Chapter - 1
INTRODUCTION

1.1 GENERAL INTRODUCTION OF THE CONSTRUCTION INDUSTRY

Construction activity is an integral part of a country's infrastructure and industrial development. The market size of global construction industry is $3.4 trillion and India accounts for 1.75% of the total market size, ranking 12th in the world. Construction is the second largest sector after agriculture in India in terms of employment and accounts for 11% of the total Gross Domestic Product (GDP).

The evolution of Indian Construction Industry was almost similar to the construction industry evolution in other countries: founded by Government and slowly taken over by private enterprises. After independence the need for industrial and infrastructural developments in India laid the foundation stone of construction, architectural and engineering services. The period from 1950 to mid 60's witnessed the government playing an active role in the development of these services and most of construction activities during this period were carried out by state owned enterprises and supported by government departments. In the first Five-Year Plan, construction of civil works was allotted nearly 50 per cent of the total capital outlay. The first professional consultancy company, National Industrial Development Corporation (NIDC), was set up in the public sector in 1954. Subsequently, many architectural, design engineering and construction companies were set up in the public sector Indian Railways Construction Limited (IRCON), National Buildings Construction Corporation (NBCC), Rail India Transportation and Engineering Services (RITES), Engineers India Limited (EIL), etc. and private sector which included M N Dastur and Co., Hindustan Construction Company (HCC) and Ansals, etc. In the late 1960s government started encouraging foreign collaborations in these services. The Guidelines for Foreign Collaboration, first issued in 1968, stated that local consultant would be the prime contractor in such collaborations. The objective of such an imposition was to develop local design capabilities parallel with the inflow of imported technology and skills. This measure encouraged international construction and consultancy organisations to set up joint ventures and register their presence in India.

In India construction has accounted for around 40 per cent of the development investment during the past 50 years. Around 16 per cent of the nation's working population depends on construction for its livelihood. The Indian construction industry employs over 3 crore people and creates assets worth over Rs.20,000 crores. It contributes more than 5 per cent to the nation's GDP and 78 per cent to the gross capital formation. Total capital expenditure of state and central govt. will be touching Rs.8,62,887 crores in 2011 12 from Rs.1,43,587 crores (1999-2000).

The share of the Indian construction sector in total gross capital formation (GCF) came down from 60 per cent in 1970-71 to 34 per cent in 1990-91. Thereafter, it increased to 48 per cent in 1993-94 and stood at 44 per cent in 1999-2000. In the 21st century, there has been an increase in the share of the construction sector in GDP and capital formation. GDP from Construction at factor cost (at current prices) increased to Rs.174571 crores (12.02% of the total GDP) in 2004-05 from Rs.116238 crores (10.39% of the total GDP) in 2000-01.
The main reason for this is the increasing emphasis on involving the private sector infrastructure development through public-private partnerships and mechanisms like build-operate-transfer (BOT), private sector investment has not reached the expected levels.

The Indian construction industry comprises 200 firms in the corporate sector. In addition to these firms, there are about 1,20,000 “class A” contractors registered with various government construction bodies. There are thousands of small contractors, which compete for small jobs or work as sub-contractors of prime or other contractors. Total sales of construction industry have reached Rs.42,885.38 crores in 2004-05 from Rs.21,451.9 crores in 2000-01.

1.1.1 Future Challenges

The Indian economy has witnessed considerable progress in the past few decades. Most of the infrastructure development sectors moved forward, but not to the requirements of the construction industry. With the present emphasis on creating physical infrastructure, massive investments are planned in this sector. The Planning Commission has estimated that investment requirement in infrastructure to the tune of about Rs.14,50,000 crore or US$ 320 billion during the 11th Five Year Plan period. This is a requirement of an immense magnitude. Budgetary sources cannot raise this much resources. Public Private Partnerships (PPP) approach is best suited for finding the resources. Better construction management is required for optimizing resources and maximizing productivity and efficiency.

Construction sector is broadly divided into three segments viz. infrastructure, industrial activities and real estate. Infrastructure development includes roads, ports, power, railways, and urban infrastructure. Industrial activity consists of construction of plants for cement, fertilizer, refining and industrial structures, while real estate consists of residential and commercial construction. In India, central, state and local bodies are mainly responsible for developing infrastructure, which accounts for 61% of the total spending in construction segment. In case of industrial construction and the real estate development, spending is done on both govt. and private sector. These segments account for 24% and 5% respectively of the total construction spending in India.

The infrastructure sector has seen a lot of action over the past three years. The key drivers of the change in infrastructure investments are: (a) political will to develop infrastructure, (b) government funding infrastructure through cess, (c) raising funds from multilateral agencies, (d) fall in interest rates, and (e) encouraging private participation.

1.1.2 CURRENT TRENDS

1.1.2.1 Growing Order book

Currently, government focus is on the road sector. Roads, being very important part of the entire chain of logistics, development of the country's road network would help overall industry to reduce time and cost of transporting goods, besides reducing pollution.
Following table shows budgetary allocation of central government towards various infrastructure segments during the last five years.

**Table-1.1**  
**Budgetary Allocation**  
(Rs. in crore)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>7021</td>
<td>7140</td>
<td>7698</td>
<td>11758</td>
<td>13741</td>
</tr>
<tr>
<td>Power</td>
<td>6008</td>
<td>5647</td>
<td>6700</td>
<td>6985</td>
<td>11072</td>
</tr>
<tr>
<td>Railways</td>
<td>5740</td>
<td>6944</td>
<td>8456</td>
<td>7185</td>
<td>6800</td>
</tr>
<tr>
<td>Ports</td>
<td>585</td>
<td>549</td>
<td>687</td>
<td>936</td>
<td>1237</td>
</tr>
<tr>
<td>Airports</td>
<td>274</td>
<td>277</td>
<td>377</td>
<td>763</td>
<td>449</td>
</tr>
<tr>
<td>Urban Development</td>
<td>3335</td>
<td>3433</td>
<td>3485</td>
<td>3675</td>
<td>3206</td>
</tr>
</tbody>
</table>

Over the past five years, the order book of various Indian construction companies has swelled significantly with transportation forming a larger chunk. A persistent emphasis on the development of road network across the country by way of increasing budgetary allocation besides private sector participation has helped many major as well as small construction companies in India to report consistently growing sales for last couple of years.

**1.1.2.2 Increase in Networth**

In construction industry, contractors are qualified on the basis of their financial capacity and technical capability to execute the projects. Financial capacity of a company is evaluated on the basis of Net worth and average cash accruals of the past few years (normally 3 to 5 years).

Taking into account the government’s thrust to build world class infrastructure in the country and therefore in order to qualify for number of large value contracts, many construction companies have increased their networth taking advantage of favourable market conditions. Many construction companies in India have increased their networth by way of private placement and / or GDR issue in the recent past. Some of them are given below.

**Table-1.2**  
**Networth of Construction Companies**  
(Rs. in crore)

<table>
<thead>
<tr>
<th>Companies</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gammon</td>
<td>12.84</td>
<td>111.15</td>
<td>12.84</td>
<td>126.39</td>
<td>152.09</td>
</tr>
<tr>
<td>HCC</td>
<td>20.03</td>
<td>119.89</td>
<td>20.03</td>
<td>139.52</td>
<td>163.90</td>
</tr>
<tr>
<td>Nagarjuna</td>
<td>9.42</td>
<td>93.31</td>
<td>9.45</td>
<td>108.71</td>
<td>162.14</td>
</tr>
<tr>
<td>IVRCL</td>
<td>10.44</td>
<td>87.18</td>
<td>10.50</td>
<td>99.01</td>
<td>132.54</td>
</tr>
</tbody>
</table>
Construction being working capital intensive in nature, initial advances are paid by clients to contractors for the mobilization of resources, putting up plants etc. As interest rates showed a downward trend during the past few years, companies preferred to rely on money market for raising funds instead of clients advance for cheaper source of fund. The proceeds from equity infusion will be mostly utilized to fund growing working capital requirement arising on account of increase in order book position of companies.

1.1.2.3 Public Private Partnership (PPP)

Privatization is the current buzzword of this sector. Over the past few years, government has given many projects especially road projects on Build, Operate and Transfer (BOT) basis. Considering the response for privatization, government is proposing to develop more and more projects through privatization.

High capital intensive projects in the segment like ports, airports, power etc. are being developed through PPP only.

1.1.3 OUTLOOK

Considerable progress has taken place in the past ten years in attracting private sector investment in various individual projects including roads, ports, airports, power etc. The total projected investment, at 2001-02 prices, required in infrastructure during the Tenth Five Year Plan, was amounting to Rs.10,89,400 crore, which was revised to Rs.11,08,800 crore in the Mid-Term Appraisal of the Tenth Plan. The Committee on Infrastructure, headed by the Prime Minister, has estimated the investment requirements at Rs. 1,72,000 crore in the National Highways sector by 2012; Rs. 40,000 crore for Airports by 2010; and Rs.55,000 crore for Ports by 2012. It is estimated that India has the potential to absorb US$150 billion of Foreign Direct Investment (FDI) in the next five years in the infrastructure sector.

<table>
<thead>
<tr>
<th>Area</th>
<th>The government’s plan of action</th>
<th>Total funding requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roads</td>
<td>National Highway Development Program (NHDP) extended to 7 phases (from 2 previously) of which 4 have been approved. In addition to NHDP village road projects (PMGSY) and rural road upgrades could cost additional Rs 1300 bn</td>
<td>Rs.1156 bn until NHDP IIIB</td>
</tr>
<tr>
<td>Ports</td>
<td>National Maritime Development Program envisages the creation of additional 528 MT of port handling capacity (from 390 MT currently) by FY14 at 11 major ports, in addition to deepening of channels, upgrade of port equipment etc</td>
<td>Total project cost Rs.604 bn, of which Rs.115 bn would have budgetary support, Rs.51 bn from the ports internal resources, and Rs.392 bn targeted from the private sector</td>
</tr>
</tbody>
</table>
Introduction

National Rail Vikas Yojana aims to remove capacity bottlenecks in critical sections of the railway network. Notable initiatives are: (i) strengthening Golden Quadrilateral to enable the railways run longer-distance express/freight trains at higher speeds of 100 Kmph (cost Rs 80 bn), (ii) strengthening of rail connectivity to ports and development of multimodal corridors to the hinterland (cost Rs 30 bn), (iii) construction of four major bridges (cost Rs 35 bn).

Airports

Construction of new airports at Hyderabad and Bangalore under way. Tenders floated for and preliminary bids received for privatisation of Mumbai and Delhi airports. Third stage is modernisation of Kolkata and Chennai airports. The extended programme of 30 airports envisages Rs.700-1,000 bn capex.

Source: NHAI, Department of Shipping, RVNL AAI

Above table shows that Indian construction companies should be geared to cash in the opportunities lying ahead.
1.2 CONSTRUCTION SCENARIOS ACROSS VARIOUS COUNTRIES

1.2.1 Construction Scenario in India

(Eleventh Five Year Plan, Chapter 8, Pg.239-245)

BACKGROUND

1.2.1.1 The development of physical infrastructure in the country and, consequently, the construction sector has been in focus during the last decade. The increasing significance of construction activities in the growth of the economy was also evident during the course of implementation of the Tenth Plan with areas such as transportation, irrigation, housing, urban development, and civil aviation having received greater importance. It is well established that the influence of the construction industry spans across several sub-sectors of the economy as well as the infrastructure development, such as industrial and mining infrastructure, highways, roads, ports, railways, airports, power systems, irrigation and agriculture systems, telecommunication systems, hospitals, schools, townships, offices, houses and other buildings; urban infrastructure, including water supply, sewerage, drainage, and rural infrastructure. Thus, it becomes the basic input for socio-economic development.

CRITICALITY TO ECONOMY

1.2.1.2 The contribution of construction to the GDP at factor cost in 2006–07 was Rs.1,96,555 crore, registering an increase of 10.7% from the previous year. The share of construction in GDP has increased from 6.1% in 2002–03 to 6.9% in 2006–07. The increase in the share of construction sector in GDP has primarily been on the account of increased government spending on physical infrastructure in the last few years, with programmes such as National Highway Development Programme (NHDP) and Pradhan Mantri Gram Sadak Yojana / Bharat Nirman Programme receiving a major fillip of late. The construction industry is experiencing a great upsurge in the quantum of the work load, and has grown at the rate of over 10% annually during the last five years. Although various steps have been taken to strengthen the construction industry, it is crucial to take necessary measures in order to prepare the industry to meet the challenges of growth.

1.2.1.3 The importance of construction activity in infrastructure, housing, and other asset-building activities can be seen from the fact that the component of construction comprises nearly 60%–80% of the project cost of certain infrastructure projects such as roads, housing, etc. In projects such as power plants, industrial plants, etc., though the share is lower but it still remains critical. In terms of magnitude, construction activity is second only to agriculture. The construction industry also has major linkages with the building material manufacturing industry including cement and steel, bricks and tiles, sand and aggregates, fixtures and fittings, paints and chemicals, construction equipment, petrol and other petro-products, timber, mineral products, aluminium, glass, and plastics. Construction materials account for nearly two-third of the average construction costs. On the basis of an analysis of the forward and backward linkages of construction, the multiplier effect for construction on the economy is estimated to be significant.
EMPLOYMENT IN THE CONSTRUCTION INDUSTRY

1.2.1.4 With around 27770 enterprises involved directly in the activity of construction in 2005, the industry is one of the largest employer in the country and is characterized by a mix of both organized and unorganized entities. The employment figures have shown a steady rise from 14.6 million in 1995 to more than double in 2005, that is 31.46 million personnel comprising engineers, technicians, foremen, clerical staff, and skilled and unskilled workers. Larger investments in infrastructure have resulted in an increased demand for construction and, consequently, for construction engineers and technicians. However, due to the limited availability of engineers and technicians in general and the greater demand in sectors such as IT, there is a substantial drop in the percentage of qualified engineers employed at the work sites from 4.71% in 1995 to 2.65% in 2005, and similarly at sub-engineering levels from 2.46% in 1995 to 1.85% in 2005. The strength of skilled workforce has also been consistently and substantially going down from 15.34% in 1995 to 10.57% in 2005, whereas relative proportions of unskilled workers have gone up from 73.08% in 1995 to 82.45% in 2005. The workers community accounted for 93% of the total employment in the construction sector in 2005, with a predominance of migrant labour workforce. It is important to create a reliable information system for labour migration both at the destination as well as at the point of origin of migration to reduce vulnerability. As macro level data are often inadequate to capture the flow and pattern of migration, state-centric surveys are required to fill in this gap. With several ambitious projects on anvil during the Eleventh Plan, the demand for construction manpower is going to grow at a consistent pace of at least 8%–9%, thereby resulting in an annual accretion of around 25 lakh persons to the existing stock.

DEVELOPMENTS DURING THE TENTH PLAN

1.2.1.5 During 2002–07, many milestones were achieved by the Indian construction industry in the areas of institutional finance, human resource development, dispute resolution, procurement procedures, safety and quality in the construction industry, and disaster mitigation initiatives. The construction industry was accorded Industrial Concern Status under the Industrial Development Bank of India (Amendment) Act, thereby providing the much-needed impetus in terms of availability of finance to the construction industry. Many national initiatives in human resource management were implemented for the non-formal construction sector, addressing workers as well as engineers and management professionals in the industry. Other major initiatives included, inter alia, the establishment of arbitral institutions for dispute resolution, development of institutions for safety and quality aspects, setting up of disaster mitigation and Retrofitting Clinics along with the training of professionals in disaster mitigation, improvement in procurement practices in public sector, development of regulatory manuals for procurement procedures, as well as dissemination of information regarding good practices and development of action framework for quality and safety audits, certification, and training of manpower.
STRATEGIES FOR THE ELEVENTH PLAN

1.2.1.6 The major challenge that the construction industry faces during the Eleventh Plan is to raise its delivery capabilities commensurate with the Plan targets for sectors such as transportation, housing, and urban development. The planned development of infrastructure would face constraints, unless the construction industry improves the delivery potentials by addressing crucial issues and impediments by bringing in systemic changes. The major issues in the construction industry have been detailed in the following sections.

PRODUCTIVITY IN THE CONSTRUCTION INDUSTRY

1.2.1.7 Since capacity building for the construction industry to achieve expected delivery capabilities is the key focus area, introduction of efficient technologies and modern management techniques to raise the productivity of the industry are vital. R&D in the construction industry should be seen as a continuing activity, because the scientific and technological advancements are needed to strengthen and raise the technological base of the construction industry. Recognizing this, support from the national institutions engaged in scientific research and incentives for private sector players to undertake in-house Research and Development (R&D) need to be provided.

1.2.1.8 The low technological level of Indian construction leads to low value addition, productivity, quality, and high time and cost overruns. A national strategy and policy framework, focusing particularly on productivity enhancement and cost reduction, is required to be developed to match the envisaged work load and delivery targets. Introduction of new technologies, construction systems, and energy-efficient materials (preferably based on waste recycling) needs to be adequately emphasized in the national strategy. For R&D sector, there is a need for developing and introducing use of ‘marginal materials’ to enhance the cost effectiveness of works. Adequate funds should be earmarked in the field of R&D for identification of appropriate and alternate materials to reduce the cost of construction.

1.2.1.9 Management of information in contemporary construction projects is one of the biggest challenges that project teams face in the upgradation of productivity levels. Information technology can be leveraged to address issues related to tendering, bidding, bid evaluation, grading of construction entities, project execution logistics, project management, as well as financial accounting and reporting for the construction industry. An appropriate MIS should be developed and implemented at the national, district, and local levels. Further, an institution needs to be nominated as the repository of National Database for construction industry.
Human Resource and Entrepreneurial Development Framework

1.2.1.10 The major impediments faced by the construction industry in raising the levels of productivity are the acute shortage of skilled manpower, both at worker and supervisory levels, as well as the lack of experienced construction engineers. The construction industry, particularly the highway and road construction sectors, is facing acute shortages of contracting agencies. The present situation is marked by lack of a harmonized skill upgradation and certification programme for construction workers and lack of incentives and regulatory framework to prescribe a certain percentage of trained and certified manpower by the contractors. There is also a need to encourage adequate intake of civil engineers in engineering institutions to mitigate the existing shortage.

1.2.1.11 One of the initiatives undertaken by Construction Industry Development Council (CIDC) is the training, testing, and certification programme of the construction workers. This initiative has resulted in successfully upgrading the skills of construction workers in 47 designated trades through training, testing, and certification of the construction workers (see Box 1.1).

1.2.1.12 A National Plan for training and certification of construction personnel at all levels needs to be developed and implemented. The plan should include initiating a system of “graded Certification” depending upon the levels of proficiency achieved. In order to meet the shortage of trained manpower, short-term courses in certain important trades may be introduced. The role of advisory and consultancy services in strengthening the stature of construction industry is vital. However, presently these services are only a small part of the overall construction services and need to be suitably upgraded.

Box 1.1

Holistic Human Resource Development (HRD)—Construction Industry Development Council (CIDC)

- CIDC, in association with several universities and industry constituents, has offered an HRD Programme for the workers from construction industry for last three years. The programme, based on an open learning and distant mode of education, offers 38 trades through 19 centres situated in various parts of the country. A number of PSUs, SPVs, and State Governments have also been actively participating.
- CIDC conducts programmes in 29 ITIs across four States—Madhya Pradesh, Rajasthan, Haryana, and Bihar. As of date, more than 100000 workers have been tested and certified under this programme and have found gainful employment with construction companies.
- Initiative has been taken by NHAI and the State Government of Madhya Pradesh for the inclusion of a prequalification condition in NHAI’s tender document that a minimum of 5% of trained and certified workers should be employed, to become eligible for any of the bid from NHAI. Such practices need to be replicated by other States.
- CIDC is also actively designing, developing, and disseminating Management Development Programmes for supervisors, managers, and senior officers in Construction Management, Project Management, Emerging Technologies, and other related issues. CIDC’s Diploma Programme in Civil, Mechanical, and Electrical Engineering for Army personnel is field tested and finds increased favour with the armed forces initiating a system of ‘Graded Certification’ depending upon the levels of proficiency achieved. In order to meet the shortage of trained manpower, short-term courses in certain important trades may be introduced. The role of advisory and consultancy services in strengthening the stature of construction industry is vital. However, presently these services are only a small part of the overall construction services and need to be suitably upgraded.
NEED TO REDUCE CONSTRUCTION COST

1.2.1.13 It is estimated that the total cost of procuring, monitoring, and supervising and other indirect costs of construction projects consists of about 22% of the cost of the asset that is created. The reduction of these and other transaction-related costs would be decisive in improving the profitability of the Indian construction industry. Apart from the measures to improve productivity, as discussed in the earlier sections, efforts are also required to streamline procedures and mechanisms within the industry as well as enhance the levels of quality for the sector as a whole.

CONTRACT PROCEDURES

1.2.1.14 The present contract conditions, procedures of procurement of projects, and services being used by various project authorities in the country, both in the public and private sector, need to be reviewed and harmonized. According to some estimates, the cost of procuring comprises 16% of the total construction cost for certain projects. Development of standard contract procedure, documents, and the evaluation criteria would lead to significant reduction in the transaction cost and time. In order to enable fair competition as well as maintain the quality of the output, the system of pre-qualification should be adopted for large PPP projects, whereby only those companies that meet the stringent qualification criteria would be shortlisted and invited to make a bid. For smaller projects, especially those involving repair and maintenance, requalification should be done periodically and bidding should be made on the basis of limited circulation. The guidelines issued by the Ministry of Statistics and Programme Implementation in the form of a set of Uniform Contract Conditions may be taken as a basis for further consultation with experts and stakeholders with a view to formulating standard contract and bidding documents. A shift from the current practices towards electronic tendering process, online publishing of tender notices, online contract bidding documents, and reverse bidding would eliminate unfair competition and make the bidding process transparent.

DISPUTE RESOLUTION

1.2.1.15 In the absence of institutionalized procedures and practices, arbitration continues to be costly and time consuming. As per a survey conducted in 2001 by the CIDC, the amount of capital blocked in the construction sector disputes was over Rs 54000 crore. To minimize disputes leading to time and cost overruns, proper project planning process should be encouraged and DPRs may be completed before technical sanction. After the Arbitration and Conciliation Act 1996 came into force, there has been an improvement in the number of disputes resolved. However, certain shortcomings remain to be addressed in the ad hoc arbitration process in terms of defined selection procedures and working ethics of arbitrators, absence of specific rules for agreement, and provision of a neutral body to administer and supervise arbitration. In view of these deficiencies, there is a need to introduce new measures to resolve disputes in a fair, speedy, transparent, and cost-effective manner.
1.2.1.16 A procedure involving the amicable resolution by conciliation should be followed, failing which reference to arbitration by a Board of Arbitrators in accordance with the Rules of Arbitration of the International Center for Alternate Dispute Resolution, New Delhi should be made. Moreover, institutional arbitration rules, a panel of accredited arbitrators based on selection criteria to maintain the quality, standards, and code of ethics/conduct, norms for negotiable terms of appointment, management of arbitrator's fees, monitoring and supervision of progress of case, etc., should be developed and institutionalized in line with Indian Arbitration and Conciliation Act 1996, after consultation with experts and stakeholders.

QUALITY AND STANDARDS

1.2.1.17 To make the Indian construction industry more competitive, aspects related to enhanced quality in construction products should be accorded attention at all levels. The inadequate quality in construction works emanates from lack of incentives for inducting new technology, lack of pre-qualification requirements for trained and certified workmen, lack of appreciation for lifecycle costing approach, and lack of adequate R&D. In order to enhance the technological capabilities of the industry, all stakeholders would be required to actively support training and certification levels for skilled workers, supervisors, and managers, and promote construction techniques (such as ready-mixed concrete, pre-fab techniques) that use information technology.

1.2.1.18 The Performance Appraisal Certificate Scheme is being implemented for the development and promotion of materials, products, and systems under the joint initiatives of Building Materials and Technology Promotion Council (BMTPC), CIDC, BIS, and other agencies. Further, in view of the widespread infrastructural development programmes, covering both urban and rural areas, particularly for roads, highways, and rural connectivity schemes, district-level testing laboratories should be established for testing and quality evaluation of materials.

1.2.1.19 The importance and benefit of adhering to performance standards, both in inviting tenders and in implementation, are being increasingly realized by construction entities and procurement agencies. Bureau of Indian Standards is formulating a performance standard for special jobs requiring high-quality levels. Another development, aimed at enhancing quality in construction works, is that a large number of construction companies are working to obtain International Standards Organization (ISO) 9000 series certification.

CONSTRUCTION FINANCE

1.2.1.20 The Indian construction industry is faced with high operation, maintenance, and financial costs. This aspect is further exacerbated by inadequate access to institutional finance, especially for small contractors who execute over 90% of the total construction works. Moreover, subsequent to the conferring of Industrial Concern Status on the construction industry, existing financial institutions, and banks should adopt construction industry-specific lending norms and eligibility criteria for the borrowers from the construction sector as well as introduce special incentives or schemes for financing import of hi-tech construction equipment for infrastructure projects.
OTHER IMPORTANT ISSUES

Safety and Related Issues of Construction Workers

1.2.1.21 Workers employed in construction activity are highly vulnerable segments of the labour force particularly because of its unorganized nature. The workers in construction industry are vulnerable to the inherent risk to their life and limbs. Construction activities are also characterized by poor training, temporary relationships between the employer and the employee, uncertain working hours, lack of basic amenities, inadequacy of welfare facilities, and casual approach of employers towards the problems of employees. In the absence of adequate statutory provisions, the requisite information regarding the nature and number of accidents is also not generally available.

1.2.1.22 In the recent past, several initiatives have been taken for the improvement of working conditions of the construction workers through the mandatory provision for instituting the Provident Fund Scheme among casual workers and the introduction of the Workers Welfare Cess. The Building and other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996 was also enacted recognizing the need for a comprehensive Central legislation for regulating the safety, health, welfare, and other conditions of service for construction workers. However, only a few States have implemented the provisions of the Act, such as setting up welfare boards, and efforts need to be renewed to speed up the implementation of the Act.

1.2.1.23 Along with the provision of appropriate training facilities for safety aspects related to construction, vigilant Safety Management Teams adequately trained in compliance procedures, hazard and risk assessment, and documentation of inspections of stipulated measures for safety of workers are required to be put in place. As a substantial segment of the construction industry workforce, women workers need to be accorded special focus in terms of vocational training and skill upgradation as well as the provision of stipulated social benefits.

Asset Management and Maintenance

1.2.1.24 Although the construction of physical infrastructure has been receiving emphasis in the successive Five Year Plans, the maintenance of the assets that are created has not been accorded similar importance due to the absence of necessary framework, planning, and professionals for asset maintenance. The present system of asset management needs to be reviewed and strengthened at the local, State, and Central government levels. A policy framework for ensuring mandatory provision for maintenance of assets needs to be evolved.
Environmental Issues

1.2.1.25 Sustainable development concepts applied to the design, construction, and operation of construction projects can enhance both the economic wellbeing and the environmental health of communities. Environmental Impact Assessment (EIA) is recognized as an important tool for integrating these objectives, wherein EIA should be a necessary pre-condition before construction projects beyond stipulated size are approved. Further, initiatives for ensuring adherence to international standards and regulations, such as the Environment Protection Act 2006 and the Energy Conservation Act of 2001 are also required. Various interdisciplinary organizations such as CIDC and Building Materials and Technology Promotion Council (BMTPC) have been set up to address the issues of environment-friendly technologies and energy efficiency in building materials, along with Central and State Pollution Control Boards to approve, monitor, and regulate projects from all sectors including construction, keeping in view their impact on environment.

Construction Law

1.2.1.26 As per the prevailing scenario, any organization engaged in construction activity requires registration under five different legislations, apart from obtaining licenses under three enactments and being subject to inspection under 12 laws. Further, there are 27 statutes pertaining only to labour. The multiplicity of laws and authorities, anomalies in the existing legal systems, and the complexities thereof suggest the need for a Unified Construction Law along with the formulation of a single window arrangement. The Unified Construction Law should have chapters pertaining to national construction policy and plan; constitution and functions of Central and State construction authorities; dispute resolution and arbitration; grants, funds, accounts, audit, and report; registration and other provisions.

Taxation

1.2.1.27 The construction sector experiences a very high incidence of direct and indirect taxes for construction and construction-related activities as compared to other sectors. The taxation and regulatory systems pertaining to construction should be reviewed with a view to rationalize the same and eliminate multisource taxation. Greater clarity needs to be brought out on the treatment of the sector as ‘Industry’ or ‘Service’ for taxation purposes.

Combating Natural Disasters

1.2.1.28 There is an increasing realization that the problem of natural disasters is grave because their frequency has recorded more than a five-fold increase in the last two decades. Institutional arrangements are required to identify, prevent, and mitigate the effects of natural disasters. New programmes need to be taken as per the guidelines and programmes announced by the National Disaster Management Association. The development of human resources and training of professionals in disaster mitigation, disaster-resistant construction technologies, and setting up of Retrofitting Clinics and Disaster Identification Centres in all major districts falling in disaster-prone regions is also recommended.
1.2.1.29 Substantial national resources are being spent on building assets and the pace of investment is going to enhance considerably during the Eleventh Plan, with several new projects related to transportation including RRs, housing, industrial infrastructure, energy, and agriculture slated for time-bound implementation. Necessary modifications, amplifications, and introduction of good practices need to be adopted to achieve the desired growth in the construction sector and to align it with global trends in terms of growth, quality, and competitiveness.

PATH AHEAD
- Enhance capacity building in the construction sector by improving productivity through introduction of efficient technologies and modern management techniques.
- Reduce transactional costs by reviewing contract procedures and dispute resolution mechanisms.
- Enhance quality standards and provision of adequate institutional finance to the construction sector.
- Develop a National Plan for human resource development through training and certification of construction personnel.
- Accord greater importance to safety in construction activities by establishing trained and certified Safety Management Teams.
- Earmark funds in the field of R&D for identification of appropriate and alternate materials to reduce the cost of construction.
1.2.2 CONSTRUCTION SCENARIO IN CHINA (Daud Ahmed and Zong Yan “An overview of the construction industry in China”, Pg.1-8)

1.2.2.1 China’s Economic Development and Role of the Construction Industry

i) Impressive Economic Development
China has achieved remarkable success in economic development since the introduction of the “opening-up” policies in 1978. A sustained growth rate of over 9% per year of the Gross Domestic Product (GDP) was accomplished through a judicious combination of economic reforms and rational investment in various sectors. China’s per capita income measured in terms of Gross National Product (GNP) has increased ten-fold in the past 15 years, from Rmb 379 in 1978 to about Rmb 3680 in 1994. At the same time total investment in fixed assets, which reached Rmb 1637 billion in 1994, have been growing at an average rate of 19.5% per year for the last ten years. Total value of exports and imports reached US $ 236.7 billion in 1994, with an annual growth rate of 14.6% during the 1986 - 1994 period. As the economy grew rapidly the government successfully introduced reforms which improved the investment environment in the country. Consequently, the utilisation of foreign capital reached US $ 43.2 billion in 1994, corresponding to an average annual increase of 28.1% from 1986 to 1994.

ii) Size and Growth of the Construction Industry
China’s construction industry is huge and widespread. Today the whole of China could be described as one large construction site! Currently the annual output of the CI is about US $ 93 billion - it employs nearly 24 million people (more than 5% of the total labour force); it accounts for more than 6% of the GDP, and has been growing at an average annual rate of nearly 10% since 1979. The high growth rate of CI is attributable to extreme shortage of infrastructure and building space. This growth rate is likely to remain high in the foreseeable future. Statistics show that the percentage contribution of the CI to China’s GDP has been increasing since 1978 - in 1994 it stood at about 6.5%, compared to 4.7% and 3.8% in 1991 and 1978 respectively (Annex 1). However, the share of China’s CI in GDP is still low compared to the developed countries, which implies a strong potential for further growth of the CI.

iii) Enterprises and Labour Force
China’s CI is composed of three distinct categories of construction forces, namely: State Owned Enterprises (SOEs); Urban and Rural Collectives (URCs); and Rural Construction Teams (RCTs). In 1994, there were more than 94,000 construction enterprises in China employing over 24.0 million workers. These were composed of about 7,250 SOEs with 8.18 million employees, 16,980 URCs with 6.36 million employees and 69,840 RCTs with nearly 9.7 million employees. The rapid growth in construction since 1979 has expanded the construction labour force, which increased from 9.8 million in 1980 to over 24 million in 1994.
iv) Output Indicators
The gross output value of the construction industry which was Rmb 34.7 billion in 1980 had reached Rmb 768.4 billion in 1994. The major construction investment outputs, for this period, could be listed as: 110,000 megawatts of new electrical generating capacity; 117 million tons of cement production; 7.484 km of new railway lines; 41.300 km of new highways, 340 million tons of additional harbour cargo-handling capacity; more than 10 new major railway stations in big cities; over 2 billion m2 of new residential housing; 9.3 billion m2 of rural housing, and a large number of public facilities. This was complemented by some 25.4 million tons of additional steel production, 312 million tons of additional coal production and 183 million barrels of additional petroleum recovery.

v) Construction Industries (CI) Linkages to the Rest of the Economy
Construction typically contributes 5% to 9% to the GDP in developing countries and provides critical backward and forward linkages to the rest of the economy. In the case of China, the backward linkages are quite significant - over 10,200 design institutes (0.75 million employees), 1,380 supervision agencies (71,000 employees) and very large construction material and service industries. A rough estimate of the employment ratio between construction enterprises and direct and indirect employment in the material and service industries is 2:1. The CI also generates large "forward linkages" to the economic activities which use the constructed facilities. Since construction in China is a labour-intensive industry, the value added by the CI itself is rather low (6.5% value added to GDP in 1994) compared with other industries.

vi) Overseas Contracting Business
Chinese enterprises are increasingly getting involved in international contracts for engineering projects, manpower services, and overseas enterprises. Since 1979, about 219,900 workers have been sent abroad and the cumulative dollar amount of overseas contracts is reported to be US $38.3 billion, of which the 1994 figure alone was US $6 billion. Most of these contracts were for civil works in the developing countries. This has helped the development of the CI at home as well. Licenses for construction enterprises abroad are issued by the Ministry of Foreign Economic Relations and Trade (MOFERT), mainly to SOEs. Every year, several Chinese corporations have appeared in the list of the top 250 international contractors, published by the Engineering News Record (ENR). In this regard, Chinese contractors could benefit a lot by first competing against foreign contractors within China.

vii) Demand
As indicated earlier, the demands on the CI are closely related to the national fixed capital construction investment scale, which has been increasing rapidly along with the country's economic growth. China's fixed capital investment in 1991 was Rmb 550.88 billion, 65.2% of which was in the construction and installation fields. In 1994, the total fixed capital investment had reached Rmb 1,637 billion, with 63.5% or Rmb 1,039.9 billion used in the construction and installation fields. CI is very sensitive to the national economy; this was evidenced during the recent austerity programme period when the government slammed brakes on the State...
Fixed Investment through a slowdown in approval of new projects and a credit squeeze. However, since early 1995, construction activities have picked up again all over China and the short term prospects look good. The recently formulated Ninth Five-Year Plan (1996-2000) calls for Rmb 13.000 billion worth of national fixed capital investment over the plan period with about 60% for construction and installation. Housing and infrastructure will be two key elements of this large construction activity.

1.2.2.2 Structure of the CI in China

i) The construction industry started to change in the early 80s with the introduction of economic reforms and the opening up process. At the central level, the government started to introduce regulations to set the basic ground rules and at the enterprise level, the entities were gradually given flexibility to operate as "commercial entities". The World Bank also made a modest contribution in this process by introducing for the first time competitive bidding and international contractors in China. One of the Bank's early projects, Lubuge Hydro Power, demonstrated the advantages of competitive bidding, efficient management, advanced technology, cost effectiveness, quality control and early project completion. Since then, China's CI has come a long way in adopting commercial behaviour. However the journey ahead towards a "socialist market" system is still long and arduous. Today, competitive bidding of some sort is widely used in China.

ii) The Emergence of MC.
The Ministry of Construction (MC) was established at the end of the eighties to take the lead role in implementing the new strategies for developing the industry. Prior to that it was a Construction Commission. MC's comprehensive responsibilities include formulating policies, preparing development programmes, monitoring implementation, training personnel, improving construction technology and managing standards, surveys, design and construction institutions. The central organisation of MC is mirrored in the Construction Commission of the provinces and three independent cities. The line ministries at the center also have their mirror image structure in the provinces. The bureaus of the line ministries and the local construction commissions handle the bulk of the construction in China.

iii) The Core Agencies.
The State Planning Commission (SPC), which is responsible for preparing long-term investment plans, has a key role of approving all major projects of the line ministries and municipal governments. Under the current system, the government investment projects are divided into three categories: large-size, medium-size and small-size. Large-size investments which are projects of national scope are becoming increasingly rare; currently about 7% of the total investment falls in this category of projects managed by SPC. The State Administration for the Building Materials Industry (SABMI), a separate agency under the State Council, is responsible for all building materials. SABMI mainly administers the manufacture and mining of the building materials, such as cement, bricks, tiles, lime, glass, etc. The State Reform Commission (SRC) which has
overall responsibility for macro-economic reforms, has been coordinating with MC, SPC and other line ministries to facilitate the reforms in the CI. The People's Construction Bank mainly provides construction credit inside the country. It is responsible for issuing loans to construction projects according to the credit quota issued by the People's Bank of China and reviewing the construction projects at various stages. The Ministry of Foreign Economic Relations and Trade (MOFERT) is responsible for overseas contract business, giving approval for the enterprises to work overseas and taking general administration roles for the Chinese construction enterprises abroad.

iv) The Line Ministries.
As indicated earlier, the various line ministries have the lead role for their respective sectors. Currently, China has 28 ministry level government agencies including ministries, commissions and administration. Each line ministry has its own network of design and research institutes, construction bureaus, and so on. Most line ministry issue their own sector specification, and in some cases construction regulations.

v) The Contractors.
The contractor is always a key entity in any construction activity. As mentioned earlier, China has three distinct construction categories, namely, state-owned enterprises, urban and rural collectives, and rural construction teams. Joint ventures and sub-contracting within these groups is common. There are no private contractors in China yet. SOEs did most of the construction in the past, but their relative share is now decreasing. SOEs which comprise both local units authorized by municipal governments and central ministry-affiliated enterprises, have done most of the construction work of China’s infrastructure projects. For some years, notable progress has been achieved in reforming these enterprises in terms of commercial behaviour, operational autonomy and competitive bidding. However, SOEs still face many unsolved problems, i.e., poor management, old technology and excessive labour force. The Urban Collectives and Rural Teams, on the other hand, have been developing fast; they now account for over 60% of the construction labour force and output value. They are different from the SOEs in that: (a) they are market-oriented and need not rely on assignment of projects, but can more easily look for work in the marketplace; (b) their management has more flexibility with respect to size and workers benefits of the unit; and (c) they are largely motivated by self-interest because the team's profit is firmly linked to the staff members' income and benefit. Their output quality, however, is relatively poor, and the professional and managerial levels are lower than those of the SOEs. They need modern construction technology, better equipment, proper credit, and more-educated personnel to improve their quality of construction. The Rural Construction Teams which previously were the main source of labour force, are increasingly taking on more construction works.
vi) **Foreign Contractors.**
Any foreign contractors wishing to enter China's CI must be approved by MC and concerned municipalities. Up to now, MC and municipal governments have given licenses to 118 foreign contractors who have implemented about 140 construction projects.

vii) **Design Institutes.**
China has a well-established system of design institutes. In 1994, nearly 10,250 design institutes employed 752,000 employees, double that of 1990. About 44% of the employment in this field is under the administration of line ministries, the rest is managed by municipal governments.

viii) **Supervision and engineering consultants.**
The need to develop construction supervision capacity was felt once contracts started to be awarded to "outside" contractors. In the early 1990s, about 400 supervision companies were established and approved by MC and the Ministry of Personnel which employed about 7000 engineers. In 1994, the approved supervision agencies numbered 1,383 and employed 71,000 staff. Some of these new companies are offshoots of ministries and design institutes as the latter had to reduce their respective work force. Engineering consulting is a new and fast growing field in China. While design institutes had done some consulting work in the past, they were not called consultants.

ix) **Associations**
There are two types of associations. The first are contractor's associations that deal mainly with the government to improve the CI and to protect their vested interests. The second are academic organizations that promote academic and technical exchanges. The second type is very common in China: presently several national academic societies and many provincial or sector level societies are involved in civil engineering and architecture. Contractor's associations are somewhat new in China. The International Construction Association was established in 1988 to protect the interests and rights of the member enterprises. The China Construction Association, an association crossing all sectors and regions, was established recently.

x) **Construction Equipment.**
Construction equipment is generally considered to be a weak link in the CI in China. Enterprises mostly own their equipment; leasing or rental facilities are minimal. In general, the available equipment is old and out-dated; much of which is not fully utilized and at times poses a heavy burden to the enterprises. Although about 30% of construction equipment is currently deemed old and out-of-date, it must still be used because the enterprises lack money to buy new equipment.

xi) **Construction Material.**
Construction material generally accounts for 60% of total construction costs. Every year, China's CI consumes 20-30% of the country's total steel production, 70% of cement, 40% of timber, 70% of glass, 50% of paint and 25% of plastic products. Even though the state planning of building materials production and supply through the quota system, has reduced significantly in the last decade overall, about 50% of building materials are still produced and supplied through the State Plan system mostly for large
projects. Currently, cement and plate glass are the two main building materials covered heavily under the quota system. Building material prices, previously controlled by the State have mostly been liberalized according to the market, but given the transitory nature of the price reforms, a rational price structure is yet to develop. Building materials are consuming a huge amount of raw material resources. China is an intensive user of raw materials and transport system compared even to other developing countries.

1.2.2.3 The Business Environment for the CI

i) The Legal Framework.
China has not had a unified construction law in the past, but one is under preparation and is expected to be issued soon. The proposed Construction Law will hopefully cover such topics as qualifications for entrance into the CI, contracts among different sections, quality of construction, investment benefits, market regulations, and procedures in construction projects. The new law will unify existing regulations issued from different sources and govern all activities in the CI.

ii) The Regulatory Frameworks.
A number of regulations have been issued over time by MC and other line ministries on qualification of contractors, design specifications, competition etc. These regulations are available from the China Construction Regulations Compilation published by MC every two years. One of the more successful regulations has been on the qualification for the contractors and design institutes. MC has the right to approve the qualification level of contractor and design institute. Each project, depending upon its nature, will require a certain level of contractor qualification to work on it. Design and construction specifications are usually prepared and issued by the line ministries for their respective sectors.

The responsibility for assuring the quality of the works also rests with respective ministries or local agencies. Each municipality now has a quality control office to monitor the works quality in accordance with the specifications. There is an elaborate system for establishing unit prices and inflation factors in China. There are offices called Quota Stations in most cities and line ministries to revise the quota (unit prices and adjustment factors) periodically -- usually, half yearly or annually.

iii) Qualifications.
Starting in 1989, MC has successfully issued service regulations on the qualifications for administration of construction enterprises, design institutes, and supervision agencies. With the assistance of line ministries and local governments, MC has evaluated all construction enterprises and classified them into five categories according to the requirements of various sectors. This rating system is generally working well to provide a basis for pre-qualifications of contractors for different types of projects. The same kind of qualifications have been applied to the design institutes, supervisors and others.
iv) Competitive Bidding.
Since 1984, China has been pursuing project bidding for contracts. Currently all 29 provinces, cities and autonomous regions are using bidding for contracts to varying degrees. In the line ministries, bidding process is now used extensively; in the Ministry of Communication about 80% of highway projects and all water transport projects are being awarded through bidding. The Ministry of Railways has also started to use bidding in its infrastructure contracts.

Despite the progress mentioned above, the system for competitive bidding is not yet fully established, and needs further improvements. The main obstacle to competitive bidding in China is the old culture where jobs were assigned. Today one witnesses a combination of bidding and assignment taking place at the same time in what may be called 'partial bidding', if there is such a thing. Another constraining factor is the lack of separation in the respective roles of the "owner", the "engineer" and the "contractor", without which true competitive bidding is not possible. Bidding documents, procurement procedures, and qualification requirements for construction enterprises and design institutes are not standardized, and ambiguous in some cases. A new Bidding Law is under preparation which should help remove some of the difficulties.

v) Quality Control.
Construction quality is recognized as a critical problem in China: everyone talks about it. According to the China Building Industry Yearbook, about 80% of the construction undertaken in 1994 was rated as acceptable quality. Quality of construction undertaken by line ministries is generally better than that of provincial enterprises, and the quality of construction by SOEs is considered to be much better than that of the urban and rural collectives. The quality of work done by rural construction teams is the weakest, with associated waste of the construction material. The reasons for low quality of construction range from poor designs, materials, weak management, ambitious completion targets and lack of worker skills etc. Improving quality of construction is one of the major challenges facing China's CI today.

vi) Tax Framework.
The basic tax obligations of the construction industry are stipulated in the state finance and tax regulations. Varieties of taxes and fees are applicable which are separated into engineering construction and management taxes, as well as national and local taxes and fees. The major applicable tax categories are: income tax; operation tax; value added tax; urban construction/maintenance tax; house tax; land usage tax; etc. The tax rates vary within sectors and locations and could be heavy in some cases. Usually the various taxes and fees for a typical civil contract could add up to 20-30% for urban public utility fee and 10-20% for taxes and local fees.
vii) Construction Credit Financing.
Availability of construction credit, or the lack of it, is another major constraint in China. While a number of established Banks like the Construction Bank of China and the State Development Bank are in the business of project financing, this facility is generally available to large national projects only. Short term financing is sometimes available to construction enterprises from local banks, but the terms are usually expensive. Most enterprises, therefore, operate without access to credit facilities. There are several major issues related to the financial aspects of CI: (i) available working capital for construction is rather low - in 1984, construction working capital accounted for about 18% of construction gross output value; recently this figure has declined to about 8-10%. (ii) Contractors usually face serious arrears in payments mainly due to shortage of available funds with the project entity, even at an early stage of implementation.

Today, construction triangular debt accounts for a large portion of China’s total triangular debt. (iii) Available investment funds based on initial cost estimates are usually insufficient. According to recent research in construction projects, about half lacked adequate financing at the time of budget approval. (iv) The system of advanced payments to the contractor is weak. It is important that China improves the financial aspects of contracting by improving the payment system to the contractor and also making construction financing more easily available.

Whereas the contractual, responsibility system has developed rapidly, the corresponding development of managerial skills has not taken place. Construction management is still considered to be a serious problem in China.

On the other hand, profit motivation is so strong that most enterprises work with short term goals. The past system of management still largely affects current construction practices. Serious consideration has not been given by the construction enterprises and design institutes to training. MC has been trying for a number of years to put in place a national programme for different aspects of the construction industry, but the task is daunting. This should be a high priority for China to train project owners, engineers, managers, technicians and workers alike to perform more effectively in a changing industry environment.

1.2.2.4 The Challenges Ahead
i) Reforms in the CI are very difficult, particularly since CI is not a single sector. Many government agencies are involved in regulating the CI and managing construction activities. It is therefore difficult for the CI to cast off often conflicting requirements from various ministries and government agencies in order to realize its potential for effective operation. The MC is not yet in a position to act as the lead agency to coordinate the construction activities in various sectors. While significant progress has been made during the last decade in commercialization of the CIs, the reform process by its very nature is not systematic and a number of conflicting/confusing legal issues still exist.
ii) The Key Challenges faced by China’s CI are summarized below:

1. Improve the quality of construction. In the past, trying to find projects and completing them without cost overrun was the main concern of all involved parties, and the quality of construction was often compromised. A number of quality control requirements have been introduced lately, including a recently approved ‘Quality Promoting Outline’ issued by the Prime Minister to improve the production quality, construction quality and services quality. The outline programme covers measures to strengthen or improve quality consciousness. It is hoped that enhanced government attention would improve the construction quality.

- Improve supporting environment for the CI. This includes the following aspects:
  a) The existing regulatory framework is incomplete and the legitimate interests of the enterprises cannot be protected. The ability of construction associations to improve the CI is limited.
  b) The respective roles of the "employer", the "engineer", and the "contractor" need to be defined and separated. Current overlapping in the roles of owner, contractor, and engineer in government hampers the development of competitive bidding and effective contract management. The required separation in roles will require extensive training programmes.
  c) China needs to establish and clarify the internal procedures for the bidding process and standardize the bidding documents and contract agreements to the extent possible. It is hoped that the proposed Bidding Law would help achieve these objectives.
  d) The many constraints on the financial aspects need to be addressed. This includes the difficulties in obtaining construction finance, funding shortages, slow payments to contractors, numerous and at times heavy taxes, etc.
  e) There is an urgent need to establish an effective mechanism through which construction equipment is made available to contractors.
  f) The production and supply system of construction materials needs urgent improvements. The role of the government needs to shift from one of producer/supplier to that of regulator and quality monitor.
  g) China’s needs for human resource development for the CI are massive. The educational and training needs to produce managers, engineers, technicians and workers are increasing due to growing volume of CI and the rapidly changing business environment, and,
  h) The government needs to re-evaluate the present quota system through which construction prices, adjustment factors and profit margins are determined and make this system more market oriented.
2. **Enhance China CI role in international business.** For China to attain a reasonable share of the international market, it has to overcome its domestic quality issues through intensified training of skilled workers and managers. China could also further open its domestic market to foreign contractors, so that the Chinese contractors could benefit from the experience of competition with foreign contractors at home while availing the "home field advantage".
1.2.3 CONSTRUCTION SCENARIOS IN SOUTH EAST ASIAN COUNTRIES
(Faridah Shaffi et al)

1.2.3.1 ISSUES AND RATIONALE OF SUSTAINABLE CONSTRUCTION

The principal issues affecting the sustainability of construction activities and the built environment were discussed previously in many references (Shafii et. al 2004, Agenda 21 in developing countries, Agenda in sustainable construction in Europe). A summary of the issues and rationales are given in Table 1.4

In general sustainable construction will provide improvements on:
- Site assessment, contaminated brown field site use, remediation and development
- Ecological damage and waste minimisation during construction
- Site design to maximise passive solar, hydrological, ecological and other features
- Selection of sustainable and low impact materials
- Integrated design of site, building structure, insulation, lighting, HVAC systems etc. to minimise running costs, heat losses and energy use
- Consideration of the environmental impacts of buildings throughout their life and continued facilities management to minimise them.

Table 1.4
Principal issues on sustainable construction

<table>
<thead>
<tr>
<th>ISSUES</th>
<th>RATIONALE</th>
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<tbody>
<tr>
<td>Environmentally friendly construction materials</td>
<td>As much as 50% of all materials extracted from the earth’s crust are transformed into construction materials and products. Including energy in use, when installed in a building, they account for as much as 40% of all energy used. Moreover, these same materials when they enter the waste stream, account for 50% of all waste generated prior to recovery.</td>
</tr>
<tr>
<td>Energy efficiency in buildings</td>
<td>The construction, operation and subsequent demolition of built facilities accounts for about 40% of all energy end use and a similar percentage of green house emissions. Moreover, the potential for reducing greenhouse gas emissions in existing and new buildings, is greater than that of any other sector and consequently represents the most significant target for reducing emissions in order to reach the targets laid down in the Kyoto Protocol.</td>
</tr>
<tr>
<td>Construction and demolition waste management</td>
<td>Construction and demolition waste constitutes the largest waste stream by weight. Disposing of these waste materials posed increasing difficulties therefore emphasis needs to be placed on waste minimisation and recycling</td>
</tr>
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</table>
### Water conservation

The operation of building places a strain on raw water reserves while waste water and sewage needs to be treated before being returned to water courses. Ways of conserving water and more efficient and effective means of treating waste water need to be developed taking better account of land use planning for such facilities.

### Health in buildings

The quality of the internal environment of buildings is an essential element to the health of its occupants. Problems caused by damp and mould can be avoided through good building practices. Bio-climatic considerations and good ventilation can also reduce or even eliminate the need for air conditioning in summer whilst reducing the amount of energy for heating in winter.

### Transportation

Studies have demonstrated that relatively compact towns and cities well served by public transport system are more energy efficient than cities with relatively low urban density (urban sprawl).

### Urban sustainability

While construction activities and the operation of built facilities are only on of many aspects linked to urban sustainability, the quality and efficient operation of buildings and infrastructure are of fundamental importance.

### Sustainable architecture

There is a lot that can be done to improve the overall performance of buildings by implementing principles and measures in the design process leading to sustainable architecture.

### Social impacts arising from construction and the built environment

Sustainable construction can improve the living context and relationship between citizens and their environment in rural and urban areas and contribute effectively towards social cohesion and job creation, promotion of cultural tourism and regional economic development.

The economic dimensions of sustainability includes the creation of new markets and opportunities for sale growth; cost reduction through efficiency improvements and reduced energy and raw material inputs and creation of additional added value.

The sustainability criteria for evaluating the impacts of a building project are given by various sources like OECD, WBDG, LEED, BREEAM (Shafii et al., 2004). The standard criteria used are:

- site design and planning,
- energy use
- water management
- materials, resources, and waste
- indoor environmental quality.
Sustainable construction seeks for proper management of all aspects of building design, construction, operations and use which can dramatically reduce the overall cost of a building throughout its life, without necessarily costing more at the design and building stages when strategically planned. Additionally, sustainable construction improves the performance of building projects at every stage, both in financial and environmental terms.

1.2.3.2 ACHIEVING SUSTAINABLE DEVELOPMENT AND CONSTRUCTION IN SOUTH-EAST ASIA (Faridah Shaffi et al)

1. ASEAN Vision 2020

The long-term sustainable development framework for the sub-region has been fully in place since the 1997 ASEAN Summit that reaffirmed the aims of the association and spelled out its vision for the region by year 2020. Since then, ASEAN Vision 2020 has been defined and translated into concrete goals, targets and activities mainly through the Hanoi Plan of Action. Besides eradication of poverty, ASEAN Vision 2020 envisaged:

“a clean and green ASEAN with fully established mechanisms for sustainable development to ensure the protection of the region's environment, the sustainability of its natural resources, and the high quality of life of its peoples.”

Construction was included in the goals of ASEAN Vision 2020 with focus on energy security, utilisation of natural resources, management of energy demands all taking into consideration of the environment. Other initiatives include the development of regional water conservation programme and enhancing regional efforts in addressing climate change.

2. Construction scenario In Southeast Asia

Sustainability is still a relatively new concept for the construction industry in the developing countries of Southeast Asia. A number of Southeast Asian countries have yet to formulate a sustainable development strategy and action plan; others are still establishing the basic legal framework for the environmental protection and management, and for the environmental impact assessment. Indonesia, Myanmar and the Philippines have prepared their Agenda 21 national sustainable development strategies. Singapore has a Green Plan; Thailand a National Economic and Social Development Plan; Vietnam a National Strategy for Environmental Protection to 2010, and Malaysia a Vision 2020 (Shaffi et. al 2005).

In the developing countries of Southeast Asia where societies and governments are faced with extreme survival issues, a management approach to development with little regards for long term impacts on the environment and the society are commonly adopted. Often, sustainability tend to emphasise on the development for eradication of poverty and provisions of basic housing to the lower income community. Hence, in regions marked by poverty and economic problems, it is very difficult to establish environmental sustainability as a national priority. Common issues surrounding construction in the region are discussed in the foregoing paragraphs.
i) Land degradation
Fragile eco-zones in many countries are being destabilised because of construction activities. Occurrence of floods, land and mud slides caused by construction on delicate hill slopes and wet lands testify to the vulnerability of the environment to interventions of the construction sector. Physical destruction of land is also caused by extraction of sand and gravel for concrete and extraction of clay for the production of bricks.

The rate of deforestation is extensive due to lumbering, land clearing for farming and building construction, which has even penetrated restricted areas like forest reserves on hill sided and highlands. This resulted in increase instability of the natural landscape and increased in erosion. Rational decision-making and implementation of transparent and effective strategies are needed to solve the conflicts between land use and the construction sector are urgently required and should be given high priority by decision makers.

ii) Depletion of non-renewable Resources
The construction industry is a major consumer of natural non-renewable resources such as metals, fossil fuel and non-renewable energy resources. Construction sector activities and the manufacturing processes of basic building materials such as cement, steel, aluminium, glass, bricks and lime are highly energy dependent where fossil fuel is a major non-renewable resource require to generate huge amount of energy. The world-wide recognition of the limited supply of fuels and the high degree of dependency on energy by the construction industry has lead to regional efforts in search of alternative energy sources and renewable sources. Malaysia, Thailand, Vietnam are known to have invested in the search of alternative energy resources for construction (UNESCAP). Consequently, as fossil fuel become more and more precious fuel wastage are prevented, and the overall energy efficiency become the overriding criterion in the design and operation of buildings. Energy efficiency is seen as the most attractive factor why stakeholders invested in sustainable building and construction.

iii) Use of Brown Sites for Construction
In some countries in Southeast Asia, in order to relieve the pressure on undeveloped land, the use of previously built-on and contaminated sites is always encouraged and has become common practice for developments. The contamination left a significant toxic legacy in the soil, eco-system and food chains thus becoming potential threats to human health. The need for decontamination of these sites in line with statutory regulations is vital to ensure that any health risks are either removed or reduced to within acceptable limits.

iv) Construction Practices and Procurement
Due to the fragmented nature of the construction industry, a number of countries experience difficulties in the execution of construction projects; this being due to factors such as inadequate capacity for the planning and design of projects hence the difficulty of obtaining tenders, inefficiency in planning, design and construction, and difficulties of obtaining materials. Project delays are common and represent a physical constraint on development.
In many cases where construction projects are implemented, the cost is often higher than anticipated. Factors such as poor estimates, variations by the client, inappropriate technology and design, inappropriate tendering and contractual procedures, inefficient on site supervision and construction management contributed to these effects.

Also, in several countries the import content of construction activity is high. For example, machineries, energy and raw materials. This may comprise up to 60 percent of materials and a significant percentage of professional, managerial and supervisory skills. The increasing dependence on imports has imposed a severe strain on the balance of payments and fuelled inflation.

v) Skilled Labour
The construction sector requires a higher percentage of skilled labour than manufacturing. In most developing countries of South-East Asia, there is a severe shortage of all kinds of skilled labour for the construction industry. A large percentage of the skills required are not available locally. Additionally, apprenticeships and vocational training schemes appear to be inadequate in both quantitative and qualitative terms. As a consequence, the local training contracting industry is not sufficiently developed. The degree of local participation in contracting varies, but it is common for local contractors to operate only on small residential projects while the larger industrial and commercial projects are awarded to foreign-based construction firms.

vi) Building Materials Shortage
The local production of building materials in countries of South-East Asia mostly are not sufficient to meet the demand for the construction sectors. In many countries that produce cement, there are severe bottlenecks in the supply of this materials cause by demand fluctuations and lack of capital for the build-up of supplies, or inputs. In cement producing countries, cement is often regarded as a local product even when 60 % of the production cost is due to imported energy.

Infact, the biggest factor influencing climate change is concrete and steel. Cement production is the biggest contributor to greenhouse gas emissions. Although cement makes up only 12-14 % of the final concrete mix, further embodied energy comes from the transportation and production of aggregates and in the case of reinforced concrete the manufacturing of steel

Shortage of other locally produced building materials, such as aggregates, bricks and tiles are also experienced. In some countries where there is a monopoly in supply, shortages have been deliberately created in order to force up the price. The scarcity of building materials has also affected development plans in other sectors, including agriculture, health and education. The steep rise of land and building materials has effectively removed decent housing from the reach of low and medium income groups in most countries in the region.

vii) Construction Design Systems and Technologies
Most developing countries had systems or frameworks inherited from their various colonial administrators and they found that some of these systems are inappropriate for their own current needs (Latham Review, 1994). Conventional designs of these types suffer from various limitations for example, lack of thermal comfort and poor ventilation. Thus attention is now more focus to include building features appropriate to tropical and local conditions. Locally produced systems and technologies have now been given more consideration in search of sustainable solutions.
The importance for improvements in air quality and day lighting for buildings have been given more recognition for healthier and happier occupants in workplaces and residential buildings. The SARS crises in South-East Asia have great impacts on design for indoor air quality especially for public buildings and hospitals, which may greatly influence health.

Many building design professionals are now beginning to get involve in “sustainable design” in response to expressed interest or requirements from their clients.

viii) Health and Safety in construction
Occurrences of fatalities from construction injuries are far more common in developing countries like South-East Asia than in the developed world and has remain high over the years; pesticide poisonings remain common; and provisions of clean water and air are major challenges as these regions industrialised and the population concentrates in urban centres.

Many countries in South-East Asia have enacted regulations and established government agencies aimed at improving workplace safety and preventing occupational diseases and injuries, however fatalities are still high. Resources focused on these goals are increasing significantly, but still fall far short of needs. The countries lack expertise in all components of occupational health including medicine, nursing, industrial hygiene, and toxicology may be one cause that contribute to the high statistics.

1.2.3.3 BARRIERS TO SUSTAINABLE CONSTRUCTION IN SOUTHEAST ASIA
Most countries in South-East Asia are facing with the growing environmental problems that have been the natural consequence of economic development. Malaysia is one of the few countries in the world that has actively attempt to balance environmental conservation with economic development.

In general, the process of driving sustainability in construction in the region is slow. Studies (Shafii et al 2005) showed that the following points contributed to barriers in sustainable construction.

(a) Lack of Awareness on sustainable building
Sustainability is still a relatively new concept for the construction industry in the developing countries of South-East Asia. Generally, there is an increase in awareness on sustainable building and construction in the region however it is not across the whole spectrum of the construction sector.

(b) Lack of Training and Education in Sustainable Design and Construction
Many important stakeholders are not even aware of the concept of sustainable building and so are naturally resistant to change. Hence the greatest barrier is the lack of understanding of the need for sustainable design.

(c) The higher cost of sustainable building Option
Many stakeholders are in the opinion that the construction industries won’t go green unless it saves them money somehow. Majority of the clients have not been interested in any sustainable features except for energy efficiency aspects, which is believed to lead to an immediate paybacks.
(d) Procurement issues
Undue emphasis on lowest price rather than best value impacts negatively on industry performance in terms of time, cost and quality. It affects the sustainability of enterprises and their ability to develop and retain a skilled workforce, and to actively promote safety, health and the environment.

(e) Regulatory barriers
Public policies and regulatory frameworks do not encourage the development of the construction sector.

(f) Lack of Professional capabilities/Designers
SBC requires another area of sub-specialisation for architects and engineers. Sustainability takes too much time to learn and design. Clearly the architecture and design curriculum in existing schools and construction education is not sufficient to prepare future architects and engineers to understand such roles and responsibilities.

(g) Disincentive Factors over Local Material Production
One of the disincentive factors to SBC is the involvement of the government in the supply of building materials. In order to meet the demand for building materials, many governments in SEA have played an active role in the supply of basic building material such as cement.

(h) Lack of demonstration examples
More demonstration examples are needed to convince stakeholders to adopt sustainable building and construction options.

1.2.3.4 RECOMMENDATIONS

The challenges of the construction sector are not confined only to find the balance between environmental, economic and social solutions but also attempt to favour decision without regrets in the life cycle or construction phase of the built facilities.

The industry will have to adapt to these new and emerging construction markets which have environmental and social dimensions. As highlighted in sustainable construction for Europe (2001), construction businesses will be expected to integrate and consider the issues valued by others at national, regional and community level where the driving forces constituted a mixture of political, social and market forces thereby requiring products responding to genuine need and concerns. Achieving sustainability means require the involvement by government and all construction stakeholders as actions for sustainability involve both policy and financial support.

In responding to these challenges and, for the construction industry in the region to move towards sustainability, the following recommendations have been proposed.

(a) Education and training should incorporate sustainable development concepts and made it well known and accepted by all people. Education is seen as an important tool in promoting sustainable development and improving the capacity of the people to address environment and development issue. This will increase the level of awareness both among the actors in the entire construction process, as well as the general public.
(b) Initiatives involving planning and construction should be through adapted regulations, standards or fiscal measures and incentives.

(c) Building owners and clients should play important roles in disseminating sustainable construction.

(d) Understanding sustainable construction through common definitions and language to address the issues.

(e) Designers adopting an integrated approach to design (integrated design approach).

(f) Improvement of the building construction process as opposed to the traditional methods.

(g) Building users should consider the environmental issues as one aspect of productivity.

(h) Manufacturers of building materials/products taking life cycle considerations as the basis of product development.

(i) Building maintenance organisations should consider environmental consciousness as a factor of competitiveness.

(j) The development of tools to help in decision making.

Some of the recommendations indicated above were general points discussed in other previous references. In summary, the recommendations made above indicate the need of capacities, technologies, tools and broad involvement of construction stakeholders in order to achieve sustainability in construction.

1.2.3.5 CONCLUSIONS

Countries of South-East Asia face very different sustainable development challenges, but at the same time confront common challenges typical of industrialising and urbanizing economies. These and other challenges make the pursuit of sustainable development and construction in South-East Asia particularly challenging. The lack of awareness, training and education and ineffective procurement systems are among the major barriers for sustainable construction in the region. In some countries public policies and regulatory frameworks do not encourage the development of the construction sector. Besides the needs for capacities, technologies and tools, total and ardent commitment by all players in the construction sectors including the governments and the public at large are required in order to achieve sustainable construction in South-East Asia.
1.2.4 CONSTRUCTION SCENARIOS IN UNITED KINGDOM (UK)

1.2.4.1 Background

The contribution from the UK construction industry towards the economy and towards the quality of life of the society is significant (European Construction Platform, 2005; Fairclough, 2002). Despite these influences towards the economy and the society, the UK construction industry is being criticised for its inefficiencies and has been identified as under-performing (Fairclough, 2002; Egan, 1998; Latham, 1994). One of the main reasons behind the under performance of the industry is recognised as insufficient research and development (R&D) activities and innovations (Dulaimi et al, 2002). Macmillan (2002) and Fairclough (2002) argue that research and innovation have a significant role to play in performance improvement, of the industry while providing benefits to its stakeholders. Therefore, prioritising R&D activities, creating longer term R&D programmes and increasing investment on R&D activities have been identified as vital factors for the growth of the construction industry (Hampson and Brandon, 2004; Fairclough, 2002).

"R&D have become more complex, as they involve many parties and have a wide range of, often interrelated, technological, market and organisational options to choose from under constrained conditions" (Kerssens-van Drongelen et al., 2000, p. 113). R&D activities require many resources ranging from human to technical which require proper utilisation. The accountability for these resources is being questioned by the management as well as by the shareholders (Wood, 1998; Nixon, 1998). As a result of that, a growing interest can be identified in managing, controlling, and monitoring R&D activities (Bone and Saxon, 2000). In this context, the use of performance measurement (PM) mechanisms benefits the R&D activities by evaluating the successfulness of their activities.

1.2.4.2 Construction research and development

Importance of construction research and development

The contribution from R&D for the development of the construction industry is immense as it leads the path to enhance the effectiveness of construction organisations and to raise the international competitiveness through technological advances and managerial developments (Hampson and Brandon, 2004). To remain competitive in the market, organisations should make sure their customer expectations are properly met, and future demands of the customers are properly addressed. In this respect R&D acts as a valuable "input" for the development of the organisations (Business Link, 2007). R&D activities are needed to find new ways to produce goods and services with less time, at lower cost, yet with increased quality and to develop new products, materials, construction methods, and processes (DTI, 2004; Gann, 2000). The demand for housing facilities, renovation of infrastructure, preservation of cultural heritage, reduction of traffic congestions require construction industry to engage more in R&D (Plooij-van Gorsel, 2000). The contribution from R&D is recognised in addressing the sustainable goals of the construction industry. Development of environmental friendly products and materials, waste management methods, energy efficient construction processes and building designs etc. are some of the outcomes of R&D applications in achieving the sustainability (European Construction Platform, 2005). Moreover, the dissemination of research results benefits the construction industry as a whole as well as its clients (Seaden, 2002).
R&D activities not only generate tangible benefits but also generate intangibles benefits such as creating informal contacts, memberships in international networks, and knowledge transfer mechanisms etc. Some of the intangible benefits of research activities are implied yet unspoken between stakeholders involved in research activity (Gilkinson and Barrett, 2004). People take on board the knowledge and good practices from research workshops, seminars to reinforce the processes of their own companies (Gilkinson and Barrett, 2004). This support the view of Cohen and Levinthal (1989, 1990) who state that the R&D activities improve firm’s absorptive capacity i.e. the ability to identify, absorb and exploit new information from internal and external environment. This led organisations to strengthen their man power and improve the organisational capabilities, leading to increased productivity and efficiency and have a competitive advantage in the market. Gilkinson and Barrett (2004) have observed that such knowledge transference has enabled organisations to change their processes, strategies, and reconsider the existing processes to reduce waste, cost and time. Moreover, these intangible benefits of R&D work would help the research community in initiating successful research partnerships, and thereby initiating and engage in successful research activities to address the problems of the construction industry as a whole.

However, despite the importance of R&D, many people question its value. First, some of the outcomes of R&D are not accepted universally (Twiss, 1992). The study carried out by Gilkinson and Barrett (2004) revealed that some of the industrial partners’ involved in their study claimed the research activities they were involved in had no impacts on their business. Additionally, R&D activities incur overhead costs in marketing, additional time and resources to search the commercial opportunities in various research proposals (Seaden, 2002). Courtney (1999) claims that even though the costs of research are certain, rewards of research are uncertain. Furthermore, as a result of the risk associated with the R&D and the utilisation of resources, some tend to view R&D as an alternative rather than a core part of their business (Roberts, 2002).

From the above literature review, it is evident that R&D plays a vital role in properly addressing the challenges placed on the construction industry. Though it involves a risk component, its role in fostering wealth in society and the construction industry is widely recognised. In some instances R&D may not rapidly deliver tangible outcomes, nor generates profit pools but, there are intangible benefits to the organisations and to the individuals in the long run to develop their businesses and carriers (see Gilkinson and Barrett, 2004). Further studies have revealed positive relationship between the investment of construction R&D and the productivity of organisations (Hampson and Brandon, 2004; Roberts, 2002). Thus, effective management of R&D activities to minimise the risk and making the returns of R&D more calculable to device clear links between investments and profits can be highlighted to enhance the R&D effort within the construction industry. Having identifying the role of R&D within construction, the next section defines construction R&D.
What is construction research and development?

Construction research varies from highly technical studies of properties of materials to "soft" research such as management relationships (Courtney, 1999). Paulson (1975) identifies four areas of construction research. They are manpower and organisational development (education and training, evaluation of management productivity etc.), management methodologies (cost engineering, planning, and scheduling etc.), innovations in construction methods (prefabrication and standardisation) and construction industry dynamics (how can the resources of construction best be used, economic modeling, long range forecasting, and environmental policies).

Courtney (1999) identifies reasons to carry out construction research activities based on their output. They are:

- to underpin and extend generic knowledge, with the aim of improving the product type (building, bridge, etc.) or the process leading to it;
- to support the development or implementation of public policy (public health safety, environmental or consumer protection policies);
- to secure competitive advantage by a firm or industry sector; and
- to understand or address the requirements of a particular project.

Similarly to Courtney (1999), Fraser and Fraser (2001) identify four types of construction related research; basic research which is intended to create new knowledge, research into the society impacts of construction activities including town planning, design, environment and employment issues, research into new processes aimed at improving efficiency and safety, and research into new product development.

It appears that the above categories take into account the customer satisfaction up to or above expectations by developing new or improved products/processes or services, and delivering the construction output within cost, time, and quality parameters. Not limiting to addressing the customer expectations, above classifications also focus on the requirements of regulatory bodies and thereby fulfilling the wider community needs by addressing environmental planning, health and safety issues, resources constraints of the industry etc. In addition to that, Paulson (1975) and Courtney (1999) identify the need of improving the in-house capabilities and to be competitive in the market through effective and efficient construction activities. Furthermore, Paulson (1975) identify the need of management methodologies to improve administration of the construction R&D activities.

By synthesising the above, construction R&D can be defined as the systematic investigation to establish new or improved products, processes, management methodologies to address:

- customer needs;
- resource, environmental and economic constraints;
- government regulations, public policies and thereby to upgrade the quality of life of the society; and
- competitive edge of the construction firms.

The above section arrived at a definition for construction R&D. With this premise, this below section identifies the major contributors for construction R&D work.
The construction research base

The largest group of construction research providers in UK is the Universities (Cripps et al., 2004). The research carried out at universities is more disciplined and focused on the long term research issues (Fairclough, 2002). Universities have complex and multi objectives which primarily target the society as a whole (Seaden, 2002). The universities have the opportunity and need of studying a particular issue deeply, rigorously and over a long period of time (Barrett and Barrett, 2003). Therefore, the research carried out within universities do an in-depth analysis about the background to the research problem and is well structured, does not generate fast solutions but consumes a considerable time. Regardless of the aforementioned advantages of University based R&D, they are often accused by the industry for not addressing the real life organisational problems, and for being low level of relevance/applicability to the industrial needs (Gilkinson and Barrett, 2004; Barrett and Barrett, 2003). The inconsistency between the research outcome of universities and the industrial needs has negatively affected the appropriate usage and implementation of the research outcome.

In terms of the construction organisations, McCaffer (2004) and Cripps et al. (2004) claim that they are not research oriented and too small to fund and to create their own research infrastructure. Most of the construction organisations do not see much financial benefits from the R&D activities (Cripps et al, 2004; Courtney, 1999). In addition to that, lack of professionally qualified people lias hindered the capability of these organisations to engage in R&D work (Gann, 2001; Brandon et al., 1999). Fairclough (2002) argues that even though some construction organisations show the desire to engage in R&D activities, their size, day to day construction activities has prevented them from engaging in long term, formal R&D in a structured manner. This is supported by the findings of the Print (1999, p. 4) who stated that "construction organisations are head down focusing on today's problems without having time or need to look to solve tomorrow's problems".

However, Brandon et al (1999) assert that construction organisations have a better perspective regarding the practical problems within the industry, and the ability of implementing research outcome and acting on the results. The research carried out in construction organisations target their own research needs and address the problems in a more practical approach. This findings are further supported by a study carried out by Seaden and Manseau (2001) which revealed that research initiated and directed by the government policies are becoming less popular within the construction industry due to the perception that "government does not always knows the best". In contrast, the industry initiating R&D work has been considered as more productive.
1.2.4.3 UK Construction Industry needs 348,000 new recruits by 2010

UK’s biggest industry to have 2.8 million workers by 2010 Construction growth to shift from North to South and East Professionals to make up almost half the new recruits

The Blueprint for UK Construction Skills 2006-2010, published today by Construction Skills, forecasts that 348,000 more employees will be needed for the construction industry by 2010 to meet expected demand - an average of 87,000 new recruits per year.

In the most comprehensive set of reports ever published for the industry, the Construction Skills Network lifts the lid on predicted construction demand UK-wide and provides detailed analysis of expected workflow and project type, and forecasts for the occupational skills requirements region by region between 2006 - 2010.

The Construction Skills Network confirms the good news that the UK construction industry will continue to experience strong growth, with construction output expected to rise by 12.7% by 2010. By identifying exactly how many new recruits in each trade will be needed over the next five years to meet additional demand and account for industry leavers, the report also provides the industry with the information needed to ensure that every construction programme can be resourced and delivered.

Although, at 11,090 new recruits every year, the highest annual skills requirements UKwide is for workers with wood trade skills (e.g. carpenters and joiners), there is also expected to be a high demand for managers, clerical staff, architects, engineers, and other design and technical professionals. In total, the number of “white collar” workers the industry needs to recruit every year to 2010 is forecast to be over 36,400 – almost 50% of the annual workforce requirement.

The report found that construction growth is expected to shift from the North to the South and East, driven by strong growth in the new build sector that includes some £36 billion of large (£100m+) projects, including the Kings Cross redevelopments, ports projects at Shellhaven, Felixstowe and Harwich, East London Line extension, Victoria Station redevelopment and the Olympics and Thames Gateway construction programmes.

- The East of England is set to experience the highest rate of employment growth with an increase of 18.6% by 2010, with London at 11% and the South East at 14%.
- Growth in the North is expected to slow: construction employment in the North West is expected to grow by 5% between 2006 and 2010, the North East by 6%, Yorkshire and Humberside by 6% and Scotland by 8%.
- Wales and Northern Ireland will also see strong growth. Construction industry employment in Wales will rise 12%, driven in part by the £3.2 billion Welsh Quality Standards Scheme, and a 13% increase in Northern Ireland can be attributed primarily to the large public investment programme planned for the region over the next 10 years.
Contrary to popular myth, the indications from the data at this stage are that delivering the Olympics programme will not impact on the successful completion of regional construction projects. Although the Olympics programme is high profile, has a value of around £2.5billion over the next seven years and will need an average workforce of 5,000 each year (peaking at 9,300 in 2010), it is not enough on its own to significantly boost output. The Construction Skills Network estimates that the Olympics programme will account for only 0.2% of the UK’s total construction workforce between now and 2010.

- The report also provides insight into the different types of construction project the new recruits will be needed to work on. It reveals that:
- Private output growth is expected to exceed publicly funded construction programmes.
- Public house building is forecast to see the strongest growth of any sector as government and private house builders seek to deliver higher levels of affordable and key worker housing, particularly in London and the South East.
- Robust growth is expected for the commercial sector, accounted for by the continued recovery for the offices market and further increases in PFI/PPP health and education work.
- Infrastructure output is also forecast to be above the industry average, driven by projects such as the widening of the M1 and M25, the five year national water and sewerage programme, nuclear decommissioning and, of course, works for the Olympic Park and Village.

Sheila Hoile, Skills Strategy Director, CITB-ConstructionSkills comments: “The Construction Skills Network provides the construction industry with its first truly authoritative basis for planning recruitment strategies, education and training mechanisms and funding delivery. For contractors and consultants, the data can be used to inform what type of building they should be designing and constructing for the client, and how best to avoid high labour costs. And it gives Government the tools to decide where it needs to focus policies and funding to avoid skills shortage and wage inflation”

“Construction Skills is already successfully bringing young people, apprentices and graduates into the construction industry and I’m pleased to say there is no shortage of applicants to the industry. One of the biggest challenges is to ensure that new and existing workers have the right qualifications, but we cannot do this alone. We call on the industry to help us build for the future by making investments in training, taking on apprentices and working with us to qualify the largest workforce in the UK.”

Phil Hope (Member of Parliament), Parliamentary Under Secretary of State for Skills, comments: “Raising skill levels is absolutely essential to sustained economic success. The Construction Skills Network is an excellent example of the sector skills planning we have introduced under our skills strategy. We want industry setting the pace, identifying the skills challenges and opportunities and driving a demand led system which puts the right training provision in place and effectively targets our investment in training.”
David Adamson, Smarter Construction Director, Office of Government Commerce, comments: “The Construction Skills Network is an extremely valuable tool for our scenario planning and will also help us to identify and plan for regional, trade and sector pinch points. We are grateful to the construction industry for providing data which will become vital in effectively managing public sector demand and securing best value from our procurement”.

The Construction Skills Network, created in 2005, represents a radical change in the way research, data and information on the future employment, skills and training needs of the construction industry is collected and produced. Created by Construction Skills, the Sector Skills Council for Construction, with the technical expertise of Davis Langdon and Experian, it draws in the knowledge and experience of Government, Sector Skills Councils, construction companies, education and training providers, regional agencies and customers across the UK. This unique collaboration means the Construction Skills Network provides, as near as possible, a consensus view of the current and future skills and training needs of the industry.

Table-1.5
Average annual requirement by occupation: 2006-2010

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Average annual requirement 2006-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managers</td>
<td>10,530</td>
</tr>
<tr>
<td>Clerical</td>
<td>8,610</td>
</tr>
<tr>
<td>Engineering, IT and other Professionals</td>
<td>4,790</td>
</tr>
<tr>
<td>Technical Staff</td>
<td>3,260</td>
</tr>
<tr>
<td>Wood Trades</td>
<td>11,090</td>
</tr>
<tr>
<td>Bricklayers</td>
<td>4,730</td>
</tr>
<tr>
<td>Painters and Decorators</td>
<td>3,620</td>
</tr>
<tr>
<td>plasterers</td>
<td>1,780</td>
</tr>
<tr>
<td>Roofers</td>
<td>1,750</td>
</tr>
<tr>
<td>Floorers</td>
<td>1,510</td>
</tr>
<tr>
<td>Glaziers</td>
<td>990</td>
</tr>
<tr>
<td>Other Specialist Building Operatives</td>
<td>2,370</td>
</tr>
<tr>
<td>Scaffolders</td>
<td>900</td>
</tr>
<tr>
<td>Plant Operatives</td>
<td>1,780</td>
</tr>
<tr>
<td>Plant Mechanics/Fitters</td>
<td>1,920</td>
</tr>
<tr>
<td>Steel Erectors/Structural</td>
<td>1,150</td>
</tr>
<tr>
<td>General Operatives</td>
<td>1,510</td>
</tr>
<tr>
<td>Electricians*</td>
<td>8,130</td>
</tr>
<tr>
<td>Plumbers*</td>
<td>5,330</td>
</tr>
<tr>
<td>Logistics</td>
<td>580</td>
</tr>
<tr>
<td>Other Civil Engineering Operatives</td>
<td>1,390</td>
</tr>
<tr>
<td><strong>Total (SIC 45)</strong></td>
<td><strong>77,720</strong></td>
</tr>
<tr>
<td>Architects and Technical Engineers</td>
<td>9,280</td>
</tr>
<tr>
<td><strong>Total (SIC 45 and 74.2)</strong></td>
<td><strong>87,000</strong></td>
</tr>
</tbody>
</table>

Source: Construction Skills Network Model, 2006; Experian.

- Numbers are rounded to the nearest ten and may not sum to the total.
- As part of SIC45, plumbers and electricians working in contracting are an integral part of the construction process.
### Table-1.6
UK construction output growth rate comparison, plus total employment figures

<table>
<thead>
<tr>
<th>Region</th>
<th>Total output growth 2000-2004</th>
<th>Total output growth 2006-2010</th>
<th>Number of new recruits required annually 2006-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>East of England</td>
<td>19.0%</td>
<td>22.8%</td>
<td>14,590</td>
</tr>
<tr>
<td>East Midlands</td>
<td>28.5%</td>
<td>11.3%</td>
<td>7,650</td>
</tr>
<tr>
<td>Greater London</td>
<td>10.8%</td>
<td>18.2%</td>
<td>9,520</td>
</tr>
<tr>
<td>North East</td>
<td>16.9%</td>
<td>5.0%</td>
<td>4,360</td>
</tr>
<tr>
<td>North West</td>
<td>27.7%</td>
<td>6.6%</td>
<td>7,300</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>-8.7%</td>
<td>18.8%</td>
<td>2,620</td>
</tr>
<tr>
<td>Scotland</td>
<td>3.7%</td>
<td>8.0%</td>
<td>6,310</td>
</tr>
<tr>
<td>South East</td>
<td>12.0%</td>
<td>18.2%</td>
<td>11,710</td>
</tr>
<tr>
<td>South West</td>
<td>32.4%</td>
<td>8.0%</td>
<td>4,920</td>
</tr>
<tr>
<td>West Midlands</td>
<td>8.3%</td>
<td>7.7%</td>
<td>7,050</td>
</tr>
<tr>
<td>Wales</td>
<td>29.5%</td>
<td>12.4%</td>
<td>5,870</td>
</tr>
<tr>
<td>Yorkshire and the Humber</td>
<td>32.5%</td>
<td>7.5%</td>
<td>6,150</td>
</tr>
</tbody>
</table>

### Table-1.7
UK Construction output 2006-2010

<table>
<thead>
<tr>
<th>Category</th>
<th>Annual percentage change 2000 - 2005</th>
<th>Annual percentage change 2006 – 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public housing</td>
<td>6.4%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Private housing</td>
<td>4.9%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>-3.4%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Public non-housing</td>
<td>7.8%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Industrial</td>
<td>-0.8%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Commercial</td>
<td>0.3%</td>
<td>4.5%</td>
</tr>
<tr>
<td>All new work</td>
<td>2.1%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Repair and Maintenance</td>
<td>3.9%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Total Work</td>
<td>2.9%</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

About Construction Skills and CITB-Construction Skills

Construction Skills is a partnership between CITB-Construction Skills, CIC and CITB Northern Ireland. It is one of the Sector Skills Councils tasked by the Government to implement UK-wide Sector Skills Agreements between the bodies responsible for delivering training in the UK and those that demand it.

CITB-Construction Skills provides assistance in all aspects of recruiting, training and qualifying the construction workforce. It also works with partners in industry and government to improve the competitiveness of the industry as a whole.
About the Construction Skills Network

The data and conclusions revealed in The Blueprint for UK Construction Skills 2006-2010 report is the result of the most thorough and comprehensive data analysis and consultation ever conducted for the construction industry. First a series of Regional Observatory Groups and one National Group, with members drawn from Government, education and the construction industry, reviewed and tested a series of assumptions and forecasts about skills, productivity and capacity based on data, research and intelligence shared by industry bodies, Sector Skills Councils, Summit Skills and others. The Observatory Groups fed back their insight into what was really happening on the ground in every UK region, and this was then built in to the forecasting programme. Their invaluable local knowledge and experience helped ensure information never before accurately factored into labour market forecasting was taken into account. Details of specific projects, project types and sectors, completions and apprenticeships and the inflow and outflow of labour across the industry, region by region, were all built into the model, and the results were then re-assessed by the Observatory Groups. The result is the most exhaustive and comprehensive analysis of supply and demand across the construction industry ever and one which gives us all the confidence to plan our future skills needs and target the investment needed at both a national and regional level.
1.3 BACKGROUND AND RATIONALE OF THE STUDY

Construction sector is the second largest after agriculture sector in India in terms of employment of manpower and deployment of Five Years Plan's (FYP) funds. However, it is an unorganized sector where principles of management were rarely applied till recently.

Some of the characteristics of construction projects are as follows:-

1) Each construction project is unique where all contingencies cannot be anticipated.
2) Majority of construction projects are in remote areas where any facilities are available for education, entertainment, healthcare, shopping, etc. are hardly available.
3) Construction is a temporary undertaking. Once the project is handed over to the client, all the men and materials etc. are shifted or disbanded.
4) Majority of contractors were illiterate till recent times. Most contractors do not enjoy a high social reputation. Contractors are not professional managers but they are “Thekedars” who’s objective is only to make money.
5) The working system in materials and technology is mainly traditional. Very few researches are done for improving the situation.
6) The Characteristics of Human Resources in construction projects are as follows:
   i. Labourers are illiterate.
   ii. There is a very high turnover of Junior and Senior Engineers.
   iii. Labourers are temporary job holders.
   iv. Demand for construction labour is effected by seasonality.
   v. Labourers are migrant.
   vi. Labourers belong to contractors and subcontractors and not the client or employer

In this situation no organization can dream of doing research in human resources.

Construction organizations suffer huge losses because of the huge attrition rate of their employees specially at bottom and middle level of management.

Also the executives are constantly under tremendous stresses for achieving objectives of time, cost, quality and safety, specially after globalization and liberalization. This leads to a frustrating situation in construction organizations.

Pestonjee in his book “Stress and Coping -The Indian Experience” (1992) says that many researches have been done on the topic for special groups like executives, public sector vs. private sector, supervisors, air traffic controllers, entrepreneurs, working women, teachers and students, police professionals, etc. but no research is done on construction professionals.
Hence the research is done with the following objectives:

1) Understanding of the stresses developed by the non professional way of designing various roles and coping up strategies for these stresses.

2) To understand the problems associated with Organizational Role Efficacy and Organizational Role Stress.

3) To suggest Role related interventions to overcome the dilemmas.

4) To study and cope up with learned helplessness.

Now-a-days construction industry has started to realize the importance of HR practices. In the following few pages results from three M.Tech. dissertations are presented. These dissertations were carried out by Pranav Mehta (2008), Chitra Bedekar (2008) and Anuj Bawa (2008).

1.3.1 In the study undertaken by Mehta, the focus was on ORS and RE dimensions amongst construction engineers. The sample comprises of twenty engineers from five construction organization out of which six engineers were at the middle level and fourteen engineers were at the bottom level.

The major findings were:

i) In case of Individual ORS dimension, there is significance difference in values of these dimensions. The value varied from person to person, from organization to organization and from the position of individual in an organization. The variation in individual ORS dimension is higher. It shows that for every person, situation causing stress is different. However, the variation in total ORS score is less compared to individual ORS dimension. So, even if stress causing situation are much different for individual, the level of stress is comparatively less different. This reinforce the theory given by Seyle, which shows that even if the stress causing event is different, the response of an individual is some-what similar and its effect on physical and mental health is similar.

ii) We can see that there is big difference in stress level between Middle Level engineers and Lower level engineers almost all individual ORS dimensions except RE. This shows that which type of ORS dimension plays major role in stress at different levels. This shows that middle level engineers have more stress in all ORS dimension except Role Erosion. The reason for lower level engineers having higher stress in Role Erosion may be such that they don't receive credit for what they have done. They may think that the work is done by them and the credit goes to some other people or some higher authority. These feelings may be higher in case of lower level engineers because at this level, their work can not be identified properly. While in case of Middle level engineers, it is comparatively easy to evaluate their work.

In case of total ORS score, there is significance difference in middle range, i.e. 41 - 60 and 61 - 80. This shows that Middle level Engineers have higher stress than that of lower level Engineers. And it affects on efficacy of Middle level Engineers. The Role Efficacy is slightly less for Middle level Engineers compared to lower level Engineers.
iii) From correlation analysis, we can say that ORS dimensions like RI, PI, SRD, RA and RE are comparatively highly correlated to total ORS score than others. All individual ORS dimension are negatively correlated with Role Efficacy. The significance level of correlation is less than 0.01 for all ORS dimensions except REC. This shows that individual ORS dimension affect Role Efficacy. But, the correlation coefficient for Total ORS scale and Role Efficacy is -0.785 and the significance level is 0.01. It is highest than any other individual ORS dimension. It reflects that Total ORS score is more correlated to Role Efficacy. This shows that although individual ORS dimension have effect on Role Efficacy, its significance is less. It is nullified by other positive ORS dimension. Even if some individual ORS dimensions are too negative and others are positive, the effect of negative ORS dimensions is not higher in Role Efficacy. Rather than an individual ORS dimension, Total ORS score affects the Role Efficacy most.

iv) Similarly, all individual RE dimensions are significantly correlated to total Role Efficacy. The significance level is 0.01 for all dimensions. This shows that all Role Efficacy dimensions contribute to total Role Efficacy.

v) There is significance difference in correlations of ORS dimensions and RE dimensions for Middle level Engineers and Lower level Engineers. For Middle level Engineers, the correlation values are less than Lower level Engineers. Correlation values for Lower level Engineers are less than that of total sample. One reason behind this type of results may be such that for middle level engineers, the sample size is less and for lower level engineers, sample size is more. So, for higher the sample size, better the results. Also, there may be another thought. For lower level engineers, the one dimension of ORS directly affects other ORS dimensions. Increase in one type of stress may result in another type of stress. While for middle level engineers, stress is a part of work life. And at this level, an individual ORS dimension doesn't affect others that much. However, the results show that combination of Middle level Engineers and Lower level engineers gives better correlation.

vi) From regression analysis, we can say that there is almost linear correlation between Organisational Role Stress and Role Efficacy. However, Regression coefficient is negative, which shows that Role Efficacy decreased with increase in ORS. From graph, it is also visible that for lower level engineers, observations are nearer to regression line. And for middle level engineers, observations are little bit more scattered. This shows that the effect of ORS on Role Efficacy is more for lower level engineers than that of middle level engineers. The reason behind this type of results may be showing the stress handling capacity of individual. If the stress handling capacity is better, than even if there is higher stress, its effect on Role Efficacy is lesser. From graph, it is also clearly visible that for higher ORS values, the ordinates are away from regression line. It means that the error is higher in case of higher ORS.
1.3.2 In the study undertaken by Bawa, the focus was on ORS and HRD climate on commitment in construction industry. The sample comprises of thirty six engineers from two construction organization. One national and other international.

The major findings were:

**Analysis for Company 1**

- A positive relationship is observed for Normative Commitment with Self-Role Distance stress and Role Overload stress with correlations ranging from 0.409 to 0.429 in case of Company 1 significant at 0.01 & 0.05 levels.
- Normative commitment had negative correlation with Top management commitment to HRD and Commitment to competence development with correlations value of -0.36 & -0.485 significant at 0.01 & 0.05 levels.
- Lower Personal Inadequacy stress shows that there is no conflict between skills v/s demands for company 2 may be because of different and better selection criteria also it's reflected in Role overload stress which is lower than that for company 1.
- Inter-Role Distance had positive correlations with other role stress variables (significant at 0.01 and 0.05 levels). Inter-Role Distance had positive correlations with Innovation and Change Experiment, Intrinsic Reward and Recognition and Commitment to Competitive development with correlation value of 0.358, 0.371 & 0.357 at 0.05 level of significance.
- Role Stagnation and other dimensions of role stress had positive correlations significant at 0.01 and 0.05 levels.
- Role Expectation conflict had positive correlations with Role Erosion, Role Overload, Role Isolation, Personal Inadequacy and Self-Role Distance (at 0.01 and 0.05 significance level).
- Role Erosion and other role stress variables, viz., Role Overload, Role Isolation, Personal Inadequacy, Self-Role Distance, Role Ambiguity and Resource Inadequacy stress had positive correlations (significant at 0.01 and 0.05 levels).
- Role overload and Role Isolation, Self-Role Distance, Role Ambiguity and Role Inadequacy stress had positive correlations (significant at 0.01 and 0.05 levels) for Company 1.
- Role Isolation and Personal Inadequacy, Self-Role Distance, Role Ambiguity, Role Inadequacy stress had positive correlations (significant at 0.01 level) for Company 1.
- Personal Inadequacy stress and Interpersonal Openness and Risk taking, Positive attitude and Objectivity had positive correlation (significant at 0.05 level)
- Self-Role Distance and Resource Inadequacy stress had positive correlation (significant at 0.05 level) for Company 1.
- Role Ambiguity had positive correlations with Role Stagnation stress, Role Expectation Conflict stress, Role Erosion stress, Role Overload stress and Personal Inadequacy stress (significant at 0.01 and 0.05 levels).
- Role Ambiguity had negative correlation with Developmental climate with correlation value of 0.398 significant at 0.01 level.
- Role Ambiguity and Role Overload stress had positive correlation significant at 0.05 level. (r=0.598)
Personal Inadequacy and Role erosion stress had positive correlation significant at 0.01 level.\( (r=0.410) \).

Personal inadequacy and role erosion stress were dominant in Company 1.

Positive attitude and objectivity is two times lower for Company 1.

Interpersonal Helpfulness and Team spirit is one third times lower for Company 1.

### Analysis for Company 2

Continuance Commitment was high as compared to other 1C variables. Negative correlation is observed between Normative Commitment and Affective Commitment with correlation value of -0.491 significant at 0.01 level.

Positive correlation is observed between Normative and Continuance Commitment with correlation value of 0.511 significant at 0.01 level. Once man is not involved emotionally he is of a higher moral standard and does effective contribution towards the work assigned. In case where they are less emotionally attached they will be more morally committed and vice-versa.

Continuance commitment had negative correlation with Role erosion stress significant at 0.05 level.

Normative commitment had negative correlation with Interpersonal helpfulness and team spirit significant at 0.01 level.\( (r=-0.351) \)

Affective Commitment of the individual is less when the dominant role is taken by the Top Management commitment towards its employee's because the emotional involvement of employee gets a beating in comparison to when the responsibility is on the employee as in case of company 1. Continuance Commitment for both the companies comes to the same level.

Continuance commitment had negative correlation with Reward and recognition and Positive attitude and objectivity significant at 0.01 level.\( (r = -0.381, -0.349) \).

Lower Personal Inadequacy stress shows that there is no conflict between skills v/s demands for company 2 may be because of different and better selection criteria also it's reflected in Role Overload stress.

Inter-Role Distance had positive correlations with Role Expectation conflict stress significant at 0.05 level, \( (r = 0.368) \)

Inter-Role Distance had positive correlation with Top Management Commitment to HRD significant at 0.05 level, \( (r = 0.377) \)

Inter-Role Distance and Interpersonal Openness and risk taking had negative correlation significant at 0.01 level. \( (r = -0.330) \)

Role Erosion and Positive attitude and Objectivity had positive correlations significant at 0.01 level.\( (r = 0.403) \)

Role Isolation and Positive Problem solving and Reward and Recognition significant at 0.05 level.\( (r = -0.416, -0.380) \)

Self-Role Distance and Top Management Commitment to had negative correlation significant at 0.05 level.\( (r = -0.355) \)
Top management commitment to HRD and Positive personal policies had negative correlation significant at 0.05 level. \( r = -0.414 \)

- Positive attitude and Objectivity is two times more for Company 2.

**Comparative Analysis of both the Companies**

- Inter-correlations between HRD Climate variables reveal that ORT-DC \( [0.421] \), CCD-DC \( [0.422] \) and RNR-CCD \( [0.641] \) have high values of positive correlations, indicating the influential nature of these factors over each other. The difference in EGDF is more than 20% for Company 1. Also IHTS is 1.5 times less for Company 2.

- Inter-correlations between ORS and HRD Climate of the total sample reveal that DTC-RA \( [0.398] \) and PAO-RE \( [0.403] \) have high values of positive correlations, indicating the influential nature of these factors over each other. RI shows the maximum number of negative correlations denoting that they have little or no influence other variables.

- Inter-correlations between ORS Dimensions reveal that RA-REC \( [0.409] \),IRD-REC \( [0.368] \) and RE-RI \( [0.635] \) have high values of positive correlations, indicating the influential nature of these factors over each other. The major difference is observed in case of Personal Inadequacy which is four times more; also Role Overload is twice for Company 1. This shows that people are not competent enough to perform the task also the Role Ambiguity is more.

- The two organizations differ in Normative and Continuance commitment. The Normative commitment is 40% more for Company 1 showing that people are more loyally committed, also Continuance commitment is 30% more for Company 1.

**SUGGESTIONS**

- Companies need to strengthen HR Systems to create a better working climate and motivating the employees to be committed to their organization. Systematic monitoring should be done to review the progress and find level of effectiveness of the system and to plan for its next steps.

- Companies need to carry out Stress Audit as an O.D. intervention. This will improve in lowering the employees stress levels and improve their productivity.

- Possibility of Role-related intervention. The Top management should be more committed towards HR issues so that employees do not have ambiguity towards their roles. The roles need to be clearly specified to reduce Personal Inadequacy stress.

- Likely outcomes in terms of heightened morale, stress-free' operations, higher productivity and personal/social wellbeing.

- The strongest contributing factor to the individual's happiness and sense of fulfillment is his family. Organisations should pay adequate attention to this aspect and extend their welfare policies in such a way that they reach to each of the family member/dependent of the employee. A better recruitment pattern should be adopted to reduce Inter-Role Distance stress.

- It is found from the present study that Personal Inadequacy and Inter-Role Distance were the dominating factors and should be taken care by the organizations.
1.3.3 In the study undertaken by Bedekar, the focus was on OCTAPACE Scale and Balance Score Card. The sample comprises of thirty two engineers in two construction organizations. One at Mumbai and the other at Ahmedabad.

The major findings were:

From the correlation analysis of OCTAPACE values it can be noted that first organisation has many negatively related factors. While for second organization all the factors are significant and positively related. Thus if we compare both the organizations it can be said that second organisation has better Organizational culture compare to first organization. In first organisation Confrontation and Proaction are more significant and positively related which shows that the employees have spontaneous expression of feelings and thoughts, and the sharing of these without defensiveness, it means giving, without hesitation, ideas, information, feedback, feelings, etc. Employees are facing rather than shying away from problems. It also implies deeper analysis of interpersonal problems. The outcome of confrontation is better role clarity, improved problem solving, and willingness to deal with problems and with 'difficult' employees and customers.

Whereas in second organisation openness and trust are positively related, this shows that the employees have feelings and thoughts, and the sharing of these without defensiveness, it means giving, without hesitation, ideas, information, feedback, feelings, etc. and the results are reflecting in maintaining, the confidentiality of information shared by others, and in not misusing it. It is also reflected in a sense of assurance that others will help, when such help is needed and will honor mutual commitments and obligations. Trust is also reflected in accepting what another person says at face value, and not searching for ulterior motives.

Also a strong correlation is established between OCTAPACE Scale and Balanced Scorecard. The OCTAPCE values like openness, trust and proaction helps in increasing efficiency of employees. The higher OCTAPACE values lead to strong organizational culture due to which employees feel motivated. Because of this the internal processes are effectively and efficiently carried out which gives total customer satisfaction. If customers are satisfied ultimately the financial objectives are fulfilled and organization reaches to the epitome of excellence.

SUGGESTIONS

Suggestions are based upon the Research carried out and upon the Limitations with has occurred during the research phase.

In this research work the attempt has been made to establish the relation between the OCTAPACE and Balanced Scorecard. These are just two of the other various HR tools available. So these two tools can independently be correlated to other tools as well.

More than two firms should be studied with different background in terms of the size, projects undertaken, nature of an organization (like this research consists of findings of two contracting firms. Developers, PMC, etc. can also be studied.)
In this research organizational culture and HRD climate is studied. Other HR related issues like Learned Helplessness, Role Efficacy, Job Satisfaction, etc. should be studied.

Firms lacking hi particular OCTAPACE characteristic should improve upon it. Organization can develop Organizational Behaviour interpretation to deal with specific deficiencies brought out by OCTAPACE analysis.

BSC should be made quantitative so that performance can be easily measured and improved. To do these integrate the HR related findings with their respective BS. This will lead to overall improvement in functioning of the organization.