

Predictive Modeling of Strategic Decision-Making Patterns in the Presence of Competitor's Decisions Using Machine Learning Techniques

YOUSEF SALAH BURAYKAH

2021204699

Supervisor: Dr. Mona Mostafa Al-Ashry

Faculty Member - College of Management - MidOcean University

Table of Contents

Table of Contents	i
List of Figures	ii
1 CHAPTER 1: INTRODUCTION	3
1.1 Introduction	3
1.2 Problem Statement	7
1.3 Importance of the Research	7
References	12

List of Figures

Figure 1.1 The top 8 car companies by market capitalization (2020) ³	4
Figure 1.2. External Investment in Machine learning companies by technology category.....	6
Figure 1.3 Tops AI Funding Worldwide:	Error! Bookmark not defined.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Strategic decision-making is a central concept in the business world, with the power to make or ruin a company. The Oxford Dictionary defines "Strategic Decision" as "carefully planned and executed actions and approaches that are designed to achieve specific goals"¹. These plans and actions usually are resource efficient and seek to have a long-term impact. There are different types of decision-making, programmed and non-programmed decisions, routine and strategic decisions, and organizational and individual decisions. Programmed decisions are routine and repetitive, while non-programmed decisions require creative thinking, routine decisions are short-term, while strategic decisions have long-term impacts, and organizational decisions are made by teams or managers, while individual decisions are based on available information and one's point of view².

In the era of globalization, where competition has become global, we now see, for example, European companies competing with Chinese companies for customers in America or worldwide. This has made strategic decision-making crucial, as organizations are now competing with minds and rivals from all around the world. Despite the importance and effectiveness of making strategic decisions, it can be a challenging task due to the complexities and uncertainties that organizations may face. The actions and reactions of competitors can also increase the difficulty and make it more complex. Therefore, it is important to have a sufficient understanding of the market, consumer preferences, and global economic conditions.

For example, one of the greatest decisions in the field of automotive manufacturing that changed the scales and turned the industry upside down is Elon Musk's decision when he decided to produce electric cars in 2004 at affordable and desirable prices, which created a revolution in the field of cars. Based on a report by CNN Business in 2020³, Tesla, in 16 years, has achieved a market value of \$600 billion in market capitalization. Creative and strategic understanding were

¹ Definition of strategic adjective from the Oxford Advanced Learner's Dictionary.

² GeeksforGeeks. (2023, November 30). Types of Decision making.

<https://www.geeksforgeeks.org/types-of-decision-making/>

³ Tesla's market value tops \$500 billion for the first time. (2020, November 24). CNN.

<https://www.cnn.com/2020/11/24/cars/tesla-worth-500-billion/index.html>

important factors in Tesla's ability to achieve this accomplishment when Tesla decided to develop electric cars that could match and maybe overcome the performance, range, and efficiency of gasoline cars while maintaining as low a cost as possible. The company accomplished in just 16 years what other companies had not been able to accomplish in 500 years of combined effort. The combination of a calculated move and an inspiring vision was what made Tesla successful, with a market capitalization greater than the sum of the market capitalizations of the next seven most valuable automakers, Figure 1.1 demonstrates that Tesla is, by far, the most valuable automotive manufacturer in the world⁴.

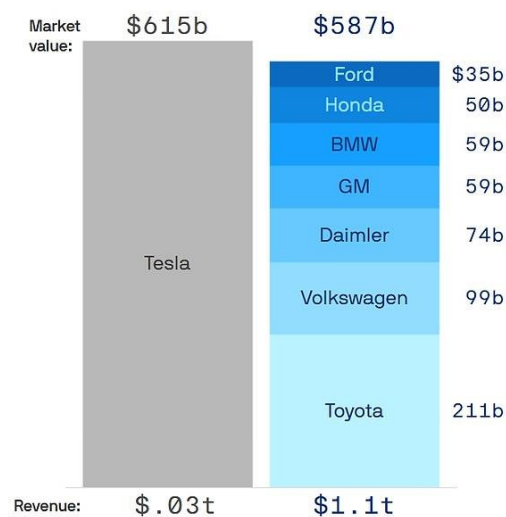


Figure 1.1 The top 8 car companies by market capitalization (2020) ³.

Many cases demonstrate strategic decision effects, like Apple opting to join the smartphone industry, Walmart deciding to participate in online retail, and Netflix selecting to shift toward streaming live events. All of these were risky paths that paid off in the end. Brave moves based on understanding, anticipating, and knowing others, allow organizations to adapt to their respective industries and stay competitive by understanding new patterns and weighing risks against opportunities for progress.

In today's evolving marketplace, businesses must take into account the strategies of their competitors and use these insights to inform their own strategic choices. The decision-making

⁴ (Ausick, P., & Ausick, P. (2020, December 22). Tesla is worth more than all big car companies in the world combined. <https://247wallst.com/autos/2020/12/22/tesla-is-worth-more-than-all-big-car-companies-in-the-world-combined/>

process against competitors can take either a reactive or proactive approach as described by Robert M. Porter (2004)⁵. Reacting involves responding to a competitor's moves with opportunistic actions. While this approach allows for quick adaptation to shifts in the marketplace, it also risks less innovation as one fails to envision impending changes.

On the other hand, being proactive means planning and taking action before your competitors do, which is about staying ahead of the game. As Porter noted, taking this approach means staying ahead of others, but being proactive also requires significant time and financial investments in prediction. Therefore, a combination of being proactive and reactive is the wisest strategy, the organization can proactively guide market developments while still monitoring competitors to react seamlessly. Being able to anticipate changes while also being adaptable to unexpected situations allows for greater flexibility.

Strategic decisions in competitive industries rely on careful consideration of many factors. This includes a deep understanding of market dynamics, competition, internal resources, risk assessment, technological advancements, economic conditions, globalization, sustainability, scenario planning, and many other factors that are interconnected in one way or another.

Recently, Machine Learning (ML) has been found to be quite convenient for businesses in their strategic decision-making processes. Machine learning algorithms possess the ability to detect patterns, trends, and even minute insights that humans may overlook when dealing with large volumes of data. Take the automotive industry as an example, where machine learning algorithms can be applied to assess information regarding consumer preferences and market trends.

Organizations can also gain advantages from machine learning by discovering the connections between various factors and the extent to which these connections can influence decision-making processes. By recognizing patterns and trends that may influence their operations, companies can aid in making proactive choices to maintain a competitive edge.

As shown in Figure 1.2, external investment in AI-focused companies was distributed by technology category in 2016, with machine learning receiving the highest investment amount.

⁵ Robert M. Porter (2004), Proactive vs Reactive: Which Management Style Is Best?

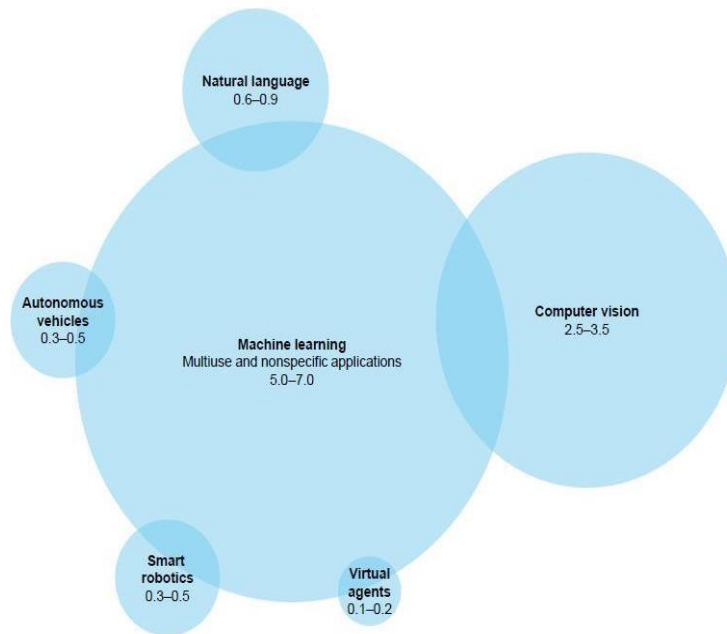


Figure 1.2. External Investment in Machine learning companies by technology category⁶.

Using predictive modeling statistics and machine learning to predict outcomes, provides companies with a competitive advantage and long-term success. By analyzing data, it identifies patterns of new insights and helps identify risks and opportunities to make better decisions. Machine learning also provides a more accurate understanding of a company's competitive environment and identifies areas of weakness and opportunities that can be exploited.

However, it is important to note that while algorithms analyze statistics, human judgment is also important to make the final decision. A balanced approach applying both machine computation and human perspectives leads to well-informed action in uncertain commercial environments. The strengths of humans and machines in decision-making can be combined to take advantage of the advantages that they offer to help organizations make the most well-informed decisions.

⁶ (Source: Capital IQ, Pitchbook, Dealogic, McKinsey Global Institute analysis)

1.2 Problem Statement

Companies face many difficulties in the ever-changing manufacturing and industry sectors to remain competitive. One major problem for most of the manufacturing companies in rivalry industrial markets is the difficulties that companies usually face when determining how to respond strategically to the actions of their competitors. As markets become more complex and competitive, companies need to continue to make wise decisions to maintain or improve their competitive advantage. Companies face complex decisions that require considering various factors. Understanding how businesses respond to competitive challenges and predict strategic decision-making patterns can provide a significant advantage.

This research, by addressing the aforementioned problem, seeks to study how organizations respond to competitors' decisions and create predictive models to assist decision-makers. Creating a more competitive and agile business approach is the goal, to enabling firms to predict their rivals' actions, react swiftly, and make calculated choices that will lead to long-term success. This research proposes a machine learning-based methodology to help organizations in strategic decision processes.

The present thesis centers on the difficulties organizations meet when deciding how to respond strategically to the acts of competitors. To stay ahead of the competition, organizations must be able to make wise decisions as they become more complex and fiercer. To accomplish this, they must anticipate an organization's patterns of strategic decision-making and comprehend how it reacts to demands from the competition. To help businesses make better strategic decisions in the face of competition and stay ahead of their rivals, an innovative methodology employing machine learning techniques will be proposed. Decision-makers will then be more prepared to make effective decisions.

1.3 Importance of the Research

It is impossible to overestimate the significance of research on the strategic decision-making that works, especially in the manufacturing and industrial sectors, which are the scope of research. These industries' organizations must contend with fierce competition, which makes it difficult to formulate wise and sensible strategic decisions. Organizations can improve their awareness of the competitive landscape and create predictive models to predict and react to rival actions by

undertaking research and investigating novel ways. This may result in less risk and uncertainty, more responsiveness and agility, and a stronger competitive edge. In the end, reaching corporate goals and objectives depends on making good strategic decisions, and studying in this field can assist organizations in staying ahead of the curve in the quickly evolving business environment of today. In this regard, firms can benefit from the application of promising approaches such as machine learning, game theory, and Multi-Criteria Decision-Making (MCDM) to make better informed and successful strategic decisions when facing competition. In the following sections, details will be provided on how these approaches could be utilized to address the research problem and improve strategic decision-making in the manufacturing and industrial sectors.

1.4 Novelties of the Research

What can be considered as novelties of the current research is addressing the reactive strategic plan by considering the competitors' strategies using a novel machine learning method. The integration of machine learning algorithms to predict and model how organizations respond to competitive pressures represents a breakthrough approach. While previous research has explored various aspects of strategic decision-making, this study aims to provide new perspectives on decision-making patterns and predictability, potentially revealing previously undetected insights and patterns. The novelty of this research lies in combining traditional strategic management concepts with machine learning. This approach offers organizations a more comprehensive and predictive framework to cope with the complexities of highly competitive markets.

1.5 Hypothesis of the Research

The purpose of this research is to investigate how effectively machine learning predicts patterns of strategic decision-making in businesses in response to competitors' actions. The following hypothesis will serve as the basis for the investigation:

H0: The use of machine learning can effectively predict strategic decision-making patterns in response to competitors' actions in manufacturing systems.

H1: Otherwise.

This hypothesis will guide the investigation and analysis of the predictive modeling of strategic decision-making patterns in competitive environments using machine learning techniques. We hope to shed light on how strategic decisions and industrial sectors gain a competitive edge by testing these assumptions.

The proposed methodology will employ a novel approach that relies on machine learning algorithms to evaluate and decide whether to accept or reject the null hypothesis (H_0).

1.6 Questions of the Research

This research aims to answer the following questions related to the use of machine learning in predicting and modeling strategic decision-making patterns in the Manufacturing and industrial sectors. These questions include:

- **Main Question:**

1. To what extent can predictive models of strategic decision-making patterns improve the performance of manufacturing companies?

- **Other Questions:**

2. Which factors influence the way businesses react to competitor's decisions?
3. What are the correlations between different factors and to what extent such correlations can affect decision-making patterns?
4. To what extent each of the identified factors can affect the efficiency of the strategic decisions in manufacturing systems?

By answering these questions, this research aims to provide valuable insights into the effectiveness of machine learning in improving decision-making processes and gaining a competitive advantage in the Manufacturing and industrial sectors. The findings of this research can help organizations make more informed decisions, anticipate competitors' actions, and adapt their strategies proactively to maintain or gain a competitive edge.

1.7 Objectives of the Research

Objectives should be set to measure the value of each aforementioned question. For this purpose, the following objectives will be set:

- **Main Objective:**

1. To determine strategic decision plans of manufacturing systems based on competitor's strategic decision patterns.

- **Other Objectives:**

2. To find the most important factors that affect a company's decision-making strategy.
3. To examine the correlations between these influential factors.
4. To determine how each factor influences success in strategic decisions.

1.8 Scope and Limitations

- This research will be conducted within the scope of manufacturing and industrial sectors with a focus on organizations operating within this domain.
- This research will be focused on organizations operating within Malaysia.
- This research excludes global economic events, geopolitical changes, or unforeseen disruptions factors.
- This research will be focused on the Automotive industry.

By acknowledging these limitations and defining the scope, this research seeks to provide a comprehensive understanding of strategic decision-making patterns in the Manufacturing & Industrial sector, while recognizing the constraints inherent in the study.

1.9 Conclusion of the Chapter

This chapter introduces the research topic of "Predictive Modeling of Strategic Decision-Making Patterns in the Presence of Competitors' Decisions using Machine Learning Techniques." By

highlighting the importance of this research and how it can help organizations make more effective strategic decisions in the dynamic and highly competitive manufacturing and industrial sectors. The chapter highlighted a set of hypotheses, research questions, and research objectives that will lead the focus and direction of the study. The scope and limitations of the research, including the industry sector of interest and potential constraints in the study's design, were also discussed. This chapter lays the groundwork for a thorough investigation into how machine learning can assist organizations in responding to competitor actions strategically and ultimately lead to their success in competitive markets.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction of the Chapter

This chapter introduces and explains the use of machine learning in strategic decision-making patterns when dealing with competitor decisions. Additionally, it will review previous studies conducted by different researchers related to strategic decision-making, machine learning techniques, and how they were employed in previous applications. Furthermore, it will cover MCDM methods, competitor analysis, game theory, and the use of machine learning methods in the strategic decision-making process.

The following four questions are aimed to be addressed through this literature review:

1. Has anyone else covered this topic before?
2. What is the history of the topic (what problem statements have been covered so far)?
3. Which methods have been used successfully to cover similar problems?
4. What gaps still exist in the area of the research?

2.2 Methodology of Reviewing the References

In this research, the opted references will be downloaded from Google Scholar by using the keywords that will be clarified in the next section (Section 2.3). Afterwards, in order to provide a comprehensive review for each reference, the following items, as shown in Figure 2.1, will be taken into consideration:

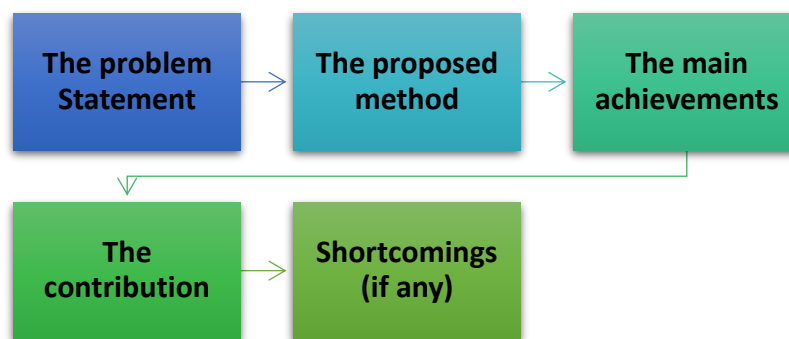


Figure 2.1 Key elements of a reference review.

2.3 Scope (domain) of the Studied Literature

The literature review will focus on research conducted within the past five years, including the essential aspects shown in Figure 2.2. These aspects will be given careful thought and consideration, with the primary focus on understanding the intersections of these areas and exploring how machine learning techniques can enhance predictive modeling in the context of strategic decision-making.

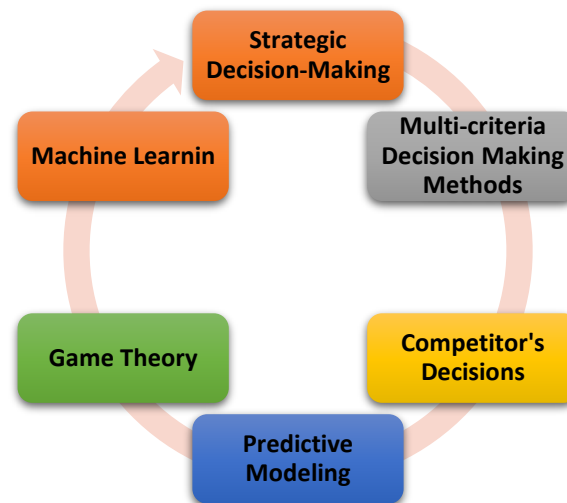


Figure 2.2 Essential elements of a literature review.

2.4 Strategic Decision-Making

Strategic decision-making refers to the process of making choices related to an organization's long-term direction. This includes deciding what objectives, resources, and capabilities to develop, and what actions are necessary to achieve these objectives, considering the relevant internal and external circumstances. Important decisions that have long-term impacts on the organization are usually made by top management, which involves a significant commitment of resources. Therefore, organizations must make informed decisions to be able to balance risks and rewards to remain competitive and achieve long-term success. It has been found that as social beings, we rely on our personal experiences, perspectives, and perceptions of others to make decisions that affect all aspects of our lives, even our work, and this may have negative effects (Suzuki & O'Doherty, 2020). According to (Papadakis & Barwise, 1997) strategic decision-making is important because of the five characteristics of strategic decisions, it requires risky decisions with long-term effects,

contributes to organizational learning, develops individual managers, and cuts across functions and disciplines.

In research by (Alzoubi & Aziz, 2021), managers of national banks in the United Arab Emirates filled out 213 questionnaires for research on the correlation between top management's social intelligence and the quality of the strategic decisions they make for their organizations. According to the research findings, following analysis and research on the data was shown that social intelligence and the quality of those managers' decisions were significantly and positively correlated. To improve decision-making accuracy and reduce the impact of human emotions, machine learning technology can assess data based on reliable scientific and statistical grounds.

By comparing human and machine learning decision-making, a new framework was developed that combines both approaches to improve organizational Strategic decision-making, (Shrestha et al., 2019) proposed a framework that outlines three categories for combining human and machine learning-based decision-making, identifies key factors that differentiate human and AI-based decision-making, provides practical examples, and emphasizes the importance of managers understanding machine learning's strengths and weaknesses, the framework offers insights on leveraging both human and machine learning decision-making to improve decision quality and performance.

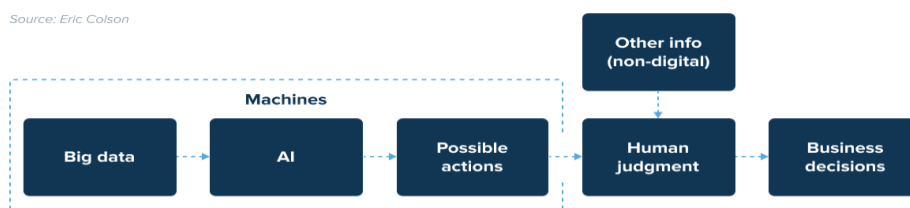


Figure 2.3 The model of AI decision-making⁷.

While machine learning can provide valuable support, human judgment, and experience remain essential for interpreting results and making final decisions as shown in Figure 2.3, using a hybrid approach that combines human and AI decision-making can effectively leverage the strengths of both approaches, leading to more informed and impactful strategic decisions. Overall, the studies

⁷ Zharovskikh, A. (2023, October 24). How artificial intelligence will change decision making. <https://indatalabs.com/blog/artificial-intelligence-decision-making>

above have proven that machine learning can be a valuable tool for enhancing the strategic decision-making process, and it can help organizations gain deeper insights and make more informed decisions that drive their long-term growth.

2.5 Multi-criteria Decision-Making Methods

Multiple criteria Decision-making (MCDM) is described as a complex decision-making tool that includes both quantitative and qualitative factors. Several MCDM methods and strategies have been proposed previously for determining the best decision among different options, sometimes with different weights. With the use of these techniques, upper management can evaluate various options according to a variety of conflicting factors. In addition, engineering, business, economics, and industry are just a few of the fields that have adopted MCDM methodologies because of their general applicability. These methods solve problems by analyzing several factors to identify the desired outcome, so without considering the decision-making process, no choice can be made effectively.

According to (Odu, 2019), when making decisions that involve multiple criteria, it is important to evaluate each criterion's importance independently, for a method to ensure objectivity, it is necessary to consider all factors that may affect each criterion's weight, the results showed that subjective weighting methods are simpler to calculate than objective weighting methods, which rely on mathematical functions to determine weights without the decision-maker's input. Furthermore, it is worthwhile to consider (Zlaugotne et al., 2020) perspective that choosing the right decision-making method is essential for making the final decision, because these methods use different techniques; for instance, TOPSIS uses normalization based on the sum of squares, while AHP uses pairwise comparisons to derive criteria weights. Several MCDM methods exist with differences in algorithm complexity, weighting criteria, preference representation, uncertain data handling, and data aggregation (Bączkiewicz et al., 2021).

The different MCDM methods that can be used to improve the strategic decision process will be explored briefly in the following sections.

2.5.1 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a method for making complex decisions that use math and psychology, was developed by Thomas L. Saaty in the 1970s. It helps to organize and analyse information in a structured way (Bukhsh et al., 2017). Due to its flexibility and many applications that can be used, Integrated AHP is a widely used and well-known decision-making technique that effectively supports decision-making processes (Ho & Ma, 2018). According to, (Dos Santos et al., 2019) many studies have used the AHP to support decision-making for strategic decision, on its own and in combination with other techniques, such as fuzzy theory, TOPSIS, and principal component analysis (PCA), and others.

For supplier selection in the automobile industry, (Dweiri et al., 2016) designed an integrated AHP-based decision support system, which is used to rank suppliers according to the fundamental criteria of cost, excellence, timeliness, and support, using surveys with experts in the automobile industry, the AHP approach is applied to assess the relative importance of criteria and sub-criteria, there was an 8% decrease in the number of inbound rejections when the study's suggested methodology was effectively used in a case company.

Furthermore, AHP approach's strength lies in its consideration of pairwise comparisons, enabling a thorough evaluation of criteria weights, however, it can be time-consuming when dealing with multiple criteria and requires consistency in the comparisons made, despite these weaknesses, pairwise comparisons offer valuable insights for decision-making (Zlaugotne et al., 2020). According to (Ho & Ma, 2018) new ways to enhancing the integration of AHP with other decision-making tools, including big data analytics, machine learning, or Artificial Intelligence (AI), may be investigated through the development of innovative integrated AHP approaches. Figure 2.4 illustrate an example of hierarchical structure as stated by (Saaty, 2001):

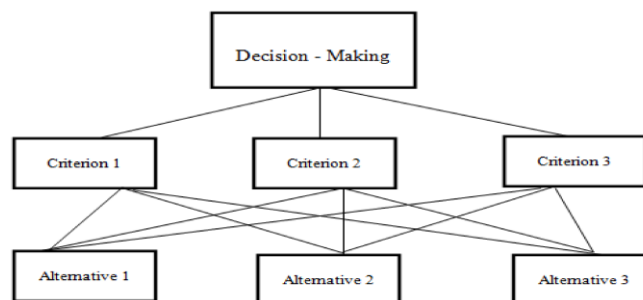


Figure 2.4 A hierarchical structure by AHP.

AHP is a popular and extensively used decision-making approach that successfully supports decision-making processes, according to the reviewed sources above. It has been effective in several domains, including supplier selection, sustainable building, and risk management. The advantages and disadvantages of AHP should thus be considered when presenting a new technique, as should alternative viable approaches that have been employed effectively in the past for comparable research projects.

2.5.2 Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

TOPSIS is one of the techniques used in multi-criteria decision-making, widely applicable method that employs a simple mathematical model, also practical due to its computer support capabilities. The method comprises identifying the positive and negative ideal solutions, calculating the distances of alternatives to these solutions, and ranking the alternatives based on these distances, it's goal is to choose the best option from a set of alternatives based on multiple criteria (Behzadian et al., 2012). The positive and negative ideal solutions are determined based on the maximum and minimum values of each criterion, while the positive ideal solution represents the best possible values for each criterion, the negative ideal solution represents the worst possible values, then these solutions help in evaluating the alternatives by calculating their distances to these ideal solutions(Pavić & Novoselac, 2013). The method has been improved through several researches, as noted by (Çelikkilek & Tüysüz, 2020).

In the study paper (Zaeri et al., 2011) discussed the challenge of supplier selection in supply chain management and proposed a three-step methodology for effective supplier evaluation, which involves identifying evaluation criteria, weighting them with expert input, and ranking suppliers using the TOPSIS method. The research emphasizes the importance of selecting suppliers with the highest potential for consistently meeting a firm's needs and contributes to the field by providing a rational and straightforward approach to supplier evaluation based on TOPSIS, to enhance supply chain performance. Moreover, (Guo & Zhao, 2015) employed TOPSIS method to select the optimal electric vehicle charging station (EVCS) site by considering economic, social, and environmental criteria, using 11 sustainability-related sub-criteria involved in the evaluation index system for EVCS site selection, and effectively determining the optimal EVCS site and performing

sensitivity analysis for robustness, also provide a new perspective for EVCS site selection and extend the applications of the TOPSIS method.

Therefore, in order to evaluate the risk categories that are common in international projects and rank them based on their impact on project success, (Dandage et al., 2018) paper suggested using the TOPSIS method as a useful tool for project managers to plan appropriate risk response strategies and suggests that a larger sample size of decision-makers and more project variety can give more exhaustive risk categories and their ranking. Additionally, (Jia et al., 2018) research proposed a multi-criteria evaluation framework for selecting between Accelerated Bridge Construction (ABC) and conventional bridge construction using the TOPSIS approach, the method estimates construction, agency, and user costs and demonstrates the advantage of using TOPSIS in decision-making.

Figure 2.5 illustrates the seven basic processes that make the structure of the TOPSIS technique for selecting the optimal alternative.

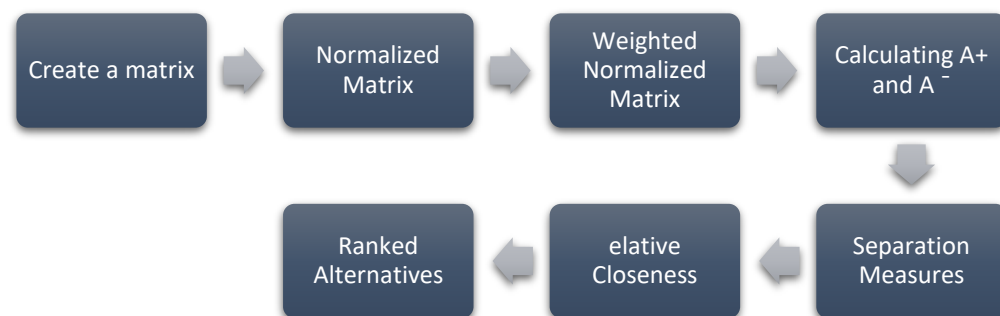


Figure 2.5 TOPSIS method steps.

The reviewed studies show TOPSIS as a powerful tool for diverse decision-making. Its ideal solution and distance-based approach are crucial factors to consider in our upcoming methodology. Additionally, its success in various fields like supplier selection and project risk management shows promise for its application in similar challenges within our own research.

2.5.3 Elimination and Choice Expressing Preference (ELECTRE)

ELECTRE is a set of methods that help compare alternatives based on a set of criteria and select the best ones using a preference threshold, was first discovered by (Benayoun et al., 1966). It's useful when there are multiple criteria to consider and when the decision maker wants to use non-

compensatory rules (Elsayed et al., 2017). The ELECTRE methods are used when multiple criteria are involved and non-compensatory rules are desired for decision making, these methods include ELECTRE I, ELECTRE-IV, and ELECTRE-IS for choice problem, and ELECTRE-II, ELECTRE-III, ELECTRE-IV, ELECTRE-A, and ELECTRE-TRI for ranking actions (Yu et al., 2018).

The ELECTRE methods are a well-known way to rank a group of options based on their outranking relationships, a synthetic weight is used to determine the concepts of concordance and discordance, this weight includes both subjective and objective factors (Fei et al., 2019). In the study of (Yücel & Görener, 2016), ELECTRE is used as a decision-making model for evaluation of transportation investments for urban city transport. Company location criteria have been evaluated by the ELECTRE method using in determining optimal location choice (Norese, 2006). ELECTRE is considered as a tool for shipping company, by means of these analyses, the location of the new branch of the shipping company was determined in the study of (Afshari et al., 2010)

The ELECTRE method has limitations and complexities that make it less suitable for the next chapter. It is complex, prioritizes outranking, has the potential for subjectivity, and there are alternative methods that might better suit the research needs.

It is essential to consider (Mary & Suganya, 2016) research when explained the ELECTRE steps as shown in Figure 2.6 and proposed a new method for software requirements prioritization using the ELECTRE method for multi-criteria decision making, which allows multiple stakeholders to rank requirements independently and considers diverse interests and preferences, the main achievement is the development of a web-based decision support model that provides an efficient ranking of software requirements. However, the potential limitations could include the complexity of implementing the method and the need for stakeholder training in using the proposed approach.

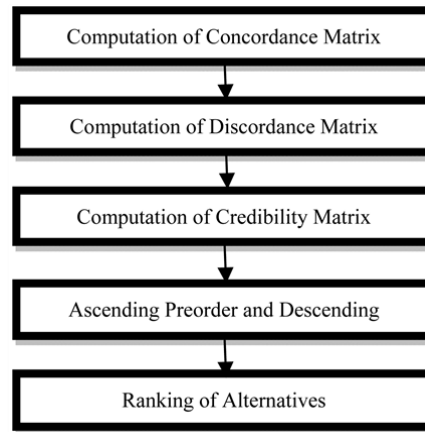


Figure 2.6 ELECTRE steps

2.5.4 COPRAS method

The Complex Proportional Assessment (COPRAS) is one of the well-known MCDM methods, which select the best alternative among a lot of feasible alternatives by determining a solution with direct and proportional ratio to the best solution to the ratio with the ideal-worst solution, first proposed in 1994 by (Zavadskas et al., 1994). COPRAS is an appropriate method to process the information in a reasonable and efficient way (Zheng et al., 2018), and powerful ranking method that actively considers the nature of criteria by handling preferences from different angles along with consideration to direct and proportional alternatives' relationship (Zavadskas et al., 2008). By employing COPRAS in the decision-making process, decision-makers can weigh and prioritize different criteria, helping them choose the most suitable alternative.

(Mousavi-Nasab & Sotoudeh-Anvari, 2017) analyzed the efficacy of COPRAS approach for auxiliary tool selection by comparison with other MCDM methods. The COPRAS method is applied for finding the best alternative in the drilling process on Al alloy using a solid carbide drill bit with a high-pressure coolant (Stanojkovic & Radovanovic, 2017). Moreover, COPRAS has been employed as a strategic decision-making tool, specifically in addressing group decision-making problems, in the site selection process for wind farms, according to (Chatterjee & Bose, 2013), showcasing its adaptability in handling complex decision scenarios. (Lu et al., 2021) applied COPRAS to address Multiple Attribute Group Decision-Making (MAGDM) issues. One notable application is in the optimal selection of green suppliers, emphasizing its relevance in

sustainable and environmentally conscious decision processes. Figure 2.7 illustrate how COPRAS works.

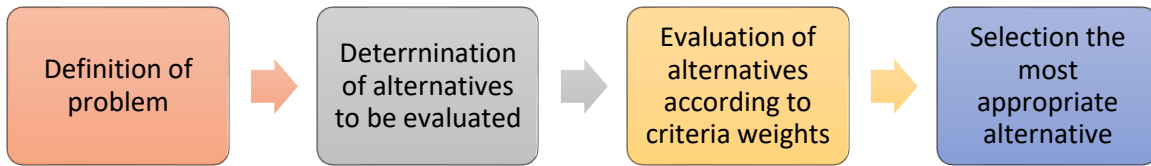


Figure 2.7 COPRAS method

Based on the review made above, it is clear that COPRAS is an interesting and flexible approach for MCDM. Moreover, (Zheng et al., 2018) rightly pointed out the superiority of COPRAS method as (i) simple and straightforward approach; (ii) considers the nature of criteria for better ranking of alternatives; (iii) offers ranking from different angles based on the calculation of complex proportional factors; and (iv) final ranking of alternatives is influenced by strategy values that associates degree of importance to the types of criteria. Driven by these advantages of COPRAS approach is effective in decision-making in various fields. Previous studies have shown that it can provide valuable insights and a scientific decision support system for complex decisions. Therefore, it is important to consider this method in proposing a methodology for accurate and objective results in the next chapter.

2.5.5 AHP/TOPSIS hybrid method

The integration of AHP with TOPSIS helps in ranking alternatives based on their proximity to the ideal solution. AHP used to determine the weights of each criterion, and then weights that were identified by the AHP were then employed to select the best alternative using TOPSIS method (Ulkhaq et al., 2018).

To improve electronic supply chain management (e-SCM) performance, (Tyagi et al., 2014) developed a hierarchy-based model with five alternatives and used a hybrid approach of AHP and TOPSIS to analyze the model. The analysis revealed that investment in web-based technologies holds the first rank among all considered alternatives. The proposed method provides a comprehensive framework and insights to managers on how to improve e-SCM performance. Therefore, (Yayla et al., 2015) proposed new methodology, a hybrid fuzzy MCDM methodology

for evaluating third-party logistics (3PL) transportation providers. It involves identifying strategic goals and sub-attributes, determining evaluation criteria weights using fuzzy-AHP extension algorithm, and using the fuzzy-TOPSIS to select the most suitable providers.

Integrated AHP and TOPSIS methods to select the most suitable tomography equipment, are presented by (Barrios et al., 2016), where AHP defines weights and TOPSIS evaluates purchase options, this provides decision makers with a scientific decision support system for complex decisions. The proposed methodology shown in Figure 2.8, which chooses the best purchase for tomography equipment in a clinic.

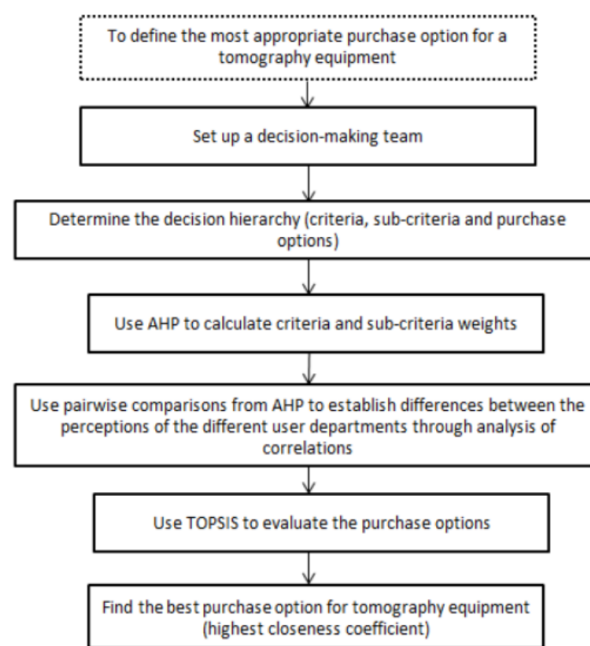


Figure 2.8 Proposed methodology by (Barrios et al., 2016).

However, a new methodology by (Chen, 2020) proposed a decision-making model called entropy-AHP weighted TOPSIS for selecting a building material supplier in supply chain management, the model integrates the entropy weight method, AHP, and TOPSIS to provide a systematic approach for supplier selection based on multiple criteria. It demonstrates its applicability through a numerical example and contributes to improving supply chain management by enhancing the accuracy of criterion weights. Similarly, (Issa et al., 2022) presented a decision support approach for selecting deep excavation supporting systems (DESSs) in construction projects, It combines AHP with fuzzy TOPSIS to handle uncertainty and multiple criteria, the model is applied to a real case study in Egypt, comparing secant pile walls, sheet pile walls, and soldier piles and lagging.

The results show secant piles as the preferred choice, followed by sheet pile walls and soldier piles and lagging, with a sensitivity analysis conducted to assess the impact of criteria weights.

2.5.6 Selecting MCDM Method

Determining the appropriate MCDM method is crucial for the predictive modeling of strategic decision-making using the machine learning model. Table 2.1 provides Comparison of AHP, TOPSIS, ELECTRE, AHP/TOPSIS, and COPRAS that were extracted from opted references (Govindan & Jepsen, 2016; Zlaugotne et al., 2020).

Table 2.1 SUMMARY OF MCDA METHODS

	AHP	TOPSIS	ELECTRE	AHP/TOPSIS	COPRAS
Normalization	Vector normalization (sum)	Vector normalization (square root of sum (L2normalization))	Not explicitly required	Combination of AHP and TOPSIS L2 normalization	Normalization to standardize the criteria values
Suitability	Choice, ranking, and sorting problems	Choice problems, ranking problems	Choice problems, sorting problems	Choice problems, ranking problems	Problems involving multiple criteria., criteria are complex and interrelated.
Inputs	Pairwise comparison on ratio scale (1–9)	Ideal and anti-ideal option weights	Pairwise comparisons on ordinal scale	Combination of AHP and TOPSIS	Performance Table Assigning weights to criteria based on their relative
Outputs	Complete ranking with scores	Complete ranking with closeness score to ideal and distance to anti-ideal	Complete ranking with preference and indifference thresholds	Complete ranking scores, closeness to ideal, and distance to anti-ideal	Alternatives based on their overall performance, considering the weighted criteria
Preference function	The pairwise comparisons	Distance metric (Euclidean distance, Manhattan distance, Tchebycheff distance)	Outranking relations and thresholds.	Combines AHP pairwise preferences with TOPSIS distance metrics	Employs a complex proportional preference function to determine the overall performance

					of each alternative
Approach	Qualitative Ranking	Qualitative and/or quantitative	Mixed qualitative and quantitative	Mixed qualitative and quantitative	Quantitative Ranking
Ranking scale	0 to 1	0 to 1	Ordinal scale (e.g., "best," "good," "neutral," "bad," "worst")	Combination of AHP score scale (0-1) and TOPSIS closeness/distance scores	Numerical, with higher values indicating better overall performance
Best alternative	Max value	Max value	No explicit best alternative	Max score, high closeness to ideal, and low distance to anti-ideal	The one with the highest overall performance score, considering the weighted criteria
Consistency levels	9	no restrictions	no restrictions	Requires consistency checks for both AHP and TOPSIS	May involve consistency checks to ensure the reliability of process
Strengths	Flexible, considers pairwise comparisons, well-understood	Simple, easy to implement, considers both ideal solutions	Handles non-compensatory preferences, flexible	Comprehensive, combines strengths of both methods	It handles complex decisions with weighted criteria
Weaknesses	Time-consuming for many criteria, requires consistency	Sensitive to normalization, ignores uncertainty in weights	Requires more information, challenging to interpret	More complex than individual methods	Needs a lot of data and may be hard to interpret for those unfamiliar with it
Software	MS Excel, MakeIt Rational, Expert Choice, Decision Lens, HIPRE 3+, Right Choice DSS, Criterium, Easy Mind.	MS Excel, MATLAB, Decerns	Decerns, ELECTRE-III	MS Excel, May require custom implementation or specialized software	Using specialized software designed for multi-criteria decision analysis

Based on the studied references above, it can be concluded that COPRAS is a promising method for solving complex decision problems with different criteria. This method has been successfully used before in similar research studies and offers a robust framework for structuring decision problems, incorporating expert judgment, and ensuring a logically sound and objective final decision. Therefore, the COPRAS method will be employed in the next chapter to develop a new methodology for addressing the specific challenges of this research. COPRAS will be used to choose the best alternative (respond plan) to mitigate the competitor's plan.

2.6 Competitor's Decisions

As Sun Tzu (1963, p. 84)⁸ once said “Know the enemy and know yourself; in a hundred battles you will never be in peril”. In today's rivalry industrial world that was set based on competition, to remain competitive in the market, you not only need to know your strengths and weaknesses, but you must also know your competitors and anticipate their movements, as it is an integral part of strategic planning. By understanding your competitors and analyzing the available information, you can exploit their weaknesses and take advantage of the opportunities and space they leave. Also, using tools such as Game Theory improves the company's ability to predict by providing insights into competitors' strategies and how to deal with them with counter strategies which will be clarified in the next section (Section 2.7).

According to (Pfeffer & Leblebici, 1973) competition increases the need for control and coordination within an organization, which leads to more reporting, advanced decision-making, and a taller structure, the degree of competition in the environment, along with the number of products, production technology, and product design, can interact to determine the organization's structure. While Less competition can lead to decentralization, less formalization, and less departments.

Managers are often advised, “beat your competitors,” which sometimes contrasts with the advice, “do the best for your firm.”, this may lead managers to focus on comparative measures such as market share (Armstrong & Collopy, 1996). Managers who focus only on the product market arena

⁸ Sun Tzu (1963, p. 84): The Art of War by Sun Tzu

in scanning their competitive environment may fail to notice threats that are developing due to the resources and latent capabilities of indirect or potential competitors (Bergen & Peteraf, 2002).

According to the Research by (Levine et al., 2017), analytic skills and strategic intelligence both independently and interactively affect competitive performance, they are beneficial in optimizing and managing cooperative efforts within a firm, while strategic intelligence is crucial for interacting strategically with competitors. The study found that individuals with higher levels of both analytic skill and strategic intelligence outperformed their competitors in a highly competitive market. The researchers suggest that understanding the mindset of competitors is crucial for making strategic decisions.

Businesses must be able to make wise judgments to remain ahead of the competition as it becomes increasingly complicated and fierce. They must anticipate an organization's strategic decision-making tendencies and comprehend how it reacts to demands from the competition to achieve this. By using machine learning algorithms to learn from historical data, organizations can identify patterns and relationships that can help predict future events.

Table 2.2 displays common competitor response strategies found in various sources (Hall & Pitt, 2020; Paley, 2021; Rajagopal & Rajagopal, 2012).

Table 2.2 Common Competitor Response Strategies

Strategy	Description	Examples
Direct confrontation	Matching competitor's actions head-on.	Price wars, product differentiation, advertising campaigns
Flanking maneuver	Attacking competitor's weaknesses or exploiting gaps in its market coverage.	Entering new markets, launching innovative products, targeting underserved customer segments
Encirclement	Surrounding competitor by establishing dominant positions in multiple market segments.	Diversifying product portfolio, expanding distribution channels, building strong brand loyalty
Guerilla warfare	Engaging in hit-and-run tactics to disrupt competitor's operations.	Disruptive marketing campaigns, surprise product launches, targeted customer poaching
Cooperative alliances	Collaborating with competitors to achieve mutual benefits.	Joint ventures, technology sharing agreements, price-fixing agreements

2.7 Game Theory

Game theory is a mathematical tool used to study situations of competition and cooperation between multiple parties (Peters, 2015). In other words, Game theory is the study of strategic decision-making in competitive situations. The fundamental idea behind game theory is to optimize one's results by anticipating and reacting to the actions of others. This enables businesses to assess various scenarios, identify potential pitfalls and opportunities, and ultimately make informed decisions that maximize their payoffs in competitive environments. Whether it's anticipating pricing strategies, predicting market entry, or navigating complex negotiations, game theory equips businesses with the tools to navigate the intricate dynamics of competition (Peters, 2015).

The Prisoner's Dilemma is a famous game theory in which two individuals must decide to cooperate or defect. The best outcome for both is cooperation, but the dominant strategy is to defect (Rapoport, 1989). International relations, commerce, and politics are just a few of the real-world circumstances that the game has been examined and prove its functionality. The Prisoner's Dilemma game is illustrated graphically in Figure 2.9 and is usually displayed as a matrix with four alternative outcomes.

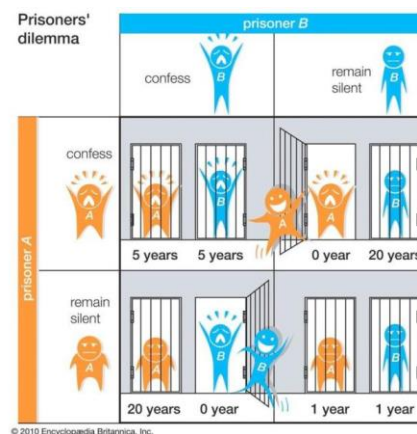


Figure 2.9 A classic game theory example: the prisoner's dilemma.⁹

Game theory has been employed traditionally as a modeling tool for describing and influencing behavior in societal systems, recently, game theory has emerged as a valuable tool for controlling

⁹ Malta, T. O. (2023, September 17). To do or not to do: the logical challenges of mathematics. Times of Malta. <https://timesofmalta.com/articles/view/to-do-logical-challenges-mathematics.1054708>

or prescribing behavior in distributed engineered systems(Marden & Shamma, 2015). According to (Ghasemi et al., 2023) in the COVID-19 pandemic, a game theory model was developed, in this model, the government and interdictor are the main players in suggesting the best location, routing and allocation of medical centers to distribution warehouses during the outbreak of Covid-19. Additionally, game theory was successfully applied to locate distribution centers, vehicle routing, and inventory problems under earthquake conditions (Ghasemi et al., 2022).

Based on (Mamoudan et al., 2022) research, the most practical approaches that can be used in green supply chain management is the use of game theory, which can lead to a constructive interaction, a game theory model presented for a 2-echelon green supply chain with a supplier and two retailers, in this model, the brand value of manufacturers, the price of products, corruption, and the demand rate have an attributive impact., all these factors are significant factors that influence customers' decisions to choose different products.

Furthermore, game theory can be combined with machine learning to predict and optimize strategic decision-making patterns in competitive settings., a new method was proposed to speed up deep learning without using a second derivative of the objective function. The new algorithm was tested on a real dataset and showed better performance compared to other similar models.(Tembine, 2019). On the other side, (Liu et al., 2020) proposed a game-theoretic approach for distributed machine learning over networks, where nodes make rational choices. Players decide learning parameters and network structure, and the Nash equilibrium characterizes the tradeoff between local performance and global agreement.

Additionally, (Hindia et al., 2015) developed a new algorithm that combines cooperative game theory and TOPSIS to improve resource allocation for smart grid applications, the algorithm distributes resources fairly among applications by calculating bankruptcy and Shapley value from cooperative game theory, then, it allocates resources to users' applications according to their preferences using the TOPSIS method, Figure 2.10 illustrates a general diagram of the proposed model, the algorithm's results showed significant improvement in scheduling compared to other algorithms. The findings of this study showed that Integrating game theory and TOPSIS algorithm helped allocate resources better, which lead to better decision-making, also prove that the scheduling scheme improved significantly compared to other algorithms.

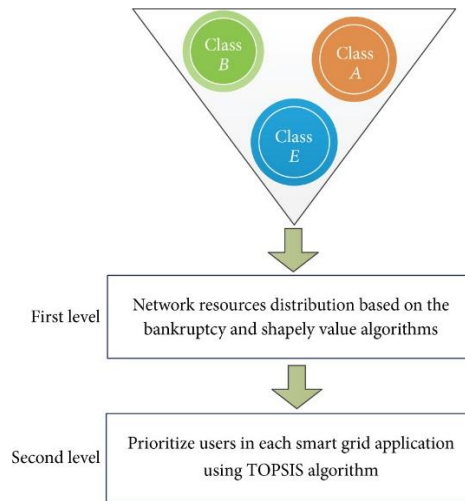


Figure 2.10 General diagram of the proposed model by (Hindia et al., 2015).

Based on the aforementioned references, as evidenced by the successful applications in green supply chain management, pandemic response, and distributed machine learning, game theory provides valuable insights for optimizing decision-making and achieving desirable outcomes. Combining game theory with machine learning offers an exciting approach to predicting strategic decision-making patterns in competitive settings. This combination holds significant promise for improving predictive models across various fields. Moving forward, further research should explore how game theory can be effectively integrated with machine learning to not only predict strategic decision-making patterns but also optimize them for a desired outcome.

2.8 Machine Learning

Machine learning is an evolving branch of computational algorithms that are designed to emulate human intelligence by learning from the surrounding environment (El Naqa & Murphy, 2015). Large-scale data analysis and identification of patterns using machine learning techniques provide an effective tool for strategic decision-making. In this area, traditional forecasting techniques often fall short because they are unable to fully capture the complex connections and dynamic changes that exist in competitive contexts. Previous research will be discussed to support the investigation of the potential of machine learning to predict competitor behavior and develop proactive strategic decision for maximizing competitive advantage. For example, building machine learning models with R, Python, and TensorFlow frameworks and tools is shown in Figure 2.11.

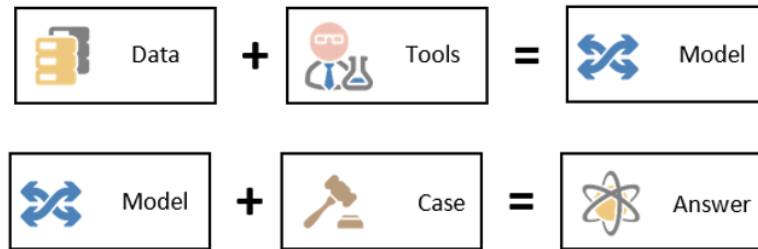


Figure 2.11 How machine learning can be used to enhance the strategic decision-making process.¹⁰

Machine learning algorithms can learn from current context and generalize into new tasks, this capability can improve the safety and effectiveness of radiotherapy practice, leading to better outcomes throughout computers that can learn and improve through experience (El Naqa & Murphy, 2015).

There are three main types of machine learning as shown in Figure 2.12, (Jane & Ganesh, 2019):

- I. Supervised learning: Algorithms require external support and involve splitting input data into training and test sets, the trained data is then used for classification and prediction.
- II. Unsupervised learning: AI algorithm that classifies input sets without guidance, it includes clustering and reduction techniques, where variables are grouped into clusters.
- III. Reinforcement learning: AI branch in which allows automatically determining the behavior within a small context to the machines.

¹⁰ Jackson, A. (2019, August 26). What is machine learning models and its power. <https://www.the-next-tech.com/machine-learning/what-is-machine-learning-models-and-its-power/>

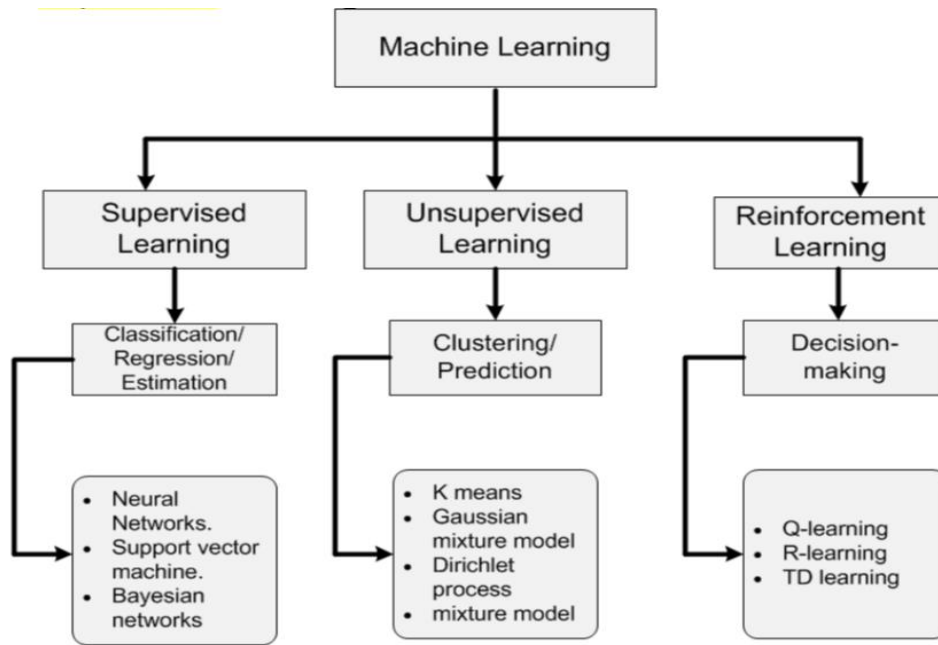


Figure 2.12 Types of Machine learning

Machine learning is increasingly being used in various fields such as health care, manufacturing, education, finance, policing, and marketing, enabling data-driven decision making.(Jordan & Mitchell, 2015). According to (Shalev-Shwartz & Ben-David, 2014), Machine learning is one of the areas of computer science that is expanding the quickest, despite its many uses and increasing impact on banking risk management, however, the profession still has a number of areas where applying machine learning approaches might be beneficial. However, the predictive power of these models can increase over time as more data is added, as evidenced by (Leo et al., 2019) literature review.

Machine learning delivers the capability to detect meaningful patterns in data, and has become a common tool for almost any task faced with the requirement of extracting meaningful information from data sets, moreover, the predictive power of these models can increase over time as more data is added, as evidenced by (Leo et al., 2019). The machine learning programs learn and improve, and can be applied when the problem that has to be dealt has the dual challenge of complexity and the need for adaptability (Shalev-Shwartz & Ben-David, 2014).

The application of machine learning and other AI techniques have been considered for many day-to-day applications in different industries(Fernandez et al., 2017). A decision tree algorithm-based Machine Learning model has been trained and optimized using evolutionary algorithms, this model

proves to be a robust and reliable tool for building analysts, enabling them to explore the expanding solution space. To evaluate the model, three thousand retrofit variations of a case study building were assessed, resulting in a root mean square error of 1.02, which represents 1.7% of error.(Seyedzadeh et al., 2020).

According to the studied references, machine learning has grown in significance as a tool for data-driven decision making across a range of industries. By anticipating competitor behavior and creating proactive strategies to maximize competitive advantage, machine learning clearly has the potential to improve strategic decision-making.

2.9 Using Machine Learning Methods in Strategic Decision-Making Process

The use of machine learning methods in strategic decision-making processes involves leveraging advanced algorithms and data analysis techniques to enhance the quality and efficiency of decision-making within organizations. Organizational performance is largely dependent on its ability to make strategic decisions, which call for thorough assessment of future risks and complicated information analysis. The emergence of machine learning has brought new prospects to improve this procedure, providing predictions and insights based on big data that may guide strategic decisions. Big data is worthless in a vacuum, and its potential value is only revealed when leveraged to drive decision-making (Gandomi & Haider, 2015). According to (Schmitt, 2020) , applications based on machine learning (ML) and artificial intelligence (AI) have the potential to disrupt all major industries, including banking, healthcare, manufacturing, and retail, all of these businesses have begun to use advanced analytics. Figure 2.13 shows which industries involve the most tasks that can be automated or automated by AI, the working hours in selected industries in the U.S, that could be automated/augmented by the use of AI. Tasks with high potential for automation can be transformed by AI with little human involvement, tasks with high potential for augmentation require more human involvement.

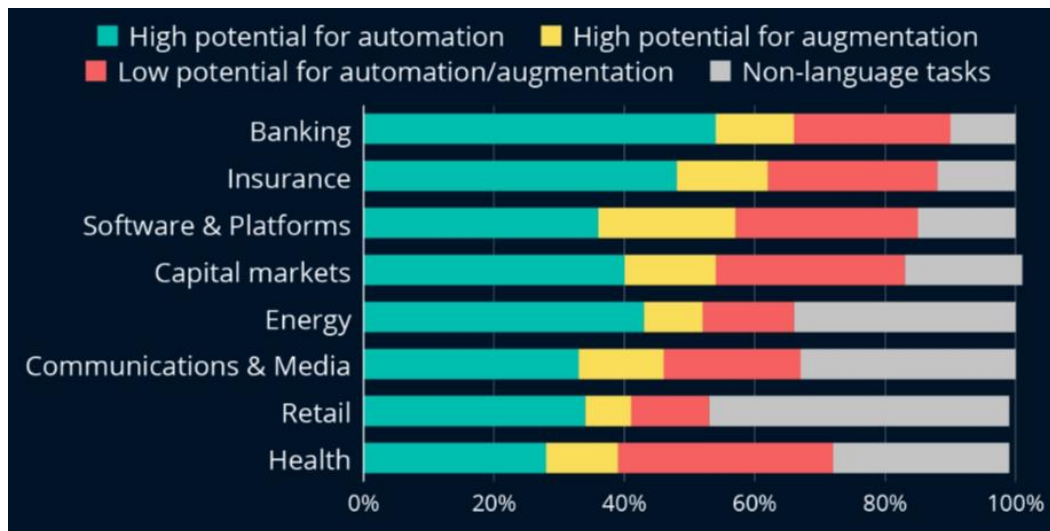


Figure 2.13 In Which Industries Could AI Do Most of the Heavy Lifting?¹¹

In a study conducted by (Miller, 2023) on "The Role of ML and AI in Strategic Management", it was concluded that implementing machine learning and AI can enhance strategic management for businesses while allowing them to analyze massive datasets and uncover hidden patterns to anticipate market shifts, predict customer behavior, and identify potential risks and opportunities, machine learning models can simulate different scenarios and help businesses make more informed decisions under uncertainty.

While (Özemre & Kabadurmus, 2020) proposed a new framework for strategic decision-making using Big Data Analytics (BDA), which uses Random Forest (RF) and Artificial Neural Networks (ANN) algorithms to forecast export volumes, the results showed that the proposed methodology makes accurate trade forecasts and helps to conduct strategic market analysis effectively, is the first study to present a holistic methodology for strategic market analysis using BDA. (Schmitt, 2023) presented a contrasting perspective, by proposing using machine learning algorithms like automated machine learning (AutoML) and predictive models, the study found that manually tuned models overcome AutoML in accuracy, and it highlighted the importance of machine learning expertise in creating robust predictive models.

11 Richter, F. (n.d.). In Which Industries Could AI Do Most of the Heavy Lifting? Statista Daily Data. Retrieved January 19, 2024, from <https://www.statista.com/chart/30160/impact-of-ai-on-work-in-selected-industries>

Additionally, (Nieto et al., 2019) highlighted the use of machine learning algorithms to predict graduate rates, supporting decision-making at the strategic level in higher educational institutions, the main achievement is the identification of Random Forests as the most effective algorithm in predicting student graduates with an accuracy rate of at least 83%.

On the other hand Machine learning algorithms have been proposed by (Brnabic & Hess, 2021) to address the limitations of traditional methods for analyzing real-world databases and create predictive models for informing strategic decision-making, their use has improved patient care decisions, identified patient treatment and intervention choices, and provided a more detailed understanding of outcomes at the patient-provider level, however, there was a need for improvement in consistency in statistical software packages, limited data confidence, and potential risks of reducing patient autonomy when relying solely on data-driven decision making.

In study about resilient supplier selection in digital manufacturing, (Cavalcante et al., 2019) presented a hybrid technique using simulation and supervised machine learning to improve data-driven decision-making for supplier selection, according to the results of the study, machine learning and simulation can be combined to improve resilience in supplier selection.

The aforementioned references point to that big data analytics and machine learning algorithms can greatly improve the effectiveness and quality of decision-making processes across a wide range of industries. Consequently, it is important to consider factors like expertise, risk management, and algorithm selection when developing a new methodology for strategic decision-making, as these findings may be useful in the.

2.10 Base Research

During the literature review, two research papers closely related to the current study were identified:

1. **Title of Paper 1:** A Competitive Intelligence Solution to Predict Competitor Action Using K-modes Algorithm and Rough Set Theory
 - **Authors:** (Sassi et al., 2016)

- **Summary:** The paper proposed a competitive intelligence solution that uses machine learning algorithms to predict and anticipate the actions of a company's competitors. Specifically, the solution was formed of two steps: action association using the k-modes algorithm and actions generation using rough set theory. According to the study, these algorithms had the capability to deal with nominal and inexact data, respectively, and drive rules from it. The paper's main contribution was the development of a complete competitive intelligence solution that could be delivered to the decision-maker, which was an original contribution as there was no work, to the best of their knowledge, that touched on the practical aspect of the field. The paper also highlighted the benefits of implementing a competitive intelligence process within an organization, such as improving analytical skills for managers, identifying new competitors or potential customers, and shedding light on competitor strategies.
2. **Title of Paper 2:** A Review On Big Data With Machine Learning And Fuzzy Logic For Better Decision Making
- **Authors:** (Jane & Ganeshi, 2019)
 - **Summary:** The research provides a review of the use of machine learning and fuzzy logic for better decision-making in the context of big data. First It highlighted the challenges of extracting useful information from large datasets and the need for efficient techniques for real-time decision-making. Then the paper discussed how machine learning and fuzzy logic can be used to extract the needed information by the learning process. Furthermore, the paper presented fuzzy logic as a technique for giving conclusions or decisions from an uncertain problem. The authors conclude that the use of machine learning and fuzzy logic can provide better knowledge-based decision-making and more efficient decision-making processes.

2.11 List of Found Gaps

After conducting the literature review, several gaps were found in the existing research related to using machine learning techniques in strategic decision-making. These gaps are as follows:

- I. Lack of research in applying machine learning techniques to analyze the impact of competitor's decisions on an organization's strategic decision-making.
- II. There are limited studies on the integration of multiple machine learning algorithms to enhance the accuracy of strategic decision-making.

- III. The absence of a comprehensive framework that integrates machine learning algorithms and MCDM methods for strategic decision-making.
- IV. There was limited research on the use of machine learning techniques for forecasting potential competitors' strategies and their impact on the organization's decision-making process.
- V. There is a need for more research on the ethical implications of using machine learning techniques in strategic decision-making.
- VI. Lack of Focus on real-time competitor analysis and a tendency to focus on competitors in general.

Therefore, future research efforts in these areas can help bridge the existing gaps and pave the way toward more effective strategic decision-making.

2.12 Conclusion of the Chapter

This literature review has thoroughly reviewed and analyzed 116 research papers and articles related to strategic decision-making, machine learning, multi-criteria decision-making, competitor analysis, and game theory. These studies were used as references to provide a comprehensive understanding of the existing research on the topic and to answer the aforementioned four research questions.

It reveals that machine learning is widely used in strategic decision-making in businesses. The study found that MCDM methods successfully and effectively improved the strategic decision-making process, particularly the AHP/TOPSIS hybrid method, with significant advantages in terms of accuracy. By combining such AHP/TOPSIS or the game theory approaches with machine learning capabilities to analyze big data, organizations can effectively address patterns in the presence of competitors' decisions. This enables them to make even more effective decisions and accurately predict their competitors' moves.

The findings of this review provide a strong foundation for the next chapter, where a novel methodology will be proposed for predictive modeling of strategic decision-making patterns using machine learning. The insights gained from the reviewed literature will be leveraged to integrate

techniques for achieving predictive modeling of Strategic Decision-Making in the presence of competitors by using machine learning.

References

McCormick, K., & Salcedo, J. (2017). *SPSS statistics for data analysis and visualization*: John Wiley & Sons.

(Ausick, P., & Ausick, P. (2020, December 22). Tesla is worth more than all big car companies in the world combined. <https://247wallst.com/autos/2020/12/22/tesla-is-worth-more-than-all-big-car-companies-in-the-world-combined/>

Definition of strategic adjective from the Oxford Advanced Learner's Dictionary.

GeeksforGeeks. (2023, November 30). Types of Decision making.

<https://www.geeksforgeeks.org/types-of-decision-making/>

Tesla's market value tops \$500 billion for the first time. (2020, November 24). CNN.

<https://www.cnn.com/2020/11/24/cars/tesla-worth-500-billion/index.html>