CHAPTER 1

CLASSICAL ENGINEERING MANAGEMENT TREATIES
- AN INTRODUCTION

There are no Frontiers to Learning – Japanese proverb.
1.1 INTRODUCTION

Thus begins the Thirukkural of world famous Thiruvalluvar, through which the Tamil poet brought out that the learning, language and literature had emanated from and evolved with letter ‘A’ \( \text{‘A’} \), and the universe / world began with the Omni Potent God. Diaz (2000) translated it as “The alphabet begins with ‘A’ so does the universe with God” and Sundaram (1990) translated it as “‘A’ begins the alphabet and God primordial the world”. Both these versions were not far from the view taken by this research study. Thiruvalluvar himself started his Thirukkural with the letter ‘A’ as a proof of his own proposition. Another poetess Avvaiyar, also re-confirmed it by beginning her couplets (respectively) of Aathichudi and Kondraivendhan with the letter ‘\( \text{‘A’} \)’ as ‘\( \text{‘A’} \) begins the alphabet and God primordial the world’, verse 1 (Dhanapalakrishnan et al. 2001) (Arram chaiya virummbu) meaning ‘wish to do ethical deeds’ and ‘\( \text{‘A’} \) begins the alphabet and God primordial the world’, verse 1 (Arasu 2000) (Annaiyum pithaum munneri thaivam), which means that Mother and Father are the Primary Gods. Finding a striking similarity between - at least in these two great Tamil literature - the present research tries to draw a parallel between the ‘Omni Potent God to the Universe’ and the ‘Quality to the Business Entrepreneurship’.

The success or failure of the business starts with quality or the absence of it. With this deep sense of understanding and meaning, that quality is universal and evolved with mankind, the present study intends to explore the past, to understand the present and to shape the future. An inscription on a rock in Singapore park “To understand the present and anticipate the future, one must know enough of the past,
enough to have a sense of the history of the people" reinforced the belief of the researcher to proceed with the study of Quality in the past and its evolution to the present day status, called Total Quality Management – TQM.

The phenomenon of the globalization has drawn diverse geographical regions, social structures and economic arrangements into a single network of transactions. Yet, this so-called globalization is not new or a recent aspect, but an ancient one, where in the business was transacted across and beyond the boundaries. It is evidenced in many similarities of the past landscapes left out at various parts of the world. The submerged cities of Alexandria in the West and Dwaraka in the East, the Pyramids of Egypt, Borobudur and Prambanan Temples of Indonesia, The Great Wall of China, Angkor Temple of Cambodia, sprinkling historical monuments and temples of India are the living examples, revealing the Architectural Quality of the past and the high level of standards followed then. The famous terrace rice cultivation of Ifugao Province in Philippines is said to be 2000 years old and considered the 'Eighth Wonder' of the world and yet modern in agriculture. The literary works like Thirukkural, Aathichudi, Ramayana, Mahabharatha, Bhagavad-Gita, Arthashastra and the artworks like cave paintings of Ajanta, Ellora and that of innumerable temples speak silently about the quality of art and literature of yesteryears. Such timeless masterpieces confirm, one thing clearly is, that Quality was born and evolved with mankind. Quality is culture and culture evolves (Mani et al. 1997 a). Nevertheless, only Thirukkural, Aathichudi and Kondraivendhan from Tamil classics and the present day contemporary literature on quality were taken up for study and evolution of TQM.
Amongst the various Indian Cultures that reined the entire eastern part of the world up to Sumatra, Java and Bali, Dravidian is one of the oldest. Its language, Tamil is the only living language of contemporary India out of two classical languages - the other being Sanskrit (Sundaram 1990). The Tamil Sangam period - between first century BC and third century AD was considered as a golden period for Tamil literature, during which period many timeless creations such as Thirukkural by Thiruvalluvar and Aathichudi and Kondraiivendhan by Avvaiyur, were created along with innumerable priceless works of others. Only the creations of Thiruvalluvar and Avvaiyar were taken up for the present study, to contain the scope with in a manageable level.

Verses of Tamil literature are scripted in Tamil, to retain the originality, followed by the text in English, as it is pronounced and with the translation / meaning in English, for comprehensive understanding of the great works of ancient culture. Thirukkural and its short form Kural are interchangeable and synonymous, and hence both are used in this thesis. All these impeccable works of great people prove that rich culture existed in the past that had boasted of progressive society who had excellent talents / skills and systems to create, sustain and live forever. Yet, its technology, the management and quality systems followed are not, explicitly, known to the contemporary world. Therefore there is a need to unearth and unravel the less understood-past, on Quality. This will help in fully comprehending the present system, so as to shape the future approach, by integrating the best of both, the past and the present. In this process, it becomes imperative to uncover the rich cultural heritage, the visionary foresight and the hidden management systems camouflaged in the poetic language behind the classical creations.
1.2 SCOPE OF THE RESEARCH

The business landscape of the corporate world had undergone quantitative and qualitative revolution, resulting in the opening of floodgates of research on the tools, techniques, methods, elements, and other organizational requirements for implementation of TQM. Hundreds of books and thousands of articles / research papers were written detailing out every aspect of Quality in general and TQM in particular. They tend to be complex and too prescriptive, rather than being a general guide (Yusof et al. 2000).

Acknowledged Quality Gurus such as, Shewhart, Deming, Juran, Crosby, Feigenbaum, Garvin from the West and Ishikawa, Taguchi, Imai, Matsushita from the East, to name a few, had contributed substantially to TQM. While all these individuals might not have used the now common buzzword, TQM, their ideas had been synthesized in TQM philosophy. The concept of total quality possesses ambiguity and some viewed it as an extension of scientific management, some others looked at it in terms of systems theory, and the rest saw it as an entirely new paradigm for management. (Dean et al. 1994 a). It was so, because, most of the concepts were based on the quality practitioners' judgment, intuition, and experience rather than on empirical research studies and evidences. Hence, the literature on quality management is predominantly unstructured, amorphous in nature, conflicting in views, practitioner oriented and consultancy driven.

TQM had been described as a management philosophy and a way of thinking that had helped many organizations towards achieving world-class status (Yusof et al. 2000). It was 'easier said than done'. The implementation of TQM is one of the most complex activities that any company can attempt, the main reason being, that it
involves a change in working culture and impacts people (Kanji et al. 1990). Moral and ethical values of the people and the organization, which determine its culture becomes a core issue. But, it appears from the literature review, that no research hitherto had ventured into this area of incorporating the moral and ethical values into the philosophy and approach of TQM. The apparent unintended omission of the cultural values in the contemporary TQM frameworks, might be due to the reason that these frameworks were answering mostly to the “how to” part (of implementation) of TQM. Even in the models addressing the part “what is” TQM, the element of cultural and human values were not addressed - at least explicitly. Therefore it became imperative to incorporate and integrate these left out ethical and moral values into TQM concept, frameworks, and models.

An attempt was made in the present study, to fill the above-mentioned gap in TQM by addressing the values associated with the people and the organization, based on what was contemplated in the classical Tamil literature. Once these cultural aspects were inducted into the philosophy of TQM, it would be complete or at least appear to be complete and comprehensive. Definitely, it would be much closer to completeness. This was not an idealistic dream or approach but a holistic and a value added human system integration in TQM, which would (expected to) result in better implementation to attain sustained success for profit, progress and prosperity. Thus, in the present research, a spirited attempt was made to develop an integrated model of TQM, incorporating the contemporary tools and techniques and classical cultural heritage of human values.

As stated earlier, to limit the boundaries of this vast subject, the study was confined to Thirukkural, Aathichudi and Kondraivendhan, which provided the basis for classical TQM, enshrined with cultural values. The review of contemporary literature
on TQM was also broad based on many, rather than going deeper on a few; since very aspect of ‘how to’ to TQM and majority of “what is” TQM had already been extensively and exhaustively dealt-with. The broad scope of the present study covered the following:

- Definitions of Quality.
- Details about Quality Gurus.
- Approaches of Classical Engineering and Management Systems.
- Evolution of Total Quality Management (TQM).
- Review of Contemporary Literature.
- Review of some of the Existing TQM Models.
- Domains and Elements of TQM.
- Integration of Classical Approaches and Contemporary Systems.
- Sustainability of TQM and Business.
- Case Studies.
- Future Scope for Research.

1.3 OBJECTIVES

The scope of study was catered to the following objectives of the present research:

➢ To bring out the Missing Elements of Contemporary TQM through Literature Survey.
➢ To comprehend the Domains and Elements of TQM for integration.
➢ To present an Integrated Conceptual TQM Model.
➢ To highlight the Sustainability Factors of TQM and Business survival.
➢ To empirically (by actual implementation) Validate the Proposed TQM Model through Case Studies.

The purpose of the present research work was to ascertain that the classical approach to TQM indeed was supportive, supplementary and complimentary to the contemporary TQM systems and not contradictory to. By incorporating classical
concepts with contemporary approach, the integrated model got synergised, and in that process, the classical values became current and got fused into contemporary approaches of TQM. It was not to re-invent the wheel but to reinforce it, to take-on the days of greater expectations.

1.4 THIRUVALLUVAR AND AVVAIYAR

Tamil literature is very rich in ethical and moral values, covering every aspect of life. Thirukkural, standing tall amongst Tamil literature, was widely read and translated in many languages. It was acknowledged as the invaluable jewel in the crown of Tamil literature. The entire Thirukkural was divided into three topics namely Aram, Porul and Enbam meaning Virtue / Dharma, Wealth / Goods, and Pleasure / Enjoyment respectively. It was equated to Arthashatra and Manu, (ancient treatises on governance and justice respectively) for the richness of the value it dealt with, in every topic. Thiruvalluvar, a saintly poet, composed the wonderful creation, Thirukkural. Details like his real name, his birth, living places, etc. were not available, and hence they were quite controversial and debatable.

Another well-known Tamil literature dealing with ethical and moral value-based management concepts is Aathichudi. In fact, it is a shorter version of Thirukkural. It consists of only one line, instead of two (as in Thirukkural). Aathichudi also starts with ‘A’- ‘😒’ like Thirukkural, but covers all the four basics of life i.e. Aram, Porul, Enbam and Veedu (Moksha). It consists of 108 couplets. The dictum followed was, short but explicit. The author of Aathichudi was Avvaiyar, a twelfth century poetess (Ragavaiyengar 1996). Avvaiyar’s personal details were also mystic, because of non-availability of concrete evidences. She also authored other creative books like Neethinoolgal, Kondraiventhal, Vertriverkai, Moodurai and Nalvazhi. All these are
current and timeless masterpieces. More details on Thiruvalluvar, Avvaiyar and their creations have been reviewed in chapter 3.

1.5 THE CLASSICAL APPROACH TO ENGINEERING

The eminent scholars and the commoners alike knew Thiruvalluvar and Avvaiyar as unparalleled philosophical poets. This is one part of the truth and the other part, which is yet to be appreciated is the one hidden beneath the poetic language i.e. the Engineering expertise, Managerial wisdom and Medicine and Treatment methods, etc. Even though Thirukkural and Aathichudi were written in First Millennium, they are still current and contemporary in the Third Millennium as well. The over-layer of its poetic language and the camouflaging strata of the philosophical meaning are to be penetrated to reach and bring out the immense valuables they behold on engineering and management subjects. Wider vision, deeper study and independent interpretation are required to comprehend such values in Tamil classicals. "There is no knowledge without interpretation," asserts, Clarence Irving Lewis, the author of Mind and the World (Lindsay et al. 1997). They might not have covered the nuts and bolts of engineering in modern day vocabulary / terminology / jargon, but certainly addressed the basic and underlying conceptual philosophies – but, yes, in poetic language.

The contemporary engineering included not only Civil, Electrical, Mechanical, Hydraulics, Communication, Computer, etc. but also included Quality Engineering, Industrial Engineering, Human Resource Engineering, etc. which, indeed, fell under the management domain. But the basic functions remained the same, as that of design, process, and service to provide trouble free life throughout its life cycle.
Thiruvalluvar and Avvaiyar had addressed every element of engineering in their creations.

Design being the first step of engineering must be great, famous, acceptable, and desired by the society for which the designer should have a thorough knowledge about it. It should be absolutely flawless. These qualities were addressed in Kurals ‘தொண்டின் பழிலுடைநுறு இயற்கையுடைநுறு ....’ Kural 236 (Varadarajanar 1978) (Thondrin phazhlodu thondruka...) meaning ‘be born for fame’ (Sundaram 1990); and ‘அத்தாவளியுல் தகம்பு ...’ Kural 391 (Varadarajanar 1978) (Karikka kasadarrak karrpavai) emphasizing to learn thoroughly. ‘நந்தி தம்பு தூய்மை’, Aathichudi verse 66 (Arasu 2000) (Naadu oppana chai), the Aathichudi advocated to do what the society had accepted. Kural also warned about a poor / bad design / act by comparing it with shadow which followed all the time, that, it (the result of poor design) would hound always (Diaz 2000).

Even if one wanted to follow / copy other designs or product he had to find out the facts and benefits before embarking upon the same. ‘பொற்றுக்குள் கூற்றுக்குள் டாரு சமீபத்தில் சூழமாதை சூழமாதை காண்பதில் காண்பதில் ஆரோதி’ Kural 355 (Varadarajanar 1978) (Yepporul yetthanmaithayunum apporul maipporul kaanbadhu arrivu) translated as ‘The mark of wisdom is to see the reality behind each appearance’ (Sundaram 1980). Through the Kural 475 ‘Too great a load of even peacock feathers will break the axle of a cart’, Thiruvalluvar cautioned the designer, regarding the effect of over loading, a safety factor (Rajagopalachari 1999). In short, the entire aspect of quality had been summed up in Aathichudi verse 36, ‘குணமது கைவிதையுல்’ (Gunamadhu khaivideyel) (Arasu 2000) insisting to follow the good.
The next important element of engineering is planning and process. The Kural 467, ‘Yennith thuniha karumam...’ (Dhanapalakrishnan et al. 2001) emphasizes ‘Think well before resolving on action’ (Rajagopalachari 1999), highlighting the importance of planning prior to process / action. Some more Kural like 464, 465, 671, etc. also dealt with planning (Diaz 2000). Kondarivendhan verse 52, ‘Nunniya karumam yennith thuniha’ (Dhanapalakrishnan et al. 2001) (Nunniya karumam yennith thuni) meaning that one should plan before acting on – even if the deed was very small. The Kural 466 (Varadarajan 1978) ‘It is ruinous to do what should not be done and ruinous to leave undone what should be done’ clearly encompassed every act of any process. The two fundamental elements for the success of any process i.e. ‘data’ and ‘document’ were equated to the vision of a person by both the classical authors, Thiruvalluvar and Avvaiyar. The Kural 392 ‘Letters and numbers are the two eyes of man’ (Drew et al. 1999), and Kondarivendhan verse 7 ‘The lore of numbers and letters should be cherished like our two eyes’ (Dhanapalakrishnan et al. 2001) emphasized the importance of ‘data’ (yen - numbers) and ‘documented’ procedures (yezhluthu-letters) for the process planning and implementation.

For engineering equipments and machineries, Thiruvalluvar used an equivalent Tamil word ‘Karuvi’ (Karuvi) at least in two Kurals 631 and 675 for equipments / machineries, and covered it along with the other resources and aspects of entrepreneurship, such as Time, Deed, Method, Means (Capital), and Place.
(Sundaram 1990) (Diaz 2000). The Kural 496 'The strong-wheeled, lofty chariot cannot run on the sea; and ships, which sail on the sea cannot run on the land' (Drew et al. 1999) exemplified on the selection and use of proper tools / equipment for proper job.

The servicing should be minimal if it could not be avoided and to achieve such a goal, one had to 'create' the product accordingly. Even a small defect / imperfection had to be taken seriously and attended to immediately. These were elaborately enlightened in Kurals 435, 'A life that does not guard against faults, is a heap of straw before fire' and 433, 'To one who would avoid a bad name, A millet of fault is as big as a palm fruit'. The treatment of service problem was addressed in Kural 948, as' Diagnose with care, discover the cause, and find and apply the remedy' (Sundaram 1990). The selection of service personnel was brought out by 'திருவளவர் விநாயக நயக் தொல்லுற செவ்விநா செவ்விநா செவ்விநா செவ்விநா', Kural 677 (Chaiyalmurai avvinal yullarrivan yullam kholal) 'in order to decide how best a particular job may be done, it is wise to tap the expertise of a person who knows it inside-out' (Diaz 2000). Some more Kurals in the chapter entitled 'Employment of servants' திருநூறு விநாயக நயக் தொல்லுற செவ்விநா செவ்விநா செவ்விநா செவ்விநா, Therinthu vinaiyadal Athikaram)(Drew et al. 1999) also catered to the needs of personnel intended for service.

To sum up Thiruvalluvar and Avvaiyar had addressed the requirements of Engineering, as that of

- The Wisdom, Attitude, and Approach of the Designers and Planners.
- The Efficacy, Efficiency and the Effectiveness of the Implementation.
- The Skill and Talent of the Personnals including that of Service.
- The Timely Response to the Customers.
The above-mentioned requirements were summarized in the Aathichudi verse 49, ‘Cteiuaior Cteiii’ (Charvana thiruntha chat), meaning that ‘Whatever you do, do it correctly’ (Dhanapalakrishnan et al. 2001) and Kurals 383 and 661 ‘....Diligence, learning and boldness’ ‘Efficiency is but strength of mind’ (Sundaram 1990). These were to be mastered by continuous practice and constant follow up like ‘practicing drawing and following the foot steps consistently’ as stated by Avvaiyar in Thanippadalhal poem 8, (Chinnasamy 1999) ‘Chithiramum khaippazhlkkam; Nittham nadaiyum nadaippazhlkkam’.

1.6 THE CLASSICAL MANAGEMENT WISDOM

Manager, as a layman understands, is the one managing the available resources for the benefit of mankind. Obviously, it will include a vast area of activities, right from water management to space management incorporating everything else in between. The present study was restricted itself to the entrepreneurship (be it small or big) management for the benefit of organization and the society. The main system of management, irrespective of the resource it manages, consists of perception, planning, performance, review and improvement as sub-systems. The cycle repeats itself with new higher strata, on completion of every cycle, there by making it as a continuously improving spiral. The branches of management are based according to the resources being managed. Thiruvalluvar and Avvaiyar had brought out the philosophical principles underlying the management, in their creations, but left the methodology and the approaches to the beholder of the concept.

The first and foremost important element i.e. the high degree of intellectual thinking and visualizing wisdom to foresee, for proper perception, planning and execution of the strategies of the management were highlighted in Kurals 354, 'All the knowledge,
acquired out of the five senses, will be of no avail, if it is not accompanied by true understanding' and 396, 'The wells in the sand abound with springs of water as one digs deep, so, with appropriate education, knowledge gets wider and deeper' (Diaz 2000). How to increase the wisdom for better perception? The answer lies in the Aathichudi verse 70, 'Nool pala kal' (Nool pala kal) meaning 'to learn more and more' (Dhanapalakrishnan et al. 2001). The complete road map of the management has to be perceived without any ambiguity or doubt. The 'Men of clear vision, who are free from delusions, will overcome darkness …' Kural 352 (Diaz 2000) and Sundaram (1990) translated it as 'the pure of vision undeluded shall taste radiant joy'. 'Excellence' had to be perceived right from the beginning as stated in Aathichudi verse 46, 'Ceermair maravel' (Ceermair maravel) which was translated by Dhanapalakrishnan et al. (2001) as 'Forget not things of excellence'.

The next sub-system i.e. planning was highlighted in Aathichudi verse 59, 'thookki vinai chai' (thookki vinai chai) insisting to perform / act after proper evaluation and planning. This was required to do so, since, failure could not be at the stage of action, because of poor planning. Wildavsky (Peters 1994 a) had put the same thing as, 'the failures of planning are not peripheral or accidental but integral to its very nature.' The Kural 666, 'A person of resolute will, and efficient action achieves his objective (perceived), in the manner in which he has designed (planned)' (Diaz 2000). (The words 'perceived' and 'planned' were added by the researcher, for clarity). Some more examples were already illustrated earlier, in section 1.5.
Kurals 651...Vinai nalam vendiya yellam tharum... (Vinai nalam vendiya yellam tharum), meaning 'only good performance can lead to all-round success' and 652, 'strive to win the victory of the worthy, the struggle is not in vain' (Yendrum oruvuthal vendum pugazhluodu niedri payavaa vinai) (Varadarajanar 1978), meaning 'Activities that will not produce good results and ardent reputation should be carefully avoided always' clearly brought out the importance of performance (Diaz 2000). Thiruvalluvar used the Tamil equivalent word 'Vinai' for 'performance, action and deed'. He had devoted at least three chapters (Athikarams) titled Vinaithuimai (Purity in action) Vinaittipam (Efficiency in Action) and Vinai chaiyal vahai (Modes of Action)(Diaz 2000), (Varadarajanar1978), (Sundaram 1990). Avvaiyar insisted that 'performance' must follow nature, rules of the land, honesty and straight forwardness, vide the Aathichudi verses 24, 43, and 72 'Eiyalbu alaathana chaiyel, Chkkara nerri nil, Nerpad aozhluhu, respectively), (Dhanapalakrishnan et al. 2001). A quote from Peters (1994 b) reads as, "Do something. Make things happen. It's inaction that kills you" encourages not to worry about failures after sincere efforts, which was stated in another way in the Kural 596 'Always aim high – failure then, is as good as success' (Sundaram 1990).

Next sub-system of management i.e. review is a must to avoid surprises. The reason for review had been explained in Kurals 664 'It is easy for anyone to talk, But hard to act thereon' (Sundaram 1990) and 674 'When duly considered, the incomplete execution of an undertaking and hostility, will grow and destroy one like the (unextinguished) remnant of a fire' (Drew et al. 1999). The review must be continuous, to eliminate or minimize the complacency which would ruin the management. 'Gunam naadik kurrtmum naadi avartrul mihai naadi mikka kola) (Varadarajanar 1978,
Kural 504). Sundaram (1990) translated as 'Examine merits and defects, strike a balance, and choose'. Aathichudi verse 39, ‘காவாது கேவு’ (Kelvi muyali), meaning, ‘to enquire / question (review)’ (Arasu 2000), emphasized the importance of review. The purpose of review is for improvement, which is a never-ending process to ensure sustained excellence in management.

The Management wisdom is a vision towards Excellence. This requires a strong leadership, built on high moral values like truthfulness, honesty, effective self-control and other virtuous qualities. Drucker had asserted that ‘an individual who puts knowledge to work, can become effective by speaking truth and commitment to honesty’ (Patel 2001). Patel in his web site article titled “Management Mantra” quoted the following to impress upon the ‘Management by Virtue’ as contemplated by Thiruvalluvar.

- Those who initiate are not easily tired, they will achieve desired results.
- If truthfulness is to be defined it utters no words of ill design.
- If one always tells truth and lives according to his true conscious, then he lives in the hearts of all the people in the world.
- Motivation and knowledge sustained with effort is the recipe for success.
- One should learn and be educated.

The management of Wealth and Finance were enshrined in Thirukkural (Patel 2001), meant for ‘Profit without Tears’.

- The wealth acquired without harm and with knowledgeable means will render life happy, virtual and clean.
- Wealth built on tears of others will leave the recipient of such wealth crying.
- Trying to safeguard wealth acquired by unfair means is like storing the water in a mud pot, which was not baked.
• Enlarge the sources of funds, use those funds to enlarge the prosperity, analyze and remove the hurdles on the way to do the job.

These were emphasized in Brian Quinn, Tuck School; Dartmouth's quote "Education, Technology and Entrepreneurship are the three great creators of wealth in the modern economy" (Peters 1994 a).

Various Kurals in the Athikarm 19, 20 and 52 dealt with the Communication and Crisis managements. Similarly Human Resource Management, from recruitment through training, was extensively covered in Athikaram 51.

Thus, the Ancient Wisdom of Management brought out by Thiruvalluvar and Avvaiyar were based on the Ideal Management Principles and Concepts having universal appeal.

1.7 SUMMARY

The development of technology and the technology of developments had become the prim-mover of today's management. Only competitive management would succeed in today's highly volatile business environment. Best way to face such a challenge would be to integrate the ancient ethical and moral value-based wisdom concepts with the modern management techniques and approaches. The incorporation of the classical and contemporary approaches ensures the best of both (past and present). It is not an option, but, a necessary 'must', since, the emerging economy is based on knowledge, imagination, curiosity and talent. It becomes all the more important, when 'the relationship between knowledge workers and their organization is a distinctly new phenomenon' as Drucker put it (Peters 1994 a).

Thiruvalluvar and Avvaiyar, the illustrious authors, by their unparalleled vision of approach to right adoption of management and engineering techniques, vide their
famous literature treatises, made the entire subject as a ‘Poetical Management Theme’, laced with information, knowledge and wisdom, the right weapons to tackle the competition. All other weapons had out lived their utility. They (Thiruvalluvar and Avvaiyar) might not have exposed the nitty-gritty of the subject of engineering and management, but definitely handled them enough to have a clear focus, to start with. Thus, they proved themselves that they were equally competent engineering experts and management philosophers, par excellence, along with their poetic wisdom.

As Avvaiyar postulated “What we have learned is like a handful of earth, What we have yet to learn is like the whole world” the present study was neither exhaustive nor complete but a short comprehensive version to uncover and reveal their engineering and managerial expertise. Thus, it had not only dealt with the philosophy of management, but also with that of classical engineering. The Total Quality Management (TQM) - the main subject of the present research - was addressed subsequently.

A battery of definitions, historical evolution and various doctrines of quality have been extensively dealt with in the next chapter, for better understanding and comprehension of quality in totality.

Note: Thiruvalluvar authored Thirukkural / Kural and Avvaiyar authored Aathuchudi and Kondraivendhan, but many people composed and published them. Kural and Aathichudi and Kondraivendhan Verses numbers were mentioned for easy reference.

*Imagination is more important than Knowledge – Albert Einstein.*