CRANFIELD UNIVERSITY

GURKAN YESILYURT

EFFECTS OF LEADERSHIP AND MORALE ON THE OUTCOME OF THE BATTLE ALONGSIDE OTHER COMBAT POWER ELEMENTS INCLUDING FORCE RATIOS

CRANFIELD DEFENCE AND SECURITY

LEADERSHIP AND MANAGEMENT

PhD

Academic Year: 2021 - 2024

Supervisor: Dr. Iftikhar Zaidi

Associate Supervisor: Dr.Irfan Ansari

Month Year

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Supervisor:  Dr. Iftikhar Zaidi

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This thesis is submitted in partial fulfilment of the requirements for the degree of Enter degree

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ABSTRACT

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LIST OF EQUATIONS

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LIST OF ABBREVIATIONS

|  |  |
| --- | --- |
| IT | Information Technology |
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# INTRODUCTION

Human history is full of strife, struggles, fights, and ultimately wars that take place on a grand scale. What the reasons for these struggles are and which side's justifications are more satisfactory constitute the field of historical science. However, with the patterns of effects on the outcome are formed over years and they become the subject of both management science, military art, and operational research.

Military theorists and scientists have produced many works on the factors affecting the outcome of wars. Some of these works are based on personal experience like Sun Tzu, some others are based on both experience and philosophy like Clausewitz, while others based on quantification with mathematical formulas like Lancaster and others. While much have been said on the physical elements of the factors like force ratios, most of these studies excludes the qualitative characteristics or take them constant because of their qualitative nature.

Although the importance of leadership and morale is generally emphasized by all authors, it has not been treated within a rigorous, and systematic study. So, in this research, the factors affecting the outcome of the battle will be examined from the perspective of leadership and morale.

## Background

The first written organized thoughts on the subject belongs to Sun Tzu. He names five fundamental factors to evaluate the war. These factors, which Sun Tzu associates with the winning of the battle are moral influence, weather, terrain, command, and doctrine (Sun Tzu, n.d., p. 63-65). With these estimation factors is laid down as principles, he prescribes some force ratio rules with the heading “art of using troops” and says when ten to the enemy’s one, surround him”, “when five times his strength, attack him”, “if double his strength, divide him” (Sun Tzu, n.d., p. 79-80).

Clausewitz ’s approach to subject is comprehensive and covers qualitative nature of the subject as well. He conditions overcoming enemy with matching the efforts against his “power of resistance” which he says product of two inseparable factors, namely “total means at his disposal” and “strength of his will” (Clausewitz, 1832, p. 77). He recognizes the fighting as a trial of moral and physical forces through the medium of physical force and asserts that psychological forces exert a decisive influence on the elements involved in war (Clausewitz, 1832, p. 127). He specifies that, with deciding; time, place, and the force of the engagement, strategy, not force ratio, has considerable influence on engagement’s outcome. These reservations in mind, he explains “superiority of numbers” as most common element in victory with an important condition which is “if purpose, circumstances, and the fighting value of the troops is disregarded”. But he further argues that if superiority reach the point where it is overwhelming, superiority of numbers will be the most important factor in the outcome of an engagement (Clausewitz, 1832, pp. 194–195).

In the 1900s, the subject attracted the attention of engineers like Lancaster. At this stage, mathematical formulas were used to explain the importance of the subject.

Lancaster contributed to the literature with two important concepts, one of which **differential explanation of the casualties** (the number of men knocked out per unit time will be directly proportional to the numerical strength of the opposing force, efficiency of weapons and unit value) and the other is **N-square law** as “the fighting strength of a force is proportional to the square of its numerical strength multiplied by the fighting value of individual units (Lanchester, 1916, pp. 39–66).

With the rapid development of technology, the subject has become the subject of operational research.

When we come to 1979, Depuy, former USA Army Officer, have examined the subject with the help of well-designed mathematical models. He had devoted himself to explain the factors effecting the outcome of the battle and use them in prediction of the future battles. He developed Quantified Judgment Method of Analysis (QJMA) of Historical Combat Data, where the outcome of a battle is predicted using a multiplicative-additive formula in which various factors relating to the strength and firepower of the fighting parties as well as the circumstances are considered. He defines Quantified Judgement Model (QJM) as a major component of the methodology and as a long but simple mathematical equation(Dupuy, 1979, p. ix). His concept of “Combat Power” is extracted from multiplication of three factors (P = S x OE x Q). For these three categories he used in total 73 combat variables prepared by USA Historical Evaluation and Research Organization (Dupuy, 1979, pp. 30–33). These factors are summarized below:

* Force Strength (P): This is the number and types of weapons plus personnel. This value is coming from Operational Lethality Indices (OLI) where he analysed the relationship between the weapons and the number of casualties.
* Operational Environmental Factors (OE): In order to reflect the battlefield realities, he added effects of weather, terrain, season, mobility, and vulnerability factors.
* Quality of Troops (Q): Although he prepared values for the morale of the belligerents, he says that analysis excludes leadership and morale factors because of their unquantifiable natures.

With calculating all these values via applied variables to the tables or formulas of the weapon inventories of each side he obtained a “Combat Potentials” and “Combat Power Ratios”.

Later he quantified the “actual results” of the battle, again with giving numerical values to mission accomplishment, holding ground, and comparing the casualties. He tested whether the “Combat Power Ratios” indicated the outcome of the battle or not (Dupuy, 1979, p. 42).

Conscious of the inconsistences in the system he developed, he further refined his system and reported the results in a totally new book named “Understanding the war: History and theory of Combat” in 1987.

Although Dupuy made comprehensive contributions to the subject especially in predicting future conflicts, his formula of assessing the quality of the troops is assessed to be “not clear” in research which includes an interview with himself also (Ciano, 1988, p. 31).

By far the latest systematic treatment came from Biddle. His research methodology combines recent historiography with formal doctrinal theory, case method, statistical analysis, and simulation experimentation. He argued that material factors alone cannot explain capability and added force employment, which is a nonmaterial variable to his analysis. He defines modern system of force employment as “the doctrine and tactics by which armies use their materiel in the field” (Biddle, 2006, p. 2). His key finding might be summarized as the effects of preponderance in the numbers and technology is mediated by “modern system of force employment”. The one who implements it better, will exploit advantageous of numerical superiority in numbers and technology (Biddle, 2006, pp. 60–80).

Other than Biddle, there are other works emphasizing and utilizing non-material factors on the outcome of the battle. One of them is UK Defence Doctrine which categorizes “fighting power” into three sections, namely conceptual, physical, and moral components(UK Ministry of Defence, 2014, p. 25).

One of them is a Rand Report which provided a detailed explanation of “will to fight” and a model designed to support assessment of forces (Connable et al., n.d., p. 10). They accept that morale, cohesion, and discipline is associated with the “will to fight” but they argue “morale” especially is ill-defined. Their model provides US army military planners an assessment tool for the “will to fight” dimension of the units.

## Area of Research

What will be studied?

In this research the factors affecting the outcome of the battle will be examined from the perspective of leadership and morale.

Why this research will be done?

Almost all contributors in this field agreed on material factors alone cannot explain the result in military conflict. Sun Tzu’s three out of five fundamental factors to be victorious (includes moral, command, and doctrine elements) relates with non-material factors(Sun Tzu, n.d., p. 63). Clausewitz puts morale factor “among the most important in war” (Clausewitz, 1832, p. 184). UK Defence Doctrine emphasizes none of fighting power elements should claim precedence and each mutually supports and informs the other (UK Ministry of Defence, 2014, p. 25).

So, there is a consensus among researchers on the importance of the leader’s role and morale in the battles. What is missing in the literature is lack of systematic research which includes these factors and explains the variance on the outcome of the battle.

This gap is problematic, because although the importance of these qualitative factors is recognized universally, research efforts has been limited so far to explore these factors because of their qualitative nature.

New text and data analysis tools presents powerful exploitation opportunities for new insights which in turn will facilitate the examination of this subject with the lenses of Leadership and Moral factors.

How it will be studied?

1st step: Literature review and case study will be conducted to identify the factors (variables) effecting the outcome of the battle.

2nd step:

Quantitative analysis will be conducted to explore the relationship between the factors effecting the outcome of the battle. In case correlation detected between the factors and the result of the battle than the relationship will be modelled with regression models.

Each factor’s contribution to variance will be analysed with Multiple Regression Analysis. This analysis is best suited since there exists multiple predictors which affect the result (James et al., n.d., p. 71).

To enable this analysis, data will be used from already in-place databases.

* One of these database is provided by “The Correlates of War Project” which was founded in 1963 by J.David Singer, a political scientist at the University of Michigan. This project consists of war data (inter-state, intra-state, extra-state, non-state war data) for the period between 1816-2007. Inter-state war data part will be utilized (Sarkees & Frank Wayman, 2010).
* Other database is U.S. Concepts Analysis Agency’s updated version of the historical combat data set which covers 660 battles for the periods between 1600-1982 (Historical Evaluation and Research Organization, 1988).

3rd step:

For the leadership and morale factors, “text analysis” will be conducted. It will be done in the steps summarized below:

* Named entities will be annotated. This step includes grouping key terms of the morale and the leadership, like military spirit which Clausewitz name as most important moral elements in war.
* Named entity recognition (NER) and Relation Extraction (RE) models will be trained with the language representation techniques.
* New features will be created to build downstream deep learning models to find relations between the outcomes and leadership and morale factors.

4th step:

Case studies supported with strategic and operational perspective will be done to supplement the “Text Analysis”.

5th step:

Results of the “Text Analysis” and “case study” will be integrated into the analysis made by Multiple Regression Analysis to conclude the nature of the relationship between leadership and morale and the outcome of the battle.

## Research Aim, Objectives, and Questions

### Research Aim:

This research will aim to explain effects of leadership and morale on the outcome of the battle alongside other combat power elements.

### Research Objectives:

To explain how far combat power elements explains the outcome of the battle.

To explain the relationship between leadership and morale and other combat power elements.

To identify the nature and the degree of the effects of leadership and morale on the outcome of the battle.

### Research Questions:

What factors relate with the outcome of the battle?

What are variances each factor has on the outcome of the battle?

What kind of effects leadership and morale have on the outcome of the battle?

How much the outcome of the battle effected with inclusion of leadership and morale as factors.

## Study Value

War theories clearly state the importance of non-materials in the battle. These theories are produced based on the battle experiences. Literature on this issue focused and tested material side so far.

Non-material factors of leadership and morale never analysed thoroughly because of their qualitative nature. Sophisticated analysis tools on the texts, developed so far, supported with artificial intelligence, gives researchers a leverage, which cannot be compared with even the start of this century.

This research will combine analysis methods of statistical reasoning, case study and artificial intelligence with text analysis feature.

With all these, it will significantly contribute to the literature.

## Limitations

This research is not aimed at quantifying the battle nor aimed at developing a theory to explain it. In line with Clausewitz’s conceptualization, who argues that “absolute, so called mathematical, factors never find a firm basis in military calculations” (Clausewitz, 1832, p. 86) this research will not calculate the winner based on mathematical formulas but will try to find the patterns of the winner side leadership and morale factors and their effects on the outcome of the battle.

The battles will be selected only from ones fought between state actors.

Since the factors might be better analysed for the battles which has a historical recording mechanism already in-place, only the battles fought after Napoleonic era will be analysed.

Although leader role might be best observed in the irregular warfare, it will be limited to the person who are given the role as commander, and hence leaders. Leader role in irregular warfare is the topic of other study.

The analysis will be made with the in-place databases. The details of the databases can be seen in the methodology part. This research has no intention to create a new battle database.

## Research outline

In this chapter (Chapter one) the general context has been set up. Questions has been so far responded with regard to what will be studied, why this research is being conducted, and how it will be conducted. Aim, objectives, questions, value, and limitations of the research has been articulated.

In Chapter two current literature will be summarized to explain what kind of approaches and models are being used so far.

In Chapter three theoretical framework will be presented to explain the factors effecting the outcome of the battle (variables) and their relationships, data collection and analysis methods.

In Chapter four how the research was carried out will be explained.

In Chapter five findings of research will be presented.

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APPENDICES

Whilst Heading 1 to Heading 6 can be used to number headings in the main body of the thesis, Heading styles 7–9 have been modified specifically for lettered appendix headings with Heading 7 having the ‘Appendix’ prefix as shown below.

Appendix Title (Use Heading 7)

Appendix Section (Use Heading 8)

Appendix Subsection (Use Heading 9)

Creating captions in Appendices

If you have chosen to include chapter numbers in your captions then follow the instructions given here to apply the same format to the captions in your appendices. This section explains how to caption the figures and tables in your Appendices, assuming that Heading 7 is numbered “Appendix A” and that the Figures and Tables are going to be labelled ‘Figure A-1’, ‘Figure A-2’, ‘Table B-1’ etc.

You will have to create new, separate labels that look like the ‘Figure’ and ‘Table’ labels you used in the main body of your thesis.

1. Select the **References** tab on the Ribbon then click on **Insert Caption**
2. Click **New Label**. Type **Figure\_Apx** then click **OK**
3. You now have two labels for figures, called **Figure** and **Figure\_Apx**  
   Repeat for table captions.
4. In the **Caption** box, type your caption text
5. Click **Numbering**. Tick **Include chapter numbering** and choose **Heading 7** from the drop-down list of styles and click **OK** twice
6. Your caption should look something like this:

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1. Delete the extraneous ‘\_Apx’ from the caption label so it reads:  
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This template already includes a List of Figures and a List of Tables, however you will have to create two new lists for the ‘Figure\_Apx’ and the ‘Table\_Apx’ labels.

1. Place the insertion point on a blank row after the existing List of Figures
2. Select the **Insert Table of Figures** command on the **References** tab of the Ribbon
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   **Note:** Word will put a single blank line between the original and new lists preventing it from appearing as one seamless list. However if you select the blank paragraph between the tables you can hide it by opening the Font dialog box from the Home tab and selecting **Hidden**.
4. Click after the List of Tables and repeat for the Caption Label ‘Table\_Apx’