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CHAPTER-3

REVIEW OF LITERATURE

The topic for this research is '*A Comparative study of location attractiveness of BRIC nations for O&G Engineering Services Outsourcing (O&G ESO) and strategic growth options for India's O&G ESO industry*'. Considering the coverage of this research, a detailed review of existing literature has been conducted which not only covers the academic research done by previous researchers but also the research or investigation done in the Outsourcing industry by academicians, investment bankers as also corporate and consulting firms with specific reference to the engineering industry. In this chapter a review of the works done in the following areas are presented:

- Outsourcing industry
- Works on location attractiveness
- Works on Engineering Services Outsourcing
- Emerging economies – Brazil, Russia, India and China
- Works on Outsourcing related to the O&G industry

3.1 WORKS ON OUTSOURCING INDUSTRY

Reviewing published material and works on the Outsourcing industry containing quantitative and qualitative data was necessary as these analyses provide helpful insight into the Outsourcing industry in general and the emerging trends in this industry.

In their book '*Business Process Outsourcing – Growth and Country experiences*' (2007), T P Rajmanohar and P Sivarajadhanavel, trace the evolution of outsourcing from the manufacturing industry contrary to popular perception that the service industry started this first. The outsourcing concept has existed for about three decades now and is fast gaining acceptance today among all businesses. The manufacturing industry in USA was the first to adopt outsourcing due to the strong dollar and competition from other countries. The next major development was the beginning of

the call centre industry and the shifting of this industry to offshore destinations like India and Philippines. Around ten years after this, came the Knowledge Process Outsourcing industry (KPO), including offshore destinations, which is growing at a very fast pace. The next important development was the outsourcing of business processes called 'business process transformation outsourcing'. India was one among the first country locations that emerged as a remote service provider for the BPO industry. The book traces the evolution and growth of the outsourcing industry from manufacturing to service. It delves into the practice of outsourcing related to manufacturing, BPO, and KPO business process transformation and discusses the experiences of various countries in the outsourcing business. The study concludes that the primary focus of outsourcing by the manufacturers is improvements in their core business. The study further states that the second benefit of outsourcing is the cost benefit they receive in the outsourcing of their process to the low cost locations.

In the paper titled 'Will India and China Profit from Technological Innovation?' (Orozco, 2007) explains that India's service exports have grown more than 20% on average since the mid 1990's. As of 2007, nearly half of the Foreign Direct Investment (FDI) is concentrated in the computer software, electronics, telecommunications, and services sectors. Almost one-third of India's exports are related to services and most of these are in the business process and software industries. This dynamic sector has been growing at a rate of 20% per year since the 1990s. India's focus on higher education, described in its 10th Five-Year Plan (2002-2007), is a source of competitive advantage and a priority for attracting export-oriented FDI. Attention is focused on engineering to reinforce an already strong technical base. To do this, India relies on institutions for higher education, which include 16 national universities and more than 12,000 colleges. With 7,000,000 total students and 100,000 engineers graduating every year, India is poised to capitalize on its human capital development, particularly within the Information and Communications Technology (ICT) and Business Process Outsourcing (BPO) sectors. Both sectors are labor intensive and require a skilled labor force. The ICT sector involves an entrepreneurial group of firms that focus on exporting software solutions. The BPO industry leverages India's tech-savvy, English-speaking workforce to provide back-office operations mainly to

American multinationals. Both sectors leverage India's comparative cost advantage and the ICT sector benefits from its resilience against infrastructural bottlenecks. The growth and promising prospects of both industries demonstrate India's comparative advantage in service- and technology-focused sectors. After the 1991 currency crisis, India opened its markets to foreign investment and reduced state involvement in the economy. Additionally, import and export controls were lowered to stimulate trade and investment. The ICT sector in particular has benefited from the government's lower restrictions on technology imports and the absence of taxes on software exports. Foreign direct investment also benefited from reduced barriers to foreign ownership.

In its fourth annual report 'Gartner on Outsourcing, 2007-2008' (2008) Gartner Inc states that outsourcing from Western countries offers tremendous revenue and growth opportunities for the developing countries. The global outsourcing market continues to grow at a steady pace, with a growth rate of 8.1 percent in 2008. However, healthy growth rates for outsourcing do not necessarily mean that user organizations are without challenges. Although outsourcing continues to grow, publicly reported Information Technology Outsourcing (ITO) and BPO contract values decreased overall by 50 percent in 2007. Part of the explanation for this apparent discontinuity is that as the outsourcing market matures and becomes more commonplace, there is less publicity of deals. Companies are simply outsourcing more, but electing to use a multi-provider strategy and more deals are simply smaller in size, with many of these deals not large or ground shaking enough to report. Buyers increasingly are moving work to lower-cost, offshore delivery centres. Although cost remains a major driver for Global Delivery Models (GDMs), more-mature users are seeking ways to better support their business needs. The availability of English language skills and educated low cost manpower helped India to penetrate fast into the outsourcing industry. However, other countries followed suit and the next major player is Philippines whose English language skills are better than what India has. Philippines also have a huge manpower with accountancy skills. China too is likely to become a major player especially for Asian language business process outsourcing. The Dalian region in China has people who know Chinese, Korean and Japanese and it is becoming a hub for BPO operations in China. Other countries like Sri Lanka, South Africa are also in

the process of becoming BPO hubs. Indian providers gained traction in Europe in 2007, but faced strong competition from more-established vendors with GDMs. Indian providers are growing approximately 40 percent annually in the USA and 60 percent annually in Europe. Although spending on offshore services is three times higher in North America than in Western Europe, the gap is closing.

Other countries are continuing to emerge as challenges to India for a number of reasons. More-sophisticated buyers are seeking a multi-country strategy to minimize risk and align near-shore and offshore delivery centres with their primary time zones.

In the study on 'Optimizing Globalization' conducted by Cambridge Research Solutions (2008), the author Alistair Niderer attempts to find out the three most critical reasons why corporates seek to outsourcing and offshoring and concludes that the three key reasons for global sourcing are:

- To achieve competitive parity or advantage - Apply best practices and quality standards to upgrade the performance of competencies or functions that lag behind the competition.
- To transform business operations - Outsourcing creates an environment in which business processes can be re-engineered and application portfolios can be re-structured and re-architected for lasting benefit.
- To achieve strategic business goals - Outsourcing can provide the variable resources, scarce skills, process discipline and compelling economics to make the pursuit and achievement of strategic goals possible in reasonable timeframes.

In the paper 'Indian Software Industry: Growth Patterns, Constraints and Government Initiatives', (Chakraborty and Dutta, 2002) state that cost is an obvious, although diminishing factor for companies to outsource work to captive centres and service providers. As for the Indian market, both domestic and export, has boomed, the wage gap between Indian software professionals and their counterparts in the developed countries has started to narrow. Nevertheless, cost advantage remains substantial even today. In addition, worldwide interest in business process reengineering, the economic imperatives in developed countries of outsourcing, cost-efficient maintenance of

existing mainframe systems and continuous development of new software for personal computers (PCs) have played significant roles. Finally, India's comparative advantage in the software industry, generated from its relative abundance of qualified software engineers, coupled with the government's timely national action plan for rapidly improving communications infrastructure has played a key role in creating confidence among buyers of Indian software products and related services. As is evidenced by the rapid growth in their demand, Indian software engineers have carved out a name in the world market for providing an unbeatable combination of quality software at a low cost; Indian software developers offer a cost advantage of 40% to 60% over their American counterpart.

In their research paper titled 'Learning paths to offshore outsourcing - from cost reduction to knowledge seeking' (Maskell, Pedersen, Petersen and Nielsen, 2006) the authors begin with the hypothesis that a corporation's offshore outsourcing may be seen as the result of a discrete, strategic decision taken in response to an increasing pressure from worldwide competition. However, empirical evidence of a representative cross-sector sample of international Danish firms indicates that offshore sourcing in low-cost countries is best described as a learning-by-doing process in which the offshore outsourcing of a corporation goes through a sequence of stages towards sourcing for innovation. Initially, a corporation's outsourcing is driven by a desire for cost minimization. Over a period of time the outsourcing experience lessens the cognitive limitations of decision-makers as to the advantages that can be achieved through outsourcing in low-cost countries: the insourcer/vendor may not only offer cost advantages, but also quality improvement and innovation. The study concludes that quality improvements that offshore outsourcing may bring about evoke a realization in the corporation that even innovative processes can be outsourced.

In the paper 'An Empirical Analysis of Motives for Offshore Outsourcing by U.S. Firms' (Paul and Wooster, 2008) present results that suggest that, from a policy perspective, restricting the ability of firms to offshore outsource may have significant consequences for the long-term competitiveness of some of the most vibrant and viable firms. This conclusion is consistent with findings in previous literature. For example, in one of few micro-level analyses, Kurz (2006) uses plant level data to

investigate differences in productivity-related characteristics between outsourcers and non-outsourcers. The author finds that firms who outsource are not only more productive but also enjoy higher productivity growth relative to non-outsourcers. In addition, outsourcing firms are found to have higher employment, sales, value added, capital, investment, and skilled labor relative to non-outsourcers.

In a related discussion of how outsourcing may be helping manufacturing firms to stay competitive, Deardorff (2006) points out that outsourcing high-cost service activities can help such firms stay competitive rather than shut down.

The study of works done on the subject of 'Outsourcing' by previous researchers helped to understand the drivers behind the offshore models and establishes the fact that the wage differential factor between developing nations and developed nations was not the only reason why companies adopt the outsourcing model.

3.2 WORKS ON LOCATION ATTRACTIVENESS

'The Global Competitiveness 2006-2007 - Creating an improved business environment' published by the World Economic Forum (2007) contains a detailed economy profile for over 125 countries featured in the study, providing a comprehensive summary of the overall position in the Index rankings as well as a guide to what are considered to be the most prominent competitive advantages and competitive disadvantages of each. Also included is an extensive section of data tables with global rankings covering over 100 indicators. The study has by far been the most sought after report on the country competitiveness index rankings that are drawn from a combination of publicly available hard data and the results of the Executive opinion survey, a comprehensive annual survey conducted by the World Economic Forum, together with its network of Partner Institutes (leading research institutes and business organizations) in the countries covered by the Report. The 2007 report was published after polling over 11,000 business leaders in a record 125 economies worldwide. The survey questionnaire is designed to capture a broad range of factors affecting an economy's business climate that are critical determinants of sustained economic growth. The Forum annually delivers a comprehensive overview

of the main strengths and weaknesses in a large number of countries, making it possible to identify key areas for policy formulation and reform.

The paper 'Emerging Destinations in Outsourcing : The Indian dilemma' (Varma and Doris, 2007), highlights the emergence of outsourcing destinations in various parts of the world. Today many new, expanding outsourcing destinations are emerging outside traditional destinations as a result of the rise in labor costs and employee turnover rates in existing locations. Corporates have started transferring outsourcing assignments to other parts of the globe like Mexico, Vietnam and Chile, though India & China remain the most preferred IT outsourcing destinations. Indian companies are estimated to have done over 17.7 BUSD in software and IT services exports revenue in the year 2006, whereas China mopped up 3.6 BUSD and Russia a little over 1 BUSD in IT exports over the same period. The study also states that the Indian outsourcing industry is still growing at a faster pace than other outsourcing destinations. Nevertheless, many new outsourcing destinations are emerging outside India as a result of the rise in labor costs and employee turnover rates in India. The paper also discusses other major emerging destinations in the world like China, Russia, Vietnam, Mexico, Philippines, Brazil, and Chile and their entry into the BPO business aided by fast growing developments in infrastructure and improved human resources. However, outsourcing to developing countries like Vietnam or China can also pose business risks, such as insurmountable language and cultural differences, geopolitical instability, and the risk of stolen intellectual property. The study concludes that India has hence an edge over these destinations in the IT outsourcing industry.

AT Kearney's 'Offshore location attractiveness index' (2004) highlights the array of issues that Chief Executive Officers (CEOs) must balance while making offshore decisions. For example, in the search for offshore destinations, many companies consider compensation costs, the quality of human resources, as well as geopolitical risks. For some companies, the offshore decision is an exercise in matching precisely defined skills - such as fluency in American English or other languages and dialects - to the tasks that should be outsourced. For others, the decision is based on which countries support technology education, protect intellectual property (IP) and institute

business-friendly regulations. The study suggests that at the end of the day, the best lessons may be those learned from watching the offshore leaders - companies that adopt multi-country strategies, moving operations to multiple locations as a way to diversify risks and tap into the broadest possible pool of global talent.

The 'Future of Global Outsourcing' (Kelly, 2005) deals with various issues related to outsourcing in the IT/ITeS and BPO industry. The study estimates that between 2000 and 2004, the Indian outsourcing industry alone added 260,000 new jobs. Observing India's development and similar growth in China and the Philippines, other regions of the world are doing what they can to encourage outsourcing on their soil as well. Countries like Dubai and Mauritius are opening up tax free zones to encourage setting up outsourcing centres and joining the bandwagon of attractive locations to do business.

AT Kearney in their research paper 'The BRIC Promise' (2007) studies the location attractiveness of the BRIC nations for the retail industry. The study aims to find an answer to the question whether global retail companies should care about expansion into the BRIC economies. The study concludes that companies cannot afford not to care about these markets and gives the example of the world's top retailers in terms of sales - fifteen of the top 20 operate globally and have made these retail opportunities a cornerstone of their strategies. Early movers have been able to and will continue to reap the rewards in these markets - for example Wal-Mart has already succeeded in building a strong presence in Brazil, China and looks to do the same in India. It is by no means a walk in the park - domestic competition, different cultures, varied consumer behavior and volatile business environments make operating in these countries challenging. Retailers who adapt and succeed in these countries will emerge as tomorrow's global leaders. Some of the research methodology concepts used by AT Kearney have been suitably adapted in the current study to determine the location attractiveness for the O&G Engineering services outsourcing industry.

In the research paper 'Knowledge economy and higher technical education' (2006, Current Science, Vol. 91, No. 1, Department of Electrical and Computer Engineering, University of Illinois) M.A.Pai states that India is at a critical point with a huge talent

pool available, but poorly served by the current infrastructure. Unless imaginative ways are implemented immediately, India will stand to lose in a big way in the knowledge economy race. The industry, which has been on the sidelines so far, must also be encouraged to join this effort.

Works on location attractiveness helped to understand the methodologies adopted by previous researchers to compare locations for different businesses. Since the O&G industry business needs and risk perception is different from other industries and processes that are normally outsourced, this study attempts to determine the variables that determine the location attractiveness specifically for the O&G ESO industry.

3.3 WORKS ON ENGINEERING SERVICES OUTSOURCING (ESO)

Booz Allen Hamilton - NASSCOM in its study 'Globalization of Engineering Services – The next frontier for India' (2006) reports that Engineering Services is a huge market and that global spending for engineering services is currently estimated at 746 BUSD per year. The report further goes on to estimate that by 2020 the worldwide spend on engineering services is expected to increase to more than 1 TUSD. Of the 746 BUSD spent today, only 10-15 BUSD is currently being offshored - a tiny fraction of the total. India brings home about 12 percent of today's offshored market, which it currently shares with Canada, China, Mexico, and Eastern Europe. By 2020, the report estimates that as much as 25 to 30 percent of a much larger 150-225 BUSD market for offshored engineering services could belong to India bringing in as much as 50 BUSD in annual revenue - if the country builds the capacities, capabilities, infrastructure, and the international reputation it needs to become the preferred destination for these complex, high-value services. The study reports Hi-Tech/Telecom (175 BUSD), Aerospace (171 BUSD), Automotive (109 BUSD) as the three major verticals that significantly spend on Engineering Services out of the 746 BUSD total market space. O&G, energy, refining, petrochemicals, consumer, basic materials and industrial electronics are classified under the broad category of 'Others' and is estimated to spend about 219 BUSD on engineering services currently. The scope of the NASSCOM-Booz Allen Hamilton study was largely restricted to five sectors – Hi-Tech/Telecom, Automotive, Aerospace, Utilities and Construction/

Industrial machinery. These five sectors alone together contribute to more than 73% of the current engineering services spend.

'Framing the Engineering Outsourcing Debate : Placing the United States on a level playing field with China and India' (Gereffi and Wadhwa, 2005) states that the effect of the dynamics of engineering outsourcing on the global economy is a discussion of keen interest in both business and public circles. Varying, inconsistent reporting of problematic engineering graduation data has been used to fuel fears that America is losing its technological edge. Typical articles have stated that in 2004 the United States graduated roughly 70,000 undergraduate engineers, while China graduated 600,000 and India 350,000. Their study has determined that these are inappropriate comparisons. These massive numbers of Indian and Chinese engineering graduates include not only four-year degrees, but also three-year training programs and diploma holders. These numbers have been compared against the annual production of accredited four-year engineering degrees in the United States. In addition to the lack of nuanced analysis around the type of graduates (transactional or dynamic) and quality of degrees being awarded, these articles also tend not to ground the numbers in the larger demographics of each country. A comparison of like-to-like data suggests that the U.S. produces a highly significant number of engineers, computer scientists and information technology specialists, and remains competitive in global markets.

In the paper 'Industry trends in engineering offshoring' (2006), Wadhwa, Rissing and Gereffi state that the driving force behind outsourcing decisions primarily to India and China is not only the supply of engineering graduates in these countries but also a combination of other factors too. The ESO industry is set to expand wings in the future but the main barriers to the growth are lack of infrastructure, wage increases, IP theft, lack of technical expertise and language and culture in the service provider countries.

'R&D Outsourcing: Indian Scenario' (Janardhan and Ravi, 2005), discusses high level outsourcing of Research and Development (R&D) in India. Outsourcing the critical value chain activities such as R&D is gaining ground across geographies. Outsourcing

R&D activities helps companies continue their R&D activities without having to worry too much about the money they will have to spend. Many companies have been ambitious enough to outsource a significant portion of their R&D activities to outside the home country. New trends are emerging in many organizations and Indian companies can adopt new business models with the development of offshore outsourced R&D models such as Build, Operate and Transfer (BOT), joint ventures, royalty agreements etc. The study quotes a McKinsey survey conducted among global executives which has ranked India as a more attractive destination for R&D investments. Already 150 Multinational Companies (MNCs) such as IBM, Texas Instruments, Google, GE, Electrolux, DaimlerChrysler and Hyundai have opened their R&D laboratories in India. Indian pharmaceutical majors such as Ranbaxy, Dr. Reddy's Laboratories and Sun Pharma have been attracting the attention of foreign companies for collaborative and contract manufacturing in drug discovery and clinical research. The study also quotes a Frost & Sullivan report that predicted that the R&D outsourcing market in India is set to grow from 1.3 BUSD in 2003 to over 8 BUSD by 2008.

In the paper 'Outsourcing of Innovation' (Lai, Riezman and Wang, 2005), one among the first published research papers to explore the economics of R&D outsourcing, the authors conclude that the central issue in R&D outsourcing is the possibility of the leakage of trade secrets and the subsequent erosion of the competitive advantage of the principal. These leakage problems might prevent R&D from being outsourced, even though it is economically efficient to do so. Here, a very simple model reveals a rich array of principles. By solving for and characterizing the optimal contract which best mitigates these leakage problems, the authors find that the optimal outsourcing contract may or may not involve revenue-sharing. With revenue-sharing, there is no leakage of information. Interestingly, under certain circumstances, manufacturing firms outsource R&D with a lump-sum contract, despite knowing that leakage will occur. In-house R&D is the optimal institutional arrangement only if the principal's loss and the agent's gain from leakage are both large. Outsourcing with revenue-sharing is optimal only when the agent's gain from leakage is sufficiently small and the principal's loss from leakage is neither too large nor too small. Although stronger

IP protection does not inhibit technology diffusion, it need not encourage more R&D outsourcing nor does it improve welfare, since other aspects of the market, such as the length of the product cycle, can be affected.

Works on ESO helped to understand the difference between IT/ITeS outsourcing, BPO model and offshore engineering models. However, there has been no significant attempt by researchers in the past on studies related to the O&G ESO industry.

3.4 WORKS ON EMERGING ECONOMIES – BRAZIL, RUSSIA, INDIA AND CHINA

The most celebrated paper on the emergence of the block of the four countries - Brazil, Russia, India and China and the acronym 'BRIC' to collectively denote them was coined by Dominic Wilson and Roopa Purushottaman of Goldman Sachs Global Economic Research group in the Global Economics Paper, 'Building Better Global Economic BRICs', published in 2001. Ever since then, the acronym BRIC has attracted global attention and a number of research firms, academicians and independent researchers have done studies on various aspects relating to the block of these four nations. Goldman Sachs Global Economic Research group went a step further and published a paper in 2003 named 'Dreaming with BRICs: The Path to 2050' and predicted that the BRIC nations could overtake the combined GDP of the G7 nations (collective term for USA, UK, Germany, Japan, Italy, France and Canada) by 2035.

Collectively, the four countries making up BRIC represent about 42% of the world population and account for over 30% of world growth. What's more, many experts, including HSBC Global Asset Management in their paper 'Can BRIC markets reshape the world' (2007), anticipate that strong growth in the next 30 to 40 years will trigger a major shift in the world's centre of economic gravity. HSBC analysts' forecasts suggest that even before 2040, the BRIC bloc could well be part of the G7, and China alone could overtake the United States to become the world's largest economy. The report further mentions that "Whatever separate courses these four nations take in the coming decades, the evolution of BRIC represents a global transformation of historic magnitude".

In their research report 'Brazil, Russia, China, India: How the Waking Giants are Reshaping the World' (2008), Deutsche Bank research quotes International Monetary Fund data to establish that the BRIC's share of the World GDP (based on Purchasing Power Parity) has been showing an increasing trend from a little over 14% in 1993 to over 21% in 2007. However, the paper cautions that the Global power shift should not be overestimated and that BRIC's collective growth and development trajectories will likely not be linear and that the G3 nations (collective term for USA, Japan and the economies of the Euro Zone) will continue to retain the lead for while.

The World Bank research report, 'BRIC Countries in Comparative Perspective' (2006, Georgieva) forecasts that the short term overall macroeconomic fundamentals are expected to remain strong in China, India and Russia but has to improve in Brazil. This, given stable external environment, will continue to attract substantial flows of foreign investment, further boosting potentials for the future output growth. However, risks related to the unwinding of global economic imbalances will continue to weight on the outlook for BRIC countries and especially Brazil. Country specific risks and challenges include:

- Russia - sustained upward pressure on the exchange rate and inflation; potential fiscal easing.
- China - potential for increased protectionism at Chinese exports.
- India - current high level of off-budget subsidies for petroleum product prices may become unsustainable, undermining the macro-micro foundation of future growth.
- Brazil - possible inconsistency between the expansionary fiscal policy and monetary easing.

3.5 WORKS ON OUTSOURCING RELATED TO THE O&G INDUSTRY

In their research paper 'Skills Shortage - The Way Forward' (2003), Rengers and Scholten discuss the concerns regarding personnel and skills shortage in the O&G industry. Several factors make the skills 'reservoir' of the O&G industry a real issue including high average age of the present professionals, reduced amount of engineers at western universities and increase in energy demands and technology. The authors

conclude that in the next 10 years a major shift to more international recruitment is needed to meet the gap that will occur with the ageing professionals leaving, reduced output at the western universities and competition of other industries. The estimate is that there are about 400,000 knowledge workers worldwide in middle to high level positions in the O&G and allied industries. The size was about double 15 years ago. For instance the total employee count of the 25 largest O&G companies has been reduced from 1,200,000 in 1986 to 600,000 in 1996. Efficiency gains have allowed the reductions, it is doubtful if another halving of the workforce, especially the knowledge workers is affordable.

'Upstream O&G – An evolving eco-system' (Philip and Marc, 2009), a research paper released by global management consulting firm Boston Consulting Group investigates the revenue model of ES companies operating in the O&G domain. Traditionally the revenue model has been low-risk, short term business models based on asset or personnel rental. These models expose these companies both to market volatility and to commoditization. By bringing risk and longer-term performance into their offerings ES companies can increase their upside potential and smooth out volatility. More widespread use of service contracts linked to performance would be particularly attractive to International Oil Companies (IOCs) and National Oil Companies (NOCs) that are facing declining productions levels from existing sources affecting their profitability.

'The Oil and Gas services market' (2005), an expert paper released by AMEC states that high energy prices and the consequent capital investment have sharply raised demand for O&G services across the whole value chain of designing, delivering and supporting projects. A large proportion of the value chain is in the supply chain – ensuring that the right parts, people and processes are available at the right time. Moreover, within the supply chain, a few key roles can be disproportionately important to the success of a project. This strategic issue has been magnified by a global shortage of skilled personnel, which has created a mismatch between the number of projects and the number of people available to carry them out. As demand for services intensifies, all sections of the O&G industry have to find new ways of implementing projects and working together to produce the energy the world craves.

In their research paper 'Capital Project Execution in the Oil and Gas Industry' (2006), the authors Mathew, Herve and David opine that end-user companies and contractors are aware that the O&G industry's environment has changed so fundamentally that many traditional ways of doing business are anachronistic. Increased project complexity in demanding environments and frontier areas, aggressive performance expectations, technological innovations, larger financial bets, competitive national and private indigenous companies, more sophisticated host countries - all coming at a time when the supply of O&G is constrained and demand is increasing - mean that management must make quantum shifts to be able to meet the future energy needs of the global economy. The paper further states that important shifts include rethinking the project framework so that companies can better leverage their internal scale and scarce internal resources to handle increasingly complex projects. Standardizing design when possible to reduce project cost and to focus technological innovation where it matters and re-examining the relationship between owners and suppliers, which involves rethinking the contractual framework and increasing the level of constructive cooperation so that both parties can jointly address current and future concerns are also some of the future trends forecasted by them in the research paper.

'Yardstick for Talent Pipeline in Oil and Gas Industry in India' (Chatterjee, 2008), discusses issues related to talent management in the O&G industry. Proper attention to talent management leads to several benefits to the company and is important for the future success of the organization. The existing talent in a company can be considered a human resource capital and its projection to the future ensures a response to tomorrow's business challenges. Thus, talent management is a form of planning to predict the quantum of talent in different areas that will be needed and ensure that it will be available when needed. It can be compared to supply chain management where we try to predict the future demand for a product and consider how the internal management can be reorganized to meet that demand.

'The Role of Independents in the Oil and Gas Industry' (Wadood, 2006) gives an overview of the current status of the Oil & Gas industry, and briefly examines the position of Major Oil Companies (MOC), National Oil Companies (NOC), as well as Integrated Service Companies (ISC) that support the end users in executing projects.

The paper concludes that service outsourcing in the Exploration and Production (E&P) area is an opportunity for mutual growth for the NOC/MOC as well as the ISC.

'Information Technology Services for the Big Crew Change: An Indian IT Services Perspective' (Lasrado and Pande, 2008) argue that E&P Companies and NOCs can leverage global Information technology services companies from India (or other talent surplus countries), to virtually expand the existing talent pool of the Industry. E&P industry trends, contrasts between the developed and developing markets such as India, capability of Indian IT services sector, and areas where IT services can make a contribution are discussed in detail. The potential of the IT services sector to build IT Solutions based on these factors and create new talent for the industry have been analyzed. Outsourcing of services to Oilfield Service Providers has been one of the strategies used to solve some of the people shortage problems in the industry. This has also allowed E&P companies to focus on their 'core competency' which is the E&P of O&G. A similar strategy which global E&P companies are tending to adopt in Information technology is IT Services Outsourcing. This helps the companies use their existing manpower, reduce costs, as also to let IT service companies do more of the 'digital' type work in E&P. Although IT outsourcing may have started purely based for cost reduction, IT outsourcing now has the strategic advantage of better access to talent and capabilities. IT service providers can help in areas like Remote management of operations, basic collaborative operations, problem solving, leveraging associated Knowledge Management, and real time Data Management - which require a mix of E&P industry domain and IT experience. The paper concludes that an increasing number of people with such experience would be required by the Industry with the increasing importance of IT function as a strategic part of business, and with the 'Digitization' of many functions.

In anticipation of continuing declines in upstream activity levels over the next 15 years, a virtual oil company model articulating a vision of fewer, leaner, but financially stronger firms that concentrate only on their core competencies and outsource the rest through well-structured partnering arrangements will come into being ('Virtual Oil Company', Garibaldi, Haney and Rom, 1995). The paper says that the leading companies will be in a better position to focus on those opportunities that

offer the potential for renewed reserve and revenue growth and forecasts that the future level of activity in the industry will be only 60% of what it is today. Of that lower level of activity, approximately 40% will be performed by outside contractors and as a result large oil companies will do about only one-third of the work they currently do. The effect of this reduction on workforce on the size of oil companies clearly will be dramatic.

'Contracting Basics to Deliver Projects in Today's Supply Market' (Benham and Marijt, 2008) explains that the world of project contracting in the O&G industry is in a state of flux, with an unprecedented high demand globally for contractor capability at a time of dwindling people and equipment resources. This is leading to seemingly ever-increasing costs, longer schedules and, all too often, inferior quality in the delivered project. The operators are struggling to find the best response to this variable and volatile situation, and a variety of outsourcing initiatives and contracting strategies are being tried and tested. However, getting the basics right in contracting and procurement is now more important than ever. In many parts of the world during the 80's and 90's, the capital contracting bias of the IOCs and other operators moved towards large EPC contracts, with a lump sum reward mechanism. Large engineering firms, in an effort to enlarge their work scopes, started to provide this integrated EPC service, allowing the IOCs to outsource their labor intensive and detailed project management activities. These EPC-lump sum contracts gave contractors a strong incentive to perform well and, driven by fierce competition and a perceived relatively certain business environment, they assumed many of the risks associated with the project execution and delivery, with sharp focus on their own cost performance and in turn the clients saw 'competitive fixed prices' being offered to deliver their projects.

'Managing Projects: Utilization of All Available Resources' (McClung, Brooker, and Laine, 1996) is a study that focuses on 'right-sizing' oil companies to cope with the challenging business environments. Work still needs to be done; however, companies no longer can justify the economics of doing everything with internal employees. In the absence of in-house employees, some of a company's needs must be outsourced. Additionally, outsourcing often allows certain activities or specialties to reach economies of scale by reducing overhead, combining overheads or fully utilizing

skilled resources. Outsourcing takes several forms, some of which are better suited to a company's specific needs. Companies also find that a need exists for outside help earlier in the upstream business cycle, which may involve external input even in a company's strategic development processes. Intersecting this competitive industry environment is the NOC, charged with improving a country's economic base through resource growth, and providing employment for a nation's emerging workforce. Historically, the model used by the NOC has been the multinational oil company, which has seen the most changes in structure over the last decade in response to the aforementioned commercial requirements of the energy industry. Growing large, fully integrated NOCs reminiscent of the multinational oil companies of the 1980s may not be a long-term solution for dealing with the global commercial environment of the next century. This paper further describes how companies can cope with an often intermittent need for resources and provides some guidance to growing NOCs for determining future human resource development and forming resource partnerships. NOCs have recently turned to effective project management concepts and are now learning to utilize a number of best-fit resource alternatives to ensure that all technical processes are executed while commercial goals are being met.

'Outsourcing Engineering Services - The Business Side of the Business (Truman, 1996), provides the guidelines for identifying, evaluating, and selecting the appropriate type of outsourcing personnel and estimating the costs associated with using these resources for the O&G industry needs. A description of available personnel resources (consulting companies, service companies, contractors and semi-retired) are provided along with their applicability and usefulness to fulfill outsourcing engineering requirements. Each of these classes of personnel also command a different price in the marketplace. The means of simply estimating these costs is provided. The rationale for these costs are developed and also presented. The information presented is useful for all petroleum company managers involved with outsourcing engineering services. This information will provide management with the guidelines for selecting a service provider which will fit their needs. The methods presented for estimating costs will assist planning and budgeting of outsourcing expenses. As O&G companies downsize many personnel have become consultants or

contract service providers to the petroleum companies. The paper states that during the last fifteen years the petroleum industry has gone through a major contraction. Since 1981 over 439,800 jobs have been eliminated from the industry. As a result of these staff reductions, many of the companies have begun to outsource engineering services, the services are provided by various organizations and personnel. The term 'engineering' is used extensively in this paper to represent all technical services including geological and geophysical services.

'Effective Techniques for Outsourcing Engineering Projects' (McGowen, 2003), explores that Outsourcing is a strategic tool for improving performance and managing cash flow in rapidly growing O&G operating companies. Outsourcing engineering projects is a means to bring specialized expertise and new ideas into an organization, freeing internal resources to concentrate on ongoing operations and core competencies, without a long-term increase in overhead. Through the application of best practices Project Management techniques, engineering project outsourcing can be a vital management tool for initiating technical innovation, expansion into new development or exploration areas, and gaining competitive advantage through intensive analysis of a specific problem. The upstream petroleum industry routinely achieves effective outsourcing in operations type projects. For example, drilling managers consistently utilize a detailed project plan as well as daily cost and progress reporting to control and manage drilling operations. Ironically, the engineering design process that creates the operations procedures, such as drilling programs and completion procedures, which control the ultimate quality of the end product, is often managed using informal methods, or not managed at all. Many operators minimize overheads by maintaining a small staff of generalists capable of managing a variety of projects. From time to time, a particularly thorny technical issue or unusually heavy work load requires some operators to contract with consulting engineering firms or independent consultants in order to accomplish project objectives. Unfortunately, the typical ad hoc methods of engineering project outsourcing often produce poor results. Consequently, many O&G operators prefer staff augmentation to outsourcing an entire engineering project.

After review of the above mentioned works, it is clear that no significant attempt has been done so far to explore the location attractiveness of BRIC nations as O&G ESO service provider nations or about India in particular. The growing importance of BRIC nations in the world economy and the global outsourcing industry, jointly offers a very interesting area of research which successfully guided me into my research topic: '*A Comparative study of location attractiveness of BRIC nations for O&G Engineering Services Outsourcing (O&G ESO) and strategic growth options for India's O&G ESO industry*'.

This research will seek to explore the answers for the objectives mentioned in Section 1.3 of Chapter-1 and present comparative case study of the 4 countries - Brazil, Russia, India and China using elements of location attractiveness. The results obtained from the Comparative Case study are tested through a Statistical analysis of survey data collected from industry experts. Finally, this study attempts to determine the relative ranking of India's location attractiveness amongst the BRIC nations for O&G ESO industry and present the strategic growth options for India.