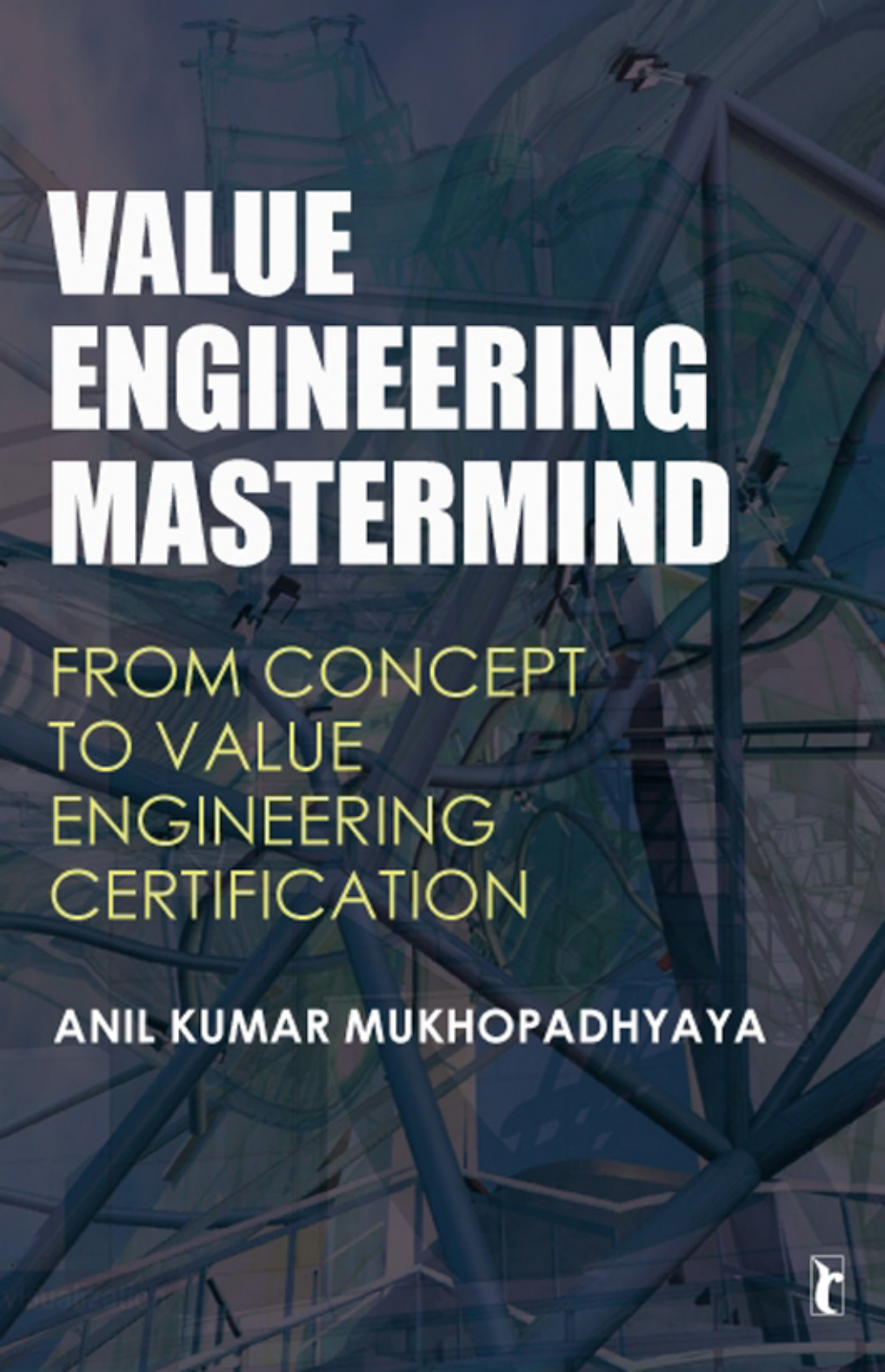
VALUE
ENGINEERING
MASTERMIND
FROM CONCEPT
TO VALUE
ENGINEERING
CERTIFICATION
ANIL KUMAR MUKHOPADHYAYA

Value Engineering Mastermind

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From Concept to Value Engineering Certification

Anil Kumar Mukhopadhyaya

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The SAGE Team: Reema Singhal, Jayshree Kewalramani, Mathew P.J and Trinankur Banerjee

Dedicated to

My parents
Shrimati Bhagirathi Devi
and
Shri Hari Bhushan Mukherjee

and

My parents-in-law
Shrimati Karuna Banerjee
and
Shri Saradindu Narayan Banerjee

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Foreword

After the globalization and liberalization, the Indian industries are at the same platform along with the other world-class leaders. It has become a prime requirement for the industries to come out with their products and services with enhanced value. This can be achieved if they resort to a proven initiative known as 'value engineering'.

The best way to adopt this initiative is to train employees from the grass-root levels to the highest executives. The knowledge of the executives can also be enriched and focused through certification programmes acquired from the highest authority of the initiative—SAVE International, USA.

Mr Anil Kumar Mukhopadhyaya, CVS-Life, in this book *Value Engineering Mastermind: From Concept to Value Engineering Certification*, has not only refreshed the value engineering concepts, but has dealt in detail about various inputs required to become a successful value engineer.

He has deliberated upon the various creativity techniques, financial aspects, management traits, details of various value engineering societies and finally, about the certification programme.

The unique thing about this book is that after every chapter, objective questions are provided. The readers will be able to test their knowledge as they progress from one chapter to the next. The answers are also provided at the end.

I have known Mr Anil Kumar Mukhopadhyaya, CVS-Life, for quite some time when he was with the leading Indian Auto Manufacturer, Messrs (M/s) Tata Motors Ltd. He is one of the oldest certified value specialists in India. He has also authored a book titled *Value Engineering: Concepts, Techniques and Applications*. This book will serve as complimentary reading material to the above mentioned book.

I congratulate the author for the fine work in this opportune moment when there has been a long-felt need for a document of this nature.

K.N. Mishra
Vice President, Tinplate Company of India Limited,
Jamshedpur and former Director (Manufacturing Panel),
SAVE International, USA.

Preface

In my first book on value engineering, titled *Value Engineering: Concepts, Techniques and Applications*, published by Response Books, a division of SAGE India, I laid stress on creating a comprehensive reference book for preparing for the value engineering certification programmes. The book was meant to be jargon-free and to help demystify all the concepts required for a well-rounded understanding of value engineering (VE).

But while practicing as a consultant and interacting with a wide range of VE professionals, industry specialists and first time enthusiasts, I realized that there was a need to make VE books more compact and user-friendly.

Since time is a premium for all sections of society, I adopted a question and answer mode of information dissemination through this book. Each chapter has a brief write-up preceding the array of questions and answers.

It is not important just to know the right answers, but also to know what the wrong options stand for. Just like all modern day management examinations have taught us, we also need to figure out what the wrong options mean and therein lies scope for comprehensive knowledge gathering.

My suggestion to all the readers of this book is to pick up whichever chapter seems interesting and start from there; read the text and then work out the right answers for the questions. Obviously there is a fallback to see the correct answers at the end of the book. But my sincere request to all my readers is to explore what the wrong options also mean.

I feel that in the modern day digitized world, compact reading materials will help ignite passion for a subject. And hence, I consider this book as a supplement for my first book mentioned

earlier. Together these two books will serve for an on-the-move reading material as well as an in-depth understanding of each subject matter.

It will be my pleasure if the readers find more ways to learn from this book, namely, through quiz sessions or other innovative means of learning. It will also be a pleasure if it enriches my readers' personal and professional pursuits.

Acknowledgements

The people who get on in this world are the people who get up and look for the circumstances they want, and, if they can't find them, they make them.

—George Bernard Shaw

When I read this, I realized that progression in life is very much a by-product of one's attitude, over and above one's aptitude. But nonetheless, the foundation of this progression lies on the shoulders of a multitude of people who have shaped our lives and helped us form the ideas and opinions that embody our present existence.

I have always wanted to thank the people who have helped me evolve into what I am today. On the professional front, I wish to thank P.N. Pandey for guiding me to the path of value enhancement. The unstinting support provided by my boss, R.N. Mishra also helped me develop my skills in value engineering. The support and affection of my VE core team consisting of M.G.K. Nambiar, Bipul Shaw, Shamsheer Singh and Yashpal Singh helped me get a handle of team spirit and the joy of making breakthroughs together as a team. They helped me build confidence in the fact that consistent pursuit of implementation of VE ideas helps sharpen ones knowledge of the VE techniques.

My sincere thanks to all my colleagues at Tata Motors who shaped my fruitful career. My special thanks to all my clients who continue to place such high regard for my consulting and training services. Thanks to all my students who have repaid the toil we went through the years by successfully achieving certifications, undertaking VE projects, delivering greater financial value to their firms, and writing papers for various conferences and journals.

My sincere thanks to my entire publishing team at SAGE Publications, which found value in my writings and helped me propagate the knowledge effectively.

On the personal front, my heartfelt thanks to my late parents and in-laws who nurtured and always stood by me. Thanks to my sister and brothers for inculcating deep-rooted family values in me. In particular, special thanks to my elder brother, Dr Ajoy Mukhopadhyaya, who was the chief architect of my formative years. Thanks to my daughter-in-law, Indrani, and elder son, Dr Ashis, who have embodied my desire to serve mankind. Special thanks to my daughter-in-law, Mitali, and younger son, Atish, who have been my sounding board and constant companions in the pursuit of dissemination of VE knowledge. And most importantly, my sincere gratitude for my life partner, my wife and constant motivator, Santa, without whom this delicate balance of life could have well been unsettled.

1

History of value engineering

The World War II forced us to forfeit numerous values from the social fabric of our lives. But it also rendered one value to us in the form of value analysis (VA)! 'Necessity is the mother of Invention' is an old adage which during the World War II served as the genesis of the concept of value analysis.

This initiative emerged from the industrial community. During the World War II, that is, from 1938 to 1945, industries were on their toes for higher and higher production. All materials like different types of steel were already planned for usage for some job or the other. The same was the case with other metals like copper, bronze, tin, nickel as well as for items like ball bearing, roller bearings, electrical resistors and capacitors.

At that time, the General Electric Company (GEC) of the USA was manufacturing turbo-superchargers and armaments. They were asked to increase the production of turbo-superchargers of B-24 from 50 per week to 1,000 per week. At the same time, there was also an increase in armament parts production. However, suppliers were overloaded with high production commitment and they said 'No' to any increase.

Then, Mr Lawrence D. Miles, a purchase engineer of the GEC, was assigned the task which was defined as 'finding a more effective way to improve a product value'.

While working on his assignment, Miles found that there were some substitutes which performed equal or were better than the existing ones. He continuously asked himself, 'If I can't get the product, I've got to get the function. How can you provide the same function by using some machine or labour or materials that you can get?'

This functional approach to the problem was very helpful during the war time. In 1947, Miles requested the GEC to establish a research cell in GE central purchasing department to study this new initiative. Miles got support from his boss William A. Sredenschek and GE's Vice President of purchasing, Harry Erlicher to develop, refine and utilize the concept. The original concept was christened as 'value analysis'.

In 1954, the Bureau of Ships, within the Department of Defence, adopted this technique to improve their cost in manufacturing ships. They changed the name of this technique from 'value analysis' to 'value engineering'. 'This change reflected the lack of job openings to analysts and abundance of openings for engineers', as mentioned by Snodgrass and Kasi (1986).

Subsequently, the definition was regularized by pronouncing that 'value analysis' is a term used when this technique is applied on an existing product and the term 'value engineering' is used when it is applied at the design stage.

Organizations such as the National Association of Purchasing Agents and publications such as *Purchasing* also promoted the use of this technique.

The sixty's decade was very important from the point of acceptance of the VE concept. In the year 1961, the VE contract clause was initiated in the USA. This clause would help to share the benefit of VE by the employer and the contractor. VE contract incentive clause, as a prerequisite for contracts above USD 100,000, came into being from the year 1962. While VE Postal Service instituted a VE programme in the year 1967, US National Aeronautics and Space Administration (NASA) implemented the VE programme in the year 1969.

During 1970, the US Congress recommended the use of VE in federal–aided highway projects and General Services Administration (GSA) also began its building contractor VE programme in the same year. The US Department of Health, Education and Welfare (HEW) adopted the use of VE on selected construction projects from the year 1971.

By this time, VE concepts got their dynamism and went from strength to strength. It was visible when it was being adopted by different industries as well as in different countries.

QUESTIONS

1. Who was the creator of this concept?
   a. Aurther Mudge
   b. Lawrence D. Miles
   c. Donald Parker
   d. Charles Bytheway

2. The concept was christened as
   a. Value management
   b. Value addition
   c. Value analysis
   d. Value engineering

3. The concept came into being during
   a. World War I
   b. Korean War
   c. World War II
   d. Vietnamese War

4. Which company is credited for this concept?
   a. Motorola
   b. General Motors
   c. General Electric Company
   d. Boeing

5. The father figure of this concept at that time was working as
   a. Production manager
   b. Purchasing engineer
   c. Industrial engineer
   d. Designer

6. In which year did Miles and his associates start analyzing product cost and function to ferret out unnecessary cost?
   a. 1946
   b. 1948
   c. 1947
   d. 1950
7. In which year was the first value analysis workshop conducted?
   a. 1950
   b. 1951
   c. 1952
   d. 1953
8. Who conducted the first value analysis workshop?
   a. Prof. Harold Tufty
   b. John H. Fasal
   c. Larry W. Zimmerman
   d. Larry D. Miles
9. Which US company first adopted this concept for reducing their product cost?
   a. US Postal Service
   b. US Navy Bureau of Ships
   c. US National Aeronautics and Space Administration
   d. US Department of Health, Education and Welfare
10. In which year did the above US company adopt the concept?
    a. 1953
    b. 1951
    c. 1954
    d. 1957

11. US Navy Bureau of Ships modified the name of value analysis to
    a. Value management
    b. Value programme
    c. Value engineering
    d. Value movement

12. Navy Distinguished Public Service Award, the US navy's highest civilian award was given to
    a. L.D. Miles
    b. Aurther Mudge
    c. Jerry Kaufman
    d. Carlos Fallon

13. Value engineering is
    a. Cost reduction technique
    b. Cost oriented value technique
    c. Function oriented cost improvement technique
    d. None of these

2

Father of value analysis/value engineering—Lawrence Delos Miles

2.1 Introduction

Lawrence Delos Miles, popularly known as Lawrence D. Miles was born in Harvard, Nebraska on 21 April 1904. His father, Delos Daniel Miles, was the superintendent of Harvard School and his mother, Vinetta Conkle Miles, was an elementary school teacher. He was also affectionately called Larry. He completed his schooling in Dorsey in May 1918.

He moved to Lincoln, NE in the year 1918 and took admission in University Place High School. He was very intelligent and completed the course, which usually took four years, in three years. He received his Artium Baccalaureatus (AB) degree from Nebraska Wesleyan University during 1921–1925.

Larry served as teacher and the principal of Winnebago High School for one year. He had a varied type of experience because in the next year, he was assistant cashier of the first National Bank of Winnebago, NE. He changed his work in the next year itself and became a teller at the Security National Bank, Creighton, NE.

He was a design engineer in General Electric (GE) during 1932–1938. During this time, he patented 12 designs on vacuum tube and related design. He was transferred to the purchasing department of GE under Harry Erlicher, Vice President, Purchasing. During this time, he worked with vendors to find less costly material which

could function as the same as the original materials. This was meant to serve the high demand of parts during the war time. The thought of a 'function approach' crept in his mind during this time.

He was again transferred to Locke Insulator, Baltimore, MD, a subsidiary of GE, as manager of purchasing. At the fag end of 1947, he returned to Schenectady, NY to Mr Erlicher's staff and was placed under William Sredenscheck who gave him full support to formulate an approach for GE to improve cost and productivity.

In December 1947, the basic value analysis functional approach was born.

2.2 Life after Value Analysis was Born

Mr Winne, Vice President of engineering and Mr Du Chemin, Vice President of manufacturing, both from GE, USA were supportive in establishing Miles's value analysis programme.

From 1948 to 1953, Miles planned to train a 1000 persons per year in the value analysis concept. He decided that the training programme should be near the plant location. He had achieved tremendous success in reducing the cost to the tune of USD 10 million.

In the year 1953, Admiral Leggett of the US Navy requested him to give a presentation of value analysis concept to the Bureau of Ships. That presentation led the way to the establishment of the value analysis programme in the US Navy.

The US Navy subsequently modified the name of value analysis to value engineering. The adaptation of this initiative helped the US Navy to earn more orders and they started to earn profit.

Mr L.D. Miles was the first president of the Society of American Value Engineers (SAVE). He was in that post from 1960 to 1962. In the year 1961, he wrote his first book titled *Techniques of Value Analysis and Engineering* which was published by McGraw-Hill Book Company.

In addition to this book, Miles wrote the following books:

1. *Value engineering theory*
2. *Value analysis*

3. *Management application of value engineering for business and government*
4. *Recollections*

Different organizations and industries rewarded L.D. Miles for his work. The awards are:

1. Coffin Award—received on 25 January 1950, given by GE for benefits to the company resulting from the creation and use of the VA/VE system.
2. Alumni Medal of Honour—received on 30 October 1964 from Nebraska Wesleyan University in recognition of high achievement in creating, developing and teaching VA/VE methodology.
3. Fallon Value in Life Award—awarded in May 1976 by SAVE International. This award has been given only three times.
4. Outstanding Services Award—given in October 1979 by the Value Engineering and Management Society of South Africa.
5. Honorary Medal of the Association of German Engineers—presented in November 1981 in Frankfurt, Germany.
6. Brazilian Medal—awarded on 11 May 1983 in appreciation of his contribution in bringing VA/VE technology to Brazil. Inscription on the medal reads, 'Your visit to Brazil is a VALUE beyond any Analysis.'
7. Recognition of Achievement—awarded in June 1984 at a meeting of the GE technical people in Orlando, Florida, some 20 years after his 1964 retirement from GE.

In 1975, SAVE International established the Miles award in honour of Mr Miles. The award is given for 'Creating and contributing an advancement to the techniques of VA/VE.'

The Society of Japanese Value Engineering was not left behind in recognizing Miles. In October 1983, the Society of Japanese Value Engineering (SJVE) honoured Mr Miles by creating the 'Miles Award'.

In the year 1964, Mr L.D. Miles retired from GE. After his retirement, he spoke at more than a dozen training seminars,

workshops and conferences around the world each year. He did this for private companies, public bodies and government agencies with equal diligence.

In the year 1985, he was invited by the Indian Value Engineering Society (INVEST) to attend the National Conference arranged in Jamshedpur. He could not attend the conference and wrote a letter to Mr S.S. Iyer, Director, Conference Programme. The letter is exhibited in Box 2.1.

Box 2.1: L.D. Miles's letter to Mr S.S. Iyer, Director, Conference Programme, INVEST

L. D. MILES
SEDGEFIELD R. 5, B. 840
EASTON, MD. 21601 U.S.A Jan. 23, 1985

MESSAGE

Dear Mr. Iyer:

Thanks you for the invitation to help in Value methodology indoctrination in India. I have great honor, for the constructive people, like you, have produced such great and growing benefits through the development and use of new methods.

I am pleased that you have embraced my VA/VE methodology. Learned of it, studied it, understand it, used it successfully and teach it to others.

My wife, Eleanor, and I would very much like to visit your country and to take part in this program. Unfortunately, my health has taken a turn into severe blood problems, with which we are dealing, as best we can, but I am prevented from making any commitments away from home at this time. We will follow your progress with great interest.

Best wishes for a successful conference.

Sincerely
Lawrence D. Miles

Source: Sixth National Conference of INVEST, 11–13 April 1985, Jamshedpur.

Lary D. Miles passed away on 1 August 1985. Value engineers all over the world had attended the condolence ceremony.

QUESTIONS

14. L.D. Miles was born at Harvard, Nebraska on
    a. 21 April 1904
    b. 20 April 1905
    c. 19 April 1904
    d. 22 May 1904

15. From 1932 to 1938, he worked in GE as
    a. Production engineer
    b. Materials manager
    c. Quality engineer
    d. Design engineer

16. Miles earned 12 patents for his new designs of
    a. Electric lamps
    b. Electronic circuit
    c. Vacuum tubes and related circuits
    d. Magnetic circuit

17. At the time of developing VA, in which department of GE was Miles?
    a. Design department
    b. Maintenance department
    c. Purchasing department
    d. Production department

18. One of the important quotations of Miles is
    a. Honesty is the best policy
    b. All cost is for function
    c. Function supersede all aspects
    d. Creativity is not for the genius alone

19. The name of one of the books written by Miles is
    a. *Value engineering—A systematic approach*
    b. *Value engineering compendium*
    c. *Practical methods of value analysis*
    d. *Techniques of value analysis and engineering*

20. GE had given Miles an award for benefits to the company resulting from the creation and use of the VA/VE system in
    a. Value Analysis Award—25 December 1947
    b. Coffin Award—25 January 1950
    c. Pulitzar Award—25 January 1948
    d. Value Award—20 February 1949

21. SAVE International had awarded Miles in May 1976, an award which has been given only three time and is known as
    a. Value World Award for Life
    b. Life award for Value Analysis
    c. SAVE Life Award
    d. Fallon Value in Life Award

3

Professional societies of value engineering

Any new initiative, after creation and proper testing of its usefulness, requires a professional body to propagate the concept—propagation to not only the other industries of that country, but for the world over. The details of some societies which are engaged in propagation of this unique technique are illustrated as:

3.1 Society of American Value Engineers (SAVE)

Based on the ideology of propagation, the USA established the professional society, christened as the Society of American Value Engineers, popularly known as SAVE in the year 1959.The first president of SAVE was L.D. Miles and his tenure was for two years—1960–1962. In the year 1973, SAVE initiated a programme for certification of value specialists. This body has been renamed as SAVE International.

3.2 Society of Japanese Value Engineering (SJVE)

Society of Japanese Value Engineering (SJVE) is a non-profit membership organization that provides and exchanges professional information about VE in Japan and overseas, for the purpose of promoting VE activities to bring about better results among industrial and other business circles.

Outline

Established (incorporated): 17 October 1980.

Mission and objectives

1. To practice research and study of VE to increase its results.
2. To create an awareness of the maximum benefits from applying VE processes.
3. To encourage the use of VE methodologies for efficient business management that will contribute enormously to the development of Japanese industry.

Activities

1. Research and development on VE concepts, theories and methodologies.
2. Sponsorship of promotional and educational programmes of VE concepts, theories and methodologies.
3. Accumulation, analysis and dissemination of VE reports from Japan and overseas.
4. Inter–exchange of VE communication with other organizations, domestic and overseas.
5. Other supportive VE activities.

Current membership (as of 31 March 2008)

Regular corporate members—290

The majority of SJVE membership consists of company–sponsored value practitioners. They participate in various SJVE activities such as annual national/regional/local conferences, workshop–style research and study as well as social exchange activities.

Regular individual members—92

These are mostly VE/VA consultants and/or those who are still active in VE/VA in their own capacities.

There are several additional members from neighbouring countries.

During the period of industrialization in Japan, they had adopted this concept for the improvement of their products. They also initiated a professional society with the name as Society of Japanese Value Engineering (SJVE) in the year 1965.

3.3 Indian Value Engineering Society (INVEST)

INVEST was formed in October 1977, but could not be registered. Mr Ashok Sethi was its first president. There was no conference in the year 1977. The first issue of journal for the INVEST, which was named as INVAVE, came out in October 1978. It contained the messages from Tom King, editor of the SAVE journal *Value World* and Akira Kodama of SJVE.

INVEST held a VE exhibition at the India International Centre, New Delhi which was inaugurated by Mantosh Sondhi, the then secretary of steel, Government of India. He was also the curtain raiser for the first five–day forty–hours workshop which was held in New Delhi at the Maurya Hotel with 24 participants.

The first conference was also held at the Maurya Hotel, New Delhi in October 1980. The total number of delegates was more than 120. Walchandnagar Industries Ltd received the main award and M/s Escorts received the best Exhibitor award. All the five conferences from 1980 to 1984 were held in New Delhi. The sixth conference was held in Jamshedpur.

A break away VE group formed another society during 1987, which is known as Society of Indian Value Management (SIVAM).

3.4 Canadian Society of Value Analysis (CSVA)

The CSVA was founded in 1993 to promote the VA methodology. The CSVA has contributed to the promotion of VA through meetings, conferences and publications (Value Net and Optimum V). The 15 founding members of the society were:

1. ABB Inc.
2. Brun, Guy (AFAV)
3. Hydro-Québec
4. Ville de Montréal
5. Parent, Yves
6. Roche ltée
7. Tahmazian, Berge
8. Raymond Chabot Grant Thornton
9. Bombardier Inc.
10. Excotech Inc.
11. Ministère des transports
12. Optimaction Inc.
13. Plaveco Gérance ltée
14. SNC–Lavalin Inc.
15. UMA Engineering Ltd

3.5 Hong Kong Institute of Value Management (HKIVM)

The HKIVM was formally established in 1995. Value management (VM) as a philosophy, together with its associated tools and techniques, emphasized the need to consider function and cost in a structured and systematic way, as part of any strategic decision process. Over the past 12 years, the HKIVM has hosted eight international conferences, conducted a number of value training workshops, its members have conducted hundreds of highly successful VM studies for both public and private construction industry clients and regularly published the *Value Manager* journal.

HKIVM's Aims

1. To create an awareness in the community of the benefits to be derived from the application of VM in Hong Kong.
2. To encourage the use of the VM process by sponsors.
3. To establish and maintain standards of VM practice in Hong Kong.

4. To contribute to the dissemination of the knowledge and skills of VM.
5. To establish an identity for the Institute within Hong Kong and overseas.
6. To encourage research and development of VM with particular emphasis on developing new applications of the process.
7. To encourage and assist in the education of individuals and organizations in VM in Hong Kong.
8. To establish and maintain a code of conduct for practitioners of VM in Hong Kong.
9. To attract membership to the institute to support these objectives.

3.6 Institute of Value Management (IVM)—UK

The IVM is the only UK based professional association exclusively committed to VM. The IVM is actively involved with other national value associations to promote its worldwide use. Membership of the IVM continues to grow and is open to anyone with an interest in VM and it does not signify a qualification in VM.

The IVM promotes VM across all sectors of the economy. Its members come from a number of areas, including construction, utilities, transportation, public and commercial services, health care, government, manufacturing, information technology and telecom, as well as training and management. The IVM, through its independent certification board, is responsible for implementing the European certification and training system within the UK.

3.7 The Institute of Value Management, Australia

This institute is a not–for–profit professional association incorporated under the Australian Capital Territory Associations Incorporation Act, 1991. It operates under its 'Rules of Association', which provide for governance by the Institute's 'Board of Management'. The code of conduct is an integral part of the rules of association.

The institute has established criteria for the various grades of personal membership, for registration as a VM facilitator and for accreditation of courses that satisfy educational requirements for admission to the membership grades of member and fellow.

The institute publishes *The Value Times*, approximately four times per year, organizes national conferences (usually every second year) and from time to time arranges seminars and other activities to assist members to maintain their professional expertise. The institute has recently endeavoured to encourage the development of regional groups of members (and other interested people are welcome to participate) who will meet a few times per year in their regional location for networking and professional fellowship, perhaps with one of the group reviewing an interesting VM project.

The Institute of Value Management, Australia, is a totally independent organization. Nevertheless, it maintains links for professional liaison and co-operation (as appropriate) with a small number of kindred and independent professional associations in other countries.

QUESTIONS

22. The first VE society was formed in the year
    a. 1957
    b. 1958
    c. 1959
    d. 1960

23. The name of the society was
    a. Society of American Value Engineers
    b. Society for Improvement of Value
    c. Society of American Value Practitioners
    d. Society of American Value Analyst

24. Which place/city was the VE society formed?
    a. New York
    b. Boston
    c. Washington DC
    d. California

25. In the year 1961, the contractors were permitted to share incentives of cost reduction through a clause known as
    a. Value management contract clause
    b. Value analysis contract clause
    c. Value engineering contract clause
    d. Value incentive contract clause

26. In the year 1973, SAVE established a programme which was known as
    a. Certification of Value Specialist
    b. Certification of Value Managers
    c. Certification of Value Practitioners
    d. Certification of Value Addition

27. In which month and year did the use of Certified Value Specialists for Value Work in the GSA building design become a requirement?
    a. June 1973
    b. September 1973
    c. January 1974
    d. April 1974

28. The name of the Value Engineering Society of Japan is
    a. Japanese Society of Value Engineers
    b. Society of Japanese Value Engineers
    c. Society of Japanese Value Engineering
    d. Institute of Japanese Value Engineering

29. When was the Japanese Society formed?
    a. 1962
    b. 1965
    c. 1969
    d. 1970

30. SAVE has been renamed as
    a. International Society of Value Engineering
    b. International Society of Value Engineers
    c. SAVE International
    d. Global Society of Value Engineers

31. What is the name of the official journal of the Indian Value Engineering society?
    a. Value Engineering Journal
    b. INVAVE
    c. Journal of INVEST
    d. Value India

32. The official organ of the parent body of Value Engineering is
    a. Value World
    b. Value Engineering World
    c. Journal for Value Engineers
    d. Value Management

33. *Interactions*, a monthly journal is published by
    a. INVEST
    b. SJVE
    c. SAVE International
    d. SAC-SAVE

34. Periodicity of the SAVE International journal is
    a. Monthly
    b. Quarterly
    c. Tri-yearly
    d. Yearly

35. Periodicity of the INVEST journal is
    a. Monthly
    b. Quarterly
    c. Tri-yearly
    d. Yearly

36. The name of the journal published by the Society of Japanese Value Engineering is
    a. *Value analysis*
    b. *Value engineering*
    c. *Value improvement*
    d. *Value management*

37. The periodicity of the journal published by the Society of Japanese Value Engineering is
    a. Monthly
    b. Quarterly
    c. Bi-monthly
    d. Half yearly

38. VMP stands for
    a. Value Management Practitioner
    b. Value Method Practitioner
    c. Value Methodology Practitioner
    d. Value Management Programme

39. Which society is not affiliated by SAVE International?
    a. Society of Hungarian Value Analysts (SHVA)
    b. Indian Value Engineering Society (INVEST)
    c. Society of Korean Value Engineers (SKVE)
    d. Canadian Society of Value Analysis (CSVA)—CA

40. Which society is affiliated to SAVE International?
    a. Hong Kong Institute of Value Management (HKIVM)
    b. Institute of Value Management (IVM)—UK
    c. European Governing Board (EGB)
    d. Society of Japanese Value Engineering (SJVE)

41. When was the Indian Value Engineering Society established?
    a. 1975
    b. 1977
    c. 1978
    d. 1976

42. At the start where was the headquarter of INVEST located?
    a. Bombay
    b. New Delhi
    c. Calcutta
    d. Madras

43. What was the address of headquarter?
    a. Tolstoy Marg
    b. Chittaranjan Marg
    c. Mahatma Gandhi Marg
    d. Bahadur Shah Zafar Marg

44. Where is the present head office of INVEST?
    a. New Delhi
    b. Bangalore
    c. Jamshedpur
    d. Pune

45. In how many zones is INVEST divided into?
    a. 2
    b. 3
    c. 4
    d. 5

46. Which zone is a INVEST zone?
    a. North–East
    b. Central
    c. South–West
    d. East

47. The highest post of the Indian Value Engineering Society is
    a. Chairman
    b. Chief Executive Officer
    c. President
    d. Patron

48. The highest post of the zone of Indian Value Engineering Society is
    a. Chairman
    b. Chief Executive Officer
    c. President
    d. Patron

49. The first issue of INVAVE was published in which month and year?
    a. October 1977
    b. January 1978
    c. June 1978
    d. October 1978

50. The first INVEST national conference was held in
    a. New Delhi
    b. Bombay
    c. Calcutta
    d. Madras

51. The venue of the first INVEST national conference was
    a. Hotel Maurya
    b. Taj Intercontinental
    c. Taj Bengal
    d. Taj Coromondal

52. In which year the first national conference was held?
    a. November 1978
    b. November 1979
    c. October 1980
    d. December 1980

4

Certification programme

4.1 What is the Certification Programme?

The certification programme is composed of two major elements: individual professional certification and educational programme approval.

The highest level is the Certified Value Specialist (CVS), which is the recognition of an individual who has met all certification requirements, both technical and experience, and whose principal career is VE.

The Associate Value Specialist (AVS) programme recognizes those individuals who decided to become professional value engineers, but who have not yet acquired all the experience or technical skills expected of a CVS.

The Value Methodology Practitioner (VMP) programme was established to recognize those individuals who acquired the basic skills of VE/VA, but their principal career is not VE.

The CVS and VMP must re-certify every four years. Although considered an entry level certification, the AVS may be maintained indefinitely as long as all certification maintenance fees are paid. Membership to SAVE is not a requirement for individual certification or for educational programme approval.

4.2 Who Administers the Programme?

The certification programme is administered by CVSs appointed by the SAVE board of directors for two-year terms. Once the applications have been received, all attempts are made to have the board represent a cross section of the society including industry, government and construction and members from both internal programmes and consultants.

It must be emphasized that the certification programme is designed for those utilizing the value disciplines as their principal career. It is not an honours programme. The society has a separate programme to honour deserving individuals and organizations. Certification must be earned by completing all criteria and requirements and is for individual recognition, and may not be transferred or used to imply that an organization or association is certified.

The SAVE certification board also maintains a co-operative certification programme with the Japanese Society of Value Engineering, the Society of Korean Value Engineering, the Indian Value Engineering Society and the Society of Hungarian Value Analysts, whereby they meet all SAVE requirements as a minimum, but also adapt the overall requirements for their own culture. Talks are being conducted with other regions to establish similar programmes.

4.3 Where do I Learn Value Management?

The best and most convenient way to learn the techniques of value management, their application and their management is as a member of SAVE.

The SAVE membership gives opportunities for career growth, professional development, information, contacts, new ideas, involvement and recognition. All this lays the foundation for a greater career success!

The certification board currently issues a certification and re-certification manual and a seminar/workshop manual, which describe these programmes and requirements in detail and include application forms. The board also issues a study guide to assist applicants in preparing for the examinations.

A master record of the current status of all CVSs and courses is maintained by the certification administrator. If you have additional questions, or wish more information about certifications, status of CVSs or courses, or copies of the manuals or guide please contact the certification board administrator.

4.4 INVEST Certification Board

The INVEST had executed an agreement with SAVE on 28 January 1995 in Phoenix, Arizona, USA. The signatories were:

1. Virginia Willingham, President, SAVE
2. Dale E. Daucher, Chairman, SAVE certification board
3. Jamshed J. Irani, National President, INVEST
4. G. Jagannathan, Secretary General, INVEST

Purpose

1. The primary purpose of this agreement was the establishment of INVEST as the authorized administrative branch of the SAVE certification programme in India.
2. The terms and conditions in this agreement are intended to establish the basis for a long-term professional relationship between SAVE and INVEST.

Authority granted to INVEST

SAVE granted INVEST the authority to administer any portion or all of the SAVE certification programme currently in effect and as modified in the future, on the basis and in accordance with all provisions of the agreement.

Acceptance of authority by INVEST

INVEST accepted the authority granted by SAVE and warranted that the certification programme standards established by SAVE would be maintained at the highest level of integrity for the duration of the agreement.

Geographical limitations

The authority granted to INVEST through this agreement was limited to operations within India and or citizens of India and included those citizens residing in other parts of the world on a temporary basis.

Answer to the various questions

INVEST certification programme offers three categories of certification:

1. Certified Value Specialist (CVS)
2. Associate Value Specialist (AVS)
3. Value Methodology Practitioner (VMP)

It also offers Re-certification for CVS and VMP (see Table 4.1).

Table 4.1: Certification requirement summary

AVS	*VMP*	*CVS*
Rs 5,000/- member application fee, if AVS examination is conducted just after completion of Module I workshop. If AVS examination is taken place at later date then it will be Rs 7,000/-	Rs 11,000/- member application fee	Rs 11,000/- member application fee
Rs 6,000/- non-member application fee, if AVS examination is conducted just after completion of Module I workshop. If AVS examination is taken place at later date then it will be Rs 8,000/-	Rs 12,000/- non-member application fee	Rs 12,000/- non-member application fee

(Table 4.1 contd)

(Table 4.1 contd)

AVS	*VMP*	*CVS*
Module I required	Module I required	Module I required
Not required	Not required	Module II required
Not required	44 certification points accumulated	88 certification points for Value Specialist 72 certification points for programme manager
Not required	Not required	Original paper
AVS examination	VMP examination	CVS examination
Annual maintenance fee of $20 SAVE member or $60 non-member fee	No annual maintenance fees (except for life non-members = $75/yr)	No annual maintenance fees (except for life non-members = $75/yr)
Does not expire	4-year certification	4-year certification
No re-certification	Must re-certify every 4 years	Must re-certify every 4 years

Source: Invest website: www.invest-in.org

Note: For detailed information, see also Save International website: www.value-eng.org.

How to Select an Advisor?

The administrator of the INVEST certification board provides all sorts of help in identifying a CVS advisor for the candidates based on request.

What documents are needed?

Documents needed are like:

1. Copy of Module I certificate (For CVS/AVS/VMP)
2. Copy of Module II certificate (For CVS only)
3. Accumulate 44 certification points (CPs) for VMP
4. Accumulate 88 certification points (CPs) for a value specialist and 72 CPs for value programme manager (see Table 4.2)

Where is the examination held and how often?

The INVEST certification board is issuing the schedule of examinations along with its venue which is held in various zones and also during the national convention every year in its journal *INVAVE*.

Table 4.2: Examination reference chart

Examination parts	*AVS*	*VMP*	*CVS*
Part I—Fundamentals			
50 questions true or false	100 points 30 minutes	100 points 30 minutes	100 points 30 minutes
Part II—Function analysis			
Identify and classify functions, analyze function, cost/worth and value index	100 points 60 minutes	100 points 60 minutes	100 points 60 minutes
Part III—FAST			
Draw a FAST diagram for the above work problem	Not applicable	100 points 30 minutes	100 points 30 minutes
Part IV—Team building			
20 Questions true or false	Not applicable	100 points 30 minutes	100 points 30 minutes
Part V—Certification			
25 questions true or false	Not applicable	Not applicable	100 points 15 minutes
Part VI—Financial			
Identify VM opportunities, first cost, annual costs, and break-even point and life-cycling costing	Not applicable	Not applicable	100 points 30 minutes
Part VII—Essay			
Choose topic and prepare essay demonstrating VM principles	Not Applicable	Not Applicable	100 points 45 minutes
Total examination time	1½ hours	2½ hours	4 hours
Score to pass : 70 per cent 70 per cent achievement is required for **each part**. Grades will not be averaged.			

Source: www.invest-in.org.

Are there any training courses available?

The Value Engineering Workshop Module I and Value Engineering Seminar Module II courses are arranged by the four zonal councils. The information is circulated in *INVAVE*. Moreover, Module I and Module II are also arranged by some industry or association for their employees or members respectively.

QUESTIONS

53. How many levels of certification are recommended by SAVE International?
    a. 1
    b. 2
    c. 4
    d. 3

54. The first level of certification is
    a. Assistant value specialist
    b. Associate value specialist
    c. Assignor value specialist
    d. Attending value specialist

55. One of the level of certification is
    a. Value methodology practitioner
    b. Value method practician
    c. Value methodology practician
    d. Value method practitioner

56. The highest level of certification is
    a. Certificate of value specialist
    b. Certified value specialist
    c. Certifiable value specialist
    d. Certifier value specialist

57. Are all levels of certification to be re-certified again?
    a. Yes
    b. No

58. Which certification cannot be re-certified?
    a. Associate value specialist
    b. Certified value specialist
    c. Value methodology practitioner

59. After how many years re-certification is to be done?
    a. 2
    b. 4
    c. 3
    d. 5

60. Which certification does not get life status?
    a. CVS
    b. AVS
    c. VMP

61. How many years after initial certification can the earliest life certification occur?
    a. 12
    b. 8
    c. 4
    d. 16

62. Once life status is achieved, the individual will even be required to re-certify every four years.
    a. True
    b. False

63. One need not select an advisor, who is an active CVS, for any certification programme.
    a. True
    b. False

64. Completion of Module I workshop is a must for
    a. AVS
    b. VMP
    c. CVS
    d. All

65. Accumulation of certification points is different for different certification programme.
    a. True
    b. False

66. Completion of Module II seminar is a must for
    a. AVS
    b. VMP
    c. CVS
    d. All

67. Submission of an original paper on a VM related subject is a must for
    a. All
    b. VMP
    c. AVS
    d. CVS

68. All practice VM certification points MUST be earned no sooner than one year prior to the completion of a Module I workshop.
    a. True
    b. False

69. Which certification does not expire?
    a. AVS
    b. CVS
    c. VMP
    d. None

70. In all certification programmes, candidates need not to appear for an examination, which will test the knowledge of VM.
    a. True
    b. False

71. How many categories does the examination consist of ?
    a. 5
    b. 6
    c. 7
    d. 8

72. AVS candidates have to appear for
    a. All parts
    b. 4 parts
    c. 3 parts
    d. 2 parts

73. VMP candidates have to appear for
    a. All parts
    b. 4 parts
    c. 3 parts
    d. 2 parts

74. CVS candidates will have to appear for
    a. All parts
    b. 4 parts
    c. 3 parts
    d. 2 parts

75. Minimum score to pass for each category is
    a. 50%
    b. 60%
    c. 70%
    d. 80%

76. Applicants are only required to retake for failed parts.
    a. True
    b. False

77. AVS applicants have to appear for any of the following two parts:
    a. Fundamentals
    b. Certification
    c. FAST
    d. Team building
    e. Function analysis

78. VMP applicants will not appear for the part
    a. Fundamentals
    b. Certification
    c. FAST
    d. Team building
    e. Function analysis

79. Is certification an individual recognition?
    a. Yes
    b. No

80. Points accumulated for a VMP are not transferable towards CVS certification.
    a. True
    b. False

81. Approved Module II seminar can be completed within six months of completing of approved Module I workshop.
    a. True
    b. False

82. Advisor for AVS/CVS/VMP should not necessarily be a current CVS.
    a. True
    b. False

83. The first 40 hours workshop in India was held in,
    a. Bombay
    b. Madras
    c. Calcutta
    d. New Delhi

84. The venue of the first 40 hours workshop in India was
    a. Hotel Ashoka
    b. Hotel Mauria
    c. Hotel Taj Intercontinental
    d. Taj Bengal

85. VMP stands for
    a. Value Management Practitioner
    b. Value Method Practitioner
    c. Value Methodology Practitioner
    d. Value Management Programme

86. CVS certification has to be renewed every
    a. One year
    b. Two years
    c. Three years
    d. Four years

5

Value engineering theory

5.1 Concept

Unnecessary cost associated with a product, process and system was present yesterday, is prevalent today and will be present even tomorrow. VE is the answer to identifying these unnecessary costs.

To quote L.D. Miles, 'Value Analysis is a system, a complete set of techniques, properly arranged, for the sole purpose of efficiently identifying unnecessary cost before, during, or after the fact.'

L.D. Miles defined VA as, 'An organized creative approach that has for its purpose the efficient identification of unnecessary cost, that is, cost that provides neither quality nor use nor life nor appearance nor customer features.'

He in his own way also explained the unnecessary costs. He mentioned, 'Costs are considered "Necessary" until another means is known to keep the performance factors without them—then they become "Unnecessary".'

The product, process and system are created to satisfy the wants and needs of a customer. Everything is created to serve certain function. It is the responsibility of the creator to see that the function is created as per the need and want of the customer as well as at the optimum cost; hence, the elimination of unnecessary costs is imperative.

VE is now defined as a systematic application of recognized techniques by multi-disciplined team(s) which identifies the functions of a product, process, service or system; establishes a

worth for the functions; generates alternatives through the use of creative thinking and provides the needed functions, reliably, at the lowest overall cost.

5.2 VALUE

Value is a word whose meaning is different for different people. This is as old as civilization. In the year 365 BC, Aristotle had mentioned about seven types of values. They are:

1. Religious
2. Political
3. Social
4. Aesthetic
5. Ethical
6. Economic
7. Judicial

In today's economic environment, VE lays stress on economic values. The constituents of economic values are:

1. Esteem value
2. Exchange value
3. Use value
4. Cost value

It requires some explanation in order to understand its relevance towards value engineering.

Exchange value is that value in the product, process, service or system which can help to trade with some other things. More the exchange value, more will it be lucrative for the customer.

Esteem value can be defined as that part of the product, process, service or system which will force the person to own them. In today's global economic situation, it becomes the responsibility for the manufacturer or service providers to inculcate these values. Esteem values are the want and desire of the customers.

Use value of the product, process, service or system is that value for which the thing has been created. Everything is being created to fulfil certain purpose. It should include the need of the customer.

Cost value is the cost of the product, process, service or the system. It is to be borne in mind that this cost is not only the acquisition cost but it is the total cost which in the parlance of finance is known as Life cycle cost (LCC) or cradle to grave cost.

Mathematical expression of value

Value may be expressed mathematically. The elements of the mathematical expression are performance (or function) and cost. It can be stated as:

$$\text{Value} = \frac{\text{Performance (or function)}}{\text{Cost}}$$

This expression is in the form of a ratio and can be improved as per the modification(s) stated as:

1. The performance or function is improved, but the cost remains the same.
2. The performance or function remains the same, but the cost decreases.
3. The performance or function is improved and cost also reduces.
4. The performance or function improves at a greater pace than the cost increase.
5. The performance or function reduces and cost also reduces at a faster pace.

Though from a mathematical point of view, all the mentioned expressions are correct, but from the VE parlance, the fifth expression is not acceptable. This is because in any way the performance/function cannot be reduced or in other words the item cannot be made less reliable.

It should be borne in mind at this point that eliminating a function is not always considered as cheapening the item. But it may so happen that the function is superfluous or it has combined with some other function.

Reasons for poor value

To improve the value of a product, process, service or system it is feasible if one knows reasons for poor value. These may be identified as:

Lack of information

Information is vital for value engineers. The more (and latest) the information that is available, the more it helps one to come out with better valued outcomes.

Wrong beliefs

An individual learns many things from seniors. Any problem encountered by them is transmitted to the individual as a belief. Many times it is seen that we fix our belief based on a single incident, which is not statistically correct. This type of wrong beliefs may create poor value to the item.

Risk of personal loss

This is a psychological frame of mind. Anybody may have the fear that if his idea does not click or gives some problem in future, he will be blamed for the entire nuance. Maybe his position could be at stake. This fear can inhibit a person to come out with his maximum efforts and thereby inculcate poor value to the item.

Reluctance to seek advice

This arises from human behaviour. People think what they know is the maximum for the occasion. They feel underrated in front of others and as such do not seek for advice. This gives rise to a sub-optimal solution and thereby poor value to an item.

Shortage of time

This is a common phenomenon in the industry. There are occasions when designers and or planners are not given enough time for any new item. This is because of various reasons which sometime may not be in the hands of the management. This is like one company may have to come out with a new design ahead of its competitors. This shortage of time will force one to take a decision on the data that is available on hand only, which can in turn create poor value.

Negative attitude

Attitude plays an important role in the successful VE application. One should try to look at impossible as 'I'm possible'. What seems impossible today is a reality tomorrow. This has been proven on various occasions. So, one should try to eradicate any negativity which may arise and form a habit of aversion or negative attitude. This is because negative attitude will not allow putting full potential and thus, will induce poor value to the items.

Changing technology

Every day is new and different than yesterday. This is possible because there is a continuous improvement technology. New materials are developed as well as new processes. The computer which was big enough for a room can now be accommodated in a small chip. The slide rule which was once an important tool for an engineer vanished against the new technological developments. So one can rest assured that poor value exists if old technology is used in the item.

Strict adherence to 'requirements'

The dynamic environment needs changes. What was a need yesterday is not required today or what was luxury has become a necessity. The needs, wants and desires of a customer change. Strict adherence will induce poor value to the item.

Poor human relations

This is the main factor responsible for poor value. The outcome from a VE activity is arrived at through various interactions with people at different stages. It starts with team members and ends with interactions with the authorities for granting approval. Any problem of human relationships at any stage may hinder the final solution.

5.3 Function

Function differentiates the VE initiative from other cost reduction techniques. This is also called the heart of the technique. Everything has been created to serve a certain purpose. The purpose is termed as function. In this technique, functions can be evolved by asking certain questions like, 'What is it?' and 'What does it do?'

There is a unique way to define a function. It has to be defined with only two words—a verb and a noun. The working function is defined by an active verb and a measurable noun and a selling function is defined by a passive verb and measurable noun. It has been observed that if there is clarity about the item, there is no problem in defining the function in two words. Moreover, it eliminates ambiguity, which is an essential requirement in a team approach.

Function is also a communication tool. It translates the need, want and desire of the customers. A properly defined function will be able to expose any misunderstanding and can also reveal misconceptions.

Take an example which will clarify the concept. In a function analysis session of VE technique, the purpose of a ceiling fan was asked. One participant said, 'provide comfort' and the other participant said, 'circulate air'. After deliberation among the participants, it was decided that the accepted answer was, 'circulate air'.

'Circulate' is an active verb, whereas 'provide' is not an active verb and does not indicate any specific action. Hence, always avoid using the verb 'provide' as a rule. So, the term 'circulate' is a more acceptable choice.

'Air' is a measurable noun, whereas 'comfort' cannot be measured. Hence, air was acceptable to the class.

How is the measurable noun useful? If a fan is going to be designed, one can find out how much cubic metre of air is needed by the customer. If a fan is to be designed for a car or for the shop floor man cooler, the requirement will be different. The design can be made accordingly. Similarly, if someone is going to value engineer an existing fan, it can be known from the throw of air of the fan whether it is as per the need of the customer. If the throw is less than required, then its value is less. On the other hand, if the throw is more than required, then unnecessary cost has crept in, which can be eliminated to improve the value of the product.

The acceptance of the correct definition also eliminates the misconception about the item as seen in the mentioned example.

Definition should have only two words, but if an adjective, participle or noun can give better understanding, then that can also be accepted. As an example,

1. Produce ultra sound
2. Prevent rotating object
3. Measure air flow rate

Now let us understand the levels of functions.

There are two levels of functions. They are basic functions and secondary functions. The basic function is that function for which the item is created, whereas a secondary function comes into being because of the particular choice of the design.

To identify a basic function, if you remove that function, the item will cease to exist. But in case of a secondary function even if you eliminate that function the item will continue to exist.

While defining a function one should be clear what the item is being used for because based on its purpose, the definition may change. As an example, the function of a piece of wire when used for an electric connection is 'conduct current'. But the same wire when used to move a material, its function will be 'transfer force'. The function will be defined as 'fasten components' when the wire is used to keep the components together.

By continuous practice, one will be efficient in defining a function. Still, to improve the function identification skill, one should use a dictionary and a thesaurus.

Many a time, parts or operation names are included in the function definition, which may be misleading. So, avoid using parts and operation names in the definition.

5.4 Cost

The basic anatomy of cost consists of three elements. They are:

1. Direct material cost
2. Direct labour cost
3. Overhead cost

Direct material cost

It is the material which goes into the product, process, service or system. The method of identification of this element of cost is that it should have a direct relation with the unit. If for one unit it requires 'x' quantity, for two units it should take '2x' quantity.

It may so happen that a material which is not a direct material in one item may be a direct material in another item. It is wise to find as much direct material as possible, but in actual situation, it may not be feasible.

Direct labour cost

Based on the mentioned logic, direct labour cost is that cost which can be directly attributed to the item, that is, if one unit requires '1 hour' then two units should take '2 hours'.

Overhead cost

While the first two costs are easily comprehensible, the third requires more elaboration. The cost elements which cannot be

directly associated with a product, process, service or system are considered as overhead. In the absorption costing method, the overhead is divided into:

1. Production overhead
2. Administrative overhead
3. Selling and distribution overhead

Managements are interested to use the past cost to take future action. But this absorption method may not be so helpful for doing that. In order to use the cost for future decision making, 'marginal cost' came into being. Marginal cost is not a method of costing; it is a technique. As per this technique, overhead costs are divided into:

1. Variable overhead
2. Semi-variable overhead
3. Fixed overhead

Those overheads which have direct relation with the volume of production are variable and those which are not are called 'fixed'. It analyzes the effect of fixed cost on the product, which will help in decision making.

To elaborate, let us take an example.

The fixed cost is Rs 10,000.

The variable cost is Rs 10.00 per unit.

At the production level of 10,000, the fixed cost per unit is Re1 and the product cost will be Rs 11. If the production increases to 20,000 units, while the variable cost remains at Rs 10, the fixed cost per unit will be Rs 0.50 and the product cost will reduce to Rs 10.50.

5.5 Life Cycle Cost

The Life cycle cost, which is also known as 'cradle to grave cost', is the total cost from acquisition of an item to the final disposal of

the same after the life of the item. The elements of Life cycle cost can be narrated as:

1. Acquisition cost
2. Operational cost
3. Maintenance cost
4. Repair and replacement cost
5. Salvage cost

These costs arise at different times of the product cycle and need some explanation.

Acquisition cost

It is not only the raw material cost for manufacturing of the item. It also includes the drawing and design cost as well as development cost.

Operational cost

Customer, after purchasing the item, may have to spend a certain amount of money to use the item. It is like petrol/diesel cost for running a car. Such type of costs will fall in this category.

Maintenance cost

There is always a cost of involvement for the maintenance of the item. This is because there may be some need to keep the item in good condition. It is like the change of engine oil for the engine of a car.

Repair and replacement cost

The item may have wear and tear, and may need repair after certain period of time. There may be some components in the item which have a limited life and need to be replaced. These costs will come under this category. Re-treading a car tyre is a repair cost and providing a new tyre is a replacement cost.

Salvage cost

The customer may sell the product and receive some amount in return. This amount is called the salvage cost.

Appreciation of Money

Before learning about the Life cycle cost, one is required to understand the appreciation of money. If Rs 100 is invested in the bank at the interest rate of 10 per cent on the first day of the year, then at the end of the year, it will become Rs 110. In other words, the present value of Rs 110, at the end of the year, is Rs 100. Table 5.1 will clarify the point in more detail.

Table 5.1: Appreciation of money

Year	*Beginning of the year (Rs)*	*Interest rate (%)*	*End of the year (Rs)*
1st	100.00	10	110.00
2nd	110.00	10	121.00
3rd	121.00	10	131.10
4th	131.10	10	144.21

Source: Developed by the author.

The present value (beginning of the 1st year) of Rs 144.21 (at the end of 4th year) is Rs 100.00. In a mathematical expression, the factor which when multiplied by Rs 144.10 will give Rs 100.00 is known as the 'Present Worth Factor'. In this case, it will be 0.69396 (100.00/144.10 = 0.69396). The table is available for different interest rates.

Similarly, if one wants to distribute the present value at the beginning of the year into all the four years (as in this case), the present value has to be multiplied with a factor which is known as the 'Capital Recovery Factor'. If one has to distribute the present worth of Rs100.00 into four equal instalments, the multiplying Capital recovery factor will be 0.3155 for the interest rate of 10 per cent.

There are two methods of calculating the Life cycle cost. These are:

1. Present worth Method
2. Annualized Method

Assumptions

The calculation of Life cycle cost needs the following assumptions:

1. The alternatives which will be compared through Life cycle cost should be equivalent to each other. In other words, comparison with an apple to apple only.
2. The acquisition cost is in the first day of the calendar year.
3. All other costs are presumed to happen in the last day of the calendar year.
4. Discounted rate is valid through out the Life cycle.
5. The cardinal rule is to use the same life span for all the alternatives.

Procedures for Calculating the Life Cycle Cost

Present worth Method

1. **Acquisition cost:** Since the acquisition cost is in the first day of the calendar year, it is the present worth and its Present worth factor is '1'.
2. **Operation and maintenance cost:** These costs take place every year. Using the discount rate and the year when operation and maintenance cost recur, find out the Present worth factor. Multiply the costs with those factors to achieve the present worth of the individual item.
3. **Repair and replacement cost:** These are single payments which may happen at any time of the life cycle. Using the discount rate and the year when repair and replacement cost recur, find out the Present worth factor. Multiply the costs with those factors to achieve the present worth of the individual item.

4. **Salvage value:** This will happen at the end of the life cycle. This is the only item which is an income, when all others are expenses. Using the discount rate and the year when it is being salvaged, find out the Present worth factor. Multiply the salvage value with that factor to achieve the present worth of the item.
5. **Life cycle cost:** To arrive at the Life cycle cost, add all the items from serial number 1 to 3, then deduct item 4 from that total.

Annualized Method

1. **Acquisition cost:** Since the acquisition cost is in the first day of the calendar year, it is the present worth. To get the annualized cost, it has to be multiplied by the Capital recovery factor based on discount rate and the life of the items.
2. **Operation and maintenance cost:** These costs happen every year. Hence, they do not require any further treatment.
3. **Repair and replacement cost:** These are single payments which may happen at any time of the life cycle. Using the discount rate and the year when repair and replacement cost recur, find out the Present worth factor. Multiply the costs with those factors to achieve the present worth of the individual item. To get the annualized cost, it has to be multiplied by the Capital recovery factor based on discount rate and the life of the items.
4. **Salvage value:** This item will happen at the end of the life cycle. This is the only item which is an income, when all others are expenses. Using the discount rate and the year when it is being salvaged, find out the present worth factor. Multiply the salvage value with that factor to achieve the Present worth of the item. To get the annualized cost, it has to be multiplied by the capital recovery factor based on discount rate and the life of the items.
5. **Life cycle cost:** To arrive at the Life cycle cost, add all the items from serial number 1 to 3, then deduct item 4 from that total.

Limitations of Life cycle cost

1. **Life of the item:** Determining the life of an item is difficult.
2. **Interest rate:** The interest rate may not be same every year.
3. **Annual expenses:** Annually operation and maintenance costs are assumed as the expenses occurring at the end of the year while calculating the LCC. Intermediate expenses are not taken into consideration.
4. **Quality/reliability:** Not considering the quality and reliability of the item, since the focus is only on costs. The lowest LCC item may not be a good quality item.
5. **Aesthetic:** Not focusing on the esteem value of the item. Hence, the lowest LCC item may fail to add to the esteem of the owner even though it provides the use value.
6. **Comfort and safety:** The comfort and safety of the customer are not considered while determining the LCC. Hence, there is a chance that the lowest LCC item may not provide sufficient comfort/safety resulting in poor value to the customer.

QUESTIONS

87. What is basic objective of value engineering?
    a. Reduction of cost
    b. Optimization of design
    c. Identification of unnecessary cost
    d. Improvement of quality

88. Value Methodology deals with
    a. Functions rather than product
    b. Product design rather than function
    c. Product materials rather than function
    d. Product rather than functions

89. How many phases are recommended by L.D. Miles in the value engineering job plan?
    a. 6
    b. 7
    c. 8
    d. 5

90. Encircle the phase not recommended by L.D. Miles
    a. Selection
    b. Information
    c. Analysis
    d. Creativity
    e. Evaluation
    f. Judgement
    g. Development

91. How many phases are there in the value engineering job plan of INVEST?
    a. 6
    b. 7
    c. 8
    d. 5

92. How many phases are there in the value engineering job plan of SAVE?
    a. 6
    b. 7
    c. 8
    d. 5

93. Value Methodology is only meant for large organizations.
    a. True
    b. False

94. Value Methodology is an approach to
    a. Locate, identify, remove or eliminate unnecessary cost
    b. Identify and analyze unnecessary cost
    c. Define, locate and remove unnecessary cost
    d. Define, identify, analyze and remove unnecessary cost

95. Value Methodology is a substitute of the other cost reduction technique.
    a. True
    b. False

96. Value Methodology does not advocate any structured approach—anybody can follow any approach.
    a. True
    b. False

97. The step by step approach is known as
    a. Schedule plan
    b. Work plan
    c. Job plan
    d. Moving plan

98. The ingredients of value are
    a. Cost and profit
    b. Function and cost
    c. Function and quality
    d. None of these

99. Esteem value in a product is
    a. What motivates one to possess that item
    b. The cost value of the product
    c. What one pays for
    d. None of these

100. Value concept is not new; it is as old as 365 BC. Who was the first person who talked about value?
    a. Aristotle
    b. Plato
    c. da Vinci
    d. Socrates

101. Which value is considered for value engineering?
    a. Ethical value
    b. Aesthetic value
    c. Economical value
    d. Moral value

102. Which is not considered as the value for value engineering?
    a. Use value
    b. Material value
    c. Esteem value
    d. Exchange value

103. Value is the ratio of
    a. Cost by profit
    b. Cost by function
    c. Profit by cost
    d. Function by cost

104. The value for which a user is willing to pay for prestige, appearance, etc., is known as
    a. Use value
    b. Esteem value
    c. Exchange value
    d. Product value

105. Exchange value relates to
    a. Need
    b. Want
    c. Worth
    d. Anything

106. Esteem value relates to
    a. Worth
    b. Want
    c. Need
    d. Anything

107. Use value relates to
    a. Need
    b. Want
    c. Worth
    d. Anything

108. The lowest overall cost which is essentially required to perform a function is known as
    a. Cost value
    b. Worth
    c. Price
    d. Market value

109. Cost value is made up of
    a. Material cost
    b. Labour and overhead cost
    c. Material, labour and overhead cost
    d. None of the above

110. Value engineering differentiates itself from other cost reduction techniques because of
    a. Cost oriented approach
    b. Value oriented approach
    c. Profit oriented approach
    d. Function oriented approach

111. Function translates the need, want and desire of the customers.
    a. True
    b. False

112. The concept of function does not differentiate Value Methodology from other cost reduction techniques.
    a. True
    b. False

113. Function can be defined by
    a. A complete sentence
    b. A complete paragraph
    c. Two words
    d. Cannot be defined

114. Function is the ‘ ’ of value engineering
    a. Soul
    b. Body
    c. Mind
    d. Heart

115. Function cannot be used to expose misunderstanding.
    a. True
    b. False

116. The most powerful/revolutionary question created by L.D. Miles for function analysis is
    a. Whom does it do?
    b. How does it do?
    c. What does it do?
    d. When does it do?

117. Function is expressed in two words, they are
    a. A verb and a pronoun
    b. An active verb and a noun
    c. An active verb and a pronoun
    d. An active verb and a measurable noun

118. There are two levels of function—work function and sell function.
    a. True
    b. False

119. Expressing understanding in terms of functions will reveal misconceptions.
    a. True
    b. False

120. To improve your function identification ability avoid using the verb
    a. Transport
    b. Support
    c. Locate
    d. Provide

121. To improve your function identification ability avoid using part and operation as noun.
    a. True
    b. False.

122. Functions of a product/process/system may be divided into two types
    a. Basic function and simultaneous functions
    b. Basic function and unnecessary function
    c. Basic function and secondary function
    d. Basic function and design function

123. The question ‘What does it do?’ does not help to expose critical and troublesome areas.
    a. True
    b. False

124. Basic function of a product/process/system
    a. Can be eliminated
    b. Can be partially eliminated
    c. Cannot be eliminated

125. There will be only one basic function in a product/process/system.
    a. True
    b. False

126. The basic function is one which
    a. Supports the secondary function
    b. Depends on design approach used to achieves secondary function
    c. Function for which the item primarily exists
    d. None of these

127. Value engineering is
    a. Cost reduction technique
    b. Cost oriented value technique
    c. Function oriented cost improvement technique
    d. None of these

128. To improve your function identification ability use
    a. Creative journals
    b. Management journals
    c. Value engineering journal
    d. Dictionary and thesaurus

129. The cost of a product is
    a. Direct material cost, indirect labour and overhead
    b. Direct material cost, direct labour cost and overhead
    c. Indirect material cost, indirect labour cost and indirect expenses
    d. Material cost, labour cost and expenses
130. Which technique can be successfully used for selecting value engineering projects?
    a. Life cycle costing
    b. Return on investment
    c. ABC analysis
    d. Return on capital employed
131. This is one of the two methods for Life cycle costing.
    a. Discounted cash flow
    b. Present worth
    c. Payback
    d. Internal rate of return
132. Value engineering emphasizes on
    a. Cradle to grave cost
    b. Total cost
    c. Total profit
    d. Total price
133. In Value engineering, the cost of the product/process/system is transferred into
    a. System cost
    b. Value cost
    c. Function cost
    d. None of these

134. The lowest overall cost which is essentially required to perform a function is known as
    a. Cost value
    b. Worth
    c. Price
    d. Market value

135. Cost value is made up of
    a. Material cost
    b. Labour and overhead cost
    c. Material, labour and overhead cost
    d. None of above

136. The cost information is relatively less important than knowledge of how a cost figure is derived.
    a. True
    b. False

137. Value engineering advocates ‘cradle to grave’ cost which is calculated by
    a. Design to salvage cost method
    b. Total cost method
    c. Life cycle cost method
    d. Marginal cost method

138. One of the constituents of ‘cradle to grave’ cost is
    a. Depreciation cost
    b. Acquisition cost
    c. Interest cost
    d. Distribution cost

139. ‘Repair and replacement cost’ is also an element of ‘cradle to grave’ cost.
    a. True
    b. False

140. One of the method of calculating the Life cycle cost is
    a. Absorption cost method
    b. Present worth method
    c. Replacement cost method
    d. Marginal cost method

141. The second method of calculating the LCC is
    a. Salvage method
    b. Historical method
    c. Revaluation method
    d. Annualized method

142. Is Salvage cost a constituent of the LCC?
    a. Yes
    b. No

143. The concept of LCC is also based on value for money.
    a. True
    b. False

144. One of the limitations of Life cycle cost is the fixed interest rate.
    a. True
    b. False

145. One of these is not the limitation of LCC.
    a. Quality and reliability
    b. Aesthetic
    c. Comfort and safety
    d. Time Value of money

146. While calculating the Life cycle cost, what should be the treatment of salvage cost?
    a. Multiplication
    b. Subtraction
    c. Addition
    d. Division

147. In the present worth method, which table should be referred to?
    a. Capital recovery table
    b. Annuity table
    c. Present worth table

148. In the Annualized method, which table should be referred to?
    a. Capital recovery table
    b. Annuity table
    c. Present worth table

6

Finance

6.1 Break-even Point

In order to understand the break-even point (BEP), one needs to know about the marginal cost technique. The marginal cost format is as below.

Marginal cost format

Direct material cost (A)	Rs 5,000.00
Direct labour cost (B)	Rs 1,500.00
Variable overhead cost (C)	Rs 500.00
Marginal cost (A+B+C)	Rs 7,000.00
Sales revenue	Rs 10,000.00
Marginal contribution	Rs 3,000.00
Fixed cost	Rs 3,000.00
Profit	Nil

Mathematical model of Marginal contribution

If the sales price per unit is ‘s’ and the variable cost per unit of the product is ‘v’, then the total revenue at ‘n’ level may be written as,

$Sn = s \times N$, where 'N' is the number of product and Marginal cost (total variable cost) at 'n' level may be written as $Vn = v \times N$,

Marginal contribution = Total revenue – Marginal cost

$= (Sn - Vn) = (s \times N - v \times N)$

$= (s - v)N$ ——— (1)

If the fixed cost is 'F' and profit at 'n' level is Pn, then, Marginal contribution = Fixed cost + Profit or,

$Sn - Vn = F + Pn$ ——— (2)

$(s - v)N = F + Pn$ ——— (3)

$s.N = v.N + F + Pn$ ——— (4)

Marginal contribution for decision making

In order to run the business efficiently, the management needs to take various decisions. This concept of marginal contribution can be a potent tool for the management in decision making. The situations where it can be utilized are:

1. To decide the product-mix to maximize profit
2. To make or buy decision
3. To decide the price of the new product during product launch
4. To plan the product-mix during recession period

Graphical presentation of Marginal contribution

The formula (4) derived in the previous section can be drawn graphically as in Figure 6.1. The x-axis represents the product volume (N) and the y-axis represents revenue/cost (Rs).

The line of 'fixed cost' is parallel to the x-axis. The variable cost is an inclined line. If the angle of the variable cost line is 'φ', then the tangent of 'φ' is the variable cost per unit. This variable cost line is placed over the fixed line, representing the fixed cost. Now, any point on the variable cost line will indicate the total cost at any production level. The sales line is drawn from the origin. It is an inclined line with an angle 'β', with the tangent of 'β' is 'sales price per unit'. Any point on the sales line will indicate the sale's revenue at that sales' volume.

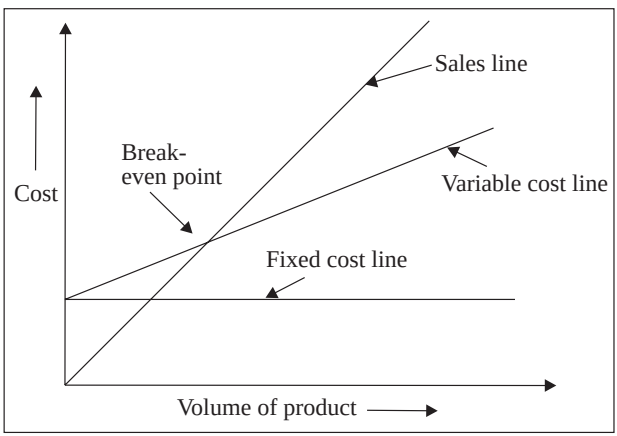
The point where sales line cut the variable line is called the break-even point (BEP). The characteristic of this point is that at this point the sales revenue is equal to total cost. In other words, at this sales volume there is no loss, no profit (see Figure 6.1).

It can also be seen that if the company operates below this line it will incur loss and if they can operate above this point they will earn profit.

Similarly, if the company can shift this point towards origin then it can start achieving profit at the lower volume of sale. This can be achieved either by increasing the sales revenue per unit or reducing the fixed cost/variable cost per unit or reducing fixed cost and variable cost per unit together.

This indicates the importance of this point.

Figure 6.1: Break-even point



Source: Developed by the author.

6.2 Payback Period

In order to choose an alternative this method can be employed. This is an easy method and can be easily assimilated.

Procedure

1. For each alternative, the increase of cost of items like raw material cost, labour cost or any other expenses per year should be noted.
2. Similarly, for each alternative, a decrease in the cost of items like raw material cost, labour cost or any other expenses per year are to be noted.
3. Initial expenditure of the alternatives to be noted.
4. Difference of item 2 and item 1 will give the benefit per year for that alternative.
5. Division of item 3 by item 4 will give the number of years to back the invested amount.
6. The alternative which will take less time will be the best choice.

Limitation

1. In this method, lives of the alternatives are not considered.
2. Time value of money is ignored.

6.3 Return on Investment (ROI)

This index is a useful index to convince the approval authority that the alternative proposed by the value engineering team is feasible from the financial point of view. This indicates the return expected from the investment is at par or exceeding the present financial norms of choosing the proposal (see Table 6.1). The mathematical formula for the return on investment can be expressed as:

$$\text{Return on Investment} = \frac{\text{Annual Cash Inflows}}{\text{Investment Cash Outflows}}$$

Example

Table 6.1: Example of ROI decision

Items	*Proposal A*	*Proposal B*
Total investment cash outflows	Rs 1,00,000	Rs 1,50,000
Cash inflows during the life	Rs 1,00,000	Rs 3,00,000
Life	10 years	15 years
Annual return	Rs 10,000	Rs 20,000
Return on Investment	10%	13.33%
Decision		Preferred

Source: Developed by the author.

Limitations

Though it is to be understood by the managers, the estimation of future cash inflow may create problems.

6.4 Discounted Cash Flows (DCF)

At the interest rate of 10 per cent, Rs 100 of today will become Rs 110 at the end of the year. In other words, Rs 110 at the end of the year, if discounted at the rate of 10 per cent, will become the value of today, that is, Rs 100. The discounted means is the reduction in value. Using this mechanism any future value can be brought to the present value (see Table 6.2).

In the DCF method, all the monetary values of all the alternatives are brought back to the present value. Then, the difference of money inflow and money outflow is calculated. The proposal whose money value thus arrived at is the highest is the choice for selection.

Example

Assuming 15 per cent as the cost of capital, examine the profitability of two proposals.

Table 6.2: Example of discounted cash flow

Year	*Investment/cash inflows*	*Proposal 1 (Rs)*	*Proposal 2 (Rs)*
	Investment/Cash inflows	1,00,000	1,00,000
1		30,000	30,000
2		36,000	30,000
3		45,000	30,000
4		45,000	60,000
5		36,000	45,000
	Total cash flow	1,92,000	1,95,000

Source: Developed by the author.

Solution

Without considering the time value for money, the choice will be for the Proposal 2. If the DSF method is used, the calculation is as seen in Table 6.3.

Table 6.3: Solution of discounted cash flow example

		Discounted cash flows	
Year	*Discounting factor @15%*	*Proposal 1 (Rs)*	*Proposal 2 (Rs)*
1	0.8696	26,088	26,088
2	0.7561	27,219	22,683
3	0.6575	29,589	19,725
4	0.5718	25,731	34,308
5	0.4972	17,898	22,374
Total		1,26,525	1,25,178
Less investment		1,00,000	1,00,000
Surplus over investment		26,525	25,178

Source: Developed by the author.

Based on the time value of money, the decision will be in favour of Proposal 1 and that should be acceptable.

6.5 Balance Sheet and Profit and Loss Account

Some aspects of accounting

Balance sheets of different organizations may differ in details of the information, but the principle will remain the same. It is an accountant who will determine the criteria which that organization will follow. But the only consideration is that it should be consistent. It should not be changed as per the demand of the organization. It is to be remembered that figures as such are not important. They matter when one compares one figure with a similar figure.

What is a balance sheet?

The balance sheet is a true and fair picture of the business at a particular time. The rule for the balance sheet is the same for the sole trader, partnership business as well as the business of a company. It is a statement where both assets and liabilities are depicted in terms of money. The liabilities are those which the business has taken from others to run the business. The assets are those which indicate how that money had been utilized. Every balance sheet should have the name of the business and there should be the date which indicates that all the statements are as on that date only.

There are two formats of the balance sheet. These are:

1. Horizontal format (see Table 6.4)
2. Vertical format

Horizontal format

Table 6.4: Balance sheet—horizontal format

Liabilities	*Assets*
• Share capital	• Fixed assets
• Reserves and surplus	• Investments
• Secured loans	• Current assets, loans and advances

(Table 6.4 contd)

(Table 6.4 contd)

Liabilities	*Assets*
• Unsecured loans	1. Current assets 2. Loans and advances
• Current liabilities and provisions 1. Current liabilities 2. Provisions	• Miscellaneous expenditure

Source: Standard format.

Vertical format

Source of fund

1. Shareholders' Funds

- Share capital
- Reserves and surplus

2. Loan Funds

- Secured loans
- Unsecured loans

Application of funds

1. Fixed assets
2. Investments
3. Current assets, loans and advances
   Less current liabilities and provisions
   Net current assets
4. Miscellaneous expenditures

The balance sheet of a company needs to be supported by:

1. The profit and loss account
2. The source and use of fund
3. Notes to the financial statements
4. The auditor's certificate

Assets

There are four main items in the asset. They are:

1. Fixed assets
2. Investment
3. Current assets, loans and advances
4. Miscellaneous expenditure

Fixed assets

The fixed assets are those which have to be used for long-term. It is not generally sold for the purpose of cash. The fixed assets are like, plant and machinery, building, fixture and fittings, motor vehicles, and so on.

Investment

It is those borrowings which are not having any specific security.

Current assets

The indicator of current assets is that this can be easily converted into cash. These are cash, inventories, debtors, etc. That asset which can be converted very easily is also known as quick asset.

Miscellaneous expenditure

This miscellaneous expenditure is like preliminary expenses, pre-operative expenses.

Liabilities

The items in the liabilities are:

1. Share capital
2. Reserves and surpluses
3. Secured loans
4. Unsecured loans
5. Current liabilities and provisions

Share capital

In order to start a business, the promoters require a certain amount of money. The amount of money required will depend upon the type of business. This money is called the share capital. Each company has to make a unit which is called share unit. It may be Rs 10 per share or Rs 2 or Re 1 per share. Based on the value of the share unit, the total share capital is divided into total share unit possessed by the company.

There are different types of shares. Important among these are the equity share and the preference share. The difference among them is basically regarding the rights to vote, preference in terms of receiving the dividend, and so on.

Reserves and surpluses

During the financial year of business, the company may make a certain amount of profit. A judicial business organization will not distribute all earnings to its share holders. They generally keep a certain amount for their business to be used in future. This amount is called the reserve, more specifically, the revenue reserve. The other type of reserve is known as capital reserve. The capital reserve is generated from the re-valuation of their fixed assets.

Surplus is that amount which comes from the profit and loss account after providing for dividend, bonus and revenue reserve.

Secured loans

For running the business, the company has to take a loan. A secured loan, which may be from a bank or from an institution, has to be taken by mortgaging the property of the company. Debenture is also a type of secured loan.

Unsecured loan

The company may have to take loans in various ways where they do not keep any security of the business. These types of loans are called unsecured loans. It is like fixed deposit from an individual or from other agencies.

Current liabilities and provisions

The money, which has to be given to different people or to an organization, is termed current liabilities. Money to be given to creditors is a current liability; similarly, the unclaimed dividend is also a current liability.

The company has to keep money for giving at different occasions. It is like money kept for giving dividend, for giving tax to the government. There are similar other accounts like those for provident fund or for insurance.

The balance sheet of a company needs to be supported by:

1. The profit and loss account
2. The source and use of fund
3. Notes to the financial statements
4. The auditor's certificate

The profit and loss account

To provide a proper picture of the business to its stakeholders or the industry as a whole, the company has to provide a profit and loss account along with the balance sheet. Here also it will bear a particular date.

There are various types of profit/loss in the profit and loss account. They are:

1. Gross profit/loss
2. Operating profit/loss
3. Profit/loss before tax
4. Profit/loss after tax

Gross profit/loss

The company sells its products and receives money, which is called sales revenue. Similarly, the company has to incur certain expenditures for making its products. This expenditure is called the cost of goods sold. The gross profit/loss is the difference between sales revenue and the cost of goods sold.

Operating profit/loss

There are a lot of operating expenses which are incurred in order to sell the products. The difference between gross profit/loss and the operating expenses is called the operating profit/loss. These operating expenses are like administrative and selling expenses.

Profit/loss before tax

There are other expenses like interest, depreciation etc. If these expenses are reduced from the operating profit/loss, the figure arrived at is known as profit/loss before tax.

Profit/loss after tax

If the tax is deducted from the profit/loss before tax, then the figure arrived at is known as profit/loss after tax.

The source and use of fund

Sources of new fund may be any of the following:

1. Net profit (after depreciation)
2. Depreciation
3. New share capital issued and subscribed
4. Sale of fixed assets
5. New loans

Uses of the funds may be any of the following:

1. Payment of dividends
2. Purchase of fixed assets
3. Repayment of loans or capital
4. Increase in net working capital

Sources of funds always equal uses. Any fund not used results in change in working capital. Working capital is current asset less current liabilities.

QUESTIONS

149. The break-even point is the crossing of two lines
    a. Sales line and fixed cost line
    b. Fixed cost line and variable cost line
    c. Sales line and variable cost line
    d. Sales line and total cost line

150. At the break-even point, the profit is
    a. Maximum
    b. Minimum
    c. Zero
    d. Optimum

151. The break-even point is the threshold point in the business.
    a. True
    b. False

152. The production level at the break-even point is the minimum requirement to start profit.
    a. True
    b. False

153. If the fixed cost increases, the break-even point will shift to
    a. Lower value
    b. No change
    c. Higher value
    d. Vanish

154. The total cost line consists of
    a. Variable cost and fixed cost
    b. Fixed cost and profit
    c. Variable cost and profit
    d. Variable cost and taxes

155. If the variable cost decreases, the break-even point will shift to
    a. Lower value
    b. No change
    c. Higher value
    d. Vanish

156. If cost reduction is done in the fixed cost, the break-even point will shift to
    a. Higher value
    b. No change
    c. Lower value
    d. Vanish

157. In order to improve the break-even point, the variable and fixed cost should be reduced.
    a. True
    b. False

158. The angle formed by sales line and the total cost line is known as
    a. Angle of reflection
    b. Angle of incidence
    c. Angle of profit
    d. Angle of reputation

159. If the angle formed by sales line and the total cost line is less, it indicates that
    a. Profit is more
    b. Loss is ahead
    c. No information
    d. Profit is less

160. The difference between the actual production level and the break-even production level is known as
    a. Margin of profit
    b. Margin of benefit
    c. Margin of progress

161. If the difference of actual production level and the break-even production level is high, then it indicates that business is
    a. Enjoying better market share
    b. Highly vulnerable
    c. No change in market share
    d. No indication

162. If the margin of safety is very large and if there is a fall in demand, then
    a. Business will be at loss
    b. No change will occur in the business
    c. Business will still earn profit
    d. Business will increase profit

163. If the margin of safety is very small, a small drop in sales will
    a. Have no effect in the business
    b. Cause violent fluctuations in profit
    c. Bring immediate loss to the business
    d. Possibly increase profit

164. A large angle of incidence with a high margin of safety indicates
    a. Business has improved
    b. Existence of monopolistic condition
    c. Gives no clarity in the business
    d. Need for change in the business

165. In an actual business situation also the break-even graph will look like a straight line graph.
    a. True
    b. False

166. The time required for net cash inflows to equal the amount of investment is known as
    a. Cash recoup period
    b. Payback period
    c. Money back period
    d. No-risk period

167. Longer is the period better is the investment.
    a. True
    b. False

168. This method does not take into account the cash inflow throughout the life of the project, hence, some profitable investment may be left out of the consideration.
    a. True
    b. False

169. The Return on Investment (ROI) is the ratio between
    a. Fixed cost by investment
    b. Total cost by investment
    c. Net benefit by investment
    d. Gross benefit by investment

170. In Return on Investment method, unlike payback method, the total life is taken into consideration.
    a. True
    b. False

171. Both payback method and Return on Investment method do take into account the value of money.
    a. True
    b. False

172. The project evaluation method which takes care of the value of money is
    a. Return on capital employed
    b. Pay-off method
    c. Discounted cash flow
    d. Marginal cost method

173. 'Today's money is more valuable than the money received a year later.'
    a. True
    b. False

174. While compounding the interest rate ascertain the future value of the present money, calculate the present value of the future money by
    a. Decreasing
    b. Reducing
    c. Minimizing
    d. Discounting

175. One of the methods of Discounted cash flow (DCF) is
    a. Salvage value method
    b. Internal rate of return
    c. Future value method
    d. Optimum rate of return

176. The DCF is also known as
    a. Present Value Method
    b. Future Value Method
    c. Return on Investment
    d. Marginal cost Method

177. In the IRR method, no discount rate is assumed, instead it has to be calculated by using
    a. Assumption Method
    b. Pre-determined Method
    c. Hunch Method
    d. Trial and Error Method

178. In the Present Value Method, the rate of discount is fixed, but does not correspond to weighted average cost of capital.
    a. True
    b. False

179. In order to understand the health of business, one has to look into the
    a. Chairman's report
    b. Directors' report
    c. Auditors report
    d. Balance sheet and profit and loss account

180. Balance sheet indicates how money has been made available and where it has been used.
    a. True
    b. False

181. Which part of the balance sheet indicates how money has been made available?
    a. Liability
    b. Assets

182. Which part of the balance sheet indicates where money has been used?
    a. Liability
    b. Assets

183. Do balance sheets of different business enterprises differ in details from each other?
    a. Yes
    b. No

184. 'Basic principles of balance sheet of different business enterprises are always the same.'
    a. True
    b. False

185. Two important things are necessary while drawing a balance sheet. They are
    a. Name of the owner
    b. Date of the balance sheet
    c. Starting date of the enterprise
    d. Name of the enterprise

186. After the criteria for drawing balance sheets are chosen, it
    a. Can be added
    b. Can be dropped
    c. Has to be consistent
    d. None

187. In balance sheet, figures are not significant unless compared with other similar sets of figures.
    a. True
    b. False

188. Two main groups in the assets side of a business enterprise are
    a. Fixed
    b. Immovable
    c. Movable
    d. Current

189. In the balance sheet of Indian companies in terms of Schedule VI of the Indian Companies Act, there is also a third group which is known as
    a. Fixed
    b. Contingent
    c. Working
    d. Investment

190. The asset which is used for the long-term requirement in the business is
    a. Current
    b. Contingent
    c. Investment
    d. Fixed

191. The asset which is used for the short-term requirement in the business is
    a. Current
    b. Contingent
    c. Investment
    d. Fixed

192. Current is more liquid than fixed asset.
    a. True
    b. False

193. The current asset which can be most quickly converted into cash is known as
    a. Fast asset
    b. Quick asset
    c. Withdrawal asset
    d. Cashable asset

194. What does not include in the current assets?
    a. Cash
    b. Receivables
    c. Patent
    d. Inventories

195. What is not included in the fixed assets?
    a. Fixtures and fittings
    b. Receivables
    c. Patent
    d. Plant and machineries

196. Fixed assets infrequently converts into cash during the life time of the business.
    a. True
    b. False

197. Current assets, other than quick asset, also infrequently converted into cash during the life time of the business.
    a. True
    b. False

198. 'If there is a choice between a higher or lower value of an asset, one should almost always choose the lower value.'
    a. True
    b. False

199. Current assets are valued at cost or market value whichever is higher.
    a. True
    b. False

200. Fixed assets are valued at cost or revaluation less accumulated
    a. Expenditures
    b. Loss
    c. Depreciation
    d. Appreciation

201. One of the three main groups in the liabilities side of balance sheet is
    a. Movable
    b. Non-movable
    c. Shareholders' fund
    d. Contingent

202. Other two main groups in the liabilities side of balance sheet are
    a. Capital reserve
    b. Fixed
    c. Taxation
    d. Current

203. 'Shareholders are the owners of the company.'
    a. Yes
    b. No

204. The money given to the company as loan is known as
    a. Fixed liability
    b. Current liability
    c. Outside liability
    d. Owners' liability

205. In the balance sheet, the shareholders fund is distinctly different from the outsiders' fund.
    a. True
    b. False

206. The outside liabilities are made up of
    a. Fixed and current
    b. Capital and revenue
    c. Movable and immovable
    d. Trade account and overdraft

207. The liability which is used for the long-term finance in the business is,
    a. Current
    b. Contingent
    c. Investment
    d. Fixed

208. The liability which is used for the short-term finance in the business is
    a. Current
    b. Contingent
    c. Investment
    d. Fixed

209. Two important items in the current liabilities are
    a. Bank overdraft
    b. Capital reserve
    c. Traders payable
    d. Inventory

210. Current liabilities represent the low financing for the business.
    a. True
    b. False

211. Along with balance sheet, an enterprise has to submit _____, for the business to be understood.
    a. Creditors list
    b. Executives list
    c. Profit and loss account
    d. Debtors list

212. One of the three basic elements of profit and loss account is
    a. Land
    b. Sales
    c. Receivable
    d. Payable

213. Tick the items which are not included in the profit and loss account
    a. Inventory
    b. Profit/loss
    c. Sales
    d. Bank overdraft

214. There are four different types of profit in the profit and loss accounts. One such item is
    a. Negotiable profit
    b. Operating profit
    c. Disbursable profit
    d. Contingent profit

215. The gross profit in a business is the difference between
    a. Total sales minus cost of sales
    b. Operating profit minus non-operating expenses
    c. Net profit minus interest
    d. Total sales minus all expenses

216. The operating profit in a business is the difference between
    a. Total sales minus cost of sales
    b. Gross profit minus selling administrative and general expenses
    c. Net profit minus interest
    d. Total sales minus all expenses

217. The profit before tax (PBT) in a business is the difference between
    a. Total sales minus cost of sales
    b. Gross profit minus total expenses
    c. Net profit minus interest
    d. Operating profit minus interest

218. The net profit is not the difference between PBT and income tax.
    a. True
    b. False

219. There are two useful indices of profitability, they are
    a. Current ratio
    b. Return on capital employed
    c. Quick ratio
    d. Return on shareholders' fund

7

Human relation

7.1 Human Aspects in Value Engineering

Man is a social animal and this nature explains the preference to stay and work with other human beings. This is not different in the case of VE too. It is the team configuration which is advocated over individualistic approach. While using the technique, one has to interact with multiple people. Hence, it becomes important for us to know how to behave with other people.

Before we know how to handle other people, we should know about our own self. To know about ourselves we have to know the following two things:

1. Individual ego-states
2. Techniques of transactions

Individual ego-states

Though each human being is different from the other, all human beings have the same ego-states, be it a kid, a man or a grandfather. In behavioural science these ego states are called:

1. Parent ego-state (taught concept of life)
2. Adult ego-state (thought concept of life)
3. Child ego-state (felt concept of life)

To know oneself it is essential to understand these terms. The mind of each person changes continuously from one state to the other, and one's behaviour also changes along with that.

Parent ego-state

It reminds me of the sentence 'The child is the father of man' in a poem called 'The Rainbow' written by William Wordsworth. When a child puts his hands on his hip and directs his little friend to study properly, he is nothing but in parent ego-state.

When a young boss is telling his elderly subordinate that you do not worry about tomorrow's meeting, instead, concentrate on your daughter's marriage, then the boss is in the ego-state of a parent.

When the principal of a school converses with his counterpart of another school, saying that the students are becoming unruly, then being at a parental level they are in the parent ego-state.

This is a taught concept of life. It is learned during the first five years of anybody's life. This is experienced from the parents during the initial five years.

From these examples, it is clear that each person changes its ego-state from time to time. There are certain indications which will reflect the state the person is in at that moment. The parental clues are:

1. Pointing index finger
2. Head-wagging
3. Hands on hips
4. Hands on shoulders

There are two different types of parental ego-state. They are:

1. Controlling or critical parent
2. Nurturing parent

It is also necessary to identify these two types of parental ego-states. This can be illustrated through the following dialogues:

'Nobody can leave until this report is finished' is a dialogue from a controlling or critical parent.

But the dialogue, 'Would you like to go to the dispensary and get some medicines' or 'I am sorry you are not feeling well today' is nothing but from a nurturing parent.

Adult ego-state

The response from an executive like, 'The production for this month is expected to be 12,000 cars because the present trend over last year is approximately 10 per cent more than the similar period of the last year' is from the adult ego-state. In the adult ego-state, one believes in inferences based on data.

The child telling his father, 'Uncle is at home because his car is in his garage', indicates that the child at the moment is in the adult ego-state.

Similarly, when you hear a gentleman talking to another gentleman saying, 'This bus is never late', you can rest assured that the gentleman is talking from his adult ego-state.

The indicators of adult ego-state, also known as 'thought concept of life' may be enumerated as:

1. Gathering information
2. Reasoning things out
3. Estimating probabilities

Child ego-state

A young lady is telling her fiancé, 'Hmm! Feel that warm sun! What a day!' is an expression coming out of child ego-state.

'Why are you always blaming me?' is the expression from child ego-state, even if it is expressed by an adult.

The boss was anxious about his report and when he received it from his junior, he suddenly said, 'OOOH, what a neat report!' This is an expression from child ego-state.

The indicators of child ego-state, which is also known as 'felt concept of life' are enumerated as:

1. Hand raising for permission
2. Laughter
3. Teasing

Techniques of transaction

If one analyzes the conversation between two persons, one may find that both are conversing from different ego-states. It will also be seen that they may change their ego-state as the talk proceeds. It could also be observed that there may be a cordial situation or a hostile one.

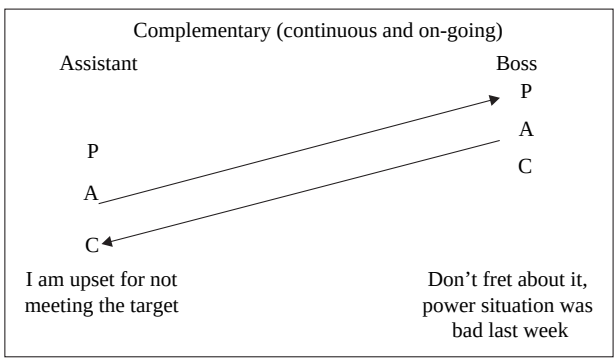
This is because there are two types of transactions:

1. Complementary (continuous and ongoing)
2. Crossed (closed off and diverted)

Complementary transaction

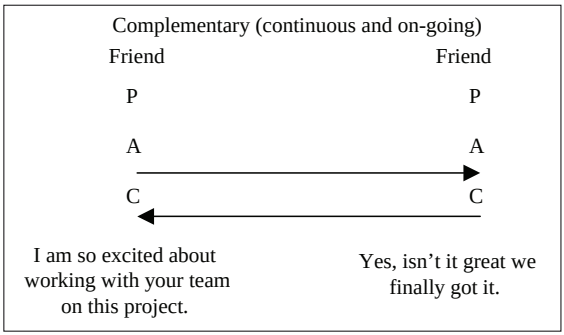
When Transactions in P–A–C diagram are parallel lines it is complementary or on-going transactions (see examples presented in Figures 7.1, 7.2 and 7.3).

Figure 7.1: Analyzing transactions—complementary example 1



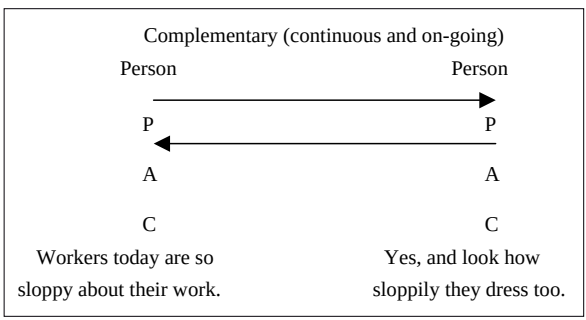
Source: Developed by the author.

Figure 7.2: Analyzing transactions—complementary example 2



Source: Developed by the author.

Figure 7.3: Analyzing transactions—complementary example 3

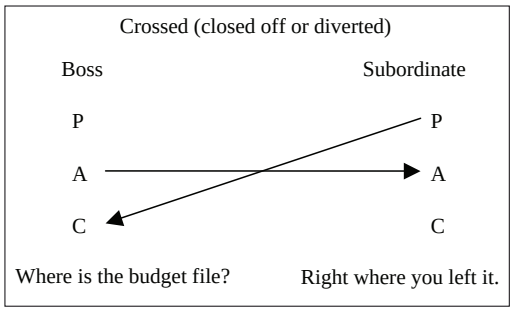


Source: Developed by the author.

Crossed (closed off and diverted)

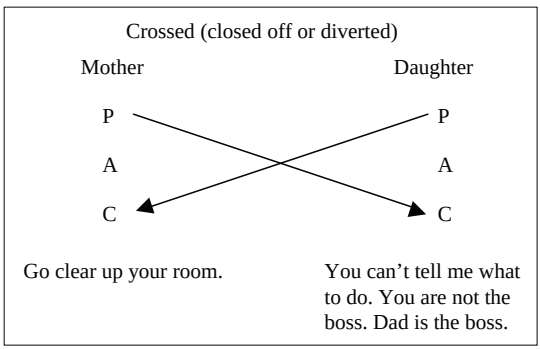
When stimulus and responses cross on the P–A–C transactional diagram, communication stops (see examples presented in Figures 7.4, 7.5 and 7.6).

Figure 7.4: Analyzing transactions—crossed example 1



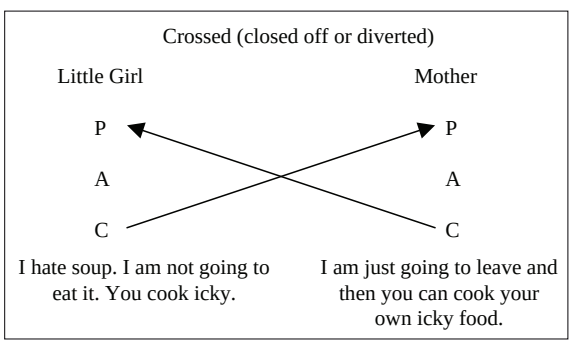
Source: Developed by the author.

Figure 7.5: Analyzing transactions—crossed example 2



Source: Developed by the author.

Figure 7.6: Analyzing transactions—crossed example 3



Source: Developed by the author.

Human interactions

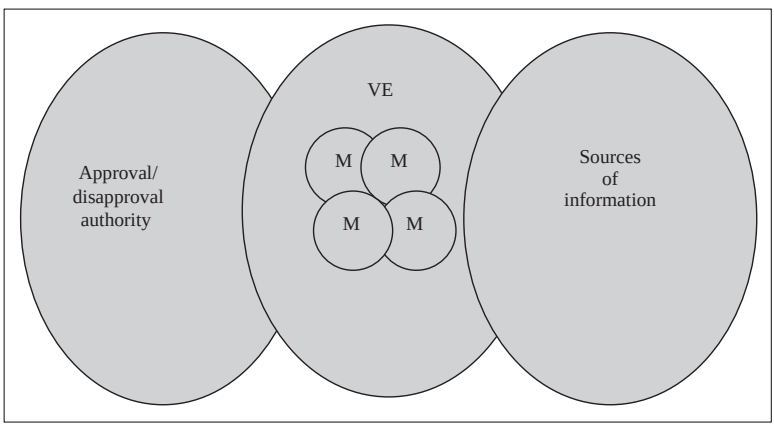
The value engineering team is a multi-disciplinary team. There may be a possibility that they may not know each other. During the course of the project, they have to interact continuously among themselves. More the interaction, the better will be the result.

Similarly, for getting any sort of information they have to interact with various types of people. These people may be from planning, design, materials, vendors or even the customers. All people are different.

The third type of people with whom the team has to interact are those who are responsible for accepting the project. They are mostly in the top management. At that level they have different expectations.

The above has been pictorially depicted in Figure 7.7.

Figure 7.7: Human interactions



Source: Developed by the author.

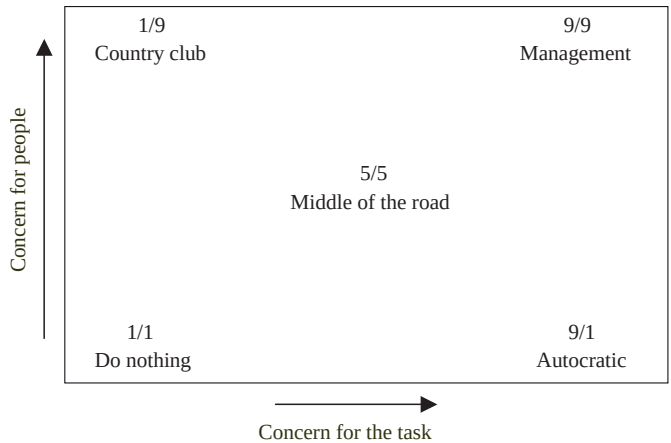
Discussion on the managerial grid

It is now clear that the VE team members have to interact with various types of people. This is because the people are not only from different backgrounds, but also from different departments. Hence, their requirements, as well as problems are also different.

If one knows what are the different types of people generally one may have to encounter and what may be the strategies to tackle them, then the whole procedure may become easier.

In order to do that, one can look into the managerial grid, which is depicted in Figure 7.8.

Figure 7.8: Managerial grid



Source: Parker (1977).

The managerial grid was developed by two American behavioural scientists, R.R. Blake and J.S. Mouton (1964).

It has two components. The x-axis depicts 'concern for the task' and the y-axis depicts 'concern for people'. There are four corners and a middle point. The nomenclatures of these points are:

1. 1/1, these people have minimum concern for the task as well as minimum concern for people.
2. 9/1, these people have concern for the task but minimum concern for people. These people are workaholic and only know work.
3. 1/9, these people are only concerned about people, but do not bother for the task.
4. 9/9, these people are both concerned for people as well as for the task. These people are mostly from the top management.

5. 5/5, these people follow the middle path. That is they are half concerned for people and half for the task.

Strategies to deal with people

Style/type 1/1

If the top people who will review the VE project fall in this category, then it is better to submit one's project to some other person as well.

Style/type 9/1

These people are known as autocrats. When one has to get their approval, the team should provide the data which will help them to improve their production, by reducing the bottle-neck they are encountering.

Style/type 1/9

To get the job done, the team has to resort to the leader's staff whom he cannot over rule.

Style/type 9/9

They are the really capable top management people. To get their approval, one has to provide all possible, technical, financial, social and political information as well. This is because they will be able to visualize all pros and cons.

Style/type 5/5

These persons like to work in a committee environment. Hence, they should be pursued accordingly.

7.2 Team Building

In VE, discussion on team building is an important aspect. The members are from various disciplines and in most of the cases, may

not be known to each other. So, they start the project as a group which after some time gels together and becomes a team. There are a lot of tools in the VE concept itself which helps them to transform a group to a team. There are three ways of transformation, which are:

1. Physical transformation
2. Mental transformation
3. Spiritual transformation

Physical transformation

In order to have physical transformation, each member has to agree to the following things.

First, the team members unanimously decide about their leader. During this process of selection there will be a lot of discussions which will indirectly help them to gel together.

Second, the team members are coming from different areas, the team has to decide about the schedule of the meeting. The schedule should include the following items:

1. Meeting venue/days/time
2. Allocation of jobs

Finally, all the team members should have a continuous dialogue which will help the team members to arrive at a unanimous decision.

Mental transformation

The mental transformation of the VE teams will be based on Split Brain Theory propagated by Dr Roger Sprey. This theory states that the brain, which is central part of the body and responsible for directing the human being, is divided into two parts. They are:

1. Left brain, is responsible for analysis, logic, verbal, etc. Most people use this part of the brain profusely to lead a regulated life.

2. Right brain, is responsible for some creative, and artistic work which a person may require to do in his life time. Intuition and dream also make use the right brain.

The VE team not only analyzes the project data, which requires the left brain working, but also comes out with some creative and innovative alternative which can do the same function not only at less cost, it can also improve performance.

The processes by which a team can mentally transform them are:

1. Formulate mission
2. Set goal
3. Communicate in two words for clarity
4. Adopt creative attitude

Spiritual transformation

After transforming the body and mind, it is time to transform the heart. The essential requirements for this aspect are:

1. Patience
2. Discipline
3. Mutual trust
4. Loyalty

The process by which one can gain the above requirement is by opening an emotional account. The deposits of this account will be as advocated by Stephen R. Covey.

1. Understanding the individual
2. Attending to the little things
3. Keeping commitment
4. Classifying expectations
5. Showing personal integrity
6. Apologizing sincerely when one makes a withdrawal

QUESTIONS

220. The 'Gordon technique' is a group conference method in which an unevaluated free-flow discussion is encouraged.
   a. True
   b. False

221. To improve the inter-personal skill, the knowledge of one of these techniques is essential
   a. Evaluation Technique
   b. Johari Window
   c. Gordon Technique
   d. Zero Defect

222. Which one is not included in the principles of social behaviour advocate by VE?
   a. Sympathy
   b. Flexibility
   c. Thoughtfulness
   d. Positive thinking

223. Transactional Analysis was invented by
   a. L.D. Miles
   b. Peter Drucker
   c. Eric Berne
   d. Lee Iacocca

224. Transactional Analysis concerns with human experience and communication.
   a. True
   b. False

225. Transactional Analysis deals with
    a. Spiritual analysis
    b. Mind analysis
    c. Structural analysis
    d. Physical analysis

226. Which ego-states are dealt with by transactional analysis?
    a. Man ego-state
    b. Child ego-state
    c. Women ego-state
    d. Adult ego-state

227. Which one is a valid transaction as per transactional analysis?
    a. Crossed transaction
    b. Useful transaction
    c. Mental transaction
    d. Spiritual transaction

228. The composition of the team should be multi-disciplinary.
    a. True
    b. False

229. Which is not the advantage of multi-discipline team?
    a. Individual may be biased
    b. Chance of one track mind
    c. Chance will be optimal solution
    d. Chance of getting more information

230. What is optimum number of the team?
    a. 2
    b. 8
    c. 6
    d. 5

231. Leader of the team should not only have the knowledge of VE technique, but should also have adequate knowledge about the project.
    a. True
    b. False

232. There are two types of teams—part time and full time.
    a. True
    b. False

233. This is one of the characteristics of a good team
    a. Nobody is willing to take risks
    b. Goals are understood by everyone
    c. Everyone need not participate actively and positively
    d. No realistic goals are given

234. This is one of the characteristics of a good team member
    a. Does not encourage the development of other team members
    b. Works for individual decisions
    c. Respects and is tolerant of individual differences
    d. Does not involve others in the decision-making process

8

Techniques

8.1 Function–Cost–Worth Analysis

The Function–cost–worth analysis is an excellent tool to identify the value improvement potential in any function. This tool will not only help to identify the potential but will also give some creative ideas as to how to achieve that. This may also be considered the first step towards creativity.

Concept of worth

1. Worth is the minimum cost of achieving a function.
2. Worth is an indispensable element of VE.
3. Worth varies with time.
4. Worth depends upon information.
5. Worth is usually determined by developing or thinking of other methods of performing functions.
6. Worth is just a technique, not an absolute value.
7. Where an item has several functions, determine worth of each function separately and add them to get overall worth.

Procedure for cost allocation

1. Split the product into components and service/system into activities.
2. Define functions of components/activities.

3. Divide the total cost of product/service/system into components/activities cost.
4. Processes performed to achieve particular function; cost allocated to that function.
5. Component provided to achieve particular function; cost allocated to that function.
6. Component accomplishes more than one function; allocation should be based on weight, volume, surface area and length.
7. Hold each function in isolation of the others to do this.

Value gap and value index

The difference between cost and worth is known as 'value gap'. It indicates the scope of possible value improvement.

The value index is the ratio of cost by worth. In other words, it is the cost per unit of worth. When the index is more than one, it means there is potential for value improvement.

The ultimate aim of the Function–cost–worth analysis is to find out the value improvement in various functions. Based on these findings, the team will approach the problem.

The following steps are required to draw the Function–cost–worth matrix:

1. Write down all functions for the project as a whole.
2. Divide the project into parts.
3. Function(s) of each part to be defined in two words.
   An active verb and a measurable noun.
4. Apply three tests to identify the basic and secondary functions.
   Is this function what users are looking for?
   Yes: Basic No: Secondary
   If this function is eliminated, will the item continue to do the job?
   No: Basic Yes: Secondary
   Will the function disappear, if the design approach is changed?
   No: Basic Yes: Secondary

5. Cost of each part to be ascertained.
6. Cost of the part to be transformed into function.
7. Check whether the cost of the functions are equal to the sum of the costs of the parts.
8. Assess the worth (least cost of achieving) functions.
   First list all functions and costs in descending order.
   Then ask the following questions:
   Will you pay if it is your money?
   If not, what do you consider reasonable?
   By whom or where a similar function is available at lower cost?
   What should you do to obtain the function within that cost?

The Function–cost–worth matrix is shown in Table 8.1 with an example.

Table 8.1: Function–cost–worth matrix—example

Item/ component	*Function*			*Present cost (Rs)*	*Worth*		*Value index/ value gap*
	Verb	*Noun*	*Type*		*Tent. Alt*	*Est. cost of Alt (Rs)*	
Rice	Supply	Carbo-hydrate	Basic	15.00 per kg	Tapioca	5.00 per kg	Rs 3/ 10.00

Source: Standard format. Example developed by the author.

8.2 Function Analysis System Technique (FAST)

History of FAST

Charles Bytheway, of Sperry–Rand's UNIVAC division, was not satisfied with the way the basic function was identified. It was that constructive dissatisfaction and the subsequent endeavour which

created this powerful technique. He presented his new technique at the SAVE Conference in 1965.

Any new concept always goes through evolution. The FAST diagram, started by Charles Bytheway, also encounters various changes in order to make it more user-friendly and understandable to all. Wayne Ruggles made a format in the year 1967, applying various aspects of FAST diagramming. This was subsequently known as the Technical FAST Diagram. The aspects included by Ruggles were:

1. Scope lines added
2. Two basic questions: how and why
3. 'Required' and 'unrequired' functions separated
4. Functions entered in the columnar fashion

R.J. Park in 1968, incorporated the 'when' logic to the Technical FAST Diagram.

Subsequently, Thomas J. Snodgrass and Theodore Fowler drew the FAST diagram using the customers' point of view in the year 1969. This diagram is now known as the Customer Oriented FAST. It has only the left scope line and customers' requirement is mentioned as 'task'. It can be narrated as:

1. 'Task' defined
2. 'Supporting functions' established
3. Supporting functions contribute to 'selling' and 'acceptance'

Definition of FAST

The FAST is a Systematic Diagramming Technique that logically identifies and visually displays the necessary function to accommodate a design purpose.

Use of the FAST diagram

1. Organize random listing of functions
2. Helps check for and identify missing function

3. Simplifies the list of functions first generated
4. Aids in identification of basic function
5. Aids in setting scope of the study
6. Deepens understanding of the problem
7. Demonstrates that a thorough team analysis has been made

Different types of FAST

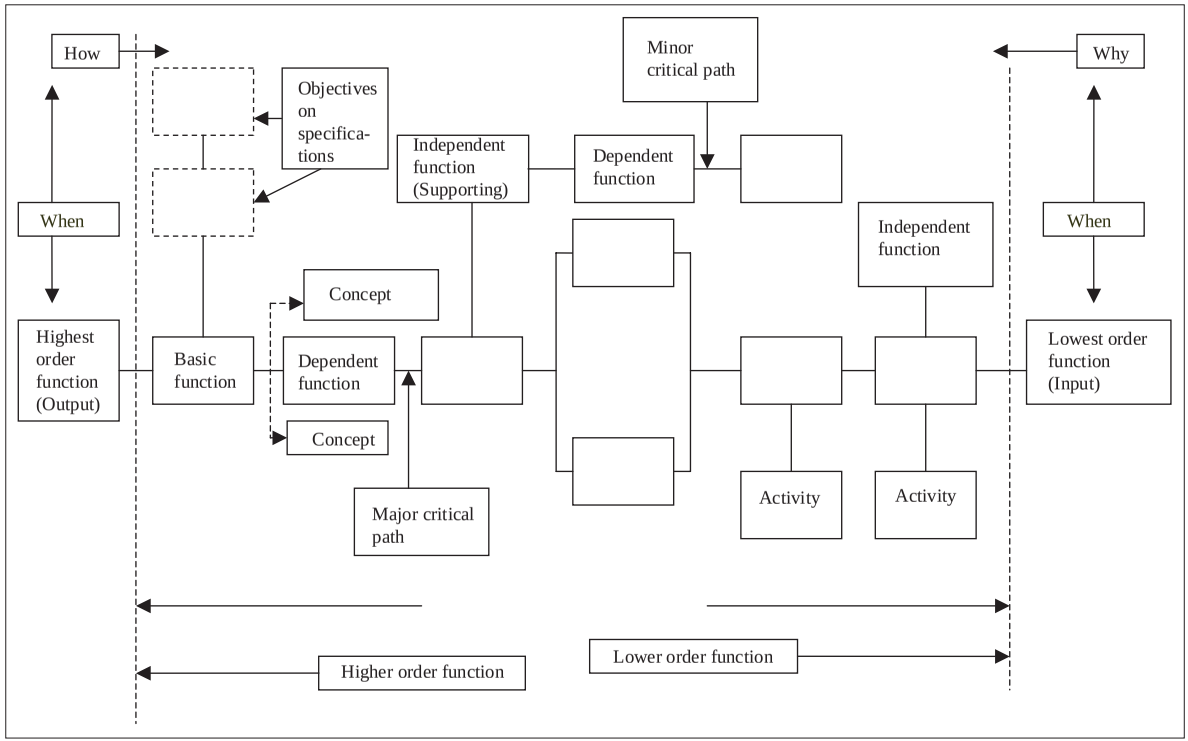
1. Classic FAST
2. Technically Oriented FAST
3. Customer Oriented FAST

How to draw a FAST diagram

FAST diagram (classic)

1. Prepare a list of all functions.
2. Use verb and noun to define a function.
3. Write each function in a small card.
4. Involve the whole team in the diagramming exercise.
5. Select the card which appears to be a basic function.
6. Apply logical question 'how' and 'why' on selected function to determine functions to right and left on this selected function.
7. Functions satisfying 'how–why' logic are 'Major Critical Path' functions to be put in line.
8. Draw scope line (dotted line) on left side of basic function.
9. Place higher order functions on the left side of scope line.
10. 'Independent function' can branch out from the function of the Major Critical Path.
11. 'Dependent function' may come from the independent function. This path is called Minor Critical Path.
12. 'Design objectives' is placed above the basic function.
13. Right scope line (dotted) to be drawn left of function that is suitable input to the system.
14. Function right to the right side of right scope line is lower order/causative function (see Figure 8.1).

Figure 8.1: The basic FAST model (classic)



Source: Kaufman (1979).

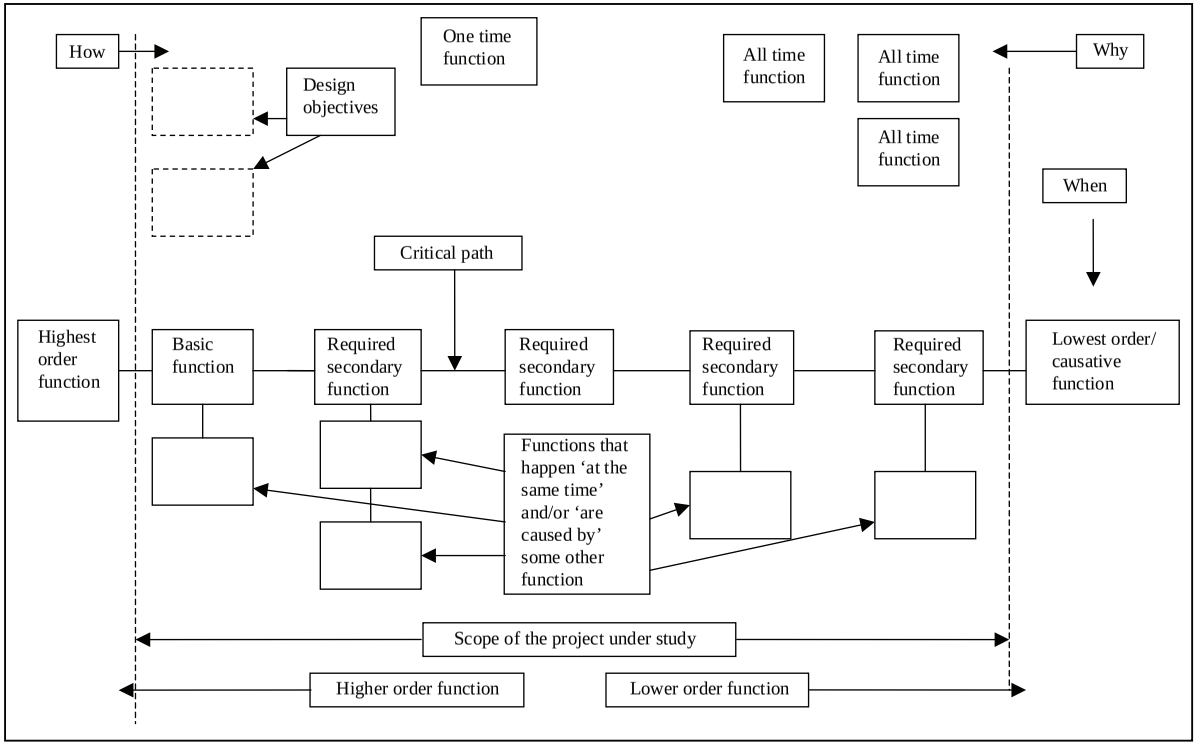
The FAST diagram (technically oriented)

1. Prepare a list of all functions.
2. Use verb and noun to define a function.
3. Write each function in a small card.
4. Involve the whole team in the diagramming exercise.
5. Select the card which appears to be basic function.
6. Apply logical question 'how' and 'why' on selected function to determine functions to right and left on this selected function.
7. Functions satisfy 'how–why' logic are 'required secondary' functions to be put in line.
8. Draw scope line (dotted line) on left side of basic function.
9. Higher order function on the left side of scope line.
10. 'All time function' to be placed in right hand top corner above critical path.
11. 'Design objectives' is placed above the basic function.
12. Functions that happen 'at the same time' placed below that function.
13. Right scope line (dotted) to be drawn left of function that is suitable input to the system.
14. Function right to the right side of right scope line is lower order/causative function (see Figure 8.2).

FAST diagram (customer oriented)

1. Prepare a list of all functions.
2. Use verb and noun to define a function.
3. Write each function in a small card.
4. Involve the whole team in the diagramming exercise.
5. Select the card which appears to be basic function.
6. Apply logical question 'how' and 'why' on selected function to determine functions to right and left on this selected function.
7. The logical question 'why' to basic function will provide 'task'.
8. Draw scope line (dotted line) on left side of basic function.

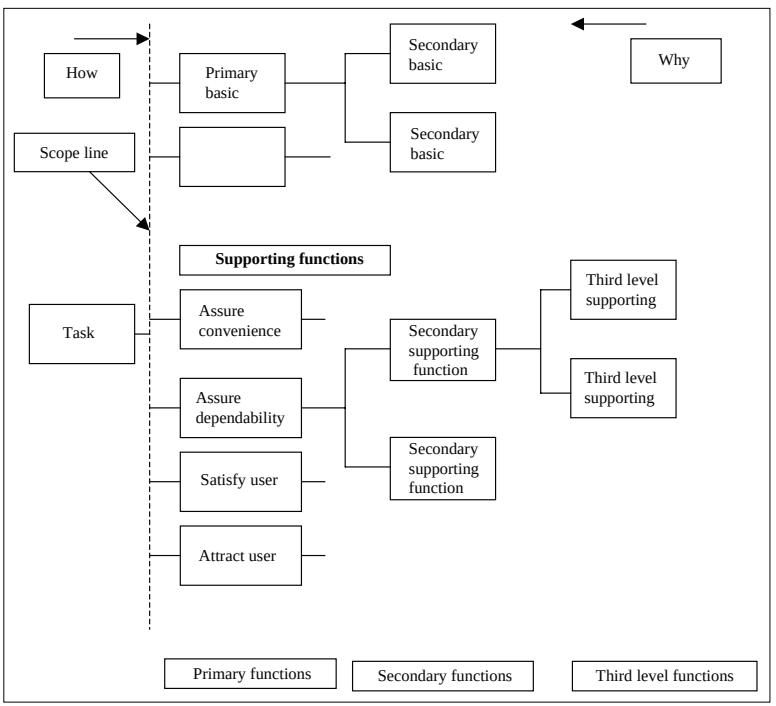
Figure 8.2: The technical oriented FAST diagram



Source: Snodgrass et al. (1986).

9. 'Task' will be on the left side of scope line.
10. Support functions should be placed below the basic function.
11. There are four supporting functions at the primary level.
12. They are: 'assure convenience'; 'assure dependability'; 'satisfy user'; 'attract user'.
13. Each supporting function will branch out to secondary level function.
14. Secondary level functions will branch out to third level functions (see Figure 8.3).

Figure 8.3: Customer oriented FAST diagram



Source: Snodgrass et al. (1986).

Diagramming perspectives

1. The FAST diagramming is just a tool, which can be used to clarify the project.
2. The process in making the diagram is important, not the perfection of the resulting diagram. As such there cannot be a unique FAST diagram.
3. The value engineering team can draw existing systems or existing designs, as well as propose system and propose design.

Caution

Do not include alternatives and choices not in the existing system.

If one wants to use the FAST in the design stage, he should:

1. Restrict the diagram to a specific concept.
2. The ‘method selected’ to perform a function brings many other functions into existence.
3. Use the future oriented questions.

QUESTIONS

235. Value gap used for value improvement potential is
    a. Value minus cost
    b. Worth minus value
    c. Cost minus worth
    d. Function minus cost

236. Value Index is the ratio of,
    a. Cost by worth
    b. Function by cost
    c. Worth by cost
    d. Market price by cost

237. Worth is the maximum cost of achieving a function.
    a. True
    b. False

238. Worth not only depends on time but also on information.
    a. True
    b. False

239. Procedure for cost allocation to different function is a skill job.
    a. True
    b. False

240. If component accomplishes more than one function; allocation should be based on:
    a. Basic element/colour/scent/look
    b. Weight/volume/surface area/length
    c. Design/process/transportation feasibility/weight
    d. Volume/colour/process/design

241. When allocating a function, hold each function in isolation of the others to do this.
    a. True
    b. False

242. Worth is usually determined by developing or thinking of other methods of performing functions.
    a. True
    b. False

243. One of the uses of the FAST diagramming is
    a. Letting others know about the creativity
    b. Identifying missing function
    c. Removing basic function
    d. Getting confused with function

244. The process in making the diagram is important, not the perfection of the resulting diagram.
    a. True
    b. False

245. While drawing the FAST on existing system, one should not include alternatives or choices not in the existing system.
    a. True
    b. False

246. To design something using FAST, use two of the following questions.
    a. How is it being done?
    b. Why should it be done?
    c. How can it be done?
    d. Why is it being done?

247. In technically oriented FAST diagram, the basic function is placed in
    a. Left side of the left scope line
    b. Right side of the left scope line
    c. Middle of critical path
    d. Outside the left scope line

248. Design requirements are placed above the
    a. Lower order function
    b. Higher order function
    c. Basic function
    d. Under required secondary function

249. Higher order function is placed on the
    a. Left side of the right side scope line
    b. Left side of the left side scope line
    c. Right side of the left side scope line
    d. Right side of the right side scope line

250. Lower order function is placed on the
    a. Left side of the right side scope line
    b. Left side of the left side scope line
    c. Right side of the left side scope line
    d. Right side of the right side scope line

251. Higher order function, lower order function, basic function and required secondary function are placed on the same line which is called
    a. Value path
    b. Cost effective path
    c. Critical path
    d. Necessary path

252. One time functions are placed
    a. Outside the left scope line
    b. Above the critical path
    c. Outside the right scope line
    d. Below the critical path

253. All the time functions are placed on the
    a. Right side corner above the critical path
    b. Left side corner above the critical path
    c. Right side corner below the critical path
    d. Left side corner below the critical path

254. Simultaneous functions should be attached with basic or required secondary function and placed
    a. Below
    b. Above
    c. Right side
    d. Left side

255. The area enclosed by the scope line is called
    a. Scope for value creation
    b. Area of functions
    c. Scope of the project
    d. Creativity area

256. Scope lines should be a
    a. Thin line
    b. Bold line
    c. Dotted line
    d. Chain line

257. Boxes which contain functions should be drawn with one of the following types of line
    a. Straight line
    b. Curved line
    c. Dotted line
    d. Chain line

258. Boxes which contain design requirements should be drawn with one of the following types of line
    a. Thin line
    b. Bold line
    c. Dotted line
    d. Chain line

259. What are the questions asked to draw the critical path functions?
    a. Where
    b. What
    c. How
    d. Why

260. The requirement in the customer oriented FAST is known as
    a. Higher order function
    b. Task
    c. Lower order function
    d. Management requirement

261. The ‘how’ logic is used from
    a. Left to right
    b. Right to left
    c. Top to bottom
    d. Bottom to top

262. The ‘why’ logic is used from
    a. Left to right
    b. Right to left
    c. Top to bottom
    d. Bottom to top

263. Which is the other logic used in the technically oriented FAST diagram?
    a. What
    b. Where
    c. When
    d. Whom

264. To put in place all functions other than functions on critical path, which logic is used?
    a. Why
    b. How
    c. When
    d. Where

265. Basic function in customer oriented FAST diagram is placed at the
    a. Centre of the diagram
    b. Top of the diagram
    c. Bottom of the diagram

266. In customer oriented FAST, how many supporting functions are there?
    a. 3
    b. 4
    c. 5
    d. 2

267. In customer oriented FAST diagram, which of these are not supporting functions?
    a. Assure convenience
    b. Assure profitability
    c. Assure dependability
    d. Assure reliability

268. In customer oriented FAST diagram, which of these are not supporting functions?
    a. Satisfy user
    b. Satisfy employer
    c. Attract user
    d. Attract employer

269. Which deterministic logic is followed in customer oriented FAST?
    a. Which
    b. How
    c. When
    d. Why

270. How many scopes lines are there in customer oriented FAST?
    a. 1
    b. 2
    c. 3
    d. 4

271. Which year was the concept of the FAST presented in?
    a. 1965
    b. 1964
    c. 1972
    d. 1966

272. Who is the creator of the customer oriented FAST?
    a. Bytheway
    b. Ruggles
    c. Snodgrass
    d. Miles

9

Creativity techniques

9.1 Creativity

There is an anecdote that the NASA took a decade and spent about USD 12 million to develop a pen which could be used for writing at zero gravity. But the same problem was solved by Russia by using a pencil instead of the pen!

Once Japan's biggest cosmetic company received a customer complaint that a soap box did not contain soap. The problem was posed by the management to its engineers to develop something which could eradicate this problem. The engineers came out with a sophisticated X-ray machine which could detect the defective item in the assembly line. It required two operators to operate the machine and was very costly.

The same when put to the rank–and–file employee of a small company, they came out with a solution to provide a high speed fan in the assembly line. The product had to pass through that point and if it was empty, the box would fly-off!

If you look at the solution in both the above cases, it will be observed that the creative solution will essentially always be a simple solution. And more importantly, anyone can be creative.

How to define creativity?

Different people have defined creativity in different ways. Some of the definitions are enumerated as follows:

1. Creativity is the art of imagination which brings something new to existence.
2. Discovery of something that is novel, useful, relevant, economical, significant and different from the beaten track.

Misconceptions about creativity

There is always a cloud over creativity. It is said that a person is creative maximum up to the age of five years. Thereafter, it begins to reduce simply because so many external factors, like social, education, etc. are imposing on the mind. Though this is known some people have certain other misconceptions like:

1. Creativity is the preserve of geniuses
2. Certain people are born creative
3. Creativity must result in a great discovery. This always persists in their mind.

Blocks to creativity

The urge for creativity does not express itself because there exist certain blocks which restrain a person from becoming creative. These blocks are:

1. Habitual block
2. Perceptual block
3. Cultural block
4. Emotional block

Habitual block

From early childhood everybody has been put in a system. This system forces them to think in a certain pattern. They are so accustomed that they cannot come out of that, even when a new procedure is available. So they always get the same result which they got earlier. Unless one changes the course, the creative possibilities will not be visible. The other factors which hold them back from becoming creative are lack of positive approach and determined effort.

Perceptual block

It has been said that many a time there may be some difference between what we see and what really is. In the process of creativity, this may create a block, which is known as the perceptual block. If one knows the cause of this block, then one can find ways to overcome it. The following may be considered as the indicators of this block.

1. Failure to use all the senses of observation
2. Failure to investigate the obvious
3. Inability to define the problem
4. Difficulty in visualizing remote relationship
5. Failure to distinguish between cause and effect
6. Mental block

Cultural block

Human beings are nurtured in varied environments. The effect of that particular environment forces them to think in a certain pattern. As an example, an Indian will think differently than an American. Similarly, people from east India will be different from those who hail from southern India. It is the culture that matters. The following can be thought of as indicators of this block. It is not exhaustive, but a few examples only.

1. Lack of questioning attitude
2. Tradition
3. Having confidence and faith only in logical reasons
4. Desire to conform to a ‘proper’ pattern
5. Fantasy and intuition are waste

Emotional block

This block will also be prevalent in a person because of the environment where one born and bought up. The following indicators may help one identify this and come out of this block:

1. Fear of failure
2. Fear of criticism
3. Fear of taking risk
4. Failure to suspend judgement

9.2 Brainstorming

The Brainstorming technique is widely used in the VE technique. This technique was developed by Alex Osbern; it is a group technique. The members of the group discuss among themselves and come out with various ideas to achieve the objective. There are two parts in the technique. The first part may be thought of as the 'divergent' and the second as the 'convergent' part. The team should elect a leader who will facilitate the whole process. One member should jot down all the ideas generated during the process.

During the 'divergent' part, the group members are responsible to generate more ideas to achieve the objective. The quantity is more important during this period. To generate more ideas, one member can piggyback the ideas of any other member. All ideas should be accepted at this time, even if they are seemingly wild ideas. No member should criticize the other members for their apparently foolish idea. The team leader should see that all members are involved in the process of generating ideas. He should encourage those members who talk less and hold those who talk more. The team can intermittently stop to energize the members' effectiveness of the thinking process. The members may play different roles like a customer or a manufacturer or a delivery agency and look to the problems from that perspective. This will help to generate more ideas.

The second part is the 'convergent' phase. During this period, only the team members should find out which are the feasible ideas. The members may use any method to discard the ideas but should not do so without any logic. One of the techniques used for this is the 'Feasibility Ranking Matrix'. The matrix is depicted in Table 9.1.

Table 9.1: Feasibility ranking matrix

Now is the time to judge! Feasibility ranking							
Ideas	*State of the art*	*Probability of implementation*	*Time to implement*	*Cost to develop*	*Potential cost benefit*	*Total points*	*Ranking*
Criteria	1–10	1–10	1–10	1–10	1–10		

Source: Standard format.

Each idea is placed in an individual box. Take one parameter, namely, 'state of the art' and evaluate all the ideas. This is because the ideas have to be evaluated on the comparative basis and when you evaluate all at the same time, you are in the same environment. Hence, evaluation is to be done vertically down against one parameter and not complete one idea and then go to the next one.

In order to evaluate properly, one can use the following scale.

Rating index for evaluating the ideas:

10. Technically feasible: significant cost and/or functional improvement.
9. Technically feasible: some cost and/or other functional improvement.
8. Technically feasible: minor cost and/or other functional improvement.
7. Could be significant improvement but requires additional analysis to verify concept and benefit.
6. Alternate approach, but no significant benefit. Design change to be suggested.
5. Cost reduction but some loss in functional requirement.
4. Benefits questionable.
3. Too many unknown to pursue further.

2. Significant disadvantages.
1. Does not meet programme requirement.

Rules of the Brainstorming technique

1. Criticism ruled out.
2. Adverse judgement of ideas must be withheld.
3. Free wheeling welcome, wilder the idea, the better.
4. Quantity of ideas wanted—not quality (at this point of time). Greater the number, more likelihood of a winner.
5. Combination and improvement sought.
6. Consider all ideas, even the most impractical.
7. Do not ridicule any idea.
8. Be careful not to judge ideas at this stage.

9.3 ABC Analysis

The Pareto principle serves as a baseline for ABC analysis. This analysis is a technique which will help to identify the potential area for investigation. If you use this technique to identify the high value inventory, you can categorize the inventory into three categories. The first category, whose total value (unit cost multiply by the total number) say Rs 1,000 and above this value, it is called the 'A' category. The items whose total value is between Rs 100 and Rs 999, can be considered as the 'B' category items. The third category is the 'C' category whose total values are Re 1 to Rs 99.

It will be observed that number wise, the 'A' category item will be hardly 5–6 per cent. 'B'will be 20–25 per cent and the rest will be 'C' category items. But total value wise, the 'A' category will be 70 per cent, 'B' category will be 20 per cent and the rest are 'C' category items. This will differ from one industry to another industry.

Hence, if you want to reduce the inventory you have to work on the 'A' category items and not 'C' category items.

Basically it shows you which stocks need more attention and which need less. It helps in utilizing resources for stock management more effectively.

9.4 Gordon Technique

The 'Gordon technique' is similar to the 'Brainstorming technique'. All the processes of the Brainstorming technique will be applicable to the Gordon technique. The rules are also the same.

There is only a certain difference in its process. In the Gordon technique, the leader starts the discussion with some of the concepts basic to, or closely associated with, the problem under consideration. The leader then stimulates the discussion and only reveals the true situation when the team is close to a satisfactory solution. Actually, the leader converts the original problem into different topics similar to that.

For example, the original problem which is 'How to clean the machines' is converted into 'Removal of dirt'. The team members discuss on this topic and generate ideas which will help to solve the actual problem.

Similarly, the problem of 'How to control traffic' is converted into the topic as 'Restrict movement'.

In the VE technique, the problem is known to all members from the beginning. So, it may not be that useful. But it can be made useful if the members changed their roles and behave as ignorant to the original problem and decide to change the problem into different topics. This will help to generate more ideas which will help the team to come to some unconventional solution which is expected from the team.

9.5 Attribute Listing

Method

List the major attributes of an existing product and then modify each attribute in the search for an improved product.

Example: screw driver

Attributes

1. A round steel shank
2. A wooden handle

3. Manually operated
4. Torque provided by twisting action

Improvements

1. Round shank to hexagonal
2. Electric power replaced manual power
3. Torque could be produced by pushing

Osborn's suggestion

1. Put to other use? Adapt?
2. Magnify? Minify?
3. Substitute? Rearrange?
4. Combine? Reverse?

9.6 Morphological Analysis

Method

Morphology means structure. This method calls for identifying the structural dimensions of a problem and examining the relationship among them.

Example

Getting something from one place to another via a powered vehicle.

Important dimensions

1. Type of vehicle (cart, chair, sling, bed)
2. Medium of operation (air, water, oil, hard surface, rollers, rails)
3. Power source (pressed air, internal combustion engine, electric motor steam, magnetic field, moving cables, moving belts)

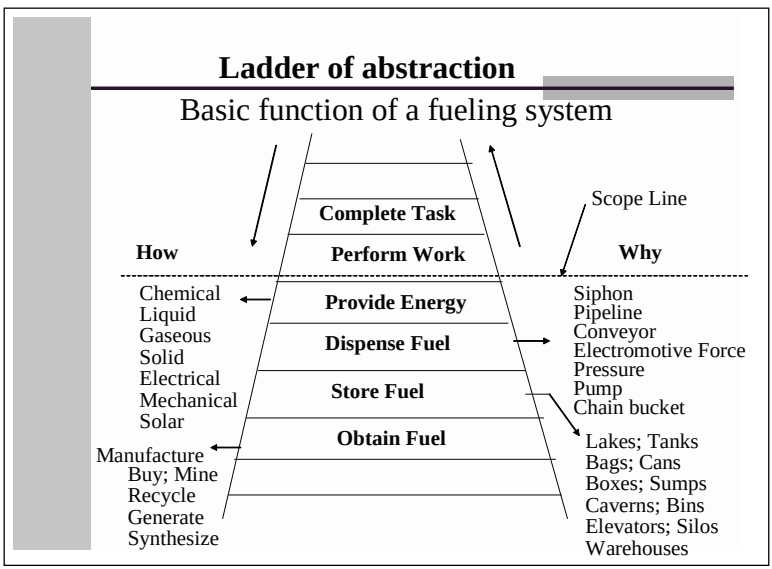
Result

1. A cart-type vehicle powered by internal combustion engine and moving over hard surfaces is 'The Automobile'

9.7 LADDERING

Another creative approach is 'laddering', which is also known as the 'Ladder of Abstraction'. Jarbo and Ferguson have shown this creative approach by using a fuelling system. This is shown in the Figure 9.1.

Figure 9.1: Ladder of abstraction



Source: Snodgrass et al. (1986).

Here, in this method by using the question 'how' one can come down the ladder and can get different levels of abstraction. If one asks a question 'How to store fuel', the answer will be 'Obtain fuel'.

Similarly, by using the 'why' logic, one can go up the ladder. 'Why store fuel' will provide the answer 'Dispense fuel'.

At a different level of abstraction, Jarbo and Fergusen found some creative solution to do that thing. The creative ways to 'provide energy' are like:

1. Chemical
2. Liquid
3. Gaseous
4. Solid
5. Electrical
6. Mechanical
7. Solar

This method can be used to generate some creative ideas.

QUESTIONS

273. Creativity is the preserve of geniuses.
    a. True
    b. False

274. Certain people are born creative.
    a. True
    b. False

275. Brain is divided into
    a. Right side
    b. Bottom side
    c. Back side
    d. Left side
    e. Top side

276. What is the maximum brain utilization?
    a. 5%–8%
    b. 10%–12%
    c. 12%–15%
    d. 15%–20%

277. Which one is the block in the parlance of creativity?
    a. Physical block
    b. Mental block
    c. Cultural block
    d. Religious block

278. Which is dealt by the left brain?
    a. Emotions
    b. Logic
    c. Sentiments
    d. Intuitions

279. Which issues are dealt by the right brain?
    a. Scientific
    b. Mathematical
    c. Linguistic
    d. Loving

280. Other than 'cultural' block, identify the other three blocks.
    a. Spiritual block
    b. Emotional block
    c. Perceptual block
    d. Social block
    e. Habitual block

281. One of the pointers of cultural block is
    a. Lack of involvement
    b. Lack of aggression
    c. Lack of questioning attitude
    d. Lack of criticisms

282. One of the pointers of emotional block is
    a. Lack of positive attitude
    b. Fear of criticism
    c. Failure to investigate the obvious
    d. Tradition

283. In order to be creative, one should avoid the failure to investigate the obvious.
    a. True
    b. False

284. Identify the killer phrase which restricts creativity.
    a. One should have positive attitude
    b. One should have a questioning attitude
    c. We have never done it before
    d. One should always take risk

285. The factor which is conducive to creativity is
    a. Constructive discontentment
    b. Fantasy and intuition is waste
    c. Mental block
    d. Aversion to determined effort

286. Distinguish factor conducive to creativity from killer phrases.
    a. Our work is different
    b. Another firm tried before
    c. Idea fluency
    d. Why change it? It is working all right

287. This is one of the creative techniques used extensively in value methodology.
    a. Critical Path Method
    b. Just-in-time
    c. Zero defect
    d. Brainstorming

288. Brainstorming was developed by
    a. L.D. Miles
    b. Peter Drucker
    c. Alex Osbern
    d. J.M. Juran

289. There are two phases of Brainstorming technique, they are
    a. Information and function
    b. Generation and judgement
    c. Information and follow-up
    d. Orientation and information

290. In the Brainstorming technique, at the outset, the team should concentrate on
    a. A few good ideas
    b. Ideas should be restricted to only 10
    c. Generate as much ideas as possible
    d. Concentrate on quality ideas

291. When you generate ideas at the beginning, you should concentrate on
    a. Criticizing the ideas
    b. Ridiculing the ideas
    c. Withholding Adverse judgement
    d. Appreciating the ideas

292. In the Brainstorming technique wilder ideas may be the nascent ideas.
    a. True
    b. False

293. In Brainstorming, the quite person should not be encouraged to come up with the ideas.
    a. True
    b. False

294. Should dominating member be handled with caution?
    a. Yes
    b. No

295. The _____ principle serves as a baseline for ABC analysis.
    a. Samuelson
    b. Parker
    c. Pareto
    d. Aristotle

296. The economic theory says that ___ % of the wealth is in the hand of ___ % of the people.
    a. 50%–50%
    b. 30%–70%
    c. 80%–20%
    d. 60%–40%

297. ‘A’ category will be __ % of items in the list for approximately __% of the cumulative annual requirement value.
    a. 15%–85%
    b. 20%–80%
    c. 30%–70%
    d. 10%–90%

298. ‘B’ category will be __ of items in the list for approximately __ of the cumulative annual requirement value.
    a. 15%–85%
    b. 20%–80%
    c. 40%–15%
    d. 10%–90%

299. ‘C’ category will be __ of items in the list for approximately __ of cumulative the annual requirement value.
    a. 15%–85%
    b. 20%–80%
    c. 50%–15%
    d. 40%–5%

300. In the Gordon technique, only the leader knows the actual problem.
    a. True
    b. False

301. In this technique, the discussion does not start with some of the concepts basic to, or closely associated with, the problem under consideration.
    a. True
    b. False

302. The true situation will only be revealed when the group is close to a satisfactory solution.
    a. True
    b. False

303. After generating the attributes of the product, process or system, the process of attribute listing is to improve attributes.
    a. True
    b. False

304. The attributes of a pencil may be shaft material, lead material, hardness of lead, colour.
    a. True
    b. False

305. In Morphological Analysis, the attributes are not mixed to create a new product in a new way.
    a. True
    b. False

306. Laddering, which is known as Ladder of abstraction or Moving up and down, is also known as
    a. Linear Programming
    b. Goal Programming
    c. Neuro Lingustic Programming
    d. Simplex Programming

307. There are two versions of the Laddering Method, the first version is
    a. Levels of abstraction
    b. Levels of goals
    c. Levels of targets
    d. Levels of creation

308. The second version of the Laddering Method is
    a. About top line
    b. About bottom line
    c. About outcome
    d. About production

309. In the first version of the Laddering method, two from the question are asked
    a. ‘What is this an example of?’
    b. ‘Why?’ or ‘Why else?’
    c. ‘What are examples of this?’
    d. ‘How?’ or ‘How else?’

310. In the second version of the Laddering Method, two from the question are asked
    a. ‘What is this an example of?’
    b. ‘Why?’ or ‘Why else?’
    c. ‘What are examples of this?’
    d. ‘How?’ or ‘How else?’

10

Managerial traits

10.1 Introduction

It is the responsibility of an enterprise to inculcate managerial traits to its employees. These traits are not only required for the top executives, but should also be evident in the grass root employees. The enterprise has to follow the adage, 'United we stand and divided we fall' in order to be effective. The five key traits are the five Pandavas who can conquer with their might:

1. Teamwork
2. Leadership
3. Communication
4. Innovation
5. Entrepreneurship

The dictionary meaning of 'traits' is 'a distinguishing feature of one's personal nature'. An enterprise is nothing but the culmination of individuals and so these personal features among their employees will help to make a synergy. The synergy is what is required to make an enterprise competitive.

10.2 Development Role of Value Engineering

The details can be enumerated how VE can provide support in developing these key traits in an individual.

Teamwork

In teamwork, the element is the team members. The team members should possess at least the following five key attributes to become a good team member. They should:

1. Trust, support and have genuine concern for other team members.
2. Respect and be tolerant to individual differences.
3. Consider and use new ideas and suggestions from others.
4. Work for consensus on decisions.
5. Consider and use new ideas and suggestions from others.

Members of any team should always come from different backgrounds—it could be social, cultural or regional. It is the responsibility of an enterprise to infuse the enumerated skills to tackle corporate challenges.

VE initiative uses the trick to work together in close proximity. The physical work done together is a very powerful method of creating identity. Multi-disciplinary team is the unit of work and not the individual. At the beginning in the information phase, the team members learn to trust others as well as get trusted by others during data collection. This skill is useful at the time of selling their new recommended ideas too. During the function phase, the correct definition is arrived at based on a consensus decision. The team member inculcates the habit of working on consensus building and team decision making. In the creative phase the members learn to respect others creativity and innovative views.

Leadership

Let me quote what Warren Bennis says: ‘Leaders learn by leading, and they learn best by leading in the face of obstacles. As weather shapes mountains, problems shape leaders.’

A member can attain his leadership quality when he is associated with value engineering initiative. According to Raymond Cattell, a pioneer in the field of personality assessments, good leaders should have at least these five personality characteristics.

1. Self-assurance (belief in yourself and your abilities)
2. Enthusiasm
3. Compulsiveness (strong motivation to succeed)
4. Conscientiousness (the quality of being in accord with the dictates of conscience)
5. Emotional stability

The Value Engineering Certification Programme will help an individual acquire education and experience required for the professional competence. This will provide an edge to others in taking up the leadership role in the team. The knowledge of one initiative will bring many more and the person will have the habit of acquiring knowledge which will inculcate self belief. During the brainstorming session, the leader has to support less vocal member(s) and restrict high vocal member(s) to achieve the goal. It is not an easy job, one has to develop the skill by trial and error and value engineering provides this platform. Another situation is very common in this initiative, and that is when ones proposal is not accepted by the management, most VE team members in such a situation get de-motivated and resign to old ways of working. Such situations help mould a leader into an emotionally stable individual who can also inculcate such qualities in his team members.

In short this initiative provides enough opportunity to develop one's leadership skill.

Communication

Value Engineering team members have three interfaces. These are:

1. Among the team members
2. Data providers
3. Accepting/approving authorities

Human aspects for value engineering provide an input like, 'How to transact with people' and 'The principles of social behaviour'. While the first provides the basic framework of the P–A–C ego

state concept, which is necessary for better communication, the second will acquaint the team members with the behavioural aspects necessary to excel in their effort. This knowledge will help the team members to communicate with not only top executives, but also the grass root employees with a win-win approach.

Innovation

In the words of Peter Drucker (2003), 'Innovation is both conceptual and perceptual.'

The five key traits for innovation may be:

1. Attraction to complexity
2. Intuition
3. Persistence
4. Curiosity
5. Intellectual honesty

If the different phases are analyzed it will be visible that right from the information phase, the concept accords more importance to non-obvious things than the obvious ones. A team member who is working in value engineering projects will become habituated with intricately complex data. One has to use one's left as well as right brain, particularly in the creative phase. This will help to utilize or develop their intuition. This characteristic will help conceptualize the value and the need of the customers. When the team comes out with the alternative, they have to perceive that what they are proposing is the same thing as what the customer wants. Many a times, it has been found that a good item is not accepted because it is not as per the needs of the customer.

Entrepreneurship

The key elements of entrepreneurship may be enumerated as:

1. A willingness to take risks
2. A high level of energy
3. An ability to get along with employees
4. Versatility

5. A desire to create
6. Innovation

Idea acceptance is not the end point of a Value Engineering project. A successful project is one which has been implemented within a certain time frame. This requires entrepreneurship quality. Some of the characteristics like ‘high level of energy’ (enthusiasm) and ‘innovation’ get developed in different phases of the VE job plan.

QUESTIONS

311. One of the leadership traits is
    a. Ethic slip
    b. Lost love
    c. Emotional stability
    d. Risk aversion

312. One item is not considered as a trait of leadership
    a. Enthusiasm
    b. Conscientiousness
    c. Tough-mindedness
    d. Poor communication

313. One of the items is not the enemy of leadership
    a. Selfishness
    b. Jealousy
    c. Self assurance
    d. Behaviour

314. One of the items is the enemy of leadership
    a. Compulsiveness
    b. Power struggle
    c. Enthusiasm
    d. Dominance

315. One trait is associated with leadership failures
    a. Poor self-management
    b. Good communication
    c. Risk-taking ability
    d. Strongly motivated

316. One trait is not the trait of bad leadership
    a. Incompetent
    b. Rigid
    c. Intemperate
    d. Empathetic

317. One trait is the trait of good leadership.
    a. Callous
    b. Dominance
    c. Corrupt
    d. Insular

318. One of these is not the personality trait for innovation
    a. Independence of judgement
    b. Aversion to complexity
    c. High energy
    d. Intuition

319. One of these is the personality trait for innovation
    a. Non-consistent
    b. Non-enthusiastic
    c. Less energetic
    d. Intellectual honesty

320. Innovation is both conceptual and perceptual.
    a. True
    b. False

321. A good team should always be willing to take risks.
    a. True
    b. False

322. One of the following is the characteristic of a good team-leader.
    a. Has his own goal
    b. Always presses his opinion
    c. Criticizes the team members
    d. Involves others in the decision-making process

323. One of the following is not the characteristic of a good team.
    a. Everyone takes initiative to get things done.
    b. Full team acceptance is expected as decisions are made.
    c. Does not involve others in the decision-making process
    d. There is plenty of communication between team members

324. All team members are not encouraging the development of other team members.
    a. Yes
    b. No

325. Generally, people can retain only __ of what they read.
    a. 8%
    b. 12%
    c. 10%
    d. 9%

326. Generally, people can retain only __ what they say and do.
    a. 85% b. 90%
    c. 95% d. 100%

327. Sender is responsible for proper communication. One of the items is not the goal of the sender.
    a. Receiver understanding
    b. Receiver response
    c. Strained relationship
    d. Organizational goodwill

328. Communication in a group will be improved if all members are skilled in
    a. Preaching
    b. Listening
    c. Humour
    d. Technical Knowledge

329. The cornerstone of effective speaking is
    a. Vividness
    b. Arrogance
    c. Technical vocabulary
    d. Low pitch

330. Even non-verbal communication can often be eloquent.
    a. True
    b. False

331. One of these items is not important for success as an entrepreneur.
    a. Self-confidence
    b. Self-reliance
    c. A strong need to achieve
    d. Procrastination

332. Important aspects for success as an entrepreneur exclude.
    a. Lack of concern for people
    b. Versatility
    c. A desire to create
    d. Innovation

333. Least important for success as an entrepreneur
    a. Ability to lead effectively
    b. A willingness to tolerate uncertainty
    c. A strong desire for money
    d. A high level of energy

334. An entrepreneur rates _____ high in his list of attributes which he values most.
    a. A need for power
    b. Patience
    c. Imagination
    d. Argumentation

11

Solution

11.1 Answers to All Questions

Question	*Answer*	*Question*	*Answer*	*Question*	*Answer*
1	(b)	2	(c)	3	(c)
4	(c)	5	(b)	6	(a)
7	(c)	8	(d)	9	(b)
10	(c)	11	(c)	12	(a)
13	(c)	14	(a)	15	(d)
16	(c)	17	(c)	18	(b)
19	(d)	20	(b)	21	(d)
22	(c)	23	(a)	24	(c)
25	(d)	26	(a)	27	(d)
28	(c)	29	(b)	30	(c)
31	(b)	32	(a)	33	(c)
34	(c)	35	(b)	36	(b)
37	(c)	38	(c)	39	(d)
40	(d)	41	(b)	42	(b)
43	(a)	44	(c)	45	(c)
46	(d)	47	(c)	48	(a)
49	(d)	50	(a)	51	(a)
52	(c)	53	(d)	54	(b)
55	(a)	56	(b)	57	(b)

(Continued)

Question	*Answer*	*Question*	*Answer*	*Question*	*Answer*
58	(a)	59	(b)	60	(b)
61	(a)	62	(b)	63	(b)
64	(d)	65	(a)	66	(c)
67	(d)	68	(a)	69	(d)
70	(b)	71	(c)	72	(d)
73	(b)	74	(a)	75	(c)
76	(a)	77	(a) and (e)	78	(b)
79	(a)	80	(b)	81	(a)
82	(b)	83	(d)	84	(b)
85	(c)	86	(d)	87	(c)
88	(a)	89	(d)	90	(a) and (g)
91	(c)	92	(b)	93	(b)
94	(a)	95	(b)	96	(b)
97	(c)	98	(b)	99	(a)
100	(a)	101	(c)	102	(b)
103	(d)	104	(b)	105	(c)
106	(b)	107	(a)	108	(b)
109	(c)	110	(d)	111	(a)
112	(b)	113	(c)	114	(d)
115	(b)	116	(c)	117	(d)
118	(a)	119	(a)	120	(d)
121	(a)	122	(c)	123	(b)
124	(c)	125	(b)	126	(a)
127	(c)	128	(d)	129	(b)
130	(c)	131	(b)	132	(a)
133	(c)	134	(a)	135	(c)
136	(a)	137	(c)	138	(b)
139	(a)	140	(b)	141	(d)
142	(a)	143	(a)	144	(a)
145	(d)	146	(b)	147	(c)
148	(a)	149	(d)	150	(c)
151	(a)	152	(a)	153	(c)

(Continued)

Question	*Answer*	*Question*	*Answer*	*Question*	*Answer*
154	(a)	155	(a)	156	(c)
157	(a)	158	(b)	159	(d)
160	(b)	161	(a)	162	(c)
163	(b)	164	(b)	165	(b)
166	(b)	167	(b)	168	(a)
169	(c)	170	(a)	171	(b)
172	(c)	173	(a)	174	(d)
175	(b)	176	(a)	177	(d)
178	(b)	179	(d)	180	(a)
181	(a)	182	(b)	183	(a)
184	(a)	185	(b) and (d)	186	(c)
187	(a)	188	(a) and (d)	189	(d)
190	(d)	191	(a)	192	(a)
193	(b)	194	(c)	195	(b)
196	(a)	197	(b)	198	(a)
199	(b)	200	(c)	201	(c)
202	(b)	203	(a)	204	(c)
205	(a)	206	(a)	207	(d)
208	(a)	209	(a)	210	(a)
211	(c)	212	(b)	213	(a) and (d)
214	(b)	215	(a)	216	(b)
217	(d)	218	(b)	219	(b) and (d)
220	(a)	221	(b)	222	(a)
223	(c)	224	(a)	225	(c)
226	(b) and (d)	227	(a)	228	(a)
229	(b)	230	(d)	231	(a)
232	(a)	233	(b)	234	(c)
235	(c)	236	(a)	237	(b)
238	(a)	239	(a)	240	(b)
241	(a)	242	(a)	243	(b)
244	(a)	245	(a)	246	(b) and (c)
247	(b)	248	(c)	249	(c)

(Continued)

Question	*Answer*	*Question*	*Answer*	*Question*	*Answer*
250	(c)	251	(c)	252	(b)
253	(a)	254	(a)	255	(c)
256	(c)	257	(a)	258	(c)
259	(c) and (d)	260	(b)	261	(a)
262	(b)	263	(c)	264	(c)
265	(b)	266	(b)	267	(b) and (d)
268	(b) and (d)	269	(b) and (d)	270	(a)
271	(a)	272	(c)	273	(b)
274	(b)	275	(a) and (d)	276	(b)
277	(c)	278	(b)	279	(d)
280	(b), (c) and (e)	281	(c)	282	(b)
283	(a)	284	(c)	285	(a)
286	(c)	287	(d)	288	(c)
289	(b)	290	(c)	291	(c)
292	(a)	293	(b)	294	(a)
295	(c)	296	(c)	297	(b)
298	(c)	299	(d)	300	(a)
301	(b)	302	(a)	303	(a)
304	(a)	305	(b)	306	(c)
307	(a)	308	(c)	309	(a) and (c)
310	(b) and (d)	311	(c)	312	(d)
313	(c)	314	(b)	315	(a)
316	(d)	317	(b)	318	(b)
319	(d)	320	(a)	321	(a)
322	(d)	323	(c)	324	(b)
325	(c)	326	(b)	327	(c)
328	(b)	329	(a)	330	(a)
331	(d)	332	(a)	333	(d)
334	(c)				

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Anil Kumar Mukhopadhyaya, CVS–Life, FINVEST, AICWA, is one of the pioneering Certified Value Specialists in India and has previously worked with Tata Motors Limited and Coal India Limited. He is also the author of the highly successful book titled *Value engineering: Concepts, techniques and applications* published by Response Books, a division of SAGE India. He has written several articles on the subject of value engineering and industrial engineering for national and international journals. He was awarded a Fellowship by the Indian Value Engineering Society in 2005 and was also awarded the Best Case Study Award by the Indian Institution of Industrial Engineering for an article on value engineering, titled 'A pragmatic approach to cost reduction through value engineering—A case study' in 1986. He had also received Productivity Award 1984 (for Individual/Groups) instituted by the Association of Indian Engineering Industry (Eastern Region). He is authorised to conduct Module I workshop and Module II seminar by SAVE International, USA.