



Competitive edge manufacturing : incorporation of Sun Tzus The Art of War
by Qian Song

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in
Industrial and Management Engineering
Montana State University
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Abstract:

Although Sun Tzu's The Art of War has been successfully applied to military campaigns and marketing, there have been few attempts to apply it to manufacturing to assist business decision making. This research explores the possibilities of incorporating The Art of War to assist manufacturing executives in competitive edge decisions.

In this research, the difference between business competition and war is carefully compared. War guidelines from The Art of War, which can be applied to manufacturing decision-making, are transformed into seventeen applicable guidelines. These guidelines are structured as an IDEFO process, so that when combined with specific manufacturing techniques, are ready for application. An example is given to describe how to combine Analytic Hierarchy Process with the transformed guidelines to assist manufacturers in decision-making.

The following are major results of this research: 1. Based on ideas of The Art of War and the evolution of post-war manufacturing, it is concluded that the competitive edge is a moving target for all manufacturing companies.

2. With counter example method, and the manufacturing examples, it is concluded that the current successful manufacturing formats, like LEAN, JIT, Gradual Improvement, are not panaceas for competitive-edge manufacturing. Therefore, every business should strive to attain the competitive edge by shaping a format to its unique situation.

3. Real manufacturing companies that apply The Art of War in their decision processes are successful. Also, typical manufacturing examples are summarized to support and exemplify the essence of the book. With scientific method of knowledge acquisition, it is concluded that Sun Tzu's transformed guidelines are a useful aid for their strategic-decision making.

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May 1998

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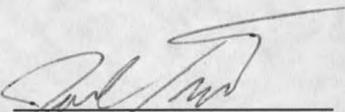
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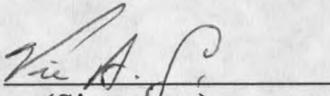
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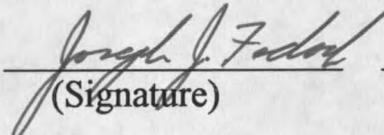
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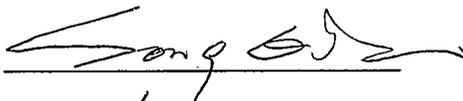
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ACKNOWLEDGEMENTS

The author gratefully acknowledges the support and the helpful suggestions of my graduate committee, Dr. Joel Troxler, Dr. Donald Boyd and Dr. Robert Marley, of the Department of Mechanical and Industrial Engineering, Montana State University-Bozeman.

Sincere appreciation is likewise expressed to my family and my friends for their support during the entire research process.

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ABSTRACT

Although Sun Tzu's The Art of War has been successfully applied to military campaigns and marketing, there have been few attempts to apply it to manufacturing to assist business decision making. This research explores the possibilities of incorporating The Art of War to assist manufacturing executives in competitive edge decisions.

In this research, the difference between business competition and war is carefully compared. War guidelines from The Art of War, which can be applied to manufacturing decision-making, are transformed into seventeen applicable guidelines. These guidelines are structured as an IDEF0 process, so that when combined with specific manufacturing techniques, are ready for application. An example is given to describe how to combine Analytic Hierarchy Process with the transformed guidelines to assist manufacturers in decision-making.

The following are major results of this research:

1. Based on ideas of The Art of War and the evolution of post-war manufacturing, it is concluded that the competitive edge is a moving target for all manufacturing companies.
2. With counter example method, and the manufacturing examples, it is concluded that the current successful manufacturing formats, like LEAN, JIT, Gradual Improvement, are not panaceas for competitive-edge manufacturing. Therefore, every business should strive to attain the competitive edge by shaping a format to its unique situation.
3. Real manufacturing companies that apply The Art of War in their decision processes are successful. Also, typical manufacturing examples are summarized to support and exemplify the essence of the book. With scientific method of knowledge acquisition, it is concluded that Sun Tzu's transformed guidelines are a useful aid for their strategic-decision making.

CHAPTER 1

INTRODUCTION

Background

In order to survive in today's competitive world, manufacturing businesses must frequently make changes in business and production methods. For many manufacturers, one of the most difficult tasks is maintaining a competitive edge. Basically, there are several important resources that can aid these companies in their decision-making to increase the competitiveness:

Following the Examples of Successful Companies and Being Aware of the Trends

In industry, new concepts, like Just-in-Time (JIT) manufacturing and Lean Production (LEAN), have been successfully applied, such as JIT in Toyota [1] and Lean Production in Chrysler [2].

Serope Kalpakjian [3] summarizes JIT manufacturing as:

The purchase of supplies just in time to be used;

The production of parts just in time to be made to sub-assemblies;

The production of sub-assemblies just in time to be assembled into finished products;

The production and delivery of finished products just in time to be sold.

The major advantages of JIT are low inventory carrying costs and the quick detecting of defects. Faizul Huq [4] simulates a JIT Kanban manufacturing process with short-term demand variation. He concludes that 2 WIPs (Work-in-Process) are the best choice for a company in such a situation.

Paul Kidd [5] delineates LEAN as:

The ability to manufacture products with less of everything — less time to design, less inventory, fewer defects, etc.

Chester Richards [6] describes the following manufacturing trends:

FLEXIBILITY: The ability to produce different products on the same production line.

VIRTUAL COMPANY: A true company in that it carries out all the functions necessary to exploit a particular set of business opportunities. It is virtual in the sense that, such functions as marketing, design, manufacturing, legal, accounting, etc., are carried out by legally distinct units that have come together just for this opportunity, and will probably go their separate ways once it is over.

GRADUAL IMPROVEMENT: A principle that the manufacturing processes and products must evolve by gradual improvement rather than radical changes.

RE-ENGINEERING: A technique for improving the overall health of a system. It not only eliminates unnecessary activities from the current system, but also attacks and simplifies the company's underlying structure.

AGILITY: The ability of an enterprise to thrive in a competitive environment of continuous and unanticipated change, to respond quickly to rapidly changing markets driven by customer valuation of products and services.

Chester also points out some relationships between these concepts. For example, agility might be the ability to switch rapidly among the various products of a flexible manufacturing system. Also, agility is one of the primary ways to measure a re-engineering technique. Chester understands that the virtual concept is not a panacea for manufacturers. Also, other literature summaries point out that manufacturing should be market-oriented and apply TQM (Total Quality Management) [7][8].

For many manufacturers, however, the question of whether the successful formats, like JIT manufacturing and Lean Production, could be a cure-all to fix manufacturing shortcomings remains a problem.

Applying Practical Suggestions

These suggestions come from business experience and studying of successful cases. Although these suggestions are everywhere, when decision-makers in manufacturing businesses must make critical decisions, they often feel that these suggestions are far from adequate in both quality and quantity.

Suggestions For Future Manufacturing Businesses

Nanua Singh [9] points out that successful manufacturing businesses must exhibit some or all of the following characteristics:

- Greater product customization
- Advanced interenterprise networking technology
- Rapid introduction of new or modified products
- Upgradable products
- Increased emphasis on knowledgeable, highly trained, empowered workers

- Interactive customer relationships
- Dynamic reconfiguration of production processes
- Greater use of flexible production technologies
- Rapid prototyping
- An open system information environment
- Innovative and flexible management structures
- Product pricing based on value to the customer
- Commitment to environmentally benign operations and product designs

Suggestions For Managers Of Manufacturing Enterprises

According to Nanua Singh [9], Goldman and Preiss suggest that managers have to unlearn many of the currently held truths, including:

- Cooperation is less desirable than succeeding on one's own
- Standards are constraining and their formulation dull work
- Labor — management relations must be adversarial
- Breakthroughs are the only targets worth aiming at
- Information is power and can be shared only to one's detriment

Quantitative Decision Support Tools

Quantitative decision support tools have been widely used, such as:

PROBABILITY AND STATISTICS: Useful tools for problems such as deciding insurance rates, risk analysis, etc. But this method usually needs a great deal of real or experimental data.

LINEAR PROGRAMMING: Helpful for problems concerning resource allocation, transportation plans, etc. However, it requires that problems be formulated as a linear model [10].

ANALYTICAL HIERARCHY PROCESS (AHP) [11][12]: Developed by Thomas Saaty. Its strength lies in its ability to support decision-making by structuring complex, multi-attribute problems hierarchically, including intangible factors. AHP is good at justifying multiple choices. Also, it provides a unique means of quantifying judgmental consistency. However, the method does not consider interactive effects among major influencing factors.

As all the major resources listed have capability limitations in assisting manufacturing company in decision-making, other feasible sources are consistently and aggressively sought by scholars and manufacturers. In this research, a book rarely noticed by manufacturers, guidelines from Sun Tzu's The Art of War are introduced as an aid for manufacturing companies to make decisions. Unique ideas are presented that outdistance the suggestions of Nanua Singh, Goldman and Preiss.

Objectives

The questions to be addressed by this research are:

1. The characteristic of the competitive edge, i.e., is it stable or moving?
2. Do successful manufacturing structures such as LEAN, JIT, and Gradual Improvement guarantee the cutting edge for manufacturing businesses?
3. Is it possible for manufacturers to apply the principles of Sun Tzu's The Art of War in their decision-making? This research explores the possibilities of using Sun Tzu's

guidelines in manufacturing business operations so that modern manufacturing may benefit from this profound ancient heritage.

CHAPTER 2

REVIEW OF HISTORICAL LITERATURE

Sun Tzu and His Influence

In the closing years of the sixth century B.C., Sun Tzu presented his The Art of War to He-lu, King of Wu, and was eventually made a general. In Sun Tzu's time, ancient China evolved from about one hundred independent states into "The Big Seven" states. Wu was a medium-sized state surrounded by larger states. Sun Tzu defeated the stronger state of Chiu to the west and entered its capital. To the north he intimidated Chi and Chin. To the south he defeated Yue. To the east of the Wu state is the China Sea. Though unbeatable, he suddenly disappeared from the political scene; however, The Art of War survived. [13]

According to British military strategist B. H. Liddell Hart [14]:

"Sun Tzu's essays on The Art of War form the earliest known treatises on the subject, but have never been surpassed in comprehensiveness and depth of understanding. They might well be termed the concentrated essence of wisdom on the conduct of war. Among all the military thinkers of the past, only Clausewitz is comparable, and even he is more 'dated' than Sun Tzu, and in part antiquated, although he was writing more than two thousand years later. Sun Tzu has clearer vision, more profound insight, and eternal freshness."

Civilization might have been spared much of the damage suffered in the world wars of this century if the influence of Clausewitz's monumental tomes On War, which

molded European military thought in the era preceding the First World War, had been blended with and balanced by a knowledge of Sun Tzu's exposition on The Art of War."

The Art of War was first brought to the Western world by a Peking Jesuit missionary, Father J. J. M. Amiot, whose interpretation was published in Paris in 1772. As one Chinese editor has affirmed, possibly, it was read by Napoleon, for as a young officer the future emperor was an avid reader. Therefore, it is unlikely these unique essays would have escaped his attention. [15]

In the East, the book was first introduced to the Japanese islands by Kibi-no-makibi between A.D. 735 ~ 747, approximately one thousand years earlier than to the West. Kibi-no-Makibi visited China twice (A. D. 716 ~ 735 and A. D. 752 ~ 754) and brought a number of classical Chinese texts back to Japan.

The Chinese refer to Sun Tzu as "The military teacher for one hundred generations". Former Chinese leader Mao Tse-tung was strongly influenced by Sun Tzu's thought [15]. This is apparent in his works, for example, On Guerrilla War and On the Protracted War, that deal with military strategy and tactics. His followers had applied Sun Tzu's precepts to their anti-Japanese military operations in the Second World War which result in repeated defeats for the Japanese.

In 1988, President Richard Nixon [23] published a book, using Sun Tzu's guideline 'Victory Without War' as title; he successfully predicted the result of the Cold War. Later, during the Gulf War, it was reported that there were always two books on President Bush's table, The Art of War and The Biography of Caesar. President Bush's handling of the entire Gulf crisis verifies this. The war process was typical of Sun Tzu's way: "The highest form of generalship is to balk the enemy

with intelligence; the next is resort to foreign relation; the last in order is to attack the enemy's forts". "With direct method to engage, with indirect method to win" [17]. In 1961, former British Marshal Montgomery suggested The Art of War should be a required textbook for all the military schools in the world.

Introduction to The Art of War

After 2,500 years, there are numerous versions of The Art of War. In April 1972, Chinese archeologists unearthed some burial objects in the Han Dynasty Tomb (B. C. 206 ~ A. C. 25) of Yinqueshan (Silver Bird Mountain), 28.8 km north of present-day Lin-Yi City, Shandong Province, China. Among them were the remains of ancient books made up of 4,942 bamboo slats. More than 200 slats, containing 2,400 characters, were the remnants of an ancient version of Sun Tzu's The Art of War. Since then, the Lin Yi discovery has been a mandatory source for all Sun Tzu's studies [15]. More than ten translations have been published in several different languages, e. g., Russian, Japanese, English, and French.

Sun Tzu's The Art of War contains thirteen sections [13]:

- Estimates
- Waging War
- Offensive Strategy
- Dispositions
- Energy
- Weakness and Strengths

- Maneuvers
- The Nine Variables
- Marches
- Terrain
- The Nine Varieties of Ground
- Attack by Fire
- Employment of Secret Agents

In the beginning of the book Sun Tzu wrote:

“War is a matter of vital importance to the state; the province of life or death; the road to survival or ruin. It is mandatory that it be thoroughly studied. Therefore, appraise it in terms of the five fundamental factors, and make comparisons with The Art of War, so you may assess its essentials. The first of these factors is morality; the second, weather; the third, position; the fourth, general; and the fifth, doctrine.”[13][14][15] [16][17]

Biography of Sun Tzu

As a hero, Sun Tzu's legend was described in various stories. Two thousand years ago, Ssu-ma Ch'ien gave the following classic biography of Sun Tzu [19]:

Sun Tzu Wu was a native of the Ch'i State. His The Art of War brought him to the notice of Ho Lu, King of Wu. Ho Lu said to him: “I have carefully perused your 13 sections. May I submit your theory of managing soldiers to a slight test?”

Sun Tzu replied: “You may.”

Ho Lu asked: “May the test be applied to women?”

The answer was again in the affirmative, so arrangements were made to bring 180 ladies out of the Palace. Sun Tzu divided them into two companies, and placed one of the King's favorite concubines at the head of each. He then bade them all take spears in their hands, and addressed them thus: “I presume you know the difference between front and back, right hand and left hand?”

The girls replied: "Yes."

Sun Tzu went on: "When I say 'Eyes front,' you must look straight ahead. When I say 'Left turn,' you must face towards your left hand. When I say 'Right turn,' you must face towards your right hand. When I say 'About turn,' you must face right round towards your back."

Again the girls assented. The words of command having been thus explained, he set up the halberds and battle-axes in order to begin the drill. Then, to the sound of drums, he gave the order "Right turn." But the girls only burst out laughing. Sun Tzu said: "If words of command are not clear and distinct, if orders are not thoroughly understood, then the general is to blame."

So he started drilling them again, and this time gave the order "Left turn," whereupon the girls once more burst into fits of laughter. Sun Tzu: "If words of command are not clear and distinct, if orders are not thoroughly understood, the general is to blame. But if his orders ARE clear, and the soldiers nevertheless disobey, then it is the fault of their officers."

So saying, he ordered the leaders of the two companies to be beheaded. Now the king of Wu was watching the scene from the top of a raised pavilion; and when he saw that his favorite concubines were about to be executed, he was greatly alarmed and hurriedly sent down the following message: "We are now quite satisfied as to our general's ability to handle troops. If we are bereft of these two concubines, our meat and drink will lose their savor. It is our wish that they shall not be beheaded."

Sun Tzu replied: "Having once received His Majesty's commission to be the general of his forces, there are certain commands of His Majesty which, acting in that capacity, I am unable to accept."

Accordingly, he had the two leaders beheaded, and straight away installed the pair next in order as leaders in their place. When this had been done, the drum was sounded for the drill once more; and the girls went through all the evolutions, turning to the right or to the left, marching ahead or wheeling back, kneeling or standing, with perfect accuracy and precision, not venturing to utter a sound. Then Sun Tzu sent a messenger to the King saying: "Your soldiers, Sire, are now properly drilled and disciplined, and ready for your majesty's inspection. They can be put to any use that their sovereign may desire; bid them go through fire and water, and they will not disobey."

But the King replied: "Let our general cease drilling and return to camp. As for us, we have no wish to come down and inspect the troops."

Thereupon Sun Tzu said: "The King is only fond of words, and cannot translate them into deeds."

After that, Ho Lu saw that Sun Tzu was one who knew how to handle an army, and finally appointed him general. In the west, he defeated the Chu State and forced his way into Ying, the capital; to the north he put fear into the States of Chi and Chin, and spread his fame abroad amongst the feudal princes. And Sun Tzu shared in the might of the King.

CHAPTER 3

SIGNIFICANCE

B. H. Liddell Hart suggests that studying The Art of War might spare civilizations great suffering and damage [14]. Sun Tzu's guidelines, such as "The supreme art of war is to subdue the enemy without fighting", provide an alternative to recent management theories. An advertisement posted at the New York La Guardia Airport says: "Does your consultant ever refer to The Art of War?", this shows that some consultants have noticed the importance of the book. Some manufacturing strategists also study Sun's book. For example, Chester Richards quoted Sun Tzu's, "According to my assessment, even if you have many more troops than others, how can that help you win." [6]. However, most sentences quoted by Richards do not capture the essence of The Art of War. Application of the book demands more accurate and profound knowledge of the author, the historical background, and the text.

Contemporary Japanese students of The Art of War have applied the strategy of the ancient classic to modern politics and business with alacrity. Indeed, some see in the success of post-war Japan an illustration of Sun Tzu's dictum "to win without fighting is best." [15].

Influenced by the Japanese application of The Art of War in business, a number of Chinese business leaders and scholars have been paying it more attention. Seminars are held almost every year. These seminars are attended by scholars and business leaders from the U.S., Japan, Europe, and countries all over the world [18][20][21].

However, The Art of War has seldom been used in manufacturers' decision-making, or to understand the situation of a business. The global competition of manufacturing is so keen that companies have invested millions of dollars and years of effort in order to gain the competitive edge. On the other hand, it takes only, a few days, to read The Art of War, and the book might be an excellent aid for the strategic decision making necessary to business survival. Therefore, it is an attractive idea to research the possible application of the essence of The Art of War.

The Art of War was written in ancient China. At that time, most Chinese works were written on bamboo slats instead of paper. The authors wrote as little as possible in order to cut down the size of "books". One Chinese character in these books could have many meanings. Therefore, it is difficult for scholars to understand and translate these abstruse books. Today, most Chinese people rely on modern editors' explanations of The Art of War. Since Kibi-no-Makibi, foreign translators have been striving to catch the essence of the book; however, their translations are far from perfect.

Because it is desirable to study the possible applications of the Sun Tzu's book to modern manufacturing business decisions, a profound understanding of The Art of War is critical.

CHAPTER 4

PREPARATION FOR THE INCORPORATION OF THE ART OF WARSelection of the Appropriate Translation

To find a good English translation of The Art of War, it is desirable to select a good Chinese version first. The original work has various Chinese versions. One of them can be dated back to Ts'ao Ts'ao (A. D. 220 ~ 265), a famous king in Chinese history, who wrote a commentary on Sun Tzu's work and published The Art of War [13]. Ts'ao Ts'ao lived in a time when China was separated into three countries (known as "Three Nations"); he was the king of one of them. Like Sun Tzu, Ts'ao Ts'ao's story is widely known throughout Asia today, especially in Japan. The Japanese recently produced a cartoon series about the history of the Three Nations; one major character was Ts'ao Ts'ao. The Three Nations Story is also translated into English from ancient Chinese as Romance of Three Kingdoms by Brewitt Taylor [22]. Ts'ao Ts'ao's commentary on The Art of War was written in ancient Chinese too. It provides one of the most prestigious commentaries on The Art of War and can be used as an aid for the selection of a modern Chinese version.

Among the Chinese versions, “Sun Tzu, The Art of War, Wuhan Publishing Co., September, 1994” is the best version, as it provides the following useful contents [13]:

1. Full contents of the original Sun Tzu’s The Art of War in ancient Chinese, exactly the same as found at Lin Yi.
2. A translation of The Art of War into modern Chinese. This provides for a good understanding of the original work.
3. Thirteen military cases support the sections of The Art of War. This helps one catch the essence of the guidelines.
4. Ts’ao Ts’ao’s and Ssu-Ma Ch’ien’s commentaries on The Art of War.

The English translations are compared in a number of different ways, but the most important consideration is the accuracy of the translation. The background of authors, the format and the comments on these translations are also important factors.

There are a number of ways to acquire English translations of The Art of War. For example, the local Hasting’s Store has four different versions for sale [14][15] [16][17]. There is also a translation by Samuel B. Griffith in Montana State University-Bozeman library that includes good information for Sun Tzu study. Samuel B. Griffith was a Ph.D. candidate in Oxford University. His translation of The Art of War is a considerably revised version of his thesis [14].

There are three different translations on the Internet at these following sites:

1. <http://home.navisoft.com/entisoft/artofwar.htm>. Sun Tzu on the Art of War, The Oldest Military Treatise in the World, Translated from the Chinese by Lionel Giles, M.A. (1910) [16].
2. <http://www.mit.edu/people/dcctdw/AOW/toc.html>. The Art of War, Sun Tzu, Translated by Thomas Cleary, Shambhala Pocket Classics, Boston, 1991 [17].
3. http://alf.nbi.dk/~jallberg/karate/art_of_war.html. The Art of War (The First Seven Sections). Translated from the Chinese by Anonymous.

One must first compare the accuracy of the table of contents translation in order to decide which translation gives the most accurate meaning of Sun Tzu's idea. Note the difference in the following:

(1) Lionel Giles's translation for content

1. Laying Plans
2. Waging War
3. Attack by Stratagem
4. Tactical Dispositions
5. Energy
6. Weak Points and Strong
7. Maneuvering
8. Variation in Tactics
9. The Army on the March
10. Terrain

11. The Nine Situations
12. The Attack by Fire
13. The Use of Spies

(2) Thomas Cleary's translation for content

1. Strategic Assessments
2. Doing Battle
3. Planning a Siege
4. Formation
5. Force
6. Emptiness and Fullness
7. Armed Struggle
8. Adaptations
9. Maneuvering Armies
10. Terrain
11. Nine Grounds
12. Fire Attack
13. On the Use of Spies

(3) Anonymous translations for content (There are no sections 8 ~ 13 in this translation.)

1. Estimates
2. Waging War
3. Offensive Strategy

4. Dispositions
5. Posture of Army
6. Void and Actuality
7. Maneuvering

(4) Samuel B. Griffith's translation for content

1. Estimates
2. Waging War
3. Offensive Strategy
4. Dispositions
5. Energy
6. Weakness and Strength
7. Maneuver
8. The Nine Variables
9. Marches
10. Terrain
11. The Nine Variables of Ground
12. Attack by fire
13. Employment of Secret Agents

By comparison with the Chinese table of contents [13], it can be seen that Lionel Giles's translation provides the most accurate translation of contents. The table of contents is the key part for most ancient Chinese books. It is understood as the second most important thing after the book title, to

attract the readers. So, the translation of this part can serve as the indicator for verifying the quality of the translation.

Lionel Giles's translation is written in a format that is familiar to the most Western readers. It is assembled in a format similar to the Bible's, sentences numbered sequentially. Therefore, this translation is selected as the best work for this research. Further review of the details reveals that Lionel Giles' 1910 edition is the most scholarly and presents the reader an incredible amount of information concerning Sun Tzu's text. Clearly, Lionel Giles's work established much of the groundwork used by later translators. He was a leading sinologist in his time and an assistant in the Department of Oriental Printed Books and Manuscripts in the British Museum.

On the other hand, Thomas Cleary's translation gives a full set of explanations about each sentence. He tells how and why these sentences are expressed. It is helpful for readers to understand the original meaning of The Art of War. Thomas Cleary uses, on the Internet, hyperlinks to give detailed comments without influencing the structure of the translated literature.

Sun Tzu's original work was written in a continuous format; its contents, like any other good book, are tightly inter-linked. So the Anonymous translation is best for reading, especially for first time reader, as it is appropriately paragrahed like the original work.

Comparison of Business Competition and War

For humans, real war is far fiercer and bloodier than business competition. There is significant difference between these two domains. Sun Tzu's work was originally written for war, not business competition. Not all of his guidelines can remain in the original form when being applied to modern business practice. Obviously, it would not be appropriate if the war guidelines used were applied to business competition without referring to law.

For example, in Section 12 of The Art of War Sun Tzu talked a great deal about "Attack by Fire". However, it is unlawful to set fire to the competitor's estate in order to gain advantage. Obviously, only those guidelines that can be applied in both domains can be considered in this research. Special attention should be paid to these guidelines having similarity and overlap between war and business concepts, and to exclude those that do not.

The Dictionary Definitions of "War" and "Competition"

Two typical dictionaries were referenced in order to find the exact meaning of the concept "war" and "competition". New Webster's Dictionary gives the definition in American English; the other, Longman Dictionary of Contemporary English, gives the definition in British English.

New Webster's Dictionary (U.S.A.)

War:

- a) Armed conflict between nations, tribes of other groups or an instance of this.

- b) A concerted effort to put down, reduce or exterminate.
- c) A state of hostility without resort to arms.

Competition:

- a) A contest in which people compete.
- b) A competing.

Compete:

- a) Try to win a contest.
- b) Try to get what others also seek which all can not have.

Contest:

- a) A struggle for domination.

Longman Dictionary of Contemporary English (Great Britain)

War:

- a) Armed fighting between nations.
- b) An example or period of this.
- c) A struggle between opposing forces or for a particular purpose.

Competition:

- a) The struggle between several people or groups to win something or gain an advantage.

The Major Feature of War and Competition Are Summarized as:

Table 1: Comparison of Competition and War

		War	Business Competition
Object	Occupy	Area	Market
	Gain	Everything	Profit
	Destroy or gain advantage over	Enemy	Competitor
Manner	Lawful	No	Yes
	Armed	Yes	No

David T. Geaslin, An American Veteran, Summarizes:

“The only difference between war and commerce is that the law regulates the use of violence. Whether your business, your home, or your job and family security is taken by sale or at the point of a gun is of little consequence. You and your family are still standing in the cold and in danger’s way. When I studied his (Sun Tzu’s) plan, I realized that it could be the perfect organizational structure for competition in commerce. The parallel between commerce and war are very similar.” [24]

The first eight sections of The Art of War — Estimates, Waging War, Offensive Strategy, Dispositions, Energy, Weakness and Strengths, Maneuver, and The Nine Variables — do not refer to war manners only, and do not concentrate on specific objects that could only be gained through war. Sun’s weighting, planning and energy-gaining methods can also be applicable to business competition. The remaining five sections will not be considered in this study because they apply mainly to military techniques.

Guidelines Selected for Possible Application

The content of The Art of War is systematically organized. The guidelines are supported by facts and analysis. Sun Tzu was very careful that his book did not contain contradictions. The selection of the guidelines to be applied in this study is governed by two considerations:

- The guidelines selected should represent the unique ideas of Sun Tzu.
- The guidelines should be easy to be transformed to an applicable form for manufacturing business decision-making, without impairing their original essences.

In this research, the following guidelines are pulled from the Lionel Giles's translation [16] and applied to business competition. They are grouped according to their original sections and numbered according to the sequence number in their sections.

Guidelines

Section One.

1. Sun Tzu said: The art of war is of vital importance to the State.
2. It is a matter of life and death, a road either to safety or to ruin. Hence it is a subject of inquiry which can on no account be neglected.
3. The art of war, then, is governed by five constant factors, to be taken into account in One's deliberations, when seeking to determine the conditions obtained in the field.
4. These are:
 - i. The Moral Law;
 - ii. Heaven;
 - iii. Earth;
 - iv. The Commander;

v. Method and discipline.

9. The Commander stands for the virtues of wisdom, sincerity, benevolence, courage and strictness.

Section Two

5. Thus, although we have heard of stupid haste in war, cleverness has never been seen associated with long delays.

Section Three

1. Sun Tzu said: In the practical art of war, the best thing of all is to take the enemy's country whole and intact; to shatter and destroy it is not so good. So, too, it is better to recapture an army in its entirety than to destroy it, to capture a regiment, a detachment or a company in its entirety than to destroy them.
2. Hence to fight and conquer in all your battles is not supreme excellence; supreme excellence consists in breaking the enemy's resistance without fighting.
18. Hence the saying: If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle.

Section Four

1. Sun Tzu said: The good fighter of old first puts himself beyond the possibility of defeat, and then waits for an opportunity to defeat the enemy.
13. He wins his battles by making no mistakes. Making no mistakes is what establishes the certainty of victory, for it means conquering an enemy that is already defeated.
15. Thus it is that in war the victorious strategist only seeks battle after the victory has been

won, whereas he who is destined to defeat first fights and afterwards looks for victory.

Section Five

5. In all fighting, the direct method may be used for joining battle, but indirect methods will be needed in order to secure victory.
21. The clever combatant looks to the effect of combined energy, and does not require too much from individuals. Hence his ability to pick out the right men and utilize combined energy.

Section Six

29. Military tactics are like water; for water, in its natural course, runs away from high places and hastens downwards.
30. So in war, the way is to avoid what is strong and to strike at what is weak.
31. Water shapes its course according to the nature of the ground over which it flows; the soldier works out his victory in relation to the foe whom he is facing.

Section Seven

2. After that, comes tactical maneuvering, than which there is nothing more difficult. The difficulty of tactical maneuvering consists in turning the devious into the direct, and misfortune into gain.

Section Eight

3. There are roads which must not be followed, armies which must be not attacked, towns which must not be besieged, positions which must not be contested, commands of the sovereign which must not be obeyed.

Transformation of the Guidelines

Obviously, the guidelines selected can be easily transformed into the following rules that are more appropriate for business competition. However, the essence of The Art of War must be maintained in this process.

Transformed Guidelines:

No. 1 The art of business competition is of vital importance to the Company. It is a matter of life and death, a road either to safety or to ruin. Hence it is a subject of inquiry which can on no account be neglected.

No. 2 The art of competition, then, is governed by five constant factors, to be taken into account in one's deliberations, when seeking to determine the conditions obtained in the field.

These are:

- i. Business ethics;
- ii. Business environment;
- iii. Mundane reality;
- iv. The Manager;
- v. Policies of the business.

No. 3 The Manager stands for the virtues of wisdom, sincerity, benevolence, courage and strictness.

No. 4 Thus, although we have heard of stupid haste in competition, cleverness has never been seen associated with long delays.

- No. 5 In the practical art of competition, the best thing of all is to take the opponent's market whole and intact; to shatter and destroy it is not so good. So, too, it is better to recapture a market position in its entirety than to destroy it, to capture a segment, a product line or a product in its entirety than to replace them.
- No. 6 Hence to fight and conquer in all your market skirmishes is not supreme excellence; supreme excellence consists in breaking the opponents competition without fighting.
- No. 7 Hence the saying: If you know the opponent and know yourself, you need not fear the result of a hundred skirmishes. If you know yourself but not the competitor, for every victory gained you will also suffer a defeat. If you know neither the competitor nor yourself, you will succumb in every market skirmish.
- No. 8 The good competitor first puts himself beyond the possibility of defeat, and then waits for an opportunity to defeat the opposing competitor.
- No. 9 He wins his market battles by making no mistakes. Making no mistakes is what establishes the certainty of victory, for it means conquering a competitor that is already defeated.
- No. 10 Thus it is that in business competition the victorious strategist only seeks battle after the victory has been won, whereas he who is destined to defeat first fights and afterwards looks for victory.
- No. 11 In all market battles, the direct method may be used for direct competition, but indirect methods will be needed in order to secure victory.
- No. 12 The clever competitor looks to the effect of combined energy, and does not require too much from individuals. Hence his ability to pick out the right men and utilize combined energy.
- No. 13 Business tactics are like unto water; for water in its natural course runs away from high

places and hastens downwards.

No. 14 So in competition, the way is to avoid what is strong and to strike at what is weak.

No. 15 Water shapes its course according to the nature of the ground over which it flows; the competitor works out his victory in relation to the foe whom he is facing. Therefore, just as water retains no constant shape, so in competition there is no constant disposition.

No. 16 After that, comes tactical maneuvering, than which there is nothing more difficult. The difficulty of tactical maneuvering consists in turning the devious into the direct, and misfortune into gain.

No. 17 There are roads which must not be followed, competitors which must be not attacked, market areas which must be not besieged, market positions which must not be contested, commands of the manager which must not be obeyed.

CHAPTER 5

THE MOVEMENT OF COMPETITIVE EDGE IN MANUFACTURING

Cutting Edge Variation

The Major Cutting Edge Changes with the Stages of the Product Life Cycle

Theoretically, the cutting edge in product competition, or the relative advantage of a product, is somehow related to the product life cycle. The major competitive edge in different stages of a product life cycle are listed below and illustrated in Figure 1.

Phase 1: Product introduction speed. In the earliest stage, the company that first sells the special product will capture the market.

Phase 2: Quantity. The capability to produce the most products of the same quality becomes important as need increases.

Phase 3: Quality. As need is saturating because of more and more competitors in the market, quality emphasis becomes important for gaining advantage.

Phase 4: Capacity for variation. As the need declines, this becomes more important than other issues.

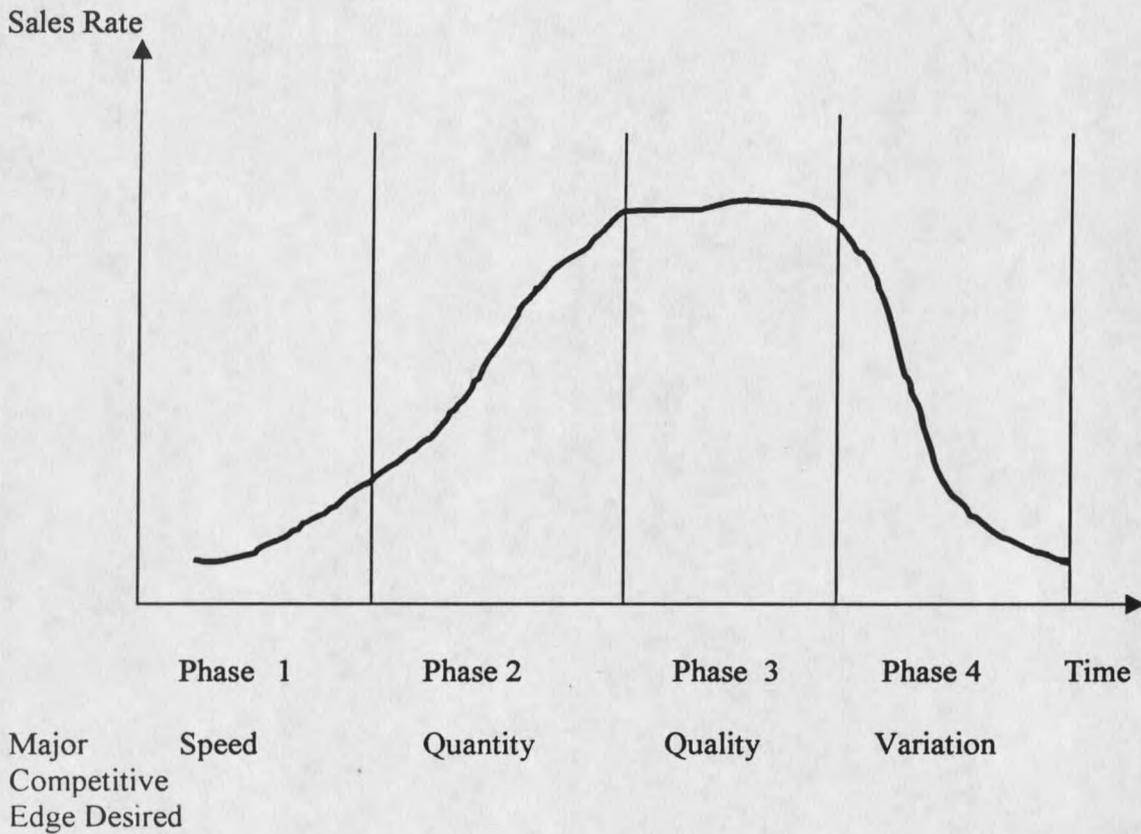


Figure 1: Product Life Cycle and the Relative Competitive Edge Desired

Competitive Edge Is A Constantly Moving Target

Manufacturing history shows that competitive edge is a constantly moving target. For manufacturing companies, the key is not to get stuck on a single notion of advantage. The best competitors know how to keep moving, and they always stay on the cutting edge of competition.

Post war Japanese manufacturing is a good example [25]. Since 1945, the Japanese have successfully shifted their cutting edge at least four times to gain advantage in world competition. Immediately after World War II, with its economy devastated, Japan concentrated on achieving a competitive edge through low labor costs. Since the yen was devaluated by 98.9% against the dollar, its labor costs were extraordinarily competitive.

The Japanese government set policies that favored industries with high labor content: textiles, shipbuilding, and steel. In these high labor content companies, the low labor rate was more than offset by low productivity rates. As a result, Japanese companies captured market share from their Western competition in these high labor content industries.

Later, rising wages, caused by high inflation, combined with fixed exchange rates, eroded the advantage. In many industries, manufacturers could not improve their productivity fast enough to offset escalating labor costs. By the early 1960s, the Japanese textile companies spiraled downward, first losing share, then volume, then profits, and finally position and prestige. In the early 1960s, the Japanese shifted their strategy, and began using capital investment to boost productivity. To achieve high productivity and low costs, they inaugurated the era of scale-based strategies by building the largest and most capital-intensive facilities that were technologically feasible. Japanese shipbuilders, for example, revolutionized the industry in their effort to raise labor productivity.

In the mid-1960s, Japanese companies moved to a new source of competitive advantage — the focused factory. Focused competitors manufactured products that were either made nowhere else

in the world or that were required by the high-volume segment of a market, often in the heart of their Western competitors' product lines. Focusing production allowed the Japanese to remain smaller than established broad-line producers, while still achieving higher productivity and lower costs. This gave them great competitive power.

In industries such as bearing manufacturing, where competition was fierce in the late 1960s, the Japanese fielded product lines with one-half to one-quarter the variety of their Western competitors. Targeting the high-volume segments of the bearing business — i.e., bearings for automobile applications was one — the Japanese used the low costs of their highly productive focused factories to undercut the prices of Western competitors. The Swedish company, SKF, was a major target for the Japanese. By adopting the Japanese strategy, however, SKF avoided business failure.

As the Japanese penetrated more markets, their narrow product lines began to pinch, limiting their ability to grow. Also, the focus strategy presented them with an unattractive choice: reduce variety further or accept the higher costs of broader product lines. Therefore, leading Japanese manufacturers began to move toward a new source of competitive advantage — the flexible factory. In a flexible factory system, variety-driven costs start low and increase slowly as variety grows. Scale costs remain unchanged. Thus, the optimum cost point for a flexible factory occurs at a higher volume and greater variety than for a traditional factory. It can be seen that there is a difference between the costs of flexible and the traditional factory: a cost variety gap, which represents the competitive advantage of a flexible factory, enjoys more variety with lower total costs than traditional factories.

Yanmar Diesel illustrates how this process works. In 1973, with the Japanese economy in recession, Yanmar Diesel was mired in red ink. As a Toyota supplier, Yanmar was impressed with the automaker's ability to go through the recession. Yanmer decided to install the Toyota procedure in its own factories. As a result, manufacturing costs declined 40% to 60%; factory break-even points dropped 50% to 80%; and total manufacturing labor productivity improved by more than 100%. During the re-construction, Yanmer quadrupled its product line.

The Toyota production system gave many Japanese manufacturers who adopted it in the mid-1970s a distinct competitive advantage. It was "born of the need to make many types of automobiles, in small quantities with the same manufacturing process"[1][25]. With its emphasis on Just-in-Time production, total quality control, employee decision-making, and close supplier relations, this system proved successful.

Other countries adopted similar strategies. Once Hong Kong focused on low capital, high labor cost apparel production. Now mainland China's apparel export plays an important role in the world apparel market, since it has cheap labor, and the apparel production does not require an intense amount of capital investment.

Based on the facts mentioned, it can be concluded that the competitive edge is a moving target. During the same time period, different manufacturing enterprises can shape their cutting edge according to their background. However, there is no panacea format for manufacturing companies.

There Is No Panacea for Manufacturing Companies

In manufacturing business, there are various concepts such as Lean Manufacturing, Just-in-Time, Gradual Improvement, etc. Which of these is better? It is tough to set a simple standard in order to answer this question. However, Sun Tzu's guideline No. 15 "Water shapes its course according to the nature of the ground over which it flows; the competitor works out his victory in relation to the foe whom he is facing. Therefore, just as water retains no constant shape, so in competition there is no constant disposition." provides a starting point for this discussion. Any business structure must adapt to the situation and conditions. For instance, Japanese auto companies developed their Just-in-Time method and the Kaban Method because of their close relations with vendors. In other countries, companies may select Virtual Manufacturing because the business itself is a virtual business.

Throughout the following inference process in this chapter, a counter-example method is applied. For each popular concept such as JIT, one or more real cases are introduced, where successful companies were unable to apply the concept. Therefore, it is concluded that the concept does not work in all situations: it is not a panacea.

Japanese Method Is Not A Panacea

Since the success of the Japanese automobile industry, the Toyota production organization model has come to be widely appreciated and accepted as the most advanced manufacturing management style. Toyota is identified with Japanese production. However, the Toyota model is not a cure-all.

The following example illustrates this:

In Sweden, the labor market remained tight throughout the 1970s and 1980s. Unemployment rarely exceeded 3% (while most other European countries had rates of 10%), and union density remained high and stable. These factors, combined with the culture difference between Japan and Sweden, explain why Swedish companies persevered with their methods of work organization. While Volvo was introducing whole-car assembly at its plant at Uddevalla in 1989, many other European car makers were seeking to imitate Japanese auto industry working practices [27].

In early 1970s, there was widespread concern throughout the West about the quality of working life. It was believed that an increasingly well-educated workforce, with higher expectations than its predecessors, would demand greater satisfaction and fulfillment from working life. The answer to these problems was thought to be to redesign jobs to make fuller use of workers' capacities.

Although there may appear to be similarities between the Japanese high employment commitment, and the Swedish desire to organize work so as to encourage high employee commitment, there are, in fact, tremendous differences between the two models. Japanese manufacturers and their imitators are able to choose from large numbers of applicants for the jobs in their plants, and can be very selective about whom they recruit. They prefer young, well-educated people with the "right attitudes". Once employed, workers in such plants have to cooperate with a demanding work-pace and ever-rising quality standards. Shop floor control methods make it difficult for employees not to contribute every ounce of effort and creativity to the enterprise. In Sweden, on the other hand, motor manufacturers have had difficulty filling jobs at all, and so have needed to make their jobs attractive both to the limited number of potential recruits and to existing workers.

When, Volvo's Kalmar factory opened in 1974, it was the world's first auto assembly plant without mechanically driven assembly lines. Teams performed its entire assembly on stationary carriers, in so-called docks. The further goal was to improve assembly **ergonomics**. The novelties in the building design and production flow became the basis for a team culture, extensive job rotation and a functional assembly, where each team was responsible for a clearly demarcated function, such as a dashboard. By 1985, the plant had become much more competitive. Assembly hours per car were 25% lower than other Volvo plants with consistent high quality and competitive overhead costs.

Kalmar, with its high efficiency and reliability, was Volvo Cars' "best-practice plant" in Sweden, and the company decided to set up another plant — at Uddevalla — which would depart from the principle of line assembly to an even greater extent. In contrast to Kalmar, the unions were involved on a full-time basis from the start. They took part in a 1987 joint labor-management study of Japanese methods at Nissan's U. K. plant. The study concluded that, given labor market pressures to provide attractive jobs, **Japanese methods were unworkable in Sweden, and that an alternative had to be found**. The new plant was opened in 1989. Its objectives were high personnel stability and a balanced workforce. By 1991, Uddevalla achieved the same productivity and higher quality output than Volvo's Swedish mass-production plant at Gothenburg.

Big Leap instead of Gradual Improvement

Due to inexpensive acquisition of facilities, manufacturing companies in developing countries can make major leaps in improving manufacturing technology. For example, Chinese Tianjin Yi-chu Motorcycle Company bought a German motorcycle company, including all the machinery and the entire technique file for a reasonable price in early '80s. So the Tianjin Yi-chu Motorcycle Company was able to greatly improve the technique level of its products [28].

Flexible without the FMS System [29]

Hong Kong watchmakers are selling watches for every occasion. Their philosophy is to convince consumers that a watch is a fashion statement and clothing accessory. This level of product variation is Hong Kong's trademark, and its production systems operate within this philosophy. As one manufacturer noted, "The Japanese always talk about automation, but it [automation] also restricts flexibility and creativity that a labor force provides. As watches become more accepted as fashion accessories, people will appreciate interesting hand-crafted items".

Hong Kong watch prices are extraordinarily low by world standards. Hong Kong dominates the low-end watch market segment. The nation has no rivals for market share in the price ranges in which the majority of its products compete. Prior to 1987 (when the yen was one-half its current value), Japanese producers made a foray into the low-priced end of the electronic watch industry. Anticipating an increased market share, two of the three major Japanese watchmakers set up assembly plants in Hong Kong to manufacture low-cost products. Even Japanese Seiko uses Hong Kong as a low-wage flexible labor location for the assembly of new products. This has become all the more important as the yen has continued to rise in value.

UPS (Uninterrupted Power Supply) Manufacturer Does Not Choose LEAN or JIT [30]

When the American Power Conversion Company was trying to get into the crowded low-tech business of uninterruptible power supplies (UPSs) for computers back in the mid-1980s, it seemed to make all the wrong moves.

It stayed in high-cost Rhode Island as the competition moved overseas. When others were leveraging up and cutting costs, American Power was giving equity and bonuses to employees, buying the latest equipment and investing in distribution. **While Lean Production was coming into fashion, the company was boldly running an inventory.**

“We target one to two months of finished goods in inventory and no backlog,” said American Power Conversion’s CEO, Rodger Dowdell Jr. **“We were getting a lot of heat from the analysts.”** In 1988, its first year of trading, the market gave American Power a price/earnings multiple of eight.

Five years later, investors understood exactly what the company, which came out on top, was up to. **“Every single penny that American Power is spending goes toward market share and improving the product”** says Rick Martin of the brokerage Chicago Corp.

American Power also lavishes money on the latest manufacturing equipment so it can lower production costs. As a result, in 1993 the company generated \$280,000 worth of business per employee, versus the competitor’s \$150,000 per employee.

With that kind of advantage, the company was able to cut prices 20% in 1990 and 12% in 1992, and still reward employees with bonuses. Indeed, American Power’s employee ownership plan is so generous it has left one line worker with nearly \$1 million in stock. The company has remained the dominant UPS supplier in the fast-changing computer business for a long time.

