



**Engineering Council of India**

**11<sup>th</sup> National Conference**

# **International Competitiveness of Indian Engineering Services**

**October 28, 2013**

## **Souvenir**

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3rd floor, Jawahar Dhatu Bhawan, 39, Tuglakabad Institutional Area  
M.B. Road, New Delhi - 110062

Phone : 011-65640356, 29963281, 29963282, Fax : 011-29963283

Email : [eci@ecindia.org](mailto:eci@ecindia.org), [ecindia@vsnl.net](mailto:ecindia@vsnl.net)

Website : [www.ecindia.org](http://www.ecindia.org)



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# **International Competitiveness of Indian Engineering Services**

**October 28, 2013**

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**Background  
Discussion Note**

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Compiled by : **P.N. Shali**

## 1

## Introduction

The core theme of the 12th Five-Year Plan, reportedly, is faster and more sustainable inclusive growth with likely investment of more than I trillion dollars (Rs 4500000 lakh Crore). Around twelve strategy challenges, which refer to some core areas that require new approaches to produce the desired results, have been identified by the Planning commission. These are (1) Enhancing the capacity for growth, (2) enhancing skills and faster generation of employment, (3) managing the environment, (4) decentralization, empowerment and information, (5) technology and innovation, (6) securing the energy future for India, (7) accelerated development of transport infrastructure, (8) rural transformation and sustained growth of agriculture, (9) managing urbanization, (10) improved access to quality education, (11) better preventive and curative health care, and (12) markets for efficiency and inclusion. It would be seen that engineers and technologists will have a major role to play in meeting these strategy challenges.

India needs to grow at 9-10 % annually on a continuous basis at least for 15-20 years. This will need investment resources including public resources, its efficient allocation with emphasis on higher investment in infrastructure. We know that economic growth realized so far has not generated enough employment. Many sectors of our economy have been facing workforce shortages, particularly of skilled technical workforce. We need multidisciplinary and multi skilled technical workforce, particularly diploma and degree engineers. We need more M.Tech engineers and PhDs. We need creators, innovators and designers of technologies.

In the field of information technology, engineering, medicine and education, no doubt,

many of our people today work for reputed scientific, industrial and commercial enterprises throughout the world. Some of our top companies is the envy of the world, as our top educational institutions are. We are producing almost every thing with in the country, and some of it is traded and consumed through the world. We are manufacturing satellites for our selves and for transfer to other countries on commercial basis. We have developed satellite launching capability also; and this is also being used on commercial basis with other countries. Despite this rosy picture, however, we need to improve our education and training systems; create efficient and accessible labour markets for all skill categories; and encourage the faster growth of small and micro enterprises. We need to give a serious attention to our designing capability. We need to develop innovation capability in our technologist and engineers. We need develop our engineering technicians who are articulate, savvy and proficient in English language. We need to catch up on many fronts and fast at that.

We need to create a world class infrastructure, particularly communication, institutional, apart from industrial. We need every thing world class including technical education. We need to change our accounting practices to world standards. We need to change the way we do our business. If we have to compete in the world for engineering services, we must look at our weakness, strengths, opportunities and threats. The big weakness that we have is that we are not designers of technologies, exceptions to this here and there apart, Second weakness that we have is that we are not having well qualified and trained, savvy, and articulate engineer technicians with English language skills; while as we have also

some improvement to do in these attributes of engineers. Nevertheless, our strength is that we are English speaking people and with a large pool of scientific and engineering workforce. In the total trade basket, engineering services are an important component. This is recognized and the areas of further working on have been identified and appropriate measures are being taken by the competent authorities for creating a world class engineering services.

Engineering services are traded abroad by individual consultants, consultancy companies who have established their competencies in some special areas of their profession. The other mode is outsourcing - which is a fast growing business. India, with a large pool of qualified engineers with exposure in various industries across the world and recognized by the engineering industry, by and large world-over, is a hotspot.

The world market of engineering services is of the size of around US \$ 200 billion. Our share in this is presently very small. There is potential to increase this share; and we must think of capturing a larger share in this cake; and we have the potential for this. The global EPO market is around US\$ 110 billion. It is poised to grow to US \$140 billion by the year 2015. India is poised to become the hub of EPO with the size of the Indian EPO market share, from the present level of a little over around US \$ 3.5, increasing to around US \$ 30 billion by 2015; and it has the potential to exceed US \$ 40 billion by 2020. It, therefore, presents a billions dollar opportunity for India. For tapping the market of engineering services all the important stakeholders, including government, service providers and trade bodies will need to boost investments in infrastructure and improve marketing efforts. Specifically, India needs to takes steps to promote EPO services in all the major countries that spend on these services. India has the potential to attract EPO as it has evolved from being a zone offering

cost arbitrage opportunity to a zone offering value. We will be facing competition in the international market of engineering services from countries like China, South Korea, Vietnam, Brazil, etc. We must keep this in mind. India will have to meet this challenge.

The main object of the conference is to share the experience of the companies/ engineers in getting and successful executing contracts for providing engineering services and identifying main issues. It will be a learning experience to discuss what problems were faced by them and how they tackled these problems in different countries. These may include the political issues, the geographical and cultural issues, licensing and regulatory aspects, professional knowledge and skills aspects and several similar areas of concern.

Proposed topics for discussion are : geographical issues - Africa, Asia, Western-USA and Europe, sector wise issues- Roads & Bridges, Ports, Railways, Buildings, Energy, Professional-Knowledge & Skills (engineering and non-engineering/management such as finance, legal, IT, communications and negotiations, project management, country specific information, etc); Quality, Safety & Environment issues; HR-Workforce recruitment and training issues, and how can associations of engineers and other organizations help in promoting export of engineering consultancy from India.

Consultancy Development Centre, a body set up by the Government of India under the Ministry of Science and Technology is doing a very good work in promoting consultancy in India including for trade in engineering services. Many capacity building programmes have been run by the council; and many more are being taken up regularly on this subject by the council including the ones with eye on export market.

**2**

## What are the Engineering Services?

Engineering Services may include providing professional engineering services to others which is limited to some specific areas in which they have developed specialization such as machine designing, mining, some aspects of industrial consultancy, provide process technologies, etc. Design services may include bridges and culverts, site development, industrial developments, dams and embankments, street overlays, water treatment and distribution systems, wastewater collection and treatment systems, land development, roads, streets and transportation, storm sewer and drainage systems. There can be other services such as land surveying, land development, planning, construction management, computer applications, transportation, public works, and water and waste water management, etc.

Major engineering services include setting up large projects, such as airports, oil refineries, power, steel, petrochemical projects, etc., some of them even on turnkey basis. The others may include product and industrial process design, construction design and management, systems engineering, and maintenance and operations. Companies in this work apply engineering principles to design, develop, and use machines, materials, structures, and processes. Engineering projects require skills in analysis, design, project management, operations, or all four.

Most firms specialize in a particular type of engineering; while companies that provide engineering services to the construction industry tend to be among the biggest in terms of revenue. Engineering companies serve other industries including automotive, aerospace, petroleum, and

technology. Most engineering work is as per projects, such as designing and constructing a highway or formulating an environmental plan for a wetlands area, etc.

Engineering services are primarily based on the need of the industrial establishments to acquire professional services which will enable them to maximize their profitability both in the short term and in the future. The criteria that they apply in this include the application of the physical laws and principles of engineering in designing, developing and using machines, materials, instruments, structures, processes and systems. These services may involve providing advice, preparing feasibility studies, preparing plans and designs, providing technical services during the construction or installation phase, inspecting and evaluating engineering projects and providing other related services.

Major companies providing engineering services include Aecom, Bechtel Group, Jacobs Engineering, and Urs (all based in the US), Amec (UK), Fugro (Netherlands), Snc-Lavalin Group(Canada),and Worley -Parsons (Australia).

RITES of India has been providing engineering services from concept to completion of multi model transport projects- studies, design and detail engineering, project management and construction supervision, quality assurance and management, material procurement services, survey and feasibility services, signaling and telecommunication services, urban engineering, and railway electrification. The sectors that they are covering include railways, roads and highways, urban transport, airports, ports and



water resources, bridges and tunnels, ropeways, urban infrastructure. They specialize in appraisal and evaluation of projects as well.

The other major companies providing engineering services include Engineers India Ltd (EIL), Engineering Projects India Ltd (EPIL), MECON Ltd, M. N. Dastur & Company (P) Ltd., Intercontinental Consultants & Technocrats Pvt. Ltd., Midrex Technologies India Private Ltd.,

Mehro Consultants, Mahendra Raj Consultants Pvt Ltd, Tandon Consultants Pvt Ltd, and many more, apart from numerous small firms and individual consultants of repute.

The Government of India has established Consultancy Development Centre under the Ministry of science and Technology (CDC) for promoting consultancy in India including engineering consultancy.



**3**

## Modes of Providing Engineering Services

Modes of providing engineering services include service provided by professional engineers on some specific aspects of engineering work. For example, tackling a technical problem of an industrial boiler related to its design. The second mode is service provided by a small consultancy firm on two or three works of a project which are of specialized nature. The third is service provided by a medium size consultancy firm on a number of items of work based on specialized skills of engineers of that firm. The fourth mode is service provided by a large consultancy firm. Say a company taking a contract to design and built an airport, a steel plant, etc- that means a complete project. India is providing engineering services through these modes including to foreign clients. The size of the market that it holds is small.

The other mode is engineering process outsourcing (EPO). In this, countries look for suppliers of engineering services in other countries. EPO is sourcing some or the organization's entire design and engineering requirement from external service providers. This may be done by contracting EPO services to a third party vendor within or outside the country or to a company-owned engineering centre (captive centre) located outside the country. Some times it also involves transfer of management and / or day-to-day execution of an entire business function to an external service provider. It is very different from IT outsourcing or BPO in the sense that it requires strong domain expertise which is considered to be the core difference.

EPO services from India will be a key element of the country's engineering export strategy; and the development of EPO sector will have a far-

reaching impact on India's engineering industry as a whole. The present strategy for growth of EPO from India deals with engineering processes outsourced to India, i.e., export of EPO services from India. It is an emerging high-growth opportunity for India. It comes with a host of benefits for the outsourcing organization.

Major regions supplying services to the global EPO markets are Asia (India, China, Taiwan and Philippines), Eastern Europe (Romania, Russia), North America (Mexico) and South America (Brazil). The fast emerging countries in this area are Vietnam and Thailand. In this service, India faces competition mainly from China, Taiwan, Philippines, Romania, Russia, Czech Republic, Mexico and Brazil. Being competitive is, therefore, the key to survival.

EPO industry is playing crucial role in efficiently supporting dynamic architecture, engineering and construction industries (AECI) worldwide. AECI has been conservative and unionized especially in developed countries. AECI is much organized in developed countries; and it is equally unorganized in developing countries. EPO for AECI is different from manufacturing and information technology for the simple reason that each project is unique. AECI has huge variations and immense complexity and one of the biggest factors of economic indicators. Its influence on economy is tremendous. Its growth has been compounding with technological growth.

EPO has made major contribution to the bottom-line of majority of companies especially in developed countries. While at the other end, EPO has opened up huge market for developing countries including India.



After IT and ITES making an impact in the outsourcing market, globalization of engineering support services is to be the next growth frontier for India. EPO can also be in the manufacturing sector of which engineering represent an important segment comprising capital goods, iron and steel items, non-ferrous metals and products, consumer durables etc., apart from being a part of R&D services.

The items to be outsourced are computer aided design, building information modeling, project management, construction management, structural design, document management system, presentations, detail engineering, reverse engineering, reliability engineering, material specifications, construction documentations, energy modeling, energy audit, aerospace design, construction, pharmaceuticals, automotive design and industrial machinery products, etc.

Global EPO outsourcing depends upon many functions including wages. Because of the rising wages in India, the wage cost arbitrage is fast diminishing. It is to be noted that India is the largest producer of English-speaking engineers/workers among the developing countries. India has a well-developed legal system and significant political stability for foreign direct investment in manufacturing and R&D activities. While it is the preferred destination for the ITO/BPO sectors, it has also the potential to become the destination for EPO for providing solutions involving high engineering complexity.

The companies look out for quality, value and domain expertise when they outsource their engineering services. Indian companies are to a large extent as good as the US, UK, German, etc, companies in providing engineering services; and that too at a cheaper rate. But what the companies which outsource really look out for is

the value offered by the service provider. Improving the service levels on the part of the government of India in terms of providing better infrastructure will certainly play an important role for the Indian EPO industry. India is obliged to WTO-related intellectual property protection laws as a member of the WTO. Outsourcing organizations stand to gain better market access and cheap labour.

EPO is an attractive investment proposition as margins are significantly higher than those in traditional IT outsourcing services. This is despite the high cost associated with experienced engineering personnel possessing intricate knowledge of the domain and client's processes. Consolidation will happen and it's only a matter of time. The domain expertise lies with the companies in the Western Europe and North America, but the action is happening in India. So it makes sense for any Indian company to buy a western company and vice versa. There are lots of good companies in this sector, but it is very fragmented. So consolidation has to happen and will happen in a similar way as it has happened in the IT industry.

The global EPO market is poised to grow from the present US \$ 110 to US \$140 billion by the year 2015. India is poised to become the hub of EPO with the size of the Indian EPO market share, from the present level of a little over around US \$ 3.5, increasing to around US \$ 30 billion by 2015 ; and it has the potential to exceed US \$ 40 billion by 2020. It, therefore, presents a billions dollar opportunity for India. For tapping the EPO market, therefore, all the important stakeholders, including government, service providers and trade bodies will need to boost investments in infrastructure and improve marketing efforts.

Then there is knowledge process outsourcing (KPO). It refers to the use of knowledge technologies (such as knowledge engineering &



knowledge management) to produce economic benefits. KPO services are much more research and analytical intensive. The essential difference is that in a knowledge economy, knowledge is a product, in knowledge-based economy, knowledge is a tool. KPO is an arrangement by which a company contracts out complex, knowledge-intensive business processes that require analytical and specialized knowledge to highly skilled and experienced staff of a different company or service provider, most often in a different country with a lower-cost work force such as India.

Optimized KPO solutions provide cost savings, operational efficiencies and access to business expertise and a highly talented workforce. KPO enables organizations to do fairly complex operations and get the benefit of time to market. It allows firms to derive operation efficiency where they do the task while transforming the way they do the task itself.

The healthcare, pharmaceutical, biotechnology and intellectual-property rights industries achieve greater efficiency through the use of KPO. Those working in the KPO field typically require a higher level of education to complete these more difficult tasks. The technology and the higher-educated workforce both would contribute to a continued expansion of KPO in the coming years.

The crux of KPO is to provide value to the client primarily in critical and strategic decision making processes. The constantly higher need for flexibility, drastic reduction in time required to 'go to the market,' increased competition in the global arena, and of course, cost pressures have all been driving forces of KPO. India needs to exploit its existing potential in this area, apart from increasing further this potential.

Then there is off shoring which means the relocation of business processes from one country

to another. In other words off shoring is defined as the movement of a business process done at a company in one country to the same or another company in another, different country. This includes any business process such as production, manufacturing, or services.

Off shoring can be seen in the context of either production off shoring or services off shoring. After its accession to the WTO in 2001, China emerged as a prominent destination for production off shoring. The economic logic here is to reduce costs. If some people can use some of their skills more cheaply than others, those people have the comparative advantage. The idea is that countries should freely trade the items that cost the least for them to produce. Almost always work is moved due to a lower cost of operations in the new location.

Off shoring is sometimes contrasted with outsourcing: subcontracting a process, such as product design or manufacturing to a third - party company. The decision to outsource is often made in the interest of lowering costs of firm or making better use of time and energy costs, redirecting or conserving energy directed at the competencies of a particular business or to make more efficient use of land, labour, capital, (information) technology and resources.

More recently, off shoring has been associated primarily with the sourcing of technical and administrative services supporting domestic and global operations from outside the home country, by means of internal (captive) or external (outsourcing) delivery models. The term is in use in several distinct but closely related ways. It is sometimes used broadly to include substitution of a service from any foreign source for a service formerly produced internally to the firm. In other cases, only imported services from subsidiaries or other closely related suppliers are included. Intermediate goods, such as partially completed



computers, are not consistently included in the scope of the term.

Another focus area has been the software industry as part of the global software industry developing global information systems. After technical progress in telecommunications improved the possibilities of trade in services, India became a country leading in this domain, though many parts of the world are now emerging as off shore destinations.

The economic logic is to reduce costs, sometimes called labour arbitrage, to improve corporate profitability. Jobs are added in the destination country providing the goods or services (generally a lower-cost labour country), but are subtracted in the higher-cost labour country. The increased safety net costs of the unemployed may be absorbed by the government (taxpayers) in the high-cost country or by the company doing the off shoring. Europe experienced less off-shoring than the United States due to policies that applied more costs to corporations and cultural barriers.

Outsourcing and off shoring are used interchangeably in public discourse despite important technical differences. Off shore outsourcing is the practice of hiring an external organization to perform some business functions in a country other than the one where the products and services are actually developed or manufactured. It can be contrasted with off shoring in which the functions are performed in a foreign country by a foreign subsidiary. Outsourcing is the movement of internal business processes to an external company. Outsourcing involves contracting with a supplier, which may or may not involve some degree of off shoring. Off shoring is the transfer of an organizational function to another country, regardless of

whether the work is outsourced or stays within the same corporation/company. Companies subcontracting in the same country would be outsourcing, but not off shoring. A company moving an internal business unit from one country to another would be off shoring, but not outsourcing. A company subcontracting a business unit to a different company in another country would be both outsourcing and off shoring. There are three stages of development--build, optimize and release--with regard to a company's off shoring operations, with the first stage focused largely on labor arbitrage and the latter two focused on increasing scale and scope and capturing full value, respectively. With increasing globalization of outsourcing companies, the distinction between outsourcing and off shoring will become less clear over time. This is evident in the increasing presence of Indian outsourcing companies in the US and UK.).

Many of our public sector companies like the Indian Oil Corporation, Oil and Natural Gas Corporation, and Bharat Sanchar Nigam Ltd are now doing business across the globe as they have grown in size and performance (Sanjay Nirupam, the Asian Age August 15, 2013).

Business process outsourcing (BPO) is a knowledge service; it is an area where we are seeing a lot of demand and continuous growth. It is very transaction-focused. It focuses on such back-office tasks as customer service (call centers), financial or accounting services and financial underwriting. PO, simply put, is BPO but at a higher level in the intellectual value chain. India is still the undisputed leader in outsourcing; many countries are up and coming in the business.

## 4

## Market of Engineering Services

A forecast by the market research report on the engineering services provides the key analysis and statistics of the industry, measures market size, analyzes current and future industry trends and shows market share for the industry's largest companies. It is expected that rising capital investment will propel the industry back to growth. 'Ibis world' publishes the largest collection of industry reports in which one can see an industry's supply chain, economic drivers and key buyers and markets (Market Research Report, Naics 54133, June 2013).

Industry analysis and trends depict that after a period of subdued economic growth due to dwindling backlogs and declining demand, engineering companies are set to rebound. The economic recovery will boost demand for construction projects, which will require the industry's services. Profitability is forecast to improve slightly, particularly among large operators that provide high-margin services like construction management. Industry profit margins should also benefit from the rising use of computer-aided design systems that provide cost-effective project assessment.

Competitive landscape depicts that demand will be driven largely by the construction needs of companies and governments and the desire of industrial customers to improve the efficiency of operations, and the ability to accurately predict costs for a project on which profitability largely depends.

Small firms, which can effectively compete with larger ones by having expertise in a particular field, are often hired as consultants on larger projects if they have special expertise. Large firms are advantaged in designing and managing large projects.

The industry is fragmented: the 50 largest firms account for about 40 percent of industry revenue. Barriers to entry in the engineering services industry are moderate. The technical complexity of most projects undertaken by this industry effectively restricts the entry of new competitors to those with demonstrated capacities across a range of complex projects. A bachelor of engineering or associate diploma of engineering is generally regarded as a minimum qualification. Qualifications, sophisticated technical skills and expertise are prerequisites for entry to the industry.

Many projects require a variety of tasks such as project feasibility, production line design and implementation, and design and management of construction.

The market will be looking for demonstrated capacities in industry products such as project management services, residential building projects, commercial, public and institutional projects, industrial and manufacturing projects, transportation projects, municipal utility projects, etc.

It will also be looking for industry activities such as: providing design and management services for construction and engineering infrastructure projects, environmental projects, industrial processes and equipments, providing construction management services, process management (e.g. assessing engineering and product problems), project planning and economic assessments, asset management, including life cycle asset management and management systems, feasibility studies, including environmental impact assessment and community consultation, quality management assessment and accreditation.



The world market of engineering services is of the size of around US \$ 200 billion. Our share in this is presently very small. There is potential to increase this share; and we must think of capturing a larger share in this cake; and we have the potential for this. The global EPO market is around US\$ 110 billion. It is poised to grow to US \$140 billion by the year 2015. India is poised to become the hub of EPO with the size of the Indian EPO market share, from the present level of a little over around US \$ 3.5, increasing to around US \$ 30 billion by 2015; and it has the potential to exceed US \$ 40 billion by 2020. It, therefore, presents a billions dollar opportunity for India. For tapping the EPO market, therefore, all the important stakeholders, including government, service providers and trade bodies will need to boost investments in infrastructure and improve marketing efforts.

India is one of the fastest growing economies in the world. It is the largest producer of English-speaking engineers/workers among the developing countries. India has a well-developed legal system and significant political stability for foreign direct investment in manufacturing and R&D activities.

There are some broad implications for engineers in trade in engineering services under WTO. These are mutual recognition of engineering degrees, competence, quality of work, temporary movements: time-frame, domestic regulations of engineering profession, etc. There are four modes of supply of services namely, cross border supply (Mode 1), consumption abroad (Mode 2), commercial presence (Mode 3), movement of natural persons (Mode 4). Mode -4 is important. The negotiation is going on for resolving these issues.

## 5

## Conclusion

Major engineering services may include technological services, design services, setting up large projects, such as airports, oil refineries, power, steel, petrochemical projects, etc., some of them even on turnkey basis. Engineering projects require skills in analysis, design, project management, operations, or all four.

Design services may include product and industrial process design, construction design and management, systems engineering, and maintenance and operations.

Modes of providing engineering services include service provided by professional engineers on some specific aspects of engineering work, service provided by a small consultancy firm on two or three works of a project which are of specialized nature, service provided by a medium size consultancy firm on a number of items of work based on specialized skills of engineers of that firm, service provided by a large consultancy firm- design and built an airport, a steel plant, etc. India is providing engineering services through these modes including to foreign clients.

Most firms specialize in a particular type of engineering. Companies that provide engineering services to the construction industry tend to be among the biggest in terms of revenue.

The other mode is engineering process outsourcing (EPO). In this, countries look for suppliers of engineering services in other countries. EPO involves transfer of management and/or day-to-day execution of an entire business function to an external service provider. EPO services from India will be a key element of the country's engineering export strategy and the

development of EPO sector will have a far-reaching impact on India's engineering industry as a whole. It is estimated that outsourcing organizations stand to gain better market access and cheap labour.

Then there is knowledge process outsourcing (KPO). It refers to the use of knowledge technologies (such as knowledge engineering & knowledge management) to produce economic benefits. KPO services are much more research and analytical intensive. Then there is off shoring which means the relocation of business processes from one country to another. In other words off shoring is defined as the movement of a business process done at a company in one country to the same or another company in different country. This includes any business process such as production, manufacturing, or services.

The market of engineering services is of the size of around US \$ 200 billion. India is one of the fastest growing economies in the world. It is the largest producer of English-speaking engineers/workers among the developing countries. India has a well-developed legal system and significant political stability for foreign direct investment in manufacturing and R&D activities.

It is the preferred destination for the ITO/BPO sectors. It has the potential to provide solutions involving high engineering complexity. While the world market of engineering services is of the size of around US \$ 200 billion, the world EPO market share of India in the global EPO market has the potential to exceed US \$ 40 billion by 2020. To tap the EPO market, all the important stakeholders, including government, service providers and trade bodies will need to boost



investments in infrastructure and improve marketing efforts.

The future of engineering services industry in India will change dramatically in the next few years. Though the Indian companies have started with some low-end jobs, they didn't stop there. They have moved up the value chain. We're doing some good work.

Our weak area is our capability and competency in the basic conceptual designs. It needs to be

addressed. It is certain that India will see a lot of high-end work being outsourced to it in the next 2-5 years. Companies are not looking at India as a mere supplier but also as an opportunity (market); they will go above and beyond to make sure it happens. They are keen on building a brand name by doing work here. The issues of trade under WTO need to be resolved through a global agreement. Negotiations are on in this regard





# Conference Papers

# Competitive Edge through “Softedge”

– Maj Gen. (Retd.) N K Dhir

## Introduction

India has a huge population of qualified and competent engineers and technologists. Some of them have made their mark in the international arena by making conspicuous contribution in their respective fields of operation. Something to be proud of as an Indian! At the same time, it is somewhat disturbing to note that globally, Indian Engineering Services do not have the necessary competitive edge. While possession of cutting edge knowledge and relevant skills do provide the essential entry point for global operations, but to create strong brand equity and a sustainable customer loyalty, something more is required. Unfortunately, engineering professionals seem to ignore it at their peril.

## Two Case Studies

### Case-1

When I rang up my electrician, let's call him Sonu, to fix some problem, he did not respond. His brother responded instead. When I enquired about Sonu, I was told he was no more. He was electrocuted while fixing a cooler at someone's house.

### Case-2

While on vacation at Chicago with my son, he called electrician to fix fans at his house. Two electricians, let's call them Tom and Jerry came on the appointed date and time, dressed as if going into a combat zone with every required tool worn on person and having all personal protective equipment. They did their job quietly and went away after taking their fee and leaving a very satisfied customer.

## Analysis

These are the two cases of providing “engineering” service at the grass root level. In both cases the electricians were competent – having knowledge about electricity, skills to fix up routine electrical problems/issues and both had an attitude. While Sonu had a couldn't careless or KFP (kyafaraqparta) attitude and he paid a heavy price, Tom and Jerry had an attitude of “it-makes- a- difference” and left a thoroughly satisfied client. Attitude thus emerges as the key differentiator. This is no great revelation, but a mere illustration of something that practitioners have often lamented about but done nothing much to alter it.

## Developing Cutting Edge

In a fiercely competitive business environment, achieving customer's delight through superior quality of product and services would appear to be an obvious way to develop a competitive edge. It is easier said than done. ISO 9000:2005, Quality management systems – Fundamentals and vocabulary, and ISO 9004:2009, managing for the sustained success of an organization – A quality management approach, have defined eight Quality Management Principles. These are generic in nature and are considered universally applicable irrespective of the field of operation of an organization. These standards are under revision and now seven principles are being discussed for finalization. These are as follows;

QMP 1 - Customer Focus

QMP 2 - Leadership

QMP 3 - Engagement of People



QMP 4 - Process Approach

QMP 5 - Improvement

QMP 6 - Evidence-based Decision Making

QMP 7 - Relationship Management

It will be seen that out of seven principles, following four principles have nothing to do with either technology or with traditional quality improvement tools;

QMP 1 - Customer Focus

QMP 2 - Leadership

QMP 3 - Engagement of People

QMP 7 - Relationship Management

These are constituents of what I have chosen to call "softedge." All the four principles are normally referred to as "soft skills" and it is my belief that these soft skills provide the competitive edge, so the term "softedge."

Fortunately, these constituents of "softedge" are trainable and learnable. Learning however is not easy and takes place in an iterative manner. In order to assess the effectiveness of learning, following Laws of Learning will provide a good indicator;

**(a) First Law.** You will learn only if there is a great felt need. This can be called the Law of Necessity. Clearly there has to be a strong felt need to undertake the learning process, which comes from the expected outcome, considered important.

**(b) Second Law.** The more you learn, the more you realize how little you know. It is the Law of Readiness. There is so much to learn that one can hardly ever be comfortable with ones level of learning. It also creates the humility of a learner and dispels arrogance that comes with limited knowledge.

**(c) Third Law.** Unless you learn to unlearn what you may have learnt earlier, you cannot learn what you need to learn today. It is the Law of Unlearning. To learn new and relevant issues one has to unlearn. Problem is not getting bright ideas, but getting rid of silly ideas or habits. Unlearning is hard but necessary.

**(d) Fourth Law.** Unless you learn to act on what you have learnt, you have not learnt anything at all. This is the Law of Action, and perhaps the most critical one. Highly knowledgeable persons waste their learning by not using it.

### Customer Focus

Organizations come into being to satisfy a given societal need at a point in time. The very reason for existence of an organization is to satisfy the needs and expectations of the customers who are the constituents of the society. Every single activity or the process of an organization should ultimately lead to better customer satisfaction. As per research carried out by Gallup organization, customer engagement index is as follows;

- Fully engaged customers : 21 percent.
- Engaged customers : 21 percent.
- Not-engaged customers : 30 percent.
- Actively disengaged customers : 28 percent

It makes good business sense to make all out efforts to keep the 42 per cent engaged customers as engaged and add some more from the not-engaged customers. Customer focus is all about building and maintaining relationships and following it up with meticulous service that will delight the customers.

### Leadership

Nearly all studies on excellent organizations have identified "Leadership" as the key factor for

success. This is one topic which is perhaps the most talked and written about. Everyone agrees about its importance, yet good leadership remains elusive. The new paradigm with a people centric approach will lead us towards what has been called by Daniel Goleman as Resonant Leadership. A leadership that creates an emotional resonance between the leader and the follower will develop an environment or organizational culture focused on achieving and even going beyond the organizational objectives.

Let us raise a question - what does a leader do? The simple answer is - he leads. So, a leader uses his knowledge, skills and ability/attitude to provide the service of "leading." As service provider he has to understand the current and future needs and expectations of his customers/clients - in this case followers among other stakeholders. Then, not only meet but attempt to exceed these needs and expectations. Ironically, leaders spare very little time for this crucial activity which is so inherent to the process of leading, and often to their own peril. Concept of Servant Leader is ancient as it has been attributed to Chanakya and quoted in Arthshastra as follows;

"The king [leader] shall consider as good, not what pleases himself but what pleases his subjects [followers]" "the king [leader] is a paid servant and enjoys the resources of the state together with the people."

In modern times the Servant Leader concept was first used by Robert K Greenleaf in his essay "The Servant as Leader." The term servant leader is not well received by corporate leaders with all the trappings of power and position that they enjoy. So, it is proposed to view the process of leading as that of providing a service and the role of a leader as service provider. Yet the characteristics of a servant leader viz Empathy, Awareness, Listening, Healing, Persuasion,

Conceptualization, Stewardship, Growth or development of the people, Foresight and Building Community are no less relevant in the present day context. In fact, these very well correspond to the leadership qualities of a Resonant Leader defined by Goleman.

The hardest trait to acquire and perhaps the most critical one is that of humility. Jim Collins in his famous book "Good to Great" clearly demonstrates that it is possible to have humility and be very focused on organizational objectives. What he called as Level V Leader actually displays a great deal of Emotional Intelligence. Mere knowledge of these qualities, traits or characteristics does not make anyone a better leader, their practice does.

Since no two situations are alike, perhaps a 'one-size-fits-all' type of a leadership model may not foot the bill. So the onus of developing Situation-specific Leadership qualities will be on the leader himself. If  $L = f(l, f, s)$ , where L is leadership, which is a function of l-leader, f-followers and s-situation, it is clear that a leader cannot change either the followers or the situation, so to provide superior leadership, only the leader has to change himself by developing key qualities.

It is now accepted that leadership and leadership qualities are trainable. Problem is not learning new ideas or even acquiring new worthwhile qualities/habits, the real problem is getting rid of many silly or outdated ideas and even more difficult is dropping old habits which have become part of one's personality. So, for leadership development, unlearning is more important than learning. It is also important to remember that when we refer to a leader it is not the CEO alone, but leaders at all levels. A great leader is one who creates more leaders. So, apart from delegation of responsibility/authority, coaching and mentoring is an inherent leadership duty. It is not a mechanical activity but has a great



deal of emotional component. Also, a good leader is a good follower too. Leadership works through “influencing.” Influencing without authority has a lasting effect. Leaders influence through the power of emotions and not highbrow logic. Leaders with greater EI competences are therefore more likely to influence people and provide superior leadership that leads to better performance.

### **Engagement of People/Motivation**

Motivation is the key to achieve superior performance as it can also convert a disengaged or partially engaged employee to an engaged one. No wonder a common question that a lot of leaders/managers often ask is “How to motivate?” There are a number of theories and approaches that have evolved over a period of time. Every situation being unique the leader will have to use his ingenuity to develop or adopt a particular approach. A point to consider is that all too often while intending to motivate the leaders/managers tends to become manipulative, which people can see through and all efforts become counterproductive. In fact, in today's hi-tech work environment working with knowledge workers an approach of “inspiring” that has an emotional content is likely to work better.

Paul Herr, who has studied/researched motivation for 35 years, in his book “Primal Management”, contends that organizations are social systems and its constituents are “people.” People have two types of appetites. First is Biological Appetites. These comprise of Nutrition (hunger and thirst), Energy Conservation (relaxation etc.), Protection of Body proper (sensory pain), Breathing (pain of holding breath) and Reproduction (Sexual pleasure). Biological Appetites a person strives fulfill on his own. The second is Social Appetites. These comprise of Self-protection (feeling of security), Innovation (curiosity and eureka.), Skill development

(elation experienced with a win), Competency (self-esteem) and Cooperation (warm family feel). A person seeks avenues to satisfy his social appetites through the social systems that he becomes a part of. Leaders will do well to create an environment that provides an opportunity to satisfy the social appetites of the people (constituent of the social system) to achieve motivation. In fact the evolution of civilization has been through the on-going satisfaction of social appetites of mankind. An approach of providing opportunities to satisfy these appetites will result in a sustainable motivating environment that will result in creating a high performance culture.

Human beings inherently look for recognition. “Stroke”- a term used in Transactional Analysis recognizes it as a unit of recognition. While strokes can be both positive and negative and both may have their place in human interaction, the importance of positive strokes or recognition can hardly be overemphasized for motivation. Recognition or appreciation or positive stroke to be effective has to be genuine and given soon after a positive action. Some people are culturally averse to praise or giving appreciation. Result of true appreciation can often be dramatic. Ironically, people seek appreciation but find it hard to provide it. It is a clear case for unlearning a learnt behavior. In industrial setting, it was not uncommon for a boss to go around the work area and often brag “I caught so and so sleeping or wasting time or not working adequately/properly etc.” It prompted the boss to initiate a corrective action which was often punitive. It created a “we” and “they” situation and a culture of mistrust. The suggested paradigm is “Catch someone doing something right!” In doing so, we seek an opportunity to give someone a positive stroke or appreciation. “Praising will spoil them” is a misplaced wisdom. Genuine appreciation has a multiplier effect and goes a long way in

building a culture of trust, achievement and openness.

### Relationship Management/Team work

*“There is no one as smart as the team” – Japanese proverb*

Team work is critical for success is well known, fully appreciated and everyone talks about it. Yet, effective team work is not observed universally. The reason is not hard to find. People at intellectual level are aware of its usefulness and importance but find it hard to practice it. Effective team work is built through emotional connect. Patrick Lencioni in his popular book *Five Dysfunctions of a Team* has identified following dysfunctions;

- (a) Absence of trust
- (b) Fear of conflict
- (c) Lack of commitment
- (d) Avoidance of accountability
- (e) Inattention to results

Lack of trust progressively leads to other dysfunctions culminating in inattention to results. Poor results or mediocre performance is the obvious outcome. For high performing teams, trust is the starting point for their journey of excellence. Trust is the cornerstone of Emotional Intelligence. While trust is the glue that binds people, groups and teams, it cannot be demanded. It has to be earned or developed. Winning the trust of people is perhaps the single most important factor of successful leadership. Trust is not logic; it develops through emotional resonance over a period of time through demonstrated actions. Admittedly, trusting is a risky proposition, yet fundamental to effective interpersonal relationships.

### Organizational Culture

For achieving high performance, creating and maintaining an organizational culture of excellence is necessary though it is not an easy task. Organizational culture reflects the internal environment of the organization. Organizational culture is the collective behavior of people who are part of an organization and indicates the likely collective response to varying situations. Culture includes and is influenced by the organizational shared values/beliefs, visions, norms, working language, systems, symbols, stories/myths and habits. Culture influences the new organizational members as a way of perceiving, thinking, feeling and doing which enables them to integrate with organization with ease. It takes a long time to build an effective organizational culture. Also, the organizational culture evolves based on organizational experiences, achievements, failures, tasks/mission, and various external factors. The key player for creating and maintaining the culture is no doubt the leader. ISO: 9000 standard, has articulated eight Quality Management Principles. One of them is Leadership which states,

*“Leaders establish unity of purpose and direction of the organization. They create and maintain the internal environment in which people can become fully involved in achieving the organizational objectives.”*

Creating and maintaining internal environment simply implies creating an organizational culture that will encourage people to get fully involved and give their best or getting fully engaged. Thus, leaders have a great responsibility in developing the right type of organizational culture. Its rewards are phenomenal and make it worth the effort. Use of Emotional Intelligence in this exercise will pay rich dividends.



## Conclusion

Organizations are social systems that come into being for a specific purpose. Organizations typically focus on technology, processes and people for success. People are its main constituents. They work together to achieve the organizational objectives. Research has shown that in most organizations there is inadequate performance and sub-optimal resultant achievement. In order to achieve superior performance and better results, we need to have a paradigm shift and adopt a people-centric approach which is driven through Emotional Intelligence. Such an organization will create a definite competitive edge through better

service, lower costs and superior quality. An effort has been made to suggest a simple and workable action plan which is based on sound theoretical concepts and demonstrated effective practices. It is noteworthy that its application starts from the top – leaders who first understand, appreciate and practice Emotional Intelligence and then through a cascading effect create a trusting culture that demands, expects, encourages, celebrates quality, higher performance and superior results. Individual goals and aspirations are either subservient to or congruent with the organizational objectives and designs. It is a workable proposition and is surely worth working for.

## Execution in IRAQ during war hostilities with IRAN

– R. K. Sharma

During the period 1970 to 1980 IRAQ witnessed boom in their development projects which faded later on with the beginning of War hostilities with IRAN starting from the year 1980. Various international firms took part in this phase of development in IRAQ. NBCC also tried hand in getting and executing some projects like sewerage project in the east of Baghdad, civil works in Baghdad University, two Flyovers project on International Airport Roads, Hotels at Mosul & Dhokan and Railway Stations Buildings on Alqaim Akashat railway project. On getting contracts for these projects after international bidding NBCC took steps to mobilize resources like manpower, plant and machinery, construction material and equipment. While most of our western contracting agencies working had fully mechanized approach with huge plant and equipment inventories, NBCC like most of the Asian agencies had adopted for judicial mix of mechanical and labour intensive approach. This mixed approach with lot of savings on costlier machinery component had resulted in economical working, thereby making our tenders quite competitive to secure the contracts in the international biddings. But this mixed approach had lot of other challenges like handling of large number of work force, arranging remittances to workers families in India and reciprocating their welfare to workers, dealing with passport authorities in India/Indian Embassy abroad, maintenance of labour records and maintenance of law and order status in the local labor camps. Taking hard steps like Issuing exit visas to the trouble creating workers was detrimental to labour morale. Handling departmental labour force was full of challenges. But these challenges had to be managed in order to maintain the progress for the timely

completion of the projects. Some of the Indian firms who had adopted the approach of Subletting labour contracts on their projects faced acute labour unrest on their work sites, faced regular criticism from their clients for slow progress, stoppages of works, ultimately leading to termination of their contracts.

Our engineering staff posted on the projects were having requisite exposure to the various activities on the project and were able to take on site decisions required for the smooth execution of the project. Whereas, engineers employed by our Western firms were found to be referring their site problems to their corporate head quarters. After start of the war hostilities with Iran in the year 1980 most of these firms had abandoned their projects and Asian firms completed the remaining works. One such abandoned project was of Railway Station buildings on the Alqaim Akashat Railway project.

Swedish firm m/s Lohjas had left after placing of precast roof elements on the station buildings and these elements deflected up and down just like piano wires. Government of Iraq invited international bids for the completion of the remaining works and out of the three bids received NBCC was found to be lowest with about 25 million Iraqi Dinars. The other two European offers were found to be 50 and 100 higher than NBCC offer. On award of this contract NBCC started to mobilize staff and labour besides machinery and material. Here again NBCC adopted mix of mechanical and labour oriented approach and arranged 150 engineers & technicians and 1000 skilled and semiskilled work force for the departmental working. The major challenge faced was in





strengthening of the thinly cast vibrating precast roofing elements for which additional strengthening was necessary before laying of the water proofing treatment. The initial trial for the strengthening was found to be satisfactory and Clients were very happy and relieved on the technique adopted by NBCC. Similar problems like placing of roofing domes and other items were also tackled to the entire satisfaction of the client's staff. This project was awarded to NBCC and also executed successfully during the period of Iran Iraq war.

The salient features of NBCC working in Iraqi projects were as follows: -

1. Departmental working on the projects.
2. Posting of staff having adequate experience in line with the project requirements.
3. Adequate attention on grasping the local regulations, customs and local laws.
4. Maintaining proper liaison with Indian Embassy for handling of local administration problems Including visas of staff and labour.
5. Arranging local driving licences, labour regulations including arranging essential provisions for staff and labour since local government did not have arrangement for such provisions.

# Meeting Environmental Challenges in Coal Mineral Utilization : India and South Africa

– Malti Goel\*

## Abstract

*"There is no country richer than ours in the most precious asset of human kind, the human resource".*

- **Rajiv Gandhi**, Ex-Prime Minister of India

Coal occupies a distinct position in mineral reserves in India. Coal resources are abundant and India is world's third largest producer of coal. Coal is essential primary resource and would continue to dominate energy scene in India in the next few decades. In the total electricity capacity attained as 209 GW in April 2013, thermal capacity has a share of 132 gigawatts (GW), majorly coal based. In 2012, coal production was 532 MT and the coal requirements for 2020 have been assessed at 1267 MT. With increasing coal use, the climate change issues related to greenhouse gas emissions, particularly increase in the carbon dioxide levels in the atmosphere are becoming important from international as well as national perspectives. Although being a non-Annex I country, India does not have a limitation on greenhouse gas emission under Kyoto Protocol. India has taken steps to improve efficiency of generation by adopting supercritical steam cycle. Carbon Capture and Storage research in universities & academic institutions has been initiated.

The coal however has high ash and a larger share

is non-coking type having impurities intermeshed with high inert mineral content, which gets converted to huge ash ponds during combustion. Coal use implies not only emission of high level of carbon dioxide, oxides of sulfur and oxides of nitrogen, but also huge solid waste generation. Indian coal industry therefore, faces greatest challenge in meeting the environment regulations, restricting the use of un-beneficiated coal in thermal power plants. At the same time, unable to meet the entire coal demand from indigenous sources, coal imports are growing both for thermal generation and metallurgical industry. Australia, Indonesia and South Africa are becoming major destinations.

South Africa is a country with high energy intensity. It also has dominant share of coal in meeting its energy demands and nearly 75 percent generation is from coal. It is expected to provide coal for majority of South Africa's energy sector needs over next 20-30 years. Being fifth largest coal producer it is also fifth largest exporter coal country. Export quality coal has high calorific value and low ash. South Africa has taken a step ahead and a Centre for Carbon Capture and Storage aiming at human and technical capacity building has been established in 2009. The vision is to install a carbon capture and storage demonstration plant by 2020. A geological atlas for carbon storage has been prepared.

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\*Former Adviser & Emeritus Scientist, Ministry of Science & Technology, Government of India, New Delhi



Both countries need to learn from each other. Each type of coal has its own 'washability' criteria, depending on the chemical composition of coal. Use of washed coal is also expected to reduce CO<sub>2</sub> emissions from 0.326 to 0.266 kg/kWh of electricity generated and responds to climate benefits. Blending with low ash coal can show similar effects. A huge opportunity for

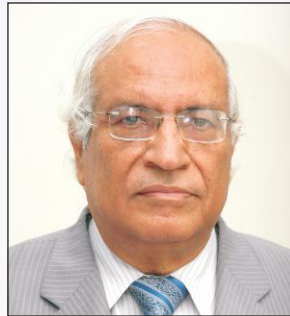
application of coal processing viz. coal beneficiation, coal gasification and coal liquefaction technologies exists. In this paper, science & technology perspectives for meeting environmental challenges in coal utilization are presented. Appropriate measures and possible collaboration areas between India and South Africa are discussed.

\*Former Adviser & Emeritus Scientist, Ministry of Science & Technology, Government of India, New Delhi



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**Mr. Mahendra Raj**  
Vice Chairman



**Mr. Chander Verma**  
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## Engineering Council of India (ECI)

Engineering Council of India (ECI) was established on April 4, 2002 by coming together of a large number of Professional Organizations/Institutions of engineers to work for the advancement of engineering profession in various disciplines and for enhancing the image of engineers in society, by focusing on quality and accountability of engineers and to enable the recognition of expertise of Indian engineers and their mobility at international level in the emerging WTO/GATS environment. It has emerged as a common voice of its member organizations. It is focusing on the following role and tasks.

### TASKS

- Representing Member Associations in government and non-government bodies, and interacting on common policy matters relating to engineering profession.
- Working for the setting up of a Statutory Council of Engineers and later interfacing with it, providing support and inputs for developing systems and procedures for the registration of engineers, CPD, code of ethics.
- Facilitating authorization of member associations to register engineers; assisting them in developing internal systems for undertaking registration, CPD, enforcing code of ethics; and providing common forum for CPD to support the member associations.
- Assisting member associations in interaction with academic institutions and regulatory bodies in regard to their examinations, award of degrees etc.
- Providing forum for exchange of information and experience among member associations, coordination, common thinking and views on important matters.
- Helping in the analysis of existing education systems/bodies and making suggestions in order to make the education relevant for the engineering profession and employability.
- Setting up a Resource Centre and Database of Engineers, which can provide necessary information required for the development of the profession.
- Interacting with professional associations/bodies in other countries & international bodies.
- Undertaking and supporting research for the development of the engineering profession.

### ENGINEER'S BILL

ECI has prepared a draft Engineer's Bill for the Consideration of the Government of India, which lays down the criteria for the process of registration of Practising Engineers and provide necessary statutory framework for the same. The draft is being processed by the Ministry of Human Resource Development.

### MEMBERSHIP

Membership of the ECI is open to societies/organisations of engineers who meet the following requirements :

- having been established statutorily or registered in accordance with law.
- having atleast 100 corporate members
- having existed for at least four years, and
- the accounts being audited annually.

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1. Association of Consulting Civil Engineers (India)
2. Broadcast Engineering Society (India)
3. Computer Society of India
4. Construction Industry Development Council
5. Consultancy Development Centre
6. Consulting Engineers Association of India
7. Indian Association of Structural Engineers
8. Indian Buildings Congress
9. Indian Concrete Institute
10. Indian Geotechnical Society
11. Indian Institute of Chemical Engineers
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13. Indian Institution of Industrial Engineering
14. Indian Institution of Plant Engineers
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17. Indian Society for Technical Education
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