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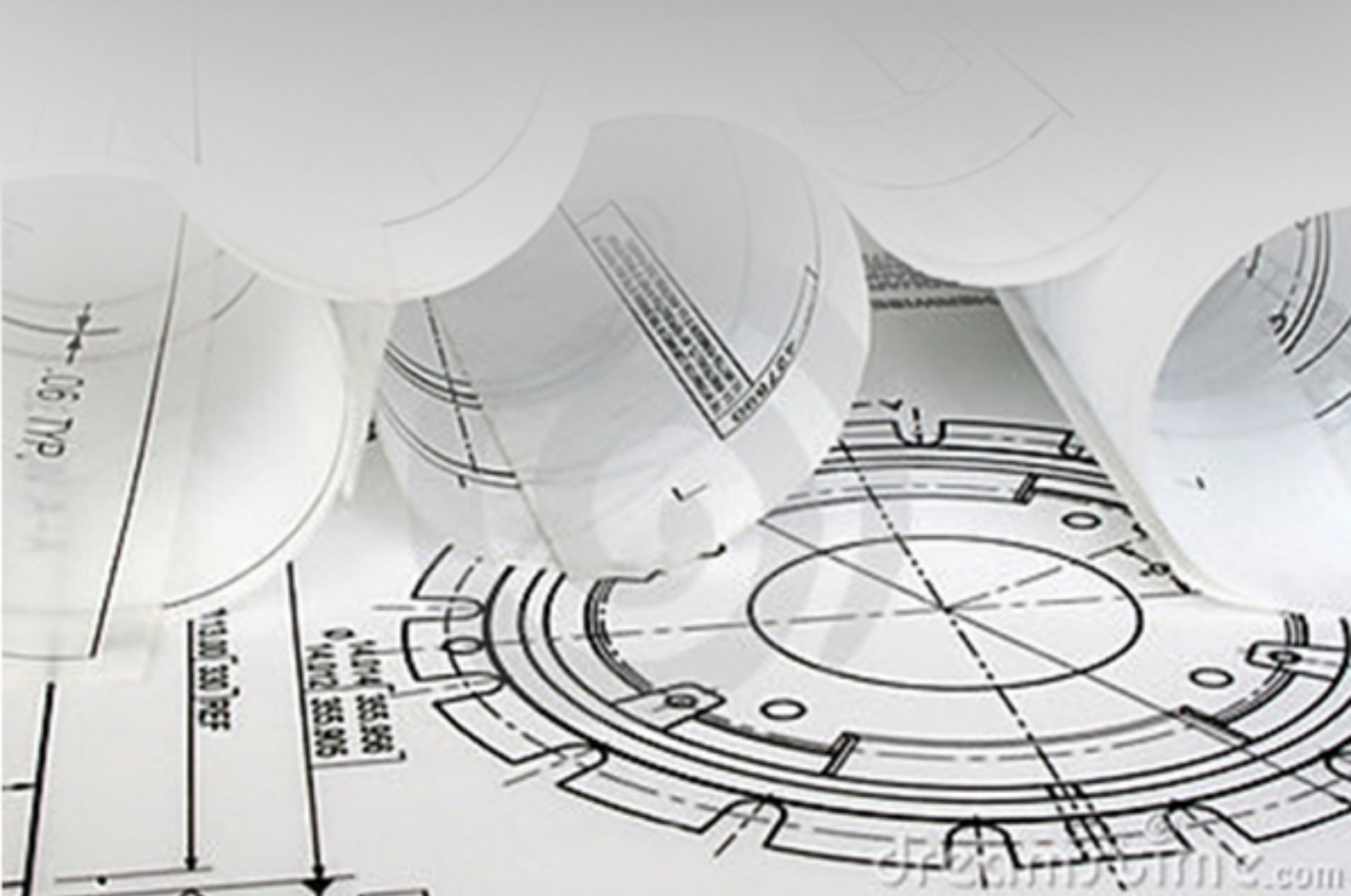
ENGINEERING DESIGN AND DEVELOPMENT



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EXECUTIVE SUMMARY

India's engineering design and development industry is growing rapidly as the country makes deeper inroads into the global engineering space. The advent of computers changed the task of engineering into modules that can be outsourced by a firm while it concentrates on its core activities. At the same time, vendors to whom the work is outsourced are usually better equipped to perform these tasks as it forms their core competency. This outsourcing, which was initially limited to onshoring within developed markets, later extended to offshoring from developed markets to low-cost countries.

Engineering services evolved into an outsourcing model that enhanced efficiency of a firm, improved processes, led to cost advantage and lowered time-to-market for the product. Indian Engineering Services Outsourcing (ESO) became a new segment of the Indian outsourcing industry, which also includes business process outsourcing (BPO) and information technology outsourcing (ITO). ESO differentiates itself from the other two in terms of the high level of domain expertise required.

The fledgling ESO outpaced growth in the more robust BPO and ITO segments during FY04 -FY11 and presently accounts for 16% of the total outsourcing market in the country. ESO's primary focus is the export market as domestic engineering expenditure is generally done in-house. While hi-tech and automotive industries are the major markets contributing 75% to total revenues, aerospace is set to be the sunrise industry over the next decade.

The industry is transforming from volume-based to value-based as clients' confidence in the Indian ESO is increasing. India is placed at a unique position of advantage with the largest talent pool of low cost, English speaking and experienced engineers. Having recognized the potential in the engineering space India has provided the required policy support for its further growth. Large foreign firms that are keen on entering the market to cater to the significant local demand, also tend to forge local subcontracting relationships to benefit from vendors' knowledge about the local needs. Local players, simultaneously, are expanding outside India through acquisitions to enhance their domain expertise.

Global engineering expenditure is projected to increase to USD1100 billion by 2020; also, the share of offshore work within the same is estimated to grow from about 4.5% presently to about 15 -20% during this period. Considering India's unique position of advantage, and India's successful track record in other outsourcing formats of ITO and BPO, the country's market share in global engineering services space is set to rise from 20% in 2009 to 25 -30% by 2020. This potentially means the industry revenues for India to be poised to reach USD40 -50 billion during this period.

1. ENGINEERING DESIGN AND DEVELOPMENT - AN OVERVIEW

Engineering is the application of science in design, development and maintenance of structures, machines, and electrical and mechanical systems. It is the first stage of manufacturing in any industry. Engineering establishes product design, tool design and manufacturing process design that need to be in place before manufacturing can actually commence. Major branches of engineering - Civil, Electrical and Mechanical - extensively require engineering design to keep pace with the rising complexity of products.

Exhibit 1
Major branches of engineering

Branch	Description
Civil	Designing of infrastructure, bridges, buildings
Electrical	Designing of various electrical and electronic systems such as generators, motors, optical fibres and computer systems
Mechanical	Designing of physical or mechanical systems such as aerospace products and compressors

Source: Nasscom, Aranca Research

Engineering design is a multi-step process which requires: (i) preliminary feasibility assessment; (ii) establishment of design requirements; (iii) performing various stages of design iterations for product; and (iv) tool design.

Engineering design involves feasibility assessment, product and tool design

Feasibility assessment entails testing the project for a balance between its design requirements such as hardware and software parameters, maintainability and costs involved; this determines whether a project would move to the design stage.

Next is the design stage, wherein iterations of preliminary designs would result in a detailed design; solid modelling and drawings would be developed and tested under operating conditions of the product. This stage is followed by tool development, which involves designing of tools that would be required in the manufacturing process.

1.1 Evolution of engineering design and development services

The task of engineering design has vastly transformed following the introduction of Computer Aided Engineering (CAE), which encompasses Computer Aided Design (CAD), Computer Aided Analysis (CAA), Computer Integrated Manufacturing (CIM), Computer Aided Manufacturing (CAM), Material Requirement Planning (MRP), and Computer Aided Planning (CAP). Different tools are used to design and analyse the performance and robustness of components and assemblies in the manufacturing process.

CAE has turned the stages of engineering design into modules

CAE tools are widely used across the automotive, shipbuilding and aerospace, industrial and architectural sectors for engineering design projects. They have become increasingly accurate and reliable over time. Of late, most of the design verification worldwide is done using computer simulations rather than physical prototype testing. The use of standardized software tools enhanced the compatibility of the engineering work conducted in several companies, thereby enabling independent vendors to satisfactorily cater to the engineering needs of large industrial firms.

Essentially, CAE has turned the engineering design stages into modules, which are outsourced to vendors by the manufacturing firm while it concentrates on that part of the value chain that is considered to be its core competency. This enables manufacturers to lower their product development cost and time-to-market while improving the overall product offering to customers. This model has led to the development of the industry - Engineering Design and Development Services, or simply Engineering Services.

Engineering services is fundamentally an outsourcing model

It was developed in Western Europe and North America with 'onshore outsourcing' i.e., the engineering work is subcontracted to a vendor within the same country. Some of this work started becoming 'offshore' with larger engineering companies setting up divisions abroad wherein they hire foreign engineers as employees. For example, Boeing has a Russian division designing airplane components. General Electric employs over 6000 engineers and scientists in Israel, Hungary, India and China to do research and development. This `offshore outsourcing' segment has been expanding rapidly, with growing preference for emerging markets, such as India, for engineering services. Globally, spending on engineering services was estimated to be around USD850 billion in 2010, with about USD40 billion flowing through the outsourcing channel into vendor countries.

While it is theoretically possible to outsource most types of engineering services, it is restricted in practice due to various reasons such as legal issues and trade restrictions as well as strategic reasons (for example, defence policy restrictions). In some cases, engineering services might be too closely linked to core engineering processes that, in turn, could lead to dilution of valuable intellectual property (IP) of the client firm.

2. ENGINEERING SERVICES IN INDIA

Over the last decade, the engineering services industry has witnessed significant traction in India. Global industrial and construction firms are looking toward India for engineering requirements that are non-core in nature. Therefore, from the perspective of the Indian economy, engineering services is the newer area of outsourcing following the prior success of ITO and BPO.

2.1 Overall outsourcing industry in India

India is the global leader in the overall outsourcing industry, and a generic player with services and capabilities across client industries including technology, telecom, auto, aerospace and construction. The sector's contribution to GDP increased to 3.7% in 2010 from 2.0% in 2004. Its total exports expanded at a CAGR of 25% during FY04 -11. The sector maintained its growth trajectory despite the global financial crisis in 2008.

The Indian outsourcing industry can be broadly divided into three segments:

- ITO - The leading segment of the industry has helped India find a place on the global economic map;
- BPO - The second wave of growth that made the country an integral part of the global value chain; and
- ESO - The next major growth driver which is already a significant contributor to the outsourcing sector.

2.2 Engineering services in India - size and growth

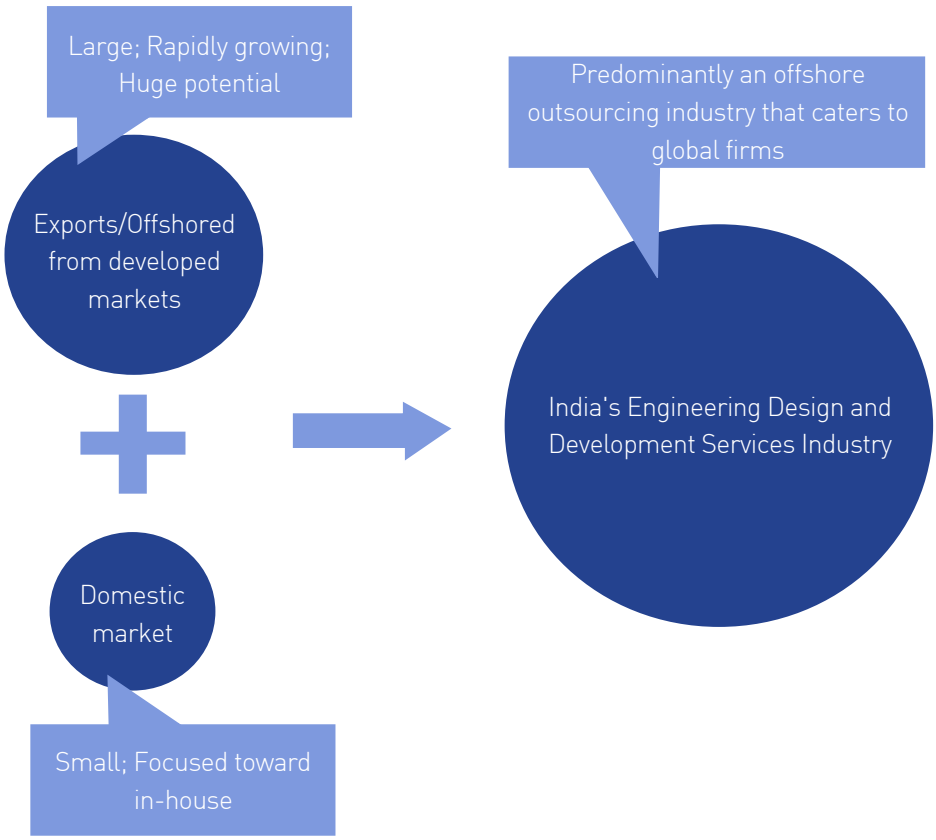
The focus of the Indian engineering services sector is the large, rapidly growing export segment that caters to the offshore work from developed markets. On the other hand, India's domestic engineering expenditure is much smaller. Furthermore, the fraction of engineering work that is outsourced by Indian industrial and construction firms is much less compared to developed

markets. Indian firms are more focused on in-house engineering as the cost advantage argument does not hold for them.

The revenue of total Indian outsourcing industry, and its three segments, in FY 2011 are given below:

Total: USD76 billion; Export - USD59 billion (77%), Domestic - USD17 billion (23%)
ITO: USD45 billion; Export - USD34 billion (75%), Domestic - USD11 billion (25%)
BPO: USD17 billion; Export - USD14 billion (83%), Domestic - USD3 billion (17%)
ESO: USD13 billion; Export - USD9 billion (72%), Domestic - USD4 billion (28%)

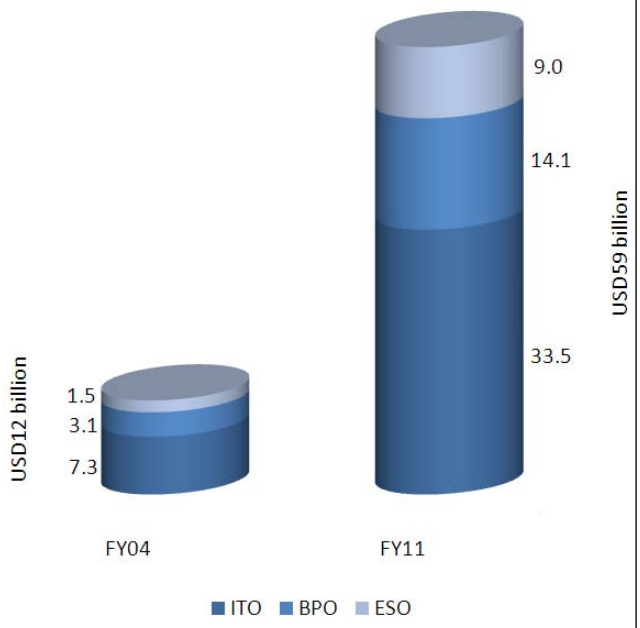
Exhibit 2
Focus of the ES industry



Source: Nasscom, Aranca Research

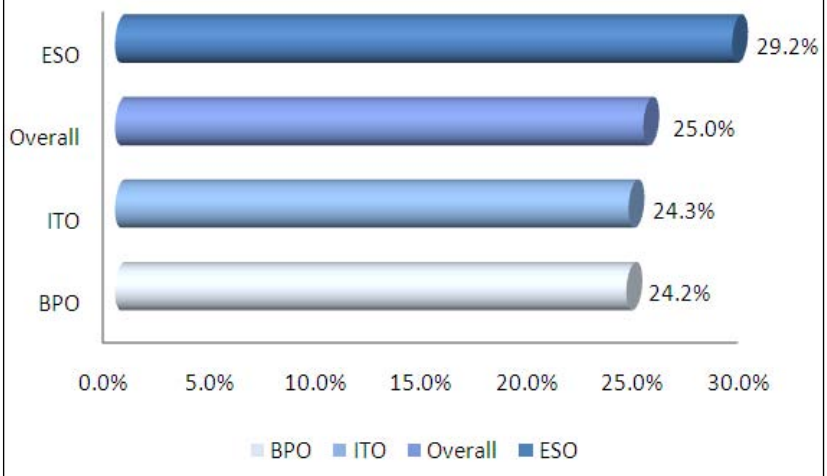
To reiterate, Indian engineering services is primarily an export-oriented industry catering to global firms through an outsourcing engagement model.

Exhibit 3
Total Outsourcing Exports from India



Source: Booz Allen Hamilton, Nasscom, Aranca Research

Exhibit 4
Growth rate over FY04 -11



Source: Booz Allen Hamilton, Nasscom, Aranca Research

Engineering services exports increased to USD9 billion in FY11 from USD1.5 billion in FY04 and accounts for 16% of the total outsourcing exports.

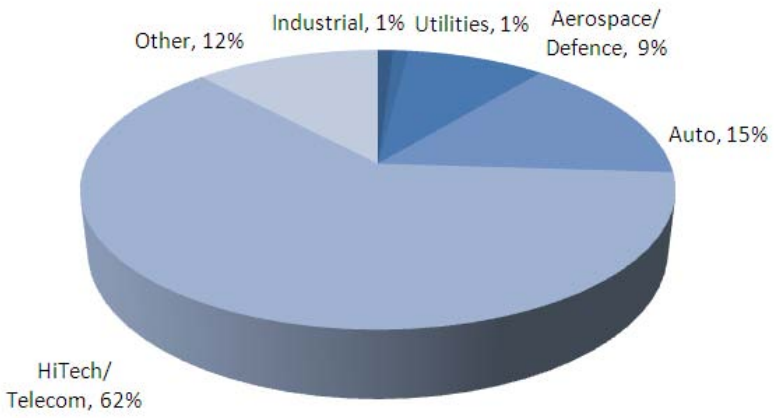
Engineering services expanded at a faster pace than the BPO and ITO segments during FY04 - 11, growing 14% year-on-year in FY11.

2.3 Key sectors of Indian engineering services

Hi-tech/telecom and automotive are the major sectors which account for over 75% of the Indian engineering outsourcing market, while the aerospace industry (currently contributes 9%) is expected to grow significantly over the next decade.

Hi-tech and automotive account for more than 75% of Indian ESO revenues

Exhibit 5
Sector wise division of revenues (2009)



Source: EIU, Aranca Research

Automotive Industry

The dual role that India plays--of being a sourcing destination as well as a large market in itself--adds to its advantage, as more global players are interested in India for reasons beyond the cost advantage. Indian service providers are significantly contributing to IP development, and clients' confidence is rising in terms of handling end-to-end design and development. Safety and efficiency norms have become stringent worldwide, and the Going Green movement is gathering momentum, providing more scope for engineering services in this domain. In India, revenues from automotive outsourcing is expected to reach USD8 billion by 2020.

Aerospace & Defence Industry

It is an emerging sector, accounting for about 2% of the global offshore engineering services expenditure. Lower complexity work such as testing, validation and design documentation were being offshored for past few years. However, recently big-ticket outsourcing deals and MoUs have been signed as a result of government's defence offset policy. According to this policy foreign firms providing defence related products have to give business to Indian firms worth a fraction of the total deal value. Service providers are gearing up for the challenge by developing required domain expertise and acquiring certifications such as SAE AS 9100. The sector is expected to result in revenues of USD11 billion by 2020 in India, higher than the automotive industry.

Aerospace is considered to be the sunrise sector; expected to be second largest vertical by 2020

Hi-tech Industry

Globally, telecommunications, industrial controls and consumer electronics firms are increasingly outsourcing design work to India. The domestic consumer electronics and telecommunications markets are growing exponentially and global organizations aim to cater to the local demand, further expanding engineering services projects in India. Semiconductor and consumer electronics are likely to contribute the most, as firm gain strategic advantage and faster time-to-market for new products by outsourcing work to India. Revenue from hi-tech outsourcing is expected to total USD14 -18 billion by 2020.

2.4 Recent large deals in the Indian engineering services landscape

Exhibit 7
Major business deals in past two years

Deal Size	Service Provider	Outsourcing Company	Vertical	Year	Tenure
USD300 million	Mahindra-Satyam	SAAB	Defence Solutions	2009	10 years
USD100 million	QuEST Global	SABCA	Manufacturing & Assembly	2009	10 years
USD50 million	HCL	Meggitt	Engineering Services	2010	5 years
-	InfoTech Enterprises [1]	Hamilton Sundstrand	Embedded S/W & Electronic Engg Design	2010	4 years

Source: Globalservicesmedia.com, Aranca Research
[1]The deal value for Infotech-Hamilton is not fixed. However, it targets an offshore team of size 300-400 engineers indicating substantial business volume

3. INDIA'S VALUE DELIVERY MODEL

Continuing growth in engineering services in India has been ascribed to the country's ability to combine two distinct benefits for clients. First, Indian firms are able to provide a large base of superior talent, which is made more desirable by its proficiency in English. Secondly, cost advantage to companies that use Indian engineering services is quite attractive. However, with growing experience and competency in the engineering outsourcing space, India's value delivery model is evolving to encompass newer advantages for clients.

Quality talent and low-cost are India's compelling advantages

3.1 Indian engineering services - core value proposition

Engineering services is fundamentally an outsourcing model, offering several distinct advantages to manufacturers apart from the obvious cost advantage. The added value provided by Indian ESO vendors is explained as follows.

- **Efficiency:** When the work is outsourced to external vendor efficiency tends to rise as the client-vendor relationship ensures there is sharper focus on quality than in-house, due to the risk of losing business.
- **Scale:** ESO firms cater to many clients unlike an in-house unit and therefore have the scale advantage. This enables them to offer a more cost effective alternative to their clients. The variety of work that ESO firms are exposed to allows them to acquire skills more easily than developing them in-house.
- **Process improvement:** Indian vendors' exposure to best practices of various global clients enables them to help improve the process for each of them with each passing project they are exposed to.
- **Reduced cycle time:** Vendors help firms lower their time-to-market by enhancing the efficiency of non-core activities, thereby making the value chain of the client leaner and better focused on core activities.

Economies of scale and faster time-to-market add significant value to clients

3.2 India's rise up the value chain

The success of engineering services delivery model is determined by vendors' capability to provide the benefits of three C's:

- **Cost** - At a basic level the vendor is expected to deliver the service at a lower cost than in-house.
- **Capacity** - Using scale advantage and a process-driven approach, vendors can provide superior capacity through faster execution and better focus on quality.

- **Capability** - Due to an industry-wide exposure, vendors can provide skills that the client lacks in-house. Vendors can also add value through knowledge of best practices and process optimization.

When the offshoring trend picked up, India received engineering services projects which were at the lower end of the complexity spectrum, such as CAD drawings and other design documents. However, over the past 5 -6 years, the complexity of the offshore work has increased significantly, with clients' showing increasing confidence in the capabilities of the Indian ES industry. Vendors are now handling modelling, thereby beginning to support actual product development. With some clients, they have even graduated to designing products right from the conceptual stage.

India has come a long way from making basic design documents to being an end-to-end service provider

Exhibit 6
Tasks with increasing levels of complexity

Source: Nasscom, Aranca Research

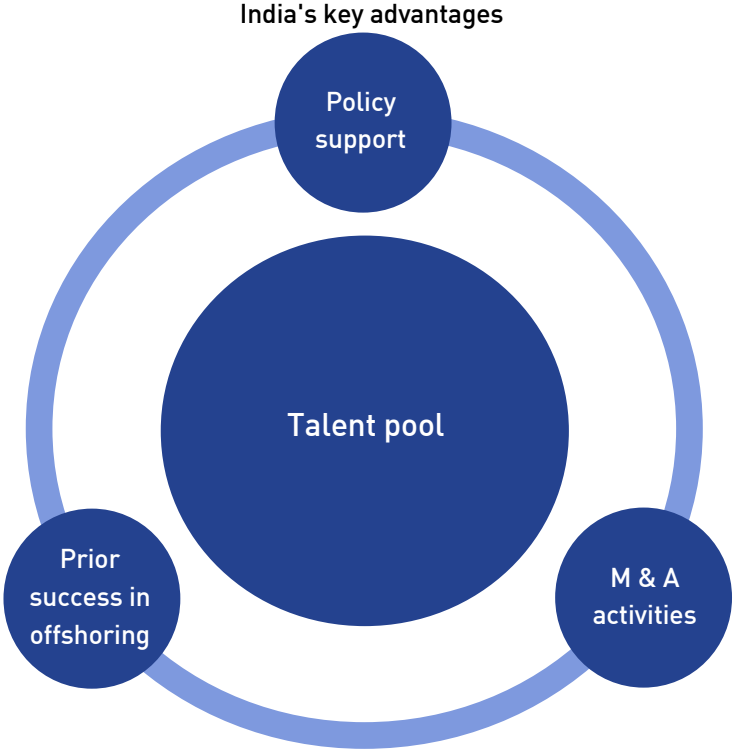
The level of complexity gradually increased from CAD drawings to design validation and automation, and conceptual design. A few clients have offshored design ownership, product lifecycle management, process improvement and e-engineering to Indian engineering services providers. With more projects of such complexity coming in, India has now firmly entrenched itself into the engineering domain as an 'end-to-end solutions provider'.

4. GROWTH DRIVERS FOR INDIAN ENGINEERING SERVICES

4.1 India's talent pool

Indian education, especially mathematics and science, is considered to be superior to that in most countries. India accounts for 28% of all of the outsourcing talent available in low-cost countries. India is estimated to have the single largest pool of engineering talent needed for ESO type of work with a base of over a million engineers. The fraction of engineers with over 10 years of experience increased from 15% in 2006 to 25% in 2009. The salary of an engineer in India is roughly a quarter of the counterparts in Europe or the US. Proficiency in English, coupled with substantially lower costs of development, places India in a more favourable position.

Exhibit 8
India's key advantages



Source: Nasscom, Aranca Research

India's success in ITO/BPO adds to clients' trust in the ESO space

4.2 Policy support

The policies of central and state governments in India are geared toward the needs of the ESO industry. A few of them are mentioned below.

- Several Special Economic Zones (SEZs) dedicated to the aerospace industry are expected to come up in Bengaluru and Hyderabad during 2011 -13 with investments of over USD1.5 billion. Respective state governments are offering attractive tax and financial incentives to investors.
- India's Defence Offset Policy is likely to generate business worth USD10 billion during the 11th Five-Year Plan (2007 -11) as it mandates a minimum of 30% offset across all acquisitions where the purchase cost exceeds USD67 million (INR300 crore). The offset can be in civil aerospace, internal security or defence sectors.
- Under the 11th Five-Year Plan, the government announced a project to further strengthen the patent offices at an estimated cost of USD67 million; while, USD30 million has already been incurred under the 9th and 10th Five-Year Plans. The government aims to improve physical infrastructure, modernize IT infrastructure and create awareness among stakeholders and users through sensitization programmes and publicity material.

4.3 M&A activities

India's large domestic market gives global players - who are acquiring captives in India - an incentive to integrate better with the country. On the other hand, Indian firms are aggressively expanding abroad to improve the accumulated domain knowledge. These two developments are set to accelerate growth in the industry in the near future. A few recent M&A deals in the industry are mentioned below.

Indian ESO players are acquiring foreign firms to strengthen access to domain knowledge

Exhibit 9
M&A deals in the industry

Investor/Fund	Target Company	Deal Size	Type of Business	Deal Type
Kasa Cos Inc	Electro Anlagen	NA	Automation solutions	Inbound
Stone & Webster	Shaw Rolta Ltd	USD35.5 million	IT services	Inbound
Tata Advanced Systems	HBL ELTA Avionics Systems	NA	Aerospace technology & equipment	Outbound
QuEST Global	ASE Technologies	NA	Aerodynamic and fluid system solutions	Outbound
Rolta India	Piocon Technologies	NA	Engineering solutions for oil refineries	Outbound
Tooltech	Misslbeck Engineering	NA	Automotive design	Outbound

Source: Thomson One, Nasscom, Aranca Research

4.4 Prior success in the outsourcing industry

Despite global competition, India commands more than half of the global offshoring market. Notably, the country's market share is still rising. In 2009, India accounted for 51% of the global offshoring revenues that rose to 55% in 2010.

China closely trails India and is trying to develop as a generic player catering to many industries; some countries such as Russia, Thailand and Malaysia are trying to focus on a particular industry. Russia has a natural foothold in aerospace outsourcing because of its deep local domain knowledge; while Thailand and Malaysia have developed good capabilities in the automotive segment. African players are trying to make space for themselves in the lowest end of the outsourcing cost spectrum.

India is ranked first in offshoring by the Economist Intelligence Unit.

Exhibit 10
EIU Offshoring Rankings

Country	Score	Rankings
India	**7.76**	**1**
China	7.34	2
Czech Republic	7.26	3
Singapore	7.25	4
Poland	7.24	5
Canada	7.23	6
Hong Kong	7.19	7
Hungary	7.17	8
Philippines	7.17	9
Thailand	7.16	10

Source: EIU

Prior success in ITO/BPO paves way for India to grow to dominance in ESO

The resounding success of ITO and BPO in India has resulted in creating successful delivery mechanisms. Indian vendors have learnt to develop partnership models which are fruitful to the global clients. They have matured in terms of integration with the global value delivery chain and thereby have been able to produce lasting business relationships in the ITO/BPO space. This creation of value delivery framework provides the ESO vendors a roadmap about how to develop successful outsourcing partnerships.

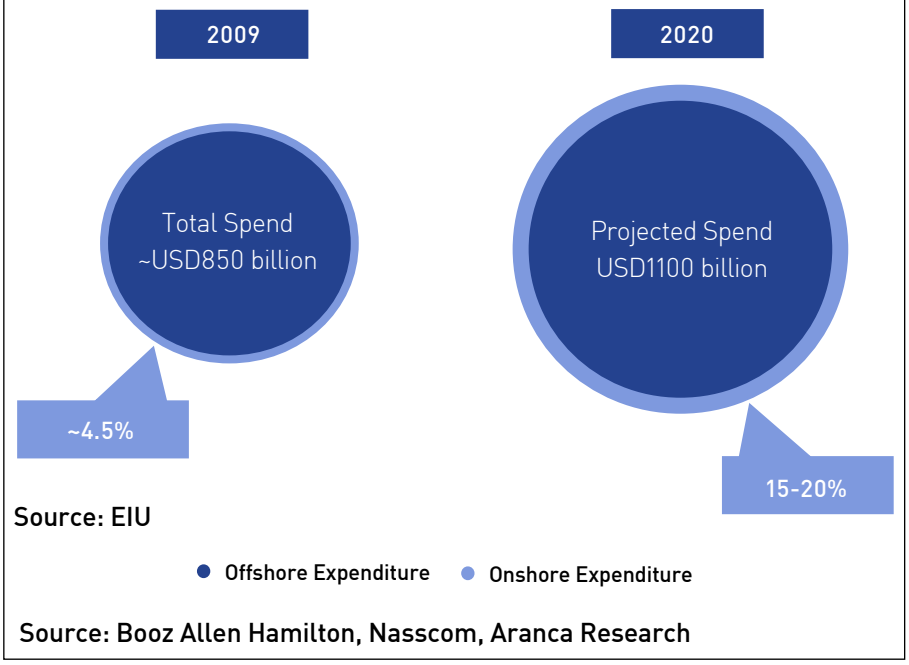
India's accumulated knowledge about running outsourcing business, as well as the leading position in the global outsourcing landscape, will go a long way in instilling confidence in clients, thereby bringing incrementally more business to Indian vendors.

5. VISION 2020

By 2020, engineering expenditure worldwide is expected to increase to USD1100 billion from USD850 billion in 2009 and more importantly, the share of offshore is likely to increase from 4.5% to 15-20% during the same period. Considering India's unique position of advantage with the talent pool in place, and on the back of the success of ITO/BPO, the country's market share is estimated to rise from 20% to 25-30% and reach USD40-50 billion by 2020 from USD9 billion in 2009.

Exhibit 11

Global engineering expenditures and percentage of offshored tasks



Source: EIU

Source: Booz Allen Hamilton, Nasscom, Aranca Research

By 2020, Indian engineering services is expected to reach USD40-50 billion

The engineering services market is undergoing a stable drift toward emerging markets with requisite capabilities. The current low fraction of activities that are outsourced indicates that the market is still nascent and growth would continue unimpeded in the medium term.

India's superior capabilities and erstwhile success in other formats of outsourcing would prove instrumental in garnering a larger share in this market. The talent pool, which is already large, can be improved in terms of quality by imparting superior domain knowledge.

With supportive policies, vendors' drive to accumulate domain knowledge, large talent pool and existing leadership position India's engineering services is strongly positioned to turn the vision 2020 into a reality. In fact, current nascent penetration level suggests that the actual size might well exceed the current expectations.

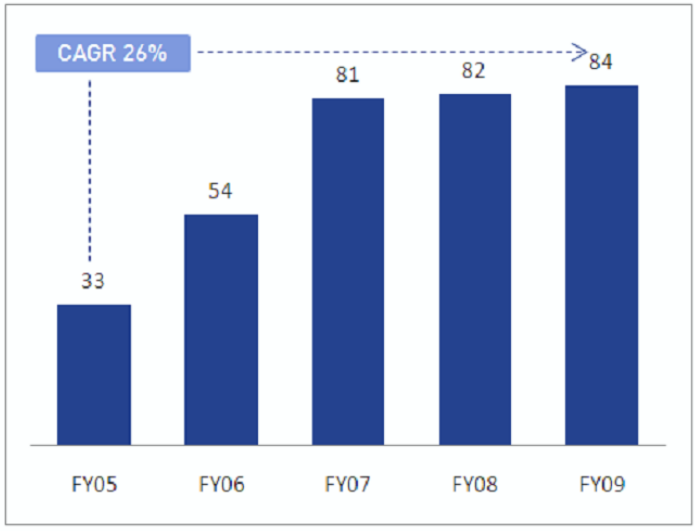
6. APPENDIX

6.1 Profiles of some engineering services firms in India

Rolta

- **Divisions** - Enterprise Geospatial & Defence Solutions (EGDS), Engineering Design & Operation Solutions (EDOS) and Enterprise IT Solutions (EITS)
- **EDOS Offering** - Engineering, Procurement and Construction Management (EPCM) services for the entire lifecycle of plants in oil & gas, power and chemical/petrochemical industries
- **Recognition**
  - FICCI Award for Excellence in Science, Technology and Technological Innovation, 2011
  - Selected by S&P on the global list of 300 "challengers"; 2008

Exhibit 12
EDOS Growth (revenues in USD million)

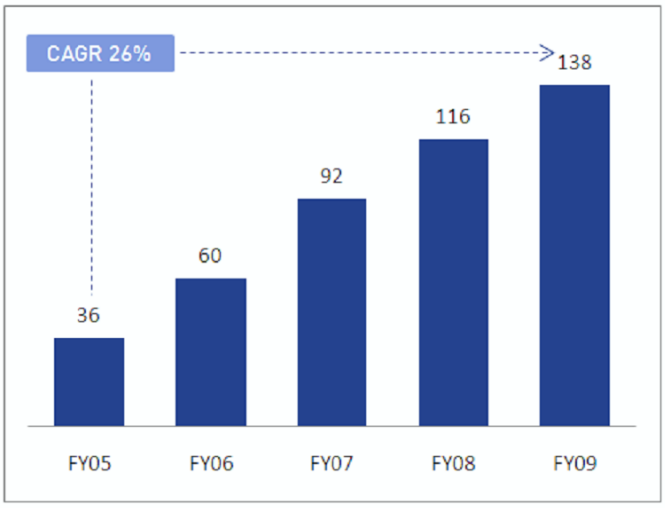


Source: Company annual reports, Aranca Research

Infotech Enterprises

- **Divisions** - Network & Content Engineering (NCE) and Engineering Services (ES)
- **ES Offering** - Product and process engineering covering the entire lifecycle of product design; clients across automotive, aerospace, energy, marine, plant engineering and railways sectors
- **Recognition**
  - Engineering Services Supplier of the Year Award on Hamilton Sundstrand Supplier Scorecard; 2010
  - Geospatial Excellence Award for CGIS Project at MapAsia in Malaysia; 2010

Exhibit 13
ES Growth (revenues in USD million)



Source: Company Annual Reports, Aranca Research

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