



Designing an Interpretive Structural Model to Mitigate Money Laundering Risk in Financial and Credit Institutions and Banks




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Abstract: In recent decades, due to the development of financial products and services, the increasing complexity of financial transactions, technological advancements, and the acceleration of global monetary flows, money laundering methods have become highly innovative. Banks are among the most affected entities in this regard. Therefore, one of the most critical risks faced by banks and financial institutions is money laundering risk. This research employs a mixed-methods approach. From the perspective of its goal, it is applied research, and in terms of methodology, it is descriptive-survey research. Initially, qualitative data were collected and analyzed, followed by the collection and analysis of quantitative data in the second stage. To address this challenge comprehensively and systematically, all the indicators influencing money laundering risk in banks were identified and extracted through interviews and document reviews using the grounded theory method. These indicators were categorized into 20 organizing themes and 91 basic themes. In the quantitative section, to organize the relationships and sequence among the components and present their structural model, the interpretive structural modeling (ISM) method was employed. Based on the findings, the indicators of "attention to general policies of the system and upstream guidelines," "interaction with domestic and international institutions," "use of modern technologies," "credit risk identification by relevant entities," "application of scientific and specialized principles," "exploration and analysis of capacities and strategic issues," and "internal factors of banks" are significant and critical.

Keywords: Money laundering risk, banking system, exploration and analysis of capacities and strategic issues, grounded theory

1. Introduction

In recent decades, the development of financial products and services, the increasing complexity of financial transactions, technological advancements, and the acceleration of global monetary flows have led to more innovative money laundering methods. Combating money laundering begins with controlling access to the financial system and preventing the entry of illicit funds into financial networks. Therefore, banks serve as the core of the protection network for the financial system. In this context, considering international experiences in anti-money laundering (AML) programs, all private and public banks, as well as credit institutions, are required to

comply with principles that align with the general consensus of international organizations and countries with AML legislation actively pursuing AML programs (Gikonyo, 2018).

With the globalization of economies, liberalization of international capital flows, development of electronic banking, and the creation and adoption of new tools for international electronic fund transfers, money laundering has become somewhat facilitated. According to estimates by the International Monetary Fund (IMF) and the World Bank, illicit revenues involved in laundering activities account for approximately 2% to 5% of global GDP (Myers, 1998).

One of the most significant risks faced by banks and financial institutions is money laundering risk. Without effective and proper risk management in this area, banks are exposed to more serious risks, particularly reputational and operational risks (Isa et al., 2015).

As financial services grow increasingly complex, financial crimes are evolving in complexity as well. However, supervisory and control systems typically develop at a slower pace. Money launderers strive to make their illicit transactions indistinguishable from legitimate ones. Consequently, banks must implement AML programs capable of distinguishing illegal transactions from legal operations (Yousefi & Peykar, 2015).

According to international research on new money laundering techniques, it is often the case that money launderers have greater knowledge than bank employees about the systems, processes, weaknesses, and gaps. They exploit even the smallest vulnerabilities for their gain. Thus, thorough evaluation of all processes, rigorous product testing, monitoring of weaknesses, and ensuring the management of system gaps are critical to reducing money laundering risks (Biabani & Assar, 2010).

Key AML tools include enacting and enforcing AML legislation, creating an inhospitable environment for criminals, reforming national tax structures, monitoring foreign currencies, establishing a robust anti-money laundering authority, and restructuring and reforming the banking system. Since banks are both the primary refuge for money launderers and a crucial point for intercepting their activities, the implementation of these tools is vital (Mahjoorian, 2015).

A significant component of bank risk management in AML efforts involves identifying vulnerable areas in the bank, such as its products, services, clients (individuals and entities), and geographic locations. After analyzing the relevant vulnerability data, risk assessment becomes especially important. Modern financial services, including electronic banking, are as susceptible to money laundering as other financial offerings. Therefore, providers of modern financial services must adhere to AML commitments, laws, and regulations. Specific considerations for managing risks in modern financial services include customer identification, record-keeping, value limits, and geographic restrictions. Customer identification is critical in the context of credit cards, as these can easily be transferred to third parties, increasing money laundering risks. Consequently, verifying the principal account holder's identity is essential (Abulhassani Hestiani & Daniali, 2018).

Record-keeping, for at least five years, is another crucial risk management practice. Maintaining complete customer information, such as name, address, nature and date of financial transactions, and type and amount of these transactions, enables legal follow-up when necessary. Value limits pertain to restrictions on the maximum amounts that can be processed through modern financial services. These include transaction value caps per transaction, cumulative daily or periodic limits, and the number of permitted accounts or cards per customer.

Modern financial services may be funded through cash deposits, transfers from other financial services, or anonymous sources, increasing money laundering risks. Geographic restrictions highlight the cross-border and international transfer capabilities of financial services, which are amplified by international credit cards and online

platforms facilitating global fund transfers. Integrating a country's payment system with international networks creates additional vulnerabilities.

Considering the significance of money laundering risks in banking, regulatory authorities play a critical role. Banks may also expose themselves to direct losses due to fraud, often a result of failing to identify undesirable customers. Regulators encourage banks and financial institutions to adopt standards that promote ethical conduct and professionalism (Tajalli, 2010).

The literature on money laundering encompasses various dimensions, ranging from its economic impacts to its geographical and institutional determinants. Lai Za et al. (2023) demonstrated that money laundering reduces long-term capital accumulation rates, although its short-term effects on savings remain ambiguous depending on the origin of laundered funds. Reganati and Elilwa (2022) highlighted regional disparities in Italy, noting that in central-northern areas, crime rates negatively correlate with education levels but are positively associated with the presence of the mafia and corruption, while in southern regions, money laundering activities are linked to the gambling industry. Capuano and Giacalone (2022) conducted a comparative analysis of crime indices across Italian provinces (2015–2021) and found that crime rankings reflect temporal changes in crime patterns and their territorial impacts, shaped by factors such as average punishments and population demographics, rather than merely highlighting the most dangerous provinces. Gikonyo (2018) argued that global crime complicates anti-money laundering (AML) efforts, as any single nation breaking the "chain of accountability" creates favorable conditions for criminals to channel illicit earnings, particularly in smaller economies that may avoid bearing the full costs of crime. Isa et al. (2015) emphasized the reality of money laundering risks in banking institutions, underscoring the necessity of human expertise in evaluating such risks even in the presence of automated risk management solutions, with compliance support and supervisory oversight playing critical complementary roles. Heinerk et al. (2010) noted the amplification of crime, corruption, bribery, and terrorism through money laundering, observing significant cross-country disparities in AML efforts and pointing to the Financial Action Task Force's (FATF) identification of "non-cooperative" jurisdictions with severe policy deficiencies. Hosseini and Nasiri (2023) found that the characteristics of virtual currencies facilitate money laundering, with hierarchical analysis indicating that the laundering process contributes to increased virtual currency circulation in governance. Pour Salimi et al. (2022) documented the escalating volume of illicit money in Iran's economy (1973–2010), highlighting its adverse cultural, social, economic, political, and security impacts. Abolhasani Hestiani and Daniali (2018) observed a lack of alignment between AML measures in Iran and international standards, while Ashrafi and Tajri (2019) emphasized the critical importance of trust in financial reporting, noting that inaccuracies undermine the reliability of such information. Yusefi and Peykar (2015) evaluated banking services and products, concluding that all offerings scored between 60 (low risk) and 120 (high risk) based on a risk matrix, thereby providing a structured measure of risk exposure in financial institutions. This body of literature collectively underscores the multifaceted challenges and implications of money laundering, advocating for comprehensive, globally coordinated, and context-sensitive policy interventions.

A risk-based approach to AML involves scenarios built on risk classification, identifying high-risk individuals, regions, professions, times, and conditions. Based on such analyses, control scenarios are defined or revised. However, no standardized global methodology universally accepted by governments and institutions exists to measure or mitigate money laundering risks effectively. Economic and political stability in any society depends on healthy, lawful transactions and interactions. In an era of globalization where all activities and organizations operate under a macro-technological and interconnected global system, economic activities are inextricably linked with political matters. The advancement of banking systems is tightly coupled with technological progress. In a

communication-driven world dominated by technology, criminals exploit modern banking and technology to launder illicit funds and conceal unlawful assets, often seeking refuge in underdeveloped countries with weak legal frameworks. Thus, the weaker a banking system, the greater the opportunities for money laundering. Training banking personnel enhances their ability to identify suspicious customers and prevent unauthorized access to banking networks. Countries' enactment and enforcement of AML laws reduce illicit transactions, curtailing criminals' involvement in unlawful economic activities. Global reports and statistics on money laundering indicate that due to various contributing factors, some countries, including ours, rank poorly. This results in significant harm to the economy, including the banking system. Addressing the challenges posed by money laundering risks, this research aims to identify and examine factors previously unexplored in Iranian studies. Employing grounded theory, this study seeks to provide valuable insights for designing a model to mitigate money laundering risks in banks and financial institutions. The structure of this article is as follows: an overview of money laundering risks, a literature review, research methodology, findings, and finally, a discussion and conclusion.

2. Methodology

The present mixed-methods study adopts a deductive-inductive approach. It is applied in terms of purpose and descriptive-survey in terms of nature and method. Initially, qualitative data were collected and analyzed, followed by the collection and analysis of quantitative data in the second phase. Semi-structured interviews were employed for qualitative data collection, while questionnaires were used for quantitative data collection. Grounded theory and Strauss and Corbin's coding methodology were utilized to analyze the qualitative data. Grounded theory involves developing informational categories (open coding), linking these categories (axial coding), and presenting a narrative that connects the categories (selective coding), culminating in a set of theoretical propositions. In the quantitative phase, interpretive structural modeling (ISM) was used to analyze the data and determine the levels of the model dimensions.

As highlighted in the research problem, money laundering is a complex concept that is challenging to identify due to its covert nature. A review of the literature reveals that many studies in this field have been conducted qualitatively. Given the primary objective of designing a model for money laundering risk in banks and financial institutions, it was essential to explore and examine various organizational levels. To uncover the intangible aspects of the subject, grounded theory was employed as it enables the development of a theory based on various factors and their interrelationships. The researcher gathered raw data through interviews and existing scientific documentation, followed by questionnaire design based on insights from the interviews.

Initially, in-depth qualitative data were gathered from interviews rather than existing theoretical foundations. Subsequently, based on the components identified in the qualitative phase, precise statistical measurements were conducted in the quantitative phase. Qualitative data collection primarily involved interviews, which were recorded with the participants' consent and documented in result-registration forms. Qualitative data analysis, including identifying similar concepts, was conducted using qualitative data coding methods. The questionnaire design ensured reliance on solid theoretical and practical foundations for measuring constructs, drawing from multiple research studies and tests (Danaiifard & Emami, 2007).

The questionnaire's validity was assessed and confirmed through content evaluation by supervisors, experts, and consultants. Its reliability was tested using Cronbach's alpha and composite reliability methods. The questionnaire was distributed among the target population, comprising managers and experts in the field, and its

conceptual framework was validated. Given the recommended threshold of 0.7 for Cronbach's alpha and composite reliability, the study's reliability was deemed adequate based on the variables' performance.

The qualitative sample size was determined using the snowball sampling method and theoretical data saturation. A purposive sampling approach was employed to select qualitative participants, using snowball sampling to identify and choose key informants. Twenty-five experts participated in interviews designed to identify and validate the proposed components. The interview process included coding and analyzing the data to confirm or refine the identified dimensions in subsequent interviews. Exploratory data collection involved theoretical sampling, continuing until categories reached theoretical saturation. In this study, saturation was achieved with the 11th interview, as no new concepts were identified, confirming sampling sufficiency.

The research literature included all relevant higher-level documents as part of the documentary research population. Strategically, the statistical population encompassed all managers and experts with the following characteristics:

- At least ten years of experience in banks and financial institutions.
- A minimum educational qualification of a bachelor's degree.
- At least five years in managerial or supervisory roles.
- Experience in teaching and research activities.
- A reputation for integrity and effective communication with staff.
- Proficiency in understanding the issues, challenges, and characteristics of money laundering risk.

3. Findings

In the present study, data were first extracted from the statements of interviewees (25 senior organizational managers and university experts). The result of these interviews was a set of initial themes gathered through open coding, from which categories were derived. Subsequently, in the axial coding phase, these categories were linked under the headings of causal conditions, central phenomenon, strategies, contextual factors, intervening conditions, and the consequences of money laundering risk within the framework of the axial coding paradigm. Through classifying and coding these factors, a theory of the issue was obtained. In other words, the qualitative data obtained from interviews were analyzed using a three-step coding process (open coding, axial coding, and selective coding), and finally, the resulting factors were used to propose the final model.

During the analysis of interview data, the most important step was identifying the categories of indicators and events so that the researcher could become gradually more familiar with the occurrences and their causes. Various methods exist for open coding. One approach is line-by-line analysis, examining the data phrase by phrase and sometimes word by word. Then, by thoroughly reading the interview transcripts, conceptualization began with an open mindset, naming concepts without imposing limitations. As the number of concepts increased, they were grouped into categories under more abstract terms. This process of associating categories with subcategories is known as axial coding. Causal conditions, contextual factors, intervening conditions, strategies, and their outcomes were identified. The final step—selective coding—involves refining and integrating categories and then presenting the theory. During integration, categories are arranged around a central concept that offers explanatory power. Once committed to a core idea, the main category is connected to others by explanatory statements indicating interrelationships. This process helps build and refine the theory, enhancing its internal validity.

As the interview transcripts and articles were read and pertinent, key words and phrases were labeled, a set of initial codes were extracted. This process is often termed axial coding, representing the final outcome of the axial

coding stage. In the second phase of coding, initial codes were examined, and those sharing similarities or differences were merged or removed. Similar codes were then placed into larger categories based on Table 1 (20 organizing themes comprising 91 basic themes).

Table 1. Themes and Axial Coding of the Research

Row	Comprehensive Theme	Organizing Theme (Code)	Basic Theme	
1	Causal Conditions	Interaction with Domestic and International Institutions (C1)	Necessity of collaboration between banks and internal/external institutions	
2			Significance of JCPOA* in international interactions	
3		The Nature and Extent of Interactions among Legislative and Influential Institutions (C2)	Deterrent role of sanctions	
4			Each legislative body's program-based interactions	
5			Defining the extent of each legislative body's interaction	
6			Monitoring and follow-up mechanisms	
7			Enhancing cooperation between executive bodies and private units	
8			Probing and Analyzing Strategic Capacities and Issues (C3)	Adopting a comprehensive, multi-dimensional approach
9				Using an agile and integrated model for action
10				Regular functioning of internal auditing in banks
11		Defining fundamental principles and systematic inspections for effective banking supervision		
12		Proper and appropriate use of information		
13		Providing essential data to AML inspectors and supervisors		
14		Timely reporting of suspicious operations by preparing and submitting STR** forms in all branches and bank units		
15		Proper customer acceptance policies to verify identity and obtain sufficient documentation		
16		Continuous monitoring by tracking unusual activities and transactions		
17	Contextual Factors	Internal Factors of Banks (C4)	Expanding credit provision	
18			Bank capital ratio	
19		Credit quality		
20		High lending risk		
20		Investment return risk		
21		Capital outflow from the system		
22		Management efficiency		
23		Ratio of loans to total deposits		
24		Role and Influence of Interest Groups (C5)	Effect of informal connections	
25			Influence of interest groups on the legislative process	
26	Economic Influencers (C6)	Resources, sectors, and impactful economic decisions		
27		Funding sources		
28		Mandated reductions in deposit rates		
29		Mandated reductions in lending rates		
30		Budget allocation		
31		Economic growth rate		
32		Liquidity growth rate		
33		Currency exchange rate increases		
34	Environmental Factors (C7)	Obligation to comply with international regulations by bodies such as the Basel Committee		
35		Competitive markets		
36		National economic conditions		

37			Lifting of international sanctions
38	Intervening Conditions	Security and Political Factors (C8)	Considering political stakeholders during implementation
39			Policy shifts and execution priorities
40		Executive and Legal Structure (C9)	Primacy of power over law during implementation
41			Achieving better outcomes by focusing executives on processes
42			Government change and AML perspectives
43			Compensation for positive results and penalties for poor performance
44			Weakness in localizing laws and standards
45			Developing shared standards for collaboration to combat corruption and its instances
46			Policy packages of the Central Bank
47		Use of Modern Technologies (C10)	Deployment of new systems
48			Acquisition of intelligent information systems
49			Proper supervision systems for financial transactions
50			Rapid technological changes
51		Use of Scientific and Specialized Principles (C11)	Adoption of precise scientific methods
52			Policy research reports
53			Commitment to professional principles
54			Collecting, registering, and retaining customer data in a classified file
55			Identification and monitoring of different customer types with relevant reporting and inquiries
56			Physical distribution of Directive 5003 on AML matters and requiring staff to read it
57		Knowledge-Based Process Development (C12)	Specialization in procedures
58			Process expertise among key institutions
59			Mechanisms to increase coordinated meetings among responsible entities
60			Holding domestic and international roundtables and seminars
61		Coherence, Integration, and Updating of Laws (C13)	Formulating complete, comprehensive regulations
62			Ensuring the existence and effective enforcement of AML laws
63			Novelty and immaturity of enacted laws
64	Strategies	Attention to General System Policies and Higher-Level Guidelines (C14)	Utilization of macro-level resolutions and bylaws
65			
66			Generating statistics on AML measures by relevant agencies and their outcomes
67			Formulating policies and solutions for greater transparency
68			Information management, establishment and reinforcement of information systems, and standardizing processes and documenting executive agency activities
69			Legislative practicality and avoidance of regulations contrary to national interests
70			Encouraging, facilitating, and supporting regional and international cooperation and providing technical assistance in oversight activities
71		Credit Risk Identification by Relevant Entities (C15)	Customer credit rating system
72			Review, oversight, and monitoring within the credit domain
73			Systematic legal processes for bank debt recovery

74		Identification of Bottlenecks and Vulnerable Points (C16)	Detection of bottlenecks and weak points
75			Multiplicity, lack of transparency, and incomplete access to credit directives
76			Limited flexibility for customers with high credit capacity
77			Uniform treatment of all customers
78			Limited accountability among managers and relevant agencies
79			Identifying gaps and shortcomings to streamline institutional interaction and participation
80		Preservation of Iranian-Islamic Values and Culture (C17)	Role of ethical and faith-based considerations in this domain
81			Governmental cooperation with other branches to promote cultural awareness and strengthen administrative integrity based on Islamic resources and global experiences
82	Central Phenomenon	Internal Control System (C18)	Supervision and monitoring
83			Risk assessment
84			Control activities
85			Information and communication
86	Outcomes	Control of Money Laundering Risk (C19)	Asset securitization
87			Credit derivatives
88			Debt sales
89		Credit Risk Management (C20)	Optimizing operational liquidity
90			Effective data collection and screening
91			Bank investments in economic activities

Next, the major categories are connected within a paradigmatic (contextual) model around the core category. Essentially, the depicted model formally describes the category and analyzes and explains it. This process involves merging the core category and refining the constructs derived from it. Such a model can be illustrated as a formal diagram that conveys conceptual meaning.

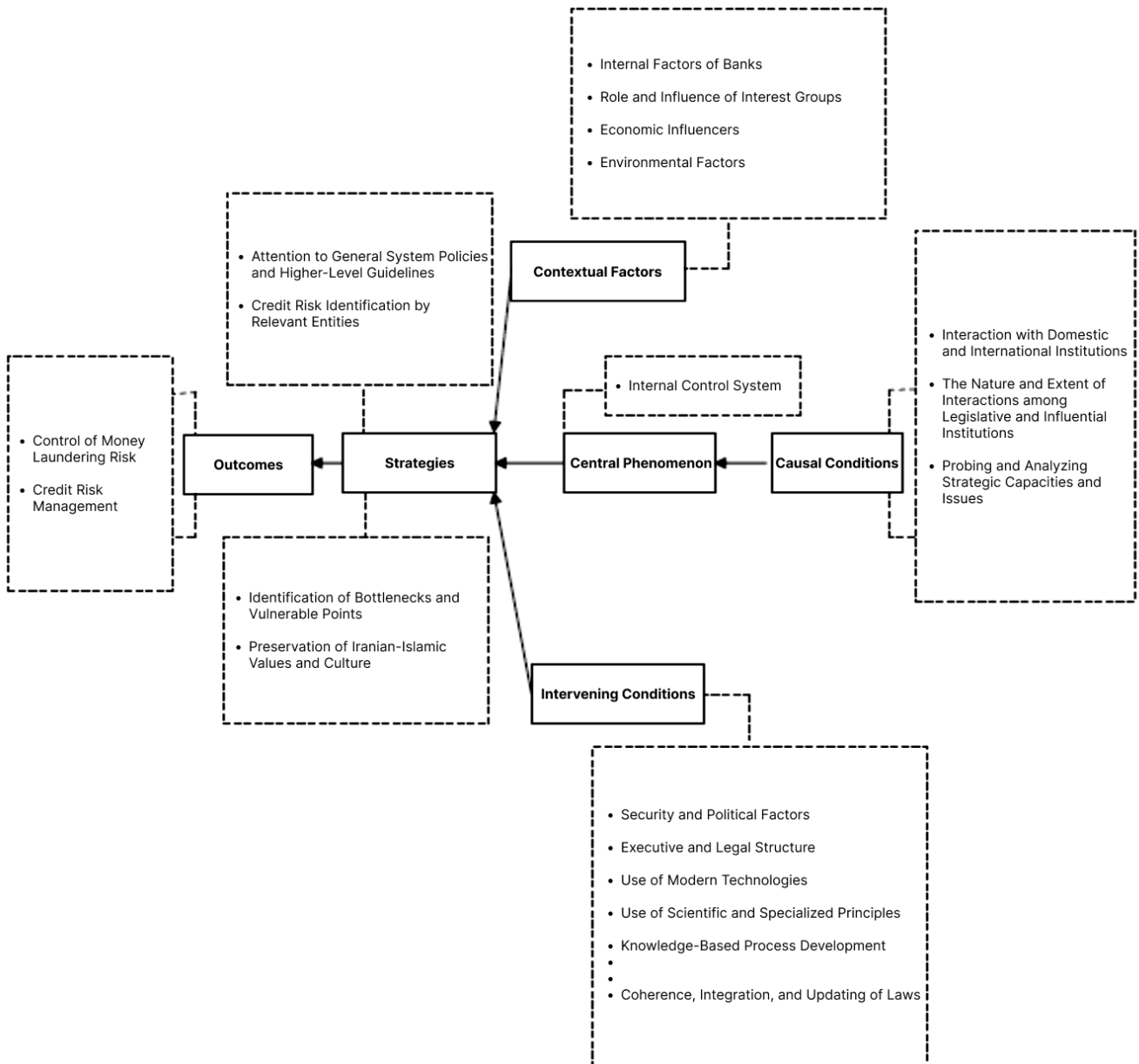


Figure 1. Paradigmatic Research Model Based on Expert Opinions for Designing a Money Laundering Risk Model in Banks and Financial Institutions (Overall Research Model)

Based on the identified components, the following propositional statements (theorems) emerge:

Theorem 1: According to prior research and the results of this study, areas including interaction with domestic and international institutions, the nature and extent of interactions with policymaking entities, and the adoption of international standards represent causal conditions influencing money laundering risk in banks and financial institutions.

Theorem 2: The internal control system is considered the central and fundamental phenomenon for designing a money laundering risk model in banks and financial institutions.

Theorem 3: Contextual conditions, such as internal bank factors, the role and influence of interest groups, key economic influencers, environmental factors, and increased lending capacity, significantly impact the design of a money laundering risk model in banks and financial institutions.

Theorem 4: Intervening conditions in designing a money laundering risk model in banks and financial institutions include security and political factors, executive and legal structures, use of modern technologies, reliance on scientific and specialized principles, knowledge-based process development, coherence and integration of laws, and the risk of banking accounts.

Theorem 5: The strategies for designing a money laundering risk model in banks and financial institutions are influenced by attention to general policies of the system and higher-level guidelines, credit risk identification by relevant entities, detection of bottlenecks and vulnerable points, and preserving Iranian-Islamic values and culture.

Theorem 6: Contextual and intervening conditions affect the influence of strategies on producing outcomes related to controlling money laundering risk levels and managing credit risk.

* JCPOA refers to the Joint Comprehensive Plan of Action.

** STR refers to Suspicious Transaction Report.

Interpretive Structural Modeling (hereafter ISM) is one of the interactive management tools used to organize and guide the complexity of relationships among indicators (Jindal & Sangwan, 2013). This computer-based approach, which involves an interactive learning process, enables individuals or groups to examine complex relationships among elements within a system and structure them into a comprehensive systematic model (Warfield, 1974). In essence, ISM transforms vague and opaque mental models of systems into explicit and transparent models, illustrating the relationships among indicators and how they interconnect based on collective decision-making and judgment.

Researchers in various organizational, management, and industrial fields have extensively employed ISM. In addition to its straightforward structure and user-friendliness, ISM is a suitable option for tackling complex issues, especially when systematic and logical thinking is required. In this study, to implement ISM, the following steps were followed (Bakhtarian et al., 2016; Kannan et al., 2009; Sindhu et al., 2016):

Step 1: Identifying the Research Indicators

In this study, according to Table 1, 20 indicators (organizing themes) were selected to structure the money laundering risk indicators.

Step 2: Data Collection and Constructing the Structural Self-Interaction Matrix

In this phase, 25 experts (senior organizational managers and university scholars) evaluated the research indicators through pairwise comparisons, employing the following symbols to determine the relationships among indicators:

- V: One-way relationship from i to j
- A: One-way relationship from j to i
- X: Two-way (bidirectional) relationship between i and j
- O: No relationship between i and j

Using these symbols, the experts indicated the relationships among the research indicators in the questionnaire.

Step 3: Forming the Initial Reachability Matrix

The initial reachability matrix is a 0-1 structural self-interaction matrix constructed by converting the symbols V, A, X, and O as follows:

- If the relationship between indicators is V, then $(i, j) = 1$ and $(j, i) = 0$.
- If the relationship is A, then $(i, j) = 0$ and $(j, i) = 1$.
- If the relationship is X, then $(i, j) = (j, i) = 1$.
- If the relationship is O, then $(i, j) = (j, i) = 0$.

(In cases where $i = j$, the diagonal entry in the matrix is set to 1.)

Step 4: Forming the Final Reachability Matrix

By incorporating transitivity into the relationships among the indicators, it is necessary to adjust the initial reachability matrix. Transitivity means that if indicator i leads to indicator j , and indicator j leads to indicator k , then indicator i also leads to indicator k . To compute the reachability matrix, Euler’s theorem is applied: the adjacency matrix is added to the identity matrix and then raised to the power n (as long as no further changes occur in the matrix entries)

Table 2 provides the results (in this table, the entries marked with an asterisk ‘*’ were 0 in the initial matrix but became 1 after applying the compatibility step).

Table 2. Final Reachability Matrix

C	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	0	1	0	1*	0	1	1*	1*	1	1*	1*	1*	1	1*	1	1*	1*	1*	1*
2	1	1	1*	1*	1	0	1	1	1*	1*	1*	1	1*	1*	1	1	1	1*	1*	1*
3	1*	1*	1*	1*	1*	0	1	1	1	1*	1	1	1	1*	1*	1*	1*	1*	1	1*
4	1*	1	1	1	1	1	1	1*	1*	1*	1	1	1	1*	1*	1	1*	1*	1	1
5	1	0	1	1*	1	1*	1	1	1	1	1	1	1	1*	1*	1	1*	1*	1*	1
6	1	1*	1	1*	1	1*	1	1	1*	1	1*	1	1	1*	1	1	1	1	1*	1*
7	1*	1*	1*	1*	1*	1*	1	1*	1	1	1	1*	1	1*	1*	1	1	1	1*	1*
8	1*	1	1	1	1	0	1	1	1	1	1*	1*	1*	0	1*	1	1*	1*	1*	1
9	1	0	1*	0	0	0	1	0	1	1*	1*	0	1*	1*	0	1*	1*	1*	0	0
10	1	0	1*	1*	1	0	1	1*	1*	1	1*	1*	1*	1*	1	1	1*	1*	0	1
11	1*	1	1*	1*	1	1	1	1	1	1*	1	1*	1	1	1	1	1	1	1	1
12	1*	1*	1*	1*	1*	0	1*	1	1*	1	0	1	1*	1	1*	1*	1*	1*	1	1*
13	1*	1*	1*	1*	1*	0	1*	1*	1	1*	1*	1*	1	1*	1*	1*	1*	1	1*	1*
14	1*	0	1*	1*	1	0	1*	1*	1*	1	1*	1*	1	1	1*	1	1	1*	0	1*
15	1*	1*	1	1	1	0	1	1*	1	1	1*	1	1	0	1	1	1*	1*	1*	1
16	1*	1*	1	1*	1*	0	1	1*	1	1*	1*	1*	1	0	1*	1	1	1	1*	1
17	1*	0	0	1*	0	0	0	1*	1*	1*	0	1	1	1*	0	0	1	1*	1*	0
18	1	1	1*	0	1	0	1	1	1	1	1*	1	1	1*	1	1*	1	1	1*	1
19	1	1*	1*	0	1	0	1*	1*	1	1*	1*	1*	1*	1*	1*	1*	1	1	1	1
20	0	1*	0	0	1*	1*	1*	1*	1*	0	1	1*	1*	1*	1*	1*	1*	1*	1*	1

Step 5: Level Partitioning of the Indicators

In this step, the final reachability matrix is classified into different levels so that each indicator’s input and output sets can be determined. The input set comprises the indicator itself and all indicators that influence it (the number of 1s in each column). The output set includes the indicator itself and all indicators that it affects (the number of 1s in each row). Next, a common set of indicators is determined, representing the intersection of indicators appearing in both input and output sets. Indicators whose output set and intersection set are completely identical occupy the highest level of the ISM hierarchy. To determine the subsequent system levels, those highest-level indicators are removed from the relevant tables, and the same procedure is used to identify the indicators of the next level.

Step 6: Model Construction

Given the variable levels and the final reachability matrix, the ISM model is constructed. In other words, by integrating the relationships among the indicators, one can depict the network diagram of their interactions. This model illustrates the hierarchy of how factors relate to one another; indicators at higher levels are influenced by indicators at lower levels. Essentially, the drawn model is a graphical representation of the preceding

computational tables. Here, the indicators are positioned from lower to higher levels. In the present study, the indicators are arranged into three levels, as shown in Figure 2.

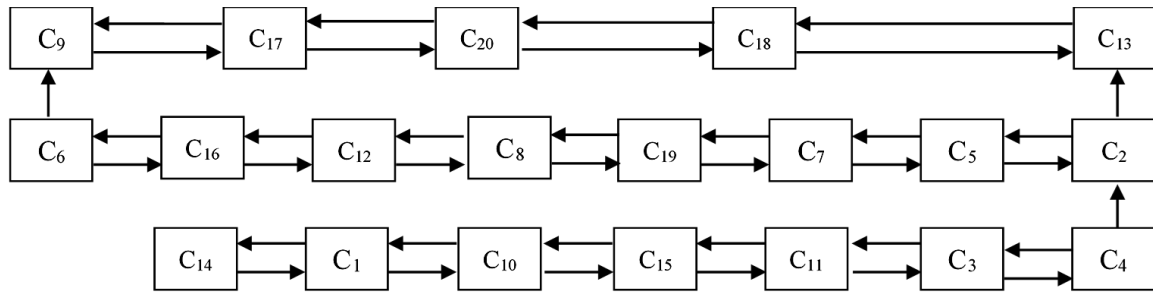


Figure 2. Structural Model of Money Laundering Risk

Based on Figure 2, the indicators “Attention to General System Policies and Higher-Level Guidelines,” “Interaction with Domestic and International Institutions,” “Use of Modern Technologies,” “Credit Risk Identification by Relevant Entities,” “Use of Scientific and Specialized Principles,” “Probing and Analyzing Strategic Capacities and Issues,” and “Internal Factors of Banks” are crucial and vital. They form the foundation for reducing money laundering risk.

The essence and foundation of MICMAC are based on matrix multiplication (Diabat & Govindan, 2011). The objective of MICMAC analysis is to evaluate the driving power and dependency of the indicators. In MICMAC analysis, it is not precisely clear how strong or weak the impact or dependency of one indicator is on another. In other words, experts only assign fixed scores to the relationship between two variables; however, in reality, the effects of indicators on each other are not so perfectly exact and comprehensive. By using exact numbers, the inherent uncertainty and ambiguity in the qualitative measurement of the indicators’ effects are eliminated (Ravi & Shankar, 2005). Another issue is that, at the stage of presenting the results, one cannot easily judge the total direct and indirect impacts. In the MICMAC method, indicators whose total impact is greater than half of the largest impact value are considered dependent, while the rest are considered independent. Hence, the fuzzy MICMAC method was designed to address this problem (Sindhu et al., 2016).

According to Qureshi et al. (2008), the steps of the fuzzy MICMAC method are as follows:

Step 1: Forming the Direct Relationship Matrix (DRM)

The direct relationship matrix is formed by replacing the diagonal entries of the reachability matrix with zeros and disregarding the transitivity property ($0 \rightarrow *1$).

Step 2: Forming the Fuzzy Direct Relationship Matrix (FDRM)

The fuzzy direct relationship matrix is developed based on experts’ pairwise comparisons of the indicators. In these comparisons, the following scale is used:

- 0 means “no impact”
- 0.1 means “very weak”
- 0.3 means “weak”
- 0.5 means “moderate”
- 0.7 means “strong”
- 0.9 means “very strong”
- 1 means “completely effective”

Experts’ responses are shown in Table 3.

Table 3. Fuzzy Direct Relationship Matrix

C	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	0	0	0	0.3	0	0	0.5	0	0	0	0	0	0	0.8	0	0.1	0	0	0	0
2	0.9	0	0	0	0	0	0	0	0.9	0.9	0	0	0	0.5	0	0	0.3	0	0	0.5
3	0.9	0.7	0	0	0.9	0.7	0.5	0.5	0.7	0	0.5	0	0	0.5	0	0	0	0	0	0
4	0	0.9	0	0	0.7	0.9	0	0	0.9	0	0.5	0	0.9	0.1	0	0	0.5	0	0	0.3
5	0	0	0	0.9	0	0.9	0	0.7	0.9	0	0	0.9	0	0.1	0.5	0	0	0	0	0.5
6	0	0	0	0	0	0	0	0.5	0.9	0.7	0.7	0	0	0	0.3	0	0.5	0	0	0.9
7	0.9	0.7	0.5	0.7	0.7	0	0.7	0.7	0.5	0	0.5	0	0	0.9	0	0	0	0	0	0
8	0	0	0	0	0	0.7	0	0	0.7	0.3	0	0.7	0.5	0.5	0	0	0.1	0	0	0.7
9	0.9	0	0	0	0	0	0	0.7	0	0.5	0	0	0	0.1	0.9	0	0.5	0	0	0.5
10	0	0.9	0	0	0	0	0	0	0.7	0.9	0	0	0	0	0	0	0	0	0	0.7
11	0.9	0	0.5	0	0.7	0.7	0.5	0.7	0.7	0.3	0.5	0.9	0.9	0.1	0.5	0	0.1	0	0	0.3
12	0.9	0.9	0	0	0	0.5	0	0.5	0.9	0.7	0.7	0.7	0	0.3	0.5	0.1	0.1	0.5	0.1	0.5
13	0.9	0	0	0	0	0	0	0	0.9	0	0	0.7	0.7	0.1	0.9	0.1	0.5	0.5	0.5	0.5
14	0	0.5	0	0	0.7	0	0	0.5	0.9	0	0	0.7	0.7	0.3	0.5	0	0	0.5	0	0.5
15	0	0	0	0	0	0.9	0	0.3	0.9	0	0	0.9	0.7	0	0	0	0.1	0.1	0.1	0.3
16	0	0	0	0	0	0	0	0.5	0.9	0.7	0.5	0.9	0.7	0.3	0.5	0	0.1	0.5	0.3	0.5
17	0	0.9	0	0	0.7	0.3	0	0	0.9	0.5	0.3	0.9	0.7	0.5	0.5	0.1	0.3	0.5	0.5	0
18	0	0	0	0.5	0	0.9	0	0.7	0.9	0	0	0.7	0.7	0.3	0.5	0	0.1	0	0.5	0.3
19	0	0	0	0.5	0	0	0	0.5	0.5	0	0.5	0.9	0.7	0	0.5	0	0.1	0.1	0	0.5
20	0	0.5	0	0.5	0.5	0.9	0	0.7	0	0	0	0.1	0.1	0.1	0	0	0.5	0.5	0.1	0

Step 3: Calculating the Stabilized Fuzzy Matrix

The stabilized fuzzy matrix is obtained through repeated multiplication of the fuzzy direct relationship matrix until the values for driving power and dependency converge. In this study, after six iterations, the stabilized fuzzy matrix was obtained, shown in Table 4. The driving power and dependency are computed by summing each row's and each column's values, respectively.

Table 4. Stabilized Fuzzy Matrix

C	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Driving Power
C1	0	0	0	0.1	0	0.3	0	0	0	0	0	0	0	0.8	0	0.1	0	0	0	0	1.3
C2	0.9	0	0	0	0	0	0	0	0.7	0	0	0	0	0.5	0	0	0.3	0.3	0	0	2.7
C3	0.9	0.9	0.5	0.7	0.7	0.7	0.5	0.7	0.7	0.7	0.7	0.7	0.7	0.5	0	0	0	0	0	0	9.6
C4	0.9	0.7	0	0.9	0	0.7	0	0.7	0.9	0.9	0	0.7	0.5	0.1	0	0	0.5	0.9	0	0.3	8.7
C5	0.9	0.9	0	0	0.7	0.7	0	0.5	0.9	0.9	0	0.7	0	0.1	0.5	0	0	0.5	0.5	0.5	8.3
C6	0.9	0.5	0	0	0	0.7	0	0.7	0.7	0.7	0	0.5	0.7	0	0	0.3	0.5	0	0	0	6.2
C7	0.9	0.7	0	0.7	0.5	0.3	0.7	0.7	0.5	0	0.5	0.5	0	0.9	0	0	0	0.5	0	0.3	7.7
C8	0.7	0.7	0	0	0	0.7	0	0.7	0.7	0.7	0	0.5	0.5	0.5	0	0	0	0.1	0.1	0	5.9
C9	0.9	0	0	0	0	0	0	0	0.9	0	0	0	0.9	0.1	0.5	0	0	0	0.3	0	3.6
C10	0.7	0	0	0	0	0	0	0	0.9	0.9	0	0	0.5	0	0	0	0	0.9	0.1	0.5	4.5
C11	0	0	0.5	0.7	0.5	0.7	0.5	0	0.7	0.3	0.5	0.7	0	0.1	0.5	0	0	0.1	0.5	0.3	6.6
C12	0.9	0.1	0	0	0	0.7	0	0.7	0.9	0.9	0	0.7	0	0.3	0	0	0	0	0.5	0.5	6.2
C13	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0.5	0	0	0.5	0	0	2
C14	0	0.5	0	0	0.7	0	0	0	0.9	0	0	0.9	0.5	0.3	0	0	0.5	0.7	0	0.5	5.5
C15	0	0	0	0	0	0.5	0	0.3	0.9	0	0	0.9	0	0.1	0.5	0	0	0.1	0.5	0	3.8
C16	0	0	0	0	0	0	0	0.5	0.9	0.5	0	0.5	0	0	0	0.3	0.5	0	0	0	3.2
C17	0	0.3	0	0	0.7	0.3	0	0	0.1	0	0	0.9	0	0.1	0	0	0.5	0	0	0.3	3.2
C18	0	0	0	0.5	0	0.9	0	0.7	0	0	0	0.9	0	0.1	0.9	0	0	0.5	0.5	0.5	5.5
C19	0	0	0	0	0	0	0	0.5	0.9	0.5	0	0.9	0.7	0	0	0.3	0.5	0	0	0	4.3
C20	0	0.5	0	0.5	0	0.9	0	0.7	0	0	0	0.1	0	0.3	0	0	0	0.3	0.5	0.1	3.9
Dependency	9.5	5.8	1	4.1	3.8	8.1	1.7	7.4	12.2	7	1.7	10.1	5	4.9	3.4	1	3.3	5.4	3.5	3.8	

Step 4: Clustering the Indicators Using Fuzzy MICMAC Analysis

In fuzzy MICMAC analysis, indicators are divided into four categories based on their driving power and dependency:

1. **Autonomous Cluster** (Region 1): Indicators with low driving power and low dependency.
2. **Dependent Cluster** (Region 2): Indicators with low driving power and high dependency.
3. **Linkage Cluster** (Region 3): Indicators with high driving power and high dependency.
4. **Independent Cluster** (Region 4): Indicators with high driving power and low dependency.

Figure 3 shows the fuzzy MICMAC analysis of the indicators for reducing money laundering risk at Tejarat Bank.

According to the figure, the experts determined that none of the indicators for reducing money laundering risk fall into the third cluster. In other words, based on the experts’ opinions, there is no single indicator that can influence the entire system. Moreover, the indicators located in the fourth region are key indicators of the system, possessing high driving power and exerting the greatest impact on other indicators.

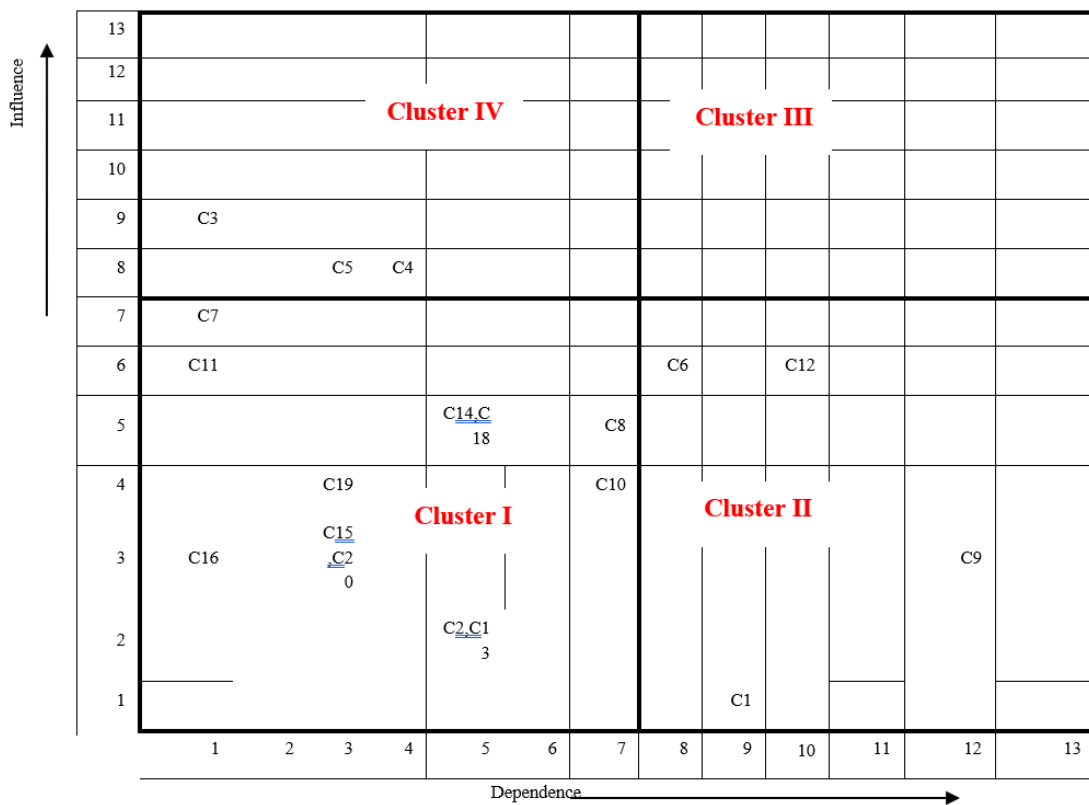


Figure 3. Fuzzy MICMAC Diagram for Clustering Money Laundering Risk Reduction Indicators

4. Discussion and Conclusion

The main objective of this study was to design a model for money laundering risk in banks and financial institutions, a framework developed based on grounded theory. First, qualitative data were collected and analyzed, followed by the collection and analysis of quantitative data. Semi-structured interviews were used for qualitative data collection, and questionnaires were utilized for quantitative data collection. Grounded theory and Strauss and Corbin’s coding method were applied to analyze the qualitative data. According to the results of the qualitative

data analysis, the pertinent themes were extracted and subsequently categorized into 20 organizing themes and 91 basic themes. A key finding from this research is the “probing and analyzing of strategic capacities and issues,” which requires continuous supervision and monitoring of unusual activities and transactions, timely reporting of suspicious transactions by preparing and submitting STR forms to all branches and units of the bank, proper customer acceptance policies to verify identity and obtain sufficient documentation, defining fundamental principles and conducting systematic inspections for effective oversight of banking operations, providing necessary information to AML supervisors and inspectors, adopting a comprehensive and multi-dimensional approach, making proper and appropriate use of information, and ensuring the regular functioning of internal auditing in banks. Another important aspect of this study is that, in order to formulate the framework, it was necessary to examine domestic and international higher-level documents and policies. Consequently, domestic documents such as the clauses of the General Administrative System Policies, the Anti-Money Laundering Law of the Islamic Republic of Iran, its Executive Bylaw, the Law on Promoting the Health of the Administrative System and Combating Corruption, the Banking AML Guidelines, and the Leader’s guidelines to representatives regarding (FATF) were utilized. Moreover, since money laundering is derived from international standards and policies, these also had to be explored and analyzed. As a result, documents including provisions of the United Nations Convention Against Corruption, the Charter of the Regional Center for Cooperation Among Anti-Corruption Agencies and Oversight Bodies of Member Countries of the Economic Cooperation Organization (ECO), the Organization for Economic Co-operation and Development (OECD) Charter on Combatting Money Laundering, and the Financial Action Task Force (FATF) recommendations were reviewed.

In the quantitative section, the interpretive structural modeling (ISM) method was employed to organize and guide the complexity of relationships among the indicators. The findings indicated that the indicators “Attention to General System Policies and Higher-Level Guidelines,” “Interaction with Domestic and International Institutions,” “Use of Modern Technologies,” “Credit Risk Identification by Relevant Entities,” “Use of Scientific and Specialized Principles,” “Probing and Analyzing Strategic Capacities and Issues,” and “Internal Factors of Banks” are critical and pivotal. These indicators serve as the foundation for reducing money laundering risk.

By reviewing domestic studies, it can be concluded that from the perspectives of content, solutions, and certain findings and results, the present study aligns with the works of Ansari Pirsaraei (2013), Rahbar (2003), and Rafiee Shamsabadi (2008). However, it differs in terms of subject matter, methodology, and approach. The main distinction arises from the fact that most domestic research primarily examines money laundering and AML measures, whereas the present study, using grounded theory, identifies money laundering risk factors and implements a systematic framework not previously explored. A third distinction of this study lies in its originality and innovativeness from a thematic standpoint. Considering the circumstances the country faces in the post-JCPOA era, one of its crucial needs is the combat against money laundering in the financial and banking system. Indeed, the banking system of any society constitutes an essential part of its overall financial framework, playing a pivotal role in national economies by bringing together and managing the prerequisites for economic activities—savings, investments, production, employment, and growth—all of which hinge on the decisions, actions, and operations of banks and credit institutions. Consequently, before adopting or implementing any financial or monetary policies, legislators must carefully analyze and evaluate how they will affect banks’ performance. Similarly, executive and political officials should cautiously present their views on banks based on accurate information.

Given that our country’s economy is heavily bank-centered, sensitivities surrounding banking operations are multiplied. Any major fluctuations in the banking system will have a direct and undeniable impact on the national

economy. Therefore, a systematic view of the responsible entities involved in combatting money laundering in the banking system of the Islamic Republic of Iran is needed. No prior research has specifically analyzed and reviewed such perspectives. Hence, in view of the importance of these matters, this study largely fills the research gap in this field by examining international strategies and introducing new capacities and capabilities.

From a methodological standpoint, this study also contains noteworthy distinctions. Its overall research design is mixed-methods, tailored to the research goals, subject, and approach. In the qualitative phase, the grounded theory method was employed to identify and extract the study's themes through interviews with experts, thus obtaining the proposed framework. The study's quantitative phase then applied ISM to illustrate the resulting structural framework from experts' viewpoints. Until now, no researcher has applied this method to study the intended variables in this domain.

The present study's results are consistent and aligned with those of Nikolovska and Simonoski (2012). In their work titled "The Role of the Banking System as an Institution in Preventing Money Laundering," they examined the concept of money laundering and offered a model to combat it. By harmonizing national legislation with the recommendations of international AML bodies, they propose an active approach to establishing a robust banking system that can confront money laundering. This system is built upon three core components. The first comprises legal institutions in this area, including ministries and government agencies. The second obligates banks by law to undertake AML measures, such as knowing their customers, monitoring and reporting specific transactions, gathering, storing, and providing information on suspicious transactions and customers, and controlling the inflow and outflow of funds according to legal regulations. The third cornerstone is the training of individuals, identified as one of the most vital actions and operations in the fight against money laundering.

Furthermore, the results of this study align with the findings of Abiola and Kehinde (2012). In their research titled "Anti-Money Laundering and Its Effects on the Credit Performance of Banks," they examined the role of AML policies in Nigeria's banking sector and the impact of these policies on banks' credit performance. They focused on three state-owned banks for this investigation. Their correlation results demonstrated a strong positive relationship (coefficient of determination = 0.891) between banks' credit performance and the formulation and implementation of AML strategies. Their conclusion states that AML approaches in banking systems significantly affect banks' credit performance in the economy, reinforcing that banks need not be a conduit for illicit monetary activities to enhance their performance. Money laundering generates adverse consequences for a nation's economy, diminishing government revenue, escalating crime rates, and jeopardizing the political stability and domestic security of nations.

From a banking and regulatory standpoint, these findings are consistent with the work of Met Isa et al. (2015). They posit that banking systems are most susceptible to money laundering. Banks are on the front lines, dealing directly with customers for services such as account opening, deposits, withdrawals, and transfers. Drawing on numerous interviews with AML managers, their study revealed that money laundering poses a serious threat to banking institutions, and front-line officers must be adequately competent in their responsibilities, as they constitute the first line of contact with the public.

Their study also highlights international AML policy risks, among the most critical being the penalties imposed on banks that engage in transactions with customers whose interactions and transactions are prohibited.

- To implement money laundering risk control, once the processes have been identified, each process's risks must also be detected. At this stage, brainstorming sessions can be held to identify the risks of each process. In risk identification, consider the following: "If event X occurs, then what consequences will we face?"

(using “if...then” helps clarify the risks). All risks and their implications should be calculated for each process. It should be noted that identifying risks is not a one-time endeavor; new risks may emerge, or previously unrecognized risks may surface over time, given the nature of the processes and a project’s life cycle. Therefore, the risk identification process must remain ongoing.

- To utilize and operationalize the proposed model (Figure 2), it is recommended to determine the extent of collaboration among governmental, public, private, international, and non-governmental sectors. One major issue in AML processes is the imbalance in collaboration among these sectors. Some entities wield very high power and typically make decisions communicated to implementing agencies, creating a top-down relationship that can lead to rigidity and significant problems. Consequently, the degree of interaction among governmental, public, private, international, and non-governmental sectors must be precisely defined.
- For more effective information gathering and screening, financial institutions should collect and filter reliable, valid information about borrowers. This is one of the key principles of credit risk management. During loan issuance, through completing loan application forms—detailing financing methods, salary amounts, bank accounts, other assets (vehicle, insurance, etc.), a customer’s current loans, credit card data, employment history, as well as personal information such as age, marital status, and number of dependents—an individual’s credit score can be ascertained. Consequently, the borrower’s credit risk can be estimated, revealing whether the person is likely to encounter repayment difficulties.
- A fundamental and practical recommendation regarding staff education in the banking system is that expanding and advancing expertise in this field requires the quantitative and qualitative development of specialists. Enhancing training and research in this domain through applied and foundational studies at both national and international levels is advisable. It is recommended that domestic banks organize training and research courses, hold national, regional, and international scientific gatherings, and publish books and scholarly journals to strengthen this subject in the country.
- It is necessary to identify, supervise, and control risks inherent in banking operations. Inspectors play a vital role in ensuring that bank management accomplishes this. Equipping inspectors with the authority to enact and implement prudential regulations to manage such risks constitutes an essential part of the supervisory process. This involves regulations on capital adequacy, non-performing loan reserves, asset concentration, liquidity, risk management, and internal controls. These measures can include qualitative or quantitative requirements. Their aim is to limit non-prudential risk-taking by banks. Such requirements must not replace management decisions but instead apply minimum prudential standards so that banks conduct their operations appropriately.

Authors’ Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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