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Strategic Planning as a Method for Building an Intelligent Crisis Management System: The Artificial Neural Network Decision-Making Model

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Abstract

The study aims to examine the relationship between crisis management and artificial intelligence as fundamental indicators supported by strategic planning in organizations. To achieve this, a research strategy will be adopted that relies on adopting and employing new concepts to provide a clear understanding of the importance of strategic planning in building a more rational and effective system to enhance the efficiency of organizations in relying on intelligent models for crisis management. This will be accomplished by integrating all these variables and establishing a new interactive pattern between them, leading to the construction of a more rational decision-making model through artificial intelligence.

The study also seeks to highlight the importance of artificial intelligence and the artificial neural network model in building models for rational decision-making in organizations, especially during crises, according to the logic of network engineering that assembles and processes complex variables. This will ensure a high percentage of sound and cost-effective rational decisions.

✓ Keyword: Strategic Planning; Crisis Management; Artificial Intelligence; Decision-Making.

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1. INTRODUCTION

One artificial intelligence enthusiast expresses, "I still dream of the day when my word processor writes an article like this while I go to the beach." Today's world witnesses a fourth scientific revolution, the revolution of artificial intelligence, which seeks not to replace humans with machines but to develop work concepts in various fields and provide more space for human creativity in other areas. Both strategic planning and crisis management are among the key concepts that can be integrated with the concept of artificial intelligence to realize their mutual benefits in various fields. The positive and negative developments in the world today have compelled organizations to adopt scientific methods that contribute to their development and continuity.

Strategic planning is an effective approach to fulfill this role, particularly in directing organizations to adopt crisis management as one of the essential methods to help them confront crises. Conversely, crisis management requires techniques that assist in early crisis detection and the rational decision-making needed to manage them correctly. Artificial intelligence is considered one of the domains that contribute to developing technologies in the field of crisis management, especially in decision-making. It ensures the safety of organizations from various threats that may even impact individuals outside them, aligning with the goal of artificial intelligence.

1.1 Study problem

The problem of this study can be formulated in the following main question:

How can a networked relationship be built among strategic planning, crisis management, artificial intelligence, and decision-making?

The following sub-questions fall under this problem:

- What is the concept of strategic planning, crisis management, and artificial intelligence?
- What is the relationship between strategic planning, crisis management, and artificial intelligence?
- What is the meaning of artificial neural network technology? And how can it contribute to making rational decisions?

1.2 Study Hypothesis

This study proceeds from the following main hypotheses:

The higher the awareness of organizations regarding the importance of strategic planning in building an intelligent crisis management system, the more they will rely on artificial intelligence technologies to make rational decisions.

1.3 Study Objectives

- The study aims to connect the field of political science with new scientific areas that enable it to transition towards adopting a more numerical language (models based on mathematical logic) in the field of decision-making.
- The study also seeks to clarify the important role of artificial intelligence in the field of crisis management within political science.

1.4 Study Structure

The study divides its axes as follows:

- A conceptual approach to the study's variables.
- The relationship between strategic planning, crisis management, decision-making, and artificial intelligence.
- Artificial neural network for decision-making.

2. Conceptual Approach to Study Variables

This section includes a set of definitions upon which the study is based. Each variable will be addressed in an order that aligns with the study's requirements, clarifying the relationship between these concepts and their ultimate purpose later on.

2.1 Definition of Strategic Planning

"It is an attempt to read the future in order to find the appropriate position for the organization in society. This requires a proactive and dynamic stance, the ability to adapt to variables, and the main goal is to identify the orientations and main objectives that the organization must achieve to be ideally successful in the future (South research, 20221, p. 02)."

The primary goal of strategic planning is to assist organizations in surviving and evolving in a proactive and dynamic manner, enabling them to adapt to any

circumstances, even during crises. Therefore, we can conclude that one of the objectives of strategic planning is to build a more rational and efficient model for crisis management. A definition for this relationship can be formulated under the name "strategic planning for crisis management." However, before delving into this definition, it is essential to define crisis management first.

2.2 Definition of Crisis Management

"It is a relatively modern branch in the field of management, involving various activities, with the primary focus on predicting potential crises, planning for dealing with them, and emerging from them with minimal losses (Al-Mutairi, 2017, p. 26)."

2.3 Definition of Strategic Planning for Crisis Management

"It is an organized and continuous process subject to technical controls carried out in advance of the expected timing of potential crises. It is a thinking process that involves a set of administrative procedures, policies, and implementation systems that provide the capacity and authority for crisis management (Jafar, 2017, p. 297)."

Through this definition, we observe that the fields of strategic planning and crisis management are scientific methods. In other words, they are based on thinking processes involving political and administrative procedures, as well as intelligent systems and technologies with an algorithmic or mathematical aspect. The aim is to enhance the effectiveness of decisions made in all the aforementioned methods. Furthermore, the field of artificial intelligence is a fertile ground for deep learning and rational thinking, harnessing the power of human intelligence and sometimes surpassing it, especially in terms of speed. Therefore, it is necessary to provide a definition for this concept first before delving into its relationship with other concepts.

2.4 Definition of Artificial Intelligence

"Artificial Intelligence is a specialization within computer science that aims to create intelligent machines that mimic the natural intelligence of living organisms, particularly humans. The concept has evolved to encompass all cognitive abilities of humans and sometimes surpass them. The term 'Artificial Intelligence' emerged in 1959, after World War II (Petricevic & Talloir, 2019, p. 08)."

Since the primary goal of artificial intelligence is to simulate human intelligence in performing complex tasks, the most important function of the human mind is its ability to think correctly and logically, especially in times that require speed and wisdom in

making crucial decisions, particularly during crisis situations. Therefore, the function of decision-making is a highly sensitive matter in the administrative field, as it represents a critical factor in it.

2.5 Definition of the Function of Administrative Decision-Making

"It encompasses all the steps preceding the moment of choosing the optimal alternative and reflects the concept of decision-making. The process of identifying, analyzing, and evaluating the problem and alternatives is a preparation for the decision-making process (Al-Azam & Al-Zafra, 2023, p. 10)."

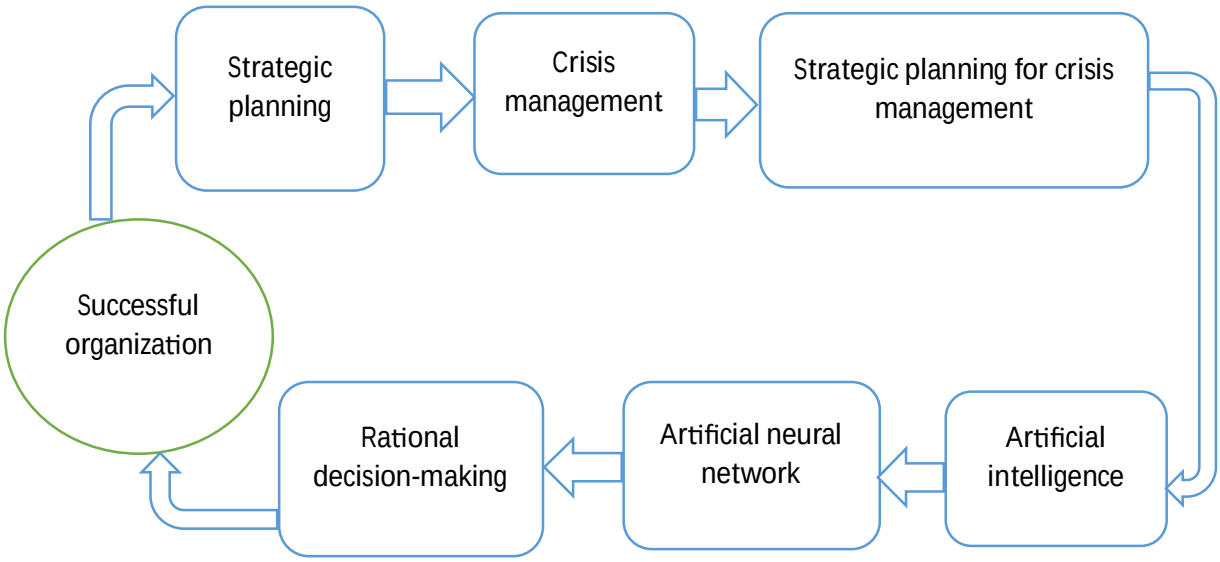
The administrative decision-making process requires various applications, as previously mentioned in the field of artificial intelligence, such as expert systems, fuzzy logic, artificial neural networks, etc. In this study, the artificial neural network technology has been chosen as the model for decision-making.

2.6 Definition of Artificial Neural Network

"It is one of the elements of artificial intelligence, born out of an ambitious attempt to simulate the human brain's method of making intelligent decisions. Its concept is derived from the study of anatomy and the neural cell, characterized by complex non-linear rates. These networks provide a cognitive model as they can learn from processed information, analyze large amounts of data, and place their features in logical positions not previously known. They operate in a parallel and dynamically interactive manner to analyze data in an environment based on the complex nature of the human brain. Therefore, their use is geared towards solving challenging problems and dealing with large quantities of information that are difficult for humans to analyze (Amina, 2021, p. 192)."

From the above, a theoretical framework for the study variables can be formed. Thus, a deeper understanding of the networked relationship between these variables as a whole can be achieved. A theoretical diagram of the aforementioned variables can be developed as a guiding reference for the study.

Fig.1. The network relationship of the study variables



Source: Prepared by the researcher

3. The Relationship between Strategic Planning, Crisis Management, and Decision-Making with Artificial Intelligence

In this section, the study attempts to elaborate on the relationship between the aforementioned variables in detail, by exploring how these variables interact positively. The study aims to establish a correlation where, as organizations lean towards adopting strategic planning, their inclination towards embracing an intelligent crisis management system based on artificial intelligence for rational decision-making increases. Therefore, this is what we will try to present now.

3.1 Relationship between Strategic Planning and Artificial Intelligence

Artificial intelligence has become an integral part of various aspects of life, especially for organizations. For this reason, it is necessary to remove the constraints and traditional rules in the strategic planning process and work on integrating artificial intelligence applications into the strategic planning process. In our current era, both strategic planning and artificial intelligence are essential factors in the development of organizations across different activities. They contribute to foreseeing the future more accurately and clearly. Artificial intelligence enhances various strategies and transforms the traditional and routine work patterns, especially in sensitive areas such as decision-making. Consequently, artificial intelligence assists in creating competencies and bringing about improvements within organizations in diverse ways (Atef Awad, 2022).

Benefits of applying artificial intelligence in strategic planning include (Atef Awad, 2022):

- Full automation operating 24/7 without human intervention.
- Instant importation and analysis of massive data, providing strategic insights for immediate response to any emergency events.
- Continuous automatic searching for data types specified by human input.
- Automated review and constant updating of data to eliminate outdated information.
- Automatic verification and cleansing of data.
- Automatic and continuous reviews of data relationships, inferences, responses, and underlying assumptions behind strategic decisions.
- Automated reviews for monitoring, executing, and evaluating the effectiveness of the strategy, analyzing results, and making adjustments for faster progress.
- Assessment and development of managers' strategic thinking capabilities, guiding them toward the correct strategies.
- Generation of a comprehensive strategic vision and proposals for strong strategies.
- Quantitative assessment of strategic risks and recommendations for the best strategies.

3.2 Relationship between Crisis Management and Artificial Intelligence

It is worth noting that the term "crisis management" originally referred to the role of the state in dealing with sudden disasters and emergencies such as earthquakes and floods. However, it quickly became a term in the field of management, used to indicate a new approach adopted by government agencies and public organizations to accomplish urgent tasks or resolve emergency situations. In this context, crisis management involves the creation of a specific management style with distinctive mechanisms for facing and managing various crises. It is a specialized management process that produces a strategic response to crisis situations to minimize losses (Al-Musa'adeh, 2012, p. 38).

Since crises occur suddenly, there must be pre-planned arrangements to predict them through interaction among various state actors and society, with crisis management plans in place. Given the rapid and complex nature of crises, there arose the necessity to employ modern technology, particularly artificial intelligence, in decision-making for crisis management (Al-Musa'adeh, 2012, p. 14).

Artificial intelligence can analyze simulation data and real-time data (including social media data) related to events and disasters in a specific area. It improves disaster preparedness, provides early warning, and identifies response priorities by coordinating information capabilities during emergencies. Deep reinforcement learning may eventually be integrated into disaster simulation processes to determine optimal response strategies (Habroiger, 2018, p. 17).

Artificial intelligence can be considered an approach characterized not only by using machines to overcome the limitations of mathematical modeling in representing highly complex social phenomena but also by overcoming the limitations of theoretical social frameworks that lack the ability to conduct laboratory experiments, similar to natural sciences. The artificial intelligence approach provides an experimental tool that does not require the human and material costs associated with field experiments. Additionally, artificial intelligence models are most suitable for representing the non-linear relationships of human behavior, as these models simulate individual behavior without the need for central control of the system (Tawadros, 2019, p. 16).

3.3 Relationship Between Artificial Intelligence and Decision-Making

Given that computers have the ability to store large amounts of data, and considering the significant similarity between computer architecture and the human nervous system, studies in the field of artificial intelligence have demonstrated that computers can be programmed to mimic the way humans interact. This involves accurately defining the rules of human behavior through disciplines such as psychology, sociology, behavioral sciences, as well as neural and cognitive sciences. Consequently, computer simulation models have emerged as an approach used for studying and analyzing social phenomena, similar to the behavioral approach that studies the behavior of decision-makers and other actors in crisis management (Tawadros, 2019, p. 15).

The relationship between artificial intelligence and decision-making is evident in the attempts of researchers to study and analyze data and information related to a given problem meticulously. Typically, these problems involve vast quantities of data,

making it challenging for the human mind to comprehensively process and analyze them. This limitation necessitates the use of intelligent systems that assist in decision-making, commonly known as artificial intelligence. When this science is applied to enhance modern decision-making systems, millions of pieces of information are stored inside computers to form a fundamental database similar to how information is stored in the human mind through learning and experiences. Subsequently, various models and programs are developed to enable computers to use this information logically in problem-solving, ultimately leading to rational and judicious decision-making (Latifa, 2017, p. 122).

It is crucial to emphasize the importance of information in decision-making to ensure its effectiveness when applying artificial intelligence. Good and accurate information results in good decisions, contributing to excellent performance across various managerial activities, especially during crisis situations. For artificial intelligence to be effective, information should possess several key attributes (Al-Huwaij, 2021, p. 182):

- **Accuracy:** Information should be correct and free from errors.
- **Accessibility:** This refers to the speed and ease of obtaining information.
- **Measurability:** Information should allow for quantitative measurement.
- **Comprehensiveness:** It should cover all aspects of the designated topic.

These are some of the characteristics that good information should have to complete the application of artificial intelligence through the implementation of its models in decision-making, similar to the artificial neural network model.

4. Artificial Neural Network for Decision-Making

In the face of the growing development of institutions locally, regionally, and internationally, and given the increasing difficulties and complexities surrounding them, traditional software solutions are no longer capable of accommodating these challenges. This led to the emergence of systems linked to artificial intelligence, its software, cognitive engineering, and the communications revolution, all of which had a significant impact on achieving integration between management support systems and systems stemming from the field of artificial intelligence. As researchers delved deeper into understanding the mechanisms of human thinking, information processing, storage, retrieval, and the reliance on simulation methods in problem-solving, a structured framework called the Artificial Neural Network was developed. It is one of

the types of information systems in the field of computers (Bouaroui, 2019, p. 79).

Among the machine learning methods that contribute to acquiring knowledge, particularly in supporting decision-making, is the neural computing method. It consists of interconnected computer units, where each unit executes processing operations and communicates the results to neighboring units. These networks can learn through training and practical exercises, allowing artificial neural networks to enhance their performance and gain expertise and knowledge. Artificial neural networks are used to solve problems that are difficult to solve and simulate (Amina, 2021, p. 196).

4.1 Components of Neural Networks

Since the neural network is considered one of the artificial intelligence techniques, as mentioned earlier, as models or computational systems that simulate the nerve cells in the human brain and the connections between them, it is an ideal method for representing relationships between variables (Osman, 2022, p. 186). It consists of a complex set of massive processing elements capable of performing complex calculations, referred to as "neurons" or "neurons," storing scientific knowledge, and making it available for use by adjusting relative weights. These neural networks consist of the following (Osman, 2022, p. 186):

- **Input Layer:** The first layer in the neural network, responsible for receiving data from various sources, with each layer containing "neurons" or processing elements corresponding to the number of incoming variables to be measured.

- **Hidden Layer:** The layer following the input layer, and the neural network may have one or more hidden layers. This layer classifies, distinguishes, and analyzes inputs by assigning relative weights to each. Analytical functions are then used to adjust these relative weights after comparing current results with the target to minimize errors and achieve better results.

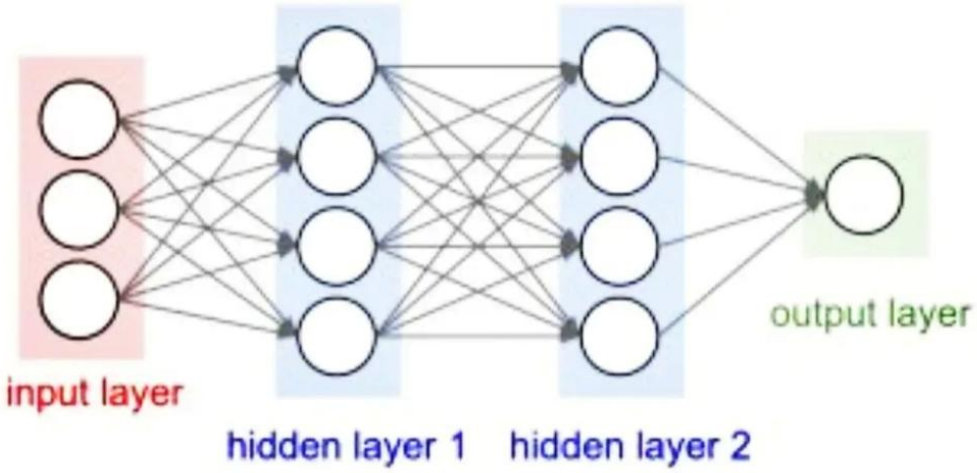
- **Output Layer:** The final layer of neural networks, containing processing elements corresponding to the number of response variables. This layer presents the results obtained from the previous layer to the end-user, displaying the final results of the neural networks.

- **Relative Weights:** These weights determine the relative strength or importance of each input. They determine the strength of the relationship between processing elements and input units, and these relative weights can be adjusted through training and learning.

- **Aggregation Function:** This function acts as the internal activator or stimulant for the neural network, calculating the relative weights of inputs by multiplying each input by its relative weight to obtain the sum.

- **Transformation Function:** Also known as the activation function, it performs mathematical equations on external values from the aggregation function, continually adjusting relative weights during the network training period. The most widely used activation functions in neural networks include the linear activation function, the step function, the sigmoid function, and more.

Fig.2. Neural network and its components



Source: (Damascus, 2019)

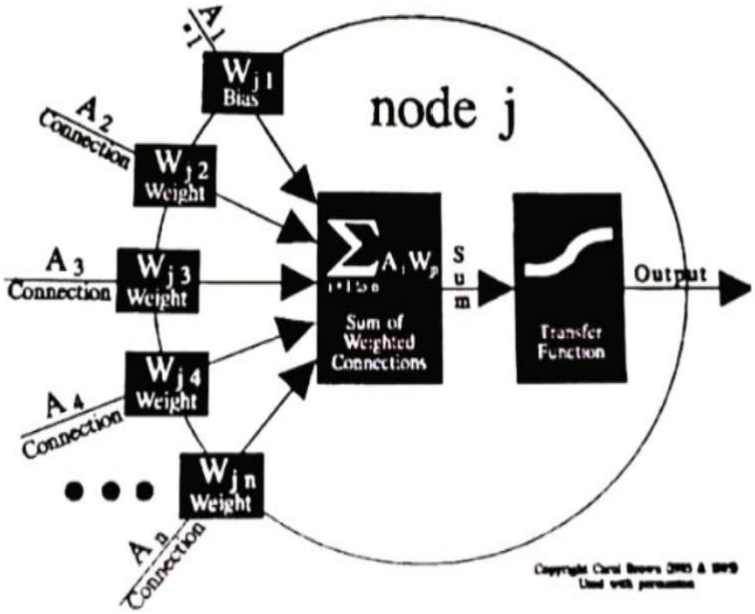
The diagram illustrates a neural network consisting of an input layer, two hidden layers (Hidden layer 1 and Hidden layer 2), and an output layer.

- Input layer: The layer that receives input.

- Hidden layer 1 and Hidden layer 2: Two hidden layers responsible for processing information.

- Output layer: The layer that produces the final output.

Fig.3. Detailed structure of the artificial neural network



Source: (Bouzidi & Aichouch, 2017, p. 48)

The following diagram presents a detailed artificial neural network, consisting of an input layer, a hidden layer, and an output layer. It illustrates how relative weights function and provides an explanation of the aggregation function along with all the symbols used in the network.

4.2 Characteristics of Artificial Neural Network

This artificial neural network possesses several characteristics (Bouzidi & Aichouch, 2017, p. 47):

- **Parallelism in Processing:** The network's architecture is built on this foundation, assembling and processing all variables simultaneously, reducing execution time compared to classical programming methods for decision-making.
- **Adaptability:** The effective training capability of the neural network allows it to incorporate new parameters for a given problem based on new external data.
- **Distributed Memory:** Events in visual neural network technology are represented according to an activation map of cells, enabling resilience against randomness. Additionally, the loss of an element in the network does not impact its performance.
- **Generalization Ability:** Through training, the network can recognize similar examples.
- **Ease of Building the Artificial Neural Network Model:** This is achieved by writing a program and conducting tests on the data, requiring minimal resources.

With these advantages, the use of artificial neural networks becomes one of the most successful solutions that can be relied upon for making important decisions, especially during crisis management. This ensures a high percentage of rational and cost-effective decisions for institutions.

4.3 Artificial Neural Network Technology as a Fundamental Pillar for Crisis Management

The role of artificial neural networks in supporting crisis management can be summarized in the following points (Bouzidi & Aichouch, 2017, p. 53):

- Studies have demonstrated the effectiveness of artificial neural networks in enhancing the performance of crisis processing operations and various related activities such as prediction and making future decisions. This leads to efficiency and effectiveness, where the network can play an intelligence role in identifying potential crisis sources and causes, for instance, in international relations. Through processing within the networks, it becomes possible to anticipate these crises and consequently prepare for their management.

- These networks can also perform functions in continuous monitoring and control operations of environmental variables. They contribute to adjusting a clear plan on how to deal with these variables, ensuring that management has ease of control over various crises, providing continuous continuity to activities and tasks, reflecting on the overall performance of institutions.

- The interaction between artificial neural network technology and crisis management is evident through the latter's ability to gather a vast amount of information and data related to risks through network branches. It classifies and analyzes risks through various processing mechanisms to develop an understanding and assessment of the severity of crises or the losses that may result from them.

- Since artificial neural networks mimic the human neural network, especially in the principles of learning, storing data, and using it in various situations, these artificial networks can also learn, store information, train on it, and continuously adjust it. This allows them to accumulate sufficient expertise to make judgments and provide accurate decisions regarding crises. This increased capability positions artificial neural networks effectively for managing both internal and external crises for institutions.

In addition to many other roles offered by artificial neural networks as a

fundamental pillar for decision-making, it can be said that political institutions can now rely on these very modern technologies to make important decisions, especially in managing their crises logically, prudently, and cost-effectively from all aspects, with high-confidence in the results. Therefore, this interaction between artificial intelligence and crisis management can be referred to as "Smart Crisis Management." Accordingly, a procedural definition can be exclusively formulated for this study.

Smart Crisis Management is a scientific approach that combines crisis management as a branch of management sciences with artificial intelligence as a branch of computer science. The primary goal of this connection is to create a new scientific model for crisis management in organizations based on the use of artificial intelligence techniques to make rational and prudent decisions.

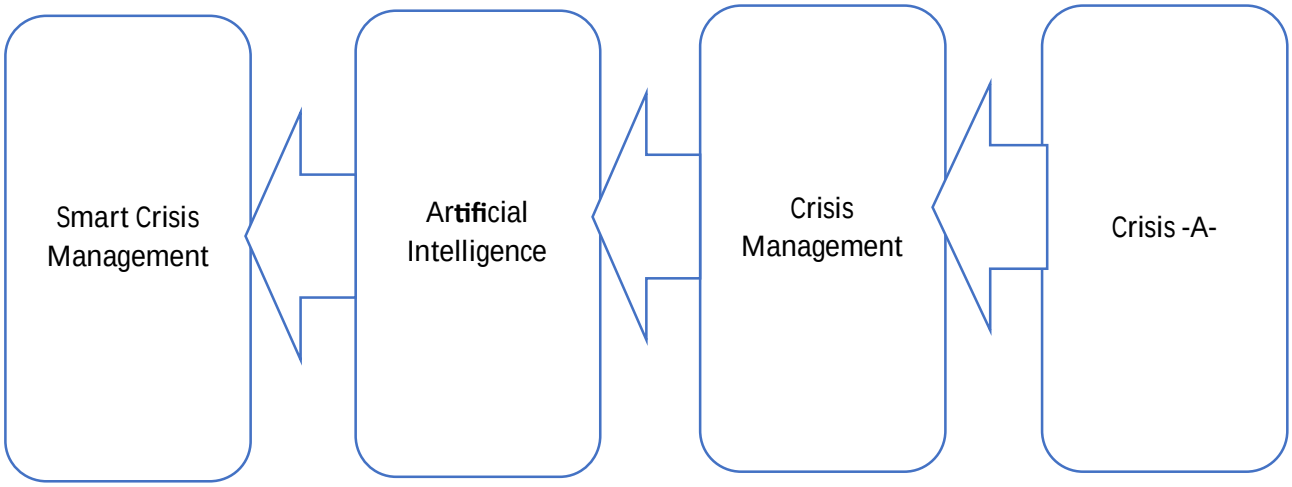
Given that the integration of artificial intelligence into human activities has become a prominent phenomenon in recent years, the impact of these technologies is expected to appear in many fields. It is not an exception that it will affect the field of political science, for example, in the area of managing diplomatic crises. The new challenge here is to transform the management of diplomatic crises from a human art and skill relying on intuition, persuasion, and even cleverness into intelligent computational models. This transformation has been achieved by artificial intelligence algorithms (Al-Shahri, 2023). This is what the study aims to clarify through the introduction of the term "Smart Crisis Management."

An overview of the operational plan of artificial intelligence techniques in crisis management is provided to establish intelligent crisis management in organizations through the following concepts:

- Crisis.
- Crisis Management.
- Artificial Intelligence.
- Smart Crisis Management. This process involves several steps:
- First, the development of a plan or strategy for implementing the work.
- Second, the precise identification of the crisis to be addressed.
- Third, the collection of necessary data about the crisis, followed by proposing anticipated solutions.

Subsequently, the stage of artificial intelligence or building an ideal model for crisis management logically and wisely comes into play. In this phase, collaboration with artificial intelligence experts is essential to implement artificial intelligence techniques, such as artificial neural networks. The data is then anchored with digital information, represented by relative weights or completed data. Once the program is ready, the intelligent, logical, and prudent crisis management process begins.

Fig.4. The theoretical concept of how artificial intelligence techniques work in the field of crisis management to create smart crisis management



Source: Prepared by the researcher

The following figure presents a theoretical overview of how artificial intelligence techniques operate in the field of crisis management to create intelligent crisis management in organizations.

5. CONCLUSION

Undoubtedly, through our presentation of the study topic "Strategic Planning as a Method for Building an Intelligent Crisis Management System – The Artificial Neural Network Model for Decision Making," it becomes evident that all these concepts are methods and techniques working towards a common goal: to enhance the performance, efficiency, and effectiveness of organizations in various fields, especially crisis management. This is highlighted through the network relationship illustrated in the study's first axis dedicated to the conceptual approach. The study emphasizes the interactive relationship between these variables or concepts by assuming that the more organizations focus on a particular variable, the greater the need for the existence of other variables. It is a reciprocal relationship, meaning that strategic planning necessarily leads to the adoption of other scientific methods that help organizations face crises, which are inevitable consequences due to the positive and negative

developments in the world. Therefore, organizations must protect themselves by adopting crisis management methods, as emphasized in the study's second axis.

For this approach to be effective, it must also be built on what the external environment imposes on these organizations in terms of developments in the field of technology. Thus, the field of artificial intelligence is considered a necessary option for organizations to develop themselves in crisis management. Since crises can occur suddenly, the organization needs to make rational decisions in a short time. Therefore, the advantage of making rational and sound decisions quickly for managing a specific crisis is the essence of the crisis management process. Consequently, the addition that artificial intelligence brings with its various techniques, such as artificial neural network technology, is that it turns crisis management in organizations into "smart crisis management." This has also been emphasized in the last axis. Therefore, the study proposes some of the following recommendations:

- It is preferable to first modify the legal system as a reference framework for institutions, based on the principle of openness towards administrative reform. Institutions should adopt various scientific methods in the reform and change process for individuals, work structures, and the technologies used.

- Institutions should be equipped with various scientific methods such as strategic planning and crisis management in their activities. They should also be provided with the latest technological technologies, such as artificial intelligence techniques.

- When initiating any strategic planning in institutions, it is advisable to rely on technological techniques to provide the plan with a quantitative aspect that enhances the effectiveness and success of strategic planning.

- It is recommended to adopt a networked interaction mindset when defining the goals of institutions and the methods to achieve these goals, considering various scientific methods.

- Training managers and employees on various scientific methods, such as strategic planning, crisis management, and artificial intelligence techniques, is recommended. This enables them to work easily with these methods and technologies and ensures their success.

- It is preferable to focus on the human element from the informal perspective to gain the trust and loyalty of employees to their institutions. This will necessarily lead to the development of their initiative, quick learning, and acceptance of change for the

common good.

- Finally, it is recommended to promote a culture of technology control and discuss its benefits through various communication channels with citizens. This facilitates the automation process in various services provided to them, promoting collaboration between various community actors. For example, good internet flow helped students continue their studies during the COVID-19 pandemic. Internet access assisted in managing the education crisis resulting from the pandemic, which imposed lockdowns worldwide. This is the essence of the study, "Building a Smart Crisis Management System in Institutions."

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