Interactive Effects of Institutional Pressures and Internal Fit on Safety Management System (SMS) Implementation and Safety Performance in the Global Aviation Context

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ABSTRACT

Interactive Effects of Institutional Pressures and Internal Fit on Safety Management System (SMS) Implementation and Safety Performance in the Global Aviation Context

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Understanding what forces within institutions could affect safety practice implementation and safety performance is critical to changing organizations and ensuring safety. This is particularly true in the global aviation context, for which safety is the primary objective. In this dissertation, I explore the interactive effects of institutional pressures and internal fit on Safety Management Systems (SMS) implementation and safety performance in aviation organizations.

This research starts from a comprehensive literature review of four theories: institutional pressures, internal fit, SMS practice, and safety performance. Based on this review's observed performance and gaps, I propose theoretical models and hypotheses to investigate the interactive effects on practice fidelity and extensiveness implementation and quantitative and qualitative safety performance from the management perspective. A quantitative cross-sectional research design was adopted, and an online survey was developed and pretested. The sample was drawn from aviation organizations in the global setting. The Structural Equation Modelling (SEM) method and the Causal Path Analysis technique were used to access the theoretical models.

The results highlight that while institutional pressures align with self-interest, self-interest positively affects organizational resource capability and SMS fidelity (establishment). In conflict situations, only institutional pressures impact SMS fidelity, and resource capability does not significantly impact SMS implementation. Moreover, SMS fidelity and resource capability fully mediate the relationship between interactive forces and SMS extensiveness in the alignment model. SMS fidelity alone fully mediates SMS extensiveness in the conflict model. SMS fidelity affects quantitative safety performance and safety culture. SMS extensiveness only directly impacts safety culture. Regulative pressures have a direct impact on quantitative safety performance, while non-regulative pressures do not have such a direct impact.

Understanding the effects of the interplay between institutional pressures and internal fit on SMS implementation and safety performance will advance SMS post-implementation and enhance regulatory policy establishment and practitioner practice implementation. These efforts will consequently improve safety performance, which is the prime objective of the global aviation community.

Keywords: Institutional pressures, internal fit, practice implementation, Safety Management System, qualitative and quantitative safety performance

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DEDICATION

To

My parents, Anlu, Wang and Shiying, Song,

And

My son, Bicheng, Liu

In my heart forever, for their love and support

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ACI: Airports Council of International

ACRP: Airports Cooperative Research Program

AMOs: Analysis of moment structures

ANSPs: Air Navigation Service Providers

ASAC: Aviation Safety Assurance Committee

AVE: Average Variance Extracted

CAAs: Civil Aviation Authorities

CANSO: Council of Air Navigation Services Organizations

CFA: Confirmatory Factor Analysis

CFI: Comparative Fix Index

CMIN/DF: Minimum Discrepancy Function by Degree of Freedom divided

COER: Coercive Pressures

CR: Construct Reliability

CSR: Cooperation Social Responsibility

EASA: European Aviation Safety Agency

EFA: Exploratory Factor Analysis

FAA: Federal Aviation Administration

FDI: Foreign Direct Investment

GDP: Gross Domestic Production

GNI: Gross National Income

IASMS: In-time Aviation Safety Management System

IATA: International Air Transport Association

IBAC: International Business Aviation Council

ICAO: International Civil Aviation Organization

ICCAIA: International Coordinating Council of Aerospace Industries Associations

IGOs: Inter-governmental Organizations

IF: Internal Fit

IFALPA: International Federation of Air Line Pilots' Associations

IP: Institutional Pressures

MINO: Mimetic and Normative Pressures

ML: Maximum Likelihood

MNCs: Multinational Corporations

MROs: Maintenance Repair Organizations

NASA: National Aeronautics and Space Administration

NASEM: National Academies of Sciences, Engineering, and Medicine

NFI: Normed Fit Index

NGAP: Next Generation Aviation Professionals

NGOs: Non-governmental Organizations

OCC: Operational Control Center

OEMs: Original Equipment Manufacturers

PCLOSE: *p* OF Close Fit

PICAO: Provisional International Civil Aviation Organization

QM: Quality Management

RMSEA: Root Mean Square Error of Approximation

RSOOs: Regional Safety Oversight Organizations

RPAS: Remoted Pilot Aircraft System

RC: Resource Capability

SA: Safety Analysis

SEM: Structural Equation Modelling

SIN: Self-interest Negative

SIP: Self-interest Positive

SPIs: Safety Performance Indicators

SPQNT: Safety performance quantitative

SPQUAL: Safety performance qualitative

SPSS: Statistical Package for the Social Sciences

SMICG: Safety Management International Collaboration Group

SMS: Safety Management System

SMSF: Safety Management System Fidelity

SMSE: Safety Management System Extensiveness

SRM: Safety Risk Management

SRMR: Standardized Root Mean Square Residual

SSP: Safety System Program

TLI: Tucker-Leris Index

TQM: Total Quality Management

UAS: Unmanned Aircraft System

UN: United Nations

CHAPTER 1 INTRODUCTION

Organizations often engage in business practices that present the opportunity to generate value chains and superior knowledge (Kostova, 1999). An organizational practice can be defined as the use of information and knowledge to perform tasks (Kostova & Roth, 2002). Organizational practices are essential for all organizations and are widely believed to be a source of competitive advantage. With globalization and internalization trends, adoption and adaptation practices in multinational corporations (MNCs) have become an area of interest for academia and industry since the late 1980s (Boon et al., 2009).

Institutional theory has been widely used to study the adoption of organizational practices among organizations (DiMaggio & Powell, 1983; Meyer & Rowan, 1977; Scott, 1995) since the 1980s. The new institutional theory defines the conditions under which organizations facing pressures from the external environment will employ similar practices to gain legitimacy in the organizational field. This theory further posits that practice adoption increases organizations' "isomorphic" structure (DiMaggio & Powell, 1983). However, institutional pressures alone cannot address variation practice adoption and implementation among firms. The need for a theory that can explain heterogeneous firm conditions through practice implementations is increasingly evident in the 1990s (Greenwood, 2011).

Oliver (1991) argues that the new institutionalism neglects the role of organizational self-interest in organizational responses to institutional pressures. She demonstrates how organizational behaviour may vary from passive conformity to active resistance in response to institutional pressures. Moreover, Ansari et al. (2010) posit that as new practices diffuse, they vary to allow a better political, technical, and cultural fit within the organization. They also introduce two dimensions of practice diffusion: fidelity and extensiveness. These dimensions impact business practice variability and adaptation in MNCs from their home country to host countries. To advance the understanding of practice transfer in multinational corporations, Fortwengel (2017) introduces the concept of internal fit and further explores how organizations transfer apprenticeship-based training to the foreign host country. He uses qualitative data to find how governance modes affect the ability to attain internal and external fits and impact the transfer process. Fortwengel introduces the concept of internal fit for the first time, which indicates " alignment with the organization's (perceived) needs, objectives, and structure" (Ansari et al. 2010, p. 68), while external fit indicates that a particular practice must gain and sustain support and legitimacy in the wider environment. However, few articles have examined the interactive effects of external institutional pressures on internal fit. There is still a great gap to explore and study interactive effects on practice implementation.

Since this dissertation focuses on the global civil aviation sector, the most prevalent safety practice is the safety management system (SMS) practice, which is a formal, top-down, organization-wide method to control safety risk(Akselsson et al.,2009; Stolzer & Georgia, 2015). It has been adopted by the aviation community since 2010. Before diving into the SMS, here is a brief introduction to the background of global civil aviation. Civil aviation was largely developed after World War II. While the military use of the air force during the war loomed large after WWII, President Franklin D. Roosevelt of the United States understood aviation's potential as a tool for peace, international connectivity, trade, and economic prosperity. Representatives from

54 countries were invited to Chicago to write a Convention on International Civil Aviation (the Convention). On December 7, 1944, 52 states signed a convention in New York that established the Provisional International Civil Aviation Organization (PICAO), and PICAO convened in Montreal on August 15, 1945. The International Civil Aviation Organization (ICAO) was formally established on March 5, 1947, when the treaty was approved and designated as a United Nations (U.N.) specialized agency. ICAO is the permanent body that administrates the principles laid out in the Convention. It sets the standards for aviation safety, security, efficiency, and regularity, as well as for aviation environmental protection. The aims and objectives of ICAO, as contained in Article 44 of the Chicago Convention, are to develop the principles and techniques of international air navigation and to foster the planning and development of international air transport.

To date, 193 Contracting States under ICAO have developed national aviation regulations based on the Convention, 19 Annexes, and manuals and guidance, which are the standards and practice recommendations (SAPRs). The regulator of States is civil aviation authorities (CAAs). Airlines, airports, air navigation service providers (ANSPs), and aircraft manufacturers are service providers from the aviation industry. Each State has more or less the same structure in the national aviation community due to the high connectivity of international air transport. More and more MNCs types of aviation corporation groups have emerged due to the liberalization and privatization of the aviation sector worldwide in the late 1990^{s} (Hameed, H., 2016). Since safety is paramount in the aviation community, many programs and practices have been implemented. The safety management system (SMS) has been one of the most influential and regulated best practices since 2010, which is the main topic of the dissertation. SMS is comprised of four components: safety policy and objections, safety risk management, safety assurance, and safety promotion. The ultimate goal of SMS implementation in the global aviation community is to improve safety performance worldwide

1.1 Research questions and hypotheses

While the rationale for organizational adoption of practice has been well researched with external factors in institutional theory (DiMaggio & Powell, 1983; Meyer & Rowan, 1977), the subsequent implementation and what happens to such practices during and after adoption have been acknowledged to be underresearched (Bromley, Hwang& Powell, 2012; Zeitz et al.,1999; Kenny & Fiss, 2009). Are new practices fully adopted, half adopted, or just initiated? Moreover, existing literature tends to focus on more generic strategic responses (Oliver,1991), or comparison of early and later adoptions (Kenny & Fiss, 2009), or internal fit on practice diffusion in the multinational corporation's context with qualitative study (Asari et al., 2014; 12 & Santos, 2010, Fortwengel, 2017). Whether exogenous factors interact with organizations' endogenous factors has received surprisingly little attention in the literature.

Hillman and Wan (2005) argue that organizations frequently face the dilemma of reconciling conflicting pressures for fit within and between organizations. Notably, there is no clear explanation of how fit (internally and externally) could influence different levels of practice implementation beyond organizational boundaries (Fortwengel, 2017; Greenwood, 2011; Kostova & Roth, 2002). At the same time, Greenwood (2011) examined internal organizational dynamics and responses facing institutional complexity, focusing on plural institutional logics refracted through field-level structures and processes. Moreover, Fortwengel (2017) considered

diffusion practice versus original practice in multinational corporations (MNCs). However, this was restricted to external key stakeholders' support and legitimacy in the environment instead of institutional pressures. Moreover, neither of the authors conduct an empirical study in this regard. In Greenwood's latest study (2017), he advocates institutional alignment with intra-organizational dynamics as one of the research agendas for future studies.

To summarize the above discussions, the existing literature provides a limited understanding of integrating external and internal factors on organizational practice pre- and post-adoption and the associated strategic responses during the practice implementation. To fill this gap, this study addresses the first research questions: ***1) How do external and internal factors interactively influence inter-organizational variation in practice implementation?***

This study uses the case of a specific organizational practice, SMS, a well-known safety-related practice that has been mandatory with diffusion among most aviation organizations worldwide since 2009. With over 10,000 aviation organizations, the global aviation sector is a highly regulated and dependent ecosystem; hence, it is an exciting context in which to explore interactive forces, as aviation's economic scale is enormous, accounting for 4.1% of the global gross domestic product (GDP) and 87.7 million jobs globally (ATAG,2022), and safety is vital to aviation's sustainable success. The ultimate goal of this research is to examine whether SMS implementation increases safety performance in aviation organizations. Organizational performance is either to make more profit from a production perspective or to increase safety from a protection perspective. In a way, improving safety performance is a practical and invisible approach to increasing production performance. Fatality and accidents cause tremendous costs for air operators to amend the damage and negative reputations from society, dramatically decreasing air operators' economic sales and profit.

Although SMS has received some attention in safety research, it is fairly under-researched, given the scope and depth of SMS practice within aviation (Dijkstra, 2007). Kelly (2017, p.4) pointed out in the international transport forum that "SMS has become a voyage of discovery, an experiment in proactive safety management that is being conducted in real-time."

SMS was widely adopted in aviation organizations, particularly State CAAs and airlines, with implementation beginning around 2010. I conducted a brief systematic review of SMS covering as many industries as possible in the last two decades based on the source of the university library and Connected Paper website. In the literature, from 2004 to 2021, only 27 articles discussed the framework of SMS in the aviation sector; three were in construction, and one was in general organization. Within these 27 articles in aviation, 28% of the studies involve the SMS components, 48% explore the relationship between SMS, safety culture, and performance, and 28% discuss the SMS overview theory and model.

However, only three articles conducted structural equation modelling (SEM) research on the relationship between SMS and safety performance. Singh et al. (2019) uses the SEM approach to explore the moderating effects of SMS and human factors on the relationship between aviation infrastructure and safety performance. Adjekum et al. (2020, 2021) investigate the four organizational management factors, principles, policy, procedures, and practices, which have significant predictive relationships with resilient safety culture. Safety performance has been explored by scholars for over 70 years. As aviation safety efforts have been increasingly

successful, safety performance measurement has transitioned from quantitative data (such as accidents and fatalities) to qualitative performance measures (such as measures of an organization's safety culture) since the 1980s. However, little empirical study exists to understand the impact of SMS on both quantitative and qualitative safety performance.

There is also little investigation from a management perspective to explore the impact of institutional pressure on SMS practice and its effect on both quantitative and qualitative safety performance. Only one article discusses the relationship between institutional theory and SMS practice (Kurt & Gerede, 2018). They investigate the diffusion of SMS among aviation organizations in Turkey and show that regulative institutional pressures mainly drive SMS adoption. However, this qualitative research study pioneered exploring SMS adoption from an institutional theory perspective, which led to significant space for future empirical research. SMS is not only involved with the technical aspects of aviation, including aviation infrastructure, operational safety, and aircraft design and maintenance (Singh, 2019; Liou, 2008) but as a systematic management system influences all aspects of the management of global aviation organizations (Maurino, 2017; Kelly, 2017). Therefore, exploring how to improve safety performance from an organizational structure and systematic management perspective leads to the second research question: ***2) How do variations in SMS implementation influence safety performance?***

Based on these two primary research questions, 12 hypotheses are proposed, tested, and analyzed. Five hypotheses are related to the interactive effects between institutional pressures and internal fit. The other two hypotheses relate to SMS theory and safety performance themselves. Another five hypotheses are involved with the relationship between SMS implementation and safety performance. The last hypothesis is for the research model to propose SMS implementation's mediation effect on the relationship between interactive force and safety performance.

1.2 Research scope

This dissertation focuses on new institutionalism and how it can act in various ways as coercive, mimetic, and normative pressures. New institutional pressures emerged in 1990 and began to replace the old institutional theory introduced by Philip Selznick (1949, 1957). From an intra-organizational management perspective, this research examines safety practice and safety performance as outcomes of the interactive effects of external and internal factors in an aviation safety context. When external pressures encounter internal goals and capacity, the organization will choose a diverse response strategy, which is consequently reflected by the practice adoption and implementation level. Strategy responses and the different levels of implementation are theoretically discussed but not empirically examined in this research.

SMS implementation in the global aviation community has been well-developed for over a decade, especially by State aviation authorities as regulators and airlines as service providers from the industry. The aim of this dissertation is to explore how these aviation organizations strategically respond to the interactive effect of external and internal factors, as well as to understand how the level of SMS implementation will impact quantitative and qualitative safety performance.

The data was collected through an online survey over a period of ten months in 2022 in the States CAAs and commercial airlines worldwide. The literature on new institutional pressures and

internal fit over the last two decades has also been reviewed to understand better how these pressures complement or conflict.

1.3 Research objectives

Exploring how external and internal factors interactively influence practice implementation varies and consequently impact safety performance could advance our understanding of the entire practice process within the organization from the initiated phase to the post-implemented phase. It provides a holistic view of various practice outcomes among organizations. Ultimately, the goal is to investigate how adopting SMS practices would impact safety performance in the global aviation community.

Since efficient practice would lead to achieving and sustaining competitiveness at the firm (Asnsari, 2014), exploring the power of interaction and determining the force on practices would help maximize practice utilization and improve organizational performance (Kostova, 1999). In a way, improving safety performance is a practical and invisible approach to increasing production performance. Moreover, this study elaborates on classic institutional theory from a novel perspective, combining the new concept of internal organization self-interest and resource capability to review well-recognized external institutional factors.

Self-interest and resource capability involve intra-organization relationships associated with the old institutional theory. Studying the interactive force is also a novel way to revisit the old institutional theory and evaluate how well it has evolved 100 years after its introduction. It might not be fully replaced by new institutional theory.

The research will enrich scholarly understanding of the impact of institutional pressures on practice adoption and emphasize the interaction between exogenous and endogenous factors on activities at the level of the organization. Understanding the impact of institutional pressures on operation also brings a new perspective to the aviation community, reviews the effectiveness of SMS from an organizational management theory perspective, and systematically improves safety performance. After over a decade of implementation, SMS provides an excellent opportunity for examining how internal fit is established and interacts with external factors in the complex and highly regulated global context. Finally, the results should enhance regulators' and practitioners' understanding of organizational engagement and commitment to safety-related practice and ultimately improve safety performance.

Safety performance has been explored by scholars for over 70 years. As aviation safety efforts have been increasingly successful, safety performance measurement has transitioned from quantitative data (such as accidents and fatalities) to qualitative measures of performance (such as measures of an organization's safety culture) since the 1980s. However, little empirical study exists to understand the impact of SMS on either quantitative or qualitative safety performance, and no existing research explores the impact of institutional pressure on SMS practice and its effect on safety performance. Thus, this dissertation research brings a novel perspective to understanding safety performance, both for managers and organizational scholars interested in technology-oriented fields, as well as management methods to efficiently improve safety performance.

1.4 Research methodology

A cross-section quantitative research design is used in this research. A survey with 51 questions was sent out to global aviation organizations during the ten-month period from January to October 2022. One hundred seventy-six responses have been collected. After cleaning data for unengaged responses, 153 samples are suitable for analysis.

The data analysis begins with an overview of the participant profile, concentrating on the time trend extrapolation test (test of independent samples) for assessing nonresponse bias and reliability. Structural equation modelling (SEM) was then applied to the analysis, including three analytical processes: exploratory factor analysis (EFA) in IBM SPSS Version 22.0 is used to derive the factors of each construct, institutional pressures, internal fit, SMS, and safety performance, respectively. Dimensionality and validity evaluation using confirmed factor analysis CFA in IBM AMOs Version 23.0 confirm and trim these constructs and items (measurement model) to make sure the model fits. They are referred to as CFA-SEM, where SEM is an umbrella term, and CFA is a subset. Afterward, path analysis is used to see whether linkages exist between these factors in the research model. Path analysis is a method for determining and assessing the effects of a collection of factors acting on a specified outcome via numerous causal routes. Hence, the causal relationship among observed variables in the research model is investigated through a path analysis approach in IBM AMOs Version 23.0.

Finally, the bootstrapping approach in AMOs is used to conduct mediation tests on the interactive effects, SMS, safety performance, and the relationship between SMS and safety performance, respectively.

1.5 Research outline

The remainder of the paper is organized as follows. Chapter 2 elaborates on the literature review of institutional pressures, internal fit, and safety management systems in industries and explicitly introduces the evolution of SMS practice and safety performance in the aviation sector. Chapter 3 addresses the theoretical research model based on finding gaps in the reviewed literature and proposes associated hypotheses. Chapter 4 illustrates the research methodology, including the survey procedure, experimental design, measures and data cleaning process, and analytical approach. Chapter 5 focuses on data analysis and hypothesis results through the SEM approach. Chapter 6 discusses the research results and findings and how they reflect aviation organization management and activities in the global aviation context. Chapter 7 concludes the dissertation, including the limitations of the experimental work and future research avenues.

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

This chapter provides a detailed literature review of the theoretical background, primarily in institutional theory, internal fit, safety management system (SMS) implementation, and safety performance. The trend in institutional theory, the development of internal fit, the background of practice adoption, and the evolution of SMS implementation are reviewed in this chapter. Last but not least, the development of safety performance measurement and the unseparated relationship with SMS practice are also explored in this chapter.

The review includes a discussion of why the research of the above theories is vital to the context of global civil aviation, provides linkages between organizations' external institutional pressures and internal fit (self-interest and resource capability), and explores such interactive effects on current SMS practices implementation and consequently the impact on safety performance. The research argues that the interplay of external and internal factors is a cause-effect approach to making sense of SMS practice implementation and safety performance across the global aviation context.

2.2 Institutional theory development

2.2.1 A brief history of institutional theory

Institutional theory is a sophisticated social-technical concept from economics, political science, and sociology. It is over 100 years old and originally arose in Germany and Austria in the late 19th century as one by-product of debating over scientific methods in social science (Scott, 1995). Although institutions are there to bring stability and order, they also go through both gradual and revolutionary changes. Therefore, this subject must also cover institutions as processes, such as institutionalization and deinstitutionalization.

To date, it is still not easy to reach a consensus on the definition of an institution. The most commonly accepted definition comes from Scott (1995, p.56), who states, "*Institutions comprise regulative, normative, and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life*." According to Tolbert and Zucker (1983), institutionalization refers to the process through which components of formal structure become widely accepted as both appropriate and necessary and serve legitimate organizations. These two definitions are omnibus conceptions of institutions and institutionalization.

Scholars have divided the evolution of institutional theory into three phases: formulation of institutional theory (between 1850 and mid-20th century), old institutionalism (1940-1970), and new institutionalism (1970-present). During the formulation phase, on the one hand, economic, political science, and sociology theorists focused their analyses on broader institutional structures on constitutions and political systems, language and legal systems, and religious structures. On the other hand, others focused on individual human beings' shared values and normative frameworks from social interaction. However, the common limitation in the earliest work on institutions is the lack of attention to organizations. During the old institutionalism phase, theorists recognized the existence and relevance of unique individual organizations in the 1940s

and 1950s as entities distinct from broader social institutions on the one hand and individual conduct on the other. At this period, old institutional theory largely stemmed from the work of Philip Selznick (1949, 1957), who posited that the concept of old institutionalism pertains to organizations that are deeply rooted in local communities, establishing strong connections through the numerous loyalties of their staff and inter-organizational agreements that are negotiated through direct, in-person interactions.

The new institutionalism phase, which mainly developed in the 1970s and 1980s, highlighted the importance of inter-organizational sectors and fields. Identifying these levels has led to many interesting institutional theories and research development. First, Meyer and Rowan (1977) point out the difference between organizations and their institutional environment in their exploration of informal structures, myths, and symbolic activities that firms adopt in attempts to rationalize their adherence to economically inefficient institutional norms, namely formal structure, and thus trade off efficiency which stems from informal structure, in pursuit of legitimacy. Next, DiMaggio and Powell (1983) unpack competitive selection and institutional forces that impact isomorphism within specific organizational fields. DiMaggio and Powell's (1983) work define and extends core institutional concepts such as coercive, mimetic, normative pressures and organizational fields, structuration, and legitimacy. Scott and Zucker point out that these seminal sociology-based contributions remain relevant and significant in the current iteration of institutional theory (DiMaggio & Powell 1983; Meyer & Rowan 1977; Scott 1987, 1995, 2008).

The new institutional theory emerged following a similar sociologic versus economic framing path. The sociology-based perspective originates in Selznick's (1948, 1949, 1957) examination of organizational rules and governance mechanisms and how they affect social relations and adaptation. The other institutional approach is grounded in economics, which was initiated by Coase (1937, 1960). North (1990) and Williamson (2000) reinvigorated costs and economic factors associated with institutional mechanisms and forces. In the economics stream, micro-level factors such as contracting, transaction cost, norms of organizing and exchange, and property rights are examined along with macro-level forces related to market efficiency inhibitors such as public policy and legal structures (North, 1990; Williamson, 2000), which added a healthy dose to the standard assumptions of microeconomic theory.

Understanding institutional theory has derivations in sociology and economics, which can be distinct in the rationale for considering institutional pressures. There is the potential for overlap in effects and outcomes. In contrasting the two perspectives, economists primarily concentrated on more formal institutional influences such as laws, rules, and regulations (La Porta et al., 2008), while sociologists focused on informal institutional effects such as cultures, norms, and values (DiMaggio & Powell, 1983; Meyer & Rowan, 1977). Further, within the economic approach, North (1990) partitions institutional pressures according to the degree of formality (i.e., between formal and informal institutional pressures). In contrast, Scott's (1995) sociology-based framework categorized dimensions as regulative (coercive), normative, and cognitive. Even though emerging from independent and distinct derivation, both dimensional frameworks converge in specifying how and to what extent laws, regulations, and rules are differentiated from norms, cultures, and ethics as formal, informal, and abstract institutional influences on the firm (North, 1990; Scott, 1995). North (1990) and Scott (1995) thus extended complementary approaches in which institutional outcomes are researched and examined in both component

dimensions, formal and informal. Central to institutional theory's underpinning of organizational behaviour and outcomes are concepts of isomorphism, legitimacy, organizational fields, and institutional change. Isomorphism is the homogenization process when organizations face institutional pressures in the field (DiMaggio & Powell, 1983). Hawley (1968) points out that isomorphism is the likeness of the functions or structures of two organizations, whether due to copying or separate development under the same conditions. The organization field refers to those groups of organizations that collectively comprise a recognized sector of institutional life. These groups include major suppliers, consumers of resources and goods, regulatory bodies, and other businesses that provide comparable services or goods (DiMaggio & Powell, 1983). I elaborate more on the new institutional theory in the following section.

2.2.2 Main institutional theories evolved from 1990 to 1999

This research focuses more on sociologic and economic perspectives related to new institutionalism, specifically comprising three institutional pressures: coercive, mimetic, and normative. Coercive pressures describe how formal structure, such as laws, regulations, and rules, would influence the organization, while mimetic and normative pressures mainly address how norms, cultures, and ethics, as informal and abstract institutional, influence organizations' practice implementation. Organizations react to institutional pressures through practice diffusion and implementation, consequently evolving to structural isomorphism in the organizational fields.

Coercive pressures arise from political influence and the problem of legitimacy. It results from both formal and informal pressures exerted on organizations by other organizations on which they are dependent. e.g., government mandates, regulatory agencies, headquarters, and essential clients, which are examples of coercive powers (DiMaggio & Powell,1983). Coercive pressures involve conformity to regulation, manipulation of sanctions, rewards or punishment in an attempt to influence organizational behaviour (Scott, 1995)

Mimetic pressures result from standard responses to uncertainty. Mimicking the choices of other organizations is one way of dealing with these pressures in an attempt to duplicate others' success (DiMaggio & Powell, 1983). An organization imitates other structurally equivalent organizations' actions because those organizations occupy a similar economic network position in the industry and share similar goals, produce similar commodities, share identical customers and suppliers, and experience similar constraints (Burt, 1987).

Normative pressures are exerted by professional networks or (trade) associations as organizations try to establish legitimacy within their professional associations and expectations regarding how work should be conducted professionally (DiMaggio & Powell, 1991). Normative pressures may also arise from social obligations as organizations attempt to do the right thing for societies (DiMaggio & Powell, 1983).

Two phases of the evolution of new institutionalism, which relate to the research questions of how the interaction impacts various practice implementations, are elaborated in this section. In the first phase from 1990-2000, one decade after the new institutional theory was built, several main institutional theories, including institutional pressures, strategic responses, and practice adoption, were heavily discussed, and studied. The second phase focuses on the period between 2000-2020 to continue Farashahi, Mehdi's systematic review of institutional theory till 2002

(2004), as well as to explore how new institutional theories evolved in the 21st century align with SMS implementation from early 2000. It aims to explore how this theory evolved in practice and refined based on empirical evidence.

DiMaggio and Powell (1991) pointedly define the differences between old and new institutionalism, the former represented by Selznick and his followers, the old model privileged conflicts of interest, power processes, informal structure, values, norms, and social commitments. They saw institutionalism as a process occurring within an organization. The new institutionalism emphasized cultural and constitutive processes, routines and schemas, legitimacy processes, and formal structure and viewed institutionalism as occurring in inter-organizations, often at the field and environment level (DiMaggio & Powell, 1991).

Hawley (1968) positions that isomorphism is a constraining process that influences one entity in a specific population to resemble other entities as a consequence of confronting the same set of environmental conditions. Within this constraining process, as posited, three forces move firms within the same organizational field to be isomorphic: coercive (forced by rules, laws, etc. - perceived and real), mimetic (copy others deemed legitimate to address uncertainty), and normative (professionalism - standards and widely held best practices) (DiMaggio and Powell 1983, 1990, 1991). New institutionalism was articulated in Meyer and Rowan's classic paper (1977) and followed closely by DiMaggio and Powell's study (1983). Meyer and Scott propose that technical and institutional forces shape all organizations but that some types of organizations are more strongly influenced by one. DiMaggio and Powell distinguished three important pressures, coercive, mimetic, and normative, in which institutional effects are diffused through a field of organizations and emphasized structural isomorphism as an important consequence of both competitive and institutional processes. Both sets of authors identified the organization field or sector as a new level of analysis suited to studying institutional processes. Organizational fields help to bind the environments within which institutional processes operate. In this vein, Scott (1995) identifies DiMaggio's three pressures as three pillars, regulative, normative, and cultural-cognitive, and explores their distinctions through symbolic systems, relational systems, activities, and artifacts perspectives, respectively.

In this period, the new institutional theory advocates that organizations active in social networks perceive intense pressures to conform to institutional pressures to acquire social legitimacy and rare resources because violations may jeopardize organizational performance in the organizational field (DiMaggio & Powell, 1983; Zucker, 1987; Scott, 1995). Recognized institutional networks include regulatory agencies, key suppliers, resource and product consumers, and other organizations that produce similar services and products (DiMaggio & Powell, 1983).

Institutional pressures can be in the form of coercive, normative, and mimetic pressures and explain how organizational practices are disseminated and institutionalized and set the foundation for the formation of institutions (DiMaggio & Powell, 1983). Hence, institutional pressures influence organizations to adopt similar structures, strategies, and processes to achieve a set of reasonable institutional behaviours that account for uncertainty and resource constraints and meet respective expectations. This helps to explain the global standardization of organizational forms and the emergence of homogenous management practices.

Due to the firm's perceived need to achieve legitimacy, it will adopt or endeavour to adopt some level or degree of the norms and practices deemed legitimate in the field. Legitimacy, a valuable resource that firms must acquire through their behaviour (Dacin et al., 2002), can be obtained through alternative pathways (Suchman, 1995). Institutional pressures exist at many levels: within the firm, in industry, in an organizational field, as well as at societal and cultural levels (Scott & Davis, 2007). The organizational field (DiMaggio & Powell, 1983) can become highly institutionalized to a level commensurate with the process by which field members have contact with, internalize, and repeat field-specific norms and practices. Such field-level dynamics alter how competitive moves and new entrant threats affect business, strategy, and decision-making (Meyer & Rowan, 1977; Miner, 2006; DiMaggio & Powell, 1983, 1990, 1991).

Institutional theory's early emphasis in relation to the firm strategy was more deterministic and constraining. Oliver (1991) uses the notion of strategic choice (Child, 1972) and variations in resource dependency of firms (Pfeffer & Salancik, 1978) to show that firms have a range of options in how they can respond to institutional pressures rather than only isomorphic. As extensions of DiMaggio (1988) and Oliver (1991), a stream of research emerged highlighting institutional change. Institutional change takes place either by an evolutionary process in which institutions may lose their utility and relevance (Oliver, 1992) or by the activities of institutional entrepreneurs and agents who pursue institutional work to defend, alter, destroy, or create new institutions (Dacin et al., 2002; DiMaggio, 1988; Lawrence & Suddaby, 2006).

Greenwood and Hingings (1996) emphasize that the complexity of political, regulatory, and technological changes confronting most organizations has made radical organizational change and adaptation a central research issue of the 1990s. The ability to cope with often dramatically altering contextual forces has become a key determinant of competitive advantage and organizational survival (D'Aveni, 1994). D'Aveni set out a framework for understanding organizational change from the perspective of the new institutional theory, which is a starting point because it represents one of the more robust sociological perspectives within organizational theory (Perrow, 1979). As Dougherty pointed out, it makes sense to "integrate some theoretical threads regarding the specific issue of transformation by building on already developed theories" (1994, p.110).

Institutional theory is not usually regarded as a theory of organizational change but as an explanation of the similarity and stability of organizational arrangements in a given field of organizations. However, Greenwood and Hingings (1996) explain both the incidence of radical change and the extent to which such change is achieved through an evolutionary or revolutionary process. First, they demonstrate that an organization's normative embeddedness inside its institutional framework is a significant source of organizational resistance to change. Second, they suggest that the incidence of radical change and the process by which such change occurs will vary across institutional sectors because of differences in the structures of institutional sectors, in particular in the extent to which sectors are tightly coupled and insulated from ideas practiced in other sectors. Third, they propose that both the incidence of radical change and the process by which such change occurs will vary within sectors because organizations vary in their internal organizational dynamics. In order to understand differences in organizational responses, organizations are conceptualized as heterogeneous entities composed of functionally differentiated groups pursuing goals and promoting interests. How organizations "respond" to

institutional pressures, particularly whether they undergo radical change and, if they do, how quickly, is a function of these internal dynamics.

In summary, DiMaggio points out that institutional pressures make organizations more homogeneous in the field. However, Oliver suggests that organizations indeed strategically respond to such external pressures, which can lead to the appearance of heterogeneous characteristics. Moreover, Greenwood addresses institutional changes that stem from external contexts, such as institutional fields or internal organizational dynamics. Consequently, it leads to changes in structure, process, and practice diffusion. Section 2.2.4 focuses more on the external factors from 2000 to 2022. Another important concept of internal dynamics from Greenwood is elaborated more in the section on internal fit (See 2.3).

2.2.3 Review of studies on institutional theory from 2000 to 2020

Farashahi (2004) synthesizes the institutional theory studies from 1983 to the end of the first quarter of 2002. He identifies interesting patterns for future analysis, including 1) the different levels of institutions, 2) the reciprocal relationships among institutions and between institutions and organizations, and 3) the impact of institutional pressures on the functional behaviours or strategies of business firms in developing nations. As a result, his research mainly focuses on the institutionalization process within organizations with a multilevel analysis of the functional activities of airlines in a developing country. Inspired by his synthesis research, I conducted a brief systematic review from 2000 to 2021 to continue his review by aiming to understand some of the main evolution areas of this literature in the last two decades and identify promising areas for future research in this field.

The candidate articles are defined in two steps.

- First, the keywords "institutional pressures" and "institutional theory" are used in the search and publication year from 2000 to 2020 from four journals in the university library: the Academy of Management Journal (AMJ), Academy of Management, Organization Studies, and Administrative Science Quarterly (ASQ) four journals. The result shows 214 articles in total. After the screening and eligibility process, the results identified 44 out of 214 articles (44=214-73-10-87), which accounts for 37% of the total articles. The detailed process includes screening the duplicates and/or non-related articles (removed 73 articles) and eligibility for full-text (removed ten articles) and articles in English (removed 87 articles in non-English).
- Second, 76 articles are identified from other sources by using the backward/forward method, resulting mainly in articles from the Journal of International Business Studies, Journal of World Business and International Studies of Management & Organization, and so on, accounting for 63% of the total 120 articles. To have a holistic view of these studies, I have used the eleven parameters (see Table 1) to codify the reviewed articles and summarized the results in Table 2.

No.	Parameters
1	Author
2	Year of publication
3	Countries of the setting

4	Region of Country
5	Name of the publication
6	Group of research design 1) Quantitative 2) Qualitative 3) Combination
7	Type of research design 1) Theoretical 2) Empirical
8	Data collection methods 1) Archival data 2) Case study 3) Interview 4) Survey
9	Data analysis method 1) Statistical analysis 2) SEM 3) QCA 4) Case analysis 5) Content analysis
10	Type of organization used in the study
11	Focus of the study, particularly on institutional theory

Table 1: Parameters used to codify the reviewed articles

The majority of the study focuses on one country setting, accounting for 78%. Only six articles are in the global setting, and the geographical distribution is in North America, Europe, Asia, and Africa. Although the articles investigated are from the last two decades, 75% of them were published from 2010 to 2020, indicating a growing trend to consider institutional theory as one of the main theoretical frameworks for exploring organizations and their activities.

Regarding research design, 81% of studies are empirical, with 44% quantitative, 33% qualitative, and only 3% combination studies. Interesting patterns are found in institutional theories studies, and quantitative approaches, such as survey (21%) and SEM (11%) methodology, have been much less used than interview or historical archive data with 79% and other methodologies with 89%.

It is worth noting that the top three focused organization types are multinational corporations, supply chains, and the healthcare sector. However, institutional theory in the last two decades has also been mentioned in a wide array of organization types, such as banks, the public sector, aerospace, small-medium enterprises, manufacturers, education, construction, sport, charity, etc., which indicates that institutional theory indeed penetrates in all kinds of organizations, in government, industry and academia. Of particular note is that 43 out of 120 articles focus on practice adoption, accounting for 36%, which is the most focused area, meaning that practice adoption has drawn significant scholarly attention. (See Table 2).

Parameters	Category	Number of Studies	Percentage of Total
Region	One country setting	94	78%
	Regional setting	20	17%
	Global setting	6	5%
Type of research design	Theoretical	23	19%
	Empirical	97	81%
Type of empirical research	Quantitative	50	44%
	Qualitative	40	33%
	Combination	4	3%
Data collection method	Survey	25	21%
	Interview	29	24%
	Others	63	55%
Data analysis type	SEM	11	11%
	Others	86	89%
The focus of study area	Adoption practice	43	36%
	Performance	9	8%
	Others	68	57%
Organization Type	Aviation	5	4%
	Others	115	96%
Interactive	Interactive between exogenous and endogenous factor	5	4%
	Exogenous or endogenous factor	115	96%

Table 2: Gap analysis for institutional pressures review (2000-2020)

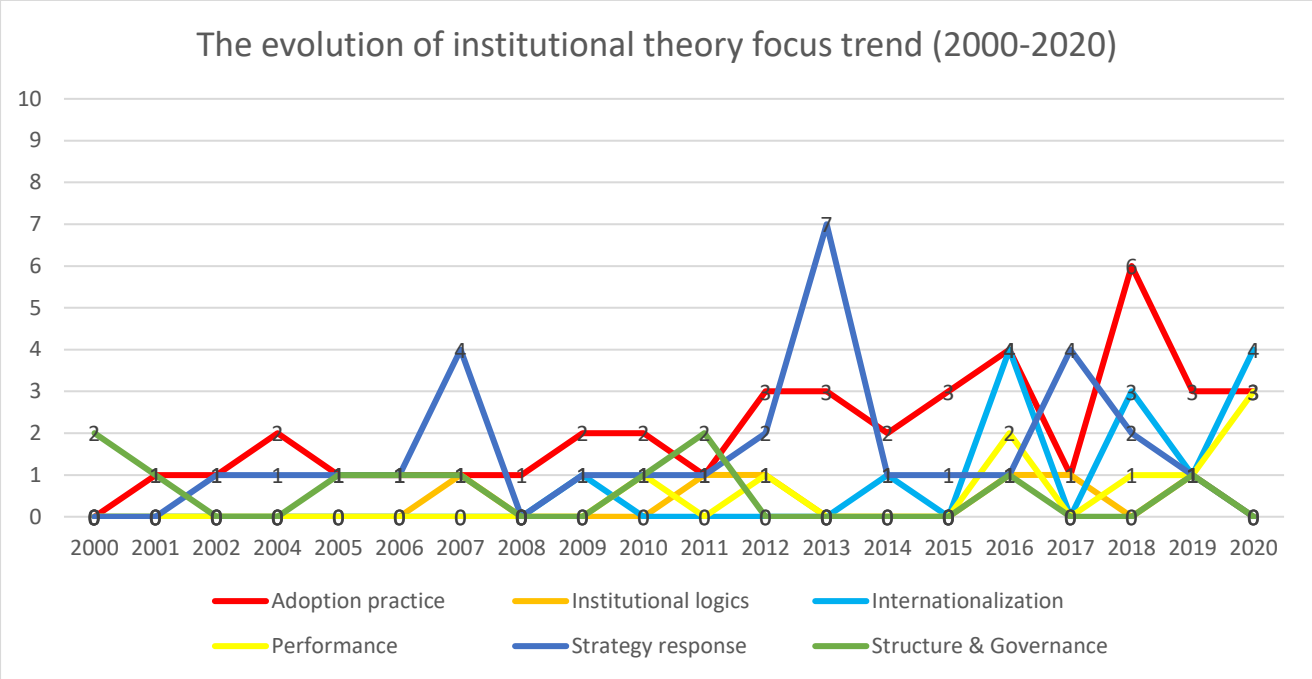

Figure 1: The evolution of institutional theory (2000-2020)

Figure 1 also shows the evolution trend in institutional theory, namely that topics of adoption practice and strategy response have always drawn attention in this field from 2000 to 2020. Topics of internationalization and performance have been mentioned more in the last ten years. Scholars have started to discuss institutional logic and structure in institutional theory, which have been more stable in discussion for the previous two decades. The details of the 120 articles that were reviewed are listed below in Table 3, and institutional pressures effects on practice adoption are elaborated in the next section, 2.2.4.

To summarize this synthesis review, while institutional pressures and practice adoption have been widely studied, only 5% of the articles identified in this review took place in a global setting, and only 8% of the articles reviewed are related to performance. 15% use SEM methodology, and 4% in the aviation sector. In a nutshell, zero studies focus on safety practices and performance in global aviation organizations, and no research has been done with an empirical study using SEM to analyze the impact of institutional pressures on safety practices and performance.

No	Author	Year	Country	Pub	Group of research design	Type of research design	Data collection method	Data Analysis Method	Organizations	Focus
5	King & Lenox	2000	US	AMJ	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Chemical Manufacturer for Care system	Structure
33	Arndt & Bigelow	2000	US	ASQ	Qual.	Cross-Sectional	Archival data	Content Analysis	Hospitals	Structure
37	Ahmadjian & Robinson	2001	Japan	ASQ	Qn.	Longitudinal	Archival data	Statistical Analysis	listed public company	Structure
38	Westphal & Zajac	2001	US	ASQ	Qn.	Longitudinal	Archival data	Statistical Analysis	large U.S Corporations	Adoption practice
21	Laurila & Lilja	2002	Finland	OS	Qual.	Cross-Sectional	Case study	Case Analysis	finished-based forest industry	Strategic response
83	Kostova & Roth	2002	US	AMJ	Qn.	Cross-Sectional	Survey	Statistical Analysis	Multinational Corporations	Quality Management practice adoption
59	Frumkin & Galaskiewicz	2004	UK	JPART	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Public sector org.	Strategic response

94	Jensen & Szulanski	2004	US	JIBS	Qn.	Cross-Sectional	Survey	SEM	Multinational Corporations	Adoption practice
96	Sturdy	2004	UK	ML		Theoretical				Adoption practice
10	Henisz et al.	2005	US	AMJ		Theoretical				Structure & Strategy in investment
28	Barnett & Coleman	2005	US	ISQ	Qual.	Theoretical			Multinational Corporations	Strategic response
73	Zsidisin et al.	2005	US	IJPR	Qual.	Cross-Sectional	Interview	Content Analysis	Supply chain	Adoption practice
15	Geppert & Matten	2006	UK	OSs	Qual.	Cross-Sectional	Case study	Content Analysis	Manufacturers	Structure
47	Fiss & Zajac	2006	Germany	AMJ	Qual.	Cross-Sectional	Archival data	Statistical Analysis	Largest publicly traded German companies	Strategic response
97	David & Strang	2006	Canada	AM	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Consulting firms	Adoption practice TQM
99	Battilana	2006	US	OA		Theoretical				Institutional entrepreneurship
4	Andres Hatum	2007	Argentina	AMJ		Theoretical			Indigenous local business	Structure
8	Martin et al.	2007	US	AMJ	Qn.	Cross-Sectional	Survey	Statistical Analysis	Country-Firm	Cross-level Firm strategy bribery
34	Guler	2007	US	ASQ	Combination	Cross-Sectional	Archival data	Statistical Analysis	Venture capital industry	Strategic response
35	Kim et al.	2007	South Korea	ASQ	Qn.	Longitudinal	Survey & Archival data & Interviews	Statistical Analysis	Education	Strategic response
43	Orr & Scott	2007	US	JIBS	Qual.	Cross-Sectional	Case Study	Case Analysis	Multinational Corporations	Strategic response
46	Vermeulen et al.	2007	the Netherlands	OSs	Qual.	Longitudinal	Interview	Content Analysis	Organizations	Organizational field
71	Farndale & Paauwe	2007	the Netherlands	HRMJ	Qual.	Cross-Sectional	Interview	Case Analysis	Organizations	Adoption practice
88	Lounsbury	2007	Canada	AMJ	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Mutual funds	Institutional logics & complexity
41	Kostova et al.	2008	US	AMJ		Theoretical			Multinational Corporations	Adoption practice
9	Weber et al.	2009	US	AMJ	Qn.	Cross-Sectional	Database	Statistical Analysis	Stock market creation	International institutional diffusion process. Country-level structure & strategy
75	Boon et al.	2009	the Netherlands	PR	Qual.	Case Study	Interview	Content Analysis	Retail & Health care Organizations	Adoption practice & Strategic response
98	Kennedy & Fiss	2009	US	AMJ	Qn.	Cross-Sectional	Survey	Statistical Analysis	Hospitals	Adoption practice, TQM
118	Aaltonen &Sivonen	2009	Finland	IJPR	Qual.	Case Study	Archival data	Case Analysis	Firms	Strategic responses
31	Alakent & Lee	2010	South Korea	MS	Qn.	Cross-Sectional	Survey	Statistical Analysis	Manufacturing org.	Structure
32	Berrone et al.	2010	US	ASQ	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Environmental family firms	Performance
84	Pache & Santos	2010	US	AM		Theoretical			Multinational Corporations	Adoption practice & Strategic response
87	Greenwood et al.	2010	Canada	OS	Qn.	Cross-Sectional	Survey	Statistical Analysis	Firm	Strategic response to institutional logic
90	Ansari et al.	2010	US	AMJ		Theoretical				adoption practice
16	Peng & Chen	2011	China	ISMO		Theoretical			Toy manufacturers	Strategic response
23	Harding	2011	Sweden	ISTR	Qual.	Cross-Sectional	Interviews	Content Analysis	Scandinavian school	Structure
27	Morgan	2011	US	ISMO	Qual.	Theoretical			Country	Structure
82	Tate et al.	2011	US	JBL		Theoretical			Supply chain	Later adoption of environmental practice & transaction cost
89	Greenwood et al.	2011	Canada	AMA		Theoretical				Institutional logics & Strategic response & Institutional complexity
3	Carmona-Moreno et al.	2012	Spain	AMJ	Qn.	Cross-Sectional	Survey	SEM	Chemical firms	Performance
11	Benner et al.	2012	US	AMJ	Qn.	Cross-Sectional	Database	Statistical Analysis	Firm	Strategy
12	Crilly et al.	2012	US	AMJ	Qual.	Cross-Sectional	Interviews	QCA	Firm	CSR strategy response
66	Barman & MacIndoe	2012	US	SF	Qn.	Cross-Sectional	Survey	Statistical Analysis	Non-profit org.	Adoption practice
76	Rautiainen & Jarvenpaa	2012	Finland	FAM	Qual.	Case Study	Interview	Content Analysis	Organizations	Institutional logics & Adoption practice & Strategic response &Performance
112	Hsu et al.	2012	Korea	ISR	Qn.	Cross-Sectional	Survey	Statistical Analysis	Firms	Adoption of Information security management
114	Berente & Yoo	2012	Georgia	ISR	Qual.	Case Study	Archival data	Case Analysis	Aerospace Industry/NASA	Adoption of Information security management Institutional logic
2	Maria Joao Santos	2013	Portugal	AMJ		Theoretical			Clusters company	Strategy

13	Wright et al.	2013	UK	AMJ	Qual.	Longitudinal	Case study	Case Analysis	Cricket sports industry	response to institutional change
17	Quirke	2013	Canada	OSs	Qual.	Cross-Sectional	Case study	Case Analysis	Private School	Organizational field
18	Dhalla et Oliver	2013	Canada	OSs	Qual.	Cross-Sectional	Interviews	Content Analysis	Banking SMEs	Strategic response
22	Heusinkveld et al.	2013	the Netherlands	OSs	Qual.	Cross-Sectional	Interviews	Content Analysis	Consultancy firms	Strategic response
45	Sakyi & Azunu	2013	Ghana	GJMBR	Qual.	Cross-Sectional	Interview	Content Analysis	Aviation organizations	Strategic response
56	Bhakoo & Choi	2013	Australia	JOM	Qual.	Cross-Sectional	Case Study	Case Analysis	Health care supply chain	Strategic response
79	Zhu et al.	2013	China	JPSM	Qn.	Cross-Sectional	Survey	SEM	Supply chain	Adoption practice Green Supply Chain Management (GSCM)
81	Qin et al.	2013	China	JMEB	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Large & medium-sized manufacturing industries	Strategic response & performance
93	Canato et al.	2013	UK	AMJ	Qual.	Longitudinal	Archival data	Case Analysis	Firms	Adoption Six Sigma practice and culture fit
95	Gondo & Amis	2013	US	AMR		Theoretical				Adoption practice
69	Khan et al.	2018	Pakistan	IMR	Qual.	Cross-Sectional	Interview	Case Analysis	Firms in a developing country	Adoption CSR practice
70	Holm	2014	Denmark	ER	Qual.	Cross-Sectional	Archival data	Content Analysis	Danish org.	Adoption practice
86	Uzo & Mair	2014	Nigeria	SEJ	Qual.	Case Study	Interview	Case Analysis	Movie industry	Institutional ambiguity & strategic response
91	Ansari et al.	2014	UK	OSs	Qual.	Case Study	Archival data	Case Analysis	Aerospace Industry/Multinational Corporations	Strategic response
117	Chueke & Borini	2014	Brazil	JIAM	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Firms	institutional distance Acquisition
14	Raaijmakers et al.	2015	the Netherlands	AMJ	Qn.	Cross-Sectional	Interview& field research	Statistical Analysis	Child care organizations	Response to institutional pressures under institutional complex
36	Guillen & Capon	2015	US	ASQ	Qn.	Longitudinal	Archival data	Statistical Analysis	Stock market	Adoption practice
51	Dubey et al.	2015	India	IJPE	Qn.	Cross-Sectional	Survey	SEM	Rubber goods manufacturing firms/Green supply chain	Adoption practice & Performance
80	Abreu et al.	2015	Brazil & UK	BE	Qual.	Case Study	Interview	Content Analysis	Regulatory, financial media and NGOs	Adoption practice (CSR)
1	Selena Aureli	2016	Italy	AMJ		Theoretical	Semi-interview & Archival data	Case Analysis	Unlisted -Medium size-Joint Stock company	Internationalization, Acquisitions
6	Simons et al.	2016	the Netherlands	AMJ	Qual.	Cross-Sectional	Interviews& archival data	Combination	Small Bars	Strategic response
7	Heese et al.	2016	US	AMJ	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Hospitals	Adoption practice
25	Yang et al.	2016	China	ISTR	Qual.	Cross-Sectional	Interviews	Content Analysis	Civic engagement	Social governance
29	Mukundhan & Nandakumar	2016	India	ISMO		Theoretical			Multinational Corporations	Performance
30	Stuart	2016	Australia	ISMO		Theoretical			Charity	Institutional logics
55	He et al.	2016	China	AAP	Qn.	Cross-Sectional	Survey	SEM	Construction Org.	Adoption practice & Performance
57	Munir & Baird	2016	Australia	JAOC	Qn.	Cross-Sectional	Survey	Statistical Analysis	Banks	Adoption practice
65	Parikshit Charan & Murty	2016	India	JKM	Qn.	Cross-Sectional	Survey	SEM	Environmental firms	Adoption practice
72	Monticelli et al.	2016	Brazil	IJEM	Qual.	Cross-Sectional	Archival data	Case Analysis	SOE	Performance & strategic response
101	Arregle et al.	2016	France	JIBS	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Multinational Corporations	Internationalization/Institution complexity
103	Buckley et al.	2016	UK	JWB	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Multinational Corporations	Internationalization, FDI
104	Conti et al.	2016	Brazil	JBR		Theoretical			Multinational Corporations	Internationalization/Institution distance
20	Batard et al.	2017	France	OSs	Qn.	Cross-Sectional	Interviews	Content Analysis	nanoscience and nanotechnologies industry	Strategic response
24	Chasse & Boiral	2017	Canada	OE	Qual.	Cross-Sectional	Interviews	Case Analysis	SMEs	Strategic response
44	Doh et al.	2017	US	JIBS		Theoretical			Multinational Corporations	Strategic response
48	Zhao et al.	2017	US	SMJ		Theoretical				Strategic response
63	Sayed et al.	2017	UK	SCM	Qual.	Cross-Sectional	Case Study	Case Analysis	Food and catering supply chains	Institutional logics
85	Fortwengel	2017	UK	OS	Qual.	Case Study	Interview	Content Analysis	Germany Company	Adoption practice
26	Raaijmakers et al.	2018	the Netherlands	OSs	Qual.	Cross-Sectional	Interviews	Content Analysis	Child care organizations	Strategic response

39	Kurt & Gerede	2018	Turkey	JMEB	Qual.	Cross-Sectional	Interview	Content Analysis	Aviation organizations	Adoption practice
50	Yang	2018	Taiwan	TR	Qn.	Cross-Sectional	Survey	SEM	Container shipping company	Adoption practice & Performance
54	Lu et al.	2018	China	S	Qn.	Cross-Sectional	Survey	SEM	Supply chain	Adoption practice & Performance
62	Nukpezah et al.	2018	US	JPBAFM	Combination	Cross-Sectional	Survey	Statistical Analysis	Public sector org.	Adoption practice
64	Chu et al.	2018	China	AF	Qn.	Cross-Sectional	Survey	Statistical Analysis	Supply chain	Performance
78	Mauro et al.	2018	Italy	M	Qual.	Case Study	Archival data	Case Analysis	Public sector org.	Adoption practice Performance-based budgeting (PBB)
102	Areole et al.	2018	France	JWB	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Multinational Corporations	Internationalization, FDI
106	Cuervo-Cazurra	2018	US	JWB	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Multinational Corporations	Internationalization& performance
108	Li et al.	2018	China	JWB	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Multinational Corporations	Internationalization, FDI
115	Khan et al.	2018	New Zealand & Pakistan	IJCSR	Qual.	Case Study	Interview	Content Analysis	Listed firms	Adoption practice, CSR
116	SCHILKE	2018	US	AMJ	Qn.	laboratory experiments		Statistical Analysis	Participants	Micro-institutional theory & Strategic response
19	Ge & Micelotta	2019	China	OSs	Qn.	Cross-Sectional	Survey	Statistical Analysis	Private firms	Strategic response
40	Kilic et al.	2019	Turkey	TP	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Aviation organizations	Adoption practice
42	Jackson & Deeg	2019	Germany	JIBS	Combination	Theoretical			Multinational Corporations	Comparative management
49	Li & Ding	2019	China	APBR	Qn.	Cross-Sectional	Survey	Statistical Analysis	Chinese Firms	Internationalization
58	López-Fernández & Pasamar	2019	Spain	ER	Qn.	Cross-Sectional	Survey	Statistical Analysis	Firms	Adoption practice
61	Kalyar et al.	2019	Pakistan	SCM	Qn.	Cross-Sectional	Survey	Statistical Analysis	Green supply chain	Performance
67	Oredo et al.	2019	Kenya	ACP	Qn.	Cross-Sectional	Survey	SEM	Financial Institutions	Adoption practice
68	Diab et al.	2019	Egypt	QRAM	Qn.	Cross-Sectional	Interview	Case Analysis	Village community	Institutional logics & response
110	Amarante & Crubellate	2020	Brazil & UK	JCA		Theoretical			University	Institutional Entrepreneurs.
52	Tang et al.	2020	China	MD	Qn.	Cross-Sectional	Survey	Statistical Analysis	Manufacturing org.	Performance
53	Abebe	2020	Lebanon	AHV	Qn.	Cross-Sectional	Survey	SEM	Food supply chain	Performance
60	Shibin et al.	2020	India	AOR	Qn.	Cross-Sectional	Survey	SEM	Auto company supply chain	Performance
74	George et al.	2020	the Netherlands	PA	Qn.	Cross-Sectional	Survey	Statistical Analysis	Public sector org.	Adoption practice
100	Kostova et al.	2020	US	JIBS	Meta-analysis	Theoretical				Institutional distance
105	Contractor et al.	2020	US	IBR	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Multinational Corporations	Internationalization, FDI
107	Karst & Gaffney	2020	US	ITJ	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Multinational Corporations	Internationalization& Acquisitions
109	Liu et Meyer	2020	UK	JWB	Qual.	Case Study	Archival data	Case Analysis	Multinational Corporations	Internationalization, FDI HRM
111	Xie et al.	2020	China	BE	Qn.	Cross-Sectional	Survey	Statistical Analysis	Firms	Adoption practice MSR
113	Dang & Pekkola	2020	Finland	ISF	Qual.	Case Study	Interview	Content Analysis	Firms	Adoption of IT practice Change of management
77	Castellano et al.	2020	France	IEEETEM	Qn.	Cross-Sectional	Archival data	Statistical Analysis	French wine firms	Institutional ambidexterity & Performance
118	Dubey et al.	2019	India	AMJ	Qn.	Cross-Sectional	Survey	SEM	Manufacturers	Adoption practice & Performance
119	Sherer & Lee.	2002	US	AMJ	Qn.	Cross-Sectional	Survey	Statistical Analysis	Law firms	Adoption practice (human resource)
120	Dunn & Jones	2010	US	ASQ	Qn.	Cross-Sectional	Archival data	Statistical Analysis	Health care	Institutional logic

Table 3: The review of institutional pressures (2000-2020)

Abbreviation of publishers:

AAP	Accident Analysis and Prevention
ACP	Africa 2019 Conference Proceedings
AF	Accounting & Financial
AHV	Agriculture and Human Values
AMJ	Academy of Management Journal

AMR	Academy of Management Review
AOR	Annual operation research
APBR	Asia Pacific Business Review
ASQ	Administrative Science Quarterly
B	Buildings
BE	Business Ethics
ER	Employee Relations
FAM	Financial Accountability & Management
GJMBR	Global Journal of Management and Business Research
HRMJ	Human Resource Management Journal
IBR	International Business Review
IEEETEM	IEEE Transactions on Engineering Management
IJCSR	International Journal of Corporate Social Responsibility
IJEM	International Journal of Emerging markets
IJPE	International Journal production economics
IJPM	International Journal of project management
IJPR	International Journal of Production Research
IMR	International Marketing Review
ISF	Information Systems Frontiers
ISMO	International Studies of Management & Organization
ISQ	International Studies Quarterly
ISR	Information Systems Research
ISTR	International society for third-sector research
JAOC	Journal of Accounting & Organizational Change
JBL	Journal of Business Logistics
JBR	Journal of Business Research
JCA	Journal of Contemporary Administration
JIBS	Journal of International Business Studies
JKM	JOURNAL OF KNOWLEDGE MANAGEMENT
JMEB	Journal of Management Economics and Business
JOM	Journal of operation management
JPART	Journal of Public Administration Research and Theory
JPBAFM	Journal of Public Budgeting, Accounting & Financial Management
JPSM	Journal of Purchasing & Supply Management
JWB	Journal of World Business
M	Management
MD	Management Decision
ML	Management Learning
MS	Management Studies
OA	Organization Articles
OE	Organization & Environment
OS	Organization Science
OSs	Organization Studies
PA	Public Administration
PR	Personnel Review

QRAM	Qualitative Research in Accounting & Management
S	Sustainability
SCM	Supply chain management
SEJ	Strategic Entrepreneurship Journal
SF	Sociological Forum
SMJ	Strategic Management Journal
TAMA	The Academy of Management Annals
TITJ	The International Trade Journal
TJIAM	The Journal of the Iberoamerican Academy of Management
TP	Transport Policy
TR	Transportation Research

2.2.4 Institutional pressures' effect on practice adoption

Three institutional pressures have been thoroughly discussed, contributing to the isomorphism of organizations and practice adoption. The majority of studies show that coercive, normative, and mimetic pressures affect practice adoption, such as quality management (QM), foreign direct investment (FDI), Cooperation social responsibility (CSR), and IT best practices (Lu et al., 2018; Li et al., 2018; Khan et al., 2018; Dang & Pekko, 2020). The following four articles are present in this regard.

Tate et al. (2011) addressed institutional pressures that are more likely to influence supplier adoption of environmental practices. They explored why more conservative latter adopters may or may not choose to use environmental practice and found that two theoretical lenses may be applied. First, transaction cost economics investigates implementation expenses that have not been taken into account in earlier studies. According to a transaction cost economics perspective, suppliers are more likely to embrace environmental practices if their costs for gathering information, negotiating, and enforcing agreements are kept to a minimum. Second, coercive, normative, and mimetic institutional pressures are more likely to result in supplier adoption of environmental practices.

The study by He et al. (2016) shows that all three institutional pressures influence organizational management commitment to safety and employee involvement. Coercive and mimetic pressure significantly influences the perception of responsibility for safety and health.

Amrante and Crubellate (2020) suggest universities' entrepreneurial turn is dependent on institutional work and can be explained by a combination of internal and external forces that are shaped by the interplay between regulative, normative, and cultural-cognitive pressures, conjointly derived from the government, industry, and academia sector.

Abebe (2020) examined how perceived institutional pressures affect food safety governance and food safety performance in developing food supply chains. He pointed out that perceived institutional pressures have a direct and strong impact on the agriculture-food supply chain (i.e., in terms of long-term relationships, strategic information sharing, information technology

connection, and logistic integration), and such integration, in turn, increases the intensity of food safety practices and food safety performance.

The majority of studies mainly focus on how institutional pressures affect strategy and adoption of practices in the organization. They analyze three pressures as a bundle, as in the above literature review, or show that any two pressures affect practice adoptions in the following sections.

- Coercive and mimetic pressures.

Arndt and Bigelow (2000) pointed out that organizations invoked coercive and mimetic pressures to create new structures, and they associated innovation with legitimate organizational activities. They also addressed organizational agency in the preventive use of the institutional forces that create isomorphism and suggested the presence of institutional forces even during the early stages of innovation in the hospitals and healthcare sector. Harding's study (2011) is to look at two case studies of Swedish organizations in the field of government-subsidized education: a Muslim organization and a youth organization. They are examined using the institutionalist concept of isomorphism. He found that coercive and mimetic isomorphism, to a degree, impede development in popular education.

- Normative and mimetic pressures

Sayed et al. (2017) demonstrated that normative and mimetic pressures have a more prevalent influence on the implementation of supply chain management practices. Xie et al. (2020) also revealed that the higher the degree of mimetic pressure, the higher the degree of CSR behaviour. Concurrently, relational behaviour mediates the relationship between normative pressures and MSR behaviour. Relational behaviour also drives CSR behaviour, and pure altruistic values moderate the relationships between institutional pressures and CSR behaviour in multinational corporations in China.

- Coercive and /or normative pressures

However, Abreu et al. (2015) confirmed that the more advanced awareness and CSR responsiveness in the UK is a consequence of a predominance of coercive and normative forces in the organizational field. The institutional forces tend to build a Brazilian organizational field that is relational-based and risk-intensive. The findings lend support to the view that CSR responses are unlikely to be easily transformed into uniform standardized practices across the globe. Despite evidence that projected returns are dropping across rounds of financing, Guler (2007) addressed the idea that venture capital firms become less likely to discontinue investments as they participate in additional rounds of funding. Regardless of the anticipated returns, decisions to maintain or terminate investments may be influenced by intra-organizational politics as well as coercive and normative demands from limited partners and co-investors. The results imply that institutional and political impacts may arise from organizational measures intended to reduce individual biases, so undermining the efficacy of the US venture capital industry's decision-making process.

According to Kostova and Roth (2002), the favorability of a host country's cognitive institutional profile, a term that refers to the cognitive categories that the people living there largely share, has a beneficial impact on the implementation of quality management practices. Surprisingly, they

found no effects on the regulatory and normative institutional profiles. However, they found strong support for the effects of host country institutional pressures on the level of internalization, which was, as predicted, negatively affected by the regulatory profile and positively affected by the cognitive and normative profiles in multinational corporations. Internalization refers to a successful practice transfer "in which a practice becomes infused with value when it is accepted and approved by employees when employees see the value of using this practice, and when the practice becomes part of the employees' organizational identity" (Kostova, 1999, p.311). Khan et al. (2018) found that MNCs show commitment to CSR programs despite underdeveloped and very weak formal institutions and that lots of these initiatives, such as education, health, environmental protection, and civil society/religious organizations, are oriented toward norms-based social CSR marketing.

Kurt and Gerede's (2018) qualitative research show that what lies beneath the diffusion of SMS is regulative institutional pressures and coercive isomorphism mechanisms, and concern for legitimacy dominates the field. Furthermore, their study found that most organizations that participated in this study had recourse to decoupling strategies in SMS and adopted SMS practices only in a ceremonial way. Decoupling strategies mean using different suppliers for marketing communications' creative and production needs rather than placing eggs in an often expensive, single-agency basket. It has been mentioned in Lega et al. (2013) related to the diffusion of strategic management tools in public health organizations, in Bromley and Powell (2012) with regard to accountability, In Beverland and Luxton (2005) with regard to Integrated Marketing Communication (another management approach), and in Tenhiala and Vuori (2012) with regard to the integration of compensation practices into human resources management in Finnish organizations. Li and Ding (2019) examined the interaction between institutional pressure and firm capability. Results suggest that firm capabilities enhance the effect of coercive pressure on internationalization and weaken the effect of normative pressure on internationalization.

As this review of institutional pressures demonstrates, the three institutional pressures can combine and interplay to influence practice adoption strongly, and two of the three pressures, coercive and normative pressures, can individually affect organizational behaviours, including the adoption of CSR. Mimetic pressures have minimal impacts on organization practice adoption unless combined with coercive or normative pressures. Moreover, institutional pressures have been well recognized as the leading force moving organizations to adopt the practice and become more homogeneous. Institutional pressures are mainly discussed, including the influence on practice adoption and the consequence of isomorphism of organizations. In the last decade of institutional pressure studies, scholars have identified intra-organizational factors related to institutional pressures, including complex goals and internal fragmentation, self-interest, and resource capability (Heese et al., 2016). As Greenwood (2011) pointed out, organizations vary in their internal organizational dynamics, and these interactive forces between institutional change and internal factors play a crucial role in the heterogeneous structure of organizations. In the following section, I elaborate on the concept of internal fit found in the literature in the following section.

2.3 Internal fit

2.3.1 Introduction

The concept of internal fit in the practice transfer is different from the construct used in business school, which is that the organizational systems, structure, and technology are aligned with the human resource systems of the organization (Deletry & Gupta, 2016). In this study, I explore the internal fit of the organization from two dimensions, self-interest, and resource capability, to analyze how the organization obtains internal fit to implement practice effectively in the section.

After DiMaggio and Powell (1983) describe that institutional pressures lead to organizational isomorphism, Covaleski and Dirimith (1988) and Oliver (1991) argued that the institutional view failed to recognize heterogeneous responses to pressures and expectations. Although Oliver's model delineates various types of responses to institutional pressure in general, it still lacks in-depth analysis when addressing responses to opposing demands. According to Greenwood and Hinings (1996), both external institutional pressures and internal dynamics form responses to the institutional mechanism, and internal demands for interest, value, power dependencies, and capacity for action are four parts of an organization's internal dynamics.

In the introduction to a collection of articles that summarized the current position of institutional theory, DiMaggio and Powell (1991a, p.27) state that "one of the principal goals of this volume is to address head-on the issues of change, power, and efficiency." They saw these three issues as neglected in the historical development of institutional theory. Their study has been to develop institutional theory's contribution to understanding radical organizational change. In particular, they have focused on the interplay of contextual forces and intra-organizational dynamics. The key forms of cognition in the old institutionalism are values, norms, attitudes, conflicts of interest, and vested interests within the organization.

In contrast, these authors suggest that new institutionalism is primarily related to organizations-in-sectors, whereas the old institutionalism centers on the individual organization. They have attempted to build something of a bridge over this gap, posing and trying to answer the question: What are the processes of individual organizations adopting and discarding practice, given the institutionalized nature of organizational fields (neo-institutionalism)? They have tried to show how the external processes of deinstitutionalization must be understood in the organizational field together with the internal dynamics of interpretation, adoption, and rejection by the individual organization, and it is still a journey to find out more about the dynamic and interactive force to date.

Scholars also suggested that understanding radical change requires more analysis of internal dynamics than the institutional field. There must be a concern with patterns of value commitments, power dependencies, interests, and capacity for action within the organization. Typically, institutional theorists have informed our thinking about the nature of institutional pressures toward conformity and uniformity. They have emphasized the exogenous nature of change, which emanates from the realm of resource dependency and legitimacy. However, understanding change is about exploring variations in response to the same pressures, which can only be done by analyzing the features of interactive force between external pressures and the internal fit of organizations.

Ansari et al.'s study (2010, p. 68) makes an important contribution here. They introduced technical, cultural, or political fits, which indicates that a practice aligns with internal meaning, "alignment with the organization's needs, objectives, and structure." They also identify that the diffusion of management practices has revealed novel insights into how practices are modified across networks, projects, and geographies due to a potential lack of technical, cultural, or political 'fit' between the practice and its new locale in the multinational cooperation context. Fortwengel (2017) continues to elaborate on such fits and names them as internal fits to explore the relationship between internal and external over the course of the transfer of organizational practices in multinational corporations (MNCs).

Another exciting finding is from Pache and Santos's (2010) study. They propose exploring the role of intra-organizational dynamics in decision-making rather than treating organizations as unitary (Kim et al., 2007) and tightly integrating entities making univocal decisions. They further argue that conflicting demands within an organization are determined by the nature of the demands and the degree to which conflicting demands represent the organization. The nature of the demand's perspective implies that conflicting demands at the goal and means levels are independent. The goal is defined as the core organizational systems of values and objectives, while means are defined as the technical capability, structure, and process required to achieve goals, usually through material and peripheral tools. Significantly, independence holds even when demand is aligned at the goal level yet leads to conflict about the means level. Internal representation implies that organizations are more likely to resist institutional demands when at least one internal group supports an alternative template.

I argue that both goal-level conflicts from the nature of demand and internal representation imply that an organization's self-interest conflicts with institutional pressures. Moreover, the other internal conflicts at the means level mainly refer to the organization's resource capability that could not support achieving goals or institutional demand.

In order to better understand the interplay of exogenous and endogenous factors, the studies that investigated interaction with internal factors from the 120 articles in the institutional theory review were selected, and summaries are provided in Table 4. In this vein, two dimensions of internal fit, self-interest and/or resource capability, have been listed in groups in Table 4. Overall, 22 of these articles have discussed either self-interest, resource capability, or both internal factors, and 73% of them were conducted after 2010, which shows the trend of exploring more internal dynamics from external organizational factors. Nine articles solely focus on self-interest from a goals-level perspective, and eight articles focus on resource capability from a means-level perspective. Five articles mention both levels, but there is no quantitative research on the interplay of institutional pressures, internal fit, and various practice implementations. The following section explains these two dimensions and how they interact with institutional pressures.

No.	Authors	Year	Interactive with self-interest (Goals level)	Interactive with resource capability (Means level)
1	Westphal & Zajac	2001	Decoupling is more likely to occur when **top executives have power over boards** to avoid institutional pressures for change.	N/A
2	Laurila & Lilja	2002	**Intra-firm contradictory pressures between functional level**.	N/A
3	Sturdy	2004	Rational views are initially contrasted with various internal factors, such as **psychodynamic, political,** dramaturgical, cultural, and institutional approaches.	N/A
4	Kim et al.	2007	The focus on organizational and political dynamics is important in understanding a period of institutional change when **multiple groups of actors are involved in the dynamic political processes of promoting each group's goals, interests, ideologies**, and institutional logic	N/A
5	Farndale & Paauwe	2007	internal processes of strategic choice and competitive differentiation(**organizational heritage & human agency**)	N/A
6	Gondo & Amis	2013	develop these dimensions to provide a framework showing that different within-organization responses will be associated with differing levels of acceptance of the need to adopt a practice—**the acceptance dimension—and differing levels of conscious reflection** during the implementation of the practice—the implementation dimension.	N/A
7	Fortwengel	2017	Internal fit describes the important condition that a practice should be aligned with **organizational goals** and must gain support internally; external fit refers to an additional condition for successful transfer, namely, that a particular practice must gain and sustain support and legitimacy in the environment.	N/A
8	López-Fernández & Pasamar	2019	Coercive pressure is revealed as the main reason why HR managers develop OHS practices at work. On the other hand, the second most important reason for implementing OHS practices is to improve workers' conditions, a **motivation** that goes beyond institutional pressures and is a more encouraging finding.	N/A
9	Tang et al.	2020	The results show that **institutional incentives** are more effective in promoting incremental innovations than radical ones, whereas institutional pressures are more pronounced in facilitating radical innovations than incremental ones. In addition, the interaction between the two divergent institutional forces is negatively	N/A

			related to innovation performance.	
10	Sherer & Lee.	2002	N/A	We argue that **resource scarcity** drives and legitimacy enable institutional change. Building on a historical account, We examine the sources and timing of innovation departing from standard human resource practices using event history analysis of over 200 principal offices of large law firms.
11	Barman & MacIndoe	2012	N/A	Argue for including the concept of **organizational capacity** to account for the uneven implementation of outcome measurement. The findings expand scholarship that examines the intersection of institutional dynamics and organizational traits in accounting for patterns of implementation of practices across an organizational field.
12	Hsu et al.	2012	N/A	Internal fit/Using Korea as the institutional setting, We argue that in addition to institutional influences, our six proposed economic-based and **organizational capability** moderating variables all have significant influences on the degree of the adoption and assimilation of information security management.
13	Bhakoo & Choi	2013	N/A	The propositions also provide a better understanding of heterogeneity in terms of which institutional and endogenous pressures dominate a specific tier of the supply chain and also highlight how the confluence of institutional and endogenous **resource pressure & efficiency pressure** leads to differential outcomes.
14	Guillen & Capon	2015	N/A	The findings suggest that the strength of state capacity influences which policy models policymakers select and adopt, whether they implement them effectively, and what the consequences of such adoption are.
15	Parikshit Charan & Murty	2018	N/A	The results support the mediating role of Absorptive CAPacity (ACAP) in the relationship between institutional pressure and the implementation of corporate environmental practices. Highlights the importance of acquisition and utilization of environmental knowledge in driving environmentalism through developing ACAP; the findings also suggest that the role of institutional pressure in the implementation of environmental practices should not be analyzed in isolation but rather in conjunction with the development of absorptive capacity that forms the internal basis of implementation.
16	Chu et al.	2018	N/A	Integrating the institutional theory and **natural-resource-based view**, this study examines green innovations of 3PL providers as a response to their institutional pressures

				and to gain competitive advantages, as well as explores the contingent effect of market uncertainty.
17	Dubey et al.	2019	N/A	This paper develops and tests a model that explains the **significance of resources** for fostering big data culture, capabilities, and skills, which in turn improves cost and operational performance. It does so by drawing on the firm's resource-based view, institutional theory, and organizational culture.
18	Ansari et al.	2010	Identify technical**, cultural, and political** elements of fit (or misfit) between diffusing practices and adopters and analyze how the process of attaining fit across these elements can trigger different patterns of adaptation.	Identify **technical,** cultural, and political elements of fit (or misfit) between diffusing practices and adopters and analyze how the process of attaining fit across these elements can trigger different patterns of adaptation.
19	Pache & Santos	2010	Explored the combined interaction of the nature of institutional demands and their internal representation, **goals level** and means level.	Explored the combined interaction of the nature of institutional demands and their internal representation, goals level and **means level.**
20	Sakyi & Azunu	2013	The study findings showed that the decoupling reform was introduced as a response to the internal problems, **objective,** operation, and structure change confronting the air transport sector at the time.	The study findings showed that the decoupling reform was introduced as a response to the internal problems, objective, **operation, and structure change** confronting the air transport sector at the time.
21	Mauro et al.	2018	The empirical analysis shows how a lack of alignment between external pressures and **internal dynamics (Interest, value commitment, power dependency)** contributes to an unfinished and apparently endless process of institutionalization.	The empirical analysis shows how a lack of alignment between external pressures and **internal dynamics (technical and managerial capabilities)** contributes to an unfinished and apparently endless process of institutionalization.
22	Xie et al.	2020	The results revealed that the higher the degree of mimetic pressure, the higher the degree of MSR behaviour **pure altruistic (willingness to act)** values moderate the relationships between institutional pressures and MSR behaviour.	The results revealed that the higher the degree of mimetic pressure, the higher the degree of MSR behaviour. Concurrently, **relational behaviour (solidarity, information sharing, flexibility, referred to as resource capability)** mediates the relationship between normative pressures and MSR behaviour.

Table 4: Summary of the interplay of institutional pressures and internal fit

2.3.2 Self-interest dimension

From a practice-related perspective, organizational self-interest refers to an organization's desire to implement a practice (Jensen & Szulaski, 2004). Organizations' self-interest or motivation as a critical factor is well documented (Hayes & Clark, 1985), without self-interest contributing to passive implementation (Jensen et al., 2004), hidden sabotage, intentionally slow implementation, or outright rejection of the practice (Zaltman et al., 1973).

The organization intends to adopt new practices under external pressures at the organizational and functional levels (Laurila & Lilja, 2002). They emphasized that pressures at the functional level within an organization are able to influence firm technical demands to the outside institutional constituents (Edelman,1992) to legitimize practices deviating from the institutional

norm. In terms of social and organizational actors, the institutional view has been criticized for being blind to self-interest (Powell, 1985). With more attention to the importance of organizational self-interest and active agency in responding to institutional pressures and expectations in firm theory (Covaleski & Dirsmith, 1988; Powell, 1985), Kennedy and Fiss (2009) argue that organizations' motivations stem from economics and social benefits. Oliver (1991) applies self-interest and resource dependence theories to show how organizational behaviour can range from passive conformity to active resistance in response to institutional pressures. Oliver (1997) also points out that the firm might be unwilling rather than unable to imitate or seek resources and capabilities, mainly when resources are without legitimacy or social approval.

Self-interest usually involves multiple groups or politics within organizations. For example, Westphal and Zajac (2001) found that decoupling is more likely to occur when the CEO has power over the board and has a political interest in avoiding institutional pressures for change. Kim et al. (2007) investigate how multiple actors are involved in the dynamic political processes of promoting each group's goals, interests, and ideologies. In their study (Kim et al., 2007, p. 287), they mentioned that "the process of choosing one institutional model over another in a period of institutional change can be characterized by conflicts among multiple groups of actors who have different sets of interests at both the field and organization levels. Agreement on which institutional model an organization should adopt is rarely achieved without political conflict among groups of actors, as each alternative affects the interests of each group differently. Thus, such political dynamics, infused with interests and power, may significantly affect how organizations respond to pressures for institutional change."

Sturdy (2004) also highlights that political views within organizations can impact or threaten how ideas and practices are implemented through the agents who introduce or impose them on others. Moreover, Farnadale and Paauwe (2007) elaborate that human agency is a critical internal driver for adopting human resource management practices. In their study, the notion of human agency refers to the impact of the organization's dominant coalition on making strategic choices (Child, 1972). The dominant coalition (the people who hold the decision-making power in the organization) can moderate the external and internal contingency factors noted so far, depending upon various factors that affect the leeway available for shaping human resource policies and practices within an organization (Paauwe, 2004).

Self-interest also includes the power of employee motivation. A very encouraging finding in López-Fernández and Pasamar's (2019) study is that implementing occupational health and safety (OHS) practices to improve worker conditions demonstrates that employee motivation is more powerful than institutional pressures. As a result, when employees are aware of the benefits of improved working conditions, the adoption of OHS policies can be accelerated.

Based on a sample of 166 manufacturing firms obtained directly through a government-supported survey in a specific city in China, Tang et al. (2020) point out that while institutional pressures are more noticeable when it comes to enabling radical breakthroughs than incremental ones, institutional incentives are more successful at encouraging incremental innovations than radical ones. Furthermore, a negative correlation exists between innovation performance and the interplay between the two opposing institutional forces. These incentives stemming from the organization are highly related to self-interest.

Gondo and Amis (2013) provide a framework showing that different within-organization responses will be associated with differing levels of acceptance of the need to adopt a practice, namely the acceptance dimension and differing levels of conscious reflection during the implementation of the practice, which is the implementation dimension. The study indicates that different acceptance levels and conscious engagement during adoption are associated with the affection of practice implementation outcomes. It demonstrates that acceptance as part of self-interest impacts practice implementation outcomes.

Fortwengel (2017) investigated the relationship between internal and external fit over the course of using different governance modes to organize the transfer process. Sakyi and Azunu's (2013) study findings show that the decoupling process was introduced as a response to internal problems, such as the objective confronting the air transport sector at the time. Mauro et al. (2018) empirically analyzes how a lack of alignment between external pressures and internal dynamics (interest, value commitment) contributes to an unfinished and apparently endless process of institutionalization.

Xie et al. (2020) explores how the external institutional pressure and internal factors composed of relational behaviour and pure altruistic values affect megaproject social responsibility (MSR) behaviour. Internal factors in his study include pure altruistic value, which is part of self-interest and refers to the willingness to act completely altruistically out of moral consideration or humanitarianism. He demonstrates that the higher the degree of mimetic pressure, the higher the degree of MSR behaviour. Pure altruistic values moderate the relationships between institutional pressures and MSR behaviour. Relational behaviour includes three dimensions: information exchange, flexibility, and solidarity, which are elaborated more in the following resource capability section.

This review of the self-interest dimension finds that it is composed of organizations' perceived goal and value (Asari et al., 2010; Sturdy,2004; Westphal & Zajac, 2004), benefits, incentives (Wendland et al., 2019; Moore & Benbasat, 1991; Jensen & Szulanski, 2004, Tang et al., 2020), compatibility (Wendland et al., 2019; Moore /& Benbasat, 1991), and challenges (Greenwood & Hinings, 1996; Wendland et al., 2019; Moorthey et al., 2017). Organizations with strong self-interest would have more incentive to seek or reallocate resources to conduct the full or true version with all practice components. The abovementioned organizational goal, objective, value, incentives, acceptance, multiple groups of interests, ideologies, employee motivation, and human agency power are composed of self-interest construct in this study is in line with Goodstein (1994), who argued that organizational responses to institutional pressures are influenced by both the strength of those pressures and by the mobilization of organizational interests.

2.3.3 Resource capability dimension

After elaborating on self-interest from the goal-level perspective, as one of the internal factors interacts with external pressures (Pache & Santos, 2010), here comes the second factor, resource capability, at the means level perspective of internal factors. The means refers to "functional strategies, processes required to achieve these goals (Pache & Santos, 2010, p.460)."

While the era of new institutionalism was well-discussed among scholars in the 1990s, resources-related studies were also prosperous. Barney (1991) addressed that organizational resources include physical, human, and organizational capital resources. Physical capital resources include a company's physical technology, plant and equipment, geographical location, and raw material access. Human capital resources refer to individual manager and employee training, experience, judgment, intelligence, relationships, and insights. The formal reporting structure of a firm, formal and informal planning, controlling and coordinating processes, and informal relations among groups within a firm and between a firm and those in its environment are all examples of organizational capital resources.

According to Teece (2019), there are two types of capabilities: ordinary and dynamic. "Ordinary capability encompasses operations, administration, and governance of the firm's activities, allowing the firm to produce and sell a defined (and static) set of products and services; dynamic capabilities enable enterprises to rapidly reconfigure resources to innovate and respond to the ever-changing market" (Teece, 2019, p.9). Teece (2019) addressed that the firm's resources, as mentioned in Barley (1991), including its employees' skills, equipment, and collective skills, belong to the ordinary capability category.

Barman and Maclndoe (2012) found that decoupling occurs because it is constrained by local circumstances, access to resources, and the requisite expertise at the technical core (Boxenbaum & Jonsson, 2008). They proposed that a severe endogenous resource strain was causing a sluggish reaction at the technical core, mainly owing to the organization's lack of financial resources.

According to Hsu et al. (2012), implementing practice entails reorganization and investments in human resources and knowledge development at various levels of the business. It is related to the requirement of "substantial reassignment of tasks and responsibilities," as described by Teece (1980, p. 465). As a result, economic-based considerations for adoption have been recognized, and the economics perspective stresses the moderating effect of institutional conformity in the adoption state of for-profit organizations (Oliver 1991, Hsu et al. 2012).

Moreover, from the intelligence_human capital perspective, Parikshit Charan and Murty (2016) point out the mediating role of Absorptive CAPacity (ACAP) in the relationship between institutional pressure and the implementation of corporate environmental practices. Operationalizing knowledge capability as absorptive capacity has been defined as organizations' "ability to absorb new knowledge from external and internal sources, assimilate it and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128). The institutional theory offers the framework for comprehending how external factors affect organizations' environmental responses (Delmas & Toffel, 2004).

Previous studies (Lin & Ho, 2016; Colwell & Joshi, 2013; Delmas & Toffel, 2004; Sharma & Vredenburg, 1998) highlighted the limits of the institutional theory framework in accounting for the underlying inter-organization heterogeneity in environmental response within the same institutional field. To overcome this limitation, institutional theory has been extended to include internal organizational mechanisms in the framework of the original theory. Their study aims to incorporate ACAP as an internal organizational mechanism impacting the effective adoption of

corporate environmental practices. According to their findings, institutional pressure for environmental sustainability influences how environmental practice is implemented within organizations. Organizations lack the expertise necessary to adopt practices because they lack the necessary environment-specific knowledge. Moreover, environmental expertise typically lives outside of traditional organizational structures in local communities, NGOs, and regulatory bodies. Through empirical study, they support that the development of absorptive capacity plays a mediation role in corporate environmental practice while facing institutional pressures.

While studying country-level practice adoption under institutional pressures, Guillen and Capon (2015) found that state capacity is critical to any process of institutional adoption due to their difference in terms of their "resources and organizational capacity to adopt (Meyer et al., 1997, p.155)." A state with greater administrative capacity can position itself as the legal authority to explore new opportunities, innovate when old policies fail, find, and analyze alternatives, and form coalitions supporting new policies (Weaver & Rockman, 1993). Their study highlights the necessity of including state capacity as a mediator in cross-national institutional adoption and decoupling studies.

Oliver (1997) combines institutional and resource-based views and argues that resource selection is heavily associated with the individual, intra-organization, and inter-organization levels by the institutional context of resource decisions. She defines institutional context to encompass decision-maker norms and values at the individual level, organizational culture and politics at the intra-organization level, and regulatory pressures and industry-wide norms at the inter-organization level. In this vein, from the intra-organizational level, organization self-interest can be considered institutional context within organizations, resulting in resource decisions.

Chu et al. (2018) uses institutional theory and a natural-resource-based view (NRBV) to study innovations of third-party logistics (3PL) providers as a reaction to institutional pressures and to gain competitive advantages. The study's finding indicates that the interplay of institutional pressures and an organization's resource capability is helpful in describing better organizations' reasons for adopting green innovation since institutional pressures focus on external motivations while the resource-based view highlights internal incentive/necessity. Consequently, the interplay enhances an organization's competitive advantages.

According to Oliver (1997), neither resource acquisition nor resource deployment is independent of the institutional framework. Scheirer (1983) argues that resources are more related to innovation implementation. Dubey et al. (2019) posit that institutional pressures positively affect firm resources, which further help implement big data predictive analytics (BDPA) practice to build organizational capability. The empirical findings show that, when it comes to BDPA adoption, industrial firms' institutional pressures directly impact internal resource allocation and, ultimately, BDPA acceptance.

Using resource dependence and institutional theories, Sherer and Lee (2002) argued that competitive constraints related to human resource scarcities drove human resource innovation in prestigious law firm primary offices, while institutional factors related to the legitimacy of very prominent law firm offices facilitated it. Their historical narrative and statistical findings both indicate (1) a human resource shortage caused by the Cravath model's standard, which was

standard human resource practice in the offices of large U.S. law firms for much of the 20th century (Galanter & Palay, 1991; Gilson & Mnookin, 1988). Its central component was an "up-or-out" system. (2) initial innovators and early adopters of senior and staff attorney track employees being able to stand out due to their prestige, and (3) late adopters (senior attorney and staff attorney tracks) embraced the advances when human resources were scarce.

Bhakoo and Choi (2013) show how institutional forces and endogenous variables interact to produce distinct outcomes at each supply chain tier. The propositions help to understand better heterogeneity regarding whether institutional and endogenous forces dominate which supply chain tier. As well as how the interaction of institutional and endogenous variables leads to varied results. Their within-tier analysis identified four endogenous pressure types—efficiency improvement, patient safety, resource allocations, and internalization. Resource rigidity seemed to be a major factor in the implementation of the inter-organization system (IOS) in the upstream part of the supply chain (Bala & Venkatesh, 2007; Gilbert, 2005).

In addition, Ansari et al. (2010) identify technical, cultural, and political elements of fit between diffusing practices and adopters. Technical fits refer to the degree to which practice characteristics are compatible with technologies already in use by potential adopters. Technical fits align with physical capital resources, including a company's physical technology, and can be considered the ordinary capacity in Barney's study (1991).

Sakyi and Azunu's (2013) study findings showed that the decoupling reform was introduced as a response to internal problems, such as operation structure change, which belongs to the organizational capital resources category (Barney 1991), confronting the air transport sector at the time. Mauro et al. (2018) empirically analyzes how a lack of alignment between external pressures and internal dynamics (technical and managerial capabilities, which belong to the physical and organizational capital resource category) contributes to an unfinished and apparently endless process of institutionalization.

As mentioned above, Xie et al.'s (2020) study examined how internal factors and external pressures affect MSR behaviour implementation. Relational behaviour, as the second internal factor, includes information exchange, flexibility, and solidarity. Their study's information exchange and flexibility are more related to resource capability as organizational structure and process. He demonstrated that relation behaviour mediates the relationship between normative pressures and MSR behaviour.

Resource dependency theory has been highly used in institutional theory and characterizes the organization as an open system, dependent on contingencies in the external environment (Pfeffer & Salancik, 1978). Oliver (1997) incorporated resource dependency theory to explain various organizations' strategic responses. In addition, Barney's resource-based view and Teece's ordinary versus dynamic capability have drawn scholars to explore how resources can influence practice adoption and organization performance. Consequently, including the above theoretic resource theories, I argue that all resource-related internal factors, physique capital, human capital, and organization structure, can be summarized as resource capability, which interacts with external factors and institutional pressures in the organizational field to impact organizations' decision of practice adoption, implementation, and performance.

The combined impact of self-interest and resource capability aligns with the goals and means levels, as Pache and Santos (2010) noted. They contend that an organization's response to conflicting institutional demands depends on the nature of these demands and the extent to which they are represented within the organization. They argue that organizations' response strategies may vary depending on the nature of the conflict and the desire of organizational groups to see one of the competing demands prevail. The nature of the demand's perspective implies that conflicting demands at the goal and means levels are independent, which is summarized in this research as self-interest and resource capability within the organization while facing external institutional pressures. Therefore, these two dimensions compose internal fits (Ansari et al., 2010; Fortwengel, 2017). There is a need for both internal fit and external fit in the effective practice transfer, in which the internal fit means alignment with the organization's (perceived) needs, objectives, and structure. External fit refers to a particular practice that must gain and sustain support and legitimacy in the organizational field (Forwengel, 2017). The purpose of an organization obtaining internal fit while facing institutional pressures is to conduct practice implementation effectively, and the ultimate goal of SMS implementation is to improve safety performance. Therefore, the following section uses the most prevalent safe practice, the safety management system, to introduce the background and current status of SMS practice implementation and safety performance in the global aviation community.

2.4 Safety Management System (SMS)

2.4.1 What is the SMS

No specific definition can best describe a safety management system, as this term may have different interpretations among academic and industrial sectors. For example, Table 5 shows different definitions of safety management systems by different sectors and studies. Another reason for having different definitions could be that most studies on safety management in the past have been done in the fields of psychology, sociology, and human behaviour (Elsebaei et al., 2013), which is different from this study focusing on the global aviation context.

Organization or Study	Definition
SMIC (Safety Management International Collaboration Group)	A safety management system is a series of defined, organization-wide processes that provide effective risk-based decision-making related to daily business.
ILO (International Labour Organization)	A set of interrelated or interacting elements to establish Occupational safety and health (OSH) policy and objectives and to achieve those objectives.
UK Health and Safety (H&S) Executive	A systematic and proactive approach to managing safety policies and procedures to mitigate the risks involved in the project
ICAO (International Civil Aviation Organization)	A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies, and procedures.

Table 5: SMS definitions in the literature

The SMS has been widely utilized as a technique approach to assess safety (Byrom, 1994) and comply with regulatory requirements (Kirchsteiger et al., 1998) in many technologically advanced domains, such as energy production, the oil and gas industry, and process systems. The

methodologies and techniques for hazard assessment and risk management are widely established and commonly applied (Hudson, 2016). It is probably for this reason that, in the commercial aviation environment, the manuals promoting SMS at the institutional level (ICAO 2018) do not discuss specific techniques or tools to be put in place for effectively implementing risk assessment and evaluation processes (Cacciabue et al., 2015 A93).

2.4.2 The Systematic Review of SMS 2004-2021

Although SMS was adopted in aviation organizations, especially state CAAs and airlines, and started to be implemented around 2010, I conducted a brief systematic review of SMS covering as many industries as possible in the last two decades based on the source of the university library. The review shows that SMS is mainly involved in the transportation and construction industry. The result also shows that from 2004 to 2021, there were 31 articles discussing SMS. 94% of the total were published after 2010, which implies it is more popular in the last ten years.

From an organization field perspective, since SMS is not limited to the aviation context, 27 articles, accounting for 87% of the total, are related to the aviation sector, three articles involve the construction field, and one is in the general organization. Of the 27 articles involving the aviation sector, only three articles are related to government organizations, e.g., the State Civil Aviation Authority, 11%. Others are all from industry, as service providers, such as the generic aviation organization accounts for 52%, airlines 26%, and airports 11%.

From a geographic region perspective, North America and Europe are the top two popular research areas, accounting for 32% and 26%, respectively. The global setting accounts for 19%, Asia Pacific (16%), Middle East (3%), and Africa (3%). Eight articles are theoretical research, accounting for 28%, and 23 empirical cross-sectional research, accounting for 74%. Among empirical research, only four articles use SEM to explore the relationship between SMS and safety performance in the last decades, and none from the management theory perspective, which leaves a great gap for scholars to investigate and explore.

No	Author	Year	Region	Pub.	Research Design	Qual./ Qn.	Data Source	Data Analysis Method	Organizations Type	Focus
1	Gill & Shergill	2004	New Zealand	ATM	Cross-Sectional	Qn.	Survey	Statistical Analysis	Aviation org.	SMS and safety culture
2	Dijkstra	2006	The Netherlands		Theoretical				Airlines	SMS Model& Resilience Engineering
3	George	2013	US		Theoretical				Aviation org.	Economic modelling of SMS benefit
4	FAA	2010	US	FAA	Theoretical				Aviation org.	SMS implementation guide
5	Remawi et al.	2011	Australia	SS	Cross-Sectional	Qn.	Survey	Statistical Analysis	Airports	SMS and Employees' attitudes
6	Elsebaei et al.	2013	Egypt	MSE	Cross-Sectional	Qn.	Survey	Statistical Analysis	Constructions	Safety performance
7	Robertson et al.	2014	US		Cross-Sectional	Qn.	Survey	Case Analysis	Airports	SMS development & implementation
8	Ulfverngren & Corrigan	2015	Sweden	GTW	Cross-Sectional	Qual.	Archival data	Case Analysis	Airlines	Safety performance
9	Odigie et al.	2014	US	QP	Theoretical				Aviation org.	Quality Management

10	Yeun et al.	2014	Global	WRITR	Theoretical				States CAA	Measurement of SMS effectiveness
11	Ruwantissa	2014	Global	ASL	Theoretical				Aviation org.	SMS Implementation
12	Chang et al.	2015	Taiwan	SS	Cross-Sectional	Qn.	Archival data	Statistical Analysis	Airports	Performance
13	Kurt and Gerede	2018	Turkey	SS	Cross-Sectional	Qn.	Interview	Case Analysis	State level CAA	Challenges for successful implementation SMS/ Just Culture
14	Cacciabue et al.	2015	Italy	GTW	Cross-Sectional	Qual.	Archival data	Case Analysis	Airlines	Risk assessment tool
15	Kelly	2017	Global	ITF	Theoretical				Aviation org.	Overview of SMS, regulation & culture
16	Ioannou et al.	2017		APHF	Cross-Sectional	Qual.	Interview	Case Analysis	Aviation org.	Safety performance indicators
17	Maurino	2017	Global	ITF	Theoretical				Aviation org.	Overview of SMS
18	Rezaei & Borjalilu	2018	Canada	A	Cross-Sectional	Qn.	Archival data	Statistical Analysis	Airlines	Risk assessment modelling
19	Stolzer et al.	2018	US	SS	Cross-Sectional	Qn.	Sur & Inter	Statistical Analysis	Aviation org.	Measurement SMS effectiveness
20	Insua et al.	2018	Spain	RESS	Cross-Sectional	Qn.	Archival data	Statistical Analysis	State level CAA	Risk management decisions
21	Alvarez-Santos et al.	2018	Spain	SS	Cross-Sectional	Qn.	Survey	Statistical Analysis	General org.	TQM
22	Yiu et al.	2019	China	B	Cross-Sectional	Qn.	Survey	SEM	Constructions	Safety performance
23	Singh et al.	2019	Global	CSTP	Cross-Sectional	Qn.	Survey	SEM	Aviation org.	Safety performance
24	Adjekum et Tous	2020	US	SS	Cross-Sectional	Qn.	Survey	SEM	Aviation org.	SMS policy, procedures, practice, principles, culture
25	Teske & Adjekum	2021	US	JSSE	Cross-Sectional	Qn.	Survey	SEM	Space SPs & airlines	SMS components
26	Khalid et al.	2021	UK	SS	Cross-Sectional	Qn.	Archival data	Statistical Analysis	Constructions	Safety performance
27	Moorkamp et al.	2014	Netherlands	SS	Cross-Sectional	Qual.	Case Study	Case Analysis	Military aviation	SMS theory
28	Lu et al.	2021	US	CARI	Cross-Sectional	Qual.	Archival data	FTA	General aviation	Safety performance
29	Spence et al.	2015	US	JATM	Cross-Sectional	Qn.	Archival data	Statistical Analysis	Aviation org.	Safety performance
30	Chen et al.	2021	China	IOP	Cross-Sectional	Qn.	Archival data	Case Analysis	Aviation org.	Safety performance
31	Onyegiri & Oke	2017	Nigeria	EASR	Cross-Sectional	Qn.	Survey	Statistical Analysis	Airlines	overview of SMS

Table 6: the review of SMS (2004-2020) in the literature

Note:

N.	No
Pub.	Publication
Air transport management	ATM
Aviation	A
Aviation Psychology and Applied Human Factors	APAHF

Buildings	B
Collegiate Aviation Review Internaltional	CARI
Case studies on transport policy	CSTP
Engineering an Applied Science Research	EASR
FAA	FAA
Gogn Tech Work	GTW
International transport forum	ITF
IOP Conference Series/Materials science and Engineering	IOP
Journal of Air Transportation Management	JATM
Journal of Space Safety Engineering	JSSE
Materials Science and Engineering	MSE
Quality Progress	QP
Reliability Engineering and system safety	RESS
Safety science	SS
The Air and Space Lawyer	ASL
World review of intermodal transportation research	WRITR

2.4.3 SMS in the aviation context

2.4.3.1 SMS background in aviation

All stakeholders need to comply with international air rules in the global aviation context. Moreover, ICAO and its 193 contracting States promulgated these international air rules. Therefore, we can understand institutional isomorphism in the context of aviation safety by reviewing the history of ICAO. It demonstrates how this regulatory agency, established by international cooperation, led to similar practice adoption (and the tools and data necessary to assess practice adoption) worldwide.

The Chicago convention established 12 annexes on a variety of themes, including airway systems, communications, and rules of the air, air traffic control protocols, licensing of operating and maintenance staff, and the airworthiness of civil aircraft registration, meteorology, map and chart production, customs, and search and rescue in 1945. Ascending to ICAO, seven additional annexes addressing, among other things, accident prevention, aerodrome, the environment, security, risky commodities, and safety management systems are covered to date. The very last Annex 19, Safety Management, which is one of the main constructs in this study, was established in 2009, and the third version is going to be published in 2024. Over the years, the 19 annexes have been changed to further the Convention's purpose of "securing homogeneity to the greatest practicable extent possible.

As of 2022, over 12,000 SARPs adopting the annexes have been accepted (Donald, 2019). The ICAO Assembly, comprised of 193 contracting States and over 40 observer organizations, meets every three years, usually in Montreal, to establish the agenda, adopt a three-year budget, and elect a 36-member Council to carry out the policies established by the General Assembly. The Council elects its president and selects the secretariat's secretary general. The 15-member Air Navigation Commission will develop technical suggestions. In accordance with Chapter 18 of the Convention, the Council is empowered to resolve disputes between contracting States.

At the global level, with such background and power of ICAO, its 193 Member State Civil Aviation Authorities (CAAs) shall adopt and develop national aviation regulations and policies accordingly. Service providers from the aviation industry, such as airlines, airports, Air Navigation service providers (ANSPs), and airframe and avionics equipment manufacturers, maintenance and training organizations, must comply with international and national regulations and implement the regulated practice for international air transport. Therefore, contracting state regulators enforce safety requirements under the treaty. Nonetheless, ICAO has developed novel incentives for state enforcement and regulatory monitoring. In 1999, ICAO established the Universal Safety Supervision Audit Programme (USOAP), which examines each contracting State's safety oversight competence. In 2007, the Assembly passed a resolution sponsored by the United States authorizing the publishing of safety audits, creating a strong incentive for States to rectify safety inadequacies and resulting in considerable demonstrable improvements in safety audit results (Bliss, 2019).

SMS adoption, one of the key practices, is mandatory for most stakeholders, including governmental CAAs and major industrial service providers. ICAO defines SMS as "A systematic approach to managing safety, including the necessary organizational structures, accountability, responsibilities, policies, and procedures" (ICAO Annex 19, 2016, p1-2) and is regarded as one of the aviation industry's most prevalent safety initiatives (Robertson et al., 2014 A103). In almost all cases, the transportation industry has implemented SMS as a result of a regulatory endeavour. SMS varied widely among modes of transportation and regions, typically due to the effect of legacy regulatory programmes and the attitudes that come with them. As a result, there is no one-size-fits-all approach to ensuring a regulatory authority's success in developing and implementing SMS legislation. SMS has become a journey of discovery, an experiment in proactive safety management that is being undertaken in real-time (Kelly, 2017).

Aviation safety management has significantly evolved in the last fifty years. Historically, safety management and safety improvement involved a "fly-crash-fix-fly" approach (Stolzer, Halford, & Goglia, 2008, A103). SMS is a recent approach to aviation safety management that attempts to utilize a more proactive and predictive approach to reducing aviation accidents. SMS can be considered a tool to translate an organization's concerns about safety into practical actions to mitigate hazards. The Federal Aviation Authority (FAA) provides a framework for SMS for aviation service providers in Advisory Circular (AC) 120-92A (2010). This Advisory Circular provides a uniform set of expectations for the aviation industry to follow during the adoption of SMS that is aligned with the structure and program set by the ICAO in 2010.

SMS is a more generic term. When SMS applies to State CAAs, it refers to the State safety programme (SSP). However, both SSP and SMS comprise four components associated with safety management systems. There is a slight difference between the components. SSP includes four components and eight critical elements (CEs), while SMS comprises the same four components with 12 elements, which are elaborated more in the following section.

2.4.3.2 The evolution of SMS theory (SMST)

Hale, Heming, Carthey, and Kirwan performed system engineering and quality management research in 1997 (Hale et al., 1997), and Moorkamp et al. (2014) produced the first journal paper to utilize the term system management safety theory (SMST) to explain the study Hale et al. (1997) had accomplished in outlining the functionality of an SMS. Initiated in the early 2000s

(Stolzer et al., 2018; Alvarez-Santus et al., 2018; Liou et al., 2008), an SMST is a complete, formal, process-based safety framework that contains an official definition of tasks, practices, actions, and procedures for risk management. SMST encompasses a variety of safety techniques, including safety management, safety culture, normal-accident theory (NAT), and high-reliability theory (HRT) (Moorkamp et al., 2014). The SMST focuses on an organization's administration and safety control procedures, intending to minimize operational uncertainty (Hale et al., 1997).

Regardless of the SMS theory, Dekker (2017) proposes that addressing and eliminating all environmental uncertainty to achieve safety is the everyday task of every organization member. Dekker (2017) argues further that safety management may not apply to all organizations and cannot substitute for strong technical methods. Hale's (2003) argument is earlier. However, it appears to concur with Dekker (2017) in debating that relying solely on an SMS to replace a fundamental knowledge of how human factors interact with operations will not boost safety. Adopting a safety programme without understanding or planning its integration into operations might lead to safety culture challenges within a company (Hale, 2003; Hale et al., 1997). Bottani, Monica, and Vignali (2009) found in a study on SMS adoption and advantages inside the industry that organizations implementing the formal SMS structure had higher measured safety performance values.

2.4.3.3 SMS components

SMS comprises four components and twelve elements (ICAO Doc 9859, 2018). Four components are 1) Safety policy and objectives (five elements: commitment, accountability, appointment, emergency planning, and documentation), 2) safety risk management (two elements: hazard identification and risk assessment), 3) safety assurance management (three elements: performance monitoring, change, and continuous improvement), and 4) safety promotion (two elements: training and communication), as listed in Figure 2. Aviation organizations have SMS manuals that include SMS components and implementation guidance and procedures.

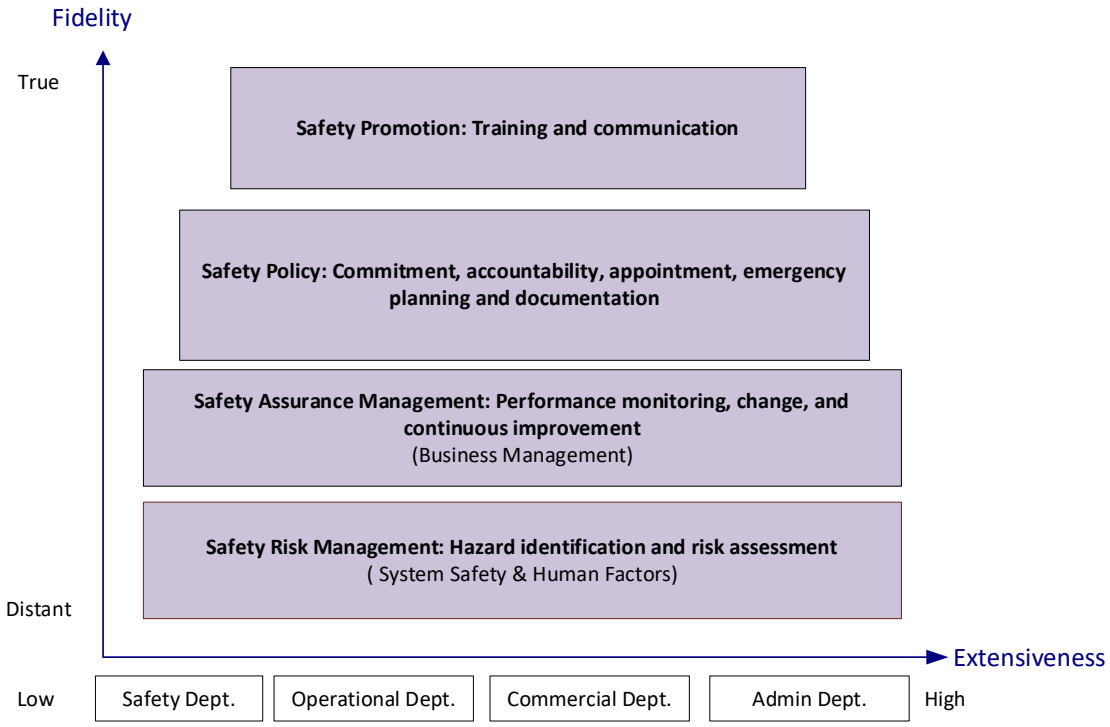

Figure 2: Four components of SMS

The first component of SMS is policy and objectives. Safety policy and objectives outline the essential role that top-leadership commitment plays in effectively implementing SMS in an organization (ICAO Doc 9859, 2018; Paries et al., 2018). Safety policy outlines the objectives, assigns responsibilities, sets standards, and outlines senior management's commitment to the organization's safety performance to its employees (FAA Advisor Circular_AC120-92A, 2010).

The management of an organization that supports SMS by establishing policies and safety standards is crucial to the foundation of SMS implementation. The policy developed by management should set the organization's direction and guiding safety principles. The policy should improve communication with staff regarding the management's commitment to enhancing safety. Simply stated, a safety policy should include management's commitments to implement the SMS and management guidance for safety objectives. Safety policy describes the organization's overall approach to safety, while safety objectives should specify the desired outcomes the SMS is trying to achieve.

The second component of SMS is safety risk management (SRM). A key philosophy within SMS is to manage risk proactively. Safety risk management seeks to identify hazards and systematically assess the risk associated with those hazards. Risk is considered to have two components: the likelihood of an occurrence and the severity of the occurrence as it relates to a threat (FAA_AC 120-92A, 2010). Controls are then put into place to lower the risk to an acceptable level. After risk is mitigated, it is essential to monitor the mitigation of the risk through its entire life cycle (ACRP, 2009). SRM establishes an organization's way of fulfilling its commitment to consider risk in its operations and to reduce it to an acceptable level (FAA, 2009).

The third component of SMS is safety assurance (SA). The AC120-92A (FAA, 2010, p. 8) defines safety assurance as "a formal management process within the SMS that systematically provides confidence that an organization's products/services meet or exceed safety requirements." The component includes self-auditing, external auditing, and safety oversight. Safety assurance aims to ensure that management's policies, procedures, and activities to improve safety are effective (ACRP, 2009). safety assurance provides the tools necessary to accomplish data collection and analysis to facilitate continuous improvement.

Safety assurance provides an organization with the necessary processes to ensure confidence that the system is meeting the organization's safety objectives, performance targets, and risk controls developed under effective SRM (ICAO Doc 9859, 2018). The synergy between SRM and SA hinges on continuous monitoring and improvements of safety processes through active identification of hazards, collection, data analysis, and risk assessments (ICAO 9859, 2018; Remawi et al., 2011; Stolzer et al., 2016). Robust organization-wide safety design, which feeds the safety assurance process, requires a complete understanding of all processes, employee functions, and other internal and external forces (Arendt & Adamski, 2016).

Figure 3 shows the synergy between SRM and SA processes as part of the SMS design and performance processes, and it also provides a decision-making framework for SMS. SRM and SA functions are highly related to one another. Initial risk assessment and hazard identification are provided by the SRM function(design). Organizational risk controls are created, and when it is decided that they can reduce the risk to an acceptable level, they are operationally implemented. The SA function (performance) ensures that the risk controls are being used and that they are still achieving their intended goals. The SA function also enables evaluation of the requirement for new controls as a result of modifications to the operational environment.

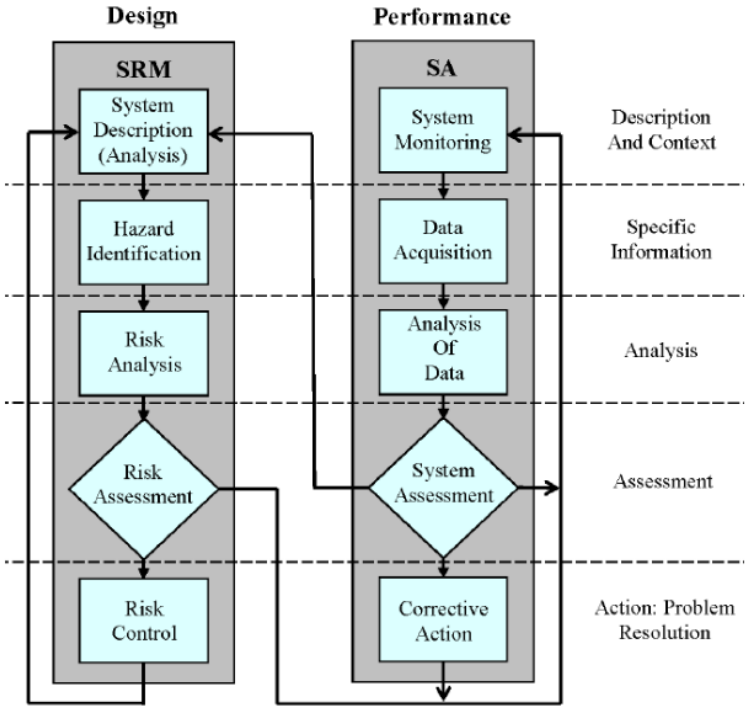

Figure 3: SRM and SA synergy for SMS design and performance process (Source: FAA, 2015)

The fourth and final component of SMS is safety promotion. The purpose of safety promotion is intended to support the development of a strong safety culture. Tools should be in place to help facilitate the transfer of critical information regarding hazards and their associated risks to individuals within the organization. Training, education, and other means of communication are key elements of safety promotion (ACRP, 2009).

The safety promotion component of SMS ensures that personnel have a solid foundation regarding their safety responsibilities, the organization's safety policies and expectations, and familiarity with reporting procedures (Bottani et al., 2009; ICAO Doc9859, 2018). Safety promotion also focuses on effective safety training and education within the organization. Safety promotional efforts must ensure expedited and clear organization-wide communication of tangible outcomes of the SMS (ICAO Doc 9859, 2018).

Another key outcome of an effective SMS is the promotion of a positive safety culture (informed culture, flexible culture, reporting culture, learning culture, and just culture), which is a product of the values and actions of the organization's leadership, as well as the results of organizational learning (FAA, 2008; Adjekum, 2014). Safety culture requires "visible" and well-articulated direction in the form of pragmatic safety policies from senior leadership in the organization (Chen & Chen, 2012; Marketwatch, 2021; FAA AC120-92A, 2009; Fernandez-Muniz et al., 2007; Hale et al., 1997). Conversely, the type of safety culture inherent in the organization may have an impact on the successful implementation of SMS (Chen & Chen, 2012; Gordon et al., 2007). A strong safety culture is an integral part of SMS. An organization cannot have a successful SMS without the existence of a strong safety culture (FAA AC120-92A, 2010); invariably, a strong safety culture helps in the development of SMS (Stolzer et al., 2008). A resilient safety culture can also be sustained by the effective implementation of SMS, which is a formal, top-down, organization-wide approach to managing safety risk and assuring the effectiveness of safety risk controls (Akselsson et al., 2009; Stolzer & Goglia, 2015). Moreover, SMS outputs will promote the growth of a positive safety culture (FAA, AC120-92A,2010).

In brief, all four of these components must exist and be executed for an effective SMS to exist within an organization. All four components rely on the existence and effectiveness of the other components. To sum up, the comprehensive SMS will help ensure that service providers will be capable of:

1. Receiving safety input from internal and external sources and integrating that information into their operational processes.
2. Establishing and improving organizational safety policy to the highest level.
3. Identifying, analyzing, assessing, controlling, and mitigating safety hazards.
4. Measuring, assuring, and improving safety management at the highest level.
5. Promoting an improved safety culture throughout their entire organization and
6. Realizing a return on SMS investment through improved efficiency and reduced operational risk.

SMS is a complex framework. Among brief reviews of last decade's SMS studies (See Table 6), the top three study areas are SMS implementation, SMS measurement, and safety performance. The SMS implementation aspect also includes in-depth studies on each SMS component, such as risk management and economic benefits of SMS implementation decisions, and the organizations

with a TQM background most likely to adopt the SMS framework (Alvarez-Santos et al., 2018). The reviews from these top three aspects are elaborated on in the following sections.

2.4.3.4 SMS implementation

SMS implementation has the following characteristics:

1. SMS requirements favour a phased implementation process. (FAA, 2010).
2. According to the performance-based approach, there is no one-size-fits-all SMS system. The diffusion is allowed (ICAO Doc 9859,2019; Kelly, 2017).

Safety implementation has caught great attention in aviation safety studies. At the early stage, Dijkstra (2006) claimed that the effectiveness of an SMS implementation is not yet substantiated by scientific research since the SMS standards and guidance include components rather than providing the method of how to implement it. He provokes the integration of safety, quality, and security into the Enterprise Risk Management (ERM) framework, like resilience engineering, which may define the functional structure of an SMS in order to facilitate SMS implementation in the industry.

Robertson et al. (2014) use the case of SMS development and implementation at Federal Aviation Regulations (FAR) Part 139 airports across the United States to address the reason some airports have chosen not to implement SMS. The study shows that many survey respondents are not willing to engage in the development and implementation of SMS until the FAA provides further guidance and resources or mandates SMS adoption.

Ruwantissa (2014) emphasizes that harmonization in this setting necessitates procedural and practice uniformity because not all aviation system block upgrades (ASBU) should be implemented at the same time. They must be prioritized based on the situations, locations, and timelines for implementation (Ruwantissa, 2014).

Moreover, in the discussion of SMS implementation, safety culture played an important role, as Gill and Shergill (2004) demonstrated that organizations prioritized workers' safety duties over creating effective safety management systems and promoting a good safety culture when it came to ensuring safety. In order to make the maintenance system function, aircraft maintenance engineers appeared to be devoted to standards, operating procedures, and effective organizational processes. Surprisingly, pilots believed that luck played a significant role in their safety. Overall, the data show that the aviation industry as a whole has to do a lot more to enhance the current safety culture.

Gerede (2015) also identified that the biggest impediment to the SMS's success had been highlighted as 'simply cultural' issues. It was projected that because these issues hampered the reporting process, they would negatively influence information acquisition within an organization, organizational learning, predictive tool efficiency, and proactivity.

Rasmussen (1997) suggests that despite the essential role of senior leadership in any safety initiative, a classic top-down approach might not provide the flexibility needed to work in a dynamic situation where operational flexibility may be required. Without a social-technical development approach, organizations that do not emphasize employee social interactions or value

identifying risk-prevention opportunities to improve the program's operation will not prosper (Alvarez-Santos et al., 2018). Chen and Chen (2012) also suggest that employee perceptions of the organization's SMS program affect their overall decision, and successful SMS practices directly relate to the safety self-talk of each member, impacted by the actions of senior management. An empirical SMS framework, as applied in aviation, may hold potential as the bedrock for commercial space operations and augment the existing commercial space sector's safety procedures and processes.

For a pragmatic implementation of SMS, senior leadership should ensure that local SMS approaches are tailored to fit the organization based on the complexity, scale, and scope of operations (ICAO Doc 9859, 2018). In the U.S., the SMS requirements in FAA 14 Code of Federal Regulations (CFR) part 5 apply to a wide array of types and sizes of aviation service providers with varying operational complexities (FAA, 2021). From a pragmatic perspective, SMS requirements from the FAA are designed to be scalable and provide flexibility, enabling service providers such as Part 121 commercial airlines to integrate safety management practices into their unique business models (FAA, 2009). An essential determinant of a service provider's SMS scope is the size and complexity of the operations to be covered, the volume of data available, the size of the employee workforce, and the resources needed to manage the organization (FAA_14 CFR, 2021).

The key pillars of SMS, namely, safety policy, safety risk management, safety assurance, and safety promotion, are the same regardless of the size of the organization, even though 14 CFR Part 5 allows service providers of different sizes to meet those requirements in different ways (FAA14 CFR, 2021). Finally, regardless of size, service providers may use existing systems, programs, and resources to document and track safety issues to resolve and enhance a proactive safety culture (ICAO Doc 9859, 2018; FAA_14 CFR, 2021; Chen & Chen, 2012). Currently, there are no formal SMS mandates for general aviation, ground handling service providers, and commercial space licensees, but any future mandate can be tailored to fit the complexity, scale, and scope of operations (Federal Register, 2020).

In terms of SMS implementation status at the global level, the ICAO Universal Safety Oversight Audit Program (USOAP) has the privilege of performing SSP audits on State CAAs. Since 2010, ICAO has started to audit contracting States, and the results show that 187 out of 193 Member State CAAs have adopted SMS, accounting for 97%. Six states have not yet adopted SMS. However, the implementation scores of 187 States shown in the audit report drastically vary, ranging from the lowest, 1.59%, to the highest, 99.63%, with an average of 74.1%.

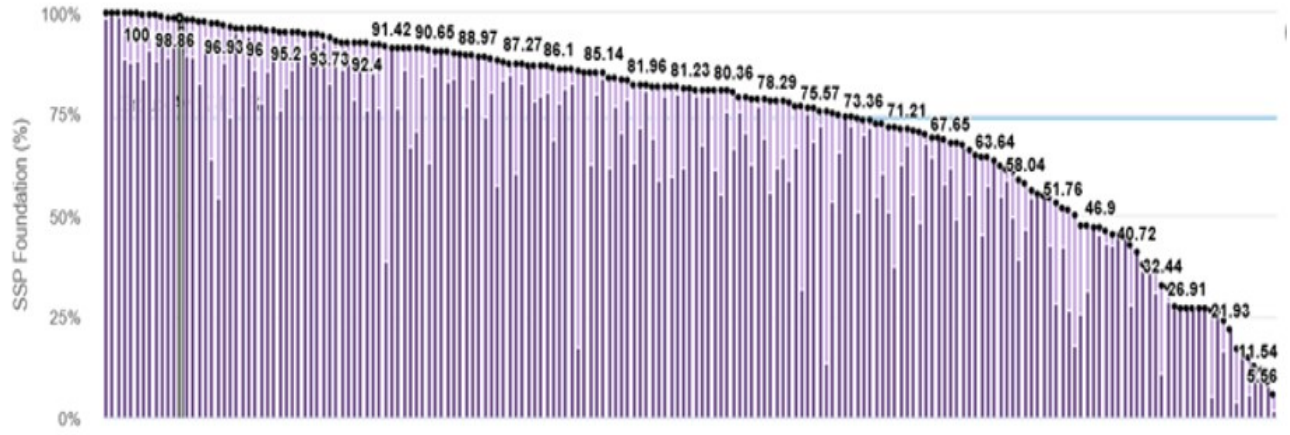

Figure 4: States CAA SMS_SSP implementation Status (Source: ICAO iSTAR, 2019)

The scores are based on the ICAO USOAP audits program, which focuses on a state's effective implementation of a safety oversight system. USOAP audits use a set of protocol questions (PQs) as a standardized tool to assess the eight critical elements (CE) and four components of the state safety programme (ICAO, 2023). It is one kind of approach for the evaluation of SMS in the global aviation community. After a decade of implementation, SMS measurement is currently a hot topic. The following section depicts the current status of SMS measurement.

2.4.3.5 SMS measurement

Implementation methods, evaluation approach, and safety culture highly impact the success of SMS implementation. However, the method of measuring effective implementation has not been well studied in the last decades. From the systematic review of SMS in this research, only two articles attempt to explore the methodology used to measure SMS implementation.

Yeun et al. (2014) investigated the problems with measuring the effectiveness of SMS to examine the issues and challenges faced by an aviation authority with the implementation of SMS for airline operations in Australia as a case study and to verify the use of SMS audit findings in creating a safety profile. He emphasizes that the usual way of evaluating an SMS through audits may not be the best option. No further study has been undertaken in Australia to discover a more rigorous technique for evaluating the efficacy of the present SMS framework almost 15 years after the INDICATE model was trialled (Thomas, 2012). Globally, there are also relatively few studies, with the exception of the Airline Safety Index (Chang & Yeh, 2004) and the SMS Measurement Method scale (Chen & Chen, 2012). As a result, each ICAO Member State must establish a mechanism that can evaluate and analyze the efficiency of its own SMS architecture.

Stolzer et al. (2018) also points out that since organizations must deploy SMS frequently at a high cost, a reliable and acceptable method of monitoring SMS effectiveness must be developed. His study aims to create a methodology for measuring and evaluating SMS efficacy. His study shows that Data Envelopment Analysis (DEA) models may be created to assist firms in determining the success of their SMS and how to enhance SMS-related performance.

In 2020, the Safety Management International Collaboration Group (SM ICG) promoted a common understanding of the principles and requirements of the Safety Management System (SMS)/State Safety Program (SSP), facilitating their application across the international aviation community. ICG has developed an SMS assessment tool to measure effective SMS.

The assessment tool requires interaction with all SMS stakeholders, such as CAAs, airlines, ANSPs, airports, and manufacturers in that State, including face-to-face discussions and interviews with a cross-section of people as part of the assessment. This group study provides the assessment tool based on a desktop review of the documentation that focuses on whether the expectations of compliance and performance are present and suitable (See Table 7). Once the desktop review has been satisfied, evidence should be collected to assess whether the expectations are met (the tool uses the terms Present, Suitable, Operating, and Effective). Finally, an assessment should be made to determine if an expectation is being met effectively. This method was promoted by ICAO and started to be recognized and adopted by many States around the world. I have incorporated this method in the SMS measurement in the later section.

ICG Assessment	Initiating	Present and Suitable	Operating	Effective	Excellence
State Safety Program (SSP)	The SSP is at the implementation stage.	All the main elements of the SSP are in place.	The systems and processes of the SSP are operating.	The SSP is working in an effective way and is striving for continuous improvement.	The State establishes, embraces, and shares its best practices.
State Safety Risk Management	State safety risk management processes are not fully developed.	A State safety reporting system(s) is in place and there is a process for how risks are assessed and managed.	State hazard and risk registers are being built up and risks are starting to be managed in a proactive manner.	The State is continuously identifying hazards, understands its biggest risks, and is actively managing them. This can be seen in their safety performance. Safety Risk Management is proactive.	Key personnel throughout the State are aware and understand the risks relative to their responsibilities and are continuously searching out new hazards and risks and re-evaluating existing risks.
Safety Policy and Objectives	Policies, processes, and procedures are not fully developed.	There are policies, processes, and procedures in place that detail how the SSP will operate.	There is a safety policy in place and senior management is committed to making the SSP work and is providing appropriate resources to safety management.	Senior management is clearly involved in the SSP, and the Safety Policy sets out the organization's intent to manage safety and is clearly evident in the day-to-day operations.	The State is a leader within the aviation system and embraces best practices.
State Safety Assurance	State Safety Assurance activities, including safety performance indicators (SPIs) are not fully developed.	Initial SPIs linked to State safety objectives have been identified and there is a change management process in place.	The State has established SPIs that it is monitoring and auditing. The State is assessing its SSP and its outputs.	The State assures itself that it has an effective SSP and is managing its risk through audit, assessment, and monitoring of its safety performance.	The State is continuously assessing its approach to safety management and is continuously improving its safety performance and seeking out and embracing best practices.
State Safety Promotion	State Safety Promotion activities are not fully developed.	There is a State safety training program and the means to communicate safety information is in place.	The State has trained its personnel and has several mediums for Safety Promotion that it uses for passing on safety information.	The State puts considerable resources and effort into training its personnel and publicizing its safety culture and other safety information and monitoring the effectiveness of its Safety Promotion.	In addition, the State provides training and Safety Promotion to its contracted service providers and assesses the effectiveness of its Safety Promotion.

Table 7: Practice type associated with ICG SSP assessment model. (SM ICG, 2020)

From management and practice literature, based on notions of diffusion as the transmission of ideas (Katz, 1999) and the literature on how knowledge is transmitted and generated, Ansari et al. (2010) study provides another tool to measure practice implementation. They explore a conceptual framework of fidelity and extensiveness to measure practice adaptation shifts through technical, cultural, and political fit (or misfit) between diffusing practices and adopters (see

Figure 5). During implementation, practices are constantly reconfigured to make them relevant and appropriate for a particular organizational context (Roberston et al., 1996). Kostova and Roth (2002) have shown that practices are adapted and diffused to the local context in the implementation phase.

1. Fidelity dimension in the true implementation

The fidelity dimension is concerned with the precision of the practice being applied and how "true" or "distant" this version of the practice is from previous adapted or prototypical versions (Ansari et al., 2010). "Fidelity refers to whether the adapted practice resembles or deviates in kind from the features of the previous versions of the practice as it is transmitted" (Ansari et al., 2010, p. 71). While Yuan et al. (2007) use the term correctness in this context, Ansari preferred the term fidelity since it does not presume the normative nature of the prototype behaviour. Fidelity relates to the breadth and meaning of the practice being adopted and adapted in terms of how "true" or "distant" this version of the practice is in comparison to earlier adapted versions. Thus, if late adopters adopt a practice (more or less), it is relative to how much early adopters adapted the practice (more or less) and not relative to a prototype form. Nonetheless, the concept of a prototype is important for mapping the topography of the potential variants of an emerging practice across time. Therefore, prototypical practices may be used to measure the fidelity of adaptation processes relative to the original prototype and later variants (Lewis & Seibold, 1993).

2. Extensiveness dimension in high implementation.

The extensiveness dimension determines if the degree of adopted practice is low or high range compared to the previous or prototypical version, which is concerned with the scope of the practice being applied. This idea is based on research that reveals that adopting businesses commonly employ either less extensive or more extensive versions of a spreading practice (Westphal & Zajac, 2001; Hays, 1996; Mooney & Lee, 1999). Extensiveness in adaptation, therefore, shows the degree to which the adapted technique requires extensive or limited implementation efforts (Mammon, 2007). This implies that the concept of extensiveness about the "dosage" of the implemented practice — low or high — is closer to the concept of implementation scale. For example, e-business deployment might range from being deployed in selective departments to being applied across the whole organization's sections (Wu et al., 2003).

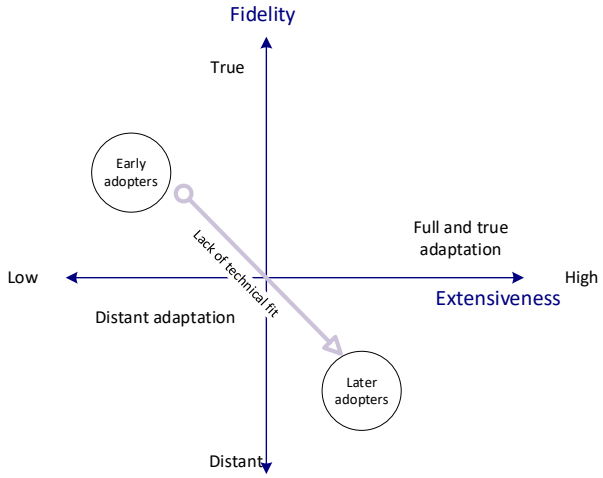

Figure 5: Patterns of practice adaptation (Source: Ansari et al., 2010)

To summarize, from Ansari's study on fidelity and extensiveness of two dimensions of practice to the INDICATE_SMS model (Thomas, 2012), Data Envelopment Analysis (DEA)_SMS model (Stolzer et al., 2018) to SMS_ICG study group's present, suitable, operational, and effective (PSOE) approach, the journey has been well started, but there is still a long way to explore. The latter three approaches have been well-discussed in the aviation community. The model of fidelity and extensiveness has not yet been incorporated with the SMS concept in aviation organizations. The nature of aviation regulation and practice is comprised of establishment and implementation, which is suitable for measuring fidelity and extensiveness. Fidelity focuses on policy and procedure establishment, and extensiveness focuses on extent implementation. This approach is explored more in the later research model section 3.2.1.

2.5 Safety performance

2.5.1 Safety performance evolution

Aviation is a key industrial sector for global economic and cultural development. Safety is essential for its healthy growth and has always been emphasized as a top concern. It is not by chance; unlike other modes of transportation, the repercussions of risk situations in aviation have frequently resulted in disasters, large-scale casualties, and negative social influence and reputation. A solid approach to safety has to be created in order to maintain interest in aviation development and benefit society. The method related to safety and protection has evolved numerous times throughout history, beginning with a grasp of aircraft technology and difficulties at the dawn of commercial air transport and culminating in a systematic point of view on the whole aviation system today (ICAO Doc 9850, 2018, Lalis & Vittek, 2014).

Progress in aviation safety may be categorized by four methods that generally correspond to activity eras. The methods are enumerated below and depicted in Figure 6 (ICAO Doc 9859, 2018).

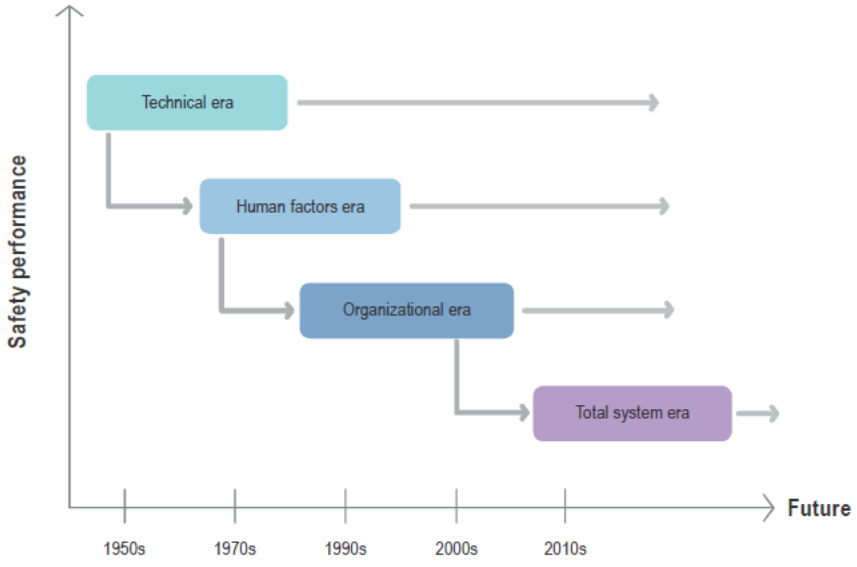

Figure 6: The evolution of safety (ICAO Doc 9859, 2018)

Technical phase: From the early 1900s through the late 1960s, aviation evolved as a mode of mass transportation in which safety shortcomings were first attributed to technical causes and technological failures. Therefore, safety efforts are centred on examining and enhancing technological elements, i.e., aircraft frames, avionics systems, aircraft navigation systems, and communication systems (Balmus, 2016). Since the first aviation accident with casualties in 1908, the modified Wright Brothers aircraft crashed during a demonstration and seriously injured the pilot and killed the observer. Many efforts have been put into improving safety in the sector. Since its creation in 1945, ICAO has focused on making aviation the safest transportation mode. In the 1950s, technical advancements led to a steady drop in accident frequency, and safety systems were expanded to include regulatory compliance and supervision.

The difficulty of sustaining a high level of performance is continual and challenging. Numerous significant safety advances have resulted from focused work on specific challenges, which have led to technology-supported solutions. Accidents involving controlled flights into terrain and increased risk from near misses in congested airspace, for instance, have been significantly mitigated by the development and adoption of ground proximity warning systems and collision avoidance systems, which identify impending safety risks and assist flight crews in mitigating them. Enhancements in communications, navigation, and surveillance technology, as well as enhanced onboard meteorological data, have assisted airlines in recognizing and avoiding or minimizing flight safety concerns.

Human factor phase: By the beginning of the 1970s, the incidence of aviation accidents had decreased dramatically as a result of technological advancements and improved safety rules. The focus of safety efforts was expanded to include human aspects, such as the "man-machine interaction," making aviation a safer means of transportation. Despite investments in mistake prevention, human factors continue to be regarded as a frequent cause of mishaps. Boeing's findings have mentioned that the crew is involved in about 70% of fatal accidents (Greenberg et al., 2005). Human factors tended to prioritize the individual over the operational and organizational contexts. Not until the early 1990s was it recognized that individual's function in a complex environment with various elements that might influence their behaviour.

The SHELL model (whose name is taken from the initial letters of its components, Software, Hardware, Environment, and Liveware) was initially devised by Edwards in 1972, with a modified graphic illustrating the model created by Hawkins in 1975. The SHELL model is well-known and useful for illustrating the interaction of systems with humans, and it emphasizes the need to consider human factors as an integrated part of safety risk management (ICAO Doc 9859, 2018).

From the safety performance indicators perspective, the human factor was involved in the frequency and severity of events. Venkataraman (2008) suggested that the average human-hour unit lost, which is the hours or days lost due to each occupational accident/incident, should also be included in safety performance indicators. Hansen (2006), in his universal model for safety excellence, found that poor leadership and poor human relationships are strong predictors of poor safety performance.

Organizational phase: In the mid-1990s, safety began to be seen from a systemic viewpoint, incorporating organizational aspects in addition to human and technological ones. The concept of an "organizational accident" started to be presented in the regulation and guidance (ICAO Doc 9859, 2018). This approach examined the influence of corporate culture and policies on the efficacy of safety risk controls. In addition, companies were able to monitor known safety concerns and identify developing safety trends through the routine collection and analysis of safety data employing reactive and proactive techniques. These advancements gave the knowledge and basis for the present safety management strategy.

Since early 1990, In the causation, investigation, and prevention of industrial accidents, the Swiss-cheese model (SCM) developed by psychologist James Reason has been a standard paradigm. Its effectiveness in several sectors, i.e., aviation, marine, healthcare, defence & nuclear, oil & gas, rails &roads, has made it the vector for a new safety science paradigm: the organizational accident (Reason, 1990, Larouzee & Guarnieri, 2015). Reason promotes integrating reactive and proactive approaches to safety analysis in what he calls the interactive phase of system operations, when safety, operational, and management systems interact. This conceptual framework has been the foundation for "Swiss cheese" models of safety management, in which the majority of incidents are attributed to numerous system failures. In Reason's work, in order for an accident to occur, all of the holes (failures in safety defences) in numerous slices of Swiss cheese must align (Reason, 1990, 1995, 1997, 2000, 2005).

Edkins (1998) addressed a new proactive airline safety program called INDICATE (identifying Needed Defences In the Civil Aviation Transport Environment) that has been applied within the Australian regional airline industry. His study suggests that the INDICATE can have a positive impact on airline safety performance, particularly by increasing staff confidence in how safety is managed, increasing staff willingness to report safety hazards and incidents, enhancing organizational safety culture, and decreasing staff perceptions of the severity and likelihood of safety hazards occurring in airlines.

Total system: Since the turn of the 21st century, several States and service providers have adopted the safety strategies of the past and reached a higher degree of safety maturity. They have begun deploying SSP or SMSs and are enjoying the safety advantages. Safety systems have concentrated primarily on individual safety performance and local control, with little attention to the broader context of the aviation system as a whole. This has led to an increased appreciation for the complexity of the aviation system and the various entities that contribute to aviation safety. There are several instances of mishaps and situations in which the interfaces between organizations contributed to disastrous results.

Since the early 2000s, the aviation safety risk management model has been widely and profoundly investigated and reimagined. Safety performance relies on the development of safety assessment. Typically, safety assessments may be separated into two categories: qualitative and quantitative.

1. Methods of qualitative analysis: FMEA (failure modes and effects analysis) (Banghart et al., 2018) and Hazop (hazard and operability analysis) (MOD 0058,1996) are utilized to discover causal linkages between component failure and system loss (Ortmeier et al.,

2006). Bowtie and event tree analyses are also introduced into the qualitative risk management framework (Insua et al., 2018).

2. Methods of quantitative analysis:
    - The Bayesian belief network (BBN) model (Greenberg et al., 2005) emphasizes the influence of airline policy and societal behaviour patterns on pilots within the piloting system. BBN can be used to bring most aviation safety critical elements into a common quantitative safety assessment despite the unique problems posed by the very low probability of accidents.
    - Gudemann and Ortmeier (2010) proposed probabilistic model-based safety analysis methods to answer the probabilities of any of the system's hazards and how different types of failures, in particular pre-time and per-demand, are.
    - Another popular quantitative model that has been discussed more in the last decade is the Assessment tree method (ATM). The ATM is a quantitative assessment of safety culture and enables the determination of the key aspects of safety culture in the qualitative analysis of accidents (Warszawska and Kraslawski, 2016).
    - Chen and Li (2016) used the DAHP model (Delphi method and Analytic Hierarchy Process) to take full advantage of expert knowledge and quantitative calculation. The DAHP model estimates the weight of each SPI, while its score is monitored and measured quantitatively with the two values of the standard deviation and average values of the preceding historical data points.
    - Due to aviation data being volume, velocity, and variety, safety performance indicators need to be constantly revised. Lalis (2017) proposes the use of time-series analysis and modelling to predict and quantitatively analyze the safety performance index. Moreover, Panagopoulos et al. (2017) developed a lean-sigma framework to improve aviation safety performance. This framework provides guidance on how organizations could design, implement, and use a proactive, performance-based measurement tool for assessing and measuring safety performance at the sigma(σ) level, a statistical measurement unit.

3. Method of qualitative and quantitative analysis:
    - FTA (fault tree analysis) (Vesley et al., 2002),
    - Apart from the above qualitative and quantitative risk management model used in industry, scholars have also proposed a systematic methodology for risk management in aviation safety based on the principle of decision and risk analysis at the state level. Its main advantages are providing an integrated, coherent framework for safety resource allocation and taking advantage of all available information, both from data and expert judgment (Insua et al., 2018). The Toolkit for ATM Occurrence Investigation (TOKAI), created by EUROCONTROL and aligned with EU and ICAO rules, enables systematic and standardized reporting by Air Navigation Service Providers (ANSPs). Patriarca et al. (2019) started with the theoretical advantages of a structured strategy for learning from events and the operational application of TOKAI in accordance with EU and ICAO regulations. They provided examples of data-driven studies and a comprehensive safety dashboard that may be created with TOKAI data to enhance the safety Intelligence

of decision-makers and enable incremental proactive risk management for holistic aviation safety performance.

In brief, in the total system era, based on Reason's model, most stakeholders have implemented SMS in regulator, industry and academia sectors, and the analysis methodology in its two components, safety risk management and assessment, has been well studied for a decade. Since there is no mandatory application of one method, such a topic will continue to draw the attention of scholars, and practitioners will choose the most appropriate method for their implementation. In this research, I am more concentrated on qualitative and quantitative safety performance, which leads to the following lagging and leading indicators in safety performance management.

2.5.2 Safety performance indicators

In October 2008, the Organization for Economic Cooperation and Development (OECD), a multinational organization that includes 30 nations, issued Guidance on Developing Safety Performance Indicators for Chemical Accident Prevention, Preparedness, and Response. The Guidance consists of two documents, one aimed at industry and the other at government agencies ("Public Authorities") and the general public (especially communities located near hazardous sites). The purpose of that Guidance is to enable each target group to evaluate their own activities, establish if their efforts to promote chemical safety are achieving their objectives, and indicate where more action is required. The 2008 Guidance consists of two basic components (Jennings & Schulberg, 2009):

1. a step-by-step strategy for building safety performance indicators programs and
2. a menu of potential indicators that address a variety of concerns associated with accident prevention, readiness, and response.

Lagging and leading indicators

In Annex 19 and Doc 9859 in 2009, ICAO also defines the two most common categories used by contracting States and industrial service providers to classify their safety performance indicators (SPIs) as lagging and leading. Lagging SPIs measure events that have already occurred. They are also referred to as "outcome-based SPIs" and are normally (but not always) the negative outcomes the organization aims to avoid. The lagging indicator includes fatality, accidents, serious incidents, etc. Accidents refer to "a person is fatally or seriously injured as a result of or a person is fatally or seriously injured as a result of, or the aircraft is missing or is completely inaccessible.:" (ICAO Annex 13,2016, p.1-1), and serious incidents refer to "An incident involving circumstances indicating that there was a high probability of an accident and associated with the operation of an aircraft which, in the case of a manned aircraft, takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, or in the case of an unmanned aircraft, takes place between the time the aircraft is ready to move with the purpose of flight until such time as it comes to rest at the end of the flight and the primary propulsion system is shut down." (ICAO Annex 13, 2016, p. 103). Since 2004, the accident rate has been relatively steady, with no significant improvement, averaging between 0.1 and 0.5 fatal accidents per million flights and fatality and serious incident rates, which have traditionally been used to evaluate an organization's safety performance (IATA safety report, 2022). However, such lagging indicators have ceased to be a relevant gauge of safety performance as safety has increased, and the number of accidents and the serious incident rate has decreased.

Leading SPIs refers to implementing processes and inputs to improve or maintain safety (ICAO doc 9859, 2018). They are also known as “activity or process SPIs” as they monitor and measure conditions that have the potential to lead to or contribute to a specific outcome. Leading safety indicators are defined by the UK's Health and Safety Executive (HSE, 2006) as measurements of processes or inputs required to achieve the intended safety results (e.g., safety climate and hazard reports). As a result, leading safety indicators give a more proactive means of gaining insight into an organization's safety performance and identifying areas where safety improvements should be made.

Scholars in safety studies divided organizations into two categories, namely, the high-risk industry and the high-reliability industry. High-risk industries are those in which failures in sophisticated human technology systems might have a catastrophic effect on performance (Shrivastava, 1986). High-reliability organizations (HROs) are those that are successful in avoiding disasters in high-risk contexts (Roberts and Rousseau, 1989). Given the low number of incidents that occur in HROS, these organizations have begun to investigate "leading indications" of safety in an effort to increase safety even further. Therefore, safety culture and safety climate are leading indicators that have caught the great attention of scholars.

Safety culture and safety climate in leading indicators

Since leading indicators are mainly qualitative indicators, which are not easy to obtain in organizations, O’Connor et al. (2010) addressed that safety climate is among the most often utilized indicators of safety in non-aviation HROs. The term "safety climate" was used by Zohar (1980) to describe a collection of employee perspectives regarding their work environment. Employees' views, attitudes, and beliefs regarding risk and safety are referred to as the "safety climate" (Mearns and Flin, 1999). It is a "snapshot" of the organization's present safety culture expression. The usage of the phrases "culture" and "climate" and whether they reflect the same or separate notions has been a source of discussion in the literature.

According to Kalteh et al. (2021), the terms "safety culture" and "safety climate" have a tenuous relationship and have been used interchangeably in some research. However, many studies specifically identify safety climate and culture as significant concepts for describing workplace safety situations (Griffin & Neal, 2000). Various definitions of safety culture and safety climate have been documented in the scientific literature, but no one definition has been agreed upon by researchers. Some indicators' definitions are preferred over others in this regard. In a report on the safety of nuclear installations, one of the most popular definitions of safety culture was given: "An organization's safety culture is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to and status and proficiency of the organization's health and safety management." (ACSNI Study group, 1993, p.268; Lee & Harrison, 2000; Zohar, 1980). The safe climate is a picture that is more superficial than safety culture. According to Gadd and Collins (HSL, 2002), safety culture has a more profound meaning than safety climate. Safety culture refers to a set of beliefs in the organization, while safety climate is the effects of environmental and organizational factors on these beliefs (HSL, 2002; Mearns & Flin, 1999).

Gao et al. (2015) studied safety culture and climate. The association with safety performance has been explored before (Zohar, 2000), and some research has shown a link between climate surveys and other safety metrics. For example, Varonen and Mattila (2000) found that perceptions of

safety climate were connected to workplace safety levels and the organization's safety measures. They discovered that companies with lower-than-average accident rates had higher safety climate scores. O'Connor et al. (2010) demonstrated that the accident rate in commercial aviation is too low to provide a sufficiently sensitive measure of safety performance. Therefore, safety culture and climate become leading indicators for measuring the construct of safety performance. Kalteh et al. (2021) pointed out that safety culture and climate have been hot issues in recent decades due to their influence on safety outcomes, such as injury and death rates and safety performance. The goal of safety culture and climate as a component of organizational culture and climate is to create a good environment where employees are aware of hazards and accidents are avoided (Choudhry et al., 2007; Zohar, 2002). Quite a few research have looked at the link between safety culture and climate and their impact on safety outcomes, including safety performance (Zohar & Luria, 2005; Smith-Crowe et al., 2003). Several studies have looked at the significance of safety and safety culture in enhancing a company's safety performance. There have been review studies in this field, but no review research that the authors are aware of has looked at the distinguishing elements of safety performance. Their study examines a great deal of research in order to assess the evidence linking safety culture and climate to improved safety performance.

Proactive and reactive approach

The relevance of analyzing safety performance to study the efficiency and identify dangers in the safety management system has been verified in recent years. Two types of safety performance evaluation instruments are available: reactive and proactive approaches. Reactive and proactive procedures have a negative and positive association with safety climate and safety culture, according to statistical findings in Kalteh et al. 's study (2021). The underlying assumption is that proactive measures that identify and eliminate risks before incidents or accidents occur will increasingly be the source of future safety improvements. In addition to standard inspection and investigation efforts, regulators will need to examine and monitor the programmes and systems now in place. Effectively, a mix of quality and auditing concepts is being used with the expectation that safety management will become more predictive with regard to safety concerns.

Federal Aviation Administration (FAA) emphasizes a proactive approach in an effort to detect and mitigate hazards (Dillingham, 2010).). Taking a proactive approach to improving aircraft safety is difficult (Roelen et al., 2008). Prospectively determining and evaluating risk entails recognizing the complicated chain of events typically linked with an aircraft disaster. Several ways have been explored over the years. These approaches include proactive causal models, which focus on anticipating problems that lead to accidents; collision risk models, which focus on the loss of separation between aircraft on the ground and in the air; human error models, which attempt to trace the series of reactions that result from an initial incorrect execution of an initial task; and third party risk models, which analyze the probability that a crashing aircraft kills or injures a third party (Netjasov & Janic, 2008).

Extending Reason's views, Lofquist argues that the use of standard safety measurements and traditional reactive and proactive analysis fails to convey how several components inside a complex aviation system may be to blame. "When accidents occur, we have a measurable indicator that things are not safe, but when nothing occurs, we have no such signal. We do not know if this is the result of well-functioning safety measures or good luck (Lofquist, 2010, p. 1523).

Aviation has traditionally depended on overlapping and interdependent systems to control safety and produce a safety margin. By concentrating on an accident's fundamental cause, organizational and management factors that led to the accident may be disregarded. Clearly, a complete approach to examining aviation safety, as proposed by Reason and Lofquist, may be extremely beneficial for developing safety measures and monitoring.

However, more conventional reactive analytic methodologies are still beneficial for identifying aviation sector segments with subpar safety performance relative to the rest of the industry. Important research possibilities exist in the production of firm-level behavioural data about safety investments, the disaggregation of incident data, and the improvement of data availability and quality regarding safety performance in specific locations and aviation segments.

Since its start, the safety of commercial flying has seen amazing advances. This achievement is even more remarkable in light of the industry's unprecedented global expansion, fueled by new technology, deregulation/liberalization/privatization, and global economic growth. This record is also the product of a coordinated effort by industry stakeholders over many years, including aircraft and engine manufacturers, airlines, governments, and regulatory agencies (Rodrigues & Cusick, 2012).

To summarize the abovementioned concepts, in SPIs, there are lagging indicators, such as fatality, accident rate, etc., which are quantitative in nature, while leading indicators are safety culture and safety climate, which are qualitative in nature in safety performance. From the responses' perspective, lagging indicators are more reactive, and leading indicators refer to more proactive actions toward safety risk management (See Table 9).

Attribute	**Safety performance**	
SPI	Lagging indicators	Leading indicators
Example	Fatality, Accident rate, Serious incident rate	Safety culture, safety climate
Response	Reactive	Proactive
Nature	Quantitative	Qualitative

Table 8: Summary of safety performance

2.5.3 SMS and safety performance

As the aviation industry's safety record improves, it has become increasingly apparent that the likelihood of an accident, especially fatality, is exceedingly low. This makes it more evident than ever that relying on post-accident assessments delivers only a limited picture of aviation safety. As a result, more emphasis has been placed on proactively determining how changes to the aviation system influence the likelihood of accidents. Reasons' model is the foundation for much of the effort and development of the safety management system (SMS). SMS is highly associated with safety performance, which has been the most focused area in SMS review in the last decade. 10 out of 27 articles in the previously mentioned SMS review studied the relationship between SMS and safety performance.

The FAA launched and implemented SMS pilot projects in 2007. Following the February 2009 tragedy of Colgan Airlines, the FAA was mandated by law to speed the implementation of the SMS programme. In the meantime, ICAO adopted SMS and promoted SMS best practices in the international aviation community in the same year. The overall objective in aviation was to develop an SMS that would demonstrate safety performance to comply with new regulations (Ulfverngren & Corrigan, 2015).

There has been global advocacy to shift from prescription-based safety management strategies among aviation organizations to a performance-based approach such as SMS to enhance operational flexibility and improve organizational safety culture (ICAO, 2013a; ICAO, 2013b). The shift has made regulators and those in charge of safety oversight, in particular, mandate SMS implementation for aviation service providers in their respective jurisdictions (ICAO, 2013b). Aviation service providers in the United States (U.S.), such as Part 121 commercial airlines, are mandated to have an SMS program (Electronic Code of Federal Registers. Part 5, 2015). However, Part 141, namely regulations for flight training institutions and flight schools in the United States, are not under any regulatory mandate to have an SMS program (FAA, 2015a).

George (2013) explored the economic benefit of SMS and noted that as safety increasingly becomes a cost liability for businesses, SMS should be viewed as a value-producing center rather than a regulatory compliance center. Although safety investment is always huge for air operators, they can never see the profit out of safety. The way of thinking about safe flights is profitable for airlines already.

Due to the consequences of emerging technology, increasing air traffic volume, and the new requirement for a Safety Management System, all stakeholders in the aviation sector are presently facing massive system changes. Simultaneously, the airline sector is under severe financial strain. As a result, there are no margins for error when it comes to adapting to and complying with these system modifications. Ulfverngren and Corrigan (2015) addressed that the success rate of organizational transformation in the industry has been observed to be low. They have developed the System Change and Operations Evaluation (SCOPE), a framework for evaluating change that emerged, called the Structured Enquiry (SE). They applied the integrated SCOPE to enhance the core functionalities of SMS and to provide complementary recommendations to the proposed enhanced SMS. Results show the benefits of combining SCOPE and SE in system change in aviation in order to encompass identified essential components for safety performance and increase the chances for a successful change.

The performance of the SMS operations at Taiwan's Taoyuan (TPE), Kaohsiung (KHH), and Taipei Songshan (TSA) international airports was assessed using a two-stage method in research conducted by Chang et al. (2015). The Analytic Network Process (ANP) was used in the first stage to obtain the weights and rankings of the SMS components and elements. The fuzzy Technique of Ordering Preference by Similarity to the Ideal Solution (TOPSIS) was then used in the second stage to rank and evaluate the performance of the components. The rankings of SMS weights of components from high to low are Safety risk management, Safety policy and objectives, Safety promotion, and Safety assurance. In stage two, they combined all evaluations of the components and ranked the above three airports with safety performance ranks. Although it is recognized that all four components are important in SMS, it is interesting to demonstrate the different weights of components from an airport perspective.

In terms of safety performance indicators, Ioannou et al. (2017) have emphasized a model of elements that may obstruct the effective SMS and the SPIs, according to interviews with aviation safety managers regarding safety procedures in their firms. The involvement of senior management, a lack of safety culture, and the impractical and fearful data collection approach may all play a part in the SMS's less-than-optimal performance. When these characteristics are present in aviation companies, they can impede or mislead an organization in designing their SPIs and, as a result, the SMSs' efficacy. Companies should employ leading and lagging safety performance indicators (SPIs) to assess their safety performance. The variables mentioned might be indicative of procedures used by other aviation service companies. Organizations that are aware of these impediments may be able to enhance their SPIs and SMS success.

Singh et al. (2019) used the structural equation modelling approach to explore the relationship between safety factors and safety performance. The safety factors include aircraft design and operational considerations, aircraft maintenance, aviation infrastructure, human aspects, environmental factors, and the safety management system. This study is based on data from 733 safety experts in aviation. The results of the study indicate that airlines can develop various policies and strategies to guarantee the safety of passengers because, among the various safety factors, aircraft design and operational considerations and aircraft maintenance were found to have a significant impact on SMS and human factors, while only environmental factors have a significant impact SMS. In addition, the moderating effects of multi-group origins in the relationship between the SMS and human factors and safety performance.

Civil aviation safety is especially essential since civil aircraft accidents can result in catastrophic injuries and fatalities. Safety performance management, as a basic component of a safety management system, is becoming increasingly crucial in boosting service providers' safety management efficiency. In order to set up a safety performance indicator system, Chen et al. (2021) developed a new risk assessment model based on four types of safety performance indicators found through the system: job analysis, event tree analysis, fault tree analysis, bowtie, and other methods. A case study of risk assessment utilizing the suggested model is provided for two airport departments that use safety performance management. The results illustrate that the operation risk of different departments can be assessed based on a safety performance indicator system.

Yiu et al. (2019) emphasized that evaluating the SMS quality and degree of achievement with the construction project's safety performance is vital. Facing low accident rates, they used proxies and a structural model to investigate the relationship between (i) SMS implementation and project safety outcome, (ii) SMS implementation and five motivation factors, and (iii) project safety outcome and six proxies. The motivation factors, including safety commitment by senior management, competency profiles, safety climate, project management, and safety requirements and incentives, all positively contributed to the improved safety outcomes of construction projects. Moreover, project management had the greatest impact on SMS implementation among all motivation factors. It is consistent with the expectation that effective project management could promote and enhance the likelihood of successful SMS implementation (Yiu et al., 2019).

Apart from the aviation industry, Elsebaei et al. (2013) pointed out that the construction industry is one of the most hazardous industries in the world. In his empirical studies with 309

respondents in Egypt, he presents a brief review of some of the most important safety management systems, such as Oregon OSHA and OTAR, in a better way of improving safety performance. In addition, his study elaborated on tools used to measure safety performance for a more accurate performance assessment. Due to a variety of contributing variables, poor safety performance is statistically the leading cause of accidents on construction sites (Elsebaei et al., 2013). Improving safety performance requires exploring prospective safety management elements. Khalid et al. (2021) investigated the relative relevance of major elements impacting Health and Safety (H&S) performance, as well as the reason for establishing a strong safety management system (SMS) that integrates all these aspects into a single framework. Their study employs an empirical research technique based on a survey of the literature and secondary data systematically acquired from peer-reviewed publications. They claim that effective safety performance can only be accomplished by effective SMS through six factors: (1) application of safety legislation, (2) leadership, (3) safety planning, (4) safety compliance, (5) performance measurement, (6) risk assessment, (7) safety inspection, and (8) Safety Culture. These six factors are interconnected and cannot be isolated; nonetheless, in order to significantly enhance the safety performance objective on construction projects, the priority allocated to factors impacting safety performance must be re-aligned and re-balanced.

In brief, safety performance has been incorporated into the third component of SMS, namely safety assurance. In this component the eighth element is safety performance monitoring and measurement. Therefore, safety performance has been managed during SMS implementation.

2.6 Conclusion

Through the analysis of these studies with the support of a brief systematic review of institutional theory, internal fit, SMS, and safety performance, the gap is evident to lie in six major areas:

1. Few articles mentioned interactive effects between institutional pressures and intra-organizational factors, such as self-interest or resource capability of organizations. A few articles indeed explored the interplay effect between institutional pressures with self-interest and institutional pressures with resource capability, respectively. Few studies have investigated the interplay between institutional pressures with self-interest and resource capability.

2. Institutional pressures have been analyzed in one country setting or multinational corporation to analyze institutional distance or pressures difference between host countries and home countries. There is a lack of analysis either in the global setting or in the aviation sector.

3. Safety management systems (SMS) as best practices have been applied in several industries, such as construction, transportation, and aviation. Most scholars have investigated the relationship between the four SMS components. Few studies have focused on how external or internal factors impact SMS implementation. No article has explored how the interactive force between institutional pressures and internal fit has an impact on SMS implementation.

4. Safety performance has drawn a great deal of attention in aviation safety research. However, the relationship between SMS and safety performance and the relationship among institutional pressures, internal fit, SMS implementation, and safety performance have not been profoundly investigated. Moreover, no articles have explored the impact of SMS's two dimensions (fidelity and extensiveness) on safety performance and the interactive effects of external and internal factors on these two dimensions.

5. Although qualitative safety performance indicators, such as safety culture, have been well discussed, few studies combine quantitative and qualitative safety performance indicators in empirical research.

6. Last but not least, few articles have conducted SEM empirical research either on institutional pressures, internal fit, SMS practice implementation, or safety performance.

Therefore, in this research, based on the abovementioned six areas found from a literature review on institutional pressures, internal fit, SMS, and safety performance, I propose the primary research model in the next section to explore the interaction of institutional pressures and internal fit. Then, I elaborate on how interplay force influences SMS implementation and how it impacts quantitative and qualitative safety performance.

3. RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

3.1 Introduction

This research aims to investigate the interactive force between exogenous and endogenous factors that impact SMS implementation and sequentially affect safety performance. These interacting forces are institutional pressures (exogenous) and internal fit (endogenous). Institutional pressures comprise coercive, mimetic, and normative pressures, while internal fit is composed of self-interest elaborating from the organization's vision and objective at the goal level, and resource capability explores from the organization's physical, human, and organizational capital's perspective at the means level.

SMS generally includes four components: safety risk, assurance, policy, and promotion. These pillars are equally critical to successful SMS implementation. Therefore, SMS is treated as an entire system and best practice to analyze from the implementation perspective. However, in terms of measuring SMS implementation, two dimensions, fidelity and extensiveness, are used to evaluate four different forms of SMS implementation. The vertical dimension is fidelity, which emphasizes the precise and true version of components of practices, while the horizontal dimension is concerned with the extent and range of organizations that may carry out the practice within the organization.

Last but not least, safety performance includes qualitative and quantitative safety performance. Accident rates, serious incident rates, and fatalities are quantitative lagging indicators that measure events that have already occurred. Qualitative indicators are usually leading indicators to measure events and processes that are being implemented to improve or maintain safety. In this study, effective safety culture is a qualitative safety performance indicator. The research concept with related constructs is presented in Figure 7.

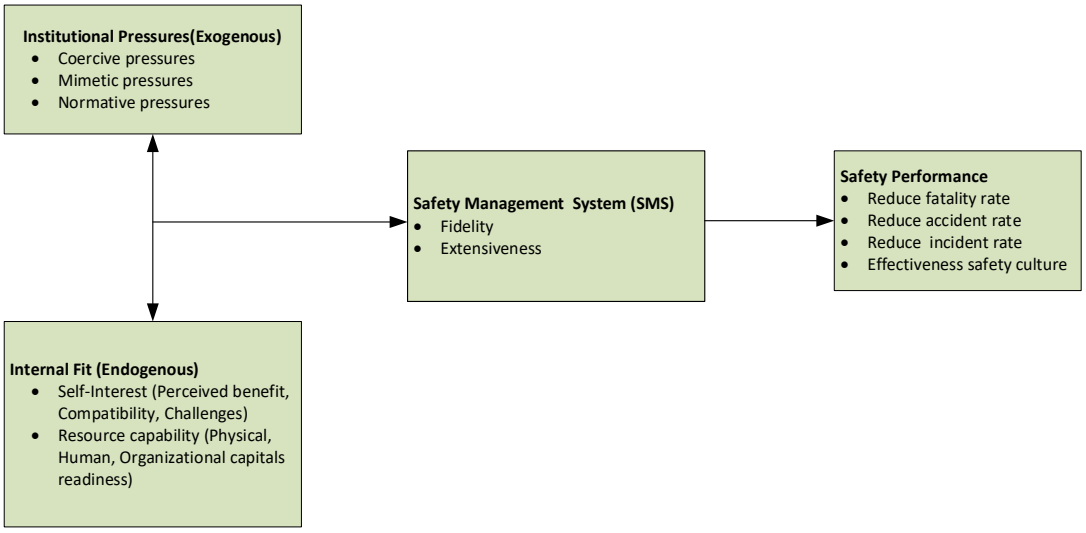

Figure 7: Research concept at the construct level

The interactive effect between institutional pressures and internal fit is the primary concept and trigger of the entire model in this study. First, section 3.2 investigates the alignment and conflict

strategic responses to the interplay between institutional pressures and internal fit, proposing the research model. 3.3 section develops hypotheses among interactive forces on SMS implementation. The hypotheses of SMS's effects on safety performance are followed in the 3.4, 3.5 and 3.6 sections. The SMS implementation mediates the relationship between interactive force and safety performance is proposed in the last section.

3.2 Research model

Before elaborating on the interactive effects of institutional pressures and internal fit, the following section needs to explore how the practice implementation is affected by interactive force.

3.2.1 Practice implementation

Scheirer (1983) argued that there are two types of studies: adoption versus implementation practice. The adoption practice studies have emphasized measuring the rates and organizational correlates of adoptions, which emphasize that external factors highly influence an organization to make the decision on adoption practice. In contrast, examinations of practice implementation typically explore the extent to which the new practice was utilized or delivered factors that facilitate or hinder the extent of implementation.

At this point, I explore the abovementioned two types of studies not only to explore how external factors influence organizations to adopt the practice but also to elaborate on how much the aviation organization implements it. Therefore, the adoption used in the study has the same meaning as the implementation. I adopt the notion of fidelity and extensiveness as two dimensions to present four basic types of practice implementation. The vertical dimension is fidelity, which emphasizes the precise components of practices, which is how to establish practice policy and procedure, and the horizontal extensiveness dimension focuses on the scope and range of organizations to implement the practice.

SMS Fidelity. From the vertical fidelity perspective, fidelity relates to the breadth and meaning of the practice being adopted and adapted in terms of how "true" or "distant" this version of the practice is in comparison to earlier adapted versions. Thus, if late adopters adopt a practice (more or less), it is relative to how much early adopters adapted the practice (more or less) and not relative to a prototype form. The core of SMS is the safety management systems manual, and it includes manual purpose, SMS organization and process charts, training, SMS components, employee reporting management, risk management, and so on, covering g four components and twelve elements of SMS. The most important part lies in safety risk and assurance management (the second and third components, as aforementioned). Figure 3 illustrates the core of SMS at the bottom two layers, which is like the foundation of cake, accounting for 45%. The good cake is made with core ingredients at the bottom, which provide the main flavour of the SMS cake. Two other components, state policy (35%) and promotion (20%), at the top two layers, are like external ingredients on the top of the cake, which provide consistency and ensure the integrity of the SMS (Maurino, 2017). Once the SMS manual is finalized, the other operational manual will also be updated with SMS-related guidance in certain chapters of all other manuals of aviation organizations.

The SMS framework is highly regulated as a safety practice and requires systematic guidance and procedures. Therefore, comprehensive establishment is highly critical. The primary guidance will be the SMS manual, which comprises four components and 12 elements. SMS-related guidance

will also be reflected in chapters of different aviation organization manuals, such as flight operational manuals, maintenance manuals, pilot management manuals, dispatch manuals, ground handling manuals, and so on. This leads to the SMS fidelity concept.

The establishment of overall policy, standards, guidance, and procedures belongs to SMS fidelity. The prototype of SMS is ICAO manual Doc 9859. The effective version is the fourth edition from 2018, and the fifth edition will be applicable in 2024. As mentioned in Doc 9856, every State, as is every service provider, is unique. SMSs and SSPs are made to be specifically customized to each State's or service provider's unique requirements (ICAO Doc 9859). There is no one-size-fits-all manual. However, for SSP/SMS to work well, all of its parts and components must be interdependent and connected. From result-based management, it is imperative that outcome is the ultimate goal, and a performance-based approach can be added to the conventional prescriptive requirements. Based on this SMS Doc 9859 manual and Safety Management Annex 19, member states have developed national SMS policies and standards suitable to their service providers. Each service provider has also developed organizational-level SMS manuals based on national and international standards. The SMS-related manual is designed in compliance with national and international standards and set up to be suitable and feasible for the organization to perform. The policy and guidance can not be beyond the organization's capacity and over-promise document. Therefore, SMS can be established as a phased approach to avoid such cases.

In brief, when this research discusses the organizational level of SMS implementation, the first dimension of SMS fidelity refers to the establishment of SMS-related policies and procedures at the organizational level.

Since the four components of SMS are all important, with the second and third components being critical, this study theoretically assumes that all four components and 12 elements being implemented well can be considered the true implementation, and one or two components with 4-5 elements being implemented is the distant implementation.

SMS Extensiveness. From a horizontal extensiveness perspective, the extensiveness dimension determines if the degree of adopted practice is low or high range compared to the previous or prototypical version, which is concerned with the scope of the practice being applied. This implies that the concept of extensiveness about the "dosage" of the implemented practice — low or high — is closer to the concept of implementation scale. On the one hand, the dosage can be considered as how deep it goes to each employee, whether it has been deeply penetrating into employees' daily work and let them commit to practice, satisfied with practice, and psychological ownership of practice, which refers to internalization of practice defined by Kostova, the success of transfer practice and the deeper level of implementation (Kostova, 1990).

On the other hand, the dosage can be considered to be prevalent in the scope of organizations. For example, e-business deployment might range from being deployed in selective departments to being applied across the whole organization's sections (Wu et al., 2003). Whereas all departments in airlines, i.e., safety, operational, commercial, and administrative departments, shall implement SMS to enhance safety performance, some organizations may choose only to involve the safety and operation-related section rather than entire departments due to insufficient resources. Thus, all departments implementing SMS can be considered to have high implementation, and one or two implemented functions have low implementation.

Implementation is another important factor after setting up the comprehensive establishment. The SMS guidance is not only in compliance with the standards and policy but also suitable for the real workplace and feasible to be implemented by front-line employees. It introduces the SMS extensiveness.

As Malakis et al. (2023) point out, there is a gap between “work as planned” which is SMS fidelity and “work as done” which is SMS extensiveness. Top-down safety management provides the means of safety, while bottom-up feedback provides hazard identification. However, “there are concerns with delayed change management, unclear processes, and rules violations” (Malakis et al., 2023, p 5). These issues have been highly discussed in the literature (Dekker, 2006; Woods & Hollnagel, 2006). Therefore, the synchronization of SMS fidelity and extensiveness is critical.SMS diffusion stems from these two dimensions, in which SMS favours a phased implementation process, and there is no one-size-fits-all SMS system. The diffusion is allowed (ICAO Doc 9859,2019; Kelly, 2017). Combining two dimensions, fidelity and extensiveness in SMS implementation, four types of SMS implementation are presented in Figure 5: True-high (full), true-low, distant-high, and distant-low. True-high and true-low implementation is more common, as organizations either decide to implement comprehensive SMS in the entire organization or a couple of core value departments.

Our review of institutional pressures on practices and the level of implementation suggests that the adoption of practice can be divided into two phases: initiation and implementation. Initiation refers to an organization's decision to adopt the practice, which can be considered distant-low-level implementation from a measurement perspective. Implementation refers to real practice progress. Scheirer (1983) argued that it is particularly important to separate the investigation of adoption decisions from the study of the implementation process. There are different phases in terms of practice progress. Rather than the institutional pressures influencing practice adoption, we argue that institutional pressures alone only affect organizations to initiate the practice. In post-practice, the different practice implementation outcomes need to be investigated, including internal factors and the interaction with institutional pressures.

It is important to note that in the SMS context, it is rare to have a distant-high implementation (Type C) since the four components of SMS are intertwined and highly rely on each other. It is not practical to just implement one or two components and ignore the other components in the entire organization.

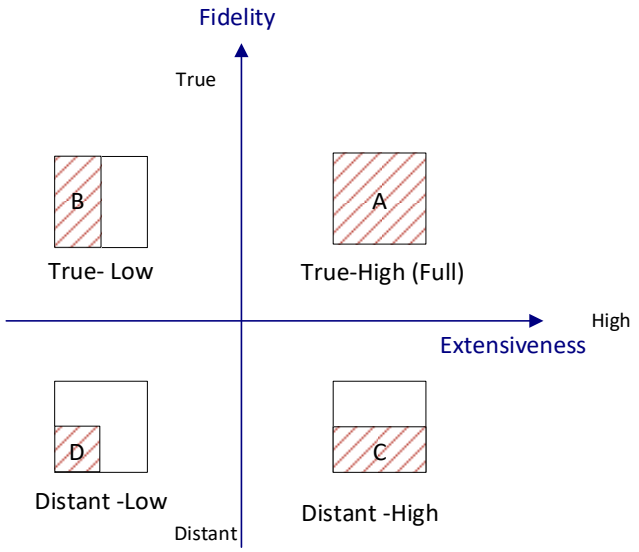

Figure 8: Four basic types of practice implementation

When integrating four basic types of practice and the four outcomes of the assessment tool, I listed the association in Table 8. Initiating refers to distant-low, present, suitable, and operating, which refers to true-low or distant-high, and effective, and excellence means true-high implementation. Coming back to the States CAA audit report, scores greater than 85% are considered full implementation with true fidelity and high extensiveness at the first quadrant. In this vein, the scores between 55% and 84% are true-low or distant-high in the second and fourth quadrants, and scores less than 55% are distant-low implementation in the third quadrant, which is deemed as initiation practice in this study. The integrated measurement is presented in Table 8.

ICG Assessment tool (2020)	**Initiating**	**Present**	**Suitable**	**Operating**	**Effective**	**Excellent**
Proposed four types of practice based on Kostova & Roth (2002)	Distant-low	True-low or Distant-high	True-low or Distant-high	True-low or Distant-high	True-high (Full)	True-high (Full)
Proposed based on ICAO SSP audit outcome (2019)	<55%	55%-84%	55%-84%	55%-84%	>85%	>85%

Table 9: Integrated SMS measurements

3.2.2 Interactive effects on practice implementation and safety performance

Pache and Santos (2010) investigate the goal and means of the level of natural demand while conflicting with institutional pressures. Ansari (2014) and Fortwengel (2017) explore the internal fitness of organizational goals and structure during diffusion of practice, which implies diversity in practice implementation. Therefore, rather than using Ansari's political, technical, and cultural fit to demonstrate internal fit, this study conceptualizes internal fit on two dimensions, self-interest and resource capability, during practice implementation while facing institutional pressures. Interplay of institutional pressures and the internal fit is highly associated with heterogeneous practice implementation.

In this vein, I argue that goal-level conflicts from the nature of demand and internal representation, which refer to "organizational members adhering to and promoting a given

demand" (Pache & Santos, 2010, p.460), imply that an organization's self-interest conflicts with institutional demands. Moreover, the other internal conflicts at the means level mainly refer to the organization's resource capability that could not support achieving goals or institutional demand.

In terms of SMS, there is a saying that SMS is the leadership's project, which means that the leadership makes a critical contribution to the success of SMS implementation. It is not any leadership but subject to the CEO, the highest management of the organization. Safety accountability is one of the twelve elements. The CEO needs to sign the safety accountability document in some States. The top management not only leads obligations to safety through words and actions but also fosters safety awareness among employees, guides the integration of safety into business strategies, processes, and performance measures, and regularly assesses and improves the organizational safety culture. Therefore, the top management's interest in SMS has determined power over the success of SMS implementation.

In terms of SMS resource capability, (Robertson et al., 2014 A103) explored the airport safety manager's reasons for not developing and implementing SMS, which included lack of funding, insufficient human resources, resistance to increased government intervention, liability issues, and the perception that "SMS is a waste of time." "Additionally, ACRP Synthesis 37 (2012) reported several challenges experienced by SMS pilot project airports attempting SMS development, including lack of FAA support/resources, lack of management support, and stakeholder "buy-in" (p. 46). ACRP Report 1, Safety Management Systems for Airports (2009), lists several common challenges associated with SMS implementation, including management commitment, behavioural change, maintaining momentum, and cultural characteristics (pp. 59-60)."

In contrast to Oliver's resource dependency theory and Teece's dynamic capability, the firm resource refers to physical, human, and organizational capital, which heavily relies on ordinary capability. Aviation's stability and safety orientation make it less dynamic than other sectors, i.e., high-tech and finance. Therefore, resource capability is classified within ordinary capability as the second dimension in our internal fit assessment, and resources are categorized into two levels: strong and weak. Resource capability determines the extensiveness of practice implementation since an organization with substantial resources can most likely conduct the practice involving all functions and sections of the organization, namely high implementation. In contrast, low implementation occurs through the partial execution of functions in an organization.

This SMS example shows the overall finding from this literature review that the combination of self-interest and resource capability heavily affects practice implementation. As illustrated in Figure 9, at the vertical axis (self-interest), three-level squares present strong, neutral, and weak self-interest, and at the horizontal axis (resource capability), they show strong and weak. The shadow area of squares describes four basic types of practice implementation. With strong self-interest and resource capability, the practice could be conducted as full implementation in the first quadrant. Following this path, with strong self-interest but a weak resource, a practice could be conducted as true-low implementation in the second quadrant. With neutral self-interest, the practice can only be implemented as a distant-high type residing on the right X-axis if the resource is capable. Otherwise, the organization would not have incentives to implement practice

when the resources are weak or when self-interest is low and no practice is implemented, as presented with three empty squares in the third and fourth quadrants.

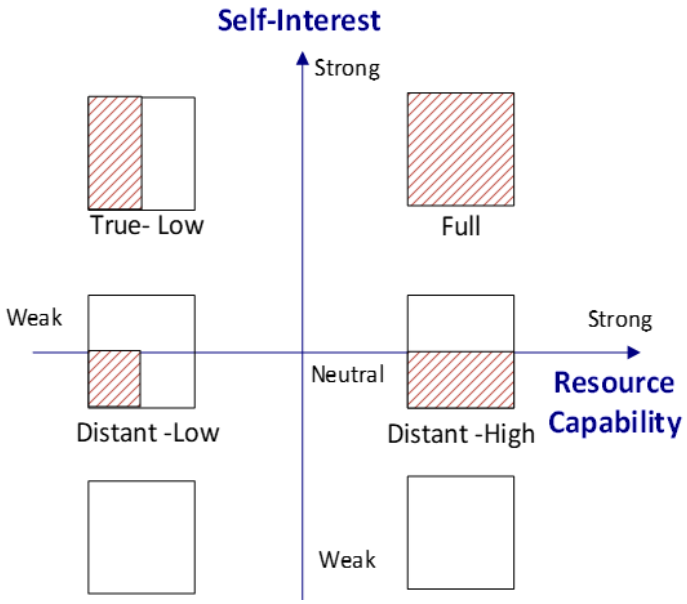

Figure 9. Internal fit influence practice implementation

Figure 9 shows the internal fit, the combination of self-interest and resource capability, including practice implementation. However, organizations always face external institutional pressures. Once institutional pressures interact with the internal fit, it leads to the discussion of strategic responses to such interactive effects. The following section explores more how institutional pressures align or conflict with self-interest and consequently impact resource capability and practice implementation.

3.2.3 Strategic responses to interactive effects

Organizations' response strategies may vary depending on the nature of the conflict and the motivation of organizational groups to see one of the competing demands succeed (Pache & Santos, 2010). In response to institutional pressures, strategic choices vary from active resistance (i.e., manipulation or defying of rules and expectations) to a passive or neutral response (i.e., to avoid, compromise, or acquiesce to institutional pressure and expectation) (Oliver, 1991). Goodstein (1994) also proposes that strategic choices for conformity or resistance are made to cope with institutional pressures. Boon's study in strategic human resource management (HRM) demonstrates the presence of different institutional pressures. However, this does not necessarily mean that organizations see the institutional environment as restrictive. Organizations can create more leeway in choosing a human resource system themselves (Boon et al., 2009). Finding the "correct" degree of adaptation to institutional mechanisms can be a source of organizational success, even if it operates in a highly institutionalized context (Oliver, 1997). Early institutional theory often overlooked the role of active agency and resistance in organization-environment relations (Oliver, 1991), reintroducing agency, interests, and power into institutional analyses of organizations (Garud et al., 2007).

Paauwe (2004) criticizes Oliver's advocacy as all responses are negatively formulated and add a positive, innovative response ("lead," "initiate," and "develop"), characterized by using institutional demands and expectations in order to develop a competitive advantage. Similarly, Mirvis (1997) distinguishes between "leaders," corresponding with the innovative response, and "followers" and "laggards," which can both be characterized as neutral or reactive responses as no explicit action is taken that aims to change the status quo.

Following Mirvis's (1997) three actors (leaders, followers, and laggards), this study differentiated conformity and resistance (Oliver, 1991) and added positive responses, resulting in five strategic responses, namely, advocate, strive, follow, reluctant, and incapable, associated into three actors as well as Mirvis's study(1997), leaders take advocate and strive action, and follower follows, and laggards will be reluctant or incapable to implement to practice.

The strategic responses are the bridge between the interplay force and SMS implementation. On the one hand, organizations responding to the interactive force of external and internal factors can be categorized into two interactive levels: alignment or conflict between institutional pressures and self-interest. On the other hand, such interactive force affecting resource capability will trigger strategic organizational responses, reflecting the practice implementation level. In this study, as mentioned above, the four types of SMS implementation are full, true-low, distant-high, and distant-low implementation. I propose that:

- The leaders' category is to advocate and strive to respond with the full implementation (A-type).
- The follower's category is to follow responses with the Full implementation (A-type) or True-low (B-type) subject to resource capability.
- The Laggard's category is reluctant and incapable responses with distant-low implementation.

Table 10 presents the interactive force between institutional pressures and self-interest (highlighted in red) impacts on organization resource capability (highlighted in yellow), the combination results lead to strategic organization responses and actors (highlighted in green), and finally, strategic management decides the project implementation (Bailey et al., 2000), which reflect on SMS practice implementation with three types (highlighted in blue). Last but not least, it impacts quantitative and qualitative safety performance, respectively. The level of influence is investigated in the following sections: 3.4 and 3.5.

Interactive effect between external and internal factors							**SMS Implementation**			**Safety Performance**	
Institutional Pressures (External)		**Internal fit (Internal) Self-Interest (Goals)**	**Interactive Level**	**Internal fit (Internal) Resource capability (Means)**	**Strategic responses**	**Actors**	**Two dimensions**		**Four Types**	**QUANT**	**QUAL**
							Fidelity	**Extensiveness**			
Coercive Mimetic Normative	Strong Or Weak	Yes	Alignment	Yes	Advocate	Leader	True	High	Full (A)	High	
				No-> Yes	Strive		True	High	Full (A)	High	

				No	Follow	Follower	Ture	Low	True-Low (B)	High
	Strong	No	Conflict	Yes->No	Follow	Follower	True	Low	True-Low (B)	High
	Weak				Reluctant	Lagger	Distant	Low	Distant-Low (D)	Low
				No	Incapable		Distant	Low	Distant-Low (D)	Low

Table 10: Summary of the research concept

With a decade of SMS implementation experience in the aviation sector, Figure 9 shows the State of SMS implementation vs. the economic development level.

- From the SMS implementation aspect, the one example of the ICAO audit result of the 187 Member State CAAs Safety Program for the period of 2010-2019 (SSP is for State civil aviation authorities, while SMS refers to the practice in the aviation industry, such as airlines, ANSP, and airport, etc.) based on SMS Audit protocol questions (PQs). In Figure 9, the blue columns show the SSP implementation of State CAAs result from the highest, 99.9%, to the lowest, 1.47%, and the vertical red line indicates the average score of SMS implementation is 74% (ICAO iSTAR, 2019).

- From the economic development aspect, in the World Bank country classification (2014), the statistical results contain a set of data that the World Economic Situation and Prospects (WESP) employs to delineate trends in various dimensions of the world economy. WESP classifies all countries into four broad categories by their level of development, which is measured by per capita gross national income (GNI). Accordingly, high-income, upper-middle-income, lower-middle-income, and low-income countries have been grouped. To maintain compatibility with similar classifications used elsewhere, the GNI per capita threshold levels are those established by the World Bank. According to the World Bank classification (2014), countries with less than $1,035 GNI per capita are classified as low-income countries, those with between $1,036 and $4,085 as lower-middle-income countries, those with between $4,086 and $12,615 as upper-middle-income countries, and those with incomes of more than $12,615 as high-income countries. GNI per capita in dollar terms is estimated using the World Bank Atlas method (World Bank, 2014), and the classification is based on data for 2012. This study uses the GNI per capita since it is more precise than the Gross Domestic Product (GDP) to reflect organizations' human and capital resource capability. Therefore, 193 Member states have been grouped as high-income (4), upper-middle-income (3), lower middle-income (2), and low-income (1), as shown in Figure 10 in orange dot (Axis Right).

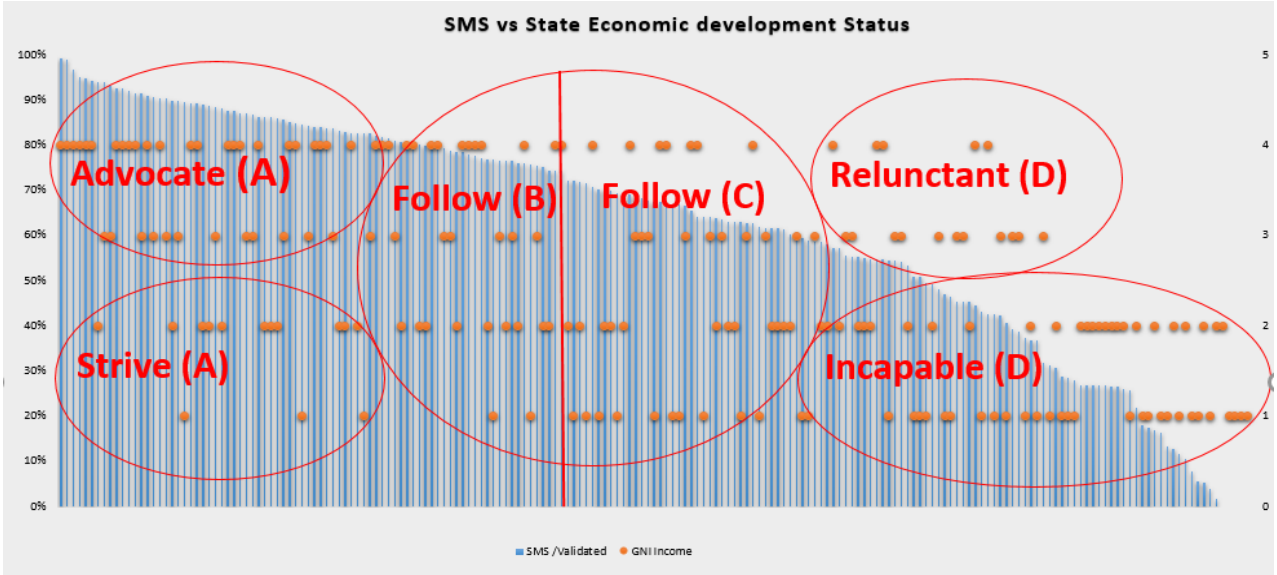

Figure 10: State CAAs SMS implementation VS State GNI Income (Per capita)

To further elaborate on five types of strategic responses, the case of the above State CAA SSP implementation data set (See Figure 10) is presented to explore the interactive forces on practice status. Five strategic responses can theoretically reside in two scenarios: alignment and conflict between institutional pressures and self-interest. It is easier to assume the top and the last group of strategic response, which is that *advocate* and *strive* can be included in the alignment scenario, whereas *reluctant* and *incapable* lie in a conflict scenario. The type of *follow* strategic response can be ambiguous since the middle group with true-low or distant-high implementation can be the consequence of either alignment or conflict.

1. From the State CAA SSP implementation perspective

Advocate

When the organizational self-interest meets institutional pressures and the organization has strong resource capability, I argue such organizations advocate practice in full implementation and become leaders. Figure 9 States CAAs among high-income and upper-middle-income groups are assumed to have strong resource capability. Their SMS has been fully implemented (greater than 85%). The major developed G7 countries are all in this group. ICAO SMS framework is recommended as a generic model for its Member States. Yeun et al. (2014), in their study of aviation SMS, indicate that some ICAO council Member States, such as the U.S., Australia, the UK, Canada, and Singapore, introduced SMS even before ICAO was initiated in 2009. With the support of such States, ICAO integrated the commonalities from the framework and promoted it to the rest of the world. Consequently, such states play the advocate and leadership role in the worldwide implementation of SMS.

Strive

Following this path, when the organizational self-interest meets institutional pressures, but organizations do not have the strong resource capability to support the goal, the organization will strive to seek or reallocate resources as possible so they can achieve the goal, and the practice implementation could be reached at the same level as the organization with sufficient resources

as full implementation. In Figure 9, states belong to the lower-middle-income and low-income groups, indicating they do not have strong resources. However, such State CAAs may have solid aviation safety strategy plans to align with coercive pressures. Besides, they may also have high mimetic pressures since under-developed State CAAs have been learning the major developed state CAAs' regulations and rules for decades. There are bilateral agreements among States for the purpose of building up the capacity of the civil authority of developing States. The developed states will send subject matter experts (SMEs) in phases to help developing states set up entire CAAs or certain programmes (e.g., SSP and SMS). Such states without sufficient resources have strong self-interests matching with institutional pressures. Consequently, they have achieved full implementation. Although there are only a few States, they indeed present a notable phenomenon. As a result, they are considered to strive for responses residing in the leader group based on the implementation score.

Follow

In the *follow* category, the situation is a bit ambiguous. There are kinds of alignments between institutional pressures and self-interest. If the organization has sufficient resources, it will not belong to this category, and it will conduct true in fidelity and high extensiveness and fall into the *advocate* and *strive* category. Therefore, in the *follow* category, it applies more that the organization doesn't have sufficient resources under alignment. The practice could be conducted as true at fidelity and low at extensiveness, namely true-low implementation (55%-74%). As presented in Figure 10, the resource capability of the state CAAs in this group covers all four levels of income and plays the follower role. Without empirical study, it is hard to differentiate the key factors in their slightly various implementation. However, I suggested comparing self-interest and resource capability among organizations having the same implementation score. In other words, when organizations have the same implementation score in the follower group, an organization with weak resources could have more self-interest than an organization possessing strong resources. For States that are high-income but have implementation scores of 55%-74%, there might be some conflict between institutional pressures and self-interest.

Reluctant

When there are conflicts between institutional pressures and self-interest, no matter how much the organization possesses resources, the practice could be conducted as distant at fidelity and low at extensiveness, namely distant-low implementation (less than 55%). The reasons for low interest could be multiple factors, even for high-income countries, such as insufficient air traffic volume in certain developed economic regions, aviation development not being the priority of the national strategic plan, unwillingness to change, and so on. The States in the high and upper-middle-income groups with low implementation scores are reluctant to implement it to respond to high conflicts between external pressures and self-interest (see Figure 10). They belong to the *laggard* category, with the response type being reluctant.

Incapable

When there are conflicts between institutional pressures and self-interest, when an organization has weak resources, the practice could be conducted as distant at fidelity and low at extensiveness, namely distant-low implementation (less than 55%). The States in lower-middle and low-income groups assume that they do not have sufficient resources, and the incentive to explore or exploit the resource is also weak because of conflicts of self-interest with institutional pressures. With

poor resources, they are incapable and only implement the distant-low practice, resulting in a laggard.

2. From the aviation industry service providers' SMS implementation perspective

The aviation industry service providers include airlines, ANSPs, airports, and manufacturers, who depend highly on each other for daily operations. A notable example of SMS adoption is mandatory for all stakeholders, including governmental CAAs and industrial service providers. Aviation organizations face different pressures in their context (Greenwood, 2011). Generally, it could be assumed that they encounter strong institutional pressures on SMS implementation. Since safety is of the utmost importance in aviation organizations, safety-related practices should always align with the organization's goals and interests.

For young (around ten years old) or newly registered airlines, since safety is a crucial aspect for airlines to survive, they desperately need to adopt a matured safety system to build the management and operation team, from the pilot, mechanics, and dispatchers to the administrative. Therefore, SMS can be very favourable to such aviation organizations, especially for young, profitable airlines that have operated for around ten years with 20 fleets with sufficient resources, and it is key to set up a solid safety system to sustain commercial activities. They are most likely to take an advocacy strategy and implement full-type SMS. Whereas newly operated airlines without sufficient resources at the initial stage will take *strive* or *follow* strategy, try to relocate resources, and implement full or true-low implementation.

However, some scenarios show self-interest as neutral or weak, conflicting with institutional pressures during SMS implementation due to over five decades of safety management evolution.

Scenario A: Some prestigious aviation organizations worldwide had been set up during the 1950s after World War II. They have already established and implemented a legacy safety system since then. Although the old safety system focuses on technology design instead of safety culture and education enhancement as a new SMS system, it has been run for over five decades and has been deeply merged into the "organization's blood." Management would be reluctant to change to the new SMS, especially when the legacy system has been highly invested in and fully functional. In such circumstances, they usually have sufficient resources, but self-interest is low, so they may take *follow* and *reluctant* strategy and implement true-low or distant-low implementation to play the ceremonial role in compromising with external institutional pressures, especially coercive and normative pressures stemming from the States CAA and aviation associations.

Scenario B: Though aircraft manufacturers are obligated to implement SMS according to ICAO annex 19, their incentive is not as high as airlines, ANSPs, and airports. Safety management was always the core of all management in a manufacturer before the "world of SMS," as the quality management system (QMS) "was just there" (Maurino, 2017). Unlike SMS, which aims to control hazards and real-time performance, the objective of QMS is to control defects and pursue compliance. Even though it is highly recognized that one system does not replace the other, and transportation organizations need both, it requires time for manufacturers to realize and take action on it (Maurino, 2017). They are most likely to implement true-low or distant-low SMS implementation, the same as scenario A.

Scenario C: When aviation organizations do not have a strong safety culture or the activities are not directly engaged in safety, such as airport handling companies and catering companies, conflicts are most likely to occur in their interest in allocating resources building SMS instead of profitable commercial activities or projects. An example of self-interest conflicting with institutional demands is illustrated by Kurt and Gerede's (2018) study. He highlights that SMS is seen as an obstacle to the operational goal of 8 aviation organizations out of 11 in Turkey. Therefore, they used a concealing strategy to display ostensible acquiescence behaviour (Oliver, 1991) and have not implemented an in-depth SMS practice since 2012. These two goals of aviation organizations, production and protection, are conflicting institutional logic. To this extent, such conflicts could undermine both the fidelity and extensiveness of SMS implementation. Consequently, they mostly like to take distant-low SMS implementation.

To sum up, from State CAAs' perspective, they are facing coercive pressures from international governmental organizations and regional civil agencies, mimetic pressures from other peer States' civil authorities, and normative pressures from aviation associations and training schools, etc., to implement SMS. The institutional pressures align or conflict with State self-interest and impact how States relocate their resources, and the insufficient resource could turn into a sufficient resource if there is strong alignment, consequently leading to full implementation, while conflict situations can be distant-low implementation even if there is sufficient resource. Between full implementation and distant-low implementation, the scenarios could be in low alignment due to more complicated situations; true-low implementation is most likely to happen. In the following section, the same strategic response and type of SMS implementation can happen in the aviation industry. Since airlines, airports, and ANSPs are the same as state civil aviation, they face institutional pressures from national governmental organizations and associations, as well as from their states' civil aviation, peers, and training schools. The above three scenarios reflect that aviation organizations from the industry will encounter the same interactive effect from external and internal factors and have different strategic responses, consequently leading to another type of SMS implementation, presented in Summary Table 10.

From the perspective of a strategic response to interactive effects of institutional pressures and internal fit, five strategic responses can be categorized by interactive effects associated with four types of SMS implementation and impact safety performance accordingly. In the following section, how three types of institutional pressures, coercive, mimetic, and normative pressures, interact with self-interest are elaborated more to reflect strategic responses on SMS implementation. The last part of this section introduces hypotheses on interactive effects, SMS implementation, and safety performance, respectively.

Table 11 summarizes ICG-developed SMS Assessment criteria, four types of practice implementation, SSP implementation results, and five strategic responses. It is more explicit to understand the relationship among strategic response to interactive effects, SMS implementation type, SMS measurement, and actual SMS implementation result.

ICG Assessment tool (2020)	Initiating	Present	Suitable	Operating	Effective	Excellent
Proposed four types of practice based on Kostova & Roth (2002)	Distant-low	True-low or Distant-high	True-low or Distant-high	True-low or Distant-high	True-high (Full)	True-high (Full)
SMS Implementation type	Type D	Type B	Type B	Type B	Type A	Type A

Proposed based on ICAO SSP audit outcome (2019)	<55%	55%-85%	55%-85%	55%-85%	>85%	>85%
Strategic response	Conflict	Conflict or Alignment			Alignment	
	Incapable or Reluctant	Follow	Follow	Follow	Advocate or Strive	Advocate or Strive

Table 11: Summary of SMS measurement

To sum up, the research concept at the factor level can be presented in Figure 11. In the internal fit area, practice type is shown by the square shadow (Type A, B, C, D), which is the outcome. However, the position of the practice shows the driving factor. For instance, under Strive, the practice level is A; however, it lacks resources, which explains why the Strive with A type is located at the second quadrant of the chart. The same case is also reflected reluctantly; the outcome is D type, distant-low practice, but since it has sufficient resources originally, it is located in the fourth quarter.

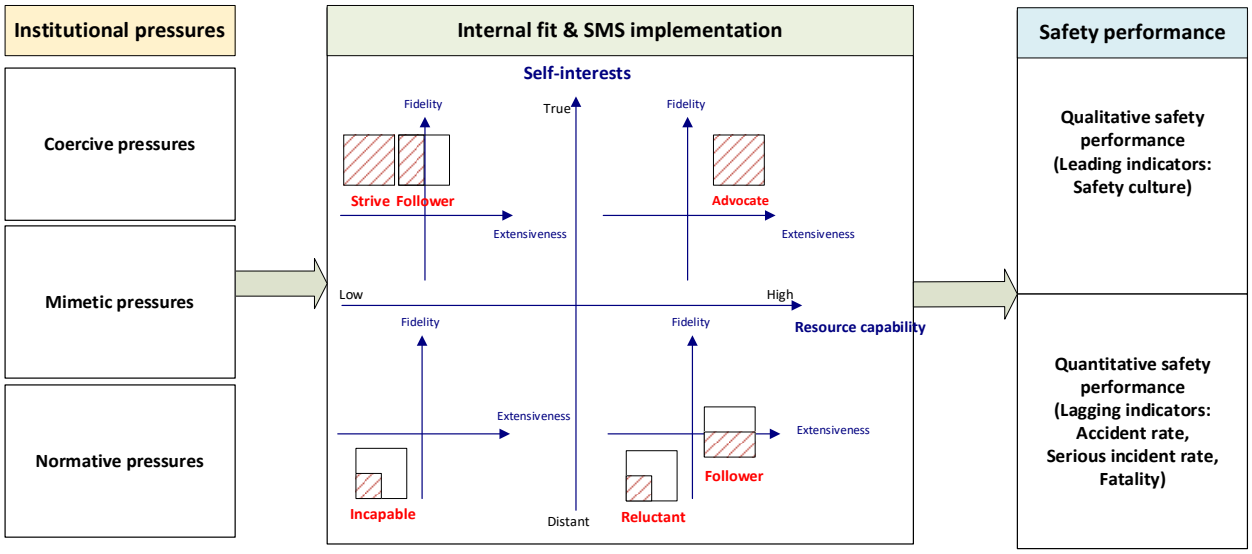

Figure 11: Research concept at the factor level

Based on the first layer and second layers of the research concept, the final research model can be summarized in Figure 12. The three institutional pressures will align or conflict with self-interest, respectively, leading to sufficient resource capability or no resource capability, then impact SMS fidelity and SMS extensiveness implementation, and two dimensions of implementations will affect safety quantitative and qualitative performance, respectively. I have theoretically proposed the four types of SMS implementations and five strategic responses in the research concept, but they are not included in the following empirical research model. Figures 12a & 12b present the research model in alignment and conflict situations. The hypothesis will be elaborated on in the following sections, and the research methodology and the associated data analysis are presented in chapters 4 and 5.

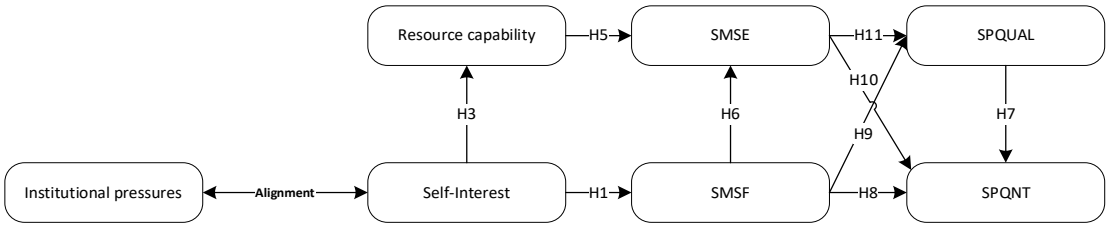

Figure 12a: Research model_Alignment

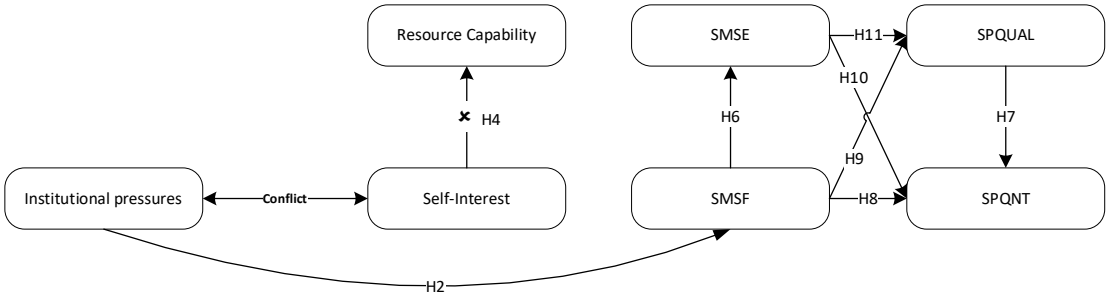

Figure 12b: Research model_Conflict

3.3 Hypotheses for interactive effects on SMS implementation

While discussing the interactive force between institutional pressures and internal fit, the nature of each pressure is different in terms of source and type of pressure. It will make more sense to elaborate on the interaction between internal fit and coercive, mimetic, and normative pressure separately. As the literature review in section 2.4.3 concludes, organizations carry strong coercive pressures in the global aviation field. Coercive, mimetic, and normative pressures could be interdependent; thus, a single practice can simultaneously trigger the three pressures (DiMaggio & Powell, 1983) or one stronger than the other two. Other scholars mention that each organization would face different pressures in its context (Greenwood, 2011). In general, the three pressures of SMS practice are fairly high. Higher pressures increase the organization's possibility to adopt the practice (DiMaggio & Powell, 1991).

Institutional pressures purely come from outside organizations and may be felt as force or persuasion most of the time (DiMaggio & Powell, 1983). Higher external coercive pressures do not mean they align with organizations' interests and objectives at the goal level nor with resource capability at the means level (Ansari, 2010). Covaleski's study (1988), by assessing the budgetary practices during a period of organizational decline, reveals that individuals and organizations act in their self-interest and pursue their ends by creating and institutionalizing corporate policies and processes rather than complying with regulations and rules. Pache and Santos (2010) argue that the degree to which conflicts between institutional demands and self-interest are reflected through organizational strategy responses consequently leads to the decision

to adopt the practice; even if the practice has been adopted, the conflicts will impact the level of practice implementation.

3.3.1 Coercive pressures interplay with internal fit

According to DiMaggio and Powell (1983), coercive isomorphism arises from other organizations on which the entity depends, e.g., regulatory agencies, headquarters, and essential clients, which are examples of coercive powers. Coercive pressures result from strict government rules and regulations and the organization's attempt to comply with established regulatory demands (Benders et al., 2006).

ICAO follows up on audits by monitoring for severe flaws and assisting governments that must address safety concerns. The President and Secretary General of the Council have taken specific actions to address potential "flags of concern" states that register aircraft, certify operators, or license pilots without adequate oversight. ICAO has implemented Article 33 of the Convention's mutual recognition clause by urging governments to recognize the certifications and licenses of other nations as evidence that ICAO standards have been satisfied. A well-known example of Safety Management System (SMS) adoption is mandatory for most stakeholders, including governmental CAAs and most industrial service providers.

At the national level, State CAAs strive to improve national safety and will require aviation organizations in the industry to comply with the safety regulations. CAAs set up several constraints on oversight of aviation organizations' SMS implementation. For example, the CAA can suspend licenses or not grant air operator certificates (AOC) if an aviation organization cannot pass the SMS audit.

While facing relatively strong coercive pressures on SMS adoption, when the aviation organization currently needs a systematic safety program, its objective aligns with coercive pressures, the organization will strive to implement a true version of SMS, and the organization will seek or relocate resources needed for SMS to implement high extensiveness which covers the entire organization, which is full implementation.

However, there are also cases in which aviation organizations resist the change and do not have the same objective or interests in introducing the new safety system to replace still functional safety programs. In such cases, they will most likely not implement the true version. Moreover, even if there are strong coercive pressures, with conflict with the organization's self-interest, the organization is most likely reluctant to seek or relocate resources to implement, resulting in the practice with a low version of extensiveness, which is ceremonial to deal with coercive pressures and gain legacy. Only strong coercive pressures impact the true version of SMS fidelity.

3.3.2 Mimetic pressures interplay with internal fit

Mimetic pressures can occur under high uncertainty and ambiguous goals; mimicking the choices of other organizations is one way of dealing with these pressures in an attempt to duplicate others' success (DiMaggio & Powell, 1983). An organization imitates other structurally equivalent organizations' actions because those organizations occupy a similar economic network position in the industry and share similar goals, produce similar commodities, share identical customers and suppliers, and experience similar constraints (Burt, 1987).

Researchers have treated mimetic pressures as external factors, but this kind of pressure stems from inside the organization since they have ambiguous goals and are not clear where to go. Therefore, they are highly motivated to copy other successful counterparts' practices to obtain competitiveness. The higher the uncertainty intra-organization, the more incentives for organizations to copy others, and the higher the mimetic pressure would be. In this case, it is apparent that strong self-interest contributes to high mimetic pressures.

Successful airline alliances adopting SMS could trigger outsider airlines to adopt SMS, enabling them to join three international aviation alliances (Star Alliance, One World, and SkyTeam). Besides, when the primary or successful competitors who have adopted an SMS are more favourable by customers, other airlines in the same sector will also adopt an SMS, i.e., new entries or small airlines will try to simulate flagship airlines who have adopted SMS as they perceive the adoption would make them competitive too. Once mimetic pressures align with self-interest in SMS adoption, the SMS is most likely to be implemented with the true version in the organization.

Although it seems mimetic pressures align with self-interest, the organization always has multi-political groups that may react differently toward SMS adoption (Greenwood & Hingings, 1996). These groups may resist adoption because SMS adoption may jeopardize an individual group's current position, or they may lack the power to guide its implementation, etc. Existing scholarship suggests that organizations are likely to encounter conflicts with institutional pressures when at least one internal group inside the organization supports an alternative option (Pache & Santos, 2010). Therefore, even under mimetic pressures, SMS adoption could encounter alignment or conflict situations with intra-organization self-interest. Once the mimetic pressures conflict with self-interest, the SMS implementation is most likely to be impacted by mimetic pressures only. There is no effect from lower self-interest and weak resources, which is the same as coercive pressures, which lead to true-low or distant-low implementation.

3.3.3 Normative pressures interplay with internal fit

Normative pressures are exerted by professional networks or (trade) associations as organizations try to establish legitimacy within their professional associations. Normative pressures may also arise from social obligations as organizations attempt to do the right thing for societies (DiMaggio & Powell, 1983). Normative pressures stem from professionalism and expectations regarding how work should be conducted professionally (DiMaggio & Powell, 1991).

Normative pressures emphasize the power of personnel, either employees inside organizations or professionals outside organizations. Such pressures arise from employees and are aligned with employee interests. Due to the complexity of internal group interests and multiple institutional logics (Dunn & Jones, 2010), normative pressures will occur, align, or conflict with the organization's self-interest. In the case of SMS adoption, the interaction effect would be similar to mimetic pressures, as illustrated in (See Figure 9 & Table 10).

In the context of rapid air traffic growth and high competition, when airlines purchase more aircraft, it results in a shortage of pilots, air traffic controllers, and senior managers specialized in the aviation sector since there is the ratio between air fleet and human capital (e.g., 1:4). The more airline increases the air fleet, the more human capital the airline demand. The aviation

professional social network is relatively small and tight, in part due to the limited number of professionals who are trained to fill these roles. One of the drivers of this dearth of employees is the education supply. Consequently, normative pressures are relatively high in the global aviation sector. However, aviation organizations are driven by two interests: financial performance and safety performance. Both groups compete with limited resources and try to prioritize their goals inside the organization. This conflict underscores the mismatch between normative pressures of safety and financial-oriented interests. Such strong conflicts could undermine the implementation of safety-related practices as a result of incomplete implementation.

Moreover, the trade association plays a vital role in the global aviation sector under an alignment scenario. Several key non-governmental organizations specializing in airlines (IATA), ANSPs (CANSO), and manufacturers (ICCAIA) [1] directly or indirectly influence members to adopt safety management programs. For instance, the International Air Transport Association (IATA), as a non-governmental organization (NGO), aims to represent, lead, and serve the airline industry and has a direct or indirect interest in its member airlines adopting safety management programs. IATA has increasingly expected airlines to be safer and more reliable air transport providers.

Although IATA has a safety audit program (IOSA) focusing on safety audits of airlines' daily operations, ICAO SMS is setting up a holistic safety system management framework covering other aviation organizations. Therefore, adopting SMS is one of the criteria for airlines to be IATA members. Obtaining IATA membership exerts a large incentive for airlines who would like to apply for membership to adopt SMS. This incentive has exerted normative pressures on airlines to adopt SMS to join as members of IATA. The effects are similar to mimetic pressures since non-regulative oriented, and associated implementation outcomes can be found in Figure 11 and Table 10.

In conflict scenarios, since SMS implementation is obligatory, regulative and non-regulative pressures directly impact SMS implementation, especially in relation to SMS fidelity, without the support of intra-organization power. The higher the external pressures, the more likely an organization is to implement the true version of the SMS. True implementation happens when mature aviation organizations already have a "well-oiled mechanism," and there is no incentive to use extra resources to make changes.

This phenomenon also applies to mature original equipment manufacturers (OEMs) in aviation. SMS evolved as a safety system within OEM organizations from total quality management (TQM). Given that few aircraft OEMs are worldwide, the OEM experience with SMS is somewhat unique. Aircraft OEMs represent different market audiences, from commercial to regional and private jets, but they hold a common safety history reaching back to the middle of the 20th century. These organizations developed 70 years of safety knowledge that co-evolved with advancing technology, and their total quality management approach has been quite successful at the manufacturing level. Within the OEM context, little internal or external pressures existed to change with the new mechanism, such as the SMS. The context for global aviation differs due to diverse manufacturers that vary across geographic, political, and cultural aspects, which makes it more complex to establish and implement a change in standard quickly.

[1] IATA: International Air Transport Association; CANSO: Council of Air Navigation Services Organizations; ICCAIA: International Coordinating Council of Aerospace Industries Associations

Given that a standard must be adapted to different contexts, a process is needed to phase out the old system, including transition time to adapt to the new system. There is also no fixed transition time since aviation safety is the top factor to ensure when the transition time is over and when the change to the new system is made. This time lag helps to explain the conflict between regulative pressures and organizations' self-interest in SMS implementation in the OEM sector.

To sum up, in the alignment between coercive, mimetic, normative pressures and self-interest, self-interest will impact resource capability, which assumes that the power of self-interest is stronger than institutional pressures. Therefore, self-interest will impact SMS fidelity. For instance, in the context of SMS, its four components are highly associated and linked. Therefore, fidelity refers to having a well-established SMS manual and implementing all four components as required in ICAO Annex 19 and Doc 9859 manual.

Whereas institutional pressures conflict with the organization's self-interest, organizations will be reluctant or incapable of implementing SMS. In this circumstance, there is no effect from self-interest, and only institutional pressures impact SMS Fidelity implementation, suggesting the following hypotheses (Figure 12a & b):

Hypothesis 1: Under the alignment between institutional pressures and self-interest, self-interest is positively associated with fidelity implementation.

Hypothesis 2: Under the conflict between institutional pressures and the organization's self-interest, institutional pressures are positively associated with fidelity implementation.

As previously described by Oliver's (1997) study, the resource decision is highly influenced by institutional context, including organizational culture at the intra-organizational level and regulatory and industry-wide norms at the inter-organizational level. In other words, organizational self-interest and institutional pressures would profoundly affect resource decisions. As the abovementioned *strive* and *reluctant* strategic responses, when there is alignment between institutional pressures and self-interest, the adopter will strive to relocate and seek resources, whereas under the confliction circumstance, even if the adopter has resources, they will be reluctant to use their resource to implement the practice.

Following this argument, I assert that resource decisions are subject to the alignment level between institutional pressures and self-interest. If the strong institutional pressures align with the organization's self-interest, its motivation would be boosted and have stronger incentives to seek resources to reach its interest or goal (Pache & Santos, 2010), regardless of whether with or without sufficient resources, and the practice is most likely full implementation. I also argue that if there were conflicts, the power of the organization's self-interest in determining resources would be stronger than the power of institutional pressures. Less self-interest leads to no resource capability, and the implementation is most likely true-low implementation. Suggesting hypotheses as below (Figure 12 a & b):

Hypothesis 3: Under the alignment between institutional pressures and self-interest, self-interest is positively associated with resource capability.

Hypothesis 4: Under the conflict between institutional pressures and the organization's self-interest, less self-interest leads to non-resource capability.

The second dimension of practice is extensiveness, which evaluates whether the level of practice implementation is larger or less at the scope perspective than the prior iteration of the practice. In the context of SMS implementation, SMS is highly safety-related, and safety has been involved in the core value chain of aviation organizations, such as operational control centers (OCC), pilot and flight standard operations, and maintenance. These departments are most likely to implement SMS first if the organization decides not to implement it in all departments. In other administrative sections, such as ground handling, finance, and human resources, it is possible to implement SMS later, once the model sections have gained experience and set up a mature model for other departments to copy. Resource capability, triggered by the alignment of institutional pressures and self-interest, ultimately governs the decision of whether to implement SMS in the entire organization or only within the core value chain.

On the one hand, SMS implementation needs skilled personnel from each section to conduct training, meetings, and workshops and to generate safety-related guidance and documentation. These activities involve not only employees but also require strong leadership since the safety responsibility needs to be officially assigned to 1) at the organizational level, the sole safety personnel (usually the CEO of the organization), 2) at the section level, the detailed safety responsibility needs to be categorized and assigned to safety personnel of the section (usually the chief of the section). Skilled personnel capital is required to implement SMS.

On the other hand, safety risk management, as the core component of SMS, must be set up within the IT system through the hazard identification and risk assessment system. Building these IT systems costs the aviation organization hundreds of thousands of dollars, which requires physical and organizational capital in terms of resources from the organization. In order to have a highly extensive implementation, improving employees' awareness through comprehensive training and workshops is essential. It also requires time and financial investment.

Therefore, in the circumstance of alignment between institutional pressures and self-interest, the resource capability highly impacts the extensiveness of practice, including high or low implementation. Restated as a hypothesis, I offer the following (Figure 12 a & b):

Hypothesis 5: Under the alignment between institutional pressures and self-interest, resource capability is positively associated with extensiveness implementation.

3.4 Hypotheses for SMS implementation

Ansari et al. (2010) compared whether early and later adopters would implement higher or lower fidelity and extensiveness versions of the practice on technical, cultural, and political fit, respectively. However, they offered little insight into how the fidelity version will affect the extensiveness version of the practice. While the practice under study has been implemented with the true version in certain core departments, the model has been set up and generated a good outcome. This good outcome would, in turn, encourage and provide incentives for the rest of the organization to simulate the true version of practice. In the context of SMS implementation, the well-established SMS framework with comprehensive manual and guidance would help to implement it extensively. The concept of operation (CONOPS) must be developed before any implementation in aviation activities. The True North survey results show that before changing to

True North from Magnetic North, the airline needs the Manufacturer to provide a retrofit program, and the manufacturer needs formal CONOPS to provide the retrofit design. The SMS fidelity is like the CONOP. The more comprehensive and pragmatic the SMS manual and establishment, the more extensive and more accessible it is to implement. It suggests the following hypothesis (Figure 12 & b):

Hypothesis 6: Fidelity implementation is positively associated with extensiveness implementation.

3.5 Hypotheses for Safety performance

In order to explore the SMS practice on safety performance, there is a need to elaborate on the studies of safety performance. As mentioned, safety performance can be presented by quantitative and qualitative performance. Quantitative safety performance can be measured with lagging indicators, such as fatality, accident rate and serious incident rate, whereas qualitative safety performance is a leading indicator and can be analyzed with safety climate (Zohar,1980; Clarke, 2006; He et al., 2016), safety culture (Clinton et al., 2013, Gill & Shergill, 2014, Ioannou et al., 2017), top management decisions influencing safety (Ioannou et al. 2017), reporting system (Lofquist, 2010) and data collection approach(Ioannou et al., 2017).

Since Zohar (1980) introduced the notion of a safety climate four decades ago, safety climate and culture have become hot topics in safety-related research. Zohar (1980) states that safety climates reflect employees' perspectives regarding the relative significance of safe behaviour in their organizational behaviour. The two most influential factors in determining the degree of safety climate were workers' opinions of management attitudes toward safety and their judgments of the importance of safety in general production processes. Safe behaviour can range from extremely positive to neutral and negative, and its average level represents the company's safety culture. Scholars demonstrated that employees' impressions of their company's safety environment are consistent, and safety compliance is associated with safety climate and safety performance (Zohar,1980; Clarke, 2006; Kalteh et al., 2021).

Clarke (2006) used meta-analysis to investigate the relationship between safety climate, safety performance, and occupational accidents and injuries. His study supported the hypotheses linking organizational safety climate to employee safety performance. In his study, employee safety performance is measured by participation and compliance. However, the links between safety climate and accident involvement were found to be moderated by research design. Clarke's study supports the link between qualitative and quantitative employee safety performance.

Kalteh et al. (2021) pointed out the vital link between safety culture, safety climate, and safety performance. Their systematic review study chose English-language papers published between 2005 and 2017 from many databases and particular safety journals. By using the terms "safety and safety performance, safety climate and safety performance, safety culture and safety performance, safety climate and safety outcome, safety culture and injury and fatalities, and safety climate and injuries and fatalities" in the 31 articles chosen for inclusion, Kalteh et al. (2021) assessed the effect of safety culture and safety climate in enhancing safety performance.

They found that reactive criteria, namely lagging indicators, e.g., accident and incident rate and safety compliance, are more compatible with safety climate and culture. The findings highlighted

that increasing the level of safety climate and safety culture, namely qualitative safety performance, could effectively reduce incidents and improve safety performance indicators, namely quantitative safety performance. Based on these arguments, I propose the following hypothesis (Figure 12 a and b):

Hypothesis 7: Qualitative safety performance is correlated with quantitative safety performance.

3.6 Hypotheses for SMS effect on safety performance

Most studies have shown that safety management systems positively impact safety performance. In the study of SMS implementation and benefits within organizations, Bottani et al. (2009) pointed out that organizations that adopted the formal SMS structure had higher measurable safety performance values than non-adopting organizations. The results showed that companies adopting safety management systems better train employees and assess risks. The benefits of the safety management system according to Bottani et al. (2009), are brief:

- Reducing the number of accidents and minimizing the risk of accidents in the workplace by controlling workplace hazards.
- Improving employee morale and enhancing productivity by minimizing production interruptions.
- Reducing the cost of employees' absence and the cost of their insurance as well.
- Reducing the cost of legal litigation in court and reducing investigation time for accidents.

An SMS is a means to optimize a company's performance and economic indicators (Fernández-Muñiz et al., 2009). SMS reduces the quantitative safety performance indicator, such as accidents and incidents (Bottani et al. 2009), but also plays a critical role in improving safety culture, which is well recognized by regulatory authorities. Within the scope of SMS, a positive safety culture is known to be reflected in the proactive and resilient behaviours of personnel in an organization and also serves as a quantitative performance indicator of good organizational management factors (Schwarz et al., 2016). For instance, the Civil Aviation Authority of the United Kingdom (2002) recognizes the safety management system as "the systematic management of risks associated with flight operations, related ground operations, and aircraft engineering or maintenance activities to achieve high levels of safety performance. Gerede(2015a) found that the most significant challenge for the successful implementation of an SMS is the problem of establishing a just culture. He further discusses the problems that create a poor safety culture and the consequences if these problems are not addressed.

Lu et al. (2021) highlight that the advantages of SMS for enhancing the corporate aviation safety culture are substantial. They examine the NTSB accident report using Fishbone Ishikawa Analysis and Free Tree Analysis, combined with decades of industry experience in air operation and safety, and the results assemble a plan for rebuilding the positive safety culture on the solid implementation of SMS, including safety policy, risk analysis, safety assurance and promotion. They also suggest that senior management must show their support and dedication, and employees and safety committees must buy in and participate. Namely, full participation is essential to the success of a safety program.

Safety performance includes quantitative and qualitative aspects, and SMS practice has two dimensions: fidelity and extensiveness. SMS, as a practice, will improve safety performance. On the one hand, the true version from the fidelity dimension provides the safety risk management component, provides hazard identification and risk, assessment and mitigation measures, and follows the safety assurance model to conduct performance monitoring, change, and continuous improvement, and such comprehensive model reduces the accident rate. The other two components, safety policy and promotion, will provide leadership commitment, accountability, and emergency planning and documentation. On top of that, safety promotion will include training, workshops, and communication plans to increase awareness in the entire organization and improve the safety culture.

On the other hand, the high version from the extensiveness dimension of practice implements the four components of SMS practice across the entire organization. It would ensure the comprehensive model is implemented in every corner of the organization, increasing awareness of safety culture and consequently reducing the accident rate, improving quantitative safety performance. Therefore, two dimensions of SMS practice (fidelity and extensiveness) will impact both qualitative and quantitative safety performance measures in alignment and conflict models. It suggests the following patterns of association (Figure 12 a & b):

Hypothesis8:Fidelity implementation is correlated with quantitative safety performance.

Hypothesis9:Fidelity implementation is correlated with qualitative safety performance.

Hypothesis10:Extensiveness implementation is correlated with quantitative safety performance.

Hypothesis11:Extensiveness implementation is correlated with qualitative safety performance.

3.7 Hypothesis for interaction force on SMS and safety performance

Resurgent academic interest in institutional pressures in innovative management practices has led to research assessing the impact of SMS on overall firm performance. Improvement of safety performance is the goal of aviation-related research. The constructed level of the entire theoretical model comprises the interactive power between institutional pressures and internal fit, both impacting SMS implementation. Consequently, the SMS implementation affects safety performance. There is a paucity of literature regarding the interactive effect between external and internal factors, especially the interactive effect on aviation organizations' safety performance through practice.

Institutional pressures have been identified as direct effects on organizational adoption practice by a majority of studies. Kurt (2018) explored the impact of institutional pressures on SMS adoption in Turkey. Singh et al. (2019) demonstrated that SMS practice positively influences civil aviation safety performance. Dubey et al. (2019) utilize the resource-based perspective of the business, institutional theory, and organizational culture to design and test a model that defines the significance of resources for developing capabilities, skills, and big data culture, enhancing cost and operational performance. They illustrate how external pressures affect

internal resource configuration to achieve big data predictive analytic (BDPA) adoption for improving manufacturing performance. Since I argue that the interactive force of institutional pressures and internal fit impacts SMS practice adoption and implementation, and SMS implementation has a positive effect on safety performance, SMS has a mediation effect on the relationship between interactive force and safety performance.

However, it does not fully mediate the relationship since the interplay also directly impacts safety performance. Yang (2018) argued that institutional pressures are positively associated with internal green practices, which are positively related to green performance in the container shipping context. Lu et al. (2018) investigated that institutional pressures significantly positively impact sustainable supply chain practices (SSCP), which positively influence economic, environmental, and social performances. The study by He et al. (2016) demonstrated that coercive, normative, and mimetic pressures positively relate to organizational management commitment to safety and employee engagement. Their study also reveals the importance of external pressures in improving project safety climate. Also, it sheds light on the utilization of institutional factors to promote the improvement of the construction industry's safety climate. It demonstrates that institutional factors have a direct impact on qualitative safety performance. Moreover, Spence et al. (2015) use Negative Binomial regression to reveal correlations between member state's compliance with international safety standards and fatality rates, as well as associations between fatality rates and state GDP and population levels.

To sum up, the interplay force of institutional pressures and internal fit not only directly affects an organization's operation and safety performance but also through the adoption of best practices to improve safety performance, which leads to the following hypothesis:

Hypothesis 12: SMS implementation partially mediates the relationship between the interactive effect of institutional pressures and internal fit and safety performance.

3.8 Conclusion

The research model comprises institutional pressures, internal fit, SMS implementation, and safety performance. In this review of these constructs' existing relationships, I identified how institutional pressures and internal fit interact with practices implementation and safety performance. The institutional pressures are considered external factors, including coercive, mimetic, and normative pressures stemming from the organization field. In contrast, internal fit is classified as internal factors, including organization self-interest and resource capability, from goal and mean levels within organizations.

Based on this review, I propose that the interactive force of institutional pressures and internal fit will affect SMS implementation, which includes fidelity and extensiveness, two dimensions to describe the different levels of SMS practice implementation.

Since the goal is to improve safety performance in the aviation community, analyzing the effect on SMS practice and safety performance is crucial in finalizing the research model. The fidelity and extensiveness of SMS implementation impact the organization's safety performance, which is composed of quantitative and qualitative safety performance.

In the hypothesis's development section, the interactive force between institutional pressures and internal fit triggers strategic responses ranging from *advocate, strive, follow, to reluctant and incapable*. These responses are divided into two scenarios: alignment and conflict. *Advocate* and *strive* reside in the alignment scenario, whereas *reluctant* and *incapable* responses lie in the conflict scenario. Practice implementation can be approached in two dimensions: fidelity and extensiveness. The conceptual model defines fidelity as establishing the SMS framework and manual and extensiveness as implementing deeply in employees' daily work and covering all sections of the organization. The chosen strategic response leads to different degrees of practice implementation presented from vertical fidelity and horizontal extensiveness dimensions. The strategic responses and four types of practice implementation are theoretically proposed in this research and presented in the research concept (Table 10). They are empirically tested in the following chapters. However, I developed 12 hypotheses in the final research model (Figure 12 a & b), which can be summarized into three categories and are empirically tested in Chapter 5:

1. *Interaction between institutional pressures and internal fit*

There are two fundamental scenarios: alignment and conflict between institutional pressures and internal fit. When institutional pressures align with an organization's self-interest, resources can be relocated to support the SMS implementation. Higher self-interest and higher resource capability lead to fidelity and extensiveness implementation, respectively. In contrast, where institutional pressure conflicts with the organization's self-interest, lesser self-interests result in no resources allocated for SMS implementation. Only institutional pressures are positively associated with SMS fidelity implementation.

2. *SMS implementation and safety performance*

Due to comprehensive SMS practice, greater SMS fidelity implementation leads to greater extensiveness of SMS implementation. Moreover, safety performance has been studied in both quantitative and qualitative dimensions. Safety qualitative performance positively impacts quantitative performance. In addition, this study proposes that SMS fidelity and extensiveness impact quantitative and qualitative safety performance, respectively.

3. *SMS implementation has a partial mediating effect on the relationship between interactive force and safety performance.*

The first two categories of hypotheses lead to the last hypothesis of the research. At the research mode at the construct level, this study proposes that SMS implementation partially mediates the relationship between interactive force and safety performance.

4. RESEARCH METHODOLOGY

This chapter presents the methodological approach of the research, including the description of the survey procedures, participants, measures, data screen, and analytical research techniques used in Chapter 5.

4.1 Survey procedure and participants

In comparison to postal questionnaire surveys, online surveys have lower costs, faster response rates, more geographical coverage, and fewer unanswered questions (Bryman, 2008). Using the online survey platform "Microsoft Form," this study is able to promptly and anonymously send questionnaires to possible participants in the global aviation community, as well as manage the surveys in a cost- and time-efficient manner. Participants are sent through email and public media, such as LinkedIn and WeChat, including a link to the survey.

Although disadvantages of online surveys have been reported (Bryman, 2008), such as a low response rate due to internet access difficulties, these limitations do not apply in this instance since most aviation organizations in the world have internet service providers, routers, or WIFI to have access to the Internet and email systems as IT systems are daily operational tools for carrying out their jobs and missions. Participation is entirely voluntary and anonymous, and respondents may cease responding at any moment and for any reason. Only if respondents are interested in this research progress or would like to participate further can they leave contacts for further updates.

4.1.1 Sample size

The unit of analysis in this study is at the organizational level. Although stakeholders in the global aviation community have implemented SMS more than others to some extent, the metric of safety performance among stakeholders is not the same. In addition, SMS is not obligatory for domestic airlines, general aviation, ground handling organizations, or other aviation-related organizations, such as catering and fuel companies. Therefore, this study focuses on State CAAs and IATA member airlines, which are all commercial airlines. As of 2021, there are 193 member states CAAs and 290 commercial member airlines of IATA, which results in the population of the study being 483.

In terms of sample size, a larger sample decreases the uncertainty and increases confidence, power, and greater precision in the estimation (Etikan and Bala, 2017). Elsebaei et al. (2020) use a z-score to calculate sample size for prevalence studies if the population is finite. The sample size equals n1=z2pq/e2, p refers to population prevalence, and q refers to 1-p. If choosing a 95% confidence interval, the Z score is 1.96, with 50% population prevalence and 0.07 margin or error, and the sample size is $196=1.96*0.5*0.5/0.07^2$. If the sample size is greater than 10% of the population, which is 49 entities (196>49), then the population is not considered large. Therefore, the sample size should be subjected to adjustments for true sample size. The true sample value can be calculated using the simplified formula recommended by Yamane (Israel, 1992): n2=n1/(1+(n1-1)/N) =196/(1+((196-1)/493)=140, which is the sample size threshold in this research). Therefore, in this research, the second method is used to target a certain sector or group.

ICAO holds an assembly every three years in which member states send delegations and industry representatives together to agree upon proposed projects by contracting states through working papers and voting processes. I targeted ICAO Assembly 41 in 2022, from 27 September to 7 October, to boost the data collection. After cleaning the data, the final sample size is 176, which is acceptable since it exceeds 140 of the abovementioned thresholds.

4.1.2 Data Source

Airlines usually assign safety-related employees, such as senior and middle-level safety managers, to establish and implement SMS. At the management level, they would be more likely to know more about institutional pressures and safety-related matters, which they are the target as a preferred source to collect data. Apart from them, the front-line workers are also appropriate to answer the survey since SMS implementation is deeply penetrated in the organization, from the front desk to higher management. Moreover, it usually takes an airline two years to establish SMS practice. Most airlines started to establish and implement it between 2010 and 2012 worldwide. Therefore, employees with a minimum of 2 years of experience in aviation safety are ideal for filling out the questionnaire.

The survey structure opens with a statement offering some background information and ethical review board criteria. The survey received approval from the Human Research Ethics Committee of Concordia University, and the relevant protocol code # 30015803 was obtained (survey link https://forms.office.com/r/qTDN6NsyL0). The second portion of the survey covers demographic questions related to respondents, such as gender, education level, position, professional field, and years of working experience in aviation. This section also includes questions related to the organization's demographics, such as organization size, type, and geographic location. Finally, the third portion of the survey comprises the questions relevant to the construct and theory sources listed in Tables 12, 13, 14, and 15.

4.1.3 Survey process

Since using the non-random sampling techniques, initially, emails were sent to the safety management committee, which are convenient to reach as well as they are experts in safety, composed of State CAA officers, advisers, and observers from industrial aviation organizations representatives, urging them to engage in the study and requesting permission for their personnel to participate. As a result, 50% out of 280 member airlines and 15% of State CAAs expressed a desire to participate and a willingness to assist in disseminating questionnaires inside their organizations. These organizations have provided valuable responses and made me better understand SMS implementation in these organizations in the last decades.

Apart from the above approach, the survey was also sent through former colleagues who have been working in CAA and IATA member airlines for over ten years. Participants were given the option to distribute the survey further to their colleagues or peers who also work in aviation by using snowball methods. Snowball sampling is a technique used in market research to collect survey responses. The survey is distributed to a small group of respondents, and each participant distributes the link with their own network or group of responders (Goodman, 1961). However, there are some discussions about the dangerous approach of this method due to birds of a feather flock together and getting similar options. However, some research focusing on awareness, pricing, and perception may cause trouble with similarity within the same population group. As

far as SMS and safety performance, they must comply with safety policy and cannot be influenced just by friends.

4.2 Experimental design

The study is conducted with a nonexperimental cross-sectional design through online surveys. The institutional pressures, internal fit, SMS, and safety performance will be measured through the survey. Considering the resistance, uncertainty, and mobility inherent in airlines during the COVID-19 pandemic, three reminders were sent to follow up on the participants after three months and after six months, respectively. Last, the survey was promoted during the ICAO Assembly 41 held in Oct 2022, sufficiently increasing responses to the acceptable sample size.

4.3 Measures

A 5-point Likert-type scale was utilized to boost the response rate and decrease respondents' "frustration level" (Babakus and Mangold, 1992). Additionally, previous research has demonstrated that respondents easily understand a five-point scale, which enables them to express their opinions (Marton-Williams, 1986). The survey was applied using a 5-Likert scale to increase response rates. Based on previous research and proper study analysis, the measurement items for evaluating institutional pressures, SMS implementation, and safety performance are listed in Tables 12,13,14 and 15.

A pilot test was employed to ascertain content validity as well as construct reliability and validity. The questionnaire was sent to 14 experts working as senior safety managers in State CAA and airlines for pilot testing. Based on their valuable feedback, the questionnaire is modified to remove duplicated items, add clarification, and make it more understandable and easier to respond to. These measurement items for four constructs are described in the following four sections: 4.3.1, 4.3.2, 4.3.3, and 4.3.4.

4.3.1 Institutional pressures construct

Institutional pressures are comprised of coercive, normative, and mimetic pressures. Previous studies on items measuring institutional pressures, such as Yang (2008), investigated green supply chain management and green performance under institutional pressures. Teo et al. (2003) investigated institutional pressures on the adoption of financial electronic data interexchange (EDI). He et al. (2016) analyzed the impact of institutional pressures on the safety climate in the construction industry. Items to measure institutional pressures in this study have been integrated with the aviation context and are listed in Table 12.

Each pressure will be operationalized using at least four items for measurement tested with exploratory factor analysis and analyzed using confirmatory factor analysis(Shah et al.,2006; Anderson and Gerbing, 1988). All indicators were scored on a 5-point Likert scale, to what extent the respondent agrees with listed pressures placed on their organization to implement SMS, ranging from 'strongly disagree' (1) to 'strongly agree' (5).

Variables	Items	Reference
Coercive pressures	1. Standards and recommended practices (SARPs) of the International Civil Aviation Organization (ICAO).	Lu et al.,(2018); Huo et al.(2013)
	2. Mandatory regulation of State/National civil aviation authority (CAA).	Lu et al.,(2018); Huo et al.(2013)
	3. Regulation and rules of Regional Aviation Safety Agency.	Lu et al.,(2018); Huo et al.(2013)
	4. Mandatory rule of the parent corporation.	Teo and Benbasat (2003)
	5. Our customers may consider us backward if we do not implement SMS.	Rameshwar et al. (2015); Teo and Benbasat (2003)
Normative pressures	6. Influence of the rules of the International/National Aviation Association, such as IATA, ACI, CANSO, and ICCAIA.	Teo and Benbasat (2003); Huo et al.(2013)
	7. Influence from training institutions in our industry.	Teo and Benbasat (2003); Huo et al.(2013)
	8. Influence from professional networks in our industry.	Teo and Benbasat (2003)
	9. Influence from professional groups who graduated from similar universities.	Teo and Benbasat (2003); Huo et al.(2013)
Mimetic pressures	10. Perceive that prestigious airlines have adopted SMS.	Teo and Benbasat (2003)
	11. Perceive those main competitors who have adopted SMS benefit greatly.	Teo and Benbasat (2003)
	12. Perceive that other organizations that have adopted SMS are more competitive.	Teo and Benbasat (2003)
	13. In our industry, organizations that do not readily adopt SMS will be left behind.	Wu et al. (2003)
	14. In our industry, most organizations will ultimately end up adopting SMS.	Wu et al. (2003)

Table 12: Institutional pressures measurement items

4.3.2 Internal fit construct

In this study, the organization's internal fit is composed of self-interest and resource capability. The self-interest dimension includes the organization's perceived benefits (Wendland et al., 2019; Moore & Benbasat, 1991; Jensen & Szulanski, 2004), compatibility (Wendland et al., 2019; Moore & Benbasat, 1991), and challenges (Greenwood & Hinings, 1996; Wendland et al., 2019; Moorthey et al., 2017). The study categorizes self-interest into positive (items 1-8) and negative (items 9-13) to differentiate the alignment and conflicts towards institutional pressures (See Table 13). The negative items 9-13 were adopted from internal groups that felt difficult and "not supportive of power dependencies as the enablers of radical challenges while facing institutional demands," according to Greenwood Hingings' study (1996, p.1037). Employees resist change (Wendland et al.,2019) or feel it is difficult to use or understand the guidance (Moorthey et al., 2017).

According to Barney (1991), there are three types of resources: physical capital, human capital, and organizational capital resources. Based on Teece (2019), ordinary capabilities play a critical role in resource building within an organization. Moreover, Chwelos et al. (2001) posit three

factors as determinants of the adoption of electronic data interchange (EDI): readiness, perceived benefits, and external pressure. In addition, they use structural equation modelling (SEM) to analyze survey data to demonstrate that constructs in the research model can be categorized into three levels: technological, organizational, and inter-organizational. The first determinant factor is readiness, which is more aligned with Barney's (1991) physical and organizational capital resources. The second determinant factor, perceived benefit, is related to the organization's self-interest. The third factor, external pressures, is related to institutional pressures., and the inter-organizational level is more related to external factors.

Based on the theoretical grounding presented above, the measure of resource capability is designed with five items (items 14-18) in Table 13. All indicators were scored on a 5-point Likert scale, to what extent the respondent agrees with related internal fit towards SMS implementation in their organization, ranging from 'strongly disagree' (1) to 'strongly agree' (5).

Variables	Questions	Reference
Self-interest: Perceived benefits	1. Enhance productivity.	Wendland et al., (2019); Moore and Benbasat (1991), Jensen and Szulanski (2004)
	2. Enhance the quality of work.	
	3. It is easy to work with the support of SMS.	
	4. Become very dependent on SMS.	
Self-interest: Compatibility	5. Align with the organization's mission, objectives, and goals.	Wendland et al., (2019); Moore and Benbasat (1991)
	6. SMS fits into organizational culture.	
	7. SMS is compatible with top management's work style.	
	8. SMS is compatible with most aspects of employees' work.	
Self-interest: Challenge	9. Consider the implementation of SMS as a threat to jeopardize the current role or position.	Greenwood and Hinings (1996); Wendland et al. (2019); Moorthey et al. (2017)
	10. Has difficulty understanding the SMS concept.	
	11. Lack of guidance or training to implement SMS.	
	12. Top management resists changing the way they work.	
	13. Employees do not want SMS to increase their workload.	
Resource Capability	14. In the context of your organization's overall budget, the financial cost of adopting and implementing SMS would be very significant.	Barney (1991); Teece (2019); Chwelos et al., (2001)
	15. Your organization has a sufficient financial budget to adopt and implement SMS.	
	16. Your organization has sufficient skillful personnel to adopt and implement SMS.	
	17. Your organization has sufficient technical resources (i.e., equipment, system) to adopt and implement SMS.	
	18. Your organization's current structure (i.e., formal and informal reporting, planning, controlling, and coordinating systems) to adopt and implement SMS.	

Table 13. Internal fit measurement items

4.3.3 SMS construct

The framework for SMS implementation has been defined in ICAO Standards and Recommended Practices (SARPs). Different authors, researchers, and standard organizations have variously defined SMS components to some extent, with more than 12 elements (Onyegiri and Oke, 2017), but the cornerstone is still based on ICAO SARPs (ICAO Annex 19, 2016; ICAO Doc 9859, 2018), the framework comprises four components and twelve elements as the minimum requirements for SMS implementation.

In this study, the level of SMS implementation is measured by two dimensions: fidelity and extensiveness. Since fidelity depicts the true version of the practice, SMS includes four components: safety policy, safety risk management, safety assurance, and safety promotion. Table 14 details the 12 items developed by Hsu et al. (2010) as the minimum requirements for SMS implementation. Extensiveness is evaluated through four items identified by Kenney and Fiss (2009). The extensiveness criteria are shown in Table 14 (items 13-16). Each item is scored on a 5-point Likert scale, which represents the extent to which the respondent agrees with SMS implementation status in their organization, ranging from 'strongly disagree' (1) to 'strongly agree' (5).

Variables	Elements	Items	Reference
Fidelity	Safety risk management	1. Hazard identification has been effective	ICAO Doc 9859 (2009) Hsu et al. (2010)
		2. Safety risk assessment and mitigation have been effective	
	Safety assurance	3. Safety performance monitoring and measurement have been effective	
		4. The management of change has been effective	
		5. Continuous improvement of the SMS has been effective	
	Safety policy	6. Management commitment has been effective	
		7. Safety accountability and responsibilities have been effective	
		8. The appointment of key safety personnel has been effective	
		9. Coordination of emergency response planning has been effective	
		10. SMS documentation has been effective	
	Safety promotion	11. Training and education have been effective	
		12. Safety communication has been effective	
Extensiveness		13. Apply to all departments of organizations, including operation and administration. (Wu et al., 2003)	Kennedy and Fiss (2009) Maurino (2017) Scheirer (1983)
		14. SMS has covered all functions of organizations. (Wu et al., 2003)	
		15. Employees in your organization understand SMS and have integrated it into their daily work. (Kennedy & Fiss, 2009)	
		16. SMS implementation is substantive rather than superficially for ceremonial reasons (Ansari et al., 2014; Boxenbaum & Jonsson, 2008).	

Table 14: SMS measurement items

4.3.4 Safety performance construct

According to ICAO Doc 9859 (2018, p.viii), safety performance refers to “the State's or service provider's safety achievement as defined by its safety performance targets and safety performance indicators. Safety performance indicators refer to a data-based parameter used for monitoring and assessing safety performance”. States and service providers use both lagging and leading indicators to classify safety performance. Lagging indicators measure events that have already occurred and are historical information, such as fatality, accident, and serious incident rates. In contrast to lagging indicators, leading (proactive) indicators can be used to identify underlying causes and contributing factors of accidents, such as the failure to identify hazards, delayed emergency response, inappropriate or inadequate training, or a lack of resources, which can be used as predictors or early warning indicators (Hinze et al., 2013; Øien et al., 2011; Sgourou et al., 2010).

In the late 1980s, as safety improved and the frequency of fatality and accidents declined, Shrivastava (1986) argued that fatality and accident rates as leading indicators had ceased to be a valuable metric of safety performance. Roberts and Rousseau (1989) described those organizations that succeed in avoiding catastrophes in high-risk environments as high-reliability organizations (HROs). Given the low number of accidents that occur in HROs, these organizations have started to examine "leading indicators" of safety in an attempt to improve safety performance even further. The United Kingdom's Health and Safety Executive (HSE, 2006) defined leading indicators of safety as measures of inputs essential to deliver the desired safety outcomes (e.g., safety climate surveys and hazard reports). Therefore, leading indicators of safety provide a more proactive method to gain insight into the organization's safety performance and identify areas in which efforts should be made to improve safety.

Safety climate is one of the most commonly used leading indicators of safety in non-aviation HROs. Zohar (1980) defined the safety climate as a summary of employees' perceptions about their work environment. Safety climate describes employees' perceptions, attitudes, and beliefs about risk and safety (Mearns & Flin, 1999). It is a snapshot of the current manifestation of the safety culture in the organization. There has been an ongoing debate within the literature regarding the use of the terms "culture" and "climate" and whether they represent the same or different concepts. The consensus is that culture represents the organization's more stable and enduring traits and has been likened to "personality." Safety culture reflects fundamental values, norms, assumptions, and expectations, which, to some extent, reside in societal culture (Mearns and Flin, 1999).

On the other hand, the climate is thought to represent a more visible manifestation of the culture, which can be seen as its mood state at a particular moment in time (Cox & Flin, 1998). O'Connor (2011) also pointed out that, in commercial airlines, fatality and accident rates have been too low to provide a sufficiently sensitive measure of safety performance. However, there are other measures of safety performance, such as the effectiveness of the aviation safety climate (O'Connor et al., 2011).

Moreover, the effectiveness of safety information systems, including self-reporting systems, emergency response systems, hazard identification systems, etc., are proven to be one of the key leading performance indexes (KPIs) in safety performance (Ioannou et al., 2017; Patriarca et al.,

2019). Safety performance indicators are an important part of the SMS as they allow for establishing, implementing, and following safety policies (Øien et al., 2011).

Based on previous research and the ICAO safety manual, safety performance is measured using nine items. Items 1 to item 3 are indicators for quantitative safety performance, and items 4-9 are indicators for qualitative safety performance. They are scored on a 5-point Likert scale, where respondents are asked to rate to what extent they agree that safety performance has been improved in their organization, ranging from 'strongly disagree' (1) to 'strongly agree' (5). Table 15 displays both the qualitative and quantitative indicators.

	Items	Reference
Safety performance quantitative indicator (Lagging indicators)	1. Fatality has been reduced (Lagging indicator)	Singh et al., (2019); ICAO Doc 9859,(2018); Lu et al.,(2018)
	2. Accident rate has been reduced (Lagging indicator)	Chen and Li (2016); Singh et al., (2019); ICAO Doc 9859,(2018); Lu et al.,(2018)
	3. Serious incident rate has been reduced (Lagging indicator)	Chen and Li (2016); (ICAO Doc 9859,(2018), Lu et al.,(2018)
Safety performance qualitative indicator (Leading indicators)	4. The effectiveness of safety management tools has been increased. i.e., hazard identification system and emergency response system.	Chen and Li (2016); Singh et al., (2019); Ioannou et al., (2017); Patriarca et al., (2019); ICAO Doc 9859,(2018), Lu et al.,(2018)
	5. Effectiveness safety culture has been enhanced.	Zohar,(1980); Clarke, (2006); O'Connor et al.,(2011); Ioannou et al., (2017); ICAO Doc 9859,(2018); Lu et al.,(2018)
	6. A voluntary reporting system has been established with clarified responsibilities, reporting processes, rewards, liability reduction, and exemption rules	ICAO Doc 9859, p.3-3
	7. Individuals act and make decisions according to a common belief that safety is part of the way they do business	ICAO Doc 9859, p.3-3
	8. Individuals value being informed and informing others about safety	ICAO Doc 9859, p.3-3
	9. Individuals trust their colleagues and managers with information about their experiences, and the reporting of errors and mistakes is encouraged to improve how things are done in the future	ICAO Doc 9859, p.3-3

Table 15: Safety performance measurement items

4.4 Cleaning of data

Data screening verifies that the data are free of structural and formatting issues and is also suitable for statistical analysis with minimal statistical error risk. This study evaluated data to verify that they are testable, dependable, and useful. This study focuses on three data cleansing concerns: missing data, unengaged responses, and normality and Skewness. Due to the exploratory nature of this study and the complexity of the suggested research model, the sample data's linearity, homoscedasticity, and multicollinearity are not examined.

If a study lacks a substantial amount of sample data, this might lead to many bias issues. The most obvious issue is that there are insufficient data points to do the analysis. The exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and path analysis models to be

employed in the study require a certain number of data points to produce estimates. This number grows as the complexity of the investigated research model increases. In addition, inadequate data may lead to incorrect interpretations of contextual concerns.

According to Huisman (2000), there are several approaches to discussing missing values, with imputation being one of the most common tactics for dealing with missing values in item scales. During the imputation procedure, missing values in a data set are replaced with approximated values. SPSS offers five distinct imputation options, and the imputation methods addressed in this study are confined to these five alternatives. These approaches may be characterized as series mean, mean of nearby points, median of nearby points, linear interpolation, and linear trend of points (Mertler & Vannatta, 2005). This study adopted median imputation since the questionnaires used ordinal variables evaluated on Likert scales. I found two responses from the survey that have missing data on questions 12 and 15, located in the institutional pressures construct. I have applied the median to these questions.

Since Likert scales are used for the sample in this study, outliers do not exist in the data, as responses at the extremes (1 or 5) do not indicate outlier behaviour. The second sort of outlier is a disinterested responder. Occasionally, respondents will input "3, 3, 3, 3"(pattern 1) for each survey item. Clearly, this person was disinterested, and their replies would skew the results. '1, 2, 3, 4, 5, 1, 2,' or '1, 1, 1, 1, 5, 5, 5, 5, 1, 1...' (pattern 2) are other patterns suggestive of disengaged responders. In order to limit the effect of unengaged response error on the results, I eliminated eight responses with a standard deviation with a zero value, which belonged to pattern one and was regarded as an unengaged response mistake. I do not find any pattern 2 in survey responses in this study. The multivariate outliers are records that deviate from the correlation patterns indicated by the other records in the dataset. Due to the exploratory character of this work, the issue of multivariate outliers was not investigated.

I also examined normality through skewness and kurtosis as part of the data-cleansing procedure. A normality test is utilized to ascertain if sample data was taken from a regularly distributed population (within a certain tolerance). The normal distribution's height and spread are described by skewness and kurtosis. Skewness is a measure of the data's horizontal pull. Kurtosis is used to determine the height of the peak or the vertical pull, and it indicates how dispersed the data is.The rule for determining whether skewness and kurtosis are acceptable is controversial, as there are several views regarding Skewness and Kurtosis to be evaluated for normality. Asymmetry and kurtosis values between -2 and +2 are commonly considered acceptable to demonstrate normal univariate distribution (George & Mallery, 2003). Hair et al. (2010) and Bryne (2010) stated that data is considered to have a normal univariate distribution if Skewness is between -2 to +2 and kurtosis is between -7 and +7, which is used in this research.

4.5 Treatment of data

As part of the data analysis, this study analyzed four commonly acknowledged forms of survey mistakes, namely sampling, non-coverage, measurement, and non-response. In addition, this study addresses elements that would lower the accuracy of the survey estimate due to survey mistakes.

Sampling error is a mistake that occurs when a sample survey includes only a part of the population (Weisberg, 2005). Typically, it may be diminished by utilizing a large, random sample of the population of interest. Since SMS is a common practice and its goal is to train and

educate all employees in aviation organizations to practice, aviation technical officers and front-line employees in organizations are the most targeted group for the survey, and the sample population accurately represents their organization in terms of SMS implementation. The non-coverage error occurs when specific population members are omitted from the sample size. In this study, sampling was collected using an anonymous approach to targeted aviation organizations, leading to random effects. Moreover, numerous reminder efforts were made to get the maximum response rate possible.

Measurement error is the amount by which a survey statistic deviates from its 'actual' value owing to flaws in the data collection process. The most frequent sort of measurement mistake occurs when researchers test hypotheses using poorly phrased questions, flawed assumptions, and inaccurate scales. To reduce these sorts of data mistakes, the survey of this study was based on theory, reviewed by other researchers and aviation technical officers who are pilots or directors at the level of organization, and pre-tested in 2019 with 14 responses. All the survey questions were derived from previously validated research or related regulations.

No matter how well a sample is chosen, some respondents will always refuse to complete the survey. As described in the section on data collection, the Dillman (1983, 1991) follow-up procedure was utilized. In addition, the surveys were designed to look simple and quick to complete, and the respondents were encouraged to participate by a concise explanation of the research's goal. The introduction of the surveys required earlier conversations with vice presidents to explain and illustrate the benefit of this study to their organization. Consequently, there was high management support prior to the administration of the survey. Furthermore, at the beginning of the survey, I asked if the respondents agreed to participate in this research. 11 respondents had not agreed to participate in the survey. I eliminated them from the data sample.

A low standard deviation suggests that the data points tend to cluster near the set's mean, whereas a high standard deviation shows that the data points are dispersed over a broader range of values. Therefore, after the treatment of the data, the final set of data samples is ready for the next steps of the analytical approach.

4.6 Analytical approach

This research includes complex, multi-faceted constructs involving political science, sociology, and transportation management disciplines. These kinds of concepts can be challenging to measure and are often measured with errors. Structure equation modelling (SEM) is a general modelling framework that integrates a number of different multivariate techniques into an overall framework rather than regression or any linear modelling. One of the valuable aspects of SEM is to make corrections for measurement errors as it integrates measurement theory from psychology, factor analysis from psychology and statistics, path analysis from epidemiology and biology, traditional regression modelling from statistics, and simultaneous equations from econometrics. Moreover, SEM is well-suited to specify multiple and causal relationships instead of a single dependent variable with a set of independent variables. SEM may have numerous outcomes or dependent variables, each affecting other dependent variables in a more complex system (Sturgis, 2016). Last but not least, to investigate the above-mentioned hypothesis of mediation effect, SEM is often used to address and test such mediation effects with direct, indirect(mediated), and total effects.

In brief, SEM is the path analysis with latent variables and investigates the causal relationships of constructs. In this way, two stages are conducted, namely measurement models and structural models processes.

- The first stage is the measurement model process to get good measures of constructs, which means eliminating errors and obtaining the true value of each construct as much as we can. Hence, two approaches were used, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), to measure the four constructs: institutional pressures, internal fit, SMS, and safety performance.

    - EFA was used to examine the nature of latent variables underlying the measured set of items, and a maximum likelihood (ML) estimate was used for analysis. Consequently, four separate EFAs are conducted on the institutional pressures, internal fit, SMS, and safety performance theories, respectively, to retain factors that explain a satisfactory number of observed variances separately. SPSS 22 is used as the analytic tool, employing a maximum-likelihood factor analysis with a Promax rotation (Kappa=4) to investigate the factor structure of the survey measures. As Gorsuch (1983, p. 205) put it, "If the simple structure is clear, any of the more popular procedures can be expected to lead to the same interpretations." He then recommends rotating with Promax. Promax Rotation, as an oblique rotation, allows factors to be correlated and can be calculated more quickly than a direct oblimin rotation if the data sample size is greater than 150.

      The EFA approach determines if the load of the assessed item is on one common factor (owing to shared method variance) (Podsakoff et al., 2003) or whether they reflect distinct constructs. The correlation of covariances (observed items' factor loading) threshold is 0.5. If the loading is less than the threshold, these observed items are eliminated from that factor in this research.

    - Eliminating the unrelated items from factors in EFA based on a set threshold leads to the next CFA approach. Such the process of fixing some indicator of items to zero in EFA makes the CFA restricted factor model, referring to the over-identify the model, which gives us more degrees of freedom to enable us to test the fit of a priori model compared to the matrix that we have actually observed the sample variance matrix. Therefore, each construct model is evaluated independently (as theoretically expected) and is integrated together in CFA to test the integrated model fit.

- The second stage is structural modelling to investigate the structural relationships among those measured constructs, which dives into the theories of how constructs are related to one another. In this stage, the below four steps are followed:
    - Establish a satisfactory measurement model for key constructs using observed variables.
    - Fit regression paths between concepts by structural equations specifying how concepts are related to each other.
    - Test hypotheses on model parameters

- Assess model fit, and if there is a well-fitting model, then I can be confident that the estimates of the model parameters are consistent and unbiased.

4.6.1 Construct reliability

Assessing the degree of consistency between several measurements of a variable is called reliability (Hair et al., 2010). Underlying the concept of reliability is the notion that all items or indicators included in one scale should be significantly intercorrelated, indicating that they measure the same thing. Cronbach's (1951) Alpha is the standard measure of internal consistency and dependability of constructs. In modern research, a Cronbach's Alpha score between 0.7 and 0.8 is often accepted. However, some research suggests that this should not be considered a norm. Kline (2000), for instance, asserts that results below 0.7 may be anticipated when evaluating psychological constructs due to the variety of the tested conceptions. Hair et al. (2009) also say that the cutoff value might be reduced to 0.6, particularly in exploratory investigations. In addition, it is well-known that Cronbach's Alpha increases as the number of measures grows (MacKenzie, Podsakoff, and Podsakoff, 2011), implying that the contrary might also occur (Cronbach's Alpha lowers as the number of measures reduces). Crobach's reliability is tested in section 5.3.

In addition to Cronbach's Alpha (1951), Fornell and Larcker (1981) provided the reliability metrics Construct Reliability (CR), which is obtained from CFA findings. CR presents the ratio of the variation accounted for by the latent construct to the overall variance in the measurements. The CR value must exceed 0.6 (Bagozzi & Yi, 1991) or 0.7 (Steenkamp and Van Trijp, 1996). As suggested by Martnez-López, Gázquez-Abad, and Sousa (2013), this research adopts Cronbach's Alpha (cut-off 0.7), the CR (cut-off 0.6), and the AVE (cut-off 0.5) as acceptable threshold levels (Table 16). CR is tested in section 5.5

4.6.2 Construct validity

Once a measurement scale has been shown to be reliable, it should be checked to see if it consistently measures what to measure (Utwin, 1995). Construct validity measures how accurately items can measure constructs. Meanwhile, reliability measures how consistent this method is in its measurement. In a nutshell, reliability is about a method's consistency, and validity is about its accuracy. It has been suggested that 'A variety of approaches should be used in testing any index, rather than relying on a single validation procedure' (McDowell & Newell 1996, p. 37). This is because validity is not absolute. It is a matter of degree rather than an 'all or nothing' concept' (Carmines & Zellar1979). 'In reality…it is not possible to take one form of measurement validity in isolation, as several forms may be applicable' (Gould 1994, p. 102).

I conduct three validity checks in this research: content validity, 'In reality…it is not possible to take one form of measurement validity in isolation, as several forms may be applicable' (Gould 1994, p. 102). convergent validity and discrimination validity:

Content validity considers whether a scale has included all the relevant and excluded irrelevant issues in terms of its content. From a psychological point of view, this means that the test covers all the questions that could be asked well. It is generally judged by 1) a critical review by a panel of experts to make sure it is clear and complete, 2) a comparison with the literature, or 3) both (Bannigan & Watson, 2009). I have conducted both in this research since the measure items in

the survey have been pilot-tested by the panel of 13 safety experts and academic professors, as well as introduced from the literature review.

Convergent validity: Convergent validity shows how much a measure of one construct correlates with other measures of the same or related constructs. Correlational evidence evolves by testing a priori hypotheses about how the measurement under development will correlate with another measurement scale. Convergent validity is measured by the average variance extracted (AVE >= 0.5 thresholds, See Table 16). The AVE should not be lower than 0.5 to demonstrate an acceptable level of convergent validity, meaning that the latent construct explains no less than 50% of the indicator variance (Fornell & Larcker, 1981).

Discriminant validity, namely, divergent validity, is how much a measure of one construct does not correlate with tests that measure different constructs. Convergent validity assesses the sensitivity, and divergent validity tests the specificity of a measurement scale. Method of testing discriminant validity in this research: the items should be loaded higher on their own construct than on the other constructs employed in the model, and the average variance shared between the constructs and their measures should be bigger than the variance shared among the constructs themselves (Fornell & Larcker, 1981). The details are presented in Chapter 5, section 5.5.

This study also investigates the dependability and validity of the conceptual model's constructs. This study adopted Maximum likelihood (ML), a commonly used estimation technique and the default estimation method in AMOS, after comparing the literature on the multiple estimation methods provided by AMOS to the aims of this study and the features of the gathered data. This decision was made due to the fact that ML is a full-information approach that reliably produces efficient and robust estimations despite modest breaches of the normalcy assumption (Diamantopoulos & Siguaw, 2000). In addition, ML estimation is accompanied by a set of statistics that may be used to evaluate competing models. Consequently, CFA was used to examine the reliability and validity of the measurement model for all research variables.

Indices for Reliability & Validity	Cut-off Point
Cronbach's Alpha	$\alpha > 0.7$ (Cronbach, 1951)
Construct Reliability (CR)	CR > 0.6-0.7 (Bagozzi & Yi, 1991; Steenkamp and Van Trijp, 1996)
Average Variance Extracted (AVE)	AVE > 0.5 (Fornell & Larcker, 1981)

Table 16: Threshold Table of Indices for Reliability and Validity

4.6.3 Assessment of model fit

Chi-square test assessment: One must examine the goodness of fit to evaluate a model's dimensionality and validity. The Chi-square test is the most often used measure for assessing the overall goodness of fit. Therefore, significant Chi-square test results indicate a considerable disparity between the data and the model, signaling that the model should be rejected. Even though it is one of the most often recommended metrics for data sets with fewer than 200 samples, conclusions on model fit based purely on the Chi-square test are frequently disregarded because sample size affects the Chi-square test (Shah & Goldstein, 2006). Since this ratio corrects the x^2 measure for model size, academics frequently evaluate the ratio of Chi-square to degrees of freedom. Values between 1 and 3 are desired as values smaller than 1 indicate an

overfitted model, while values higher than 3 indicate an under-parameterized model (Schumacker & Lomax, 2010). Several alternative fit indices have been created to compensate for the shortcomings of Chi-square statistics. Another popular way of evaluating model fit is the so-called fit indexes that have been offered to supplement the x^2test. Fit indices are often divided into three broad categories: absolute, incremental, and parsimony (Bollen & Lennox, 1991). As Hu and Bentler (1999) pointed out, the fit indexes are necessary to combine multiple indexes to measure the model fit, such as ML-based TLI or CFI close to 0. 95 and SRMR close to 0.08, with RMSEA close to 0.06 are considered a relatively good fit. Hence, it introduces the three-category model fit assessment described in the following section.

Absolute measures of fit assessment: An absolute measure of fit presumes that the best-fitting model has a fit of zero. The measure of fit then determines how far the model is from perfect fit. In addition to the fundamental measure of absolute fit (the Chi-square test), standardized root means square residual (SRMR), Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI), and Adjusted Goodness of Fit is frequently utilized (AGFI). The RMSEA and SRMR are absolute measures of fit and are defined as the standardized difference between the observed and predicted correlations. It is a positively biased measure, and that bias is greater for small sample sizes and for low-degree freedom studies. As the RMSEA and SRMR are absolute measures of fit, a value of zero indicates perfect fit. A value RMSEA close to 0.06 and SRMR less than .08 are generally considered a good fit (Hu & Bentler, 1999). Since GFI and AGFI vary by sample size, the current consensus is not to use these measures (Sharma, Mukherjee, Kumar, & Dillon, 2005).

PCLOSE (*p* of Close Fit) measure is a one-sided test of the null hypothesis when the RMSEA equals .05, what is called a close-fitting model. The alternative, one-sided hypothesis is that the RMSEA is greater than 0.05. So, if the p is greater than .05 (i.e., not statistically significant), then it is concluded that the fit of the model is "close." If the p is less than .05, it is concluded that the model's fit is worse than close fitting (i.e., the RMSEA is greater than 0.05). Therefore, RMSEA, PCLOSE, and SRMR are used in this research.

Incremental adequate measures assessment: An incremental (sometimes called in the literature relative) fit index is analogous to R^2, and so a value of zero indicates having the worst possible model, and a value of one indicates having the best possible. Common incremental fit metrics include the Tucker–Lewis Index (TLI), the Comparative Fit Index (CFI), the Normed Fit Index (NFI), and the Non-normed Fit Index (NNFI). This incremental measure is directly based on the non-centrality measure. If the CFI is less than one, then the CFI is always greater than the TLI (Kenny and McCoach,2003). Incremental assessment TLI and CFI are used to evaluate model fit.

Parsimony fit measures assessment: Parsimony Normed Fit Metric (PNFI) is the parsimony index with the most widespread acceptance. Akaike's Information Criterion (AIC) and the Expected Cross-validation Index (ECVI) are also utilized (Hu & Bentler, 1999). There are ongoing discussions over whether or not parsimony fit metrics are suitable for evaluating models. Therefore, it does not apply to this research.

In the research methodology literature, there has been substantial disagreement over the superiority and suitability of one index over another, and no consensus has yet been established

regarding the optimal index for evaluating the overall goodness-of-fit of a model (Ping, 2004). In addition, no conclusive fit indices for fit evaluation have been created so far. Consequently, based on the substantial literature research that was briefly stated above, I have opted to provide numerous incremental and absolute measures of model fit according to the cut-off criteria specified in the table (Table 17). It should be noted that the ideal cut-off values mentioned in this table should not be treated as a given since they may vary significantly based on sample size. Cut-off values for certain indices, such as CFI and TLI, grew consistently with sample size, but they declined for SRMR and RMSEA (Sivo et al., 2006).

Measure Fit Type	Indices for Factor Analysis	Cut-off Criteria
Absolute fit index	Standardized Root Mean Square Residual (SRMR)	< 0.08 Good (MacCallu et al., 1996; Hu & Bentler, 1999) <0.1 Acceptable(Benjamin P.L. and Gaskin, J., 2014)
	Root Mean Square Error of Approximation(RMSEA)	<0.05 Good (Hu & Bentler, 1999; Browne & Cudeck, 1993;Wan, 2002; Schumacker & Lomax,2004, Garson, 2009) 0.5< value <=0.08 Acceptable (Wan, 2002; Schumacker & Lomax,2004)
	p of Close Fit (PCLOSE)	>=0.05 (Garson, 2009)
Incremental fit indexes	Bentler Comparative Fit Index (CFI)	>=.95 Good (Schreiber et al., 2006) >=.90 Acceptable (Hu & Bentler, 1999; Bentler, 1992; Byrne, 2001)
	Tucker -Leris index (TLI)	>=0.95 Good (Hu & Benter, 1999; Schumacker & Lomax, 2004) 0.90=< value < 0.95, Acceptable (Hoe, 2003)
The Chi-square Test (x^2)	Chi-square/DF	<=2 (Ullman, 2001) <=3 (Kline,1998) <=4 (Kline, 2005; Wan, 2002)

Table 17: Model fit indices

4.6.4 Path analysis in SEM

Once the good measures of constructs and a satisfactory measurement model are assessed and modified in CFA, it is time to specify how these constructs are related to one another and test the causal theory, which is structural equation modelling. There are two approaches; one is to use latent variables in CFA with observed items to build up relationships among constructs. The other approach is to use observed variables with path diagrams to lay out the causal theory. Since the goal of this research is to present causal relationships, the second approach_path analysis with observed variables is used, which explicitly tests hypotheses about the direction and significance of those model parameters suggested by our theory, and then the last step would be to assess the fit of the model. If there is a well-fitting model, then I can be confident that the estimates of the

model parameters are consistent and unbiased. No matter which approaches to use, the three key features of path analysis are as follows:

The first key feature of path analysis is that the model fitting the data is represented diagrammatically rather than in the form of equations. Again, this visual aspect is very appealing for social scientists who are perhaps less comfortable and less intuitive in their equations reading.

Secondly, the path analysis diagrams present regression equations between measured variables and illustrate relationships between multiple observed variables.

A third key feature of path analysis is its focus on direct, indirect, and total effects. So, there is no simple linear model for the research questions. The pathways between multiple independent variables and possibly multiple dependent variables are investigated in path analysis in Chapter 5. The assessment of the effects of mediation is elaborated on in the following section.

4.6.5 Assessment of mediation effect

Mediation has been studied for a very long time (Hyman, 1955; MacCorquodale & Meehl, 1948; Wright, 1934) since mediation is an extremely popular subject, and it happens in any subject area. Baron and Kenny (1986) have over 70,000 citations, and there are four books on this subject: Hayes, 2013; Jose, 2013; MacKinnon, 2008; VanderWeele, 2015. There are various reasons why the mediation effect has drawn intense attention among scholars: 1) one rationale for evaluating mediation is to attempt to comprehend the mechanism through the causative variable's effect on the outcome; 2) mediation and moderation analyses are essential components of what has been referred to as process analysis. However, mediation analyses are typically more effective than moderation analyses. 3)moreover, when examining most causal or structural models, the mediational portion of the model is frequently the most intriguing component. Before diving deep into the methodology of the mediation effect, I would like to introduce the basic concept briefly and then elaborate on five steps when using the SEM method and AMO software to test the mediation effect in this study.

Consider a variable X, which is a cause, as an independent variable, whereas the variable Y is known as a dependable variable (See Figure 13). Path c in the model is referred to as the total effect, while effect c' is known as the direct effect. The mediator Z is also known as an intervening variable or a process variable (David & Kenny, 2021). The impact of X on Y may be mediated by introducing mediating variable Z, when X may still have an impact on Y (with C'), which means Z has a partially mediated effect on the relationship between X and Y, whereas X does not have any impact on Y (C’=0), which refer that Z has a full mediation effect.

To sum up, when introducing mediator (Z) into the relationship between X and Y, the total effect of X on Y is equal to the direct effect (C') plus the indirect effect (a*b), which is the rest effect of X on Y plus the production of Z effect on Z and Z effects on Y, also refer to the equation: C=C’+ a*b, when C’=0, it is full mediation, C'≠0, it is partial mediation.

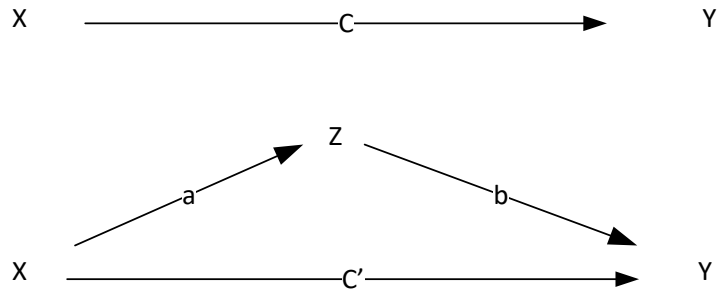

Figure 13: Mediation effect diagram (Kenny and McCoach,2003)

As Kenny and McCoach (2003) pointed out, the mediator model is causal. For instance, it is assumed that the mediator caused the outcome, not vice versa. If the assumed causal model is incorrect, the mediation analysis results will likely be of little use. Statistics cannot be used to define mediation, but they may be used to assess a putative mediational paradigm.

The pathways of c, a, b, and c' may be calculated using multiple regression, often known as ordinary least squares or OLS, assuming the mediational model is appropriately stated. In certain instances, other estimation techniques (such as logistic regression, multilevel modelling, and structural equal modelling) must be utilized instead of multiple regression. Regardless of the data analysis technique employed, the processes required for assessing mediation are identical. This section explains the analyses necessary for evaluating mediational hypotheses previously reported by Baron and Kenny (1986), Judd and Kenny (1981), and James and Brett (1984). For a more modern introduction, see also Frazier, Tix, and Barron (2004). In this study, combining Baron and Kenny (1986), Judd and Kenny (1981), and James and Brett's (1984) methods to establish mediation, I summarize the procedure to measure mediation and test its statistical significance in the following five steps.

Step 1: Establish a correlation between the independent and dependent variables. Use Y as the dependent variable in a regression equation and X as the independent variable (estimate and test path c in the above figure). This stage demonstrates the existence of an impact between X and Y.

Step 2: Demonstrate a correlation between the independent variable and the mediator. Use M as the mediator variable in the regression equation and X as the independent variable (estimate and test path a). This stage essentially considers the mediator as a dependent variable.

Step 3: Demonstrate that the mediator influences the dependent variable. In a regression equation, use Z as a mediator and Y as the dependent variable (estimate and test path b). It is insufficient to simply correlate the mediator with the dependent variable because the total effect may not only be from mediator to Y but also may be associated with variable X. In order to determine the influence of the mediator on the outcome, the X variable must be manipulated.

Step 4: To demonstrate that Z fully mediates the X-Y link, the effect of X on Y when controlling for Z (path c') must be zero (see step 5 below on significance testing). In the same equation, the impacts of both Steps 3 and 4 are calculated. If all four of these conditions are satisfied, then the data support the hypothesis that variable Z fully mediates the X-Y connection; if the first three conditions are met but not the fourth, then partial mediation is suggested.

Step 5: Last but not least, note that the above four steps are expressed in terms of zero and nonzero coefficients rather than statistical significance. There is a need to test statistical significance by using Bootstrapping in AMOs.

Bootstrapping is an increasingly used approach for investigating indirect effects (Bollen & Stine, 1990; Shrout & Bolger, 2002). Bootstrapping is a non-parametric technique based on repeated sampling with replacement, such as 500 times with 95% interval confidence. The indirect impact is determined for each of these samples, and a sampling distribution may be empirically created. An adjustment for bias can be performed since the mean of the bootstrapped distribution will not precisely equal the indirect impact. With the distribution, one may establish a confidence interval, a p-value, or a standard error. Extremely frequently, a confidence interval is produced, and its inclusion of zero is examined. If zero does not fall inside the interval, the researcher can be certain that the indirect impact is not zero. Also, a Z value may be calculated by dividing the bootstrapped estimate by its standard error.

4.7 Conclusion

This chapter starts with the survey procedure and participant requirements, including the sample size, data source, and survey process.

Secondly, it describes the experimental design and measures of four constructs: institutional pressures, internal fit, SMS, and safety performance.

Thirdly, it focuses on the data cleaning and treatment method, based on the collected 176 sample size, with data cleaning and treatment to remove the non-engaged responses. The final sample size is 153 respondents for the SEM analysis in the next chapter.

Lastly, it elaborates on the method of construct reliability and validity, assessment index of model fit, path analysis and assessment method of mediation effect in this study.

- Construct reliability: Using Cronbach's Alpha, construct reliability (CR) and average Variance Extracted (AVE) to test reliability.
- Construct validity: Convergent and discriminant validity.
- Assessment index of model fit: CFI, TLI, RMSEA, PCLOSE, SRMR, CMDF.
- Use path analysis with diagrams in AMOs to investigate the causal relationships among observed variables.
- Assessment method of mediation effect: Bootstrapping in IBM AMO to test whether the full or partial mediation effect is statistically significant.

5. DATA ANALYSIS AND RESULTS

This chapter begins with a brief presentation of the participant profile (see 5.1). The second part of the chapter focuses on the time trend extrapolation (test of independent samples) test for the assessment of nonresponse bias and reliability (see 5.2 & 5.3). The third part provides the findings of the research and the refinement of all items and scales utilized in this study (See 5.4, 5.5, and 5.6). Three analytical processes are conducted in this part: factor loading using EFA, dimensionality and validity evaluation using CFA, and path analysis used to find if relationships exist among observed variables. Collectively, they are known as CFA-SEM, where SEM is an umbrella term, and CFA is a subset. This study uses the term SEM specifically for the hypothesis testing part (testing relations among observed variables). The last section of the third part elaborates on the effects of mediation.

5.1 Respondents profile

The study collected 176 respondents from global aviation organizations. From this, 11 respondents declined to participate, and 12 were assessed as unengaged responses, leaving 153 samples suitable for analysis. The demographic profile of respondents is provided in Table 18.

- The gender distribution is 76% male, 22% female, while 2% preferred not to say.
- 78% of participants indicated more than two years' experience in the aviation sector, and the majority had 10-19 years of working experience, accounting for 31% of the total respondents. 30% reported more than 20 years but less than 35 years, and 22% had more than two years but less than a decade's experience.
- 47% of participants have a bachelor's degree, 37% of participants have a master's degree, and 10% have a Ph.D. degree.
- The majority of respondents are in the 30- 49-year age range, accounting for 57% of the total respondents.
- 40% of participants are pilots, followed by others 29%, engineers 10%, air traffic controllers 10%, ground handling 7%, and maintenance 7%.

Gender	**Percentage**
Male	76%
Female	22%
Prefer not to say	2%
Working experience	**Percentage**
10-19	31%
20-35	30%
2-9	22%
<2	14%
>35	3%
Education	**Percentage**
Bachelor	47%
Master	37%
Ph.D	10%

Bachelor below	5%
Age	**Percentage**
30-39	29%
40-49	28%
<30	24%
50-59	16%
>=60	3%
Position	**Percentage**
Pilot	40%
Others	29%
Engineer/Technical	10%
Air traffic controller	8%
Ground handling personnel	7%
Maintenance personnel	7%

Table 18: Demographic profile of respondents

The organization profile is presented in Table 19, which shows that:

- Most organizations are commercial airlines, accounting for 69%; the second rank is State CAA, accounting for 16%, and others are 15%.
- 53% of the organization has less than 1000 employees, and 47% have more than 1000 employees.
- The majority of respondents are located in the Asia Pacific continent, accounting for 64%. The second and third in Europe and North America are 16% and 11%. South America, the Middle East and Africa are 6%, 2% and 1%, respectively.

Organization Type	**Percentage**
Commercial Airline	69%
Civil Aviation Authority (CAA)	16%
Airport	5%
Training Organizations	4%
Air Navigation Service Provider (ANSP)	3%
Manufacturer	2%
Maintenance Repair Overhaul (MRO)	1%
Organization Size	**Percentage**
<300 employees	24%
600-999 employees	16%
>=10000 employees	16%
1000-1999 employees	16%
300-599 employees	13%

5000-9999 employees	9%
2000-4999 employees	7%
Geographic Area	**Percentage**
Asia Pacific	64%
Europe	16%
North America	11%
South America	6%
Middle East	2%
Africa	1%

Table 19: Organization Profile

5.2 Assessment of nonresponse bias

Before further analysis, nonresponse bias should be evaluated. Unfortunately, due to the anonymity of the survey, it was impossible to identify non-responders and inquire about why they did not participate.

Armstrong and Overton (1977) proposed the time trend extrapolation test to investigate nonresponse bias. This method compares early respondents to late ones. If there is a significant difference between early and late responses, then nonresponse bias exists in the data. Vise versa, if there is no significant difference between early and late responses, there is nonresponse bias in the data. One of the underlying assumptions of this method is that later survey respondents are more similar to nonrespondents than early respondents. Based on the survey response date, respondents were categorized into approximately the same size (such that the mean response in each group would have about the same precision). It is common to use a T-test by comparing early and late groups (Bose, 2001).

A paired T-test is used in SPSS to compare the top 50 (responses from the first two months) and the last 50 respondents (responses from the last two months) on each variable. As the survey is designed with a 5-point Likert scale, the Mean and Standard deviation of two groups on each variable are shown in Table 20. In SPSS, using Paired samples T-Test, the Mean of early and late groups unde each variable shows no significant difference (p-value from 0.263-0.839) (See Table 21, Statistic description of two groups and pair sample test). The absence of statistically significant differences suggests that nonresponse bias is unlikely to affect the analysis outcomes.

Constructs	Variables	Groups	Mean	N	Std. Deviation	Std. Error Mean
Institutional pressures (I.P.)	Coercive pressures (COER)	Early	3.92	50	.654	.093
		Late	3.96	50	.574	.081
	Normative pressures (NORM)	Early	3.61	50	.741	.105
		Late	3.77	50	.641	.091
	Mimetic pressures (MIME)	Early	3.89	50	.707	.100
		Late	3.95	50	.650	.092
Internal fit (IF)	Self-interest (SI)	Early	3.56	50	.491	.069
		Late	3.65	50	.484	.068

	Resource capability (R.C.)	Early	3.54	50	.599	.085
		Late	3.68	50	.699	.099
Safety management system (SMS)	SMS fidelity (SMSF)	Early	3.79	50	.543	.077
		Late	3.87	50	.667	.094
	SMS extensiveness (SMSE)	Early	3.68	50	.696	.098
		Late	3.73	50	.657	.093
Safety performance (SP)	Safety performance _quantitative (SPQNT)	Early	4.07	50	.642	.091
		Late	4.04	50	.679	.096
	Safety performance _qualitative (SPQUAL)	Early	3.91	50	.651	.092
		Late	3.94	50	.634	.090

Table 20: Statistic description comparison between two groups

Variables		Paired Differences					T	Df	Sig. (2-tailed) *p*-Value
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Coercive pressures (COER)	Early Late	-.048	.842	.119	-.287	.191	-.403	49	.689
Normative pressures (NORM)	Early Late	-.165	1.031	.146	-.458	.128	-1.132	49	.263
Mimetic pressures (MIME)	Early Late	-.060	.966	.137	-.334	.214	-.439	49	.662
Self-interest (S.I.)	Early Late	-.088	.744	.105	-.299	.124	-.834	49	.408
Resource capability (R.C.)	Early Late	-.148	.968	.137	-.423	.127	-1.081	49	.285
SMS fidelity (SMSF)	Early Late	-.080	.869	.123	-.327	.167	-.651	49	.518
SMS extensiveness (SMSE)	Early Late	-.052	.984	.139	-.332	.228	-.374	49	.710
Safety performance_quantitative (SPQNT)	Early Late	.027	.923	.131	-.236	.289	.204	49	.839
Safety performance_qualitative (SPQUAL)	Early Late	-.027	.832	.118	-.263	.210	-.227	49	.822

Table 21: Paired sample test

5.3 Reliability

Initially, the reliability of aggregated scales was evaluated using Cronbach's alpha coefficient of internal consistency, that is, how closely related a set of items is as a group (see Table 22). Cronbach's Alpha is a measure of scale reliability. There are different reports about the acceptable values of Alpha, ranging from 0.70 to 0.95 (Nunnally & Bernstein, 1994; Bland, 1997;

Devellis,2003). If a low alpha is due to poor correlation between items, then some should be revised or discarded. "If Alpha is too high, it may suggest that some items are redundant as they are testing the same question but in a different guise. A maximum alpha value of 0.9 has been recommended" (Tavakol & Dennick, 2011, p 54).

In this study, the reliability calculated from SPSS is from 0.782 to 0.944, according to column 2 in Table 22. Three items above 0.9 refer to high reliability, which may be caused by a longer test (i.e., more items), which increases the reliability of a test regardless of whether the test is homogenous or not. The highest value is 0.944 from SMS with 12 items, considering items under SMS are more closely related and more concentrated in this area. The lowest value is 0.782 from coercive pressures with five items. A "*high*" value for Alpha does not imply that the measure is unidimensional. The following section of exploratory factor analysis is one method of checking dimensionality.

	Cronbach's Alpha *Column 1*	**Cronbach's Alpha based on standardized items** *Column 2*	**N of items** *Column 3*
Institutional pressures (I.P.)	**0.909**	**0.910**	**14**
COER	0.779	0.782	5
MIME	0.859	0.859	5
NORM	0.842	0.845	4
Internal fit (IF)	**0.870**	**.0.876**	**18**
SI	0.830	0.841	13
RC	0.849	0.847	5
Safety management system (SMS)	**0.948**	**0.950**	**16**
SMSF	0.944	0.944	12
SMSE	0.879	0.880	4
Safety performance (SP)	**0.930**	**0.931**	**9**
SPQNT	0.892	0.896	3
SPQUAL	0.933	0.933	6

Table 22: Cronbach's Alpha reliability test

5.4 EFA

Several studies that were undertaken to examine the measuring model followed a two-step strategy outlined by Anderson and Gerbing (1988): Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). The essence of the two-step method of theory testing and development is the distinction between exploratory and confirmatory analyses. EFA is used to derive constructs for the groups of these items and is employed to discover a measure's factor structure and examine its internal reliability, while CFA is used to confirm and trim these constructs and items and to test the model fit of each measure. This study intends to gain insight

into the structure of individual components through EFA analysis. The EFA results are followed by the CFA assessment of dimensionality, Construct reliability, convergent validity, and discriminant validity, which aims to test the construct validity in the CFA process. The steps are below:

Step 1: Based on the theory identified in the literature review section, EFA is used on the four independent theories, which include institutional pressures, internal fit, SMS, and safety performance in IBM SPSS, respectively, to generate the new factors in each theory model.

Step 2: Based on theories and the proposed research model, the alignment and conflict model is tested for the model fit with CFA in IBM SPSS Amos.

Step 3: The path analysis approach is used in Amos to investigate causal relationships among observed variables proposed in the hypotheses.

Step 4: The path analysis and the bootstrap approach are used in Amos to analyze mediation effects.

5.4.1 EFA of institutional pressures constructs

The original items of institutional pressures are listed in Table 23. After conducting EFA in SPSS, the Bartlett test of Sphericity was significant for the institutional pressure's dataset (approximately Chi-square = 860.761; Degree of Freedom (D.F.) = 55; significant (sig) = 0.000) and the Kaiser-Meyer-Olkin (KMO) measure of Sampling Adequacy values were 0.839, indicating that the data is suitable for conducting an EFA.

Original construct	Item	Item code
Coercive pressures (COER)	1. Standards and recommended practices (SARPs) of the International Civil Aviation Organization (ICAO)	IP1
	2. Mandatory regulation of State/National civil aviation authority (CAA)	IP2
	3. Regulation and rules of the regional aviation safety agency	IP3
	4. Mandatory rule of the parent corporation	IP4
	5. Our customers may consider us backward if we do not implement SMS	IP5
Normative pressures (NORM)	6. Influence from the rules of International/National Aviation Association, such as IATA, ACI, CANSO, ICCAIA	IP6
	7. Influence from training institutions in our industry	IP7
	8. Influence from professional networks in our industry	IP8
	9. Influence from professional groups who graduated from similar universities	IP9
Mimetic pressures (MIME)	10. Perceive that prestigious airlines have adopted SMS	IP10
	11. Perceive those main competitors who have adopted SMS benefit greatly	IP11
	12. Perceive that other organizations that have adopted SMS are more competitive	IP12

	13. In our industry, organizations that do not readily adopt SMS will be left behind	IP13
	14. In our industry, most organizations will ultimately end up adopting SMS	IP14

Table 23: Institutional pressures original factors

IP5, IP6, and IP10 loadings are lower than 0.4 (cut-off value for IP) and removed. It is noted that only the cut-off value (0.4) for IP is lower than the other three constructs (cut-off 0.5) since I tried to capture coercive pressures as much as I could explore interactive relationships with the internal fit, according to Whitley and Kite (2012, p335), on EFA analysis guidance, "the loading score greater than 0.4 in the factor matrix is acceptable". The sample confirmed the two-factor solution by choosing an Eigenvalue greater than 1 in SPSS (See Table 24). This two-factor solution was described using the Promax rotation with Kaiser Normalization, which explained 53.19% of the total variance. All items used in this EFA have been forwarded for the CFA assessment in the following sections.

Item code	Factor	
	1	2
IP11	.801	
IP13	.770	
IP7	.760	
IP12	.700	
IP8	.691	
IP9	.672	
IP14	.638	
IP3		.998
IP4		.716
IP2		.544
IP1		.400

Table 24: Institutional pressures EFA pattern matrix table

The airlines' external stakeholders involve regulators, associated suppliers, aircraft manufacturers, competitors, and customers. Since safety is of the utmost importance in the aviation community, regulations and recommendations from regulators are essential guidance to support daily operations. In the literature, existing institutional pressures greatly address three kinds of pressures in multinational cooperation, healthcare, and education. In the aviation community, mimetic and normative pressures become one factor, which is referred to as the non-regulation factor, whereas coercive pressures refer to the regulation factor. Therefore, based on EFA results, the new components significant to aviation are elaborated as follows. New factors are shown in Table 25:

1. Component 1 (IP1F: Mimetic &Normative pressures): EFA results show the loadings combine the mimetic and normative pressures together. Airlines are the biggest stakeholders in the aviation community and industrial environment and play crucial roles in daily operations. Mimetic pressures from competitors and peers highly influence airlines to implement similar safety practices. Moreover, aviation professionals are mainly from aviation-related universities in each country. Therefore, the same background, education, and networks impact professional decisions and behaviours. This homogenous educational background adds to the mimetic and normative pressures that are non-regulative-related.

2. Component 2 (IP2F: Coercive pressures): EFA results show that coercive pressures are highly consistent. The regulative entities in the global aviation community are national civil authorities, inter-governmental organizations, i.e., ICAO, and 15 regional safety oversight organizations worldwide (RSOOs). The regulated body is the national CAA, which has strong regulative power over the aviation stakeholders in their country since ICAO only defines international air transport rules. Domestic air transport and strictly domestic airlines must only comply with national aviation law. The parent or headquarters also creates regulative pressures on their subsidiaries within the cooperation. Setting up RSOOS aims to help small or underdeveloped countries build up their national CAA. The role of RSOOs has been explored and developed in recent years at global and regional levels. If the country is too small to have its own CAA, it is allowed to delegate certain functions to RSOOs. Under such circumstances, RSOOS is really important in the global aviation community.

In this vein, the institutional pressures in this study are categorized into the new two factors, regulative pressures (COER) from regulative entities and non-regulative pressures (MINO) from industrial-related stakeholders and academia (MINO) in global aviation, which are shown in Figure 14. The regulative entities comprise ICAO, member States CAA, RSOOs, and parent corporations. The non-regulative entities include industry stakeholders (airlines, airports, ANSPs, and manufacturers), and academia includes aviation training organizations and aviation-related universities. It indeed reflects the current structures of the aviation community at the global level.

New identified factor	Item code	Original theory factor	Item
Mimetic & Normative pressures (MINO)	IP11	Mimetic	Perceive those main competitors who have adopted SMS benefit greatly
	IP13	Mimetic	In our industry, organizations that do not readily adopt SMS will be left behind.
	IP7	Normative	Influence from training institutions in our industry
	IP12	Mimetic	Perceive that other organizations that have adopted SMS are more competitive.
	IP8	Normative	Influence from professional networks in our industry
	IP9	Normative	Influence from professional groups who graduated from similar universities
	IP14	Mimetic	In our industry, most organizations will ultimately end up adopting SMS
Coercive	IP3	Coercive	Regulation and rules of the Regional Aviation Safety Agency

pressures (COER)	IP4	Coercive	Mandatory rule of the parent corporation
	IP2	Coercive	Mandatory regulation of State/national Civil Aviation Authority (CAA)
	IP1	Coercive	Standards and recommended practices (SARPs) of the International civil aviation organization (ICAO)

Table 25: New factors of institutional pressures

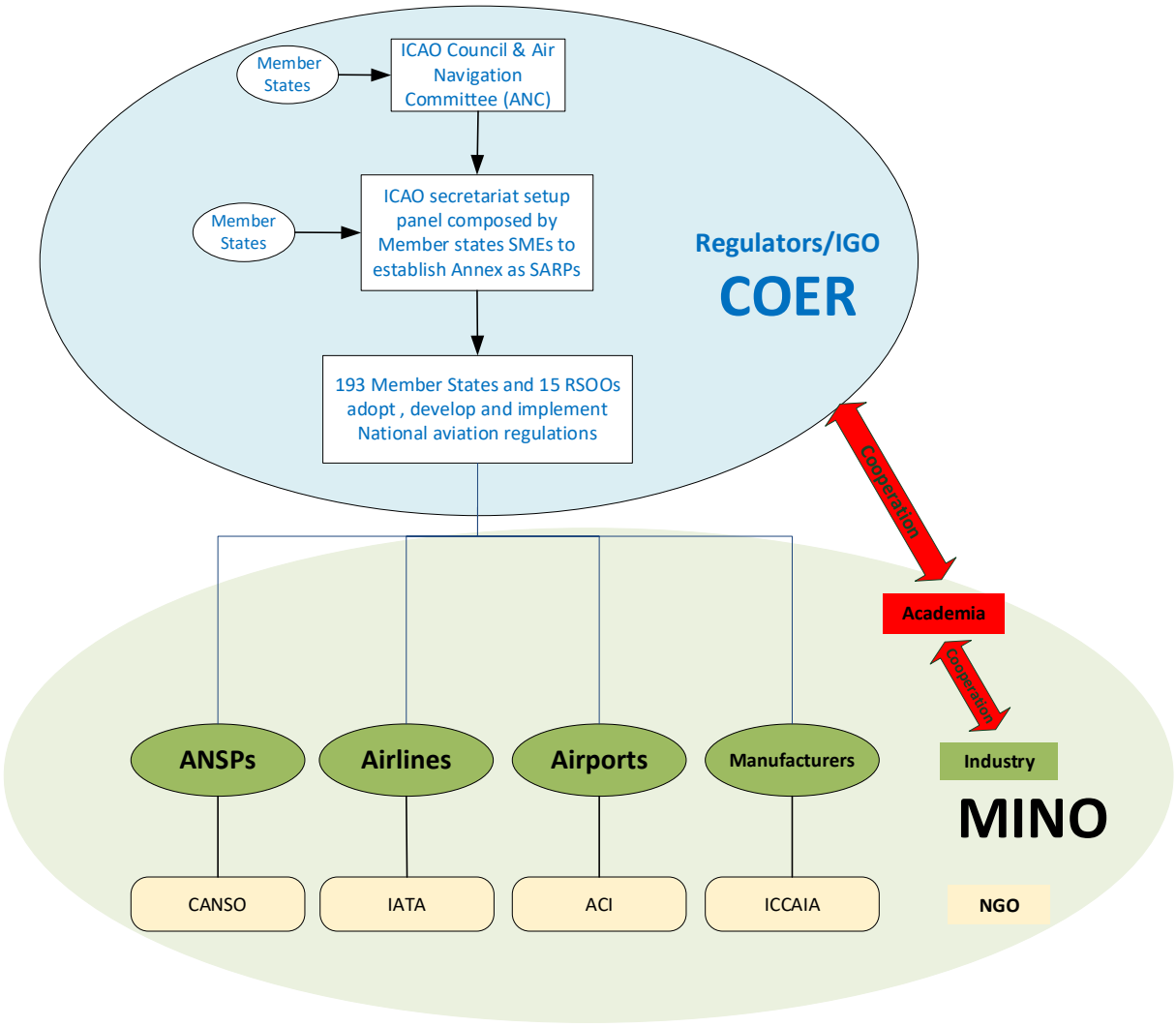

Figure 14: Global aviation framework_Regulative entities Vs. Non-Regulative entities

5.4.2 EFA of internal fit constructs

The original items of internal fit are listed in Table 26.

Original construct	Item	Item code
Self-interest: Perceived benefits	1. Enhance productivity	IF1
	2. Enhance the quality of work	IF2
	3. It is easy to work with the support of SMS	IF3
	4. Become very dependent on SMS	IF4
Self-interest: Compatibility	5. Align with the organization's mission, objectives, and goal	IF5
	6. SMS fits into organizational culture	IF6
	7. SMS is compatible with top management's workstyle	IF7
	8. SMS is compatible with most aspects of employees' work	IF8
Self-interest: Challenge	9. Consider the implementation of SMS as a threat to jeopardize the current role or position	IF9
	10. Has difficulty understanding the SMS concept	IF10
	11. Lack of guidance or training to implement SMS	IF11
	12. Top management resists changing the way they work	IF12
	13. Employees do not want SMS to increase the workload	IF13
Resource	14. In the context of your organization's overall budget, the financial cost of adopting and implementing SMS would be very significant	IF14
	15. Your organization has a sufficient financial budget to adopt and implement SMS	IF15
	16. Your organization has sufficient skillful personnel to adopt and implement SMS	IF16
	17. Your organization has sufficient technical resources (i.e., equipment, system) to adopt and implement SMS	IF17
	18. Your organization's current structure (i.e., formal and informal reporting, planning, controlling, and controlling, and coordinating systems) to adopt and implement SMS	IF18

Table 26: Internal fit original factors

The IF14 has been removed since the loading is much lower than 0.5 (the cut-off value). Therefore, a three-factor solution was confirmed in the sample. By conducting EFA in SPSS, it is evident that the KMO measure is above the accepted level with the value of 0.851 and Bartlett's Test of Sphericity (Chi-square =1402.749; DF=136; Sig=0.000). This solution was specified

using the Promax rotation with Kaiser Normalization, whereby 57.079% of the variance could be explained. In addition, all items have factor loading above 0.5, which is satisfactory for the purpose. Therefore, all identified items used in this EFA are forwarded for CFA assessment (Table 27).

Item code	Factor		
	1	2	3
IF2	.818		
IF3	.771		
IF1	.756		
IF4	.737		
IF5	.710		
IF6	.670		
IF7	.635		
IF8	.543		
IF17		.954	
IF16		.889	
IF18		.776	
IF15		.615	
IF11			.861
IF12			.741
IF 13			.723
IF10			.694
IF 9			.599

Table 27: Internal fit EFA pattern matrix table

In the literature, self-interest is the first component of internal fit, which can align or conflict with external pressures. When self-interest is positive, employees inside the organization treat SMS practices as beneficial and compatible with the organization's goal. Therefore, the internal fit aligns with the external pressures on SMS implementation. In contrast, when employees feel SMS practice is too difficult or unnecessary and could jeopardize their current job or position, self-interest conflicts with external pressures on SMS implementation.

The second component of internal fit is resource capability, which includes not only the three main dimensions of resource capability, physical capital, human capital, and organizational capital but also the ability of the organization to build up internal resources, such as organizational structure, including the systems that control and implement the SMS (See Table 28).

New identified factors	Item code	Original theory factor	Item
Self-interest_ Positive (SIP)	IF2	Perceived benefits & Compatibility	Enhance the quality of work
	IF3		It is easy to work with the support of SMS
	IF1		Enhance productivity
	IF4		Become very dependent on SMS
	IF5		Align with the organization's mission, objectives, and goal
	IF6		SMS fits into organizational culture
	IF7		SMS is compatible with top management's workstyle
	IF8		SMS is compatible with most aspects of employees' work
Self-interest_ Negative (SIN)	IF11	Challenges & Jeopardy	Lack of guidance or training to implement SMS
	IF12		Top management resists changing the way they work
	IF13		Employees do not want SMS to increase the workload
	IF10		Has difficulty understanding the SMS concept
	IF9		Consider the implementation of SMS as a threat to jeopardize the current role or position
Resource capability (RC)	IF17	Resource	Your organization has sufficient technical resources (i.e., equipment, system) to adopt and implement SMS
	IF16		Your organization has sufficient skillful personnel to adopt and implement SMS
	IF18		Your organization's current structure (i.e., formal and informal reporting, planning, controlling, and controlling, and coordinating systems) to adopt and implement SMS
	IF15		Your organization has a sufficient financial budget to adopt and implement SMS

Table 28: New factors of internal fit

In this study, I analyze the alignment and conflict between self-interest and institutional pressures, respectively. In the CFA model testing, I separately use positive self-interest with resource capability and negative self-interest without resource capability to prepare for path analysis later in this chapter.

5.4.3 EFA of SMS constructs

The original SMS items are listed in Table 29.

Original construct	Original theory component	Items	Item code
SMS_Fidelity	Safety risk management	1. Hazard identification has been effective	SMS1
		2. Safety risk assessment and mitigation have been effective	SMS2
	Safety assurance	3. Safety performance monitoring and measurement have been effective	SMS3
		4. The management of change has been effective	SMS4
		5. Continuous improvement of the SMS has been effective	SMS5
	Safety policy	6. Management commitment has been effective	SMS6
		7. Safety accountability and responsibilities have been effective	SMS7
		8. The appointment of key safety personnel has been effective	SMS8
		9. Coordination of emergency response planning has been effective	SMS9
		10. SMS documentation has been effective	SMS10
	Safety promotion	11. Training and education have been effective	SMS11
		12. Safety communication has been effective	SMS12
SMS_Extensiveness		13. Apply to all departments of organizations, including operation and administration	SMS13
		14. SMS has covered all functions of organizations	SMS14
		15. Employees in your organization understand SMS and have integrated it into their daily work	SMS15
		16. SMS implementation is substantive rather than superficially for ceremonial reasons	SMS16

Table 29: SMS original factors

SMS10, SMS11, and SMS12 have been removed since the loading is much lower than 0.5 (cut-off). A two-factor solution was confirmed in the sample. It is evident that the KMO measure is above the accepted level with the value of 0.921 and Bartlett's Test of Sphericity (Chi-square =13426.597; DF=78; Sig=0.000). This solution was specified using the Promax rotation with Kaiser Normalization, whereby 62.56% of the variance could be explained. In addition, all items have factor loading above 0.5, which is satisfactory for the purpose. Therefore, all identified items used in this EFA are forwarded for CFA assessment (Table 30).

Item code	Factor	
	1	2
SMS3	.838	
SMS7	.808	
SMS1	.800	
SMS8	.792	
SMS6	.791	
SMS2	.771	
SMS4	.720	
SMS5	.704	
SMS9	.609	
SMS15		.930
SMS14		.829
SMS16		.746
SMS13		.618

Table 30: SMS EFA pattern matrix table

In the literature, best practice can be assessed through two dimensions: fidelity, which measures how true the best practice has been implemented through establishing frameworks and guidelines, and extensiveness is used to measure how broadly the best practice has been implemented within organizations. Two factors have been identified based on the loading: fidelity and extensiveness.

On the one hand, SMS fidelity focuses on safety policy, safety assurance and risk management, covering the three components of the SMS, which will describe how true the organization has established the SMS framework and implementation guidelines.

On the other hand, the extensiveness measures mainly how much the implementation has penetrated into employees' perspective and value towards daily work and how many departments of an organization have implemented SMS practices, only focusing on safety-related departments, core-value chain-related departments, or including human resource and administrative departments of organizations. According to ICAO Annex 19 and guidance of Doc 9859, SMS should be implemented throughout the entire organization. In practice, it is really up to the organization's alignment of external and internal forces and resource capability to decide how far SMS implementation can go.

New identified factor	Item code	Original theory component	Items
SMS_Fidelity (SMSF)	SMS3	Safety assurance	Safety performance monitoring and measurement have been effective
	SMS7	Safety policy	Safety accountability and responsibilities have been effective
	SMS1	Safety risk management	Hazard identification has been effective
	SMS8	Safety policy	The appointment of key safety personnel has been effective
	SMS6	Safety policy	Management commitment has been effective
	SMS2	Safety risk management	Safety risk assessment and mitigation have been effective
	SMS4	Safety assurance	The management of change has been effective
	SMS5	Safety assurance	Continuous improvement of the SMS has been effective
	SMS9	Safety Policy	Coordination of emergency response planning has been effective
SMS_Extensiveness (SMSE)	SMS15	Extensiveness	Employees in your organization understand SMS and have integrated it into their daily work
	SMS14		SMS have covered all functions of organizations
	SMS16		SMS implementation is substantive rather than superficially for ceremonial reasons
	SMS13		Apply to all departments of organizations, including operation and administration.

Table 31: New factors of SMS

5.4.4 EFA of safety performance construct

The original items of safety performance are listed in Table 32.

	Items	Item code
Safety performance quantitative indicator	1. Fatality has been reduced (Lagging indicator)	SP1
	2. Accident rate has been reduced (Lagging indicator)	SP2
	3. Serious incident rate has been reduced (Lagging indicator)	SP3
Safety performance qualitative indicator	4. Effectiveness of safety management tools has been increased. i.e., hazard identification system, emergency response system	SP4
	5. Effectiveness safety culture has been enhanced	SP5

	6. Voluntary reporting system has been established with clarified responsibilities, reporting processes, rewards, liability reduction, and exemption rules	SP6
	7. Individuals act and make decisions according to a common belief that safety is part of the way they do business	SP7
	8. Individuals value being informed and informing others about safety	SP8
	9. Individuals trust their colleagues and managers with information about their experiences, and the reporting of errors and mistakes is encouraged to improve how things are done in the future	SP9

Table 32: Safety performance original factors

A two-factor solution was confirmed in the sample (Table 33). It is evident that the KMO measure is above the accepted level with the value of 0.875 and Bartlett's Test of Sphericity (Chi-square =1184.290; DF=36; Sig=0.000). This solution was specified using the Promax rotation with Kaiser Normalization, whereby 73.4% of the variance could be explained. In addition, all items have factor loading above 0.5, which is satisfactory for the purpose.

Item code	Factor	
	1	2
SP8	.975	
SP9	.901	
SP7	.840	
SP6	.790	
SP5	.744	
SP4	.504	
SP2		.992
SP3		.853
SP1		.778

Table 33: Safety performance EFA pattern matrix table

Safety performance indicators have drawn significant attention in aviation safety literature. Along with improved safety performance since the Second World War in the aviation field, the fatality and accident rate in the global aviation sector has dramatically decreased to 2.14 accidents per million departures in 2020 from 10 accidents per million departures in 1950 (ICAO Safety Report 2021). Current accident numbers are so low that this quantitative indicator is no longer sufficient to measure safety performance. Instead, safety culture and climate have emerged as better indicators of safety performance. These measures stem from other high-reliability sectors, such as construction and maritime. During the amendment of Annex 19 in ICAO from 2021-2022, along

with the fifth edition of guidance Document 9859, which will be published in 2024, the safety management panel (SMP) started to update the definition of safety performance and safety performance indicator (ICAO Annex 19, 2023, p13). The proposed definitions for safety performance and safety performance indicator are "Safety performance: A State or a service provider's safety achievement as assessed through quantitative and/or qualitative means; Safety performance indicator: the measurable result that demonstrates how effectively a State or a service provider is achieving a safety objective.

This thesis will assess safety performance using safety culture and climate to measure qualitative safety performance, leaving space to explore important, unmeasured qualitative aspects of safety performance. Currently, it is common to use the effectiveness of self-reporting systems to measure or indicate the performance of safety culture.

The loading indicates that the two factors match the literature's qualitative and quantitative safety performance. How two factors interact with other constructs is elaborated in the CFA in the following sections.

New identified factors	Item code	Original theory components	Items
Safety performance _Qualitative (SPQUAL)	SP8	Safety performance qualitative indicator	Individuals value being informed and informing others about safety
	SP9		Individuals trust their colleagues and managers with information about their experiences, and the reporting of errors and mistakes is encouraged to improve how things are done in the future
	SP7		Individuals act and make decisions according to a common belief that safety is part of the way they do business
	SP6		A voluntary reporting system has been established with clarified responsibilities, reporting processes, rewards, liability reduction and exemptions rules.
	SP5		The effectiveness safety culture has been enhanced
	SP4		Effectiveness of safety management tools has been increased. i.e., hazard identification system, emergency response system
Safety performance _Quantitative (SPQNT)	SP2	Safety performance quantitative indicator	Accident rate has been reduced (Lagging indicator)
	SP3		Serious incident rate has been reduced (Lagging indicator)
	SP1		Fatality has been reduced (Lagging indicator)

Table 34: New factors of safety performance

5.5 CFA

Theory-driven exploratory research in the CFA investigates the links among the final components and items of the EFA. This study adopted Maximum likelihood (ML), a well-known estimation method, after studying the literature concerning the several estimate methods provided by AMOS in relation to the aims of this investigation and the features of the data obtained. This decision was made due to the fact that ML is a full-information approach that reliably produces efficient and robust estimations despite modest breaches of the normalcy assumption (Diamantopoulos and Siguaw, 2000). In addition, ML estimation is accompanied by a set of statistics that may be used to evaluate competing models. Consequently, CFA was used to examine the reliability and validity of the measurement model for all constructs employed in the investigation.

5.5.1 CFA of model fit measures

CFA was used to validate the discovered factor model by demonstrating whether or not the model fits the observed data (Netemeyer et al., 2003). Therefore, this research employed the confirmed relationships obtained in the EFA analysis and utilized the CFA model for evaluation.

Since CFA aims to measure whether the theoretical model fits the data, there is a need to clarify the theoretical models and steps first. With the EFA factor analysis results, the institutional pressures are restructured into two new factors, regulative-related and non-regulative pressures, to replace the original three pressures. The regulative pressures replace the original coercive pressures to be more regulative-related factors, while the non-regulative pressures are the combination of mimetic and normative pressures, which are induced by industrial and association-involved forces.

Since two scenarios, alignment and conflict between institutional pressures and self-interest, are discussed, the interactive model has been divided into two scenarios, alignment and conflict. Within each scenario, there are two models to reflect the relationships between two factors (regulative and non-regulative pressures) of institutional pressures and self-interest, respectively. In this vein, the final model is presented with six models, as shown in Table 35.

- The alignment scenarios include COERSIP, MINOSIP, and COERMINOSIP models. COERSIP are regulative pressures (COER) and positive self-interest (SIP), and the MINOSIP model is non-regulative pressures (MINO), positive self-interest (SIP), SMS, and safety performance (SP). COERMINOSIP is to combine COER, MINO and SIP.

- The confliction scenarios include COERSIN, MINOSIN, and COERMINOSIN models. COSIN are regulative pressures (COER) and negative self-interest (SIN), and the MINOSIN model is non-regulative pressures (MINO) and negative self-interest (SIN), SMS, and safety performance (SP). COERMINOSIN is used to combine COER, MINO, and SIN.

Research Models	Models	Description
Alignment models	**COERSIP_SMSSP**	COERcive pressures, Self-Interest Positive, SMS and Safety Performance
	MINOSIP_SMSSP	MImetic & NOrmative pressures, Self-Interest Positive, SMS and Safety Performance
	COERMINOSIPS_SMSSP	COERcive & MImetic & NOrmative pressures, Self-Interest Positive, SMS and Safety Performance
Conflict models	**COERSIN_SMSSP**	COERcive pressures, Self-Interest Negative, SMS and Safety Performance
	MINOSIN_SMSSP	MImetic & NOrmative pressures, Self-Interest Negative, SMS and Safety Performance
	COERMINOSIN_SMSSP	COERcive& MImetic & NOrmative pressures, Self-Interest negative, SMS and Safety Performance

Table 35: Alignment and conflict models between institutional pressures and self-interest

After linking errors or removing problematic variables, the CFA measurement model would be re-specified and re-estimated, leaving us with validated models that have been finalized. This study evaluates the theory model using model fit indices from three aspects mentioned in research methodology section 4.6.3, Table 17.

1. In incremental fit measure with TLI & CFI, the threshold of TLI & CFI is greater than 0.95, which is a good model fit (Salisbury et al., 2002). TLI and CFI greater than 0.9 are acceptable model fits (Haajistaropoulos et al. 1999, Hair et al. 1998).

2. Absolute measure of fit was evaluated with RMSEA, PCLOSE, and SRMR. MacCallum, Browne, and Sugawara (1996) have used RMSEA values of less than 0.01, 0.01~0.05, and 0.05~0.08 to represent Excellent, Good, and acceptable fit, respectively. Park et al. (2002, p 566) also addresses that "RMSEA values less than .05 indicate good fit, values from .05 to .08 acceptable/reasonable fit, values from .08 to .10 marginal fit, and values above .10 unacceptable/poor fit (Browne & Cudeck, 1993)". However, RMSEA does not always fully present the model fit. For instance, a particular model may have an RMSEA population value of 0.05, but the sample value may exceed 0.10. Therefore, using the confidence intervals and tests of PCLOSE can be supplemental in comprehending the sampling error in the RMSEA. PCLOSE is a one-sided test of the null hypothesis, which states that the RMSEA = 0.05 and that the model is well-fitting. This model has specification errors but "not a great deal" of specification errors. The alternative, one-sided hypothesis is that the RMSEA is greater than 0.05. Therefore, if PCLOSE is more than 0.01 (i.e., not statistically significant), it is argued that the model is "near" to fit the data. If p is less than 0.05, it is determined that the model is not fitting. In this section, I have presented most theories and models that have good or acceptable fits. While RMSEA is greater than 0.08, PCLOSE has been present at a greater than 0.05 level to indicate the acceptable model fit.

Moreover, SRMR, as another index under the absolute measure, has been used to support the RMSEA mode fit measure. SRMR is less than 0.08, a good model, and is less than 0.1, an acceptable model (Benjamin P.L. and Gaskin, J., 2014).

3. The Chi-square test: CMIN/DF < 3 indicates an acceptable fit between the hypothetical model and sample data (Benjamin P.L. and Gaskin, J., 2014; Kline, 1998). Although I use CMIN/DF (degree of freedom) less than three as the threshold, all models had CMIN/DF of less than or around 2, which refers to acceptable model fits. The details of model fit are presented in the following CFA figures extracted from AMO and model fit tables.

5.5.2 CFA measurement for alignment model

In the CFA alignment model measurement, the integrated model is tested step by step to determine whether each part of the model is fit and then to test if the integrated model is fit.

Step 1: Test the SMSSP model. The model fit indexes are presented in Table 36, and the CFA measurement model is illustrated in Figure 15. The SP4 has been deleted for a better model fit in CFA testing the safety performance model process. In other models, no items have been eliminated.

Step 2: Test each theory model, including the interaction between institutional pressures and self-interest, such as COER-SIP, MINO-SIP, SMS, and SP, respectively. Avoid too many tables and figures; CFA for single constructs is not presented with tables and figures.

Step 3: Test the COERSIPSMS and MINOSIPSMS models separately. COERSIPSMS includes regulative pressures, positive self-interest, and SMS implementation. MINOSIPSMS includes non-regulative pressures, positive self-interest, and SMS implementation. The model fit indexes are presented in Table 36, and the CFA measurement model is not presented.

Step 4: In this step, safety performance is added to test two integrated models. COERSIPSMSSP includes regulative pressures, positive self-interest, SMS implementation, and safety performance. MINOSIPSMSSP includes non-regulative pressures, positive self-interest, SMS implementation, and safety performance. The model fit indexes are presented in Table 36, and the CFA measurement model is illustrated in Figures 16 and 17.

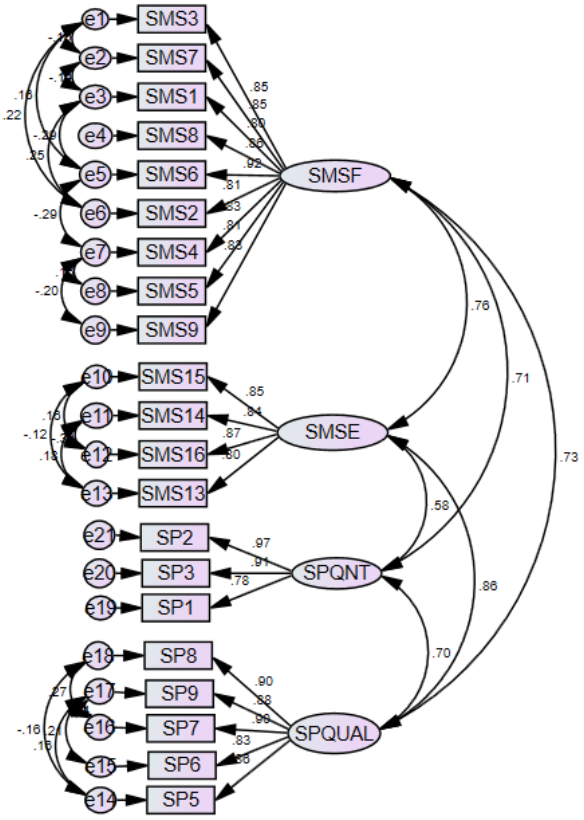

Figure 15. CFA measurement model of SMSSP

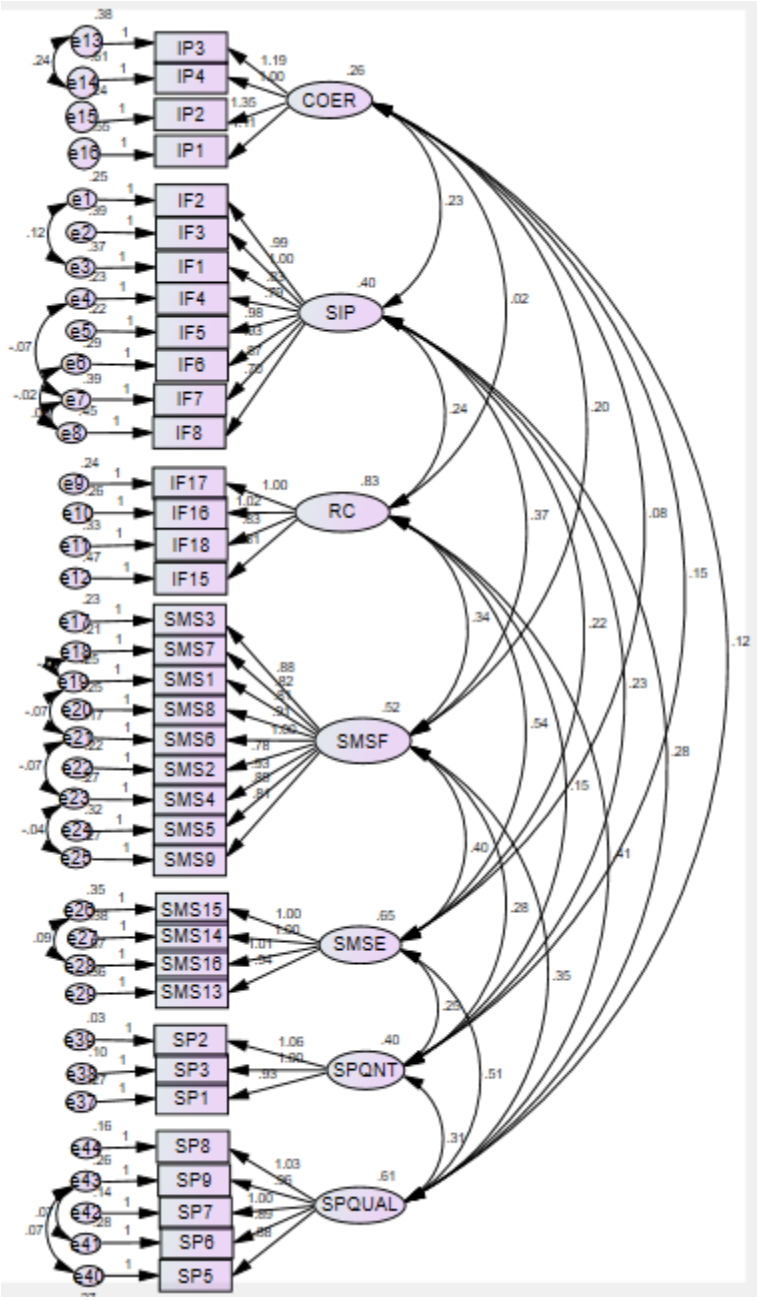

Figure 16. CFA measurement model of COERSIP_SMSSP

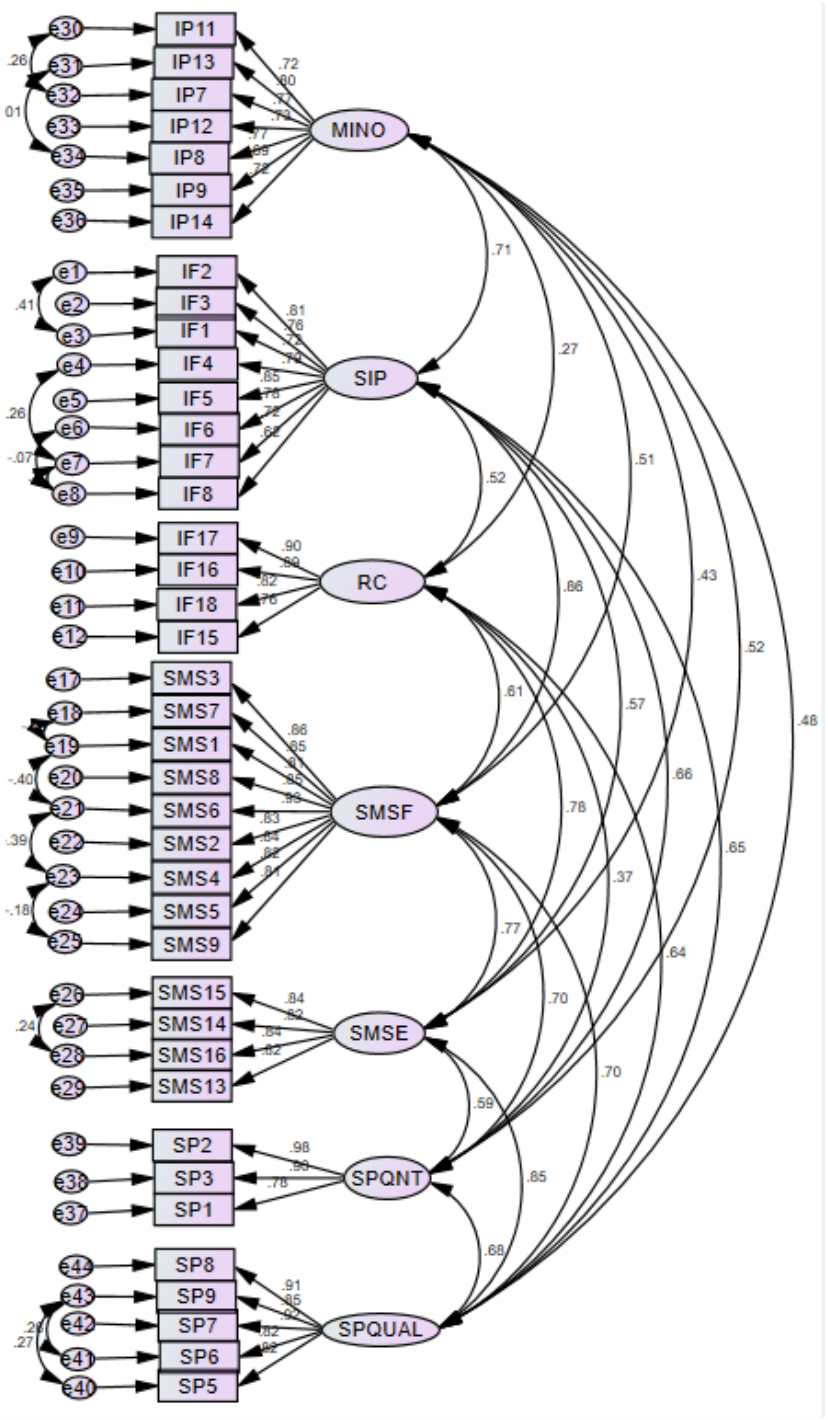

Figure 17. CFA measurement model of MINOSIP_SMSSP

All models are fit. TLI and CFI are greater than 0.9. The RMSEA ranges from 0.057-0.064 (less than 0.08 threshold), with PCLOSE being greater than 0.01(threshold), which refers to an acceptable model fit. Moreover, SRMR, as another absolute measure of fit close to 0.1, is

acceptable. CMIN/DF are all less than 3(<3 threshold). Therefore, the overall alignment model has an acceptable model fit.

	TLI	CFI	RMSEA	PCLOSE	SRMR	CMIN/DF	Model Fit
SMSSP	0.949	0.960	0.064	0.053	0.0980	1.625	Acceptable
COERSIPRCSMS	0.932	0.945	0.058	0.117	0.1040	1.504	Acceptable
MINOSIPRCSMS	0.915	0.928	0.061	0.024	0.0979	1.566	Acceptable
COERSIPRCSMSSP	0.926	0.938	0.057	0.093	0.1043	1.486	Acceptable
MINOSIPRCSMSSP	0.908	0.920	0.060	0.011	0.0973	1.551	Acceptable

Table 36. Alignment model fit indices

5.5.3 CFA measurement for conflict model

Following the same procedure of alignment measurement, in conflict model measurement, the integrated model is tested step by step in order to find out whether each part of the model is fit and then to test if the integrated model is fit.

Step 1: Test interactive conflict between institutional pressures and self-interest, such as COER-SIN and MINO-SIN. SMS, SP, and SMSSP models are the same as step 1 and steps in the alignment model testing.

Step 2: Test the COERSINSMS and MINOSINSMS models separately. COERSINSMS includes regulative pressures, negative self-interest, and SMS implementation. MINOSINSMS includes non-regulative pressures, negative self-interest, and SMS implementation. The model fit indexes are presented in Table 37, and the CFA measurement model is not presented.

Step 3: In this step, safety performance is added to test two integrated models. COERSINSMSSP includes regulative pressures, positive self-interest, SMS implementation, and safety performance. MINOSINSMSSP includes non-regulative pressures, negative self-interest, SMS implementation, and safety performance. The model fit indexes are presented in Table 37, and the CFA measurement model is illustrated in Figures 18 and 19.

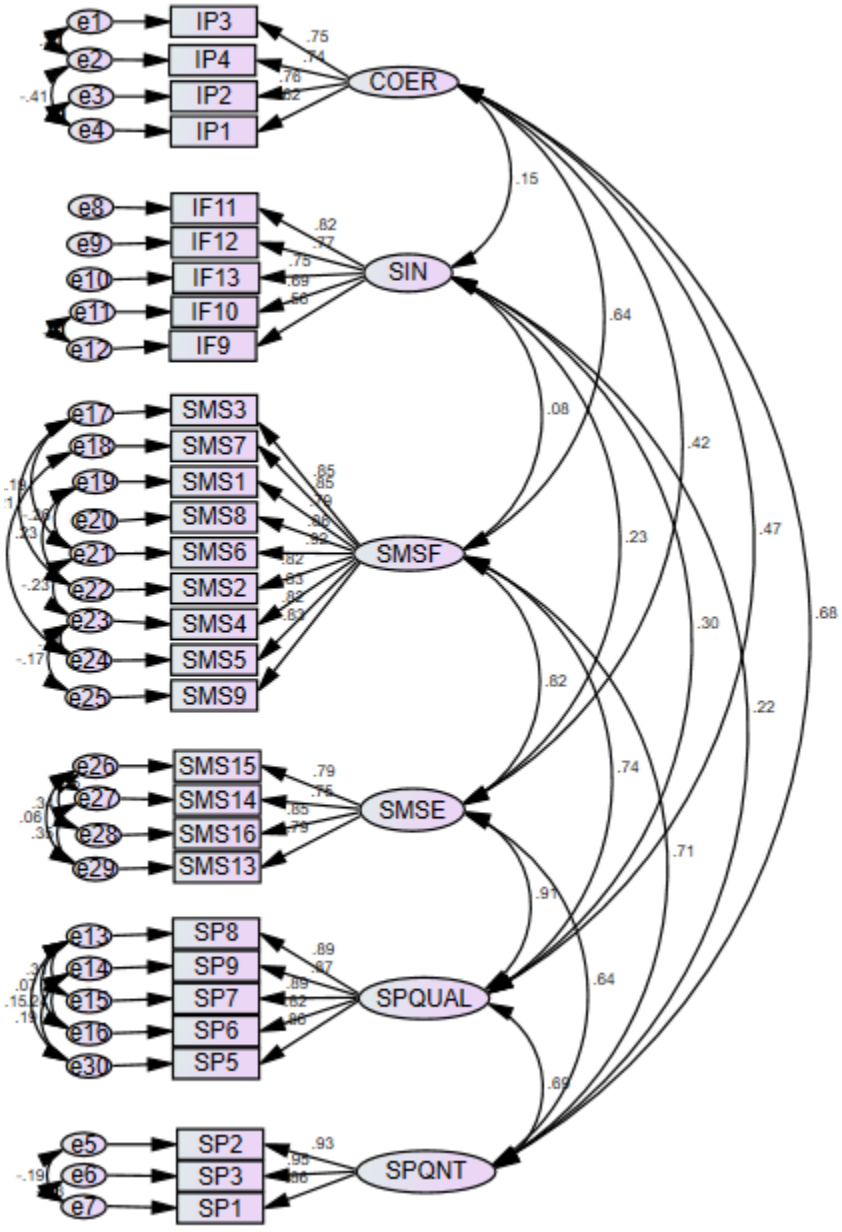

Figure 18. CFA measurement model for COERSIN_SMSSP

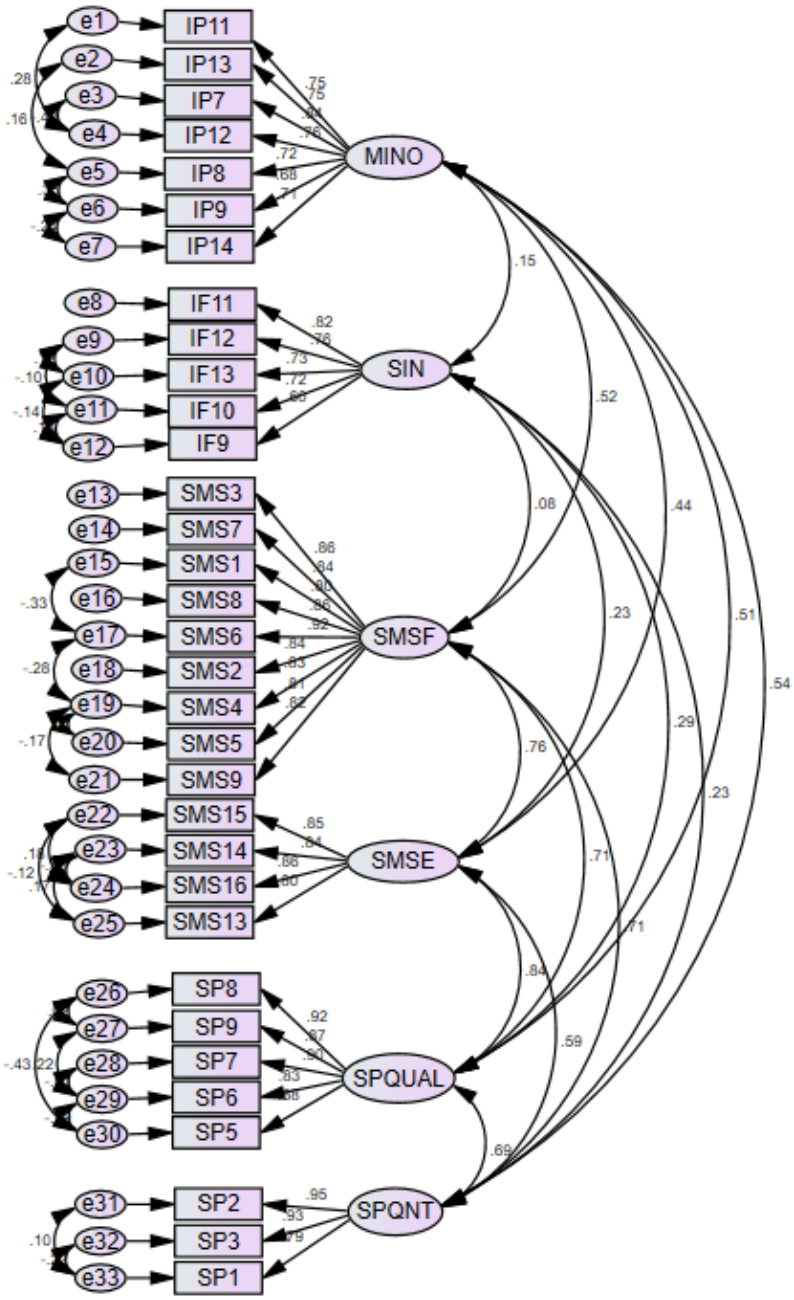

Figure 19. CFA measurement model for MINOSIN_SMSSP

All models are fit. TLI and CFI are greater than 0.9, especially for MINOSINSMS. The model fit is good since RMSEA is less than 0.05 and TLI and CFI are greater than 0.95. The RMSEA of all models ranges from 0.049-0.064 (less than 0.08 threshold), with PCLOSE all greater than 0.01(threshold), which refers to an acceptable model fit. Moreover, SRMR, as another absolute measure of fit close to 0.1, is acceptable. CMIN/DF are all less than 3(<3 threshold). Therefore, the overall conflict model has an acceptable model fit.

	TLI	CFI	RMSEA	PCLOSE	SRMR	CMIN/DF	Model fit
SMSSP	0.949	0.960	0.064	0.053	0.0980	1.625	Acceptable
COERSINSMS	0.935	0.946	0.060	0.112	0.0900	1.548	Acceptable
MINOSINSMS	0.951	0.959	0.049	0.523	0.089	1.370	Good
COERSINSMSSP	0.919	0.933	0.063	0.013	0.0974	1.610	Acceptable
MINOSINSMSSP	0.923	0.935	0.059	0.061	0.0906	1.520	Acceptable

Table 37. Conflict model fit indices

5.5.4 Construct reliability of the research model

Construct reliability (also referred to as composite reliability) is a measure of internal consistency in scale items comparable to Cronbach's Alpha (Netemeyer, 2003). CR is viewed as the ratio of the entire variation of real scores to the total variance of scale scores (Brunner & Süß, 2005). It is an "indicator of the shared variance across observed variables that serves as a sign of a latent construct" (Fornell & Larcker, 1981).

Construct reliability thresholds are debatable (a suitable criterion might range from 0.60 to greater than 1.0), with different writers proposing varying thresholds. Much relies on the number of items on the scale. Smaller numbers of scale items are associated with lower reliability levels, whereas greater numbers of scale items are associated with better reliability levels. In Scaling Procedures: Issues and Applications, Richard Netemeyer and colleagues (2003) claim that a tightly defined construct is "acceptable" with five to eight items to achieve a minimal criterion of 0.80.

I follow the formula[2] to calculate CR with standardized loading in SPSS for all factors among four models, and the results are shown in Table 38. The CR of new factors among the four models is higher than 0.8, which supports the fact that all models have construct reliability.

5.5.5 Validity of the constructs

Cross-structure validity includes convergent validity and discriminant validity.

- Convergent validity refers to a convergence among different methods designed to measure the same construct. Convergent validity is measured by the average variance extracted (AVE >= 0.5 thresholds). Using the standard loading in SPSS, the results of AVE of nine new factors among four models are listed in Table 38. Among these factors, all factors have an AVE value greater than 0.5 criteria, indicating good convergent validity.

- Discriminant validity refers to the distinctiveness of constructs, demonstrated by the divergence of methods designed to measure different constructs, namely, the extent to which a test is not related to other tests that measure different constructs. (Pedhazur & Schmelkin, 1991). There are several ways of testing the discriminant validity, but the most rigorous and popular method is to compare the square root of the AVE value for any construct with the correlation estimate(also known as the shared variance) between that

---

2 $CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + (\sum \epsilon_i)}$ λ : Standard loading of measurement items of each factor; ε=1- λ

construct and other constructs (Fornell and Larcher, 1981; Hair et al., 2018). The last seven columns in Table 38 show the correlation between that construct and other constructs. The results show that the square roots of the AVE value of each factor are higher than the related correlation. Therefore, it can be concluded that there is sufficient evidence to confirm discriminant validity.

		Number of Items	CR	AVE	Square AVE	Correlation						
							SIP	RC	SMSF	SMSE	SPQNT	SPQUAL
COERSIP	COER	4	0.82	0.53	0.73	COER	0.731	0.207	0.613	0.37	0.57	0.435
	SIP	8	0.92	0.58	0.76	SIP		0.548	0.857	0.582	0.695	0.664
	RC	4	0.89	0.68	0.82	RC			0.603	0.774	0.361	0.66
	SMSF	9	0.96	0.71	0.84	SMSF				0.78	0.71	0.724
	SMSE	4	0.90	0.69	0.83	SMSE					0.597	0.85
	SPQNT	3	0.94	0.78	0.89	SPQNT						0.708
	SPQUAL	5	0.92	0.76	0.87							
							SIP	RC	SMSF	SMSE	SPQNT	SPQUAL
MINOSIP	MINO	7	0.88	0.53	0.72	MINO	0.582	0.245	0.496	0.436	0.509	0.503
	SIP	8	0.92	0.60	0.78	SIP		0.508	0.857	0.582	0.382	0.664
	RC	4	0.89	0.68	0.83	RC			0.613	0.791	0.382	0.648
	SMSF	9	0.96	0.71	0.84	SMSF				0.78	0.705	0.731
	SMSE	4	0.90	0.69	0.83	SMSE					0.603	0.856
	SPQNT	3	0.92	0.78	0.89	SPQNT						0.696
	SPQUAL	5	0.94	0.76	0.87							
							SIN	SMSF	SMSE	SPQNT	SPQUAL	
COERSIN	COER	4	0.82	0.53	0.73	COER	0.151	0.627	0.395	0.667	0.504	
	SIN	5	0.85	0.53	0.73	SIN		0.088	0.229	0.226	0.288	
	SMSF	9	0.96	0.71	0.84	SMSF			0.788	0.706	0.786	
	SMSE	4	0.90	0.62	0.79	SMSE				0.884	0.61	
	SPQNT	3	0.93	0.81	0.90	SPQNT					0.75	
	SPQUAL	5	0.93	0.72	0.85							
							SIN	SMSF	SMSE	SPQNT	SPQUAL	
MNOSIN	MINO	7	0.89	0.55	0.74	MINO	0.181	0.549	0.452	0.554	0.561	
	SIN	5	0.85	0.53	0.73	SIN		0.097	0.238	0.233	0.293	
	SMSF	9	0.96	0.70	0.84	SMSF			0.755	0.722	0.773	
	SMSE	4	0.90	0.70	0.84	SMSE				0.588	0.865	
	SPQNT	3	0.92	0.78	0.89	SPQNT					0.75	
	SPQUAL	5	0.93	0.72	0.85							

Table 38: Summary table for CR, AVE, Sqrt AVE of factors

5.5.6 Normal distribution analysis

According to Hair et al. (2009), a considerable violation of SEM assumptions, i.e., normality, continuity, linearity, homoscedasticity, and independence of observation, may compromise the validity of the conclusion and its findings. SEM data analysis presupposes homoscedasticity is obtained. Homoscedasticity denotes that "dependent variables display the same variation across all predictor variables" (Hair et al., 2010). The connection is considered heteroscedastic if dispersion is uneven across values of the independent variable. However, this study does not evaluate homoscedasticity, which is currently contested in the scientific community and outside the scope of our investigation. A normal distribution has zero skewness (Hair et al., 2010). Hence, symmetric data should have a skewness close to zero. Negative skewness numbers show skewed data to the left, whereas positive skewness values suggest skewed to the right. In this study, the variables are more leftward. IP1, IP2, IF2, IF6, SMS1, SMS2, and SP2 were determined to be the greatest.

In this study, the Skewness of the obtained data in the investigation from IBM SPSS is -1.816 and -0.005, which are within the acceptable bounds (-2<value, +2) according to Hair et al. (2010) study and refer to section 4.4.

Moreover, the normal distribution has a kurtosis of zero. In our situation, IP1, IP2, IF2, IF6, SMS1, SMS2, and SP2 exhibit the greatest positive kurtosis, indicating a "peaked" distribution. A negative kurtosis denotes a "flat" distribution. In this study, there are no extra negative values, meaning there is a higher peaked distribution than a flat one. Overall, the results are from the lowest, -0.958, to the highest, +3.565, within the threshold (-7<value<+7) according to Hair et al. (2010) and refer to section 4.4. Therefore, based on the findings of the normality test, it could be argued that no substantial deviations from normal data were discovered in this investigation.

5.6 Path analysis and hypotheses results

SEM is a comprehensive statistical approach to testing hypotheses about relations among observed and latent variables. It can investigate causal relationships among variables in complex models rather than linear regression models (Schumacker & Lomax, 2010). The complicated model in this research, including multiple exogenous variables and multiple endogenous variables, involved direct and indirect effects, which is suitable for the SEM approach. Path analysis is a special case of SEM with no latent variables. Path analysis assumes that all variables are measured without errors and uses latent variables to account for measurement errors. Since this research focuses more on social science with management and safety performance than research methodology, path analysis can provide more explicit directional and non-directional relationships among observed variables.

In order to analyze the relationship among variables, the alignment or conflict effect between institutional pressures and self-interest is illustrated by the covariance between them. Since covariance measures the direction of a relationship between two factors rather than the causal relationship, it leads to the alignment and conflict model:

- When the covariance between institutional pressures and positive self-interest is positive, it depicts scenarios where the organization faces higher external institutional pressures and also has strong self-interest within the organization, including COERSIP and MINOSIP models.

- When the covariance between institutional pressures and negative self-interest is positive, it indicates a conflict scenario, which is the higher institutional pressures, the higher the negative self-interest, namely, the lower the self-interest, including COERSIN and MINOSIN models.

Based on the hypotheses presented in the causal relationships among variables (See Table 39), the path diagram is presented in AMOs following CFA measurement models. Path analysis is conducted in the same order: regulative and non-regulative in the alignment model (COERSIP, MINOSIP) and regulative and non-regulative in the conflict model (COERSIN and MINOSIN). The analysis follows through model specification, identification, and model fit to make sure data fit models. Then, standard regression estimates of relationships between multiple observed variables are analyzed to demonstrate whether the hypotheses are supportive or not. The model fits well in this research, and there is no need to do model re-specification.

The summary of hypotheses proposed in Chapter 3 is presented in Table 39.

Model	Related constructs	Hypotheses
Research models	COER, MIME, NORM align with SI, SI is positively associated with SMSF	H1
	COER, MIME, NORM align with SI, SI is positively associated with RC	H3
	COER, MIME, NORM align with SI, RC is positively associated with SMSE	H5
	COER, MIME, NORM conflict with SI, COER is positively associated with SMSF	H2
	COER, MIME, NORM conflict with SI, less SI leads to no RC	H4
	SMSF is positively associated with SMSE	H6
	SPQUAL is positively associated with SPQNT	H7
	SMSF is positively associated with SPQNT	H8
	SMSF is positively associated with SPQUAL	H9
	SMSE is positively associated with SPQNT	H10
	SMSE is positively associated with SPQUAL	H11
	SMS mediation of the relationship between the interactive effect (IP& IF) and SP	H12

Table 39: Hypotheses in the research model

5.6.1 Alignment model_ path analysis and hypotheses results

In the alignment models, COERSIP and MINOSIP are shown in Figure 15 and Figure 16, respectively. The model fit index is elaborated below and summarized in Table 40.

- In the COERSIP model, TLI.959, CFI.988, RMSEA.087, PCLOSE.150, SRMR.0338, and CMIN/DF 2.153 are within the threshold. Only RMSEA .087 is slightly higher than .08 and less than 0.1 (Park et al., 2002). It is still an acceptable fit. Moreover, SRMR is excellent, which is less than the .05 threshold. Therefore, the fit of the COERSIP model is acceptable.

- In the MINOSIP model, TLI.982, CFI.994, RMSEA.057, PCLOSE.371, SRMR.0266, and CMIN/DF 1.502 are within the threshold. Therefore, the MINOSIP model fit is acceptable.

- In the COERMINOSIP model, TLI.956, CFI.983, RMSEA.084, PCLOSE.118, SRMR.0360, and CMIN/DF 2.067 are within the threshold. Therefore, the fit of the COERMINOSIP model is acceptable.

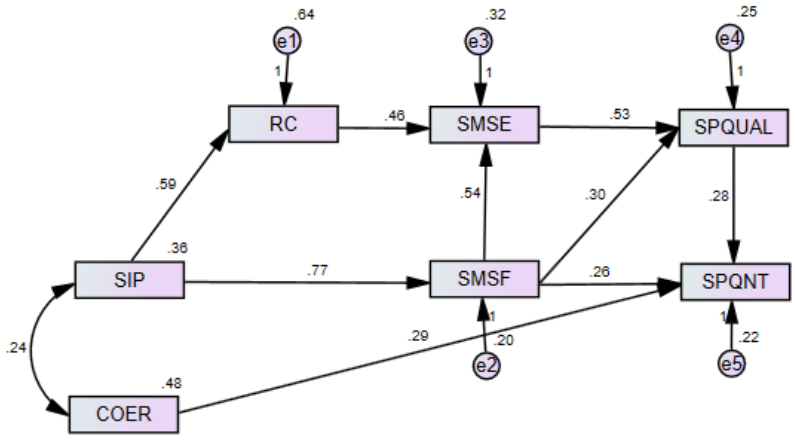

Figure 20: COERSIP alignment model

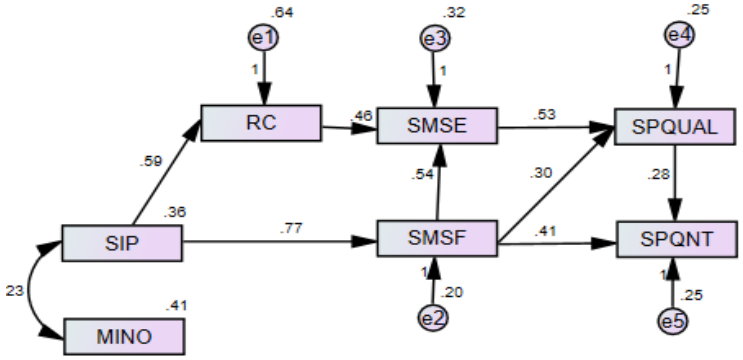

Figure 21: MINOSIP alignment model

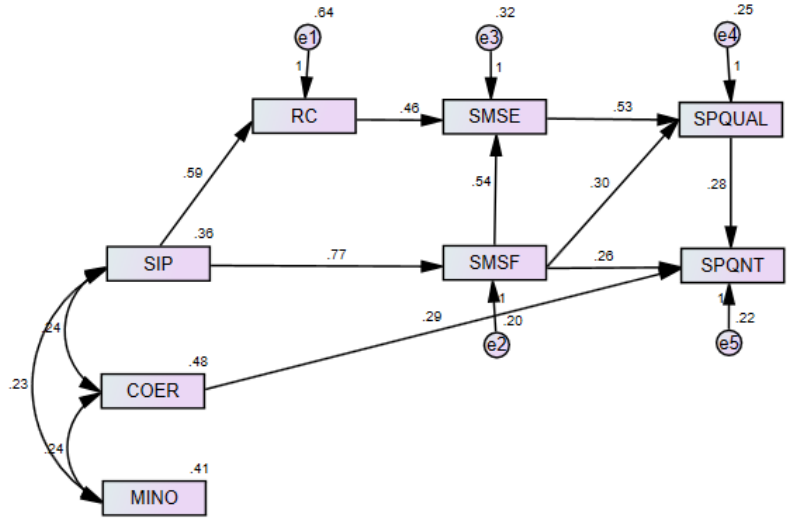

Figure 22: COERMINOSIP alignment model

Models	CMIN/DF	TLI	CFI	RMSEA	PCLOSE	SRMR	Model fit
COERSIP	2.153	.959	.988	.087	.150	.0338	Acceptable
MINOSIP	1.502	.982	.994	.057	.371	.0266	Acceptable
COERMINOSIP	2.067	.956	.983	.084	.118	.0360	Acceptable

Table 40: Alignment model fit indices

Relationships among variables are presented in the standardized regression weight Table 41. Path among variables are all significant. This implies that when institutional pressures align with the organization's self-interest, positive self-interest is highly associated with the fidelity of SMS implementation (H1 is supportive). Moreover, positive self-interest is positively associated with

resource capability (H3). Consequently, sufficient resources will impact the extensiveness of SMS implementation (H5 is supportive), which applies to all institutional pressures.

Interestingly, regulative pressures are slightly different from non-regulative pressures under the alignment; regulative pressures impact SPQNT, whereas non-regulative pressures do not have such an impact (See Figure 20 and Figure 21).

SMS fidelity (SMSF) also affects SMS extensiveness (SMSE) (H6 is supportive). If an organization realizes that a good example has been set up in one department or section and that SMS works successfully there, the organization would be encouraged to apply such best practices to all other departments, from core value sections to supportive sections. It explains why SMSF would be positively associated with SMSE.

Last but not least, when qualitative safety performance (SPQUAL) and safety culture have been highly absorbed into the organization structure and operations, fatality, accident, and serious incident rates (SPQNT) fall dramatically, which explains why SPQUAL is positively associated with SPQNT (H7 is supportive). In addition, SMS fidelity significantly increases quantitative safety performance, including quantitative and qualitative performance (H8 and H9 are supportive). In contrast, SMS extensiveness only impacts qualitative safety performance (H11 is supportive) but has no effect on quantitative safety performance (H10 is not supportive).

Path among variables			Standardized Regression Weights			*p*-Value	Hypothesis	Supportive
			COERSIP	MINOSIP	COERMINOSIP			
SIP	<--->	COER	0.245	n/a	0.245	***	H1	√
SIP	<--->	MINO	n/a	0.234	0.234	***	H1	√
MINO	<--->	COER	n/a	n/a	0.236	***	H1	√
RC	<---	SIP	0.405	0.408	0.405	***	H3	√
SMSF	<---	SIP	0.723	0.726	0.723	***	H1	√
SMSE	<---	RC	0.550	0.545	0.550	***	H5	√
SMSE	<---	SMSF	0.237	0.247	0.237	*/**/*	H6	√
SPQUAL	<---	SMSF	0.444	0.439	0.444	***	H9	√
SPQUAL	<---	SMSE	0.489	0.492	0.489	***	H11	√
SPQNT	<---	SMSF	0.302	0.476	0.302	**/***/**	H8	√
SPQNT	<---	SPQUAL	0.368	0.397	0.368	***	H7	√
SPQNT	<---	COER	0.265	n/a	0.265	***		
SPQNT	<---	SMSE			-0.019	0.869	H10	×

Table 41: Standard regression weights of relationships in COERSIP & MINOSIP models

*** P is significant at 0.001
** P is significant at 0.01
* P is significant at 0.05. (The same as all the following tables with P value)

Relationships among variables	Hypotheses	Supportive
COER, and MINO align with SIP, and SIP is positively associated with SMSF	H1	√
COER, and MINO align with SIP, and SIP is positively associated with RC	H3	√
COER, MINO align with SIP, RC is positively associated with SMSE	H5	√
SMSF is positively associated with SMSE	H6	√
SPQUAL is positively associated with SPQNT	H7	√
SMSF is positively associated with SPQNT	H8	√
SMSF is positively associated with SPQUAL	H9	√
SMSE is positively associated with SPQNT	H10	×
SMSE is positively associated with SPQUAL	H11	√

Table 42: Hypotheses for alignment model

5.6.2 Conflict model_path analysis and hypotheses results

In a confliction scenario, two models, COERSIN and MINOSIN, are model fits and model indexes are summarized in Table 43.

- In the COERSIN model, TLI.950, CFI.980, RMSEA.094, PCLOSE.112, SRMR.0819, and CMIN/DF 2.337 are all within the threshold. Although RMSEA is higher than 0.08 but less than 0.1, it can be considered an acceptable fit. With PCLOSE .112 and SRMR 0.0819, the COERSIN model fit is acceptable.

- In the MINOSIN model, TLI 1.006, CFI1.000, RMSEA.000, PCLOSE.770, SRMR.0178, and CMIN/DF .772 are within the excellent threshold. Therefore, the MINOSIP model fit is good.

- In the COERMINOSIN model, TLI .976, CFI.990, RMSEA.075, PCLOSE.200, SRMR.0946 and CMIN/DF 1.864 are all within the excellent threshold. Therefore, the COERMINOSIN model is acceptable.

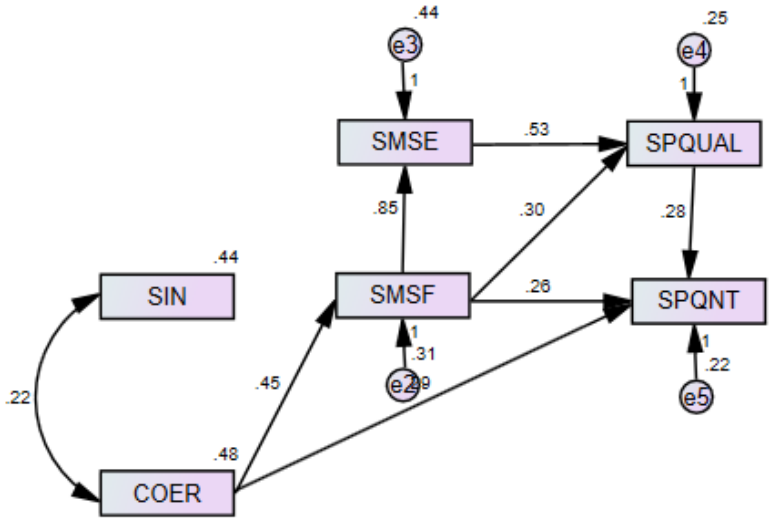

Figure 23: COERSIN conflict model

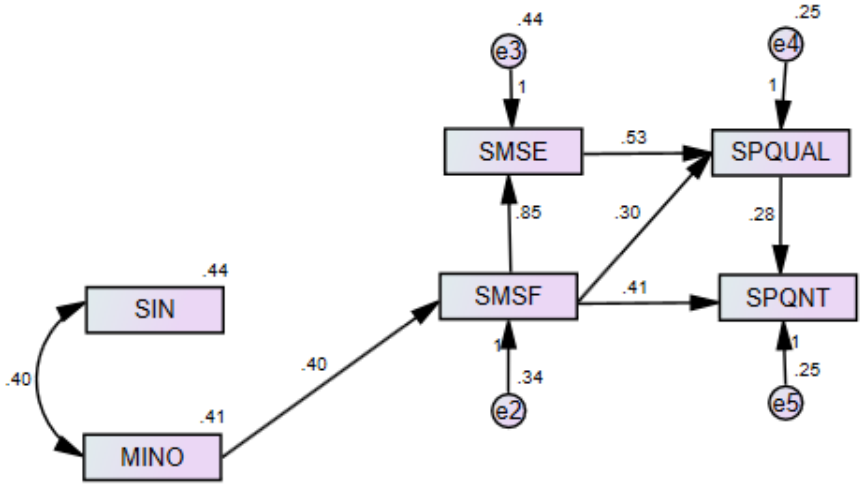

Figure 24: MINOSIN conflict model

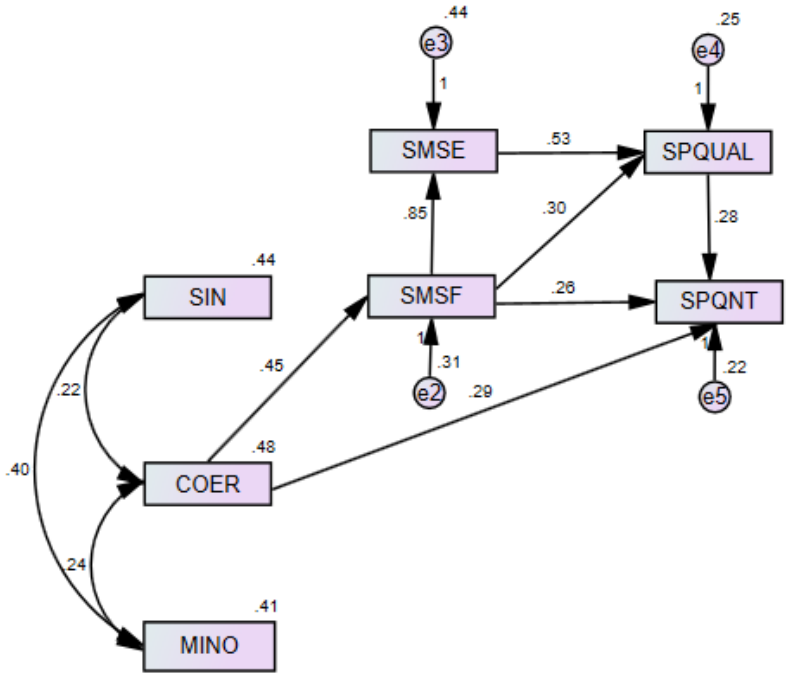

Figure 25: COERMINOSIN conflict model

Models	CMIN/DF	TLI	CFI	RMSEA	PCLOSE	SRMR	Model fit
COERSIN	2.337	.950	.980	.094	.112	.0819	Acceptable
MINOSIN	.722	1.006	1.000	.000	.770	.0178	Good
COERMINOSIN	1.864	.976	.990	.075	.200	.0946	Acceptable

Table 43: Conflict model fit indices

Relationships among variables are presented in the standardized regression weight Table 44. Path among variables are all significant. When institutional pressures conflict with the organization's self-interest, the resource capability has not been triggered. Consequently, there is no resource capability available for the following SMS implementation. Therefore, only institutional pressures impact the fidelity of SMS implementation (See Figure 23 and Figure 24). H2 and H4 are supportive.

The exciting finding is that under a conflict scenario, regulative pressures impact the fidelity of SMS implementation and the quantitative safety performance, which is similar to the alignment scenario (See Figure 25). On the other hand, non-regulative pressures do not have such power over safety performance. It can be summarized no matter whether self-interest regulative pressures impact quantitative performance directly.

Relationships			Standard Regression Weights			*p*-Value	Hypothesis	Supportive
			COERSIN	MINOSIN	COERMINOSIN			
SIN	<--->	COER	0.224	n/a	0.224	***	H2	√
SIN	<--->	MINO	n/a	0.403	0.403	***	H2	√
MINO	<--->	COER	n/a	n/a	0.236	***	H2	√
SMSF	<---	COER	0.485	n/a	0.485	***	H2	√
SMSF	<---	MINO	n/a	0.400	n/a	***	H2	√
RC	<---	SIN	n/a	n/a	n/a	Not sig.	H4	√
SMSE	<---	SMSF	0.418	0.634	0.418	**	H6	√
SPQUAL	<---	SMSF	0.246	0.550	0.388	***	H8	√
SPQUAL	<---	SMSE	0.581	0.572	0.539	***	H11	√
SPQNT	<---	SMSF	0.251	0.492	0.249	**/***/***	H9	√
SPQNT	<---	SPQUAL	0.334	0.567	0.332	***	H7	√
SPQNT	<---	SMSE			-0.046	0.615	H10	×
SPQNT	<---	COER	0.310	n/a	0.308	***		

Table 44: Standard regression weights of relationships in COERSIN & MINOSIN models

Relationship between variables	Hypotheses	Supportive
COER and MINO conflict with SIN, COER and MINO are positively associated with SMSF	H2	√
COER and MINO conflict with SIN, and negative self-interest leads to no resource capability.	H4	√

Table 45: Hypotheses for conflict model

5.6.3 Mediation effect

Four mediation effects are analyzed in this section. The first one is in the hypotheses and elaborated in alignment and conflict scenarios. The other three mediation effects among SMS fidelity, extensiveness, and qualitative and quantitative safety performance are newly found in the path analysis, which has not been assumed in the research model and hypotheses. The medication effect provides evidence and the underlying mechanism to explain the causal relationships between observed variables.

1. SMS partially mediates the relationship between interactive force and Safety performance.
2. RC and SMSF fully mediate the relationship between SIP and SMSE in the alignment model, while SMSF fully mediates the relationship between IP and SMSE in the conflict model.
3. SMSE partially mediates the relationship between SMSF and SPQUAL.
4. SMSE and SPQUAL partially mediate the relationship between SMSF and SPQNT.

5.6.3.1 SMS partial mediation effect on IP and SP

In order to focus on SMS mediation's effect on safety performance in general, SMS has been analyzed as one construct by combining fidelity and extensiveness, and safety performance has been analyzed as one construct by combining quantitative and qualitative as well. Since SIP impacts SMS in the alignment model and institutional pressures impact SMS in the conflict model, there is a need to analyze them separately.

1. SMS mediation effect under alignment model

COER and MINO for their impacts on SMS and safety performance with the same regression weight used in the analysis for institutional pressures (See Figure 26). Two model indices are shown in Table 46. In alignment with the SMS model, TLI is .936, CFI is .992, RMSEA is high, .068, PLCOSE is .298, and SRMR is .0340. Therefore, the model is fit. In the alignment without the SMS model, TLI .958, CFI .986, and RMSEA is 0.1. However, PLCOSE .162, and SRMR .0409, are all within thresholds. Therefore, the model is fit.

	CMIN/DF	TLI	CFI	RMSEA	PCLOSE	SRMR	Model fit
With SMS	1.696	.936	.992	.068	.298	.0340	Acceptable
Without SMS	2.506	.958	.986	.1	.162	.0409	Acceptable

Table 46: alignment model for mediation effect indices

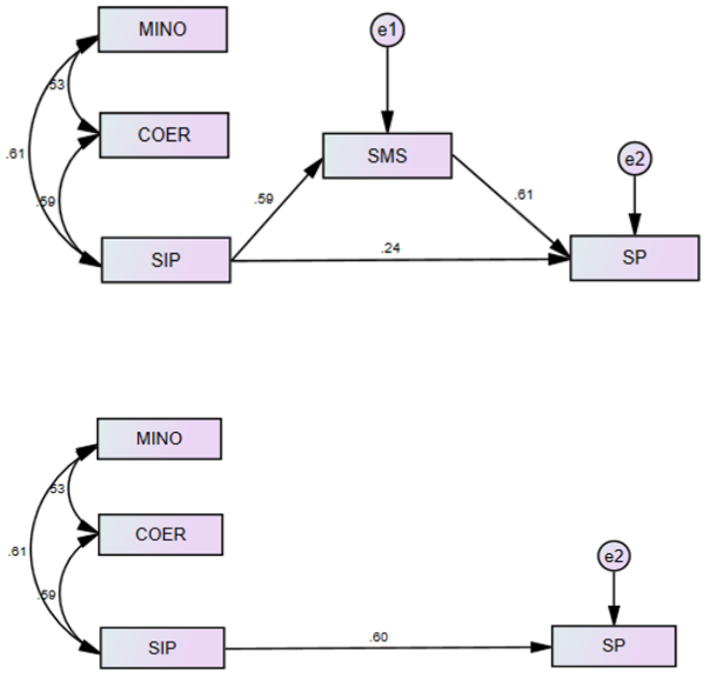

Figure 26: SMS mediation effect in the alignment model

Once the model is fit, it is time to explore the SMS mediation effect. As mentioned in Chapter 4.6.5, mediation can be either full or partial. Full mediation is the case in which variable X no longer affects Y after the mediation variable has been controlled, making path C' zero. Partial mediation is the case in which the path from X to Y is reduced but still greater than zero when the mediator is introduced (See Figure 27). In the partial mediation effect, the total effect C equals a*b plus the direct effect C' (C=a*b+C').

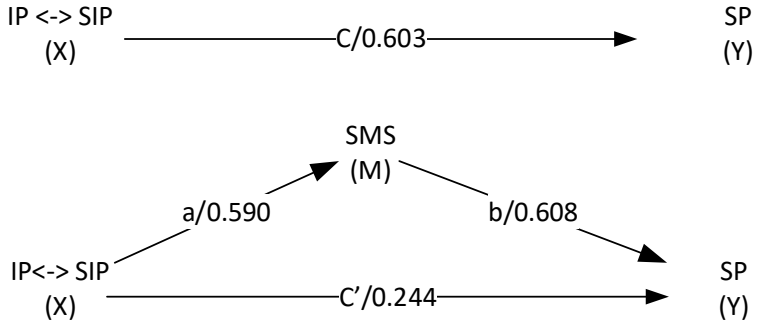

Figure 27: SMS partial mediation effect

Based on this definition, Figure 27 shows how SMS partially mediates SIP and SP. The total effect C (0.603) is the direct effect of SIP on SP. Once the SMS is controlled, C' (0.244) is not reduced to zero. Therefore, Table 47 shows that the total effect (0.603=0.244+0.359) is the sum of direct C' (0.244) and indirect effect a*b (0.359=0.590*0.608).

Total Effects (Group number 1 - Default model)

	SIP	SMS
SMS	0.590	0
SP	0.603	0.608

Direct Effects (Group number 1 - Default model)

	SIP	SMS
SMS	0.590	0
SP	0.244	0.608

Indirect Effects (Group number 1 - Default model)

	SIP	SMS
SMS	0	0
SP	0.359	0

Table 47: Regression weight of total, direct and indirect effects

Moreover, Table 48 shows that SIP is significantly correlated with SP, SIP is significantly correlated with SMS, and SMS is significantly correlated with SP, but it has not shown whether the indirect effect a* b is statistically significant. In the following section, Bootstrapping is used in AMOS to explore the statistically significant level of the indirect effect.

Alignment model with SMS			**Estimate**	**S.E.**	**C.R.**	**P**
COER	<--->	SIP	0.245	0.039	6.248	***
SIP	<--->	MINO	0.234	0.037	6.400	***
COER	<--->	MINO	0.236	0.041	5.760	***
SMS	<---	SIP	0.668	0.074	9.014	***
SP	<---	SMS	0.574	0.06	9.635	***
SP	<---	SIP	0.261	0.067	3.869	***
Alignment model without SMS			**Estimate**	**S.E.**	**C.R.**	**P**
SP	<---	SIP	0.644	0.069	9.328	***

Table 48: Regression weight of mediation effect and statistic significance

Bootstrapping is an increasingly used approach for investigating indirect effects (Bollen & Stine, 1990; Shrout & Bolger, 2002). Bootstrapping is a non-parametric technique based on repeated sampling with replacement, such as 500 times. The indirect effect is determined for each of these samples, and a sampling distribution may be empirically created. An adjustment for bias can be performed since the mean of the bootstrapped distribution will not precisely equal the indirect impact. With the distribution, one may establish a confidence interval, a p-value, or a standard error. Extremely frequently, a confidence interval is produced, and its inclusion of zero is examined. If zero does not fall inside the interval, the researcher can be certain that the indirect effect is statistically significant.

Fritz, Taylor, and MacKinnon (2012) have expressed concern that a bias-corrected bootstrapping test with an alpha of approximately .07 is too permissive. In fact, it appears that omitting the bias correction improves the Type I error rate. Hayes and Scharkow (2013) suggested adopting the bias-corrected bootstrap if power is the primary issue, but the percentile bootstrap if Type I error rate is the primary concern.

In this study, AMO and bootstrapping were used with 500 sample sizes and 95 confidence intervals, and the results are shown in Table 49. Zero falls out of the lower bounds of 0.455 and upper bounds of 0.807. Moreover, the two-tailed significance is 0.004. Therefore, the indirect effect of SIP on SMS and SMS on SP are statistically significant.

To sum up, since the direct effect does not reduce to zero (See Table 47 and Figure 27, 0.244), and zero does not fall inside the interval (0.455-0.807, see Table 49), indicating that the indirect effect is statistically significant. Therefore, it can be concluded that SMS partially mediates the relationship between SIP and SP. Therefore, Hypothesis 12 is supported (See Table 50).

Indirect Effects - Lower Bounds (B.C.) (Group number 1 - Default model)

	SIP	SMS
SMS	0.448	0
SP	0.455	0.416

Indirect Effects - Upper Bounds (B.C.) (Group number 1 - Default model)

	SIP	SMS
SMS	0.832	0
SP	0.807	0.733

Indirect Effects - Two-Tailed Significance (B.C.) (Group number 1 - Default model)

	SIP	SMS
SMS	0.004	...
SP	0.004	0.004

Table 49: Indirect effect confidence interval table

Model	Related constructs	Hypotheses	Supportive
SMS mediation effect under alignment scenario	The SMS has a mediation effect between the alignment effects (IP vs SIP) and safety performance.	H12	√

Table 50: Originally assumed mediation effects in alignment model.

2. SMS Mediation effect under conflict scenario

Under the conflict scenario, two factors, COER and MINO, in institutional pressures have slightly different impacts on the relationship between SMS and safety performance (See Figure 28). Models for COER and MINO fit the data, as shown in the next paragraph.

In the COERMINOSIN model, TLI .960, CFI .984, and RMSEA are high at .123, greater than the marginal fit threshold of 0.1. However, PCLOSE is greater than 0.01, SRMR.0691. Therefore, the model is acceptable. In the MINOSIN and MINOSIN without SMS model, TLI 1.0, CFI.1.0, RMSEA.081, PCLOSE.926/.972, and SRMR.0022/.0004, both models have good model fit (See Table 51). The non-regulative model has a good model fit, while the regulative model has an acceptable one.

Models	**CMIN/DF**	**TLI**	**CFI**	**RMSEA**	**PCLOSE**	**SRMR**	**Model fit**
COERMINOSIN with SMS	3.309	.960	.984	.123	.043	.0691	Acceptable
MINNOSIN with SMS	.112	1.0	1.0	.000	.926	.0022	Good
MINNOSIN without SMS	.002	1.0	1.0	.000	.972	.0004	Good

Table 51: Mediation effect in confliction model indices

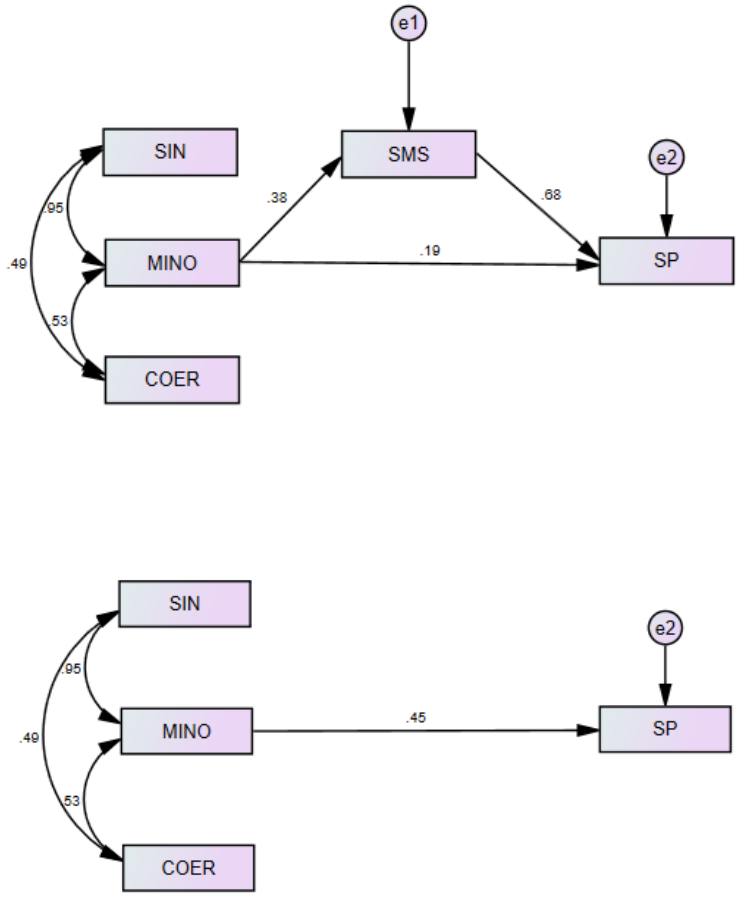

Figure 28: SMS mediation effect in the conflict model

Table 52 presents the correlation among factors, which are all statistically significant. MINO is correlated with SP, and they are correlated with SMS, respectively as well. SMS is correlated with SP.

The total effect C (0.449) is the effect of MINO on SP directly, highlighted in yellow in Table 53. Once the SMS is controlled, direct effect C' (0.191) is not reduced to zero. Namely, the total effect (0.466=0.191+0.258) is the sum of direct C' (0.191) and indirect effect a*b (0.258=0.380*0.68).

Regarding whether the indirect effect is statistically significant, bootstrapping 500 times is used, and a 95-confidence interval in AMO is used to test the significance level. Table 54 shows that zero falls out of the lower bounds of 0.279 and upper bounds of 0.599, and the two-tailed significance is 0.004. It indicates that the indirect effect of MINO on SP is statistically significant. Therefore, it can be concluded that SMS partially mediates the relationship between IP and SP. Based on the above analysis, SMS partially mediates between the IP&SIN and safety performance. H12 is supported (See Table 55).

MINOSIN			**Estimate**	**S.E.**	**C.R.**	**P**
SIN	<--->	MINO	0.403	0.047	8.499	***
SMS	<---	MINO	0.401	0.079	5.066	***
SP	<---	SMS	0.642	0.052	12.222	***
SP	<---	MINO	0.190	0.055	3.429	***
MINOSIN_NOSMS			**Estimate**	**S.E.**	**C.R.**	**P**
SP	<---	MINO	0.447	0.072	6.199	***

Table 52: Regression weight of mediation effect and statistic significance

Standardized Total Effects (Group number 1 - Default model)

	MINO	SMS
SMS	0.380	0
SP	0.449	0.680

Standardized Direct Effects (Group number 1 - Default model)

	MINO	SMS
SMS	0.380	0
SP	0.191	0.680

Standardized Indirect Effects (Group number 1 - Default model

	MINO	SMS
SMS	0	0
SP	0.258	0

Table 53: Regression weight of total, direct, and indirect effect

Standardized Total Effects - Lower Bounds (P.C.) (Group number 1 - Default model)

	MINO	SMS
SMS	0.189	0
SP	0.290	0.459

Standardized Total Effects - Upper Bounds (P.C.) (Group number 1 - Default model)

	MINO	SMS
SMS	0.656	0
SP	0.603	0.795

Standardized Total Effects - Two-Tailed Significance (P.C.) (Group number 1 - Default model)

	MINO	SMS
SMS	0.005	...
SP	0.004	0.004

Table 54: MINOSIN model _Indirect effect confidence interval table

Model	Related constructs	Hypotheses	Supportive
SMS mediation effect under conflict scenario	The SMS partially mediates between the conflict effect (IP vs SIN) and safety performance.	H12	√

Table 55: Originally assumed mediation effects in the conflict model.

The following three full and partial mediation effects are not proposed in the hypotheses. However, they are found during path analysis in AMOs, so it is worth elaborating on them in the following sections.

5.6.3.2 RC and SMSF full mediation effects on SIP & SMSE in alignment model

Relationships among RC->SMSE and SMSF->SMSE are significant, as presented in Table 41.SIP on SMSE is significant and equal to .395, and once RC and SMSF come into control, the SIP effect on SMSE decreases to zero. The total effect of SIP on SMSE comes from the two indirect effects (See Table 56 and Figure 29):

1) SIP effects on RC products and RC effects on SMSE are equal to .405*.550=.223
2) SIP effects on SMSF products SMSF effects on SMSE, equal to .723*.237=.172
3) The total effect is the sum of the two routes, equal to .223+.172=.395

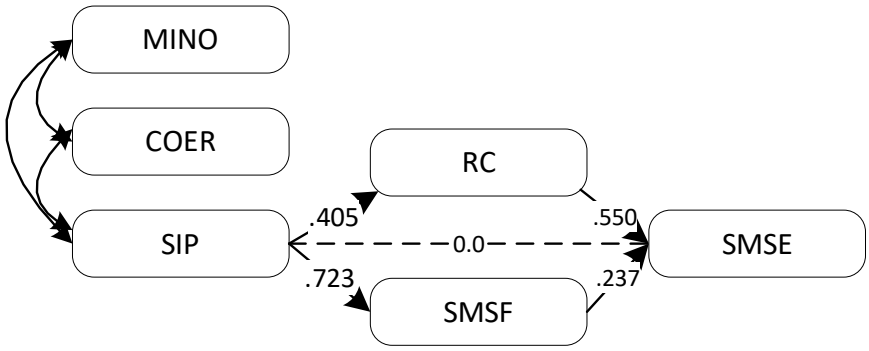

Figure 29. RC and SMSF full mediation effects on SIP & SMSE in alignment model

Standardized Total Effects (Group number 1 - Default model)

	COER	SIP	RC	SMSF	SMSE	SPQUAL
RC	.000	.405	.000	.000	.000	.000
SMSF	.000	.723	.000	.000	.000	.000
SMSE	.000	.395	.550	.237	.000	.000
SPQUAL	.000	.514	.269	.560	.489	.000
SPQNT	.265	.407	.099	.508	.180	.368

Table 56: Standardized Total Effects of SIP->SMSE

Moreover, I used bootstrapping 500 times and a 95-confidence interval to test if the indirect effect of SIP on SMSE is statistically significant. The results show that zero falls out of the lower bounds of 0.314 and upper bounds of 0.753 (See Table 57, highlighted in yellow). In the meantime, from the two-tail table, the SIP effect on SMSE shows p= 0.005. Both parameters indicate that the indirect effect of RC and SMSF on the relationship between SIP and SMSE is statistically significant. Therefore, it can be concluded that RC and SMSF fully mediate SIP and SMSE.

Standardized Indirect Effects (Group number 1 - Default model)
Indirect Effects - Lower Bounds (BC) (Group number 1 - Default model)

	COER	SIP	RC	SMSF	SMSE	SPQUAL
RC	.000	.000	.000	.000	.000	.000
SMSF	.000	.000	.000	.000	.000	.000
SMSE	.000	.314	.000	.000	.000	.000
SPQUAL	.000	.454	.136	.017	.000	.000
SPQNT	.000	.226	.037	.090	.062	.000

Standardized Indirect Effects - Upper Bounds (BC) (Group number 1 - Default model)

	COER	SIP	RC	SMSF	SMSE	SPQUAL
RC	.000	.000	.000	.000	.000	.000
SMSF	.000	.000	.000	.000	.000	.000
SMSE	.000	.753	.000	.000	.000	.000
SPQUAL	.000	.847	.354	.314	.000	.000
SPQNT	.000	.641	.130	.372	.225	.000

Standardized Indirect Effects - Two Tailed Significance (BC) (Group number 1 - Default model)

	COER	SIP	RC	SMSF	SMSE	SPQUAL
RC	...	...	...	...	...	...
SMSF	...	...	...	...	...	...
SMSE	...	.005	...	...	...	...
SPQUAL	...	.005	.003	.033	...	...
SPQNT	...	.004	.001	.003	.002	...

Table 57: Statistically significant indirect effect of SIP -> SMSE

5.6.3.3 SMSF full mediation effect on COER & SMSE in conflict model

COER effect on SMSF and SMSF effect on SMSE is significant; once SMSF comes into control, the COER effect on SMSE decreases to zero. The total effect of COER on SMSE comes from the two indirect effects (See Table 58 and Figure 30):

1) COER effects on SMSF, .485, SMSF effects on SMSE, .418;
2) COER total effects on SMES are equal to the production of the above two effects, .485*.418=.203

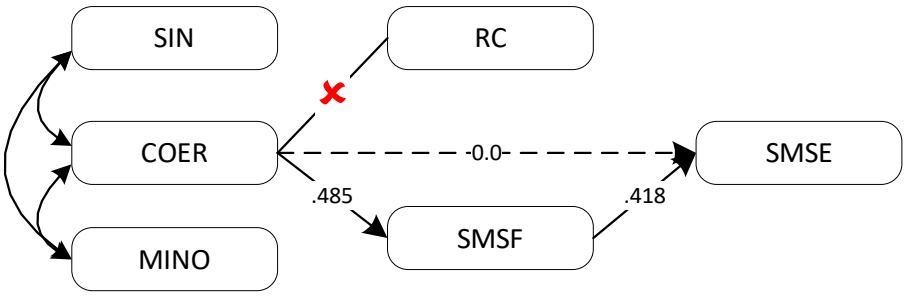

Figure 30. SMSF full mediation effects on COER & SMSE in the conflict model

Standardized Total Effects (Group number 1 - Default model)

	COER	SMSF	SMSE	SPQUAL
SMSF	.485	.000	.000	.000
SMSE	.203	.418	.000	.000
SPQUAL	.298	.614	.539	.000
SPQNT	.527	.453	.179	.332

Table 58: Standardized Total Effects of COER->SMSE

Moreover, I used bootstrapping 500 times and a 95-confidence interval to test if the indirect effect of COER on SMSE is statistically significant. The results show that zero falls out of the lower bounds of 0.09 and upper bounds of 0.402 (See Table 59, highlighted in yellow), which indicates that the indirect effect of SMSF on the relationship between COER and SMSE is statistically significant. Therefore, it can be concluded that SMSF fully mediates COER and SMSE.

Standardized Total Effects - Lower Bounds (BC) (Group number 1 - Default model)

	COER	SMSF	SMSE	SPQUAL
SMSF	.258	.000	.000	.000
SMSE	.009	.017	.000	.000
SPQUAL	.094	.287	.315	.000
SPQNT	.378	.234	.080	.167

Standardized Total Effects - Upper Bounds (BC) (Group number 1 - Default model)

	COER	SMSF	SMSE	SPQUAL
SMSF	.644	.000	.000	.000
SMSE	.402	.679	.000	.000
SPQUAL	.471	.890	.685	.000
SPQNT	.653	.596	.290	.478

Standardized Total Effects - Two-Tailed Significance (BC) (Group number 1 - Default model)

	COER	SMSF	SMSE	SPQUAL
SMSF	.005	...	...	...
SMSE	.035	.041	...	...
SPQUAL	.004	.004	.003	...
SPQNT	.004	.006	.003	.005

Table 59: Statistically significant indirect effect of COER -> SMSE

5.6.3.4 SMSE and SPQUAL partial mediation effects

There are interesting findings of mediation effects in the SMS and safety performance model, which I have not assumed in the research model. The path analysis indicates that SMSE has a partial mediation effect on SMSF and SPQUAL, and SPQUAL and SMSE have combined partial mediation effects on SMSF and SPQNT. Since the model fit is presented in the previous section, according to Table 48, here is to analyze the mediation effects within the model.

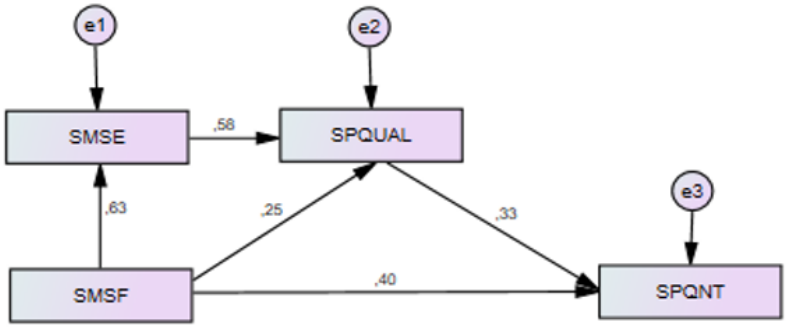

Figure 31: SMS and safety performance model

In order to investigate if SMSE has a mediation effect on the relationship between SMSF and SPQUAL and if SPQUAL has a mediation effect on the relationship between SMSF and SPQNT, I have conducted an indirect effect analysis and bootstrap. The results are shown in Tables 60, 61, and 62.

1) Regarding the SMSE mediation effect on SMSF & SPQUAL:
    a. Table 60 and Figure 31 show that SMSF is correlated with SPQUAL, SMSF is correlated with SMSE, and SMSE is correlated with SPQUAL. All p-values are significant. Table 61 (highlighted in green) shows that the total effect C (0.614) is the effect of SMSF on SPQUAL. Once the SMSE is controlled, direct effect C' (0.246) is not reduced to zero. Therefore, the total effect (0.614=0.246+0.369) is the sum of direct effect C' (0.246) and indirect effect a*b (0.369=0.63*0.58).

    b. Moreover, I used bootstrapping 500 times and a 95-confidence interval to test if the indirect effect of SMSF on SPQUAL is statistically significant. The results show that zero falls out of the lower bounds of 0.481 and upper bounds of 0.735 (See Table 62, highlighted in green). It indicates that the indirect effect of SMSE on SMSF and SPQUAL is statistically significant. Therefore, it can be concluded that SMSE partially mediates SMSF and SPQUAL (See Table 63).

2) Regarding the SPQUAL mediation effect on SMSF & SPQNT,
    a. Table 60 and Figure 31 show that SMSF is correlated with SPQNT (direct), SMSF is correlated with SPQUAL, and SPQUAL is correlated with SPQNT (indirect). All p-values are significant. Table 61 shows that the total effect C (0.602) is the effect of SMSF on SPQNT, highlighted in yellow. Once the SPQUAL is controlled, direct effect C' (0.398) is not reduced to zero. Therefore, the total effect (0.602=0.398+0.204) is the sum of direct C' (0.398) and indirect effect a*b (0.204=0.614*0.322, See Table 61 highlighted in yellow).

b. Moreover, bootstrapping 500 times and a 95-confidence interval level are used to test if the indirect effect of SMSF on SPQNT (a*b) is statistically significant. The results show that zero falls out of the lower bounds of 0.426 and upper bounds of 0.734 (See Table 62, highlighted in yellow). It indicates that the indirect effect of SPQUAL on SMSF and SPQNT is statistically significant.

c. There is an exciting finding that, in the SPQUAL mediation effect, the result shows that SMSE and SPQUAL have combined mediation effects on the relationship of SMSF and SPQNT, as noted that in the indirect effect a*b (0.204=0.614*0.322, See Table 62 highlighted in yellow), the 0.614 actually stems from the total effect of the second mediation effect of SMSE as described in the previous section. In addition, SMSE has a partial mediation effect on SMSF and SPQUAL. Therefore, it can be concluded that SMSE and SPQUAL have combined partial mediation effects on the relationship between SMSF and SPQNT (See Table 63).

SMSSP model			**Estimate**	**S.E.**	**C.R.**	**P**
SMSE	<---	SMSF	0.849	0.084	10.118	***
SPQUAL	<---	SMSF	0.298	0.083	3.611	***
SPQUAL	<---	SMSE	0.527	0.062	8.544	***
SPQNT	<---	SMSF	0.413	0.08	5.139	***
SPQNT	<---	SPQUAL	0.283	0.066	4.28	***
NO_SPQUAL			**Estimate**	**S.E.**	**C.R.**	**P**
SPQNT	<---	SMSF	0.624	0.067	9.303	***
NO_SMSE			**Estimate**	**S.E.**	**C.R.**	**P**
SPQUAL	<---	SMSF	0.746	0.078	9.602	***

Table 60: Standard regression weight in the SMSSP model

Standardized Total Effects (Group number 1 - Default model)

	SMSF	SMSE	SPQUAL
SMSE	0.634	0	0
SPQUAL	0.614	0.581	0
SPQNT	0.602	0.193	0.332

Standardized Direct Effects (Group number 1 - Default model)

	SMSF	SMSE	SPQUAL
SMSE	0.634	0	0
SPQUAL	0.246	0.581	0
SPQNT	0.398	0	0.332

Standardized Indirect Effects (Group number 1 - Default model)

	SMSF	SMSE	SPQUAL
SMSE	0	0	0
SPQUAL	0.369	0	0
SPQNT	0.204	0.193	0

Table 61: Total, direct, and indirect effects in the SMSSP model

Bootstrapping Indirect Effects - Lower Bounds (BC) (Group number 1 - Default model)

	SMSF	SMSE	SPQUAL
SMSE	0.508	0	0
SPQUAL	0.481	0.446	0
SPQNT	0.426	0.1	0.171

Indirect Effects - Upper Bounds (B.C.) (Group number 1 - Default model)

	SMSF	SMSE	SPQUAL
SMSE	0.736	0	0
SPQUAL	0.735	0.696	0
SPQNT	0.734	0.284	0.482

Indirect Effects - Two-Tailed Significance (BC) (Group number 1 - Default model)

	SMSF	SMSE	SPQUAL
SMSE	0.004	…	…
SPQUAL	0.004	0.004	…
SPQNT	0.004	0.004	0.004

Table 62: Statistically significant of the indirect effect in the SMSSP model

	New findings not in hypotheses	Status
SMSE mediation effect	SMSE has a partial mediation effect on SMSF & SPQUAL	√
SPQUAL mediation effect	SPQUAL and SMSE have combined partial mediation effects on SMSF and SPQNT	√

Table 63: New mediation effects found in the research models.

5.7 Conclusion

This chapter focuses on data analysis and results. It starts with presenting the survey respondent profile and assessing nonresponse bias. The reliability of each construct, institutional pressures, internal fit, SMS, and safety performance are tested by Cronbach's Alpha with 0.909, 0.870, 0.948, and 0.930, demonstrating the excellent correlation between items.

EFA and CFA have been used to measure the model. In IBM SPSS, EFA is conducted on the four independent theories and generates new factors of each construct. Institutional pressures restructure into regulative and non-regulative pressures. Internal fit includes self-interest and resource capability; SMS implementation includes SMS fidelity and extensiveness; and safety performance includes quantitative and qualitative safety performance.

Each newly identified factor is used in IBM SPSS AMO to measure the research model with CFA. Since the theory involves multiple constructs with many observed items, in order to figure out which construct is not model fit, CFA model measurement is performed in steps.

- The first step is to measure the model fit of the SMSSP model, including SMS implementation and Safety performance. Since there are alignment and conflict scenarios for relationships between institutional pressures and self-interest in SMS implementation,
- The second step is to analyze the model fit of two scenarios: COERSIPSMS, COERSINSMS, MINOSIPSMS, and MINOSINSMS, respectively.
- The last step is integrating all constructs to analyze the model fit, including COERSIPSMSSP, COERSINSMSSP, MNOSIPSMSSP, and MINOSINSMSSP. All model fit are either good or acceptable with TLI, CFI, RMSEA, PCLOSE, and SRMR index to present the model fit.

After that, path analysis is used in IBM SPSS AMO to analyze the causal relationships among variables and test hypothesized results. Two scenarios, alignment and conflict between institutional pressures and self-interest, are discussed. Within each scenario, there are three models to reflect the relationships between two factors (regulative and non-regulative pressures) of institutional pressures and self-interest.

- The alignment scenarios include COSIP, MINOSIP, and COERMINOSIP models. COSIP are regulative pressures (COER) and positive self-interest (SIP), and the MINOSIP model is non-regulative pressures (MINO) and positive self-interest (SIP), COERMINOSIP includes COER, MINO, and SIP.

- The confliction scenarios include COSIN, MINOSIN, and COERMINOSIN models. COSIN are regulative pressures (COER) and negative self-interest (SIN), and the MINOSIN model is non-regulative pressures (MINO) and negative self-interest (SIN), and COERMINOSIN includes COER, MINO, and SIN.

The results in path analysis show that most of the path relationships among variables are statistically significant.

- With regard to the 12 hypotheses, only hypothesis 10 is not supported. Others are supportive.

- In addition, a new causal relationship emerges from path analysis, not proposed in the hypothesis, which is regulative pressures directly impact quantitative safety performance.

- Moreover, three mediation effects emerge from the path analysis: RC and SMSF fully mediate the relationship between SIP and SMSE in the alignment model, while SMSF fully mediate the relationship between IP and SMSE in the conflict model; SMSE has a partial mediation effect on SMSF and SPQUAL; and SPQUAL and SMSE have combined partial mediation effects on SMSF and SPQNT.

6. DISCUSSION

This dissertation used an online survey to collect 173 responses from worldwide aviation organizations to explore the interactive force between institutional pressures and internal fit (self-interest and resource capability) and investigate how such interactive force impacts SMS implementation and safety performance in the global aviation community.

As discussed in the literature review in Chapter 2, organizational practices reflect the value chain and the firm's knowledge, which are crucial to the organization's life cycle (Kostova, 1999). SMS has been one of the most prevalent practices in the aviation sector since 2010 because it has been deeply involved in aviation organizations' activities and safety performance.

Using new institutionalism in the practice adoption to recognize macro impact from the common factors influencing organizations in the same field (Meyer, 1977), DiMaggio and Powell (1983) found that institutional pressures make organizations adopt similar practices in organizational fields and tend to be isomorphic in the structure and form of organizations. However, these theories only partially describe organizations' homogeneous features. In the real world, organizations implement practices heterogeneously at different levels in the workplace. As a consequence of institutional changes, practice adoption can change and react differently over time. Status changes can include disappearing, diffusing, deinstitutionalizing, or institutionalizing in organizations (Greenwood et al., 2017).

New institutionalism evolution is unfolding two realities of how organizations adapt their form and structure according to the common influences from their field: the tendency of isomorphism (common approaches among organizations within the same field) and different practices implementation between organizations of similar types. Olivier explored these two realities from a strategic response perspective (1992). She pointed out that although external factors influence an organization's practice adoption and implementation, organizations will have different strategic responses from resistance to conformity.

Greenwood et al. critique Oliver's work and find that her analysis does not do enough to understand the interaction effects between the two realities, namely field-wide effects and in-firm attributes (Greenwood et al., 1996). Thus, Greenwood attempts to draw attention to intra-organizations to explain the variety of organizations by introducing the concept of intra-organizational dynamics to theoretically investigate the response of the individual organization to institutional pressures from four aspects: interests, values, power dependencies, and capacity for actions, inspired by old institutionalism, which emphasize values, attitude, and conflicts of interest within the organization. Pache and Santos (2010) posit that organizations will implement the practice from the goals and means at two organizational levels.

Ansari (2010) explores the technical, political, and cultural fits in multinational cooperation implementation practice when facing institutional pressures from home and host countries, resulting in four practice implementation types. These fits have been extended to the concept of internal fit in Fortwengel (2017). He explores how organization governance models affect the ability to attain internal and external fits over the transfer of organizational practice in multinational corporations.

The studies mentioned above have explored intra- or inter-organizations in depth but have conducted a limited investigation of the interactive forces between intra-organizations and inter-organizations in practice implementation. It rarely applies to SMS implementation and safety performance aspects. Moreover, no study has yet empirically explored the organization's institutional pressures and internal fit, nor has it decoupled the relationship to examine the four types of practice implementation and safety performance.

Using the concept of the internal fit from Ansari (2010) and Fortwengel (2017), the connection between old institutionalism, different strategic responses (Oliver, 1991), Greenwood's conceptualization of self-interest under intra-organizational dynamics (interest, power of dependency), and goals and means level (Pache & Santos, 2010) theories allowed me to build the first dimension of internal fit, self-interest. Furthermore, combining another part of Greenwoods' intra-organization dynamics (capacity of action) and Baily's (1991) resource concept with Teece's (2017) ordinary capacity is to build up the second dimension, resource capability of internal fit, in my study. The concept of internal fit comprises self-interest and resource capability, which differentiates Ansari's technical, political, and cultural fit in the concept of multinational cooperation. The survey allowed me to focus on the interactive effects of exogenous (institutional pressures) and endogenous factors (internal fit) and, critically, the interplay between these forces that impact SMS implementation and safety performance.

In brief, I try to fill these gaps by thoroughly investigating the effect of institutional pressures on internal fit (self-interest and resource capability). Meanwhile, using the most influential SMS practice in the global aviation community. I adopt fidelity and extensiveness implementation (Ansari's (2010) to the SMS practice. Four implementation types, full, true-low, distant-high, and distant-low, associated with five strategies: *advocate, strive, follow, reluctant, and incapable* were theoretically proposed. Moreover, I empirically explore how interactive effects impact SMS practice implementation from a fidelity and extensiveness perspective. Consequently, how such interactive and two levels of practice implementation will affect quantitative and qualitative safety performance.

EFA is a statistical technique used to reduce data to a smaller set of summary variables and explore the underlying theoretical structure of the construct of institutional pressures, internal fits, SMS, and safety performance. The Maximum likelihood method is used with Promax rotation, which simplifies the column of the factor matrix so that the factor extracts are clearly associated. Each construct contains more than four items to ensure all models are just or over-identified models. Factor loadings of all measurement items of four constructs above 0.5 remain. To have a better model fit, a total of five items (IF14, SMS10, SMS11, SMS12, SP4) have been removed. The EFA results reveal that regulative pressures (coercive pressures) and non-regulative pressures (mimetic and normative pressures) are responsible for external pressures on global aviation organizations (see Section 6.1). At the same time, internal fit includes self-interest and resource capability. SMS includes fidelity and extensiveness implementation, and safety performance comprises quantitative and qualitative performance.

CFA is used to confirm the structural factors of each construct and measure the model's fit. Data analysis results confirm reliability, convergent, and discriminate validity among variables, and all models fit are either good or acceptable.

Furthermore, path analysis is used with observed variables to investigate the relationships among variables. The interactive force lies in the alignment or conflict between two pressures and self-interest. This study also explores how fidelity and extensiveness of SMS impact both qualitative and quantitative safety performance under alignment and confliction scenarios.

The results reveal that alignment and conflict impact resource capability differently. While institutional pressures align with self-interest, self-interest positively affects organizational resource capability and SMS fidelity, and SMS fidelity and resource capability highly impact SMS extensiveness implementation. In conflict situations, only institutional pressures impact SMS fidelity and lead to no resource capability, and SMSF alone influences SMS. Moreover, the research outcome indicates that SMS fidelity affects quantitative safety performance (i.e., accident and serious incident rate) and safety culture. SMS extensiveness only impacts safety culture.

In addition, the results integrate three institutional pressures into two pressures: regulative and non-regulative pressures.

Last but not least, the effects of mediation have been analyzed as well. The result supports 1) the notion that the SMS implementation partially mediates the relationship between interactive force and safety performance; 2) Resource capability and SMSF have full mediation effects on the relationship between self-interest and SMS extensiveness; 3) SMSE and SPQUAl have partial mediation effects on the relationship between SMSF and safety performance. The mediation outcomes are elaborated more in sections 6.2.2, 6.3.4, and 6.5.

6.1 Restructure institutional pressures with two pressures

The first exciting finding is that the three original factors of institutional pressures, coercive, mimetic, and normative pressures, became two factors, regulative and non-regulative pressures, from the EFA and CFA approaches. The result reflects the current aviation environment with two categories of pressures: the regulative pressures over aviation organizations mainly stem from coercive pressures, i.e. regulator, and non-regulative pressures from mimetic and normative pressures in global aviation organizations, i.e. association, professional network, and competitors.

CFA confirmed the factor structure. Regulative pressures contain four items with 0.82 Construct reliability and 0.53 AVE value to confirm convergent and discriminative validity. Non-regulative pressures contain seven items with 0.88 Construct reliability and 0.53 AVE values to confirm convergent and discriminative validity as well. The key five aspects of viewing two pressures in the global aviation community can be listed as follows: global level, national level, industrial, academic, and NGO perspectives, respectively.

6.1.1 From the global level in the aviation sector

From a top-down system in the global aviation sector, the Chicago Convention is the cornerstone document that has guided ICAO for eight decades worldwide. ICAO is the global platform for 193 contracting States to make international air transport and safety operation policies, standards, and recommended practices. The 19 annexes of the Chicago Convention encompass all technological aviation sectors, from personnel license, international air navigation, aeronautical charts, aircraft registration and airworthiness, flight operation, aerodromes, and environmental protection to search and rescue, accident and incident investigation, etc. Each Annex is the

outcome of the annex panel. Usually, the panel members include several working groups based on different topics or job cards. The panel comprises experts from State CAAs and advisers or observers who may come from industry and academia. There are also task forces under the panel that focus on particular projects or study groups and mainly work on specific topics for further research. The secretariat of each panel will be a technical officer of ICAO, while the chair of the panel and rapporteurs of working groups will be selected from the panel members and can not be staff of ICAO. The implication of such a structure emphasizes the power of regulative pressures from Intergovernmental organizations (IGOs) and State CAAs. The non-regulative, normative pressures come from members of industry and non-governmental organizations, such as ICCAIA, IATA, CANSO, ACI, IBAC, IFALPA, etc., and academia.

ICAO holds an assembly every three years. Most recently, Assembly 41st took place in October 2022. While the 41st Assembly set up a hybrid conference due to the Pandemic, almost 2000 participants, delegations of 193 Member States, and 60 non-governmental organizations (NGOs) came in person to Montreal, the headquarters of ICAO, for this Assembly. The Assembly elected new council members and approved working papers proposed by member State CAAs and NGOs. The working paper mainly focuses on new proposals, challenges, change management, and best practices incorporated in 19 Annexes, standards and recommendations, and manual guidance. In brief, the mechanism of the Assembly presents the force that stems from regulative pressures (governmental states' CAAs) and non-regulative pressures (industry, NGOs, and academia).

6.1.2 From the national level in the aviation sector

From the national level, the State CAA is the bridge between ICAO and the aviation service providers in their countries. State CAAs face regulative pressures from ICAOs, whereas non-regulative pressures are from other states, NGOs, and academia. Regulative pressures from ICAO are more regulation-related since 19 living annexes need compliance if international air transport is related. Non-regulation pressures are not obligatory for obedience. However, to improve the management and safety operations, the State CAA will simulate other State CAA best practices due to a lack of resources and knowledge sharing in aviation safety and operation management.

States CAA commonly requests targeted academic research to conduct a comprehensive feasibility study. Therefore, such an interactive situation creates loop feedback. The policy from CAAs impacts academic research scope, and academic outcomes influence the regulator's policy processing. Consequently, such non-regulative pressure will be embedded into States CAA's daily work and progress in aviation safety and operation management. In brief, at the national level, regulative (coercive) and non-regulative pressures (mimetic and normative pressures) co-existed.

6.1.3 From the aviation industry perspective

The aviation industry includes airlines, air navigation service providers, airports, manufacturers, ground handling, and other organizations. While they are largely commercially oriented, and most are listed in different stock markets worldwide, safety is paramount to their success. Therefore, financial and safety performance are always criteria factors that impact all activities in aviation organizations. The dynamic balance of protection and production plays a vital role in the life cycle of aviation organizations.

As before, we see two types of pressures on aviation organizations. Coercive pressure describes organizations' strict compliance with State CAAs' safety policies and international standards for international air transport activities. They will take or share scarce resources from production lines for safety protection activities, such as SMS implementation. Therefore, organizations face intense coercive pressures from State CAAs and International Standards.

Mimetic pressure describes how aviation organizations simulate prestigious or competitors' activities, including production and protection-related practices. Moreover, the normative pressures from the association, such as IATA, have been deeply involved in airlines' daily operations, such as IATA operational safety audits (IOSA). Last but not least, aviation academia also provides exclusive aviation resources to organizations due to professional and long-term knowledge training requirements, especially pilot and senior management specific in the aviation management sector. They most likely graduated from the few aviation academies at the global and national levels. Such pressures belong to normative pressures. Hence, mimetic and normative pressures are combined as non-obligatory than obligatory coercive pressures.

Although this study focuses more on State CAAs and airlines, other aviation organizations, such as academia and NGOs, also face obligatory (coercive) and non-obligatory (mimetic and normative) pressures.

6.1.4 From the aviation academic perspective

Due to highly regulated and specific technology requirements, academia works closely with State CAAs, aviation associations, and industry by sending professors as advisors to participate in ICAO panels at the State CAA level or designing curriculum compliance with SARPs. These universities also collaborate with associations or industries to conduct specific research.

The next-generation aviation program (NGAP) in ICAO aims to establish a network of aviation universities to conduct research, promote aviation as a career, and enhance the harmonization of curricula. Moreover, NGAP advocates regarding aviation to UN organizations and government bodies, including education and industry, to engage them in strategies to support future aviation personnel needs. Therefore, academia must closely follow aviation regulation, which faces regulative pressures, to simulate with other aviation education institutes to improve their education program and face non-regulative pressures from their employees and surrounding networks and associations. In addition, it can stem from simulating best practices posited by other academics worldwide.

6.1.5 From the aviation NGO's perspective

Unlike ICAO as a governmental organization, four major non-governmental organizations (NGOs) exist in the global aviation community. IATA works on behalf of airlines. CANSO represents air navigation service providers, ICCAIA represents aircraft and avionic equipment manufacturers, and ACI represents airports in the global aviation sector. They all work under the umbrella of aviation, but from professional and technical aspects, airlines aim to carry passengers from A to B safely. Air navigation service providers guide aircraft and pilots to fly safely. Airports aim to provide safe places for aircraft to take off, land, and transfer passengers. Manufacturers are responsible for building safe aircraft. Since each sector is commercially and highly connected, technical requirements are comprehensively different and independent, especially from the perspective of standards and regulations. Therefore, there is a need to have

four NGOs present these four industrial sectors to coordinate among ICAO, State CAA (regulator party), and industrial organizations. The NGOs' role is to participate in ICAO regulation and to work closely with the industry to help them with commercial and safety operations. They also face regulated pressures from ICAO and State CAAs or non-regulative pressures (normative and mimetic) from their human capital, networks, and other associations.

To conclude, sections 6.1.1-6.1.5 analyze the pressures faced from the perspective of each aviation organization type. The findings indicate that in the global aviation context, regulative and non-regulative pressures are best understood under the framing of institutional pressures. The following sections unfold how these two pressures interact with the internal fit and affect SMS implementation and safety performance.

6.2 Relationships between interactive force and SMS

I generate six models by exploring the interactive forces between external and internal factors. On the one hand, regulative pressures aligning with self-interest refer to the COERSIP model, and those conflicting are the COERSIN model. Non-regulative pressures aligning with self-interest are the MINOSIP model, and those that conflict is the MINOSIN model. On the other hand, it combines regulative and non-regulative pressures to generate alignment and conflict models, such as COERMINOSIP and COERMINOSIN. These models mainly describe how alignment or conflict between institutional pressures and self-interest can lead to the different consequences of resource capability allocation. The finding shows that regulative pressures are more dominant than non-regulative pressures.

In brief, when institutional pressures align with self-interest, self-interest and resource capability will impact SMS fidelity and SMS extensiveness, whereas, in the conflict scenario, only institutional pressures impact SMS fidelity, with no resource capability influence on SMSE. The alignment and conflict model's causal path between SMS and safety performance is the same. Only path coefficient parameters are different, which is elaborated more in the 6.3 section.

6.2.1 The importance of self-interest

In the alignment model, institutional pressures positively covariance with self-interest $Cov(IP, SIP) = 0.245$, which implies that the higher the institutional pressures, the stronger the self-interest; vice versa, the lower the external pressures, the less self-interest. In the conflict model, institutional pressures positively covariance with negative self-interest $Cov(IP, SIN) = 0.224$, which implies that the higher the institutional pressures, the stronger negative self-interest, namely lower self-interest, is deemed as conflict model. Note that weak external pressure and strong interest inside the organization would not be considered a conflict but rather an alignment since alignment or conflict is decided by positive or negative self-interest. Since there are always institutional pressures on SMS, whether strong or weak, as long as the interest is positive, it belongs to the alignment scenario. On the other hand, if the organization considers SMS implementation negative, it will be a conflict scenario.

In the alignment model, self-interest (SIP) highly impacts SMSF ($\beta=.723$, $p<0.001$) and RC($\beta=.404$, $p<0.001$), and mainly stems from it is to enhance the quality of work (IF2, $\beta=0.864$), align with the organization's mission, objectives, and goal(IF5, $\beta=0.811$), SMS fits into organizational culture (IF6, $\beta=0.758$), easy to work with the support of SMS(IF3, $\beta=0.753$),

enhance productivity (IF1,β=0.744), become very dependent on SMS (IF4, β=0.718), SMS is compatible with top management's workstyle (IF7, β=0.712), SMS is compatible with most aspects of employees' work (IF8, β=0.632), according to standardized regression weight in order in CFA alignment model. If organizations internally feel it is time to reform and rebuild the safety structure, they will be incentivized to adopt comprehensive SMS and strongly stimulate their resource capability accordingly.

In contrast, institutional pressures covariance with negative self-interest results in conflict and no resource capability (p=0.314, insignificant). Only institutional pressures (β=.485/.400, p<.001) significantly impact SMS fidelity. It indicates that resource capability is a reactive factor that needs to be triggered by self-interest. Although aviation organizations have sufficient resources, if they are unwilling to implement the SMS, the resource capability will be weak or zero. The only driver here is external institutional pressures influence SMS fidelity and through the SMS fidelity to influence SMS extensiveness (See Figure 32).

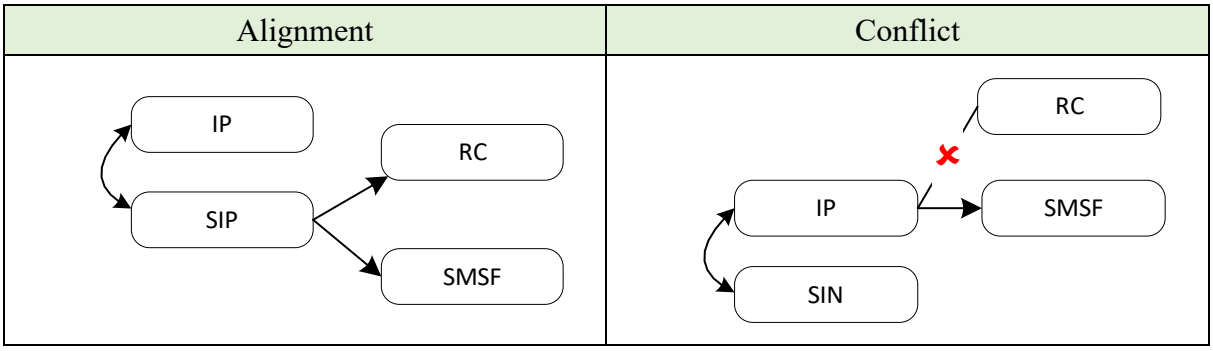

Figure 32. The difference between the alignment and conflict model on RC

The negative response to institutional pressures is that the organization experiences a challenge in SMS implementation due to a lack of guidance or training to execute (IF11, β=0.815), employees do not want SMS to increase the workload(IF13, β=0.748), top management resists changing the way they work (IF12, β=0.772), and, has difficulty understanding the SMS concept (IF10, β=0.692), and consider the implementation of SMS as a threat to jeopardize the current role or position (IF9, β=0.564) which are the five conflict items in order in standardized regression weight in CFA conflict model.

Such results in the conflict model indicate less resource capability, even if no resource capability is available to implement SMS. Therefore, only external institutional pressures impact SMS implementation, especially on the SMS establishment dimension. The higher the external pressure, the more accurate the understanding of SMS implementation and whether the organization will implement it in a few departments or the entire organization. External pressure influences the true version of SMS implementation rather than self-interest, which is a different case from the alignment scenario.

To sum up, these findings imply that corporate self-interest indeed plays a critical role. Although aviation organizations may face the same external pressures, their organization's decisions can change the direction of SMS implementation differently. The political party, investor, internal group, or even the organization's top management, whoever decides the interest, will determine

the practice implementation outcome. External pressures are critical to pushing SMS establishment when there is no interest within the organization.

6.2.2 Resource capability and SMSF full mediation impact

In the alignment model, both institutional pressures have positive covariance with positive self-interest with 0.245 and 0.234. When combining regulative and non-regulative, the results are the same as the regulative pressures alone model, again indicating that regulative pressures have dominant power. When institutional pressures align with self-interest, self-interest impacts resource capability and SMSF, and then RC and SMSF positively impact SMSE through two separate routes as below:

- **SIP->SMSF->SMSE (**β=.171**):** Self-interest highly influences SMS fidelity with the strongest coefficient (β=.723, p<0.001), which reflects that self-interest has determined power to drive aviation organizations to establish SMS framework in alignment scenarios. No matter what external pressures operate, if organizations internally feel it is time to reform and rebuild the safety structure, they will be incentivized to establish a comprehensive SMSF framework and guideline with 12 elements. In return, SMSF positively affects SMSE. The more well-established SMS model, the more extensiveness of SMS implementation (β=.237, p<0.001). The indirect effect of this route is (β=.171=.723*.237, p<0.001).

- **SIP->RC-SMSE (**β=.223**):** SMS extensiveness implemented in the entire organization requires sufficient resource capability, including skillful personnel, financial capital, and a solid organizational structure. Strong self-interest can gather more capacity resources from stakeholders or investors (β=.404, p<0.001). The SMS implementation requires at least a two-year time span to reach the operational level. Experienced safety managers will be highly demanded to operate SMS implementation and purchase or build technical information systems required in SMS. Therefore, RC highly influences SMS extensive implementation (β=.550, p<0.001). The data supports the fact that the resource capability is associated with SMS extensiveness only. There is no direct association between resource capability and SMS fidelity, which is highly affected by the organization's self-interest in internal fit. The indirect effect of this route is (β=.223=.405*.550, p<0.001).

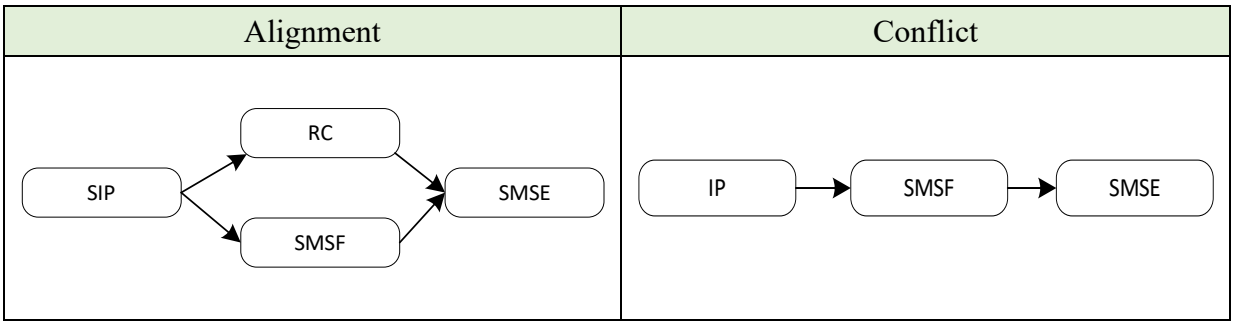

Figure 33. The difference between the alignment and conflict model on SMSE

From the above two routes (See Figure 33, left part), RC and SMSF fully mediate the relationship between SIP and SMSE (β=.395, p<0.001, See Table 56). Both routes result in SMS being extensively implemented on the track to the internalization level in the organization (Kostova,

1999), which employees value and integrate into their daily work. Sufficient resource capability influences SMS extensiveness (β=.223), which is slightly higher than the effect of SMS fidelity on SMS extensiveness (β=.171). The results highlight that resource capability is critical but not the only factor; a well-established SMS model is also important to fulfilling SMS extensiveness implementation in the alignment scenario.

Refer to Figure 33 (right part). Since there is no RC in a conflict scenario, SMSF alone fully mediates the relationship between institutional pressures and SMS extensiveness (β=.203, $p<0.001$). When there are strong institutional pressures with conflicting organizational interests toward SMS implementation, the well-established SMS model is critical in order to have extensive SMS.

From the outcome of the alignment and conflict model, there is a very important finding since it supports the idea that effective SMS implementation does not require sufficient resource capability. Many organizations, or even at the section level, consider that they cannot implement SMS if there are not enough human or financial resources. This evidence supports that the well-established SMS, as long as it is suitable and practical for daily operation, can also lead to extensiveness implementation.

SMS fidelity emphasizes how standards and procedures of critical elements have been established and designed. The standardized regression weights of SMS fidelity items in orders in CFA are SMS policy, SMS assurance, and risk management, which indicate these three components are the most important in SMS establishment. SMS policy (SMS6/.923, SMS8/.856, SMS7/.852, SMS9/.822) focuses on management commitment, the appointment of key safety personnel, safety accountability and responsibility policy and rules, and coordination of emergency response planning. Safety assurance (SMS3/.858, SMS4/.839, SMS5/.806) includes change management, safety performance monitoring and measurement, and continuous improvement. Safety risk management (SMS2/.821, SMS1/.79) focuses on risk assessment, mitigation procedures, and hazard identification mechanisms.

SMS extensiveness from the results reflects that SMS implementation is substantive rather than superficially for ceremonial reasons (SMS 16/.862), employees understand SMS and have integrated it into their daily work (SMS15/.847), SMS has covered all functions of the organization (SMS14/.822), SMS applies to all departments, including operation and administration (SMS13/.800), which are ordered by standardized regression weights in CFA.

SMSF highly affects SMSE, which implies that it is critical for regulators to put much effort into establishing the SMS standard and guidance since the effective policy will highly influence the extent of SMS implementation, whether in alignment or conflict model. SMSF influence on SMSE (β=.560) in the conflict model is higher than in the alignment model (β=.318). This implies that the SMS policy establishment and standardized model are more important in the conflict organization than in the positive organization, leading to the implementation of SMS extensiveness since there is no RC to boost SMS extensiveness in the conflict model.

Suppose the organization chooses only to implement SMS in certain departments due to limited resource capability, which is well established. In that case, department-level SMS fidelity becomes very effective and mature in safety management, and the other departments may start to

be interested in the implementation. Once it is mature, it will be extended to the entire organization in a phased approach. At the cooperation group level, if the headquarters have implemented SMS and have had a very good outcome, the headquarters may encourage the subsidized organizations geographically to implement the same. In this case, once the true version of SMS implementation has shown an effective outcome, it impacts the extensiveness of SMS implementation within the organization. The lesson of cooperation also applies to the aviation community when SMS is well accepted by airlines, airports, and ANSPs. State CAAs and ICAO have encouraged more service providers, such as ground handling, general aviation, aircraft maintenance organizations, training organizations, and even the remote pilot aircraft system (RPAS) and unmanned aircraft system (UAS), to implement SMS. In some States, the military also shows interest in SMS implementation when they witness the maturity and effectiveness of SMS in improving civil safety performance.

In brief, SMS fidelity establishment will impact SMS extensiveness implementation within an organization in a conflict scenario, combining with resource capability in the alignment scenario. To this extent, organizations are most likely to reach full implementation instead of just a ceremonial show to deal with institutional pressures (Mayor, 1991). It is a non-zero-sum situation (Win-win) for the regulator and industry. They both get the benefit of SMS implementation. Therefore, regulators need to set up a comprehensive and efficient SMS model for practitioners to implement extended SMS, whether there is sufficient resource capability or not. When the SMS is led by an advocate and striving type of player, it could eventually turn the reluctant and incapable player into a follower if the outcome is effective and beneficial.

6.3 Relationships between SMS and Safety Performance

The relationship between SMS and safety performance, especially qualitative performance, has not been heavily discussed in the literature over the last two decades, although SMS has been implemented since 2010. This study analyzed SMS with two dimensions, fidelity and extensiveness, while safety performance is explored from both quantitative and qualitative perspectives.

It is noted that the SMS implementation and safety performance impact path are all the same in the six models, although there is a slightly different coefficient between regulative and non-regulative pressures. The solid impacts between SMS and safety performance imply that no matter how institutional pressures interact with the internal fit, the SMS implementation's impact on safety performance is stable. In brief, SPQUAL highly influences SPQNT. SMSF impacts SPQNT and SPQUAL, while SMSE only impacts SPQUAL (See Figure 34).

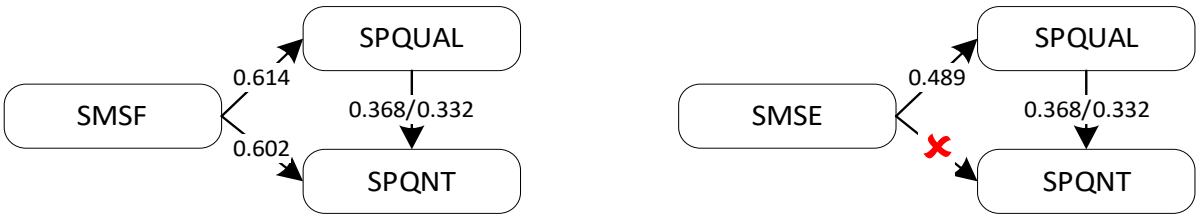

Figure 34. The difference effect on safety performance between SMSF and SMSE

6.3.1 SPQUAL highly influences SPQNT.

In this study, qualitative safety performance refers to safety culture, mainly stemming from high to low standardized regression weight, such as individuals acting and making decisions according to a common belief that safety is part of the way they do business (SP7/.899), individuals trusting their colleagues and managers with information about their experiences (SP9/.892), Individuals value being informed and informing others about safety (SP8/.892), the effectiveness safety culture has been enhanced (SP5/.851), a voluntary reporting system has been established with clarified responsibilities, reporting processes, rewards, liability reduction and exemptions rules (SP6/.812). SMSF's influence on safety culture is greater than its influence on safety quantitative performance.

Quantitative safety performance refers to measurable safety performance. The loading of safety quantitative performance from high to low is the accident rate (SP2/.959), serious incident rate (SP3/.913), and fatality (SP1/.773). These metrics reflect that fatalities have dramatically dropped in the last four decades, and fatalities are no longer an accurate indicator for evaluating safety performance. The accident and serious incident rates may become more and more critical since they are more common in daily operations. Tables 41 and 44 show that safety culture impacts serious incident and accident rates in aviation organizations regardless of alignment or conflict model (β=0.368/0.332, $p<0.001$).

The study results reflect the importance of safety culture in the aviation community. This study provides empirical support and again emphasizes that increasing the safety culture level reduces incidents and improves safety performance indicators (Kalteh et al., 2021). When safety culture (SPQUAL) has been highly absorbed into the organization's structure and operations, fatality, accident, and serious incident rates (SPQNT) fall dramatically.

6.3.2 SMS fidelity is positively associated with quantitative and qualitative safety performance.

The SMS establishment will influence safety performance, including quantitative (β=0.302/0.249, $p<0.01$) and qualitative (β=0.602/0.614, $p<0.001$), in alignment and conflict models, respectively (See 5.6.3.4 mediation part).

As mentioned above, a robust safety policy has been established in SMS fidelity through management commitment (SMS6), the appointment of key safety personnel (SMS8), safety accountability and responsibilities (SMS7), and coordination of emergency response planning (SMS9) will positively impact safety performance.

In addition, coordination of emergency response planning (SMS 9) is the key indicator to evaluating safety culture. The findings indicate that the higher the safety response planning system performance, the higher the qualitative safety performance. The safety culture has been included in the safety promotion component of SMS (ICAO Annex 19, 2016; Ellis and Kirkman, 2018). It is considered an indispensable part of SMS, and building up a positive culture in aviation organizations ensures SMS can be implemented effectively and efficiently. It demonstrates that the relationship between SMS and safety culture is a feedback loop in which one can positively affect the other (Roelen and Klompstra, 2012).

Moreover, in the safety assurance component, the effective procedure of safety performance monitoring and measurement (SMS3), management of change (SMS4), and continuous improvement (SMS5), and in the safety risk component, safety risk assessment, mitigation (SMS2) and hazard identification (SMS1) system set up will greatly improve the quantitative safety performance.

From previous literature, scholars have pointed out that companies adopting SMS demonstrate significantly higher performance against the safety goals, refer to quantitative safety performance, and their communication to employees, the attitude to update risk data, and the attitude to implement employees training programs, which lies in qualitative safety performance (Bottani et al.,2009). This study emphasizes that SMS fidelity highly impacts quantitative and qualitative safety performance. In brief, SMS's four components comprehensively cover the technical foundation of safety risk and assurance management, as well as a cultural aspect, including safety commitment and promotion. Both technical and cultural aspects will affect quantitative and qualitative safety performance simultaneously.

6.3.3 SMS extensiveness is only highly related to qualitative safety performance.

From the data analysis result in Figures 20,21,22,23,24,25, the scope of sections of SMS implementation, namely SMS extensiveness in the organization, will impact safety culture (β=0.489/0.539, $p<0.001$, See Table 41 and 44). The extensiveness of SMS will cover every organizational corner, profoundly increasing employees' safety awareness. The new systematic safety management will improve the quality of work, and the new response planning system will enhance the positive safety culture.

The extensiveness of SMS implementation mainly describes how, rather than what to implement, to which degree to follow the formal rules implied by the practice. To an extent, it will transition from the implementation level to the internalization level, which the employees “infuse with value” (Selznick, 1957). The SMS becomes infused with value when it is accepted and approved by employees, when the employees see the value of using this practice, and when the practice becomes part of their organizational identity. Such SMS extensiveness will build up a solid safety culture in the aviation organization.

In the real world, SMS has been implemented using a phased approach. It is most likely to start from the organization's core value chain or the headquarters' subsidiaries. Furthermore, it has evolved gradually and has been implemented in the entire organization, especially in the group corporation. Since policy components of SMS are more weighted factors for improving safety

culture, management commitment (SMS6) and coordination of emergency response planning (SMS9) have been highly investigated in safety culture literature (Gerede, 2015; Jausan et al., 2017). The more such essential elements covered in the organization, the more influence the safety culture building.

6.3.4 SMSE and SPQUAL partial mediation impact

One of the benefits of path analysis is that it can help explore the effects of mediation. In the total of six models, including the alignment and conflict model, within the relationship of SMS and Safety performance, the result shows that SMSE and SPQUAL partially mediate the relationship between SMSF and SPQNT. SMSE partially mediates the relationship between SMSF and SPQUAL (See Figures 31, 35, and Tables 60, 61, 62).

In this vein, adding safety culture and extensive SMS implementation in the loop increases the effect of SMSF on SPQNT. The same case of SMSE will increase the impact of SMSF on SPQUAL. Both are partial effects, meaning the original effects still exist, from SMSF to quantitative and qualitative safety performance. Adding SME extensiveness will increase the effect of SMSF on safety culture, and adding SMSE and SPQUAL will increase the effect of SMSF on quantitative safety performance. Therefore, it implies that SMS extensiveness and safety culture are key to enhancing quantitative safety performance.

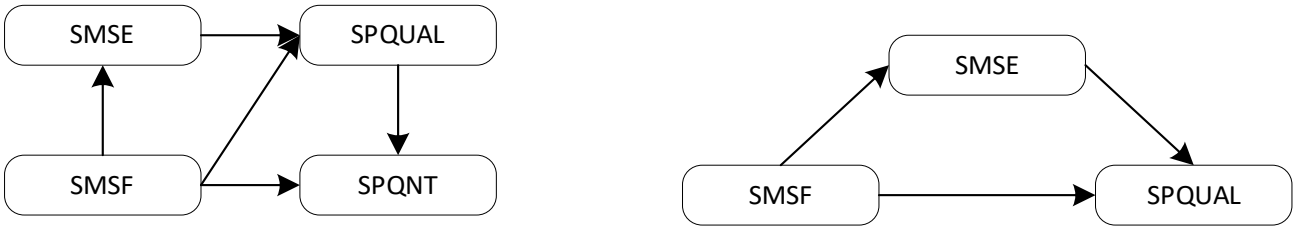

Figure 35. The difference between two partial mediation effects

6.4 Relationship between regulative pressures and SPQNT

Another interesting finding is that regulative pressures (COER) directly impact quantitative safety performance (β=.265 & β=.310, $p<0.001$, See Table 41 and 44) in both alignment and conflict models, while the non-regulative pressures (MINO) do not have such a direct impact. Moreover, in conflict cases, the regulative pressures (β=.485, $p<0.001$) have slightly higher effects on SMS fidelity than non-regulative pressures (β=.403, $p<0.001$). Lastly, when regulative and non-regulative pressures covariance, the influence is similar to the regulative pressure alone model, implying that regulative pressures can determine the final effects rather than non-regulative pressures (See Figures 20 and 25, 36).

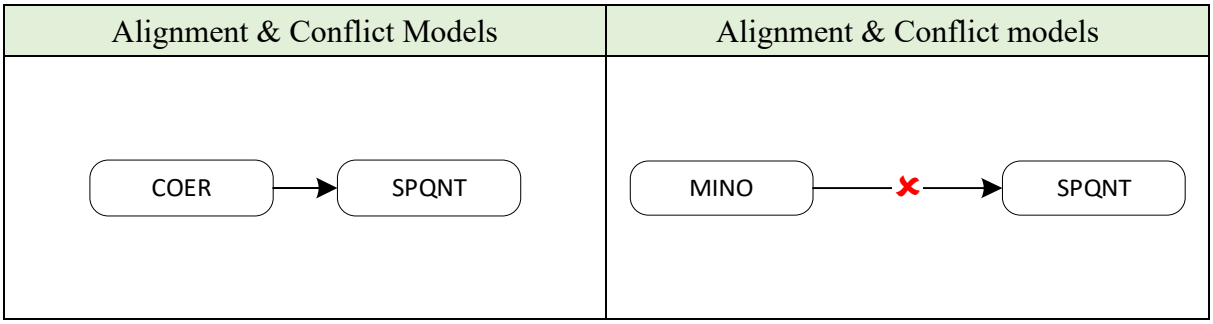

Figure 36. The difference between the regulative and non-regulative pressures on SPQNT

The above three findings explain the regulative nature of the aviation community. In the highly regulated aviation community, standard and recommended practices (SARPs) indeed play a strong role in aviation operations. From an aviation organization perspective, SMS implementation typically stems from international aviation standards. SMS has been incorporated into Annex 19 safety management, which refers to SARPs, and most aviation organizations in the global aviation community have been obligated to implement SMS since 2010. When Annex 19 becomes applicable, each Member state's CAA shall promote SMS establishment and implementation in their aviation stakeholders, including airlines, ANSPs, airports, and manufacturers.

According to standardized regression weight, since many survey responses are from industry service providers, this explains why State-level pressures (IP2/.832) are the highest in the regulative pressures construct. The second weighted factor is the regional aviation safety agency (IP3/.731). In some oceanic areas, such as the Caribbean and Africa, regional aviation safety agencies play the State CAA's role since building a national-level CAA in each small island country is too expensive. To share with one safety agency among multiple small countries is more efficient and effective. It fits into the results showing that such regional aviation safety agencies generate regulative pressures on SMS implementation in aviation organizations in those areas. Following those, the latter two pressures are from the SARP of the United Nations (IP1/.689) and the parent company (IP4/.648). Since most respondents are from the industrial sector, the first-hand pressures are more from the national level (IP2). In brief, the regulator enhances aviation policymaking and establishes comprehensive standards and guidance, and systematic safety management will decrease accident and incident rates.

Safety policymaking aims to protect organizations and make them safer, but such policies can also be hurdles to production and increase the financial burden on governments and industry. Therefore, the balance of safety-related policy is the most important factor that must be considered during policymaking. The finding supports that effective policy indeed increases safety performance more than other means, such as workshops and guidance. However, the policy also needs to make sure it will not generate a great deal of burden on aviation organizations. The objective is to enhance safety performance, not slow down production and economic development.

In addition, although non-regulative pressures have no direct effect on quantitative safety performance, it is worth elaborating on the top two highest standardized regression weights of measurement items in the non-regulative pressures CFA model. Non-regulative pressures

(mimetic and normative pressures) fall in the non-regulative force, which involves the incentive of simulating peer or competitor organizations (mimetic pressures), influence from non-governmental organizations, education and training organizations, and professional networks (normative pressures)

- In the normative pressures aspect, the top two non-regulative (normative) pressures are influenced by training institutions (IP7/.757) and professional networks in the industry (IP8/.714). In the global aviation community, from the airline perspective, training organizations are essential to airline activities since airline operation has a pseudo-military mechanism, which needs to follow strict standards and procedures, and all standards and procedures are living documents and updated periodically. Therefore, a tremendous amount of training is involved, especially in pilot training. All pilots worldwide graduate from a handful of universities and perform continuous training in flying and aviation training schools. Education targets aviators from first-year students to continuing training and management workshops in this highly concentrated sector. These programs act like the body's red cells to generate the airlines' fresh blood. SMS has been embedded into the curriculum in aviation universities, and training courses have been developed by training organizations in the community. The influence of such associations has brought plenty of pressure through professional networks and training institutions, which explains why training institutions (IP7) and professional networks (IP 8) have the highest two-factor loading in the model of non-regulative (normative) pressures.

- In the mimetic pressure aspects, the two highest standardized regression weights are IP13(.833) and IP14(.771). IP13 indicates that organizations that do not readily adopt SMS will be left behind, while IP14 demonstrates that most organizations will ultimately end up adopting SMS. These findings indicate that organizations always observe and feel pressures from their competitors and external environment. Therefore, the regulator and organizational field may benefit organizations that have adopted SMS early, which will encourage the rest and eventually encourage them to be adopters.

6.5 Relationship among interactive force, SMS, and safety performance

This study is like peeling an onion. I explored the onion's inner layer in the previous sections. This section focuses more on the outside layer of the onion: the research model. There are three major aspects: 1) the interactive force between institutional pressures and internal fit, 2) SMS implementation, and 3) safety performance. The result analysis shows that SMS partially mediates the relationship between interactive force and safety performance, which is the outside layer of the onion (See Figures 26 and 28 in section 5.6.3.1).

In the literature, institutional pressures have always impacted safety performance. In this study, I have added more evidence to show that when SMS is added to the effect, the influence of interactive force between institutional pressures and internal fit on safety performance increases. It indicates that implementing SMS indeed increases the safety performance of aviation organizations.

Aviation organizations recognize that the financial and human resources invested in SMS can be clearly calculated and shown as a benefit in the organizations' balance sheets. However, the improvement in safety performance is not easy to see. The inability to quantify safety causes the

organization and management to be more skeptical about implementing SMS. Broad implementation is a long-term goal that requires broader knowledge and a systems-level scope to be well-recognized in the aviation community. The results shown here support the argument that SMS implementation increases safety performance. Such promising results will encourage more aviation organizations to implement SMS pragmatically.

6.6 Conclusion

In this section, based on data analysis and hypothesis results shown in Chapter 5, I highlighted five aspects instead of going through each hypothesis.

1. EFA results in two factors of institutional pressures in aviation: regulative pressures are from coercive pressures, and non-regulative pressures include mimetic and normative pressures, which highly reflect two categories of pressures in the current aviation sector. The regulative pressures have more dominant power over the non-regulative pressures. Aviation regulation and standard pressures decrease safety accidents, and pressures from associations and peer organizations do not have such an impact.
2. When an organization's objective aligns with institutional pressures, the organizational self-interests have determined the power to relocate resource capability and establish the SMSF framework establishment, consequently leading to SMS extensiveness, while in the conflict model, only institutional pressures impact SMSF establishment, which influences SMSE.
3. Through the path analysis approach, the research model shows multiple mediation effects. Resource capability and SMS establishment fully mediate the relationships of SIP and SMSE in the alignment model, which highlights that not only organizational resources, but also comprehensive SMS establishment can impact the extent of SMS implementation. It encourages organizations with low budgets to implement SMS extensively. With less or no resource capability in the conflict model, SMSF alone fully mediates the relationships between institutional pressures and extensive SMS implementation. In brief, a comprehensive SMS framework and guidelines are the most important factors in influencing the extensiveness of SMS implementation.
4. The relationship between SMS and Safety performance is solid regardless of the alignment or conflict model regardless of regulative and non-regulative pressures:
    a. Positive safety culture helps to decrease safety accidents.
    b. Comprehensive SMS framework and guidelines support increasing positive safety culture and decreasing safety accidents, while the extensiveness of SMS implementation increases positive safety culture.
    c. SMSE partially mediates the effect of SMSF on SPQUAL, highlighting that the SMS's extensive implementation enhances the SMS establishment's impact on safety culture.
    d. SMSE and SPQUAL partially mediate the effect of SMSF on SPQNT, indicating that SMS extensiveness and safety culture help SMS establishments decrease safety accidents.

5. SMS practice implementation helps interactive force of institutional pressures and organizations' internal fit to improve safety performance.

7. CONCLUSION

7.1 In brief

In this dissertation, I have zoomed in on SMS practice implementation and used it as a mirror to reflect the interaction between institutional pressures (DiMaggio and Powell,1983) and internal fit. The research explores how external institutional pressures interact with organizational self-interest and resource capability and lead to practice implementation variation, which, in turn, impacts qualitative and quantitative safety performance, respectively.

The case of SMS practice implementation presented here takes place in a highly regulated global aviation community, which led us to divide our evaluation of the institutional pressures into two parts. Regulative pressures are tightly related to coercive pressures, while non-regulative pressures are related to mimetic and normative pressures.

Internal fit intersects with adoption and implementation in essential ways. The study combines theories from the goals and means aspect of the nature of demands (Pache & Santos, 2010), fidelity and extensiveness dimensions of practice variability and adaptation (Ansari, 2010), old institutionalism focusing on intra-organizational self-interest (Selznick, 1949), The interest and power of dependency under intra-organizational dynamics (Greenwood, 1996), firm resources (Barney,1991) and ordinary capacity (Teece, 2009), the concept of internal fit (Fortwengel, 2017) and integrated them into two dimensions of internal fit, self-interest, and resource capability in this research.

The study analyzes the interactive effect between regulative and non-regulative pressures (exogenous factors) and self-interest (endogenous factor), which is highly associated with organizations' resource capability and leads to alignment and conflict scenarios. Consequently, each scenario affects the fidelity and extensiveness of practice implementation and safety performance.

In brief, with regard to the proposed 12 hypotheses in the research model, only hypothesis 10 is not supported. Others are supportive. In addition, a new causal relationship emerges from path analysis, which is not proposed in the hypothesis: regulative pressures directly impact quantitative safety performance. Moreover, three mediation effects emerge from the path analysis: 1)resource capability and SMS fidelity establishment fully mediate the relationship between self-interest and SMS extensiveness in the alignment model, while SMS fidelity establishment fully mediates the relationship between institutional pressures and SMS extensiveness in the conflict mode; 2)SMS extensiveness has a partial mediation effect on SMS fidelity and qualitative performance; and 3) qualitative performance and SMS extensiveness have combined partial mediation effects on SMS fidelity and quantitative performance.

The results reveal that alignment and conflict impact resource capability differently. While institutional pressures align with self-interest, self-interest positively affects SMS fidelity establishment, and combining organizational resource capability impacts SMS's extensive implementation. In conflict situations, only institutional pressures positively impact SMS fidelity and lead to no resource capability, and SMSF alone influences SMSE. Moreover, the research outcome indicates that SMS fidelity positively affects quantitative safety performance (i.e.,

accident and serious incident rate) and safety culture. SMS extensiveness positively impacts safety culture only.

I use SEM methodology to empirically analyze the six final models: regulative pressures align or conflict with the self-interest models, non-regulative pressures align or conflict with self-interest models, and regulative and non-regulative pressures covariance together in align and conflict model.

The data analysis also sheds light on the relationship between SMS practice implementation and safety performance by demonstrating that 1) extensiveness implementation partially mediates the relationship between fidelity and qualitative safety performance, 2) combining extensiveness implementation and qualitative safety performance partially mediates the relationship between fidelity implementation and quantitative safety performance. In brief, SMS's extensive implementation impacts safety culture, and both enhance SMS establishment's effect on decreasing safety accident rate. The study also supported the notion that practice implementation facilitates the interactive force effect on safety performance.

Moreover, this analysis of practice implementation allowed me to propose the four different levels of practice implementation theoretically, true-high(full), true-low, distant-high, and distant-low practice implementation, from the perspective of fidelity and extensiveness dimensions perspective. In this study, I conceptually propose that the interactive force of external and internal factors affects different organizational strategic responses: Advocate, Strive, Follow, Incapable, and Reluctant. The different strategic responses lead to four different types of practice implementations.

7.2 Contribution

Organizations in the highly regulated aviation sector will always face external pressures on compliance with SARPs and implementing practices. The dissertation not only presents the importance of such external pressures but also highlights the internal fit of the organization playing a critical role in the degree of practice implementation. The research indicates that organizational self-interests determine resource capability and SMS establishment, which emphasizes how an organization's self-interest interacts with institutional pressures to form different strategic responses.

Moreover, the results explore the underlying mechanism of how organization self-interests can influence SMS internalization through resource capability and SMS fidelity's full mediation effects. It provides evidence that two ways can lead to SMS internalization: through sufficient resource capability and comprehensive SMS establishment. Without consuming human and financial capital, setting up comprehensive and practical SMS establishment can also reach the level of SMS extensiveness implementation. It encourages practitioners that SMS is not a cost burden or requires tremendous human resources to implement it.

The study empirically supports the interactive force between institutional pressures and internal fit results in heterogeneous practice implementation. The study theoretically proposes five different types of strategic responses, as shown in the four types of implementations.

The EFA analysis, in particular, demonstrates that institutional pressures come down to two primary factors: regulative pressures, which refer to original regulator-related coercive pressures, and non-regulative pressures, which include mimetic and normative pressures. This is due in part to the highly regulated context of practice adoption. These findings shed light on the difference between regulative pressures and non-regulative pressures. The result shows that regulative pressures directly influence quantitative safety performance in both alignment and conflict models, while non-regulative pressures do not have such an effect.

Burying the lede, the in-depth analysis of safety performance and how SMS practice fidelity and extensiveness implementation affect qualitative and quantitative performance has never been studied. These findings can help aviation organizations prioritize SMS implementation either from a fidelity perspective, setting up comprehensive and practical SMS manuals or guidance, or from an extensiveness perspective, relocating resource capacity covering as much of the organization's functions to implement the practice as possible.

Last but not least, in terms of safety performance improvement, fidelity practice implementation will improve both proactive-leading and reactive-lagging safety performance, while extensiveness practice implementation will solely improve proactive-leading qualitative safety performance.

7.3 Limitation

The first limitation of this study is that a cross-sectional design is weak in examining mediation effects. This was because the data was collected once through an online survey. The hypothesized relationships were then examined based on this static snapshot of responses. In addition, SMS implementation is a phased approach among most aviation organizations. This single snapshot lacks temporal precedence and might not be able to provide strong evidence for mediation and causal effects even if they exist. It is suggested that the momentum of this study be used to continue a longitudinal research design and revisit SMS mediation effects on institutional pressures and safety performance in the future.

The second limitation is that the study was conducted only with civil aviation authorities and the airline sector, which might limit the generalizability of the results to other institutional contexts. The four service providers in the aviation community, airlines, ANSPs, airports, and manufacturers, are highly dependent, and the majority of them have implemented SMS. Including the other three service providers in future research may help to get a holistic view of relationships among institutional pressures, SMS implementation, and safety performance in the aviation community.

The last limitation is that the study focuses on the relationship between fidelity and extensiveness, and this relationship is impacted by interactive force and, in turn, impacts safety performance. However, within these two dimensions, true and distance of fidelity, high and low in extensiveness, how true or high in these two dimensions are associated with SMS indicators in evaluation system have not been empirically investigated due to the overloaded volume of research. In the study, I have proposed some indicators to measure the true and high for practice implementation, but further data collection and data analysis are needed.

7.4 Future research avenues

There is a need for an empirical study that analyzes five strategic responses toward practice adoption: advoke, strive, follower, incapable, and reluctant, and how it leads to four different types of implementation: full (true-high), true-low, distant-high, and distant-low practice implementation. In this study, I conceptually point out and propose the causal effects. The designed survey and data collected are necessary to conduct the empirical analysis.

SMS practice will be a continuous primary practice implementation to manage safety performance in the global aviation community. More and more stakeholders, including grand handling, general aviation, training organizations, maintenance organizations, and the military, are willing to adopt SMS practices. New users have emerged in air space, such as remote pilot aircraft systems (RPAS), unmanned aircraft systems (UAS), and supersonic operations. System-wide safety projects have become more and more popular. The goal is to explore, discover, and understand the impact on the safety of the growing complexity introduced by modernization aimed at improving the efficiency of flight, access to airspace, and/or the expansion of services provided by air vehicles.

In a broader safety context, this research raises the broad question of whether we can improve safety management by developing new services, functions, and capabilities (SFCs) that dramatically increase responsiveness (In-Time). NASA developed the In-time Aviation SMS(IASMS) concept to evaluate this question (NASEM&ASAC, 2018). IASMS aims to quickly manage known operational risks at scale and identify and respond to unknown risks. The goal is to develop and demonstrate innovative solutions that enable this modernization and the aviation transformation envisioned for the global airspace system through proactive mitigation of risks in accordance with target levels of safety. This effort relates to the fidelity_true version of SMS evaluated in this thesis since IASMS focuses on the risk management and safety assurance component of SMS by adding monitoring, assessment, and mitigation. The primary purpose here is to dramatically increase responsiveness to fit into digital aviation in the future. The element of IASMS can update the current 12 elements of SMS practice.

More work also needs to be done to understand the difference between ordinary and dynamic capacity. Ordinary capacity refers to ordinary skills that are entrenched in some combination of (1) skilled employees, including independent contractors in certain cases; (2) facilities and equipment; (3) procedures and routines; and (4) the administrative coordination required to do the job., which is highly analyzed in the study (Teece 2019). Dynamic capacity refers to an organization's competitive advantage, which opens another broad and profound area to investigate organizational competence. Ordinary capabilities are primarily operational in character, whereas dynamic capabilities are generally strategic in nature. At the same time, the IASMS evolution and dramatic competition for aviation organizations are worth adding to the dynamic capacity of resource capability in future related studies.

To conclude, understanding the role of institutional complexity is critical to improving performance through practice implementation. The results of this study aim to tie institutional change, intra-organization factors, and practice to safety performance and extend units of analysis to service providers to get a holistic view of the relationships among institutional pressures, internal fit, SMS implementation, and safety performance in the global aviation community.

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