



LIFE - A JOURNEY TO LEARN LESSONS

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It has often been said by several Wise men of various faiths that life on Earth (school) is meant for learning. At the end of the day, it is good reminiscing to see what lessons came one's way, what one learnt and how one applied the learnings; also, to see how one passed on the best of one's learnings to others- for, except the first torch, all other torches have been lit from some other. Life, they say, is a series of lessons to be learnt and taught! I find that this has been the case with me also and that I have been given many chances of learning various lessons over time. *Thus learning never stops and continues all the time in our life.* This learning can be in terms of one's chosen career, in personal life, in interactions with family, friends and the society at large, in interactions at the workplace and so on. Also, while we have been given free will and we are supposed to do our actions/karma on our own, the hand of Providence steps in now and then to give new twists to the directions of Life or to give a helping touch! I believe that I have been working quite hard in my career, as well as on the personal front, *and when one gives all that one could for the task at hand, the guiding/ helping Hand is not too far away;* that is to say, I would not feel that I can take much personal credit for the various milestones that I have achieved! I feel that the above principles have played a significant part in my life.

In my early part of life till about the age of 10, I was living with my grandparents due to certain family circumstances. Thereafter, in the course of my studies I had spent seven years in hostel life in IIT's and had also spent four years in various sites, till the time of marriage. Such a life had given me *certain independence, as well as a willingness to accept any situation* (and quality of food!) that came my way! While I tell my wife that she should be happy with my acceptance of whatever food that comes on the table, she is unhappy that one is not able to appreciate the wonderful cooking that she is capable of!

After passing my B. Tech, not being able to afford higher education, I was looking for a job but jobs were not looking my way for quite some time, it being a recession period for civil engineers! I got a break with a construction company later, after trying out with a sales job and in PWD. The first time I went to work at a construction site as part of a contracting firm was the first time I had ever gone to North India, and that too, to a remote site – with hardly any Hindi speaking skills as I came from an anti-Hindi agitation (!) State and time period-- with many hilarious situations developing often! Controlling the labour or dealing with working levels of the client or just managing one's daily life (such as ordering food), all without knowing the local language well were all full of learnings! I learnt the fascinating skills of rowing a boat on Chambal alone in

the night (the boatman used to go away in the nights) on the way home from the site late, walking on a simple steel joist without hand railing strung across 20m tall piers over a dam spillway, learning to eat north Indian village food, etc. Once in a village in a northern State, my Jeep was impounded and I had to wend my weary way alone on foot late in the night on a hungry stomach, for about 15 km along a mountain path through a nallah rumored to have been haunted! Hard lessons indeed! Fortunately I did not know the local language well at that time and local ghosts would have had a tough time scaring me in their native language convincingly! Being in charge at remote sites does teach a lot of independence and adaptability! An interesting interlude was a project for strengthening of the foundation of the famous Qutab Minar tower in New Delhi, working day and night. I am glad that I could do my mite for flying India's colours very high!

There is a lot of debate on the subject of the actual usefulness in life of all theoretical studies which one has to do in the course of education. It has also been said that what one learns in college is the ability or art of managing life, career, et cetera and also the art of interactions with our fellow human beings. *The ability to find solutions for problems for which a solution is not that readily apparent is a skill which one should pick up in college.* I guess that in this respect, seven years of IIT education has been of great help to me. I would also say that if one is going to continue a technical career, then some of the foundations laid in the course of learning the subjects in college would definitely come in handy in the course of a long career.

A lot of different viewpoints have come out over the ages on why IIT's are successful or why they make the students do things differently. Apart from the academic leanings, one also learns a lot in the hostel life, from friends and peers, one gets broad exposure to think out one's approach to life, etc. Looking from the importance of the environment shaping one's life, my association with Ramakrishna Mission schools and IIT's was of great help. Good teachers do provide a lot of inspiration and I could do some original work for my M. Tech project only with the inspiration I derived from my excellent top-notch guides.

As an instance of serendipity in life, I got posted by chance - after a long period in sites- in Mumbai for a short period, came across an ad for M. Tech course in IIT Bombay, applied and wrote the exam, got selected by IITB, and resigned & got relieved from the previous employment - all in a matter of days! The MTech course was a "life-changer" for me. It was during this period that I did a lot of introspection and engaged myself in many self-improvement measures - developing more self-confidence, improving my physique, postures and manner of speaking, engaging in extra-curricular activities, becoming more extrovertish, etc. Doing well in my M.Tech course, I got back into the technical stream and immediately got an assignment in a top design company.

I owe a lot to my engineering career in STUP Consultants, where I picked up *skills of problem-solving, finding innovative solutions, perseverance and hard work.* I also learned that *an atmosphere of excellence breeds further excellence* (as they say, for the life in IIT's also). I could progress considerably after the initial learnings from several of my seniors - who had great intelligence, structural design capability and intuitions, skills for developing construction methods, innovative out-of-the-box thinking, and engineering values - a very good team built up

by Mr Alimchandani. Very fortunately, opportunities came my way to attempt the design of various types of structures covering practically the entire gamut - the tallest structure in India (a 323 m tall TV tower), 67 m long cantilever tie-back roof, a marine project involving launching and positioning of precast concrete caissons, several hyperbolic paraboloid natural draught cooling towers including thermal and structural designs evolved practically from first principles, parts of nuclear containment structures, long span continuous bridges, several flyovers, innovative schemes of design and construction, et cetera. As mentioned earlier, the inspiration received from the seniors, the conducive environment, the able back-up available for construction engineering, availability of good juniors, etc contributed to steering through uncharted waters. Another basic value that I learnt was *integrity to the client* in ensuring the best possible design, that tender-time quantities are not to be exceeded during the detailed engineering, keeping the interest of the client in mind at all times, et cetera. I had to get many designs approved by third parties and this was often quite hard – due to different perceptions, different agendas, difficulties in understanding the structural intricacies involved, etc. Everyone would like to be conservative and play safe, but the project cost goes up! One has to persevere and apply all of one's technical knowledge and arguments as well as persuasive skills to get one's design approved as submitted. A great challenge and full of learnings! I also learned *the importance of integrating design engineering with construction engineering/construction methods* as the two always go hand in hand for most structures. The highly innovative technique developed by my colleagues there of launching 650t bridge girders using only tidal power was a great revelation! *I learnt to do safe but economical designs, which meet the requirements adequately but without any fat.* But this often meant putting in more work to convince the approving authority by looking for more references and doing more computations.

At that time I got an excellent opportunity for working with computational mechanics. I had the responsibility for developing computer systems as well as technical software. Software development or analytical abilities have been some of my very strong points, right from college. For the engineering of the Second Thane Creek Bridge, which was at that time a landmark project, we developed a great extent of software for completing the designs in time, with innovativeness and keeping the cost within limits. It was a challenge getting design approvals for this project successfully from an international consultant, RPT, and it was a pleasure dealing with professionals with whom one could see eye-to-eye. I also recall the very able support from bright younger colleagues. *Apart from one's own abilities, the environment, the seniors, and the supporting juniors also matter for success in one's projects.* I was able to develop and use software for repeated optimization to ensure efficient designs for many structures, to make up for any lack of intuitive design outlook. I could also do some pioneering work in the country at that time: implementing the SAP IV software, managing to do with only available computational resources -which were quite scarce, of much limited capability compared to today's versions and expensive at that time- for a variety of problems. It had 14,000+lines of code and was too big to be run as a single unit. The coding as well as the theory - developed by leading international professionals - had to be understood, split up into smaller self-supporting modules and run for actual cases after validation with trial problems. Some of the problems which had to be tackled included complex problems for nuclear containment structures, which were being analyzed in the country for the first time. The project was being handled by a senior with

tremendous insight into structures and it was a pleasure being of assistance with the software support! It was a challenging task which was successfully accomplished with a lot of determined efforts. *The lessons here were tenacity, adaptability and determination.*

These attributes were also useful for unraveling the mysteries of thermal and structural designs of hyperbolic paraboloid natural draught cooling towers. At that time indigenous design know-how was not freely available for these aspects and in a period of limited computational resources our methods had to be developed from first principles. I recall –now with horror!- the enormous time invested by myself and an associate and heart-rending trial-and-error explorations without the availability of any learned counsel, before coming up with workable solutions! These projects were all design-and-build (D & B) projects and the challenge was keeping to the quantities committed at the time of tendering even after detailed engineering and proof-checking by third parties. I believe *the D&B type of project realization helps integrate the design and construction schemes well, with innovative outcomes and well suiting the capabilities of the constructor, paving way for fast and smooth completion.* For two tenders we had to fight tooth and nail to get the projects even with being the lowest in price, for various reasons. From these “battles” *I learnt from others the principle of not giving up and fighting hard for one’s rights.*

Another landmark project was a railway bridge, which was designed and built by the precast segmental construction method in the 80’s (still in use), probably for the first time in the country. Again, it was a challenge to master the basics of this (then very daring) concept (particularly for a railway bridge) and get the design approved, keeping one’s commitments to one’s client duly fulfilled. Today practically all elevated Metro construction uses this concept, but I must salute Er. E. Sreedharan, who pioneered this concept with tremendous engineering courage. I have been fortunate to work with this great engineer and administrator on a couple of other projects as well. To me he was a person with his head high above in the clouds with tremendous vision, but with feet firmly planted on the ground to ensure realistic implementation of the vision. On the railways side, I was also fortunate to design the first leg of the elevated MRTS superstructure in Chennai with full spans precast and launched into position.

In this context, I have to emphasize *the need for young engineers to keep studying and learning to improve their technical abilities.* I owe a great deal to a great book by Podolny & Muller on bridge design and construction, and every time I went through the book I would mine some golden nuggets of ideas, concepts and knowledge. Such books are indeed a real treasure trove! How I would love to write a book like that! In STUP I also got some opportunities for writing in the house magazine, as I was supposed to have a flair for a “breezy style”!

In L&T Dr A. Ramakrishna was a great inspiration. His passion for innovation and good technology, efficient and quality construction, strong customer orientation and genial outlook were key factors for me to desire an entry into L&T. He had done pioneering work in precast concrete construction, particularly with shells and folded plates. Though I would have liked to work with innovative design and construction of buildings or bridges, I was assigned to work with power projects, mainly in a developmental mode. I was part of L&T’s thrust into thermal and hydro power plant construction and the hydro connection also took me to underground

construction. This association with L&T came about due to a chance meeting I had with AR in Mumbai airport when he persuaded me to join him. This was another instance of Providence taking the lead!

There were many lessons to be learnt in my L&T career. Joining an established company with somewhat conservative orientation and joining laterally at somewhat senior levels have their own challenges, and *adaptability and humility are two important requirements, coupled with lots of patience!* Changing over from a life of design engineering to construction management, learning the ropes of site work without being able to spend much time in sites, etc were some of the challenges. An "EPC fever" had gripped the nation in the early '90's when India seemingly opened the doors for international private sector participation in power generation. Many opportunities came along for associating with many international agencies- developers, EPC contractors, consultants and so on and one had to learn the new ways of these foreign agencies, including understanding the nuances of the jargon, mainly from the US-based companies. The contracting formats and many intricate contract conditions –one can recall the Dhabol project with consternation!- were new to us and it was an interesting time learning and mastering these. The EPC bidding format involved working with different equipment manufacturers, engineering consultants and project management associates and it was *very instructive and interesting to be part of such multi-disciplinary, multi-national and multi-skilled teams.*

This gave me *a realization that the life of an individual gets shaped not only by his own endeavours but also to a major extent, by the aspirations of the employer and the developments in the workplace milieu!* Flowing with the times I tried to weave into whatever developments were taking place and which were taking me along. *In any case, L&T had many good people from whom I could learn many things.* Two interesting projects for which I could add significant value were a 330 MW gas-based power project and a 54 MW cogeneration project with a petroleum coke calcination adjunct. It was quite fascinating to deal with associates from many countries ranging from US, Europe, Korea and Japan and building friendships with many diverse people. As a creative aside, I helped make a film, including developing the script, showcasing our capabilities for power projects!

My stint in the field of hydroelectric projects was quite fascinating, for most of these projects were in the Himalayas. A slight diversion here! *I believe that the Universe does work towards giving everyone what one desires deep inside, in the long run, consistent with the greater good of all!* Rhonda Byrne's best-selling book, "The Secret" enshrines this principle. In my life whether it was working with L&T, living in Bangalore or being in the Himalayas, all came out of this deep - though unexpressed outright - desire. One caution is that *what seems to work is not what one professes outside but what lurks deep inside!*

Regarding being in the Himalayas, my jurisdiction included projects right from J&K to Arunachal Pradesh, covering in between HP, Uttaranchal, Nepal, Sikkim and Bhutan, and apart from them, others in WB, Karnataka, Chhattisgarh, AP and Kerala! The country's largest hydro-electric project- 2000 MW Subansiri project- was another land mark project for me. It had many problems and was very slow to take off. Difficult access, tough terrains, poor geotechnical

conditions, inappropriate designs, hostile locals, inter-state border problems, etc conspired to make our life very difficult! Many of these hydro projects involved considerable road travel, mostly through winding narrow roads with a hill on one side and a precipice on the other! Some of them were in areas with inimical environments. Apart from these, there were also projects in other parts of the country, thus enlarging my scope of travel to practically all corners of the country, at uncomfortably frequent intervals. Incidentally, in the course of my stays in various parts of the country I picked up smattering of a few Indian languages, supplementing a couple of foreign languages which I had studied, which all led me to realize that I had a liking for languages. Though the travels took a considerable toll on my health and physique, it was an interesting experience dealing with many different and diverse projects. I liked the hills very much and incidentally, I believe (though probably somewhat irrationally!) that the hills "stoked up" my spiritual aspirations to a good extent to make me "let go" at a somewhat early stage! At that time we were mulling setting up a joint venture engineering company with a leading international engineering company and though it didn't fructify, the experience was quite interesting. This reminds me of another learning which I had come across that *people come into one's life either to teach one something or learn something from one, and most of them have only a limited window in one's life, suited to that purpose!* When one ponders over this, it is wondrous to recollect how some people who were so important to oneself at a given time did not matter at all later or simply vanished from one's life; strained attempts to retain such contacts often prove to be infructuous!

The project for an underground unlined rock cavern for storing LPG was a very challenging project with many lessons! An underground rock cavern of 1.25 lakh cu.m. capacity had to be built 200m below ground using only two small diameter shafts of 4m and 6.5 m diameter, adopting the drilling and blasting technique, under stringent specifications. The contracting format was very interesting and the key factor was *the stringent safety requirements* which had mainly come from the French part of the owner team, TotalFinaElf - HP. Their overriding concern for safety during construction and the processes and procedures adapted to ensure the same were real eye-openers! Working totally underground, taking in and bringing out all the large equipment in dismantled condition, evacuating all the blasted rock pieces only through the 200m deep small diameter shafts were awesome requirements. What took the project through were the *excellent enthusiasm and man-management of the knowledgeable site team, its coherence and the never-say-die positive attitude.* Though the project had many hiccups in the earlier days, it picked up very well afterwards and it was very satisfying to see the positive surge of energy in the site and the excellent camaraderie not only within the site but also with the clients. The whole work took a team approach and it was very humbling to be part of such a great team. The continuous emphasis on safety ensured that the entire project was completed without a single fatal accident underground. *I would say that the cavern project was one of the excellent landmark projects of L&T.*

Another interesting short-term shift in my life was my stewardship of a new L&T company, L&T-Ramboll Consulting Engineers Limited (LTR) for about four years. To fulfill a need for a strong engineering company to service infrastructure construction projects, L&T set up this company in collaboration with a leading Scandinavian engineering company. Given L&T's Danish origin, association with another Danish company was somewhat natural. Ramboll had many wonderful

people who gave their support unstintingly. Setting up a brand new company, evolving and organizing all the procedures and processes, recruiting all the skilled staff (a very precious commodity, indeed, at all times!), getting business and executing the same and satisfying the two different parent companies were all big challenges. This engineering company had to be totally separate and independent from the parent construction companies but with the strong ethical precepts of the parent companies and hence all the formative work had to be done independently and with a strong vision. A wonder was we could make a profit right from the first year of inception! It is satisfying to see that the association had lasted more than 15 years. In this assignment I could further broaden my horizons in going into Development of projects as well as trying out some pioneering concepts. The Greenfield Gangavaram Port and the MIHAN airport at Nagpur are some examples. We also seized a good opportunity for designing a cable stayed bridge, the first for our group of companies - a rather simple application for a pipe bridge, but nevertheless a cable stayed bridge (again probably the fulfillment of a deep-lurking desire of mine)!

One of the projects which I can never forget came across my life at this juncture. We landed up with a project for designing nine flyovers at pre-designated locations - including all surveys for topography, traffic and geotechnology- and detailed engineering including good-for-construction drawings and bar bending schedules along with draft tender documents for construction contracts ----all to be completed in just four months! This was LTR's first project, when the company staff strength was just building up. This project was a tremendous challenge. We were able to deliver the job quite well with very cost-advantageous, innovative, aesthetic solutions with high functionality and which were also built within the short time periods envisaged by the client. This was possible since we had integrated the design scheme and construction methods (which were very simple in nature, suiting most constructors) and these methods were spelt out in detail in the tender document itself, ensuring that the bidders could minimize their risks and quote on a common platform. *The learnings were the importance of construction methods, integrated engineering and well-made contract documents.*

Coming to the concept of giving back, I was fortunate- with a lot of serendipity again, thanks to INAE's Distinguished Professor scheme and an earlier referral by Mr KV Rangaswami- to join IIT Madras to share with the students something of what I had learned during my career. I was also elected to a senior position in the IITM Alumni Association and was fortunate to play a leading part in the setting up of the first-ever IIT Alumni Club, in Chennai. I must say that these developments took place *due to chance encounters with certain others and paying heed to certain promptings which could have been attended to, or left to float away!* Incidentally, again as a creative aside, I produced two videos for IITMAA showcasing the alumni's involvements with charitable work.

In the current phase of my career I am engaged at IIT Madras, covering some teaching, guiding some research, participating in consultancy assignments and driving new technologies such as Lean construction management. The latter is a recent paradigm, which has caught on quite well in the developed world, but is yet to find strong practice in India. In the campaign undertaken by IIT Madras and ILCE, I have been playing a lead role in popularizing Lean, as well as trying to get Lean implemented at actual construction sites. *It is never too late to learn!* In this regard in a

recent program carried out at nine sites of five major construction organizations, Lean was implemented over a period of eight months in a fairly successful manner with significant gains. I had also presented a paper from IIT Madras on this program at an international conference held in Norway recently and as a follow-up, I was the Chair for the first national conference on Lean construction, which took place in February this year at Mumbai. In the civil engineering Department of IITM, we discovered a few subjects in which I could contribute with my industry background to supplement the academic teachings, the range covering construction methods, project management, contract management, underground structures, construction safety, Lean construction management, etc.

When I look back on my long career. I find that too often I have placed significant focus on work, sometimes at the cost of personal life or family life! Not that I was too much of a workaholic, because I also had other interests such as reading, music, films and walking. I do realize that one has to evolve a healthy balance between work and family life, and also "personal life" and it has been a regret. The tricky thing is that the children are born and the family is developing, especially at the time when one's career is also at a key stage demanding a lot of attention! In my case I console myself that I was doing a lot of pioneering work at that time, which demanded a considerable amount of time for evolving solutions for difficult problems without much external guidance. A few awards and recognitions have come my way, but fortunately I learnt not to chase them! However, with things turning out not so bad at the end of the day, one can only thank God for setting things right in His own way! Getting back to the concept of giving back, I am trying as much as possible to give back to the society in various ways! I still need to write some books - a long-pending goal- to share some of my technical learnings as well as some spiritual learnings (which I am yet to understand properly)! Also, I still have not learnt how to say "No" or how to stay non-judgmental!

Looking back, I have to admit that I could not have led the life described above without the active and commendable support from my very able and understanding wife, who has been a great pillar of strength, all through- steering not only myself but also our children successfully through the streams of life! My father - who rose to good heights in his career from very humble beginnings through personal brilliance and sheer hard work, but still supporting the family through many difficult times -was also a good inspiration.

Knowledge is an important part in the lives of engineers and contacts with other professionals and organizations play an important part for realizing one's objectives and those of one's organization. I realized at an early stage that seminars and conferences help considerably towards the above. I have delivered about 170 articles and talks in various technical forums in India and abroad. I have also seen that *more than reading books, interactions with other professionals and visiting actual project sites help us learn a lot more and see many angles which one would totally miss by having a merely theoretical approach.* Of course, one has to find time for these in addition to doing proper justice to the main work at hand, and this also contributes to longer hours of working and work pressure in the shorter run.

Finally, a pet subject somewhat dear to my heart, at this stage of my life. Of late, I have taken to reading many books on subjects which could be called spiritual or new-age or theosophical.

Based on these readings, interactions with certain people who have come across my life in the recent years and a good amount of introspection, I have formed certain new outlooks on life. Though this is not the forum for expounding on the above, I would still like to summarize the above essentially as following: *life on this earth is for learning in the Earth School; people we come across and events that happen to us are all meant to further us in our learning or help others in their learnings; all religions lead to the same God, and all men are but a part of the One, giving rise to an all-important requirement of Universal Love. Seek and ye shall definitely find!*

Summing up, one owes a lot to one's seniors and other professionals from whom one has learnt the basics and my heartfelt gratitude to all of them. I have not mentioned any names of my numerous benefactors, because there were so many! "EndaroMahanubhavulu" (Salutations to all those great men in this world who have come before") comes to my mind! I realize that on many occasions in life *sincere prayers have worked to get the blessings of the One. Apart from playing the cards one has been dealt with according to one's best ability and as shaped by the then-prevailing environment, the Providential hand is always benevolent; the present moment is always the best offering by the Universe!*

I would like to thank INAE for the kind invitation to write this article, which really helped me to introspect and discover more aspects of my life than I would have imagined otherwise! Thank you for your understanding and patience. I wish all the readers the best of everything in their lives- work, family and personal.