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Future Trends and Developments in Weapon Selection using the DEMATEL Method

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Abstract: Weapon selection is a critical process in various domains, including military operations, law enforcement, and personal defense. Choosing the most suitable weapons involves considering multiple factors, such as effectiveness, reliability, cost, weight, and usability in different climate conditions. DEMATEL provides a structured framework to analyze the interrelationships, dependencies, and influences among the criteria and factors involved in weapon selection. This paper explores the application of DEMATEL in weapon selection, highlighting its benefits in prioritizing criteria, identifying key factors, and evaluating the interactions and feedback loops between different aspects. The integration of DEMATEL in the weapon selection process supports informed and objective decision-making, leading to more effective and robust weapon selection outcomes in various operational contexts. The art of selecting weapons is a critical aspect of warfare, self-defence, and various other contexts where the use of force is required. Throughout history, individuals and organizations have faced the daunting task of choosing the most suitable weapons to achieve their objectives effectively. The process of weapon selection involves considering a wide range of factors, including the nature of the threat, the intended purpose, the environment, technological advancements, and the capabilities and limitations of the user. Weapons are tools designed to enhance human capabilities, enabling us to overcome physical limitations and gain an advantage over adversaries. They come in various forms, from ancient melee weapons like swords and spears to modern firearms, explosives, and cutting-edge technological advancements such as drones and cyber weapons. Each weapon has its unique characteristics, strengths, and weaknesses, and choosing the right one requires a comprehensive understanding of the operational requirements and the current state of technology. When it comes to selecting weapons, one must consider the specific needs and objectives of the situation at hand. In military contexts, weapon selection is driven by the strategic objectives, the nature of the enemy, and the operational environment. Factors such as range, accuracy, firepower, portability, reliability, and ease of use are crucial considerations when equipping soldiers or planning military campaigns. Additionally, the availability of ammunition, maintenance requirements, logistical considerations, and the cost-effectiveness of the weapons play a significant role in decision-making processes. Weapon selection is not limited to the military sphere alone. Law enforcement agencies, security personnel, and even civilians seeking self-defence must evaluate the appropriate weapons to ensure their personal safety and the safety of others. Factors such as legality, ease of concealment, non-lethal alternatives, and the ability to de-escalate a situation come into play when considering weapon options in these contexts. Technological advancements continually influence weapon selection. With the rapid progress of science and engineering, new weapon systems are developed regularly, introducing enhanced capabilities and increasing the complexity of decision-making processes. Emerging technologies such as artificial intelligence, robotics, directed energy weapons, and cyber warfare tools add new dimensions to weapon selection, forcing individuals and organizations to adapt and understand the implications of these advancements. In conclusion, weapon selection is a critical process that requires careful analysis and consideration of numerous factors. Whether in military operations, law enforcement, or personal defense, selecting the appropriate weapons can mean the difference between success and failure. By understanding the specific requirements, assessing available options, and keeping abreast of technological advancements, individuals and organizations can make informed choices that maximize their effectiveness and safety in the face of diverse challenges.

Methodology: This study will draw conclusions Testing and evaluation Let's use the lab, it is there in a data of relative relevance base decisions on decision-making test and Provides an evaluation laboratory A research approach. Alternative parameters taken as price, weight, barrel, modularity, usability in different climate conditions and maintenance. Evaluation parameters taken as price, weight, barrel, modularity, usability in different climate conditions and maintenance. From the result it is seen that Price is got the first rank where as is the barrel is having the lowest rank. DEMATEL allows for a comprehensive

analysis of interrelationships and dependencies among various criteria and factors involved in the selection process. By prioritizing criteria and identifying key factors, DEMATEL enhances the decision-making process, leading to more informed and effective weapon selection outcomes. Additionally, evaluating interactions and feedback loops helps mitigate risks and unintended consequences.

Keywords: Key performance indicators, new product development, Delphi method, knowledge maps, decision-making trial, evaluation laboratory.

1. INTRODUCTION

Arms systems to end war as it is considered important, selecting weapon systems an important national decision. Of military technologies rapid development of weapons to make systems more sophisticated, makes it expensive, and to select these settings research methods quickly accelerates. 30% of its defense budget is raising more, in which most are for weapons systems purchase is also, on budget and expenditure efficiency and rationality commonly followed by along with the course, mnd is his defense all the rest of the budget same as government spending transparency and under pressure to produce efficiently has to improve efficiency comments and directions are being evaluated. However, this effort is mainly a formal one high level for important decisions relying on the intuition of commanders carried out in it is mostly subsequent changes and led to revisions, it wastes the defense budget and procurement of weapons systems delays. Force requirements force to decide efficiently to improve the structure aimed at methods substantial tests and despite the advances these wastes and delays occurred. Because efforts mainly conceptual, macroscopic and focus on ambiguous projects paid, it takes power development of the general direction required anything but symptoms did not give this current armed with situational analysts to select settings assertive and assertive methods to continue to create demands. Most real-world as with decision problems. A variety to consider a great alternative in attributes madm chooses. Very much among the popular madm techniques includes ahp. In making decisions with alternates firm and ahp measures intangible criteria structurally integrated. Ahp is a logical decision maker judgment, experience and intuition combines its usability and due to the flexibility, resource allocation, alternative selection, production and military decision-making as complex and unstructured ahp for decision making problems widely used. Recently, hierarchically unstructured analysis to handle decision problems a network process is created (chatti, 2005). Also, vague to facilitate decisions in situations fuzzy ahp is introduced (kong & liu, 2005). Many studies combines madm and modm. These studies combined ahp-math includes a programming approach. Vaidya and kumar (2006) misc integrating ahp with applications performed a comprehensive review of also, ho (2008) ahp-mathematical programming a number of approaches have been studied reviewed the studies. Ahp and in combining gp there are many articles. In weapons systems projects, some researchers are mixed ahp a holistic programming approach such integrated approaches used and a great one in ambiguous contexts comparing alternatives to solutions by regulating performance integrating ahp with a technique approach. Despite the usefulness of ahp, intuition of decision makers its limit on is higher. Existing ahp-gp models concrete data and eye unknown intuitive factors in the ability to deal with both are defined. Weapon selection of systems, a force of the demand decision-making process considered the terminal stage, this should be taken into account criteria to be and a huge spectrum of data contains however, now until then, the researchers used this data in a limited manner have used assertiveness that can be incorporated into decision making when real data is available, fuzzy factors and weighting ahp with decision elements only it is unfair to use may be. Ambiguity in ahp and by arbitrariness to overcome the shortcomings, in the present study gp sample primary component to determine weight analysis (pca) and ahp combines from pca, in contrast to ahp weights obtained are actual derived from the data, also containing additional information too much weight for criteria is allocated. Our proposed in the hybrid ahp-pca-gp model, solid real data, with intangible intuition is elevated to equal status; thus, the decision is made integrated into components in producing weights both have the same importance has this plan will decide real data in the process by intensive use reality and rationality follows. Weapon system the selection problem is a strategic one issue and security in systems performance significant impact causes generally, many tactics and technical characteristics many are available with best from candidates select the setting, and many of them are interrelated relevant and interactive. The same at the time, many of them were uncertain and incomplete information properties have so, a weapon system is fair and scientific how to choose wisely time consuming and difficult action, and advanced knowledge for this rich experience is also required.

2. MATERIALS AND METHODS

The DEMATEL method is a specific problem, pinup binding work through problems and a hierarchical structure contribute to identifying workable solutions structural modeling techniques, for one reason interrelationships between components of the organization identifying dependencies and basic concept of situational relations can affect and influence of elements causal charting uses direction charts. The DEMATEL system is integrated with

emergency management together with manage. In the manner proposed, it is not necessary to defuzzify obscure numbers before using the DEMATEL method. Modeling this structure approach adopts the form of a driven diagram, which is a causal effect for presenting values of influence between interrelated relationships and factors. By analyzing the visual relationship of conditions between systemic factors, all components are a causal group, and the effect is divided into groups. It also provides researchers with structure between system components better understanding of the relationship and complexity for troubleshooting computer problems can find ways. The Therefore, decision-makers need to determine obstacles to the legal framework is strong and make sure it is controllable in order to minimize impact or influence barriers. Therefore, derived from the ism and DEMATEL methods the results are somewhat consistent. Integrated ism DEMATEL results for e-waste management constraints determine not only the structure but also the structure of the interactions between these barriers. Accordingly, the preliminary drawback cluster one became about topics including the comparative weights of selection makers in the DEMATEL approach who did not well bear in mind linking to the team decision-making. Obviously, in a group decision-making hassle, regular decision-makers can always trust their factor of view and count on it to be prevalent via other selection-makers. This way the very last evaluation guides must be close to their judgments, and if the very last assessment effects are near their critiques, the choice maker is willing to simply accept it; otherwise, they may deny it. It is believed that a significant purpose for the aforementioned discrepancies lies in methods based on unstructured comparisons such as DEMATEL. DEMATEL is widely accepted for analyzing the overall relationship between factors and classifying factors into cause-and-effect types. Therefore, this article considers each source as a criterion in decision-making. Based on DEMATEL, the significance and level of significance of each piece of evidence can deal with a mixture DEMATEL method with the source theory for better conclusions. In this article, instead of the comparative criteria provided by the experts in DEMATEL. The corresponding propositions between the bodies of sources are changed. The DEMATEL technique was used as well as creating causal relationships between criteria for evaluating the integrated multiple scale decision making (MCDM) outreach personnel program. Integrates DEMATEL and a new cluster-weighted system in which dematel system is a company the reason for the complexity between the criteria is to visualize the structure of relationships it is also used to measure the influence of criteria. Buyukozkan and ozturk can integrate anp and DEMATEL an innovation in terms of technology and have developed an approach, which is for companies to help determine important six sigma projects and logistics specifically prioritize these projects helps to identify companies.

Alternative parameters:

Price: In the context of weapon selection, the term "price" refers to the financial cost associated with acquiring, maintaining, and operating a particular weapon. Price is an essential factor that influences decision-making processes when selecting weapons, as it directly impacts the feasibility and sustainability of a weapon system.

Weight: In the context of weapon selection, the term "weight" refers to the physical mass or heaviness of a weapon. It is a crucial factor to consider when choosing a weapon as it directly affects the usability, mobility, and overall effectiveness of the weapon in various operational scenarios.

Barrel: In the context of weapon selection, the term "barrel" refers to the cylindrical tube-like component of a firearm through which the projectile or bullet is propelled. It is a critical element of a firearm that plays a crucial role in determining its accuracy, range, and effectiveness.

Modularity: In the context of weapon selection, the term "modularity" refers to the design and capability of a weapon system to be easily customized, adapted, or modified for different purposes or operational requirements. A modular weapon system allows users to interchange or replace various components, such as barrels, stocks, handguards, and accessories, to tailor the weapon to specific needs.

Usability in different climate conditions and maintenance: In the context of weapon selection, "usability in different climate conditions and maintenance" refers to the consideration of how a weapon performs and can be effectively maintained in various environmental conditions, including extreme temperatures, humidity, precipitation, and other factors that may impact its functionality and reliability. Usability in different climate conditions is a crucial consideration as it directly impacts the weapon's reliability, accuracy, durability, and overall performance. Weapons that are designed to operate reliably in a wide range of climates are better suited for military operations, law enforcement activities, and other scenarios where weapons may be exposed to varying weather conditions.

3. RESULTS AND DISCUSSIONS

TABLE 1. Weapon Selection

	Price	Weight	Barrel	Modularity	Usability in different climatic conditions and maintenance	SUM
Price	0	3	2	4	2	11
Weight	3	0	2	3	2	10
Barrel	2	2	0	4	1	9
Modularity	2	2	2	0	2	8
Usability in different climatic conditions and maintenance	2	2	2	1	0	7

Table 1 shows alternative parameters: price, weight, barrel, modularity, usability in different climate conditions and maintenance. Evaluation parameters: Price, Weight, Barrel, Modularity, Usability in different climate conditions and maintenance.

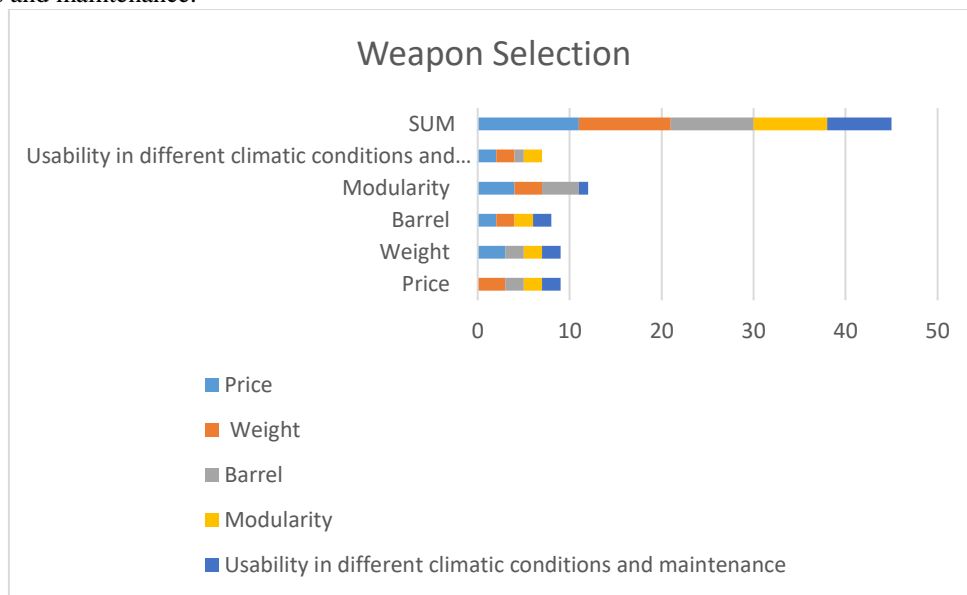


FIGURE 1. Weapon Selection

Figure 1 shows that weight per barrel shows a higher value while price shows a lower value. A higher value indicates a lower value for modularity. The barrel shows the highest value for use in different climatic conditions and the lowest value for maintenance. The barrel shows maximum value for use in different climatic conditions and minimum value for maintenance. Usability in different climatic conditions and maintenance Weight per barrel shows the highest value, shows the lowest value.

TABLE 2. Normalization of Direct Relation Matrix

Normalisation of direct relation matrix					
	Analog & Digital E	Power Systems	Electric Circu	Electric Machines	Digital Controllers
Analog & Digital E	0	0.272727273	0.18181818	0.363636364	0.181818182
Power Systems	0.272727273	0	0.18181818	0.272727273	0.181818182
Electric Circuits	0.181818182	0.181818182	0	0.363636364	0.090909091
Electric Machines	0.181818182	0.181818182	0.18181818	0	0.181818182
Digital Controllers	0.181818182	0.181818182	0.18181818	0.090909091	0

Table 2 shows normalisation of direct relation matrix of alternative parameters: price, weight, barrel, modularity, usability in different climate conditions and maintenance. evaluation parameters: price, weight, barrel, modularity, usability in different climate conditions and maintenance.

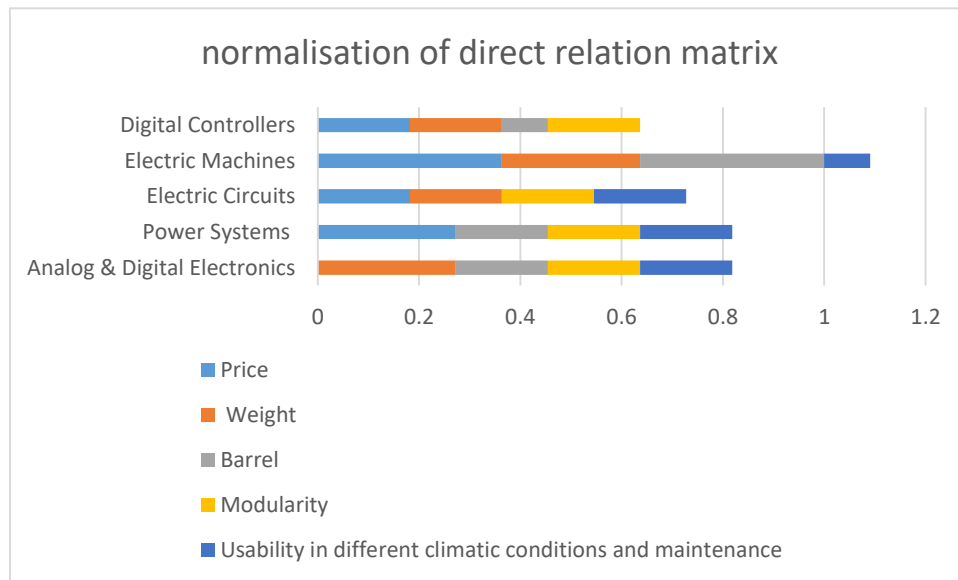


FIGURE 2. normalization of direct relation matrix

Figure 2 shows alternative parameters: price, weight, barrel, modularity, usability in different climate conditions and maintenance and evaluation parameters: price, weight, barrel, modularity, usability in different climate conditions and maintenance.

TABLE 3. Calculate the Total Relation Matrix

	Analog & Digital Electronics	Power Systems	Electric Circuits	Electric Machines	Digital Controllers
Analog & Digital Electronics	0	0.181818182	0.363636364	0.181818182	0.27272727
Power Systems	0.363636364	0	0.181818182	0.090909091	0.18181818
Electric Circuits	0.181818182	0.090909091	0	0.272727273	0.09090909
Electric Machines	0.090909091	0.272727273	0.181818182	0	0.18181818
Digital Controllers	0.181818182	0.363636364	0.090909091	0.272727273	0

Table 3. Calculate the Total Relation Matrix shows the Analog & Digital Electronics has a total relation value of 1.0 with itself, 0.8182 with Power Systems, 0.6364 with Electric Circuits, 0.7273 with Electric Machines, and 0.9091 with Digital Controllers. Power Systems has a total relation value of 0.8182 with Analog & Digital Electronics, 1.0 with itself, 0.6364 with Electric Circuits, 0.3636 with Electric Machines, and 0.5455 with Digital Controllers. Electric Circuits has a total relation value of 0.6364 with Analog & Digital Electronics, 0.3636 with Power Systems, 1.0 with itself, 0.7273 with Electric Machines, and 0.3636 with Digital Controllers. Electric Machines has a total relation value of 0.7273 with Analog & Digital Electronics, 0.5455 with Power Systems, 0.7273 with Electric Circuits, 1.0 with itself, and 0.5455 with Digital Controllers. Digital Controllers has a total relation value of 0.9091 with Analog & Digital Electronics, 0.8182 with Power Systems, 0.3636 with Electric Circuits, 0.5455 with Electric Machines, and 1.0 with itself. These values represent the strength of relation between each pair of concepts in the given matrix.

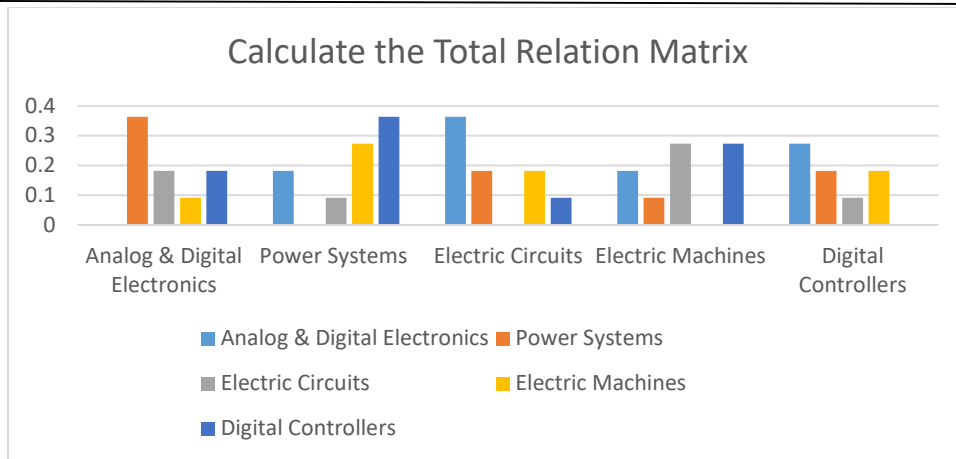


FIGURE 3. Calculate the Total Relation Matrix

TABLE 4. $T= Y(I-Y)^{-1}$, I= Identity matrix

I				
1	0	0	0	0
0	1	0	0	0
0	0	1	0	0
0	0	0	1	0
0	0	0	0	1

Table 4 Shows the $T= Y(I-Y)^{-1}$, I= Identity matrix in Analog & Digital Electronics, Power Systems, Electric Circuits, Electric Machines, Digital Controllers is the common Value.

TABLE 5. Y Value

Y				
0	0.181818182	0.363636364	0.181818182	0.27272727
0.363636364	0	0.181818182	0.090909091	0.18181818
0.181818182	0.090909091	0	0.272727273	0.09090909
0.090909091	0.272727273	0.181818182	0	0.18181818
0.181818182	0.363636364	0.090909091	0.272727273	0

Table 5 Shows the Y Value in Weapon Selection is Analog & Digital Electronics, Power Systems, Electric Circuits, Electric Machines, Digital Controllers is Calculate the total relation matrix Value and Y Value is the same value.

TABLE 6. I-Y Value

I-Y				
0	-0.181818182	-0.363636364	-0.181818182	-0.27272727
-0.363636364	0	-0.181818182	-0.090909091	-0.18181818
-0.181818182	-0.090909091	0	-0.272727273	--0.09090909
-0.090909091	-0.272727273	-0.181818182	0	-0.18181818
-0.181818182	-0.363636364	-0.090909091	-0.272727273	0

Table 6 Shows the I-Y Value in Weapon Selection is Analog & Digital Electronics, Power Systems, Electric Circuits, Electric Machines, Digital Controllers table 4 $T= Y(I-Y)^{-1}$, I= Identity matrix and table 5 Y Value Subtraction Value.

TABLE 7. Total Relation matrix (T)

	Total Relation matrix (T)				
Price	0.890832008	1.100689	1.168345	1.038156	1.010775
Weight	1.081081081	0.837838	0.963964	0.864865	0.873874
Barrel	0.749867515	0.735559	0.612259	0.81558	0.633104
Modularity	0.788553259	0.952305	0.832538	0.666137	0.766826
Usability in different climatic conditions and maintenance	1.020137785	1.195019	0.936584	1.031797	0.768239
Ci	4.530471648	4.82141	4.51369	4.416534	4.052818

Table 7 shows the Total Relation Matrix (T) the direct relation matrix is multiplied by the inverse of the value that the direct relation matrix is subtracted from the identity matrix.

TABLE 9. Ri+Ci and Ri-Ci

	Ri	Ci	Rank	Identity
Price	5.208797	4.530472	1	cause
Weight	4.621622	4.82141	2	cause
Barrel	3.54637	4.51369	5	cause
Modularity	4.006359	4.416534	4	cause
Usability in different climatic conditions and maintenance	4.951775	4.052818	3	cause

Table 9 shows the Calculation of Ri+Ci and Ri-Ci to Get the Cause and Effect. the final result of this paper the Price is in 1st rank cause, Weight is in 2nd rank cause, Barrel is in 5th rank cause, Modularity is in 4th rank cause and Usability in different climatic conditions and maintenance is in 3rd rank cause. The final result is done by using the DEMATEL method.

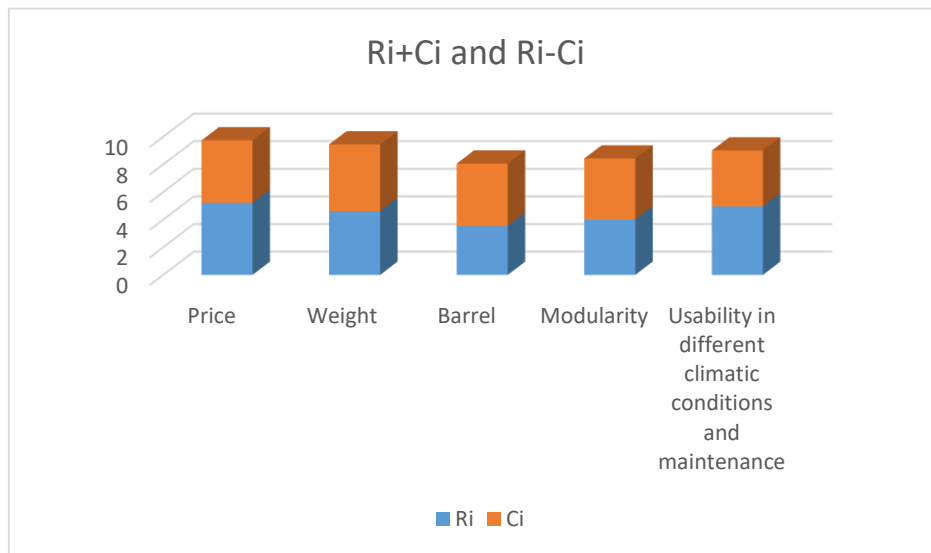


FIGURE 5. Ri+Ci and Ri-Ci

Figure 5 shows ri+ci and ri-ci of alternative parameters: price, weight, barrel, modularity, usability in different climate conditions and maintenance and evaluation parameters: price, weight, barrel, modularity, usability in different climate conditions and maintenance.

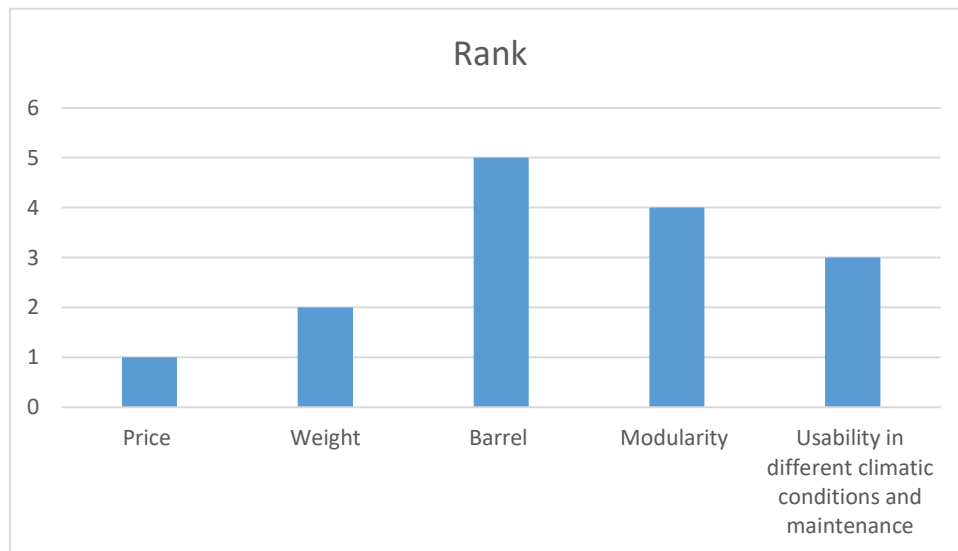


TABLE 6. Rank

Table 6 shows the final result of this paper the Price is in First rank, Weight is in Second rank, Barrel is in Fifth rank, Modularity is in Fourth rank and Usability in different climatic conditions and maintenance is in Third rank.

4. CONCLUSION

Weapon selection is a complex and critical process that requires careful analysis and consideration of various factors. By using DEMATEL, decision-makers can assess and evaluate the interrelationships among different criteria and factors involved in weapon selection. DEMATEL provides a structured framework to analyze the cause-and-effect relationships, dependencies, and influences between these factors, allowing for a more comprehensive understanding of their importance and impact on the overall decision. The application of DEMATEL in weapon selection enables decision-makers to prioritize criteria based on their relative significance and determine the key factors that heavily influence the selection process. It helps identify critical areas that require attention and resources, ensuring that the decision-making process is based on informed and objective evaluations. Furthermore, DEMATEL allows decision-makers to evaluate the interactions and feedback loops between different criteria and factors, enabling them to consider the potential ripple effects and consequences of their decisions. This comprehensive analysis can help prevent unintended consequences and minimize risks associated with weapon selection. Overall, the application of DEMATEL in weapon selection offers a systematic and analytical approach that enhances decision-making processes, leading to more informed, robust, and effective weapon selection outcomes. The integration of DEMATEL in the process of weapon selection contributes to better decision-making, improving the overall effectiveness, efficiency, and strategic outcomes in military operations, law enforcement, and personal defense scenarios.

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