CRANFIELD UNIVERSITY

GURKAN YESILYURT

ASSESSMENT OF THE EFFECTS OF THE STRATEGY, LEADERSHIP AND MORALE ON THE OUTCOME OF THE BATTLE

CRANFIELD DEFENCE AND SECURITY

LEADERSHIP AND MANAGEMENT

PhD

Academic Year: 2021 - 2024

Supervisor: Dr. Iftikhar Zaidi

Associate Supervisor: Dr.Irfan Ansari

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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

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

Keywords:

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LIST OF ABBREVIATIONS

|  |  |
| --- | --- |
| IT | Information Technology |
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# INTRODUCTION, BACKGROUND AND METHODOLOGY

## Introduction

Understanding human role in causing social conflicts and resolving them has been studied by many social scientists. Rummel see human being’s nature and needs as the basic reasons of the social conflicts (1977, Chapter 2). There are other explanations of the conflicts and its main causes. Marx for example, believes that the “surplus value” which is created by the labourers, by no means only should be owned by the capitalist and defined conflict as a social struggle between the working class and the capitalists for the control of the means of production and the sharing of wealth (2008, pp. 315, 384), while Huntington points to the conflicts between groups from differing civilizations (1996, p. 13). Clausewitz, before analysing the war and battle, gives the definition of conflict in terms of fighting and he says it is a trial of moral and physical forces through the medium of physical force(1989, p. 127).

Rummel analyses the conflict in comprehensive manner to frame the dynamics of conflict and war with his five-volume series of *Understanding Conflict and War*. He first analyses the inner person, psychology of human being to detect the roots of the conflict and defines it as a “process of balancing of powers”. He conceptualizes the conflict in four levels, as conflict-space (sources of conflict, like existence of slaves and the master), conflict-structure (dispositions of the elements in the conflict-space, like slaves wish to be free), conflict-situation (if slavery is illegal then there is situation). In the last level we observe real conflict (struggle of slaves will to be free) which yields a new balance. He then applies these four level to socio-cultural field and defines social conflict as confrontation of social powers and opposition and balancing of interests. This confrontation is in recursive nature and after balance has been reached, disrupted expectations initiate previous phases, that’s why he names this as “the conflict helix” (1976, Chapters 26–29).

Balancing of opposing interests, capabilities, and wills in the international level is being expressed as conflict behaviour, violence, and war. So, war is seen as one form of conflict(Dubois et al., 1997, p. 17; Rummel, 1979, Chapter 1). Below perspectives on war summarizes importance of it.

* War is a matter of vital importance to the state and the area of life or death (Tzu, 1971, p. 63),
* War is the prince’s most important matter to keep the state live (Machiavelli, 2008, p. 50),
* War is a is murder unless the life of the nation is in danger (Ataturk, 2006, p. 305) .

This vital feature of the war makes it an important topic of analysis in all ages (Frankel, 2021, sec. War). 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 (Clausewitz, 1989, p. 134). Although the importance of non-material factors are generally emphasized by authors (Clausewitz, 1832, pp. 127, 184, 194; N. T. Dupuy, 1979, p. 47; Lanchester, 1916, p. 37; Machiavelli, 2008, p. 39), it has not been treated within a rigorous, and systematic academic study.

Since social conflicts is caused by the human factors, it is reasonable to argue that successful resolution of them also necessitates subtle human intervention. So, in this research, the factors affecting the outcome of the battle will be examined from the perspective of strategy, leadership, and morale.

## Background

Determinants of war is a special interest of topic which encourage the stateman, commanders and researchers to explain the causes of the outcome. Sun Tzu names five fundamental factors to evaluate the war. These factors, which he associates with the winning of the battle are moral influence, weather, terrain, command, and doctrine. With these estimation factors laid down as principles, he prescribes some force ratio rules in the “art of using troops” part of his famous Art of War and says, “when ten to the enemy’s one, surround him”, “when five times his strength, attack him”, “if double his strength, divide him”(Tzu, 1971, pp. 63–80).

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 opponent’s power of resistance which he says product of two inseparable factors, namely “total means at his disposal” and “strength of his will”(1989, p. 77). He specifies that, with deciding; time, place, and the force of the engagement, strategy, not force ratio, has “considerable influence” on an engagement’s outcome. However, if the superiority of numbers reaches to the point where it is overwhelming then it becomes the most important factor and counterbalances all other factors (like quality of troops, leadership, or circumstances (Clausewitz, 1989, pp. 194–195).

Lancaster, on the other hand, developed a combat model that includes mathematical formulas to predict the winner of the battle. His first formula is named as Linear Law which basically explains the casualties in differential equations (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). His second contribution is N-square law which is defines fighting strength of a force as the proportional to the square of its numerical strength multiplied by the fighting value of individual units (Lanchester, 1916, pp. 39–66).

The width of mathematical formulas is so enlarged by the Depuy, former USA Army Officer, who tried to quantify almost every factor in the battle. His efforts started with calculating the lethality of weapons with the name “Operational Lethality Indices (OLI)” in 1963. He then integrated these OLI values to all combat variables defined by the Historical Evaluations and Research Organization (HERO) to get and compare the Combat Power Potentials of the sides to predict the theoretical winner and named this model as Quantified Judgement Model (QJM). He evaluates these theoretical results with the Actual Results of battle which is again quantified with giving values to three criteria’s (mission accomplishment, holding ground, and comparing the casualties). He named this as Result Model. In the end he tests the QJM accuracy with the Result Model. Aware of his model’s inability to quantify all non-material variables he approximates the effects of leadership, training, experience, morale, and logistics in a Combat Effectiveness Value (CEV) (N. T. Dupuy, 1979, pp. 19–105).

Biddle used multiple methods (formal theory, case study, statistical analysis, and simulation experimentation) to better explain the outcome of the battle and argued that material factors alone cannot explain capability. He added force employment, the doctrine and tactics by which armies use their materiel in the field. He argues that armies will be successful if they execute offensive and defensive operations conforming with the modern system of force employment tactics of cover and conceal, dispersion, combined arms, and independent small unit operations. His key finding might be summarized as the effects of preponderance in the numbers and technology is mediated by modern system of force employment. He concludes that technology and preponderance’s effects are radically different as a function of force employment, it can be decisive or almost immaterial as a function of the implementation of the modern system force employment. The one who implements force employment better, will exploit advantageous of numerical superiority in numbers and technology (Biddle, 2006, pp. 29–77).

Aware of the importance of the non-material factors in warfare, *British Defence Doctrine (BDD)* categorized “fighting power” into three sections (conceptual, physical, and moral) in 2001 and this approach has been used by UK since then. This doctrine constitutes the linkage between the subject and a military that follows a theoretical foundation from a practitioner perspective. 2001 BDD conceptualize fighting power as being made up of three inter-related components, conceptual, moral, and physical of equal value. It asserts that combat power is the product of these three components. While conceptual component provides the thought processes to develop the ability to fight (principles of the war and the doctrine supported by strategy). Physical component is the means to fight and consists of five elements (manpower, equipment collective performance, readiness, and sustainability). And the moral component is about persuading the people to fight which requires motivation, leadership, and management(UK Ministry of Defence, 2001, pp. 4-1: 4-5).

It is worth to mention the report of RAND which argues that morale, cohesion, and discipline is associated with the will to fight and provides an explanation of how to assess this important feature of forces by military planners (Connable et al., 2018, p. 10).

## Problem Statement

### Considerations

The literature presents models and information mostly quantifiable determinants of the outcome of the battle. Lancaster’s models only take number of troops and the weapon effectiveness as an input and excludes training, morale, leadership, and other qualitative factors of fighting strength since, he says, these cannot be put into the equations. He assumes these factors are equal on both sides. (Lanchester, 1916, p. 47).

Dupuy’s models are evaluating material factors much more detail than Lancaster (OLI values for all weapons and platforms, operational and environmental variables as well). His Combat Effectiveness Value (CEV) which combines non-material factors in a group is the most controversial and erroneous part of his models since this value is either determined generally (ex. German CEV value is 1.2 of Allied Powers in WWI in western front) or if there is inconsistent result, related factor (such as surprise) is added afterwards to CEV to calibrate the model to give correct value (Ciano, 1988, p. 31). Another weak point of Dupuy’s model is the subjective selectness of the non-material factors which is included to the model in the beginning of the analysis only if evaluators of the models detect any discrepancy (N. T. Dupuy, 1979, p. 39).

Biddle’s model includes one non-material factor of force employment and doctrine, but it also fails to explain major battles like USA withdrawal from Afghanistan or Battle of France in WWII.

In the Battle of France in WW II, the whole front is broken by General Guderian corps with only three Panzer Divisions and Motorized Infantry elements, against France forces of 10 Divisions at from Ardennes and dislocated BEF forces to Dunkirk and French forces to south of the country where they were ineffective throughout the war. Inferior by all predictions or force ratios in this decisive point, superior tactic of strategic penetration by independent armoured force combined with effective leadership enabled these victory (Aitken et al., 1994, pt. 1; Hart, 1974, p. 71). Guderian would not have attempt to this manoeuvre if he is to use current models of Lancaster or Dupuy.

The same question looms when the world’s biggest military spender, $778 billion in 2020 (Sipri, 2021, para. 5), USA, has had to withdraw from Afghanistan after nearly two decades of campaign in favour of Taliban. Malkasian asks the question why although superior in numbers, Afghan Government, supported mainly by USA, was consistently losing to inferior numbers of Taliban (2021, pp. 4–5). Again, current models including Biddle’s one (because his main argument was force employment, the one Americans is excellent at), cannot explain this withdrawal.

### Theoretical Approach to the Problem

Clausewitz’s conceptualization of the war and the manner he presents the importance of the numbers is the basic to understand the roots of the problem in the current models. In order to understand real war, Clausewitz analyses the absolute war, like Isaac Newton, who conceptualized the relative motion theories to understand the true motions of the individual bodies in the space (Harper, 2005, p. 592). Clausewitz’s perfect world of the war is absolute war, in which human factors, politics, and elite interests are taken away and each side pushes toward the extremes (extreme use of force, disarming the opponent, maximum exertion of strength) to win the war. Then he describes the modifications to this absolutism and says extreme use of force and maximum exertion of the strength is restricted by the limits of the human nature which in turn reduces the power of resistance. Realities, prospects of future events, political considerations, and possibility of the peace also prevents sides from employing all available forces. In reality opponents use their physical and moral forces in this limited sense (Clausewitz, 1989, pp. 75–80).

In Clausewitz approach success on the battlefield is attributed to the superior numbers only in this absolute mean of the war, when human factors, leadership, morale, will, determination is taken away from analysis. This constitutes his mechanical way of predicting the outcome of the battle. Then he qualifies this by saying that if superior numbers reach to the point of overwhelming, it will counterbalance all other contributing circumstances (strategy, morale and etc.). That’s why he suggests that bringing as many troops as possible into the engagement at the decisive point as the first principle of strategy (Clausewitz, 1989, 194-195).

This conceptualization and model of war is adopted by USA military, and they postulated six times strength over enemy to attack (USA Department of the Army, 1976, pp. 3–4). Because USA Army attributed the victory in the WWII to overwhelming numbers (Herbert, 1988, p. 99). USA military planners continue to think overwhelming combat force would guarantee the success even with the flawed strategy. So, they thought that morale factors should be taken away from considerations. Vietnam, Korea, Afghanistan, Libya, and Iraq cases have demonstrated flaws in this way of thinking. The reasons of these flaws of the models constitute the problem statement of the research.

The problem is literature presents very mechanical approach to understanding the outcomes of combat. There is highly subjective Dupuy method of bringing in the non-material factors in the QJM.

And there is a price for those tools that the Americans walked into Afghanistan based on models of predictive models that suggested that Afghanistan, Libya, Iraq, or all going to be cakewalks. They're going to be absolute total victory without any problem. In each of these cases they have been unsuccessful in achieving the initial war aims. I want something like this in the beginning. In the core of the problem these models treat non-material factors either as equal or non-existent. This research will add the effects of the strategy, leadership, and morale to better understand the determinants of the outcome and it will not challenge these models but will complement to explore other qualitative factors to add new information to the literature.

### Problem Statement

Current models which explain the reasons of the outcome of the battle is basically using material factors as predictor of the winner and this is not reflecting reality and remain simple”. That is why they cannot explain outcomes like the Taliban defeating a superpower or numerically inferior forces defeat their opponents like Germany in Battle of France. Germans would never attack to France if they were to use Lancaster’s and Dupuy’s models. Current models including Biddle (because his main argument was force employment, the one Americans is excellent at) would have said Taliban can never triumph in Afghanistan. So clearly there's a clear problem in those tools that we are applying. Afghanistan case would be the test of this research’s predictive model (How does this predictive model explain the success of the Taliban?).

## Aim and Objectives

### Aim:

This research will aim to **explore** effects of non-material factors on the outcome of the battle alongside other combat power elements.

### Objectives:

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

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

## Scope

There are so many non-material factors that affect the outcome of the battle. This research will mainly focus on leadership and morale effects. Material factors that influence the outcome of the battle will be explained in general to put the research into context. It is not intended to identify all elements affecting the course of the events in the battle.

## Problem Analysis

The problem spotted in this field is over generalization and of the first contributors and overstrain of the topic by the latest ones. Literature reflects the individualistic experiences of the first contributors (Sun Tzu, Clausewitz) and mathematically overstrained explanations of others (Dupuy).

Sun Tzu forecasts victor by comparing five fundamental factors (i.e moral influence, weather, terrain, command, and doctrine) (Tzu, 1971, p. 66). Although still valid all these factors today, current complexity of the battle in compare with the approximately 4th B.C. warfare, the time when “The Art of War” is crafted, requires more comprehensive analysis. Clausewitz, laid down philosophical foundations of the military art, comprehensively approached all disciplines of the warfare, appreciate the importance of the all the intangible factors of the battle, although his concepts need to be tested with the current level of scientific methodological approaches.

When we come to the latest contributors like Lancaster and Dupuy, the detected main problem is enforcing an overarching model to explain all kinds of battles mainly with mathematical models, which seems to be impossible when we consider the nature of the warfare which is mainly laid down by Clausewitz, who states that “uncertainties and lack factors always plays an important role to the extent of which makes the battle almost a gamble”(Clausewitz, 1832, p. 85).

Having said so 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(Tzu, 1971, p. 63). Clausewitz puts morale factor “among the most important in war” (Clausewitz, 1989, p. 184). Biddle’s conclusion is far more assertive and states “Material alone correlates poorly with observed capability” (Biddle, 2006, p. 27). UK Defence Doctrine also 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 non-material factors in the battles. What is missing in the literature is robust academic research on these factors, especially leader’s role and morale, because of their qualitative nature.

New data analysis tools to conduct “content analysis method” on the text materials presents powerful exploitation opportunities for new insights which in turn will facilitate the examination of these subjects.

## Research Value

This research is expected to provide contribution to literature new knowledge by analysing the leadership and morale in the battle environment and exploring the nature of their effects in deductive approach.

The reasons of adopting deductive approach will be explained in the first phase of the research with analysing the current gap within the existing literature.

This research will also test the two basic assumptions of the Clausewitz on the effect of numerical preponderance on the victory. First assumption is “Superior numbers may actually be contributing very little, depending on the circumstances”, and the second one is “Superiority, when reaches to the point where it is overwhelming, is the most important factor in the outcome of an engagement”(Clausewitz, 1989, p. 194).

This research will also complement four decades of effort by Dupuy from late 1950s to 1990, although he named “intangible factors” (leadership, training and morale, logistics, time and space, momentum, intelligence, technology, initiative, and combat effectiveness) to the outcome of the battle (N. T. Dupuy, 1979, pp. 37–39), inclusion of these factors to analysis is either incomplete or lacked the rigorous methodology.

This research is expected to add value to leadership studies in the battlefield environment. Off intangible factors stated by Dupuy, time and space, intelligence, surprise, and initiative factors are also referred to be related with leadership. And most importantly the strategy, which has “considerable influence” on the outcome of the battle (Clausewitz, 1989, p. 194) is devised by the leaders, in turn will be treated as the by-product of the leaders. All these factors will be analysed to appraise to what degree leadership matters on the battlefield.

## Positioning

This research will be a basic research, “with a purpose to know the way some phenomenon or process works” (Guillermina, n.d., pp. 52–53). The phenomenon is leadership and morale in the complex process of battle.

Ontological assumption is shaped by the particularities of the battle environment and the drivers of it. Reality in this field lies within the human being’s perception. In essence it is the people who follows the leader, and it is the mood of people which triggers action in the battle. In line with this understanding, epistemological assumption, the way to frame the knowledge within this reality, is assessed to be battle databases and the views of expert personnel in this field which are mainly articulated by military history books, soldiers who expressed their experiences with the memoirs, states, who provides official accounts of the events.

So, exploring the nature of these two phenomena requires to examine them with both positivist and social constructivist approaches. Positivist approaches has yielded valuable results so far for the material side of the topic, while producing unsatisfactory results for non-material factors. That’s why this research will adopt mainly constructivist approach.

## Research Questions

### Research Question 1:

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

### Research Question 2:

How much the outcome of the battle affected with inclusion of leadership and morale as factors alongside with other material factors?

## Hypothesis / Thesis

### Hypothesis:

Hypothesis to be tested with initial quantitative research is an existing theory form Clausewitz: (his famous “On War” will be used as “working theory” for this research).

“If superiority of numbers reaches to the point where it is overwhelming, it will be the most important factor in the outcome of an engagement, so long as it is great enough to counterbalance all other contributing circumstances” (Clausewitz, 1989, pp. 194–195).

### Thesis:

Initial thesis of this research is leadership and morale affect considerably the outcome of the battle.

All qualitative research will be conducted to collect evidence to test this thesis.

## Concepts and Variable

Concepts for the first phase (quantitative research) of the research are combat variables, material factors (numbers of personnel, weapon, and others), non-material factors (leadership, training, experience, morale, logistics). Each of these factors stated in parenthesis will be used as independent variables.

For the second phase of the research, although not as measurable as the quantitative research (Bryman, 2012, p. 388), the reference concepts will be leadership and morale in the battle context. These are also the intervening variables for the research since they have moderating effect (calibrating the effects of the independent variables on dependent).

Outcome of the battle is an ambiguous concept that will be used as dependent variable to appease the determinant’s importance.

## Methodology

In line with the positioning of the research as stated in 1.7 Positioning section, methodology of the research will be “explanatory sequential design” (Creswell, 2003, p. 213), with quantitative methodology preceding the qualitative one in supporting role.

Statistical methods will be used to identify the correlations between independent and dependent variables and variance coefficients on the outcome of the battle with the use of current battle databases. Then relationship between leadership and morale on the battle result will then be explored with qualitative methodology, mainly with “content analysis” method. These two methodologies will allow to gain the knowledge how and to what degree leadership and morale affects the battle, which literature currently lacks.

Theoretical framework of the research is depicted on the Figure-1

Diagram

Description automatically generated

Figure 1‑1 Theoretical framework of the research

### Research Steps:

How it will be studied?

1st step: Literature review 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.

Graphical demonstration for material factors is presented in the Figure-2.

Text

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Figure 1‑2 Material Factor Analysis

3rd step:

For the leadership and morale factors, “content analysis” method will be conducted. Current level in content analysis allows to measure how important a word is to a document. It will be done in the steps summarized below:

* Named entities will be annotated.
  + This step includes locating and classifying key terms of the morale and the leadership into pre-defined categories. Examples are given below:
    - “Military spirit” term (named as the most important moral elements in war (Clausewitz, 1989, p. 189) will be classified in morale category,
    - “Intellectual powers and courage” of the commander (named as “soldiers first requirement” (Clausewitz, 1989, p. 101) will be classified in the leadership category.
  + Literature will be reviewed comprehensively to cover all possible important features associated with the effectiveness of these two variables (leadership and morale) to better represent the named entities.
* Named entity recognition (NER):
  + Once named entities annotated manually, recognition of all these entities from raw text will be conducted by Natural Language Processing (NLP).
  + Raw texts might be official battle reports, academic products, or memoirs of soldiers. In the methodology chapter it will be expressed which raw texts will be used as input to the model. It will be beneficial to use raw texts of the battles of which regression analysis is made.
* 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.

Graphical demonstration for material factors is presented in the Figure-3.

Timeline

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Figure 1‑3 Non-material Factor Analysis

4th step:

Results of the “Content Analysis” will be integrated into the quantitative research results to conclude the nature of the relationship between leadership and morale and the outcome of the battle.

## Research Ethics

This research’s focus will be on leadership and morale on the warfare. Leadership qualities and morale effects will be solicited from universally accepted literature. It is expected that maximum objectivity will be attained in this term.

In order to provide maximum objectivity for the selection of the battles however there are some limitations when the effects of the material factors analysed. Main limitation is the availability of the datasets. There are two widely used dataset for the battles, which are Correlates of War (Sarkees & Frank Wayman, 2010) and USA Army’s CDB Dataset(USA Historical Evaluation and Research Organization, 1990). COW Dataset includes wars rather than battles. Since this research’s unit of analysis is battle, usability of this dataset will be limited to only analysing the effects of the material features. CDB90 dataset is centred on the battles. However, it has also drawbacks. The battles analysed in this dataset is mainly from USA, German, and Israeli experiences. The second main limit of this dataset is reliability. After reflecting the errors of it Biddle concludes that “real errors thus doubtless remain in the CDB90 data, in frequency that is difficult to assess but could well be significant”(Biddle, 2006, p. 153).

The effect of this risk related with the databases is assessed to be limited for this research, since the focus will not be on the material factors of warfare.

In analysing leadership and morale factors, text analysis will be used. For that purpose, Relation Extraction Model will be created. This model will be a simple software application through which a raw text will be inserted as input. Selection of raw texts will be arranged in a transparent, fair, and objective way that the model will yield the empirically sound results.

There is no intellectual property or conflict of interest issue related with this research.

## Limitations

The biggest limitation of this research is not coming from the nature of the subject, which is leadership and morale, but coming from the nature of the environment, which is battle. The factor of “chance”, which Clausewitz terms it as the most abundant thing in the battle(Clausewitz, 1989, p. 85), has a potential to prevent crystal clear understanding of the reasons of the outcome. Conscious of this fact, the focus will be on the patterns of leadership and morale in the battlefield.

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, 1989, 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.

## Layout of the Research

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.

# LITERATURE REVIEW

## Numbers, Predictions and War:

Dupuy’s approach to detect the values of the intangible variables of the battle is assessed to be heuristic, a kind of hasty response to fill this gap, a short-term approximation to complete the QJM.

Force Strength (S): The sum of the values of the weapons of a force (Operational Lethality Indices (OLI) – modified to reflect environmental variables. OLI factors were base of his research where he analysed the relationship between the weapons and the number of casualties. He added Operational Environmental Factors (OE) to the formula to better reflect the battlefield realities like effects of weather, terrain, season, mobility, and vulnerability factors. Force strength is calculated by multiplication of weapon effectiveness and environmental conditions.

Combat Power Potential (P): This value is calculated by applying (multiplying) all identifiable operational variables to the Force Strength (S) value. These variables are mobility factor, leadership, training and experience, morale, and logistic factors. Where applicable he gave mathematical weights to these variables. As an example, he gave values for the morale of the belligerents (excellent morale: 1.0, Panic: 0,2 and etc). Where he found solid proof, he multiplied these values with the Force Strength.

## Analysis of the Factors that Have Influenced Outcomes of the Battles and Wars: A Data Base of Battles and Engagements

This analysis conducted by Dupuy and colleagues under the auspices of US Army Concept Analysis Agency. They define their report as below:

“A comprehensive analysis in six volumes of the factors that have significantly influenced the outcomes of 600 major battles of modern history, commencing with the Netherlands' War of Independence and the Thirty Year' War, and continuing through the 1973 Arab-Israeli War. Volume I include the summary and introductory materials. Volumes II-VI present matrices and narrative summaries for the engagements, which are grouped chronologically by wars and campaigns factors affecting outcome in historical engagements, surprise in warfare, combat forms and resolution in historical engagements, advance rates, and frontages in historical engagements within wars. The matrices summarize all important elements of data and qualitative information concerning each engagement, plus a historical assessment of the factors that were important to the course of the engagement and its outcome. Following each group of matrices are narrative summaries of engagements listed in the matrices. These narratives succinctly describe the background, course, and outcome of each engagement, include a brief assessment of its significance, and list the sources consulted with respect to the presentation for each. Bibliographies are listing the major sources consulted during the research for each.”(T. N. Dupuy et al., 1984, sec. Report Documentation Page)

In summary, the review of the HERO reports and the subsequent random assessments resulted In a conclusion that the report and the assessments will provide a valuable starting point for orginizitions desiring to investigate the relationship between history, Its "numbers," ana analysis or prediction of battle Intricacies. However, as HERO points out in their own introduction (IOL II), the work needs rigorous review, some gar require filling, and other time periods and battle coverage would help in providing(T. N. Dupuy et al., 1984, pp. 2–3).

a more comprehensive work.

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### Unit of Analysis

Unit of analysis for this research is “battle” with the identification of Clausewitz, who defines it as “the struggle by the main force” (Clausewitz, 1989, p. 248). In his terms war consists of “engagements” with all kinds of purposes. Of these engagements that fought to attain main objective is termed as “battle”.

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).

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Of 60 division-sized engagements in the USA 5th Army Zone in Italy in WWII, these two models estimated %68 of the battles correctly. He attributes the insufficient explanation to the curve-fitting exercise and added 21 more battles as validating database. This time

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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:

**Figure\_Apx A‑1 This is the caption text for a Figure in the Appendix**

1. Delete the extraneous ‘\_Apx’ from the caption label so it reads:  
   **Figure A‑1 This is the caption text for a Figure in the Appendix**  
   **TIP:** Instead of deleting each ‘\_Apx’ individually use **Find & Replace** to modify all the labels at once.

Creating Lists of Figures and Tables for Appendices

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
3. Set the **Caption Label** box to ‘**Figure\_Apx**’ and click **OK**  
   **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’