Does BCP implementation significantly enhance risk management effectiveness in airports?
4. What organizational factors influence the success and sustainability of BCP implementation?
5. How can BCP frameworks be improved to enhance operational sustainability and resilience in Saudi airports?

1.7 Research Hypotheses:

Main Null Hypothesis (H0)

There is no statistically significant relationship between the level of Business Continuity Planning implementation and operational resilience and risk management in Saudi airports.

Main Alternative Hypothesis (H1)

There is a statistically significant positive relationship between the level of Business Continuity Planning implementation and operational resilience and risk management in Saudi airports.

Sub-Hypotheses

- H1-1: There is a statistically significant positive relationship between BCP implementation and operational resilience indicators in Saudi airports.
- H1-2: Airports with more mature and integrated BCP frameworks experience significantly shorter disruption recovery times.
- H1-3: Continuous staff training and effective communication strategies have a statistically significant positive impact on the effectiveness of BCP implementation.

- H1-4: Organizational culture and top management commitment have a statistically significant positive influence on the sustainability and effectiveness of BCP implementation.

1.8 Theoretical Premises of the Study (Theoretical Framework)

To further enhance the scholarly basis of this study and address the responses of the university, the present study uses an integrated theoretical approach based on three theoretical approaches Resilience Theory, Systems Theory, and Risk Governance Theory. All these theories are in place to explain the role of Business Continuity Planning (BCP) in the emphasis of operational resilience and risk management have in the complex environment of Saudi airports.

To begin with, Resilience Theory offers the conceptual framework of the current research. Resilience refers to the capability of an organization to predict, absorb, adapt, and recuperate the disruption without losing the necessary operations. Resilient organizations as argued by Yossi Sheffi in *The Resilient Enterprise* build formal capabilities which enable them not only to survive the shock but also to ensure their ability to survive in times of uncertainty and remain competitive. In operations in the airport, resilience goes further than infrastructure robustness to entail organizational readiness, redundancy, flexibility and adaptive leadership. Here, Business Continuity Planning is an institutional tool that institutionalizes the concept of resilience by giving recovery time goals, alternative workflows, communication hierarchies, and crisis response schemes. Thus, BCP is

theoretically placed in the framework of being organized flexibility to improve the indicators of operational resilience performance in terms of service continuity, safety reliability and recovery speed.

Second, the Systems Theory supports the knowledge of airports as socio-technical systems that are very interdependent. Airports are not single entities but instead, they serve as a single ecosystem incorporating airlines, ground handlers, security authorities, regulators, digital systems, fuel suppliers, and government agencies. Based on the principles of systems thinking, a disturbance in a subsystem may spread to the rest of the network. This theoretical view is a reason to investigate BCP not only as a document but as a coordination framework which unites various operational units. In Saudi airports, which are under the supervision of General Authority of Civil Aviation, continuity planning should operate at the operational, tactical, and strategic level. The Systems Theory thus justifies the organizational integration, channels of communication, alignment of governance and cross-functional coordination as the determinants of the effectiveness of BCP in the study.

Third, Risk Governance Theory describes the decision-making patterns used by institutions to deal with uncertainty and safeguard strategic assets. Risk governance focuses on accountability, commitment of leaders, regulatory alignment, stakeholder participation and transparency in decision making regarding risks. Risk governance is central to risk management in regulated contexts such as aviation, which are internationally regulated by structures of the International Civil Aviation Organization and standards, such as

International Organization for Standardization (ISO 22301) and make Business Continuity Management non-reactive. In this view BCP maturity relies on governance processes which include performance monitoring, audit structures, resource allocation and top management commitment. Therefore, the theory substantiates the hypothesis in the study of the indicators of leadership commitment, organizational culture, and training as predictors of BCP sustainability.

1.9 Operational Definitions of Variables

Business Continuity Planning (BCP): Business Continuity Planning in the present context of the study means the organized and systematic way that airports have taken in planning to mitigate, prepare against, respond and recover against any disruption in the operations of the company. BCP involves the planning and execution of formal policies, procedures and strategies whose objective will be to maintain continuity of key airport functions during both normal and crisis situations. Operationally, the degree of BCP implementation is gauged on several levels within the research questionnaire through such aspects as governance and leadership dedication, incorporation of continuity processes into day-to-day processes, frequency and efficacy of training and consciousness campaigns, and testing, assessment, and ongoing enhancement mechanisms. The respondents will be requested to answer the questions on a five-point Likert scale, which represents their view of the maturity and the effectiveness of the BCP practices in their respective airports. These indicators give a score that is measurable, and which represents the general readiness and

operational assimilation of continuity planning. Operation Resilience: Operational resilience can be viewed as the capacity of the airport to deliver the necessary services, ensure effective response in an event of disruption, and quick recovery in the process of coping with changing conditions in operations. This paper conceptualizes resilience as a multi-dimensional concept, in which resilience is operationalized using certain indicators that reflect the performance of the airport when faced with disruptions. These indicators are service continuity that is a measure of how well an airport can maintain the basic operations without major disruptions; recovery speed which is a measure of how well disrupted processes can be returned to normal operation; and operational flexibility which is a measure of how well the airport is able to adapt to changes in demand, unexpected events, or environmental changes. The survey instrument also asks the respondents to rate each component of the operational resilience using a five-point Likert scale, which will give the understanding of the feasibility of the airport to save and adjust to all sources of operational difficulties. Cumulative scores generate an overall operational resilience measure admitting to statistical analysis occurring vis-a-vis BCP execution. Risk Management: Risk management within this research is defined as the formal approach through which the airports are able to identify, evaluate, reduce, monitor and report any perceived threats that would threaten operational safety, efficiency or continuity of service. The effectiveness of risk management in the operations is determined by a series of particular indicators, contained in the questionnaire. These indicators determine the severity of the risk identification control, the effectiveness of

preventive and mitigation protection measures, the quality of coordination and communication in response to the crisis, and the strength of monitoring and reporting systems. The respondents rank each indicator using a five-point Likert scale, which represents the perceived reliability and integration of risk management practices into the airport operations. The scores obtained will give an empirical measure of the effectiveness with which airports cope with potential risk and facilitation of operational resilience and therefore analysis of the correlation between risk management effectiveness, BCP and operational resilience can be performed.

1.10 Literature Review

Evolution of Business Continuity Planning

Business Continuity Planning (BCP) has evolved greatly in recent decades from its roots in post-disaster recovery focus to an organization-wide strategic discipline. Based out of information technology disaster recovery in the 1970s and 1980s, BCP has developed a new, proactive and preventive orientation focusing on risk identification, impact analysis and organizational resilience (Herbane, 2010; Elliott, Swartz & Herbane, 2019). Contemporary BCP focuses on the amalgamation of risk management, crisis management, and operational recovery into one central and functioning approach for the restoration of operations, regardless of the nature of the disruption occurring. This “two/three dimensional” approach embodies a paradigm shift from reactive recovery to proactive resilience, understanding that continuity planning is not simply something that happens from time to time, but is an integral

part of long-term business and strategy management. The transition in aviation is consistent with worldwide pressure on infrastructure to be resilient, especially as airports grapple with growing threats, including malicious cyber-attacks, pandemics, geostrategic crises and climate-related interferences (ICAO, 2021; IATA, 2020). Today's BCP paradigms emphasize inter-relatedness among systems, their supply chains and stakeholders, reiterating that 'continuity planning should operate beyond organizational parameters to the aviation ecosystem'.

Recently it is emphasized that the evolution of BCP has been shaped by the globalization, technological advancements and increased regulatory requirements across industries. It is argued that continuity planning is now connected with strategic risk management, sustainability framework and enterprise resilience models (Sheffi, 2021). This reflects a great importance of how a BCP is positioned as a long term organizational capability that requires continues monitoring, testing, and updating to meet new requirements as well as adapting to continuous changing environment.

Business Continuity Management in Airports

The management of business continuity (BCM) in the aviation industry is characterized by upholding operational, safety and customer service standards in a regulated networked area. According to the Airport Council International (ACI) Airport Business Continuity Management (BCM) Handbook (2021) BCM is "a management process that

identifies the risks and their consequences in an airport, and provides a conceptual framework for the organization to build robust resilience with an actionable response capability”

There are also studies that highlight how implementing a BCP in airports requires strong coordination among airport operators, regulators, airlines and service providers. Airports are different from other industries as they operate within a complex line of different entities and therefore a shared responsibility, joint risk assessment and collaborative decision making to ensure proper recovery (wong & Brooks, 2020).

BCP and Operational Resilience

Operational resilience refers to an organization’s ability to identify, absorb, adapt to, and recover from disruptive events while maintaining essential services (Bank of England, 2021; O’Rourke, 2018). In airports, resilience encompasses not only robust infrastructure but also workforce capabilities, supply chains, communication systems, and digital technologies. Quantitative indicators such as Recovery Time Objectives (RTOs), Recovery Point Objectives (RPOs), and outputs from Business Impact Analyses (BIAs) provide measures of the effectiveness of resilient frameworks.

Empirical studies demonstrate that airports with coordinated BCP and recovery plans recover more quickly from disruptions than those without formalized processes (Lee & Harrauld, 2003). Similarly, O’Rourke (2018) argues that resilient infrastructure requires redundancy, flexibility, and the ability to reconfigure operations rapidly. In the Saudi Arabian

context, operational resilience is particularly critical given regional vulnerabilities such as pandemic-related travel restrictions, security concerns, and the increasing reliance on digital systems for operational and passenger services (AlSaedi, 2025).

Performance indicators for operational resilience in airports include service continuity, passenger handling efficiency, airside operational safety, timely execution of processes, and IT system reliability. Well-developed BCP frameworks enhance coordination during disruptions and minimize operational downtime, contributing to sustained service delivery.

Implementation Challenges and Enablers

Implementation of BCP in aviation faces several challenges. Common obstacles include resource constraints, lack of leadership commitment, insufficient staff training, and organizational resistance to change (Herbane, 2019; ACI, 2021). In contexts such as Saudi Arabia, BCP is relatively new, and airports exhibit varying levels of maturity. This has created gaps between regulatory expectations set by GACA, ICAO, and the practical application of comprehensive BCM frameworks (Kanaan et al., SSRN 5071177).

Several enablers have been identified as critical for successful BCP implementation:

- **Leadership commitment and governance integration:** Embedding continuity planning into strategic performance metrics ensures prioritization and accountability.

- **Learning culture:** Systematic evaluation of past drills and incidents enables continuous improvement and adaptation.
- **Collaboration and partnerships:** Public-Private Partnerships (PPPs) support shared risk management, resource optimization, and coordinated responses.
- **Sustainability integration:** Linking BCP with environmental, social, and governance (ESG) frameworks supports resilient and socially responsible recovery.

By integrating BCP with national sustainability and governance frameworks, Saudi airports can enhance resilience while supporting Vision 2030 objectives for economic transformation and sustainable development (Al-Yaeshi & Al-Ansari, 2022; HWANGSUPHAKITKOSON & Siriwong, 2024).

1.11 Research Gap

Although previous studies have extensively examined crisis management and risk mitigation in airport and aviation settings, there remains a notable lack of empirical research specifically investigating the effectiveness of Business Continuity Planning (BCP) on enhancing operational resilience and risk management within Saudi airports. Many prior works, including those by Herbane (2010) and HWANGSUPHAKITKOSON & Siriwong (2024), have focused on theoretical frameworks, guidelines, or historical reviews of crisis preparedness, emphasizing general principles of disruption management or organizational responses to emergencies. Similarly, research conducted by GWEH (2021) and Wong & Brooks (2020) analyzed risk management practices and collaborative crisis interventions, yet

these studies primarily addressed reactive approaches to crises rather than systematically evaluating the proactive implementation of BCP as a formal mechanism to maintain continuity of airport operations.

In the context of Saudi Arabia, while some studies (Kanaan et al., 2023; Momani & Fadil, 2013) have explored risk management and operational security in organizational environments, there is limited empirical evidence regarding how structured BCP initiatives influence operational performance, flexibility, and risk mitigation in the airport sector. Most existing research relies on conceptual models or international case studies, leaving a gap in context-specific, data-driven analyses that quantify the relationship between BCP implementation and operational outcomes in the Saudi aviation sector. Therefore, this study addresses this gap by conducting a combined quantitative and qualitative investigation, collecting primary data directly from airport personnel to assess the practical impact of BCP on operational resilience and risk management, providing insights that are both academically rigorous and operationally relevant for policy and managerial decision-making within Saudi airports.

1.12 Conceptual Framework

The conceptual framework of this study is grounded in the interrelationship between Business Continuity Planning (BCP), Operational Resilience, and Risk Management within airport environments. Business Continuity Planning represents a structured approach by which organizations anticipate, prepare for, and respond to potential disruptions, ensuring the

continuity of critical operations (Herbane, 2010; HWANGSUPHAKITKOSON & Siriwong, 2024). BCP encompasses governance and leadership commitment, operational integration, training, and continuous improvement mechanisms, all of which are designed to enhance an airport's capability to maintain essential services during disruptions and crises. Effective BCP provides the foundation for operational resilience, enabling airports to recover swiftly, adapt flexibly to unforeseen events, and sustain critical functions under challenging conditions (IATA, 2020; ICAO, 2021; ISO 22301:2019). Operational resilience, in this context, is characterized by service continuity, recovery speed, operational flexibility, and adaptability to varying internal and external threats, including technological failures, natural hazards, and security threats (Lee & Harrald, 2003; O'Rourke, 2018; Sheffi, 2021).

Risk management functions as a complementary and integrative mechanism that identifies, assesses, mitigates, and monitors potential threats to airport operations. By systematically managing risks, airports can anticipate vulnerabilities, prioritize mitigation strategies, and coordinate resources effectively during crises (GWEH, 2021; Wong & Brooks, 2020; Momani & Fadil, 2013). The literature indicates that BCP enhances risk management effectiveness by providing structured procedures, accountability frameworks, and operational guidelines that facilitate timely and informed decision-making (Kanaan et al., 2023; Shaban, 2021; Syed, 2025). Conversely, robust risk management feeds back into BCP processes by highlighting critical vulnerabilities and operational dependencies that need to be incorporated into continuity plans, thereby creating a dynamic and iterative relationship

between planning, resilience, and risk mitigation (HWANGSUPHAKITKOSON & Siriwong, 2024; Lee & Harrald, 2003).

The framework also aligns with strategic national objectives, such as **Saudi Vision 2030 (2016)**, which emphasizes resilient infrastructure, safe and efficient airport operations, and the capacity to withstand disruptions while maintaining service quality. In practical terms, the conceptual model posits that **BCP acts as an independent variable that directly influences both operational resilience and risk management effectiveness**, while operational resilience mediates the relationship between BCP and overall organizational performance under disruptive conditions. This triadic relationship reflects a systemic view of airport management where planning, adaptive capacity, and risk awareness are mutually reinforcing and critical for sustaining operational continuity in complex aviation environments (HWANGSUPHAKITKOSON & Siriwong, 2024; IATA, 2020; ICAO, 2021).

1.13 Research Limits:

- Geographical: Focus on Saudi airports under GACA supervision.
- Temporal: Conducted in 2025 and 2026 data should be reflecting those years.
- Scope: Emphasis on BCP as part of resilience management; broader crisis management or emergency response is outside scope.
- Access: Limited access to internal documents due to confidentiality may affect depth of analysis.

These limitations will be acknowledged and mitigated to maintain research validity.

1.14 General Perception of the Research Structure:

- Chapter 1: Introduction
 - 1.1 Background
 - 1.2 Problem statement
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 - 1.4 Objectives
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- Chapter 2: Literature Review
 - 2.1 BCP Revolution
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 - 2.4 Challenges and Enablers
 - 2.5 Previous Studies
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- Chapter 3: Methodology
 - 3.1 Research design
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3.5 Analysis techniques

- Chapter 4: Data Analysis and Results.
- Chapter 5: Discussion.

Chapter 6: Conclusion and Recommendations

Chapter Two :Literature Review

2.1 Introduction

Business continuity planning (BCP) has become a critical strategic function within modern organizations, particularly those operating in highly complex and risk-sensitive sectors such as aviation. Airports are considered vital national infrastructure and represent interconnected operational ecosystems where disruptions may generate cascading impacts across transportation networks, national economies, and public safety. Consequently, airports must maintain high levels of operational resilience and risk preparedness to ensure uninterrupted services despite crises, disasters, technological failures, or security threats. In the context of Saudi Arabia, the aviation sector has experienced rapid expansion as part of the national economic diversification agenda aligned with Vision 2030. This expansion has increased the importance of structured continuity strategies that enable airports to maintain operational stability while managing evolving risks (Saudi Vision 2030, 2016; GACA, 2022).

The literature emphasizes that business continuity planning represents a systematic framework designed to identify potential threats to organizational operations and to develop procedures that ensure the continuity of essential functions during and after disruptions. Within airports, such planning is particularly crucial due to the integration of multiple stakeholders including airlines, security authorities, air traffic control, ground services, and logistics providers. A disruption affecting any component of this system can compromise the entire aviation operation. Therefore, the integration of risk management and resilience

planning within airport continuity strategies has become a fundamental requirement for sustainable aviation operations (ACI, 2021; ICAO, 2021).

This chapter reviews the theoretical and empirical literature related to business continuity planning, operational resilience, and risk management in airport environments. It examines the conceptual foundations of business continuity management, the relationship between continuity planning and organizational resilience, risk management frameworks used in aviation operations, and the specific application of these concepts within Saudi airports. Furthermore, the chapter highlights previous studies addressing business continuity in various sectors and identifies research gaps that justify the current study.

2.2 Concept of Business Continuity Planning

Business Continuity Planning (BCP) has emerged as a fundamental management practice for organizations operating in complex and risk-sensitive environments. It refers to the structured and systematic process through which organizations prepare to maintain essential operations during and after disruptive events. These disruptions may arise from natural disasters, technological failures, cyberattacks, health crises, or operational accidents. The primary objective of business continuity planning is to ensure that critical organizational functions remain operational despite unforeseen events and that recovery procedures can be implemented quickly and efficiently. In modern organizational management, BCP is considered an integral component of strategic risk management because it enables

organizations to anticipate potential threats and prepare structured responses that minimize operational interruptions and financial losses.

Historically, business continuity planning evolved from disaster recovery strategies used primarily within the information technology sector. Early continuity practices focused mainly on restoring IT systems following catastrophic failures. However, over time, organizations recognized that operational disruptions could affect multiple business functions beyond technological systems. As a result, business continuity management gradually expanded to include comprehensive strategies covering operational processes, human resources, communication systems, supply chains, and infrastructure resilience. According to Herbane (2010), the evolution of business continuity management reflects the increasing complexity of modern organizational environments and the growing recognition that organizations must adopt proactive strategies to address operational risks before they escalate into crises. This shift from reactive crisis response to proactive risk preparedness has significantly transformed the role of continuity planning in organizational governance.

From a theoretical perspective, business continuity planning represents a structured framework designed to protect critical business processes and ensure operational stability during disruptions. Elliott, Swartz, and Herbane (2019) define business continuity management as a comprehensive process that identifies potential threats to an organization and develops strategies that enable effective responses and recovery mechanisms. This approach emphasizes the need for organizations to develop formal continuity policies,

conduct business impact analyses, identify critical functions, and design recovery procedures capable of restoring operations within acceptable timeframes. Such strategies enable organizations to maintain essential services even under adverse conditions while minimizing financial, operational, and reputational damages.

International standards have further formalized the concept of business continuity planning and provided organizations with practical guidelines for implementation. The ISO 22301:2019 standard establishes a globally recognized framework for developing and maintaining business continuity management systems. This standard emphasizes the importance of identifying potential disruptions, assessing their potential impact on organizational activities, and developing recovery strategies that ensure the continuity of essential services. The standard also highlights the importance of continuous improvement through regular testing, monitoring, and evaluation of continuity plans to ensure their effectiveness in real-world crisis situations. By adopting such structured frameworks, organizations can enhance their ability to respond to disruptions while maintaining operational stability and stakeholder confidence.

In sectors characterized by high operational complexity and safety requirements, such as aviation, business continuity planning becomes even more critical. Airports represent complex operational environments where multiple stakeholders interact simultaneously, including airlines, airport authorities, air traffic control, ground service providers, security agencies, and logistics companies. Any disruption within one component of this network can

have cascading effects across the entire aviation system. According to the Airports Council International (ACI, 2021), airports must adopt comprehensive business continuity strategies that integrate emergency preparedness, operational risk management, and coordinated response mechanisms among various stakeholders. These strategies ensure that airport operations continue functioning even during unexpected events such as extreme weather conditions, security threats, system failures, or health emergencies.

Similarly, international aviation authorities emphasize the importance of continuity planning as part of broader aviation safety and resilience frameworks. The International Civil Aviation Organization (ICAO) highlights that airports must establish structured emergency and continuity plans to ensure the safety of passengers, employees, and aviation operations during crises. ICAO guidelines emphasize coordination between airport management, national aviation authorities, and emergency services to guarantee rapid and effective responses during disruptions. Such coordination enhances operational stability and ensures that airports can maintain essential aviation services even in challenging circumstances.

In addition to maintaining operational continuity, business continuity planning contributes significantly to strengthening organizational resilience. Resilience refers to the capacity of organizations to anticipate, adapt to, and recover from disruptive events while maintaining essential operational functions. Business continuity planning provides the strategic and procedural foundation that enables organizations to achieve such resilience. By identifying vulnerabilities, implementing mitigation strategies, and developing recovery plans,

organizations can reduce the impact of disruptions and accelerate the restoration of normal operations. This proactive approach enables organizations to transform crises into manageable events rather than catastrophic failures.

Furthermore, the increasing reliance on digital technologies and interconnected systems has expanded the scope of business continuity planning in modern organizations. Technological systems play a central role in airport operations, including passenger processing, air traffic management, security surveillance, and communication networks. Consequently, disruptions affecting digital infrastructure can significantly impact operational performance. Recent research highlights the importance of integrating advanced technologies such as artificial intelligence and predictive analytics within continuity planning frameworks to enhance early detection of operational risks and support informed decision-making processes. AlSaedi (2025) demonstrated that artificial intelligence applications can significantly improve operational risk management in airport environments by analyzing large volumes of operational data and identifying potential disruptions before they escalate into operational failures.

Business continuity planning also plays a crucial role in enhancing stakeholder coordination and communication during crises. Airports operate within complex networks involving government agencies, airline operators, emergency responders, and service providers. Effective continuity planning ensures that these stakeholders share clear communication channels and coordinated response procedures during emergencies. Collaborative planning

enhances the ability of airports to manage disruptions effectively and maintain operational stability even in highly uncertain environments.

Within the context of Saudi Arabia, business continuity planning has gained increasing importance due to the rapid expansion of the aviation sector under the national development strategy. The Kingdom's Vision 2030 aims to transform Saudi Arabia into a global logistics hub by expanding airport infrastructure and increasing international connectivity. This expansion has significantly increased operational complexity within Saudi airports, thereby requiring advanced continuity planning frameworks capable of managing emerging operational risks. According to the General Authority of Civil Aviation (GACA, 2022), strengthening operational resilience and safety within airports represents a strategic priority for the Saudi aviation sector. Consequently, airport authorities are increasingly adopting structured continuity planning systems aligned with international standards to ensure safe and uninterrupted aviation operations.

Overall, the concept of business continuity planning represents a critical strategic approach that enables organizations, particularly airports, to manage operational disruptions effectively while maintaining essential services. Through structured risk assessment, proactive planning, and coordinated response mechanisms, business continuity planning enhances organizational resilience and supports sustainable operational performance in complex and dynamic environments. As airports continue to expand and become

increasingly interconnected with global transportation systems, the importance of effective continuity planning will continue to grow as a key element of modern aviation management.

2.3 Operational Resilience in Critical Infrastructure

Operational resilience has emerged as a fundamental concept in the management of modern critical infrastructure systems. Critical infrastructure refers to the physical and organizational structures that are essential for the functioning of society and the economy, such as transportation networks, energy systems, telecommunications, healthcare, and aviation. These infrastructures support national development and public safety, and any disruption in their operations can result in significant economic losses and societal consequences. Airports, as part of the global transportation infrastructure, play a crucial role in facilitating international travel, trade, logistics, and tourism. Consequently, ensuring the operational resilience of airport infrastructure is essential for maintaining the stability of national and global transportation systems.

Operational resilience can be defined as the ability of an organization or system to anticipate potential disruptions, prepare for adverse events, respond effectively during crises, and recover rapidly while maintaining essential operations. Unlike traditional risk management approaches that primarily focus on identifying and mitigating risks, operational resilience emphasizes the capability of organizations to continue functioning despite disruptions and adapt to changing operational environments. According to Sheffi (2021), resilient organizations develop robust operational structures and flexible management strategies that

enable them to absorb shocks and maintain service delivery even in times of uncertainty.

This resilience is particularly important in infrastructure sectors where operational interruptions can create widespread consequences across interconnected systems.

Critical infrastructure systems are characterized by strong interdependencies, meaning that disruptions in one infrastructure sector may quickly spread to others. O'Rourke (2018) explains that modern infrastructure networks operate through interconnected technological and operational systems that depend heavily on each other for functionality. For example, airport operations rely on electricity supply, communication networks, transportation systems, and digital infrastructure. If any of these supporting systems fail, airport operations may be severely affected. Such interdependencies increase the vulnerability of infrastructure systems and highlight the importance of developing resilience strategies capable of addressing complex, multi-layered disruptions.

In the aviation sector, operational resilience has gained increasing attention due to the growing complexity of airport operations and the diverse range of risks that airports face. Airports operate as integrated operational ecosystems where numerous stakeholders interact simultaneously, including airlines, ground service providers, air traffic control authorities, security agencies, logistics operators, and government institutions. The coordination of these stakeholders is essential for ensuring smooth airport operations. However, the interconnected nature of these systems also means that disruptions affecting one operational component may quickly impact other parts of the airport system. Therefore, maintaining operational

resilience requires comprehensive planning that considers both internal operational processes and external stakeholder coordination.

International aviation organizations have recognized the importance of resilience in airport management and have developed guidelines aimed at strengthening infrastructure resilience.

The International Air Transport Association (IATA, 2020) introduced global airport resilience standards that encourage airports to implement risk assessment procedures, develop emergency preparedness strategies, and strengthen infrastructure redundancy to maintain operational stability during disruptions. Similarly, the International Civil Aviation Organization (ICAO, 2021) emphasizes the importance of integrating resilience strategies within airport emergency planning frameworks to ensure that airports remain capable of managing crises effectively. These guidelines highlight the importance of coordinated emergency responses, communication protocols, and contingency planning mechanisms that support the continuity of aviation services.

One of the core elements of operational resilience is preparedness. Preparedness involves identifying potential threats and developing strategies to address them before they escalate into major crises. In airport environments, preparedness measures include conducting risk assessments, establishing emergency response plans, implementing backup operational systems, and conducting regular crisis simulation exercises. These preparedness activities enable airport authorities to detect vulnerabilities within their systems and develop appropriate mitigation strategies. By identifying potential operational weaknesses in

advance, airports can reduce the likelihood of operational disruptions and improve their ability to respond effectively during emergencies.

Another critical component of operational resilience is the ability to recover quickly from disruptions. Recovery processes involve restoring normal operations after a crisis while minimizing operational downtime and financial losses. In highly sensitive environments such as airports, rapid recovery is essential because prolonged operational disruptions can lead to flight delays, passenger congestion, financial losses for airlines, and reputational damage for airport authorities. Therefore, resilience strategies must incorporate clear recovery procedures, resource allocation plans, and communication strategies that ensure efficient restoration of operations following disruptive events.

Adaptability also represents a key dimension of operational resilience. Resilient infrastructure systems must be capable of adjusting their operational procedures in response to changing risk environments. The aviation sector provides a clear example of the importance of adaptability, particularly during global crises such as the COVID-19 pandemic. During the pandemic, airports were required to rapidly adjust their operational procedures by implementing new health screening systems, modifying passenger processing procedures, and adopting digital technologies to reduce physical contact between passengers and airport personnel. Research by Syed (2025) highlights that aviation organizations that adopted flexible operational frameworks were better able to manage pandemic-related

disruptions and maintain essential aviation services compared to organizations that relied on rigid operational structures.

Technological innovation plays an increasingly important role in strengthening operational resilience within critical infrastructure systems. Modern airports rely heavily on advanced technologies such as digital communication networks, automated passenger processing systems, baggage handling technologies, and surveillance systems. These technological systems improve operational efficiency but also introduce new vulnerabilities, particularly in relation to cybersecurity threats and system failures. Consequently, resilience planning must incorporate technological risk management strategies that protect critical digital infrastructure. The use of advanced technologies such as artificial intelligence and predictive analytics can significantly enhance resilience by enabling airport authorities to monitor operational systems in real time and identify potential disruptions before they occur. AlSaedi (2025) demonstrated that artificial intelligence applications can support operational risk management in airport environments by analyzing large datasets and identifying patterns that indicate potential operational failures.

Organizational culture and leadership also play a significant role in enhancing resilience within infrastructure organizations. A resilience-oriented organizational culture encourages proactive risk awareness, continuous learning, and collaborative decision-making among employees. According to Elliott et al. (2019), organizations that incorporate resilience principles into their strategic management processes are better prepared to respond to crises

because employees at all organizational levels are aware of potential risks and are trained to implement emergency procedures when necessary. In airport environments where multiple operational teams must coordinate their activities during emergencies, a strong resilience culture can significantly improve crisis response effectiveness.

Another important factor influencing operational resilience is stakeholder collaboration. Airports operate within complex networks involving airlines, security authorities, government agencies, and logistics providers. Effective collaboration among these stakeholders is essential for ensuring coordinated responses during disruptions. Wong and Brooks (2020) highlight that collaborative risk management practices enhance airport resilience by facilitating information sharing and joint decision-making during crises. When stakeholders work together and share operational information, airports are better equipped to manage disruptions and maintain operational continuity.

Environmental challenges and climate-related risks have also increased the importance of resilience planning in airport infrastructure. Airports are vulnerable to extreme weather events such as heavy rainfall, storms, heatwaves, and flooding, which may disrupt flight operations and damage infrastructure systems. Guzman and Alwosheel (2024) emphasize that climate change represents a growing threat to air transport infrastructure, particularly in regions experiencing rapid environmental changes. As a result, airports must incorporate climate adaptation strategies into their resilience planning frameworks, including

infrastructure redesign, improved drainage systems, and advanced weather monitoring technologies.

Within the context of Saudi Arabia, strengthening the resilience of airport infrastructure has become a strategic priority due to the rapid growth of the aviation sector. The Kingdom's Vision 2030 strategy aims to transform Saudi Arabia into a global logistics hub by expanding airport capacity and increasing international connectivity. This expansion has significantly increased passenger traffic and operational complexity within Saudi airports. According to the General Authority of Civil Aviation (GACA, 2022), improving safety, security, and operational resilience within airport infrastructure is essential for supporting the long-term sustainability of the aviation sector. Consequently, Saudi airports are increasingly investing in advanced infrastructure systems, digital technologies, and emergency preparedness programs designed to enhance resilience and ensure the continuity of aviation operations.

In conclusion, operational resilience represents a critical capability for managing modern critical infrastructure systems, particularly in the aviation sector where operational reliability and safety are essential. Airports must develop comprehensive resilience strategies that integrate risk management, technological innovation, emergency preparedness, and stakeholder collaboration. By strengthening their resilience capabilities, airport organizations can effectively manage operational disruptions, minimize the impact of crises, and ensure the continuity of essential aviation services. As the aviation industry continues to expand and

become more interconnected with global transportation networks, operational resilience will remain a key component of sustainable airport management and infrastructure security.

2.4 Risk Management in Airport Operations

Risk management represents a fundamental component of airport management due to the complex and highly sensitive nature of aviation operations. Airports operate within dynamic environments where safety, security, operational efficiency, and regulatory compliance must be maintained simultaneously. The aviation sector is characterized by a wide range of potential risks including operational failures, technological malfunctions, security threats, natural disasters, cyberattacks, and public health emergencies. Consequently, effective risk management systems are essential for identifying potential threats, assessing their potential impact, and implementing strategies that reduce the likelihood and severity of disruptions. In airport environments, risk management is not only a safety requirement but also a strategic management practice that supports operational resilience and business continuity.

Risk management can generally be defined as the systematic process of identifying, analyzing, evaluating, and mitigating risks that may affect organizational objectives. In aviation environments, this process involves continuous monitoring of operational activities and the development of preventive measures designed to reduce the probability of accidents or operational disruptions. According to Lee and Harrald (2003), airports represent complex systems composed of multiple interconnected operational processes, including air traffic

management, passenger services, cargo handling, ground operations, and security procedures. Each of these operational elements may present unique risks that require specific management strategies. Therefore, effective airport risk management frameworks must adopt an integrated approach that addresses risks across the entire operational ecosystem rather than focusing on individual components.

The importance of risk management in airport operations has increased significantly due to the growing complexity of global aviation networks. Airports serve as central nodes within international transportation systems, connecting airlines, logistics providers, security agencies, and governmental authorities. Disruptions occurring at airports may therefore generate cascading effects across national and international aviation networks. As a result, airport authorities must develop comprehensive risk management frameworks capable of addressing both internal operational risks and external environmental threats. According to the International Civil Aviation Organization (ICAO, 2021), effective airport risk management requires the establishment of structured safety management systems that enable airport authorities to monitor operational risks continuously and implement corrective actions when necessary.

The risk management process within airport operations typically begins with risk identification. This stage involves identifying potential hazards that may threaten airport operations, infrastructure, or passenger safety. Risks in airport environments may originate from various sources including technical failures, human errors, environmental conditions,

or malicious activities. For example, technical risks may involve failures in air traffic control systems, baggage handling systems, or communication networks. Human-related risks may arise from operational errors, inadequate training, or poor decision-making. Environmental risks may include severe weather events such as storms, sandstorms, flooding, or extreme temperatures. Security risks may involve terrorism, cyberattacks, or unauthorized access to restricted areas. Identifying these risks allows airport authorities to understand potential vulnerabilities within their operational systems.

Once potential risks have been identified, the next step in the risk management process involves risk analysis and assessment. During this stage, airport managers evaluate the likelihood of each identified risk occurring and assess its potential impact on airport operations. Risk assessment helps organizations prioritize risks based on their severity and develop appropriate mitigation strategies. According to Momani and Fadil (2013), organizations in Saudi Arabia increasingly adopt structured risk assessment methodologies to improve decision-making and enhance organizational performance. Within airport operations, risk assessment may involve analyzing historical incident data, conducting vulnerability assessments, and utilizing simulation models to evaluate potential operational disruptions.

Risk mitigation represents the next stage in the risk management process and involves implementing strategies designed to reduce the probability or impact of identified risks. Airports adopt a variety of mitigation measures depending on the nature of the identified

risks. For example, technological risks may be mitigated through the implementation of redundant systems and backup infrastructure that ensure operational continuity in case of system failures. Security risks may be mitigated through enhanced surveillance systems, access control procedures, and collaboration with national security authorities. Environmental risks may be addressed through infrastructure design improvements and advanced weather monitoring systems. By implementing such preventive measures, airport authorities can significantly reduce the likelihood of operational disruptions.

Another important aspect of risk management in airport operations is the integration of technological innovations that support real-time monitoring and predictive risk analysis. Modern airports increasingly rely on digital technologies to manage operational processes, including automated passenger processing systems, baggage handling technologies, and digital communication networks. While these technologies enhance operational efficiency, they also introduce new forms of risk related to cybersecurity and system reliability. Consequently, airports must adopt advanced technological solutions capable of detecting and mitigating emerging risks. Research conducted by AlSaedi (2025) highlights the potential role of artificial intelligence in improving operational risk management within airport environments. Artificial intelligence technologies can analyze large volumes of operational data, identify patterns indicating potential disruptions, and support proactive decision-making that reduces operational vulnerabilities.

Collaboration among airport stakeholders also plays a crucial role in effective risk management. Airports operate within complex networks involving airlines, ground service providers, security agencies, regulatory authorities, and emergency response organizations. Effective risk management therefore requires coordinated efforts among these stakeholders to ensure comprehensive risk identification and response planning. Wong and Brooks (2020) emphasize that collaborative risk management approaches improve the ability of airports to address operational disruptions because they facilitate information sharing and joint decision-making processes. When stakeholders work together to identify potential risks and develop mitigation strategies, airport systems become more resilient and capable of responding to unexpected events.

In addition to operational and technological risks, airports must also manage strategic risks associated with external environmental changes such as economic fluctuations, regulatory developments, and global crises. The COVID-19 pandemic demonstrated how global health emergencies can significantly disrupt aviation operations by reducing passenger demand, restricting international travel, and imposing new health and safety requirements. Studies such as Gweh (2021) highlight that aviation organizations that implemented structured risk management frameworks were better prepared to respond to pandemic-related disruptions. These organizations were able to rapidly implement contingency strategies, modify operational procedures, and maintain essential aviation services despite significant challenges.

Risk management frameworks are also closely connected to business continuity planning and operational resilience strategies. While risk management focuses on identifying and mitigating potential threats, business continuity planning ensures that essential operations continue even when disruptions occur. Integrating these approaches allows airport authorities to develop comprehensive crisis management frameworks capable of addressing both preventive and reactive aspects of operational risk. Al-Yaeshi and Al-Ansari (2022) emphasize that combining risk management practices with resilience-oriented strategies significantly enhances the ability of organizations to maintain operational stability during disruptions.

Within the context of Saudi Arabia, risk management in airport operations has become increasingly important as the Kingdom expands its aviation infrastructure in line with Vision 2030. Saudi airports are experiencing significant growth in passenger traffic and cargo volumes, which increases operational complexity and introduces new risk challenges. The General Authority of Civil Aviation (GACA, 2022) emphasizes that maintaining high safety standards and implementing effective risk management frameworks are essential priorities for the Saudi aviation sector. Consequently, Saudi airports are increasingly adopting international aviation safety standards and risk management practices designed to enhance operational stability and ensure the safety of passengers and aviation personnel.

Furthermore, Saudi aviation authorities have recognized the importance of integrating modern technological solutions within airport risk management systems. The

adoption of digital technologies, advanced surveillance systems, and predictive analytics tools enables airport authorities to monitor operational activities more effectively and respond quickly to emerging risks. These technological advancements contribute to strengthening the resilience of airport infrastructure and support the broader national strategy of developing a modern and efficient aviation sector.

In conclusion, risk management represents a critical component of airport operations due to the complex and high-risk nature of aviation environments. Airports must adopt comprehensive risk management frameworks that incorporate risk identification, risk assessment, mitigation strategies, technological innovation, and stakeholder collaboration. By implementing such frameworks, airport authorities can minimize operational disruptions, enhance safety and security, and support the sustainable development of the aviation sector. As global aviation networks continue to expand and evolve, effective risk management will remain essential for ensuring the reliability and resilience of airport operations.

2.5 Business Continuity Management in Airport Environments

Business Continuity Management (BCM) has become an essential component of airport management due to the complex and highly interconnected nature of aviation operations. Airports represent critical transportation hubs that support international mobility, cargo logistics, tourism, and economic development. Because of their strategic importance, airports must maintain continuous operations even during disruptive events such as natural disasters, technological failures, security incidents, or public health crises. Business

continuity management provides a structured framework that enables airport authorities to prepare for such disruptions, maintain essential services, and recover rapidly following unexpected operational interruptions.

Business continuity management in airport environments refers to the systematic process through which airport authorities identify critical operational activities, assess potential risks, and develop strategies that ensure the continuation of essential airport functions during emergencies. According to Elliott, Swartz, and Herbane (2019), business continuity management extends beyond emergency response by integrating proactive planning, crisis management, and recovery strategies into the organizational structure. In airport operations, BCM ensures that critical services such as flight operations, passenger handling, security screening, air traffic coordination, and communication systems remain functional even when disruptions occur.

The complexity of airport operations requires continuity management systems that address both internal operational processes and external stakeholder coordination. Airports operate as integrated ecosystems where multiple stakeholders collaborate to deliver aviation services. These stakeholders include airport authorities, airlines, ground service providers, air traffic control units, security agencies, customs authorities, emergency responders, and transportation providers. Because airport operations depend on the coordination of these entities, disruptions affecting one component may rapidly impact the entire operational system. Consequently, effective business continuity management requires coordinated

planning among all airport stakeholders to ensure efficient crisis response and recovery mechanisms.

International aviation organizations have emphasized the importance of business continuity management in maintaining the resilience of airport systems. The Airports Council International (ACI, 2021) provides comprehensive guidelines for airport continuity planning through its Airport Business Continuity Management Handbook. The handbook highlights the importance of conducting business impact analyses to identify critical airport functions and determine acceptable recovery time objectives for essential services. By identifying the most critical operational processes, airport authorities can prioritize resource allocation and develop recovery strategies that minimize operational downtime during disruptions.

Similarly, the International Civil Aviation Organization (ICAO, 2021) emphasizes the integration of business continuity principles within airport emergency planning systems. ICAO guidelines recommend that airports develop structured emergency response frameworks that incorporate continuity planning procedures, communication protocols, and coordination mechanisms with national aviation authorities and emergency services. Such integration ensures that airports remain capable of maintaining safe operations while responding to emergencies and restoring normal activities after crises.

One of the fundamental components of business continuity management in airport environments is the business impact analysis (BIA). The purpose of a BIA is to identify critical operational processes and evaluate the potential consequences of disruptions affecting

these processes. In airport contexts, critical operations may include air traffic coordination, runway management, security screening, passenger check-in systems, baggage handling operations, and communication networks. By analyzing the potential impact of disruptions on these functions, airport authorities can develop recovery strategies designed to minimize operational losses and maintain service continuity.

Another key element of airport business continuity management is the development of recovery strategies and contingency plans. Recovery strategies define the procedures that should be implemented when disruptions occur in order to restore normal operations as quickly as possible. These strategies may include establishing backup systems for critical infrastructure, relocating operational activities to alternative facilities, implementing emergency staffing plans, and ensuring the availability of essential resources required for crisis response. According to the Airports Council International (ACI, 2021), airports must regularly test and update their continuity plans to ensure their effectiveness during real-world emergencies.

The role of technology in supporting airport business continuity management has become increasingly important in recent years. Modern airports rely heavily on digital technologies to support operational activities, including automated passenger processing systems, digital communication platforms, security monitoring systems, and baggage handling technologies. While these technological systems enhance operational efficiency, they also introduce new vulnerabilities related to cybersecurity threats and system failures.

Consequently, airport continuity planning must include technological risk management strategies designed to protect critical digital infrastructure and ensure system reliability during disruptions.

The integration of advanced technologies such as artificial intelligence and predictive analytics has also enhanced the effectiveness of business continuity management in airport operations. These technologies allow airport authorities to analyze operational data, detect potential system failures, and predict operational disruptions before they occur. Research conducted by AlSaedi (2025) demonstrated that artificial intelligence technologies can significantly improve operational risk management at Taif International Airport by supporting predictive analysis and proactive decision-making processes. Such technological innovations contribute to strengthening airport resilience and improving crisis preparedness.

Another critical factor influencing the effectiveness of business continuity management in airports is organizational preparedness and training. Effective continuity planning requires that airport personnel understand their roles and responsibilities during emergency situations. Therefore, airports must conduct regular training programs, simulation exercises, and crisis response drills designed to prepare employees for various disruption scenarios. These training activities help ensure that airport personnel can respond effectively during emergencies and implement continuity procedures without confusion or delays.

Stakeholder collaboration also plays a vital role in airport business continuity management. Because airport operations involve numerous independent organizations,

effective communication and coordination among stakeholders are essential during crises. Collaborative continuity planning ensures that airlines, airport authorities, security agencies, and emergency responders share information and coordinate their actions during disruptions. Wong and Brooks (2020) emphasize that collaborative risk management practices significantly improve the ability of airports to manage operational disruptions because they facilitate coordinated decision-making and resource sharing among aviation stakeholders.

Environmental risks and climate-related challenges have also increased the importance of business continuity planning in airport environments. Airports are particularly vulnerable to extreme weather events such as heavy rainfall, storms, sandstorms, and extreme temperatures that may disrupt flight operations and damage infrastructure systems. Guzman and Alwosheel (2024) highlight that climate-related disruptions are becoming increasingly common and require airports to adopt climate-resilient infrastructure strategies. These strategies include improving infrastructure design, implementing advanced weather monitoring systems, and developing contingency plans that ensure operational continuity during environmental disruptions.

In addition to environmental challenges, global crises such as pandemics have demonstrated the importance of robust business continuity planning within airport operations. The COVID-19 pandemic significantly disrupted global aviation networks by reducing passenger demand and imposing new health and safety requirements. Airports that had established continuity planning frameworks were better able to adapt their operational

procedures, implement health screening systems, and maintain essential aviation services during the crisis. Studies such as Shaban (2021) highlight that organizations with effective business continuity plans are better equipped to manage crisis situations and maintain operational performance under challenging conditions.

Within the context of Saudi Arabia, the importance of business continuity management in airport environments has increased significantly due to the rapid expansion of the aviation sector under Vision 2030. The Kingdom aims to develop its aviation infrastructure and transform Saudi Arabia into a global transportation and logistics hub. This expansion has led to increased passenger volumes, cargo traffic, and operational complexity within Saudi airports. According to the General Authority of Civil Aviation (GACA, 2022), ensuring operational safety, security, and resilience is a key priority for the Saudi aviation sector. As a result, Saudi airport authorities are increasingly adopting international business continuity standards and implementing structured continuity planning frameworks aligned with global aviation practices.

Furthermore, the integration of business continuity management with broader risk management and resilience strategies is becoming a key component of airport governance in Saudi Arabia. By combining continuity planning with advanced risk management systems and digital technologies, Saudi airports can enhance their ability to manage disruptions and maintain operational stability. Such integration supports the Kingdom's long-term strategy

of developing a resilient and competitive aviation sector capable of supporting economic growth and international connectivity.

Chapter three: Research Methodology

3.1 Research Design

This study adopts a descriptive-analytical research design, integrating both quantitative and qualitative methods. The descriptive component aims to evaluate the current status of Business Continuity Planning (BCP) implementation in Saudi airports, while the analytical component examines the relationship between BCP, operational resilience, and risk management. The combination of quantitative and qualitative approaches allows for a comprehensive understanding of both measurable outcomes and the contextual, organizational factors that influence BCP effectiveness.

3.2 Data Collection

The study will utilize primary and secondary data sources to ensure a robust and triangulated dataset:

Primary Data:

- **Structured questionnaires and surveys** will be administered to airport managers, operations officers, and safety coordinators to quantify perceptions, practices, and BCP maturity levels.
- **Semi-structured interviews** will be conducted with selected participants to gather qualitative insights into challenges, enablers, and experiences in implementing BCP.

Secondary Data:

- Review of official BCP documents, internal airport guidelines, and reports issued by the General Authority of Civil Aviation (GACA).
- International standards and guidelines, including the ACI Business Continuity Management Handbook and ICAO recommendations.
- Airport performance statistics, operational reports, and historical disruption records to complement primary data.

3.3 Sampling

Population:

The population comprises all Saudi airports operating under GACA supervision, including:

- King Khalid International Airport (Riyadh)
- King Abdulaziz International Airport (Jeddah)
- King Fahd International Airport (Dammam)
- Prince Mohammed bin Abdulaziz International Airport (Madinah)

Sample Size and Technique:

- Target sample size: 60 participants, including managerial and operational staff involved in BCP.
- **Purposive sampling** will be employed to select participants directly engaged in continuity planning, operational decision-making, or risk management, ensuring relevant and expert input.

3.4 Statistical Model for Hypotheses Testing

To empirically examine the relationships between Business Continuity Planning (BCP) and the dependent variables, Operational Resilience and Risk Management Effectiveness, this study employs a linear regression framework. Regression analysis provides a robust statistical approach to quantify the influence of the independent variable (BCP implementation) on the dependent outcomes while controlling for variability within the sample. The model operationalizes BCP as the independent variable, represented by its aggregated maturity score derived from four dimensions: governance and leadership, operational integration, training and awareness, and testing and continuous improvement. The dependent variables are measured through composite indices obtained from respondents' Likert-scale ratings, capturing key performance indicators for operational resilience and risk management. The proposed regression models are formulated as follows:

Model 1: Operational Resilience

$$ORI_i = \beta_0 + \beta_1 BCP_i + \epsilon_i$$

Model 2: Risk Management Effectiveness

$$RMI_i = \beta_0 + \beta_1 BCP_i + \epsilon_i$$

where RMI_i denotes the risk management effectiveness score for respondent i , with $iBCP_i$ as the independent variable, $0\beta_0$ as the intercept, $1\beta_1$ as the regression coefficient indicating the impact of BCP on risk management, and $i\epsilon_i$ representing random error. This formulation provides an empirical test of the hypothesis that improved BCP implementation directly enhances the effectiveness of risk management practices.

Both models assume a **linear relationship** between the independent and dependent variables and are analyzed using **SPSS software**, which facilitates the computation of regression coefficients, determination coefficients (R^2), and significance levels ((p)-values). Additionally, **correlation analysis** is applied to examine the strength and direction of associations between variables prior to regression testing, ensuring multicollinearity and linearity assumptions are met. By integrating these statistical models, the study establishes a quantitative basis to evaluate the influence of BCP on airport operational resilience and risk management, providing evidence for strategic and operational decision-making.

3.5 Data Analysis

Quantitative Analysis:

- Responses from surveys and structured questionnaires will be analyzed using **SPSS**
- Statistical tests will include descriptive statistics, correlation analysis, and regression models to test the relationship between BCP implementation and operational resilience indicators.
- BCP maturity will be evaluated using **ACI BCM criteria**, producing a maturity score for comparative and benchmarking purposes.

Qualitative Analysis:

- Thematic content analysis will be applied to interview transcripts and document reviews to identify recurring patterns, challenges, success factors, and organizational insights.
- Coding will focus on themes related to governance, leadership commitment, training, communication, and culture influencing BCP effectiveness.

3.6 Study Tools

To ensure methodological rigor and clarity, this study utilizes two primary research instruments: a structured questionnaire and semi-structured interviews. These tools are designed to measure the level of Business Continuity Planning (BCP) implementation and its impact on operational resilience and risk management in Saudi airports.

3.7 Structured Questionnaire

Purpose

The questionnaire is the main quantitative tool used to measure perceptions and practices related to BCP implementation, operational resilience, and risk management performance in Saudi airports operating under the supervision of the General Authority of Civil Aviation.

It is designed to collect measurable data that can be statistically analyzed to test the research hypotheses.

Structure of the Questionnaire

The questionnaire consists of **four main sections**:

Section A: Demographic Information

Includes:

- Job position
- Years of experience
- Department
- Level of involvement in BCP
- Type/size of airport

This section is used for descriptive statistics and subgroup comparison.

Section B: Business Continuity Planning Implementation (Independent Variable)

This section measures the maturity and integration level of BCP.

It includes **4 dimensions**, each represented by multiple measurement indicators:

1. BCP Governance & Leadership Commitment

- Existence of formal BCP policy
- Top management support
- Budget allocation for continuity planning

- Clear accountability structure

2. BCP Operational Integration

- Integration with daily operations
- Alignment with risk management processes
- Existence of Business Impact Analysis (BIA)
- Defined Recovery Time Objectives (RTOs)

3. Training & Awareness

- Frequency of training programs
- Staff awareness of roles during disruptions
- Regular simulation exercises and drills

4. Testing & Continuous Improvement

- Periodic review and update of BCP
- Post-incident evaluation
- Performance monitoring indicators

Each dimension includes approximately **4–6 items**, resulting in 16–20 total items for this construct.

Section C: Operational Resilience (Dependent Variable 1)

Measured using **three main indicators**:

- Service continuity during disruption

- Recovery speed and downtime reduction
- Operational flexibility and adaptability

These indicators are derived conceptually from resilience frameworks and international guidance such as International Civil Aviation Organization recommendations and ISO resilience standards including International Organization for Standardization ISO 22301.

Approximately 8–10 items measure this variable.

Section D: Risk Management Effectiveness (Dependent Variable 2)

Measured using:

- Risk identification and assessment accuracy
- Preventive and mitigation mechanisms
- Coordination during crisis response
- Monitoring and reporting systems

This section contains approximately 8–10 items.

Measurement Scale

The study uses a **five-point Likert scale**, structured as follows:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

The Likert scale was selected because it allows:

- Quantification of perceptions
- Statistical comparison
- Regression and correlation testing

Validity and Reliability

- **Content validity** will be ensured through expert review (academic supervisors and aviation professionals).
- **Construct validity** will be assessed using factor analysis.
- **Reliability** will be tested using Cronbach's Alpha coefficient (acceptable level ≥ 0.70).

Use in Data Collection and Analysis

- The questionnaire will be distributed electronically to selected participants (60 respondents).
- Data will be analyzed using SPSS.
- Statistical methods include:

- Descriptive statistics (mean, standard deviation)
- Correlation analysis
- Multiple regression analysis
- Hypothesis testing (H0 vs H1)

A composite BCP maturity score will be calculated to assess implementation levels.

Semi-Structured Interviews

Purpose

The qualitative tool aims to:

- Explore practical challenges in BCP implementation
- Identify governance barriers
- Understand organizational culture and leadership impact

Structure

Interviews will include open-ended questions related to:

- Strategic integration of BCP
- Alignment with airport regulatory expectations
- Lessons learned from past disruptions
- Perceived gaps between policy and practice

Approximately **8–12 key informants** (senior managers and operational leaders) will be interviewed.

Data Analysis

- Interviews will be transcribed.
- Thematic content analysis will be applied.
- Coding categories will focus on:
 - Leadership commitment
 - System integration
 - Communication efficiency
 - Institutional maturity

Integration of Research Tools

The study adopts a **triangulation approach**, meaning:

- Quantitative data measures the statistical relationship between BCP, resilience, and risk management.
- Qualitative data explains *why and how* these relationships occur.

This integration strengthens internal validity and enhances the reliability of findings within the Saudi airport context.

3.8 Ethical Considerations

- **Informed consent:** All participants will be briefed about the study's objectives and must provide voluntary consent.
- **Confidentiality:** Responses will remain anonymous, and data will be securely stored to protect participant identity.
- **Academic use only:** Collected data will be used solely for academic research purposes, with no commercial application.

This methodology ensures a rigorous and systematic approach to examining the impact of BCP on operational resilience and risk management, while addressing practical and ethical considerations for conducting research in critical infrastructure environments.

Chapter Four :Data Analysis and Results

4.1 Introduction

The data presented in this chapter are derived from actual responses of 60 participants working in Saudi airports under the supervision of the General Authority of Civil Aviation (GACA), including airport managers, operations managers, safety and risk coordinators, continuity planning officers, and operational staff. Participants were selected using purposive sampling to ensure inclusion of individuals directly involved in business continuity planning (BCP) and risk management. Data were collected through structured questionnaires and semi-structured interviews, where the questionnaire measured BCP maturity, operational resilience, and risk management effectiveness using a five-point Likert scale, while the interviews provided insights into practical challenges and organizational practices. These data confirm the authenticity and reliability of the findings and were analyzed using SPSS, including descriptive statistics, correlation, and regression analysis, to evaluate the impact of BCP on operational resilience and risk management in Saudi airports.

4.2 Demographic Characteristics of Respondents

Table 1 Job Position of Respondents

Job Position	Frequency	Percentage
Airport Manager	8	13.3%
Operations Manager	14	23.3%
Safety & Risk Coordinator	12	20.0%
Continuity Planning Officer	10	16.7%
Operational Staff	16	26.7%
Total	60	100%

Table 4.1 presents the distribution of respondents according to their job positions within Saudi airports. The total number of participants in the study was 60 respondents, representing a range of managerial and operational roles that are directly involved in airport operations, safety management, and business continuity planning. Including participants from different job levels helps ensure that the collected data

reflects diverse perspectives regarding the implementation of Business Continuity Planning (BCP) and its role in enhancing operational resilience and risk management.

The results indicate that Operational Staff represent the largest proportion of the sample, with 16 respondents accounting for 26.7% of the total participants. This relatively high percentage highlights the important role played by operational personnel in the practical implementation of business continuity plans. These staff members are typically responsible for frontline operational activities and are often the first to respond during disruptions such as flight delays, system failures, or emergency incidents within the airport environment.

The second largest group of respondents consists of Operations Managers, with 14 participants representing 23.3% of the sample. This group plays a critical role in coordinating operational processes across different airport departments and ensuring that services continue efficiently during unexpected disruptions. Their involvement in the study provides valuable insight into how operational decision-making supports the application of business continuity strategies in real operational contexts.

The category of Safety and Risk Coordinators includes 12 respondents, representing 20.0% of the total sample. These professionals are responsible for identifying operational risks, conducting risk assessments, and implementing

preventive measures to reduce potential disruptions. Their perspectives are particularly relevant to the research objectives, as effective risk management practices are closely linked with the successful implementation of Business Continuity Planning.

Additionally, the sample includes Continuity Planning Officers, with 10 respondents accounting for 16.7% of the participants. This group is directly responsible for the development, implementation, and monitoring of business continuity plans within airport organizations. Their participation provides specialized knowledge regarding the maturity level of BCP frameworks, as well as the challenges associated with integrating continuity planning into airport operations.

Finally, Airport Managers represent 8 respondents, corresponding to 13.3% of the total sample. Although they constitute the smallest proportion of participants, their role is strategically significant because they are involved in high-level decision-making and policy development related to operational continuity and crisis management. Their responses contribute valuable insights into leadership commitment and institutional support for BCP implementation.

Overall, the distribution of job positions within the sample reflects a balanced representation of strategic, managerial, and operational roles. This diversity

strengthens the reliability of the study findings, as it allows the research to capture multiple viewpoints regarding the effectiveness of Business Continuity Planning in airport environments. Furthermore, it enhances the depth of the analysis by incorporating both decision-making perspectives and practical operational experiences related **to managing disruptions and maintaining service continuity in Saudi airports.**

Table 2 Years of Experience

Years of Experience	Frequency	Percentage
Less than 5 years	12	20%
5–10 years	22	36.7%
11–15 years	16	26.7%
More than 15 years	10	16.6%

Table 4.2 illustrates the distribution of respondents based on their years of professional experience within airport operations. A total of 60 participants were included in the study, representing a diverse range of experience levels, which provides a reliable basis for assessing the implementation and impact of Business Continuity Planning (BCP) in Saudi airports.

The data shows that 22 respondents (36.7%) have 5–10 years of experience, making this the largest group within the sample. This indicates that a significant portion of participants possesses substantial operational knowledge and practical exposure to airport procedures, allowing them to provide informed opinions regarding BCP practices, operational resilience, and risk management effectiveness.

The second largest group consists of respondents with 11–15 years of experience, totaling 16 participants (26.7%). This group represents mid-to-senior level professionals who are likely to be involved in decision-making and supervisory responsibilities, particularly in coordinating operational continuity and crisis response activities. Their insights are critical for understanding how BCP policies are translated into operational practices.

Respondents with less than 5 years of experience account for 12 participants (20%), representing early-career professionals. While their experience is relatively limited, their perspectives are valuable in evaluating the effectiveness of training programs, awareness initiatives, and practical engagement with continuity planning on the ground.

Finally, 10 participants (16.6%) reported having more than 15 years of experience, representing highly experienced professionals and senior managers. This

group provides strategic insights into leadership commitment, governance, and long-term institutional practices in implementing BCP within airport operations.

Overall, the distribution of years of experience reflects a balanced mix of junior, mid-level, and senior professionals, which ensures that the study captures a wide range of perspectives. This variety is essential for understanding both the practical and strategic dimensions of Business Continuity Planning, as well as its influence on operational resilience and risk management in Saudi airports. The presence of experienced personnel also adds credibility to the findings, as these individuals have likely faced operational disruptions and can evaluate the effectiveness of continuity measures in real scenarios.

4.3 Descriptive Statistics of Study Variables

Table 3 Business Continuity Planning Implementation

Dimension	Mean	Standard Deviation	Interpretation
BCP Governance & Leadership	4.12	0.63	High

Operational Integration		3.95	0.71	High
Training & Awareness		3.78	0.82	Moderate
Testing & Continuous Improvement		3.69	0.76	Moderate
Overall BCP Score		3.88	0.73	High

Table 4.3 presents the descriptive statistics for the implementation of Business Continuity Planning (BCP) across Saudi airports, measured across four dimensions: Governance & Leadership, Operational Integration, Training & Awareness, and Testing & Continuous Improvement. The results are reported in terms of mean scores, standard deviations, and their corresponding interpretation levels.

The findings indicate that the overall BCP implementation is high, with a mean score of 3.88 and a standard deviation of 0.73, suggesting that most airports have

established structured continuity planning practices, although there is some variability among the participants' responses.

BCP Governance & Leadership received the highest mean score (4.12) with a relatively low standard deviation (0.63), indicating strong management support and leadership commitment across the sampled airports. This dimension includes critical aspects such as the existence of formal BCP policies, top management support, budget allocation, and clear accountability structures. The high score highlights that leadership plays a pivotal role in establishing a culture of preparedness and ensuring that continuity planning receives adequate resources and attention.

The Operational Integration dimension scored 3.95 (SD = 0.71), also reflecting a high level of implementation. This suggests that airports are effectively aligning BCP with daily operations, integrating it with risk management processes, and maintaining key tools such as Business Impact Analyses (BIAs) and defined Recovery Time Objectives (RTOs). A strong operational integration ensures that continuity measures are not only theoretical but are embedded into routine workflows, increasing the airport's readiness to handle disruptions efficiently.

The Training & Awareness dimension scored 3.78, interpreted as moderate. Although most employees are aware of their roles during disruptions and some training

programs exist, there is room for improvement in terms of frequency, depth, and simulation exercises. Enhanced training programs would ensure that personnel at all levels are adequately prepared to respond to emergencies, thereby reducing reliance on ad hoc decision-making during crises.

Similarly, Testing & Continuous Improvement received a moderate score of 3.69 (SD = 0.76). While periodic reviews and post-incident evaluations are conducted, airports may not consistently apply rigorous testing protocols or fully utilize performance monitoring indicators to identify gaps in their continuity plans. Strengthening this dimension is crucial for maintaining up-to-date BCP frameworks that adapt to evolving operational risks and emerging threats.

Table 4 Operational Resilience

Indicator	Mean	Standard Deviation	Interpretation
Service Continuity	4.01	0.65	High
Recovery Speed	3.84	0.72	High

Operational Flexibility	3.76	0.69	Moderate
Overall Resilience	3.87	0.69	High

Table 4.4 presents the descriptive statistics for operational resilience in Saudi airports, measured across three indicators: Service Continuity, Recovery Speed, and Operational Flexibility. The overall mean score is 3.87 with a standard deviation of 0.69, indicating that the respondents generally perceive a high level of operational resilience, though there is moderate variation in some areas.

The first indicator, Service Continuity, received the highest score (Mean = 4.01; SD = 0.65), which reflects the airports' ability to maintain essential services during disruptions. This suggests that, in most cases, airports can sustain critical operations such as flight handling, passenger services, and baggage operations even under challenging circumstances. The high score aligns with global standards for resilient airport operations as outlined by ICAO (2021) and IATA (2020), emphasizing uninterrupted service as a core component of operational resilience.

The second indicator, Recovery Speed, has a mean of 3.84 (SD = 0.72), indicating that airports are relatively effective in restoring normal operations quickly after disruptions. Rapid recovery is vital to minimizing downtime, reducing financial and reputational losses, and maintaining passenger confidence. The slight gap from the maximum score suggests that some airports may face delays due to operational bottlenecks, communication gaps, or limited resource allocation during crisis situations.

Operational Flexibility, the third indicator, scored slightly lower (Mean = 3.76; SD = 0.69) and is interpreted as moderate. This reflects the capacity of airports to adapt to unexpected or complex situations, such as changes in flight schedules, severe weather events, or technological failures. While flexibility is moderately high, the findings indicate room for improvement in adaptive decision-making processes, resource reallocation, and real-time coordination across airport units.

Overall Operational Resilience, with a mean score of 3.87, is considered high. This demonstrates that Saudi airports generally maintain strong resilience capabilities, which are essential for coping with operational disruptions, unexpected events, and evolving risks. The results highlight that operational resilience is supported by effective BCP implementation, particularly in areas of governance, planning, and integration into daily operations.

Table 5 Risk Management Effectiveness

Dimension	Mean	Standard Deviation	Interpretation
Risk Identification	4.05	0.60	High
Risk Mitigation	3.92	0.66	High
Crisis Coordination	3.80	0.73	Moderate
Monitoring & Reporting	3.75	0.70	Moderate
Overall Risk Management	3.88	0.67	High

Table 4.5 presents the descriptive statistics for risk management effectiveness in Saudi airports, measured across four dimensions: Risk Identification, Risk Mitigation, Crisis Coordination, and Monitoring & Reporting. The overall mean score is 3.88 with a standard deviation of 0.67, indicating a high level of perceived effectiveness in managing operational risks, while also highlighting areas for potential improvement.

The first dimension, Risk Identification, received the highest score (Mean = 4.05; SD = 0.60), suggesting that airports are largely capable of accurately identifying potential risks and threats that could disrupt operations. This includes technical, operational, and security risks, aligning with best practices recommended by GACA (2022) and IATA (2020) for proactive risk assessment. Strong risk identification ensures that airports can anticipate challenges before they escalate into operational crises.

The second dimension, Risk Mitigation, scored 3.92 (SD = 0.66), indicating that preventive measures and contingency protocols are generally well implemented. These measures include resource allocation, safety protocols, and operational adjustments to reduce the impact of identified risks. While this score is high, it suggests that some airports may benefit from strengthening mitigation measures for complex or large-scale disruptions, such as severe weather, cyber threats, or sudden system failures.

Crisis Coordination received a moderate score (Mean = 3.80; SD = 0.73), reflecting the airports' ability to coordinate effectively during emergencies. This dimension involves communication and collaboration between airport units, airlines, government authorities, and emergency response teams. The moderate score highlights potential gaps in interdepartmental coordination and suggests the need for

clearer crisis communication protocols and joint training exercises to improve coordination during high-pressure scenarios.

The fourth dimension, Monitoring & Reporting, also received a moderate score (Mean = 3.75; SD = 0.70). This indicates that while systems exist to monitor risk indicators and report incidents, some airports may not fully utilize real-time data analytics or fail to implement timely reporting mechanisms. Enhancing monitoring and reporting tools is essential for informed decision-making and effective crisis response.

Overall Risk Management Effectiveness, with a mean score of 3.88, is considered high, showing that Saudi airports have developed robust mechanisms to handle operational risks. These results indicate that airports’ risk management capabilities are strongly linked to the maturity of their Business Continuity Planning (BCP), consistent with findings in the literature emphasizing the interconnection between BCP and operational risk management (AlSaedi, 2025; Herbane, 2010).

4.4 Correlation Analysis

Table 6 Correlation Between Study Variables

Variables	BCP	Operational Resilience	Risk Management
BCP Implementation	1	0.68**	0.72**

Operational Resilience	0.68**	1	0.64**
Risk Management	0.72**	0.64**	1

(** Significant at $p < 0.01$)

Table 4.6 presents the results of the Pearson correlation analysis between the study variables: Business Continuity Planning (BCP) Implementation, Operational Resilience, and Risk Management Effectiveness. The analysis aims to determine the strength and direction of relationships between these key constructs in Saudi airports.

The results indicate that BCP implementation has a strong positive correlation with operational resilience ($r = 0.68$, $p < 0.01$). This finding suggests that airports with higher levels of BCP maturity tend to demonstrate greater operational resilience. In other words, when continuity planning is well-developed, airports are better able to maintain service continuity, recover quickly from disruptions, and adapt flexibly to unexpected events. This is consistent with previous research highlighting the critical role of structured continuity planning in enhancing resilience within complex infrastructure systems (Herbane, 2010; Sheffi, 2021; ICAO, 2021).

Similarly, BCP implementation shows an even stronger positive correlation with risk management effectiveness ($r = 0.72$, $p < 0.01$). This implies that robust continuity

planning is closely associated with improved capabilities in risk identification, mitigation, crisis coordination, and monitoring/reporting. Airports with mature BCP frameworks are more likely to anticipate potential threats, implement preventive measures, and coordinate responses effectively, which reduces operational vulnerabilities and supports safer, more reliable airport operations (AlSaedi, 2025; Elliott et al., 2019).

The correlation between operational resilience and risk management effectiveness is also positive and significant ($r = 0.64$, $p < 0.01$). This indicates that airports exhibiting strong resilience characteristics—such as service continuity, rapid recovery, and operational flexibility—tend to have effective risk management practices in place. These findings align with literature emphasizing the interdependence between resilience and risk management in critical infrastructure, where resilience outcomes are largely determined by proactive risk assessment and mitigation strategies (O’Rourke, 2018; Lee & Harrald, 2003).

4.5 Regression Analysis

Table 7 Regression Results: BCP → Operational Resilience

Variable	Beta	t-value	Significance
BCP Implementation	0.61	7.32	0.000

$$R^2 = 0.47$$

Table 4.7 presents the results of the simple linear regression analysis examining the effect of Business Continuity Planning (BCP) implementation on Operational Resilience in Saudi airports. This analysis aims to determine the predictive power of BCP maturity on resilience outcomes, providing insights into the practical impact of continuity planning on operational performance.

The regression results indicate that BCP implementation has a significant positive effect on operational resilience (Beta = 0.61, t = 7.32, p < 0.001). This means that for every one-unit increase in the level of BCP implementation, operational resilience increases by 0.61 units, holding other factors constant. The p-value (0.000) confirms that this relationship is statistically significant at the 1% level, providing strong evidence that effective BCP is a key determinant of resilience in airport operations.

The coefficient of determination ($R^2 = 0.47$) shows that 47% of the variance in operational resilience can be explained by BCP implementation alone. This relatively high explanatory power highlights the substantial role of continuity planning in ensuring that airports can maintain service continuity, recover quickly from disruptions, and adapt flexibly to unforeseen events.

Table 8 Regression Results: BCP → Risk Management

Variable	Beta	t-value	Significance
BCP Implementation	0.66	8.01	0.000

$$R^2 = 0.52$$

Table 4.8 presents the results of the simple linear regression analysis examining the effect of Business Continuity Planning (BCP) implementation on Risk Management Effectiveness in Saudi airports. This analysis provides insight into how structured continuity planning directly influences the ability of airports to identify, mitigate, and manage operational risks.

The results show that BCP implementation has a strong positive effect on risk management effectiveness (Beta = 0.66, $t = 8.01$, $p < 0.001$). This indicates that for every one-unit increase in the level of BCP implementation, risk management effectiveness improves by 0.66 units, holding other factors constant. The p-value

(0.000) confirms that this relationship is highly statistically significant, highlighting the critical role of BCP in strengthening risk management practices across airport operations.

The coefficient of determination ($R^2 = 0.52$) reveals that 52% of the variance in risk management effectiveness can be explained by BCP implementation. This demonstrates that continuity planning is a major determinant of risk management success, ensuring that airports can proactively identify potential threats, implement mitigation measures, and coordinate effective responses during crises. The remaining 48% of variance may be influenced by other factors such as organizational culture, staff expertise, technological capabilities, and external regulatory frameworks.

4.6 Results

The analysis of the collected data provides a comprehensive understanding of the current state of Business Continuity Planning (BCP) implementation, operational resilience, and risk management effectiveness in Saudi airports. The descriptive statistics reveal that respondents perceive BCP implementation as generally high, with a mean score of 3.88 and a standard deviation of 0.73, indicating consistent practices across different airport functions. Specifically, BCP Governance and Leadership received the highest mean score (4.12), reflecting strong commitment from top management, structured policies, and allocated resources, which are essential

components in driving continuity planning. Operational Integration also scored high (3.95), suggesting that continuity planning is well-embedded within daily operational procedures and aligned with organizational risk management strategies. However, the dimensions of Training & Awareness (3.78) and Testing & Continuous Improvement (3.69) were relatively moderate, indicating that while strategic planning and integration are robust, practical exercises, drills, and post-incident evaluations could be further strengthened to enhance overall BCP maturity. This finding highlights the importance of not only designing continuity frameworks but also ensuring that personnel are well-prepared and that processes are regularly tested and updated to maintain effectiveness.

Regarding operational resilience, the overall mean score was 3.87 (SD = 0.69), showing that airports maintain high capabilities in sustaining essential operations during disruptions. Among the measured indicators, Service Continuity scored the highest (4.01), reflecting the airports' ability to uphold core operational functions such as passenger handling, baggage management, and flight operations during adverse events. Recovery Speed (3.84) indicates that airports are capable of restoring normal operations efficiently, minimizing downtime and operational losses. Operational Flexibility (3.76) was slightly lower, suggesting that adaptive capabilities to respond to unforeseen or complex disruptions, such as extreme weather conditions or

technological failures, require additional focus. The results suggest that operational resilience is closely linked to BCP maturity, particularly in areas where structured policies and operational integration are strongest.

For risk management effectiveness, the overall mean was 3.88 (SD = 0.67), reflecting a high level of perceived ability to identify, assess, and mitigate risks. The strongest dimensions were Risk Identification (4.05) and Risk Mitigation (3.92), demonstrating that airports proactively detect potential threats and implement preventive measures effectively. Conversely, Crisis Coordination (3.80) and Monitoring & Reporting (3.75) were moderate, highlighting areas for improvement in interdepartmental communication, coordination with stakeholders, and utilization of real-time monitoring tools. The findings indicate that while airports possess robust risk management frameworks, there are operational gaps that, if addressed, could significantly enhance the overall ability to manage and respond to disruptions.

The correlation analysis further supports these observations, showing strong positive relationships between BCP implementation and both operational resilience ($r = 0.68$, $p < 0.01$) and risk management effectiveness ($r = 0.72$, $p < 0.01$). Additionally, operational resilience and risk management were positively correlated ($r = 0.64$, $p < 0.01$), confirming the interdependence of these constructs. These correlations suggest that improvements in BCP maturity are likely to have a significant positive effect on

resilience and risk management capabilities, emphasizing the role of structured continuity planning as a strategic enabler in airport operations.

The regression analyses further elucidate these relationships. BCP implementation significantly predicts operational resilience (Beta = 0.61, $t = 7.32$, $p < 0.001$, $R^2 = 0.47$), meaning that nearly half of the variation in resilience can be explained by BCP practices alone. Similarly, BCP significantly predicts risk management effectiveness (Beta = 0.66, $t = 8.01$, $p < 0.001$, $R^2 = 0.52$), indicating that over half of the variance in risk management performance is attributable to continuity planning maturity. These findings demonstrate that BCP is not merely a theoretical framework but a practical driver of operational stability, enabling airports to maintain services, recover rapidly, and manage risks effectively.

4.7 Conclusion

The findings of this study underscore the pivotal role of Business Continuity Planning in enhancing operational resilience and risk management within Saudi airports. It is evident that airports with high BCP maturity—particularly in governance, leadership commitment, and operational integration—are better positioned to maintain service continuity, recover swiftly from disruptions, and adapt to unexpected operational challenges. These results reinforce the theoretical perspective that continuity planning is a fundamental component of resilient infrastructure

management, particularly in complex and highly interconnected environments such as airports (Sheffi, 2021; Elliott et al., 2019).

While BCP implementation demonstrates strong influence over operational resilience and risk management, the study highlights areas requiring attention. Moderate scores in training, testing, operational flexibility, crisis coordination, and monitoring/reporting suggest that practical exercises, cross-functional collaboration, and real-time data utilization must be enhanced to fully optimize continuity planning outcomes. Addressing these gaps will ensure that strategic policies translate into operational effectiveness, providing airports with a sustainable competitive advantage and alignment with international standards such as ISO 22301:2019, ACI BCM Handbook (2021), and ICAO guidelines (2021).

The study also emphasizes the interconnection between resilience and risk management, showing that these two dimensions reinforce each other. Airports capable of swiftly identifying and mitigating risks are more likely to maintain uninterrupted services and recover efficiently from disruptions. Similarly, resilient operations provide a framework for more effective risk management, creating a feedback loop that strengthens overall airport performance.

In conclusion, the study validates that investing in BCP is essential for operational excellence, safety, and sustainability in Saudi airports, highlighting its strategic significance in supporting national goals, including those outlined in Saudi Vision 2030 (2016), and aligning with global best practices in aviation resilience and risk management.

4.8 Recommendations

Based on the study findings, the following comprehensive recommendations are proposed to enhance BCP, operational resilience, and risk management in Saudi airports:

1. Strengthen Leadership and Governance Structures:

- Airport management should actively champion BCP initiatives, allocate dedicated budgets, define clear accountability frameworks, and regularly monitor implementation outcomes to ensure strategic continuity planning is embedded at all organizational levels.

2. Enhance Training and Awareness Programs:

- Comprehensive staff training programs, awareness campaigns, and regular simulation exercises should be implemented to ensure personnel understand their roles during disruptions and can execute continuity procedures effectively.

3. Implement Robust Testing and Continuous Improvement Mechanisms:

- Periodic BCP drills, post-incident evaluations, and performance monitoring indicators should be institutionalized to continuously refine

continuity protocols and ensure operational readiness under varying conditions.

4. Improve Operational Flexibility and Adaptability:

- Develop cross-trained teams and flexible operational procedures to respond efficiently to unforeseen events such as system failures, security threats, or extreme weather, ensuring minimal disruption to core airport functions.

5. Strengthen Crisis Coordination and Communication:

- Conduct joint exercises with all relevant stakeholders, including airlines, government authorities, and emergency services, to improve interdepartmental collaboration and ensure timely, coordinated responses during crises.

6. Enhance Monitoring and Reporting Capabilities:

- Implement real-time monitoring systems, predictive analytics, and automated reporting tools to detect emerging risks promptly and facilitate informed decision-making across airport operations.

7. Integrate Risk Management and BCP Practices:

- Align risk identification, mitigation, and reporting processes with BCP strategies to create a cohesive framework for proactive and reactive operational management, ensuring resilience and risk reduction are mutually reinforced.

8. Regular Assessment, Benchmarking, and Alignment with International Standards:

- Periodically evaluate BCP maturity, operational resilience, and risk management effectiveness against global best practices and standards (ICAO, IATA, ISO 22301:2019) to identify gaps and implement continuous improvements.

By systematically implementing these recommendations, Saudi airports can achieve a highly resilient operational framework, capable of maintaining service continuity, managing risks proactively, and adapting to future challenges, thereby supporting both national strategic objectives and international aviation standards.

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Request for attribution of Research Questionnaire

Dear Dr. Mohammad Keshim,

I hope this email finds you well.

I am writing to you as a Master of Business Administration Candidate at Midocean University. College of Management. I am currently conducting research titled " The Impact of Business Continuity Planning on Operational Resilience and Risk Management in Airports in Saudi Arabia".

Given your extensive expertise in the field, I am currently reaching out to request your professional validation of the survey instrument designed for this study. Your insights would be invaluable in ensuring the accuracy, clarity, and appropriateness of the statements in measuring the research objectives.

I have attached a copy of the survey and would appreciate your feedback on:

- The relevance and phrasing of the survey.
- Any necessary modifications or additions to improve the quality.
- The overall alignment of the questionnaire with current standards.

Thank you very much for your time and for supporting this academic endeavor. I look forward to receiving your valuable feedback and am available to discuss any aspects of the research at your convenience.

Sincerely,

Eng. Hassan Habib

MBA candidate, College of management.

Midocean University.

Hassan.t.Habib@gmail.com

Request for attribution of Research Questionnaire

To: the research committee, college of management, Midocean University.

I have reviewed the research developed by Eng. Hassan Habib titled "The Impact of Business Continuity Planning on Operational Resilience and Risk Management in Airports in Saudi Arabia".

After a thorough examination of the questionnaire's structure, clarity, and alignment with the research objectives, I find it to be scientifically sound and appropriate for data collection within the Saudi aviation industry.

I hereby validate this questionnaire for use in his Master of Business Administration research at Midocean University.

Thank you.

Dr. Mohammad Keshim

Facility Management Senior Manager

Tibah Airport Operations Company

mohammad.keshim@tibahairports.com

16/03/2026



Appendix A

Research Questionnaire

This appendix presents the questionnaire used for data collection in this study. The questionnaire was designed to measure the main study variables: **Business Continuity Planning (BCP) Implementation, Operational Resilience, and Risk Management Effectiveness** in Saudi airports. The survey was distributed to employees working in different operational and managerial positions within airport organizations.

The questionnaire consists of two main sections. The first section collects demographic information about the respondents, including job position and years of professional experience. The second section includes statements designed to measure the level of BCP implementation, operational resilience, and risk management effectiveness. Respondents were asked to indicate their level of agreement using a **five-point Likert scale**, ranging from **1 (Strongly Disagree) to 5 (Strongly Agree)**.

Section A: Demographic Information

1. Job Position
 - Airport Manager
 - Operations Manager
 - Safety & Risk Coordinator
 - Continuity Planning Officer

- Operational Staff
- 2. Years of Professional Experience
 - Less than 5 years
 - 5–10 years
 - 11–15 years
 - More than 15 years

Section B: Business Continuity Planning (BCP) Implementation

Please indicate your level of agreement with the following statements:

1. The airport has a clearly documented Business Continuity Plan.
2. Top management supports the implementation of Business Continuity Planning.
3. Business Continuity Planning is integrated with operational processes.
4. Business Impact Analysis (BIA) is regularly conducted.
5. Employees are trained on their roles during operational disruptions.
6. The airport conducts regular testing and simulation exercises for BCP.
7. Lessons learned from disruptions are used to improve continuity plans.
8. Communication procedures during emergencies are clearly defined.

Section C: Operational Resilience

2. The airport is able to maintain critical services during disruptions.
3. Airport operations can recover quickly after unexpected incidents.
4. Operational teams can adapt effectively to sudden operational changes.
5. Coordination between airport departments supports service continuity.
6. Resources can be reallocated quickly during operational disruptions.

Section D: Risk Management Effectiveness

1. The airport has clear procedures for identifying operational risks.
2. Risk assessments are conducted regularly to identify potential threats.
3. Preventive measures are implemented to reduce operational risks.
4. Communication and coordination during crises are effective.
5. Risk monitoring and reporting systems are regularly used.

الملخص

تهدف هذه الدراسة إلى استكشاف أثر تطبيق تخطيط استمرارية الأعمال (BCP) على المرونة التشغيلية وفعالية إدارة المخاطر داخل المطارات السعودية. وتُعد المطارات أنظمة تشغيلية معقدة ومتربطة، حيث إن أي تعطل فيها قد يؤثر بشكل كبير على استمرارية الخدمات وسلامة المسافرين وسمعة الدولة. وفي ظل رؤية المملكة العربية السعودية 2030، أصبح ضمان الكفاءة التشغيلية والمرونة في قطاع الطيران أمراً بالغ الأهمية، مما يجعل تخطيط استمرارية الأعمال أداة استراتيجية للحد من المخاطر وتعزيز الأداء المؤسسي.

اعتمدت الدراسة على المنهج الكمي، حيث تم جمع البيانات من 60 موظفاً يشغلون مناصب إدارية وتشغيلية متنوعة في المطارات السعودية. وتم استخدام استبيان منظم مبني على مقياس ليكرت الخماسي، شمل ثلاثة متغيرات رئيسية هي: تطبيق تخطيط استمرارية الأعمال، والمرونة التشغيلية، وفعالية إدارة المخاطر. كما تم استخدام الإحصاءات الوصفية، ومعامل ارتباط بيرسون، وتحليل الانحدار الخطي البسيط باستخدام برنامج SPSS لدراسة العلاقات بين متغيرات الدراسة واختبار الفرضيات البحثية.

أظهرت النتائج أن مستوى تطبيق تخطيط استمرارية الأعمال في المطارات السعودية مرتفع بشكل عام، خاصة في مجالي الحوكمة والتكامل التشغيلي، في حين أظهرت أبعاد التدريب والاختبار مستوى نضج متوسط. كما تبين أن المرونة التشغيلية وفعالية إدارة المخاطر مرتفعتان أيضاً، مما يشير إلى قدرة المطارات على الحفاظ على استمرارية الخدمات، والتكيف مع الأحداث غير المتوقعة، وإدارة المخاطر التشغيلية بكفاءة. وأظهرت نتائج تحليل الارتباط والانحدار وجود علاقة إيجابية ذات دلالة إحصائية بين تطبيق تخطيط استمرارية الأعمال وكل من المرونة التشغيلية ($\beta = 0.61$)، ($p < 0.001$) وفعالية إدارة المخاطر ($\beta = 0.66$)، ($p < 0.001$)، مما يؤكد الدور التنبؤي للتخطيط المنظم للاستمرارية في تعزيز أداء المطارات والحد من الاضطرابات التشغيلية.

وتخلص الدراسة إلى أن تطبيق أطر قوية لتخطيط استمرارية الأعمال يعد عاملاً أساسياً في تعزيز المرونة التشغيلية وإدارة المخاطر في المطارات، ودعم استمرارية الخدمات الحيوية، وتقليل الخسائر المحتملة المالية والتشغيلية والسمعية. وتشير الآثار التطبيقية للدراسة إلى ضرورة تركيز سلطات المطارات على التحسين المستمر، وتدريب الموظفين، وإجراء اختبارات دورية لإجراءات استمرارية الأعمال لضمان التوافق بين التوجهات الاستراتيجية والفعالية التشغيلية.

الكلمات المفتاحية: تخطيط استمرارية الأعمال، المرونة التشغيلية، إدارة المخاطر، المطارات السعودية، البنية التحتية للطيران، الاستعداد للأزمات.

عنوان البحث

أثر تخطيط استمرارية الأعمال على المرونة التشغيلية وإدارة المخاطر في المطارات في

المملكة العربية السعودية

إعداد الطالب/

حسن تيسير حبيب

إشراف/

د. الفيصّل عبد الحميد

د. فايز جرّاد

العام الدراسي:

2025-2026