

STRATEGY DEVELOPMENT & EVALUATION IN THE BATTLEFIELD USING QUANTIFIED SWOT ANALYTICAL METHOD

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Summary: *Strategy development and evaluation in military operations in the battlefield is highly complex activity and requires a systematic approach for detailed analyses on the internal and external key environmental factors, which can be both qualitative and quantitative.*

This study proposes a newly structured Quantified SWOT Analytical Method for strategy development and evaluation to provide operational achievement. In the proposed methodology, while SWOT analysis supports the decision situation by structuring the decision hierarchy, Analytic Hierarchy Process (AHP) measures the relative importance of the SWOT factors in this hierarchy. Using the quantitatively evaluated SWOT factors weighted by AHP, operational strategies can be developed for the purpose of building on the strengths, eliminating the weaknesses, exploiting the opportunities and/or countering the threats with the highest weights. The assigned relationships between the SWOT factors and alternative strategies allow the ranking of these strategies that yields the selection of the applicable strategies in practice. An illustrative case study is presented to demonstrate the applicability and efficiency of the proposed methodology. The results show that this methodology helps the commanders to manage the complexity of the battlefield and to organize indefinite strategic decision-making process in the battlefield.

1. Introduction

Military strategy is the management of the military resources in the conduct of warfare. It deals with planning the conduct of warfare, control of large military units, the movement and disposition of forces, and the deception of the enemy. Tactics are the execution of plans and maneuvering of forces in battlefield. Strategy is large scale while tactics are small scale.

The conduct of war may include issues such as the seizure of territory, the destruction of the enemy's ability to prosecute military action, etc. Typically, any military action by one side is countered by the military forces of one or more sides. Victory may be accomplished variously by out-outmaneuvering them, by destroying them in open battle, by causing them to desert or surrender.

Technological advances had a huge influence on strategy: command and control systems, aerial reconnaissance, artillery techniques, armored vehicles etc, but responsibility of commanders is same, victory. The commanders must be flexible in formulating a strategy. The militaries of today have huge armored and conventionally configured army units backed up by air forces and navies designed to support or prepare for these forces. As the size and number of the armies grew and the technology to communicate and control improved, formulating a strategy gets harder.

As mentioned above, the high complexity degree of strategy development and evaluation as a commander in the battlefield requires a systematic approach for detailed analyses on various internal and external key

factors. However, systematic approaches and analytical decision-making tools are commonly not utilized for this purpose in the battlefield. In this study, the need for utilization of analytical tools in the battlefield is clearly identified, especially in terms of decision-making and operational strategic planning.

That's why; it is determined to use Quantified SWOT (Strengths, Weakness, Opportunities, and Threats) Analysis as a strategy development and evaluation method in the battlefield. Although relevant applications on utilization of Analytic Hierarchy Process (AHP) method in SWOT analysis exist in literature, introduced in the further section widely, a newly structured model is determined by extending the typical Quantified SWOT Analysis to satisfy the utility of the approach. It is eagerly expected that this proposed approach is provide an extreme decision support to the commanders for managing the various difficulties and organizing indefinite strategic decision-making process for different kinds of cases in the battlefield.

The rest of this paper is organized as follows: In Section 2, proposed approach is introduced by describing the theoretical framework of Quantified SWOT and AHP. In addition to these, process flow of the proposed approach is presented. For testing the applicability of the proposed approach, an illustrative case study is presented in Section 3. Finally, next section concludes examining the utility of findings and discussing the proposed approach in advance.

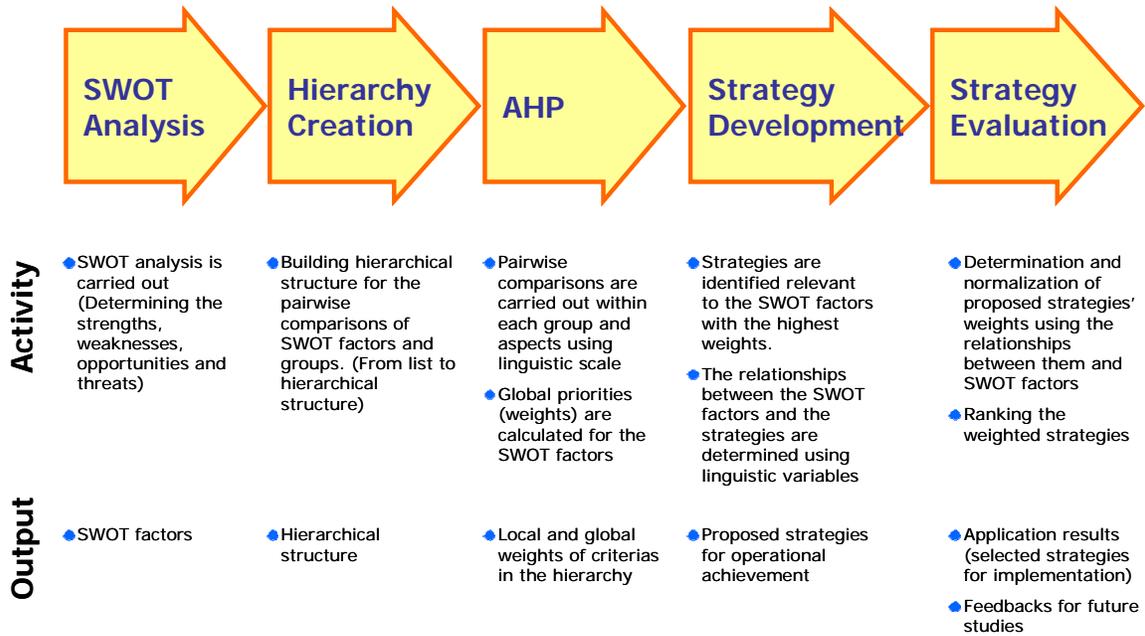
2. Proposed Approach

The proposed approach is based on the Quantified SWOT Analytical Method (Kurttila et al., 2000; Chang and Huang, 2006; Shinno et al., 2006). This technique of utilizing the AHP in the SWOT analysis has also been referred to as A'WOT in subsequent studies (Leskinen et al., 2006; Kajanus, Kangas and Kurttila, 2004). This hybrid method was first developed to eliminate the weaknesses in the measurement and evaluation steps of the SWOT analysis (Kurttila et al., 2000; Hill and Westbrook, 1997). SWOT analysis is a commonly used tool for analyzing internal and external environments in order to attain a systematic approach and support for a decision situation (Kotler, 1988; Wheelen and Hunger, 1995). AHP is a commonly used multi criteria decision making method that can deal with both qualitative and quantitative criteria (Saaty, 1980). Utilizing AHP in SWOT analysis yields analytical priorities for the factors included in SWOT analysis and makes them commensurable (Kurttila et al., 2000). In the combined utilization, while SWOT analysis supports the decision situation, AHP measures the relative importance of the SWOT factors (Kurttila et al., 2000).

This method was utilized in the various application areas such as environment (Kurttila et al., 2000; Leskinen et al., 2006; Pesonen et al., 2000; Masozera et al., 2006; Kangas et al., 2003), tourism (Kajanus, Kangas and Kurttila, 2004), project management (Stewart, Mohamed and Daet, 2002), agriculture (Shrestha et al., 2004), manufacturing (Shinno et al., 2006; Yüksel and Dağdeviren, 2007) as well. Furthermore, there are some other studies that Simple Multi-Attribute Rating Technique (SMART) (Kajanus, Kangas and Kurttila, 2004), Stochastic Multi-criteria Acceptability Analysis with Ordinal criteria (SMAA-O) (Kangas et al., 2003) and Analytic Network Process (ANP) (Yüksel and Dağdeviren, 2007) techniques are applied in Quantified SWOT approach instead of the AHP.

However, all the previous studies on Quantified SWOT Analysis only deal with prioritization of the SWOT factors and sub-factors, and neither strategies nor alternatives are included in the hierarchical structures based on the strategic factors. In our proposed approach, this issue is taken into account by extending the typical Quantified SWOT Analysis considering the relationships between the SWOT factors and the proposed strategies. These assigned relationships between the SWOT factors and proposed strategies yields checking back to see whether the highest rated SWOT factors were all being addressed by the proposed strategies. As a result of the proposed approach, the proposed strategies are ranked using the relationship matrix and finally some of them are selected to utilize in practice. The detailed process flow of the proposed framework is shown in the Figure 1.

Figure 1. Process flow of the proposed approach



Additionally, the final output of the proposed approach, strategy development and evaluation matrix, can be seen in Figure 2. Furthermore, the details of the steps will be given in the case study.

Figure 2. Strategy development and evaluation matrix

		Strategies			
		Actions			
SWOT factors	Relative importance of SWOT factors	Relationship Matrix			
				Absolute importance of Strategies	
				Relative importance of Strategies	
				Ranking of Strategies	

3. An Illustrative Case Study

In this section, strategy development and evaluation process of a fictitious brigade commander in the battlefield is presented as a case study. In this case study, two opponent brigades are conducting an operation against each other.

All the data are unclassified and generic. The aim of this case study is to demonstrate the applicability of the proposed approach.

The proposed approach is applied in the following sub sections for the case study.

3.1. SWOT Analysis

SWOT analysis is carried out using the brainstorming technique. The relevant factors of the internal and external environment (strengths, weaknesses, opportunities and threats) are determined and included in the SWOT analysis as shown in Table 1.

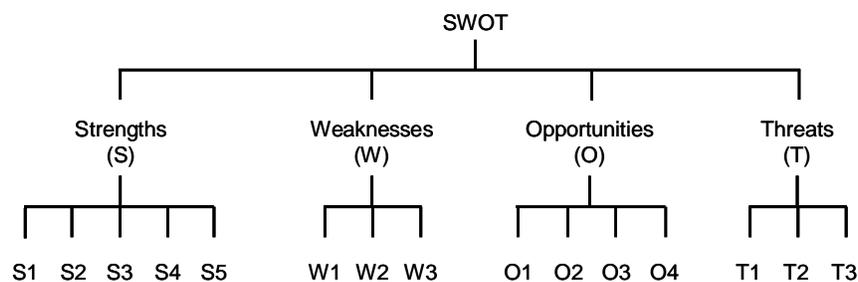
Table 1. SWOT factors

SWOT group	Abbreviation	SWOT factors
Strengths	<i>S1</i>	Effective armored units
	<i>S2</i>	Attack helicopter squadron
	<i>S3</i>	Stability of command & control systems
	<i>S4</i>	Fast maneuvering capability
	<i>S5</i>	High motivation and leadership
Weaknesses	<i>W1</i>	Camouflage unavailability
	<i>W2</i>	Lack of intelligence about enemy units
	<i>W3</i>	Wrong tactical organization in the battlefield
Opportunities	<i>O1</i>	Close air support
	<i>O2</i>	Artillery support
	<i>O3</i>	Logistics support and flexibility
	<i>O4</i>	Reserved units on demands
Threats	<i>T1</i>	Geographical positioning difficulties
	<i>T2</i>	Unsuitable weather conditions
	<i>T3</i>	Enemy raid

3.2. Structuring the Decision Hierarchy

Normally, the result of a SWOT analysis is a list structure. Hierarchical structure is built for the AHP pairwise comparisons of SWOT factors and groups (Figure 3).

Figure 3. Hierarchical view of SWOT analysis



3.3. Determining Priority Weights of SWOT Factors using AHP

After completing the structure of the problem hierarchy, pairwise comparison values (1-9 scale) are assigned. Then, the priority weights of the SWOT groups and factors are obtained by the AHP method using these pairwise comparisons (Table 2). Furthermore, the strengths (S), weaknesses (W), opportunities (O), threats (T) of the brigade can be seen easily in Figure 4. Also, this figure can help commanders compare their force and evaluate their situation in the battlefield. Determining the SWOT factors having the highest weights is the critical issue for this step as this will provide insights into the following strategic planning process.

Notice that, in Figure 4, for the strengths and opportunities higher values are better, whereas for weaknesses and threats lower values are better. As can be seen from Figure 4, the brigade has significant strengths such as effective armored units (*S1*), attack helicopter squadron (*S2*) etc. Moreover, it also has significant opportunities such as close air support (*O1*) and artillery support (*O2*). On the other hand, there are some weaknesses to be eliminated and threats to be countered such as wrong tactical organization in the battlefield (*W3*), lack of intelligence about enemy units (*W2*), geographical positioning difficulties (*T1*) and enemy raid (*T3*) etc.

Table 2. SWOT factors and their weights

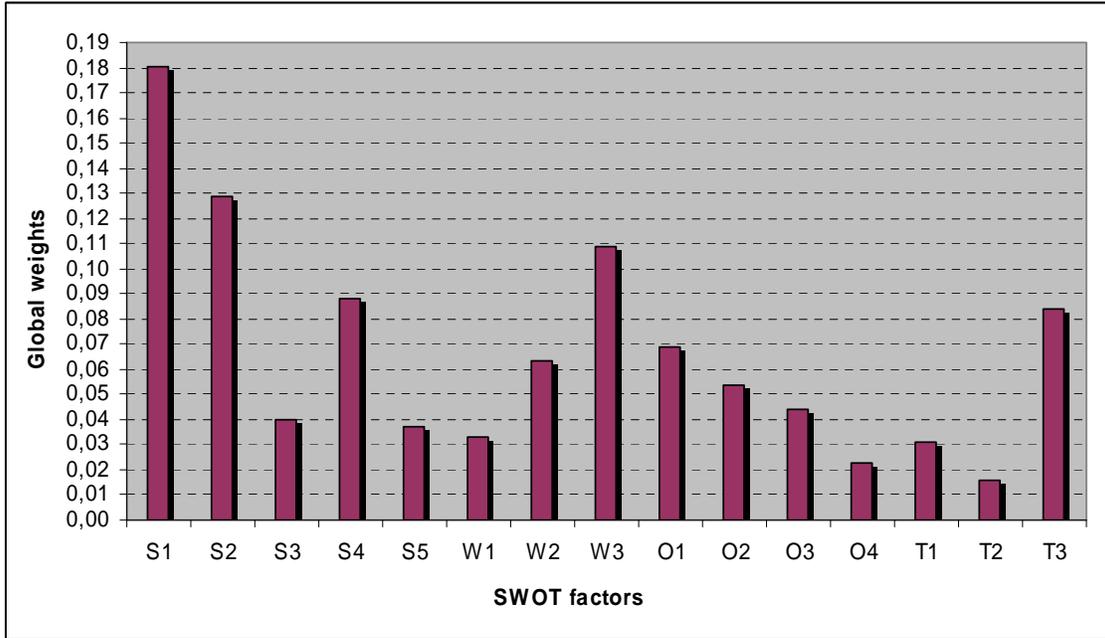
SWOT group	Group priority	SWOT factors	Local weights	Global weights
Strengths	0.474	<i>S1</i> Effective armored units	0.380	0.181
		<i>S2</i> Attack helicopter squadron	0.271	0.129
		<i>S3</i> Stability of command & control systems	0.083	0.040
		<i>S4</i> Fast maneuvering capability	0.185	0.088
		<i>S5</i> High motivation and leadership	0.077	0.037
Weaknesses	0.205	<i>W1</i> Camouflage unavailability	0.162	0.033
		<i>W2</i> Lack of intelligence about enemy units	0.309	0.063
		<i>W3</i> Wrong tactical organization in the battlefield	0.529	0.109
Opportunities	0.189	<i>O1</i> Close air support	0.362	0.069
		<i>O2</i> Artillery support	0.284	0.054
		<i>O3</i> Logistics support and flexibility	0.233	0.044
		<i>O4</i> Reserved units on demands	0.121	0.023
Threats	0.130	<i>T1</i> Geographical positioning difficulties	0.238	0.031
		<i>T2</i> Unsuitable weather conditions	0.121	0.016
		<i>T3</i> Enemy raid	0.641	0.084

3.4. Strategy Development for Operational Achievement

Using the quantitatively evaluated SWOT factors, determined by proposed approach, operational strategies and actions for the implementation of these strategies can be developed for the purpose of building on the strengths, eliminating the weaknesses, exploiting the opportunities and/or countering the threats. The most significant issue in this step is the consideration of the SWOT factors having the highest priority weights.

Strategy proposals for operational achievement in the battlefield are presented in Figure 5. There are four main strategies: attack, defend, delay and withdraw.

Figure 4. SWOT factors and their weights



Attack strategy is used to direct military units to perform attack operations. Usually, attack strategy is part of a larger plan involving many units and, frequently, both air and ground operations. This strategy is a larger plan, which might consist of several units attacking, other units reinforcing them by fire, and other units following in reserve or for exploitation. Defend strategy is used to cause military units to stop any current maneuver or movement, and enter a defensive posture at their current locations. Delay strategy is used to direct military units to execute a tactical delay, trading space for time. This is usually an economy of force measure, where the unit fights on a set of successive positions, leaving each position only when forced to do so, but avoiding becoming decisively engaged. Withdraw strategy is used to direct military units to withdraw, typically to avoid contact with hostile forces. This break of contact allows the unit to recover or be committed to another location.

On the other hand, the relationships between the SWOT factors and the proposed strategies are assigned using linguistic variables in Table 3. These assigned relationships between the SWOT factors and the strategies allow the ranking of these strategies that yields the selection the applicable strategies in practice.

When assigning the relationships, the issue at stake is; there is a contribution of the proposed strategy for the SWOT factor (to build on the strengths, eliminate the weaknesses, exploit the opportunities and/or counter the threats) and how much. With these relationships as the input, the weights of the strategies are then computed. Assigned relationships can be seen as graphic symbols in strategy development and evaluation matrix (Figure 5).

3.5. Evaluation of Proposed Strategies

With the linguistic relationships as the input, weights of proposed strategies are calculated as a crisp value using the following formula:

$$T_i = \sum_{j=1}^n G_j R_{ij} \quad (1)$$

where

T_i : Total weight of the i^{th} strategy,

G_j : Global weights of the j^{th} SWOT factor,

R_{ij} : Degree of relationship between i^{th} strategy and j^{th} SWOT factor,

n : Number of SWOT factors.

Then, normalized value of the strategy weights:

$$N_i = \frac{T_i}{\sum_{i=1}^m T_i} \quad (2)$$

where

N_i : Normalized weight of the i^{th} strategy,

m : Number of strategies.

Figure 5. Strategy development and evaluation matrix

SWOT Group	Weight	SWOT Factors	Local Weight	Global Weight	Strategies			
					Attack	Defend	Delay	Withdraw
Strengths	0,474	S1	0,380	0,181	■	△	●	●
		S2	0,271	0,129	△	○	○	
		S3	0,083	0,040	●	○	○	○
		S4	0,185	0,088	□	●	△	●
		S5	0,077	0,037	△	△	△	●
Weaknesses	0,205	W1	0,162	0,033		●	○	●
		W2	0,309	0,063		○	●	●
		W3	0,529	0,109	○	●	○	△
Opportunities	0,189	O1	0,362	0,069	△		○	
		O2	0,284	0,054	△	●	●	●
		O3	0,233	0,044	△	○	●	●
		O4	0,121	0,023	○	△	●	●
Threats	0,130	T1	0,238	0,031		○	○	●
		T2	0,121	0,016		○		○
		T3	0,641	0,084	○	△	●	●
Total Weight					4,246	2,800	2,383	2,515
Relative Importance (%)					0,355	0,234	0,200	0,211
Ranking					1	2	4	3

Table 3. Degree of relationship, graphic symbols and their corresponding numbers

Degree of relationship	Graphic symbol	Number
No		0
Very Weak	○	1
Weak	●	3
Medium	△	5
Strong	□	7
Very Strong	■	9

Finally, proposed strategies are ranked according to their normalized weights in the descending order within Figure 5.

3.6. Extended Discussion on Case Study Results

The outcomes of the case analyses indicate that the proposed newly structured Quantified SWOT Analytical Method can provide an important foundation for formulation of successful strategies on operational achievement in the battlefield. The effective strategic action plan can be developed by examining the normalized weights of the proposed strategies with respect to SWOT factors.

In this case, the proposed strategies, attack, defend, delay, and withdraw has the relative importance of 0.355, 0.234, 0.200, and 0.211 respectively. Attack strategy is seemed to be the best strategy for implementation. Afterwards, the commanders can develop action plans for each function or element of the attack strategy such as attack with armored vehicles, destroy enemy armored vehicles using attack helicopters, damage enemy supplies, fire long range missiles, create a physiological war, support units by reserved units, conduct electronic warfare (EW) etc.

In the real world, unlike our generic illustrative example, there are a plenty of key factors which makes the battle environment difficult to understand for the commanders. Also, there can be more strategies and actions. Therefore, our proposed approach can provide insights into the following strategic planning process for the commanders.

4. Conclusions and Further Suggestions

A newly structured Quantified SWOT Analysis to develop and evaluate operational strategies in the battlefield has been presented in this study. The proposed approach provides commanders to take into account both qualitative and quantitative data during the strategic decision-making process in the battlefield. Furthermore, SWOT factors, relatively weighted by AHP calculations, increases the situation awareness in the battlefield. Based on these SWOT factors, successful operational strategy planning could be achieved. In other words, proposed approach takes into account the internal and external key environmental factors that can provide an important foundation for formulation of a successful strategy.

The results of this systematic approach;

- show the way to the following main operational strategies such as attack, defend, delay and withdraw,
- support the suitable course of action formulization,
- accelerate the decision process,
- help the commanders to manage the complexity of the battlefield, and
- represent the strengths and weaknesses of the military forces and opportunities and threats of the battle environment.

As a result, our study provides commanders a more objective, comprehensive and flexible approach to be utilized for strategy development and evaluation in the battlefield.

For future research, a software tool based on the proposed approach to develop and evaluate operational strategies under multiple criteria in the battlefield could be developed. Furthermore, the actions for strategy implementation could be evaluated using the same approach, strategy development and evaluation matrix.

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