Overseas Market Information

# Market Study on Engineering Process Outsourcing

***(Part - II)***

## Engineering Process Outsourcing from India

Engineering Process Outsourcing (EPO) services from India will be a key element of the country's engineering export strategy, and the development of the EPO sector will have a far-reaching impact on India's engineering industry as a whole. This was stated by Shri Kamal Nath, Minister of Commerce and Industry, at the meeting of the Parliamentary Consultative Committee of the Ministry of Commerce and Industry. "The EPO market in India has the potential to exceed US$ 40 billion by 2020, which will catapult India's market share in this category to 30% from the current 12%. And to tap the EPO market all the important stakeholders, including Government, service providers and trade bodies will need to boost investments in infrastructure and improve marketing efforts", he said. Engineering goods exports from India have crossed US$ 5 billion in the first quarter of the 2006, showing a growth of 20%. But it has the potential to grow at a rate of 30% annually.

India has already proved its capability in the field of IT services and is a successful business process outsourcing (BPO) nation. After the success in the IT and BPO sectors, India is now a sought-after destination for outsourcing services in other areas as well. They include specific types of knowledge transfer like legal, tax and accounting services, etc., all grouped under Knowledge Process Outsourcing (KPO) services.

Engineering knowledge transfer had once been a part of KPO services. But growing demand for such services and because of their highly technical nature, EEPC has grouped them separately as engineering process outsourcing (EPO). Engineering Process Outsourcing (EPO) is an emerging high-growth opportunity for India. For manufacturers across various industry sectors, it is an attractive option because of increasing pressure resulting from shorter product life cycles and the strain on their internal resources. Also, EPO comes with a host of benefits for the outsourcing organization.

India's technological capabilities, a large pool of good English-speaking engineers backed by a well developed IT and telecom infrastructure, and the wage cost arbitrage makes India an attractive destination for those wanting to outsource engineering processes. Global organizations have identified the engineering talent available with India and are outsourcing both low- and high-end services from the country.

The growing demand for engineering processes have led to the setting up of engineering centre by overseas and domestic organizations to tap the country's engineering talent. India's burgeoning economy also makes it a strategically important destination for foreign direct investment (FDI) in setting up captive centre for research and development (R&D) activities.

The global EPO opportunity is expected to grow manifold in the years to come, thus making it an important services export focus area. Besides India, the other countries that can competently handle EPO services are countries like Brazil, China, Philippines, etc. They too have similar advantages and are fast competing with India in the export of EPO services.

What prompted EEPC to prepare this report was (i) the nascency of the EPO industry in India, (ii) its huge potential, and (iii) the competition that India faces from other countries in engineering process outsourcing services. This strategy paper outlines the industry's structure, assesses the market potential and details the approach and strategy for growth of EPO exports from India.

## Scope of Work

The terms of reference for the study are :

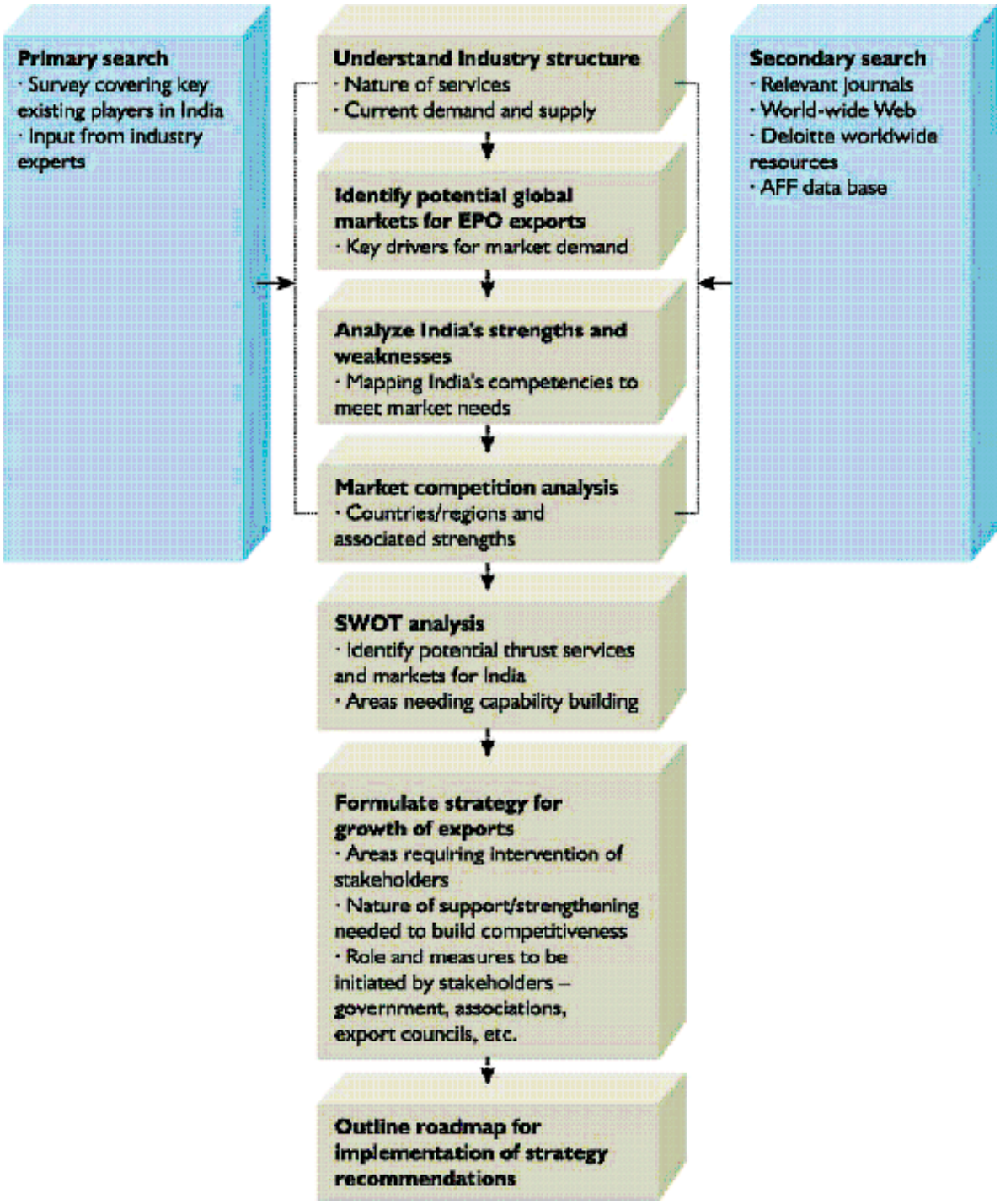
- **Industry structure**
  - o Delineate various services constituting EPO
  - o Define the industry structure. This will cover major services and industry sectors, countries/regions at the demand and supply side
- **Potential market opportunities**
  - o Identify key drivers that impact engineering process outsourcing
  - o Identify major regions and countries with a potential for outsourcing engineering services
  - o Broadly assess range of potential market size and associated growth trends in the short term (0-2 years), medium term (3-5 years) and long term (6-10 years)
- **India's competitiveness**
  - o Analyse current status of export of EPO from India and assess competitive advantages and strengths
  - o Broadly map India's strength and competitiveness with respect to global potential market opportunities
- **Competition analysis**
  - o Identify major countries/regions that cater to the market demand
  - o Broadly assess the profile of competing countries/regions
  - o Develop an overview of existing EPO industry structure in India
- **SWOT analysis**
  - o Carry out a SWOT analysis based on the above
  - o Identify potential thrust sectors and thrust markets for India
- **Formulation of export strategy**
  - o Formulate strategy for the growth of EPO
  - o Assess the scope of small engineering organizations in the export of engineering services from India
  - o Identify the thrust industry sectors and regions for EPO
  - o Measures to be initiated by various bodies for the growth of EPO
- **Implementation roadmap**
  - o Draw up a roadmap to implement the recommended strategy and indicate the timeline and action to be taken

## Approach and Methodology

The approach to the study included a combination of secondary and primary research followed by analysis. The secondary research included Deloitte World Wide resources, AFF database, Worldwide Web and relevant journals.

The primary search consisted of contacts with about 33 respondents in major Indian cities (Bangalore, Mumbai, Kolkata, Delhi and the NCR). They included engineering service providers and related industry associations. This was followed by data collation and analysis of the information gathered from the primary and secondary research.

### Schematic Outline of the Methodology



## Engineering Process Defined

An Engineering Process (EP) is defined as a complete engineering design cycle activity for a product or a service from the conceptualization stage till the pre-manufacturing stage including the development of the prototype. It also extends beyond the manufacturing stage : this includes applications like product life cycle management (PLM) solutions and product re-engineering solutions, etc. Engineering processes also entail design and R&D activities across industry sectors like automotive, aerospace, telecom, utilities, etc. Besides the design elements of a product or service, the engineering process also include the infrastructure, equipment and processes used in delivering the service.

## Industry Structure

The key areas of engineering process application are :

- Product Engineering
- Process Engineering
- Plant Automation
- Enterprise Asset Management (EAM)

## Major Industry Sectors that Outsource Engineering Processes

The global R&D expenditure is considered to be a fair indicator of the expenditure on EPO services in various industry sectors. A detailed analysis of various secondary sources and primary sources shows that the major industry sectors in which the bulk of expenditure on EPO services happens are :

- Electronics and Telecommunications
- Automotive
- Aerospace and Defense
- Utilities and Industrial Construction

The largest spend is by the electronics and telecom industries which together account for about 40 per cent, followed by the auto sector at 29 per cent, aerospace at 9 per cent, utilities and industrial construction at 9 per cent, and heavy engineering at 2 per cent. The remaining 10 per cent is outsourced to other industry sectors. This 10 per cent is held by sectors like ship building/marine engineering, architectural services, materials, mining and industrial conglomerates, etc.

## Major Spenders on Engineering Processes

The global R&D spend is a fairly representative indicator of the expenditure on engineering processes and is spread across various industry sectors. Besides the R&D spend in the engineering sectors, non-engineering sectors like IT, Pharmaceuticals, Biotech, and Chemicals who do not constitute a part of EPO, spend a significant amount on R&D. A detailed analysis of the R&D expenditure by various secondary sources is presented in *Annexure - II*. (Please refer to *Annexure - II* for sector-wise breakdown of R&D expenditures in various industry sectors including non-engineering sectors like IT, Pharmaceuticals, and Chemicals).

***Annexure II***

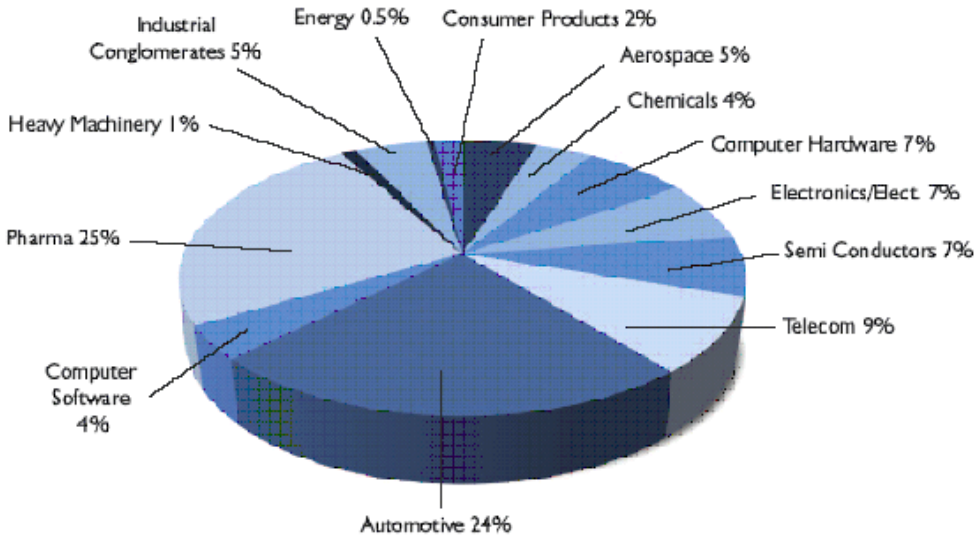
## Analysis of Industry Sector-wise R&D expenditure through various sources

According to the report by Technology Review, September 2005, the global R&D expenditure of the top 150 companies in the year 2004 adds up to about $ 280 bn. This was more than 30 per cent of the global R&D expenditure of $ 922 bn in the year 2004. According to the report, the expenditure in the pharmaceutical sector is the maximum at 25 per cent followed by the automotive sector contributing 24 per cent. If we club the spending on telecom, semiconductors, electronics/ electrical and computer hardware, the total share of the electronics and telecom sector in R&D spending come to 30 per cent. The aerospace sector takes the next place with 5 per cent. (It is important to note that this figure is from corporate

spending only. A considerable part of the R&D spend in the aerospace industry comes from the defence sector.) *Exhibit 2A* depicts the sector-wise expenditure by the top 150 companies spending on R&D work.

## Exhibit - 2A

### Sector-wise R&D spend by the top 150 companies in 2004

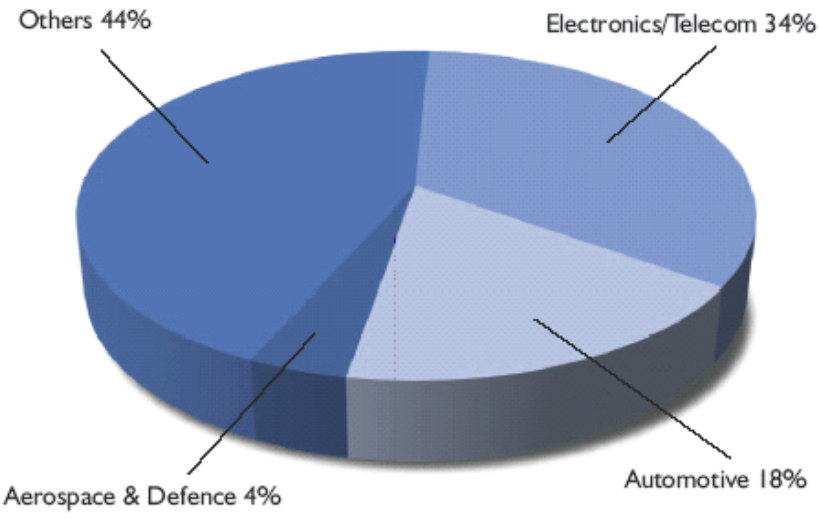



*Source: Corporate R&D Scorecard- Technology Review September-2005*

UNCTAD's World Investment Report 2005 gave this breakdown of the R&D expenditure of 700 of the top MNCs : 34 per cent came from the electronics and telecom, 18 per cent from the automotive sector, and 3.9 per cent from aerospace and defence. *Exhibit 2B* represents the industry sector wise expenditure on R&D.

## Exhibit - 2B

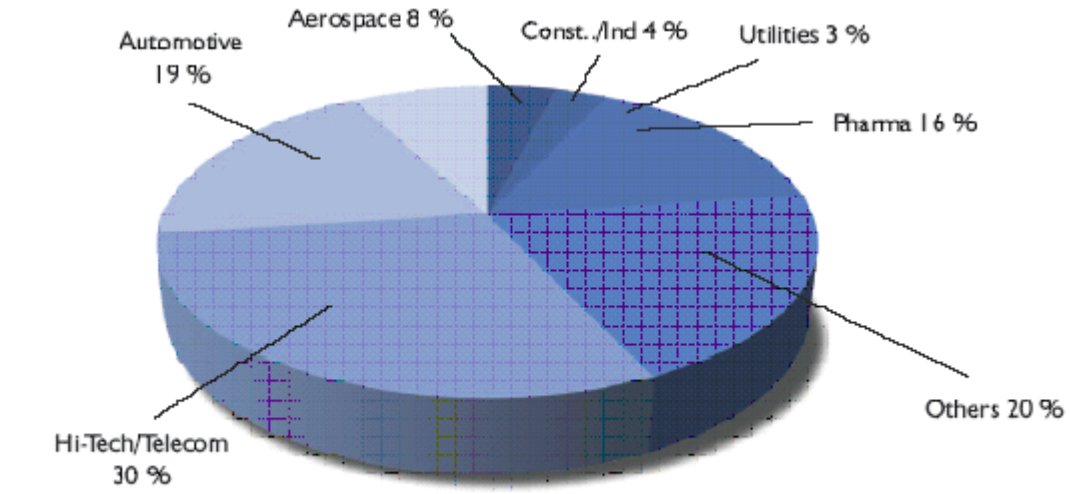
### Sector-wise spend on R&D by the top 700 companies in 2003




*Source: World Investment Report, UNCTAD*

## Exhibit - 2C

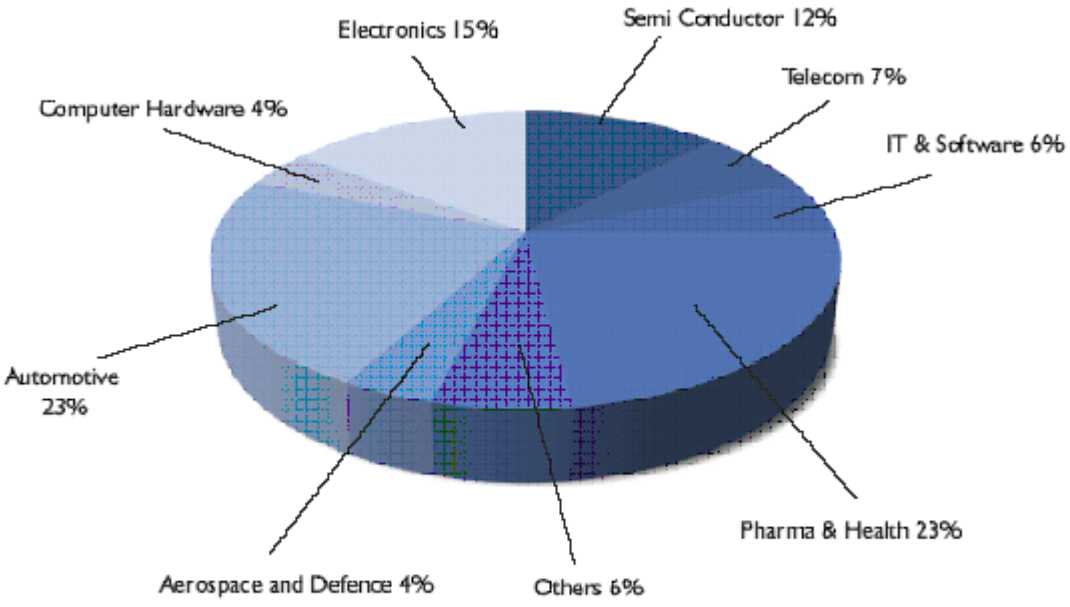
### Industry Sector-wise global engineering spend in 2004




*Source: Globalization of Engineering Services. Booz Allen Hamilton*

## Exhibit - 2D

### Sector-wise R&D spend by top 100 companies in 2004




*Source: Global R&D spend 2002-04 – Clentifica Survey October 2005*

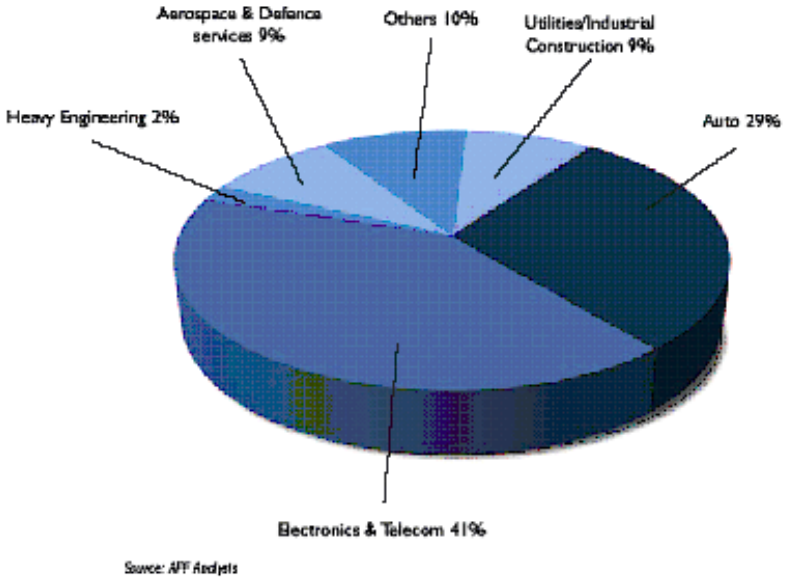
According to the study Globalization of engineering services conducted by Booz Allen Hamilton, the global expenditure on engineering services distribution among the various industry sectors place automotive at 19 per cent, aerospace and defence at 8 per cent & high-tech and telecom at 30 per cent. *Exhibit 2C* (above) shows the industry sector-wise R&D expenditure. Similar observations are made by a survey by Clentifica on the R&D spending of the top 100 companies. The industry sector analysis of the spend suggest that about 23 per cent of the spent was accounted by the automobile sector, electronics and telecom put together was 38 per cent and aerospace and defence at about 4 per cent. *Exhibit 2D* (above) shows the industry sectorwise R&D expenditure of the top 100 companies in 2004.

Based on the above analysis, a breakdown of the R&D/engineering expenditure by various industry sectors is shown in *Exhibit 4*. This breakdown excludes the R&D expenditure by non-engineering sectors like Pharmaceuticals, Chemicals and IT. The expenditure on utilities has also been appropriately accounted for through various primary and secondary sources.

**Exhibit : 4**

**Industry sector-wise R&D breakdown**

**(Excluding non-engineering sectors)**

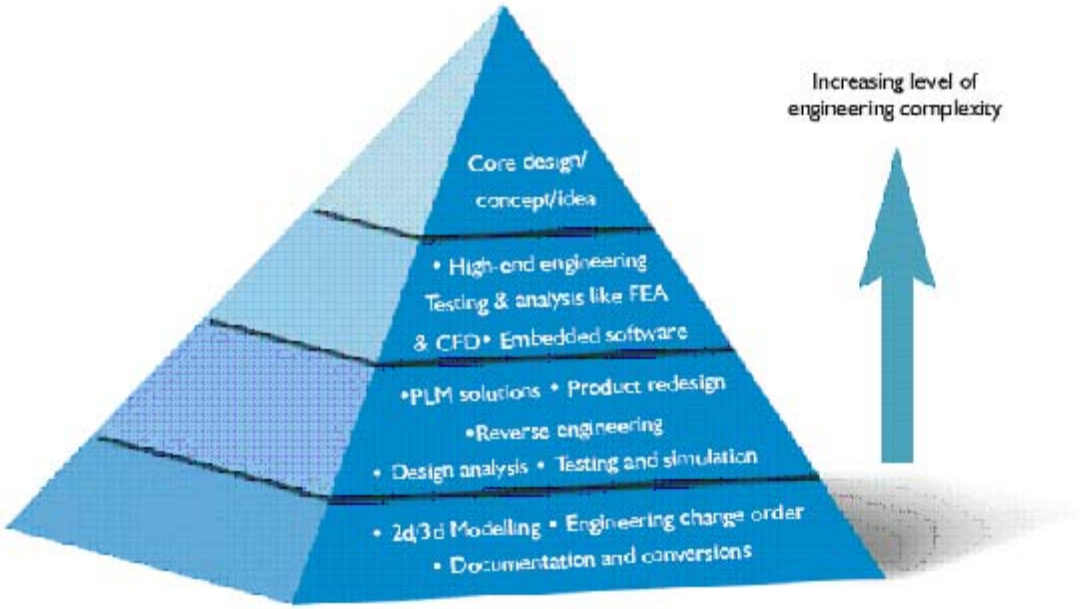



## The EPO Value Chain

The value chain of EPO services shows that engineering process outsourcing is done at various levels of engineering complexity. Some of the major EPO services applications (in order of increasing engineering complexity) are :

- 2d/3d Modeling
- Engineering Change Order
- Documentation and Conversions
- PLM Solutions
- Product Redesign
- Reverse Engineering
- Design Analysis
- Testing and Simulation
- High-end engineering testing and analysis like FEA and CFD
- Embedded software development
- Core design/concept/idea

## EPO Value Chain




Traditionally, outsourcing engineering work has been limited to low-end and labour intensive jobs. Organizations outsourced jobs that involved lower levels of complexity or intensive labour like digitizing engineering data, conversions from 2D to 3D, technical manual writing, etc. But with increasing globalization and the growing levels of domain engineering expertise of the suppliers, outsourcing has risen significantly. Shrinking product life cycles, and increasing pressure to lower costs and retain engineers involved in core engineering activities has led to global engineering outsourcing moving up the value chain over the years. Overall, engineering process work involving lower levels of complexity is still being outsourced in higher volumes. It will, however, be incorrect to pinpoint an application in the value chain that is being outsourced more because the drivers to outsource the extent of engineering processes changes with the product and the strategies of the organization.

### Outsourcing Strategies

An outsourcing organization may adopt different engineering outsourcing strategies as per requirements. The outsourcing strategy of an organization can be a function of :

- Cost of the EPO services
- Availability of domain competence with the vendor
- Criticality of the IPR involved
- Impact of the outsourcing function on the functionality of the final product

### Outsourcing Strategies can be broadly classified into four Categories

- In-house development (not out-sourcing) : meeting the engineering requirements in-house, i.e., within the organization and not outsourcing
- Offshore outsourcing to owned engineering centre (Captive Outsourcing) : off shoring EPO services to owned captive centre, which are located outside the country of the outsourcing organization
- Outsourcing onshore: onshore outsourcing is where the services are outsourced to a third party engineering organization but located within the country
- Outsourcing offshore : outsourcing of engineering processes to a third party engineering organization, which is located outside the country of the outsourcing organization

## Major Regions Outsourcing Engineering Processes

On the basis of primary and secondary sources, the major countries outsourcing EPO services are :

- North America (US)
- Western Europe (France, Germany, UK)
- Japan

Emerging markets outsourcing engineering processes are :

- Canada and Italy

It was also observed that the major markets, which constitute for most of the demand for engineering processes, are industrially developed economies where the industries fund for innovation and hence their share in the global R&D spend is also the maximum. The contribution to the global R&D spends by America and Europe alone was close to 57 per cent in the year 2005 while Japan accounted for 13 per cent of the global R&D spend in the same year (2006 Global R&D report, R&D Magazine September 2006). Also, the global R&D expenditure by these developed countries as explained above forms an additional bearing to the primary and the secondary findings that US, Japan and Europe (UK, France, and Germany) are the major countries from where the bulk of the EPO work originates. The global R&D expenditure contribution of 70 per cent by the big three markets (US, Japan and Europe) does not necessarily mean that their contribution towards global outsourcing of engineering processes is also in the same ratio. Engineering process outsourcing by these developed countries is in fact much higher than their share of the global R&D expenditure.

The R&D expenditure of China and India is quite high. Though China's R&D expenditure is as high as Japan's, it is not an indication of China's expenditure on EPO services. The reason is that MNCs have opened a large number (more than 700) of R&D centres in China (and in India too). For an indication of the potential for EPO services (demand side), an analysis of the global R&D expenditure was done after excluding the R&D expenditure done by China, India, Brazil, Russia, Taiwan and Mexico – the major countries that supply EPO services to global markets. *Exhibit 8* shows the global R&D expenditure breakdown. This will indicate potential EPO business areas.

**Exhibit : 8**

**Global R&D Expenditure – 2005 ($ Bn)**

| *Country* | *R& R&D Expenditure D Expenditure* | *% of total of total* |
|---|---|---|
| US | 319.6 | 32.7 |
| Japan | 124.48 | 12.7 |
| China | 124.03 | 12.7 |
| Germany | 59.68 | 6.1 |
| France | 41.36 | 4.2 |
| UK | 36.72 | 3.8 |
| India | 36.11 | 3.7 |
| Korea | 27.33 | 2.8 |
| Brazil | 24.44 | 2.5 |
| Canada | 20.66 | 2.1 |
| Russia | 20.66 | 2.1 |
| Italy | 19.55 | 2.0 |
| Taiwan | 13.89 | 1.4 |
| Spain | 12.36 | 1.3 |
| Sweden | 11.04 | 1.1 |
| Australia | 10.7 | 1.1 |
| Netherlands | 9.78 | 1.0 |
| Israel | 6.95 | 0.7 |

| Country | R& R&D Expenditure D Expenditure | % of total of total |
|---|---|---|
| Belgium | 6.93 | 0.7 |
| Switzerland | 6.63 | 0.7 |
| Austria | 6.1 | 0.6 |
| Finland | 5.8 | 0.6 |
| Denmark | 4.55 | 0.5 |
| Mexico | 4.37 | 0.4 |
| Singapore | 2.73 | 0.4 |
| South Africa | 4.27 | 0.4 |
| Turkey | 4.21 | 0.4 |
| Norway | 3.29 | 0.3 |
| Poland | 3.05 | 0.3 |
| Malaysia | 2.03 | 0.2 |
| Portugal | 1.85 | 0.2 |
| Ireland | 1.68 | 0.2 |
| Hungary | 1.51 | 0.2 |

*(Source : R&D Magazine- September 2006)*

## A Description of the major countries Outsourcing EPO Services

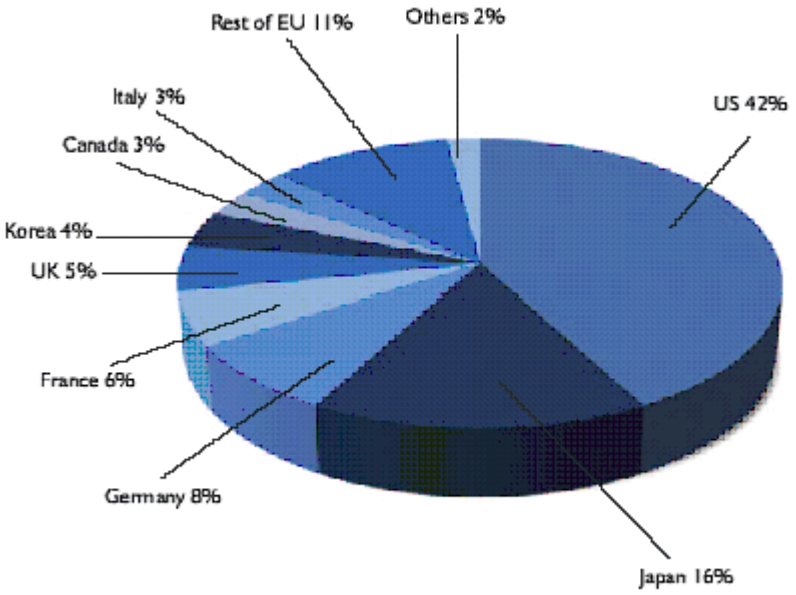
***North America (the US) :*** The US stands at the apex of the global R&D spend. It has a well-developed automotive, aerospace and electronics industry, which caters to global markets. With an annual spending of $ 320 bn in 2005, the US contributed more than a third of the global R&D expenditure of $ 978 bn. The US also contributes the maximum to global engineering process outsourcing. The result has been that the considerable experience the US has gained over the years about outsourcing encourages them to outsource even more. In fact the first R&D centre established by a foreign company in India was by Texas Instruments (TI) at Hyderabad in 1985. To increase their technological base, US organizations significantly invest in captive centre also known as Offshore Development Centre (ODC) in India and China. US MNCs like GM, Ford, Dell, and Fluor Daniel have set up R&D centre in India. The international expenditure of US organizations on R&D has risen continuously with more then $ 21 bn spent in the year 2002. This was 13.3 per cent of the total American R&D spent in that year (World Investment Report 2005). While being present in emerging economies like India and China through captive centre, US organizations also outsource a significant amount of EPO services to third party vendors located in these locations. The recent services contract awarded to HCL Technologies to provide engineering support to Boeing's 7E7- Dreamliner is an important example of an American major outsourcing critical engineering service to an Indian EPO organization. Boeing works with HCL Technologies to co-develop entire software that will run navigation systems and landing gear to the cockpit controls of the 7E7.

***Western Europe (Germany, France, UK) :*** Western Europe is the second largest market after the US for outsourcing engineering processes to the world – in 2005 Germany spent $ 59.68 bn, France $ 41.36 bn and UK $ 36.37 bn. The expenditure of these three countries put together accounts for more than 14 per cent of the global R&D spend next only to the US which contributed 37 per cent in 2005 (source: R&D Magazine September 2006). Western Europe has a well-developed automotive and aerospace industry with global companies like Daimler Chrysler, Bosch, Airbus, and Rolls Royce. Outsourcing by these organizations has risen with rising global demand and reduced product life cycles. West European organizations have in the past demonstrated an increasing global R&D spends. UNCTAD's survey from November 2004-March 2005 conducted for the world's top 700 spenders on R&D showed that while most of the organizations had increased their international R&D spend in the past, West European organizations showed the highest levels of internationalization of R&D. Among the top three West European spenders, Germany's R&D internationalization

has been the most prominent. The international R&D spending of German organizations grew to $ 12 bn in 2001, a 130 per cent jump from 1999. In 2004, of the 45,000 R&D employees working in German organizations, 49 per cent worked in locations outside Germany *(Source : UNCTAD : World Investment Report 2005)*. *Exhibit 9* shows the extent of internationalization of R&D (extent of R&D investment at offshore locations) by major regions/countries.

**Exhibit : 9**

**Global R&D spend (minus major EPO providers)**




Source: AFF Analysis (base figures sourced from R&D Magazine September 2006

The R&D expenditure distribution indicate that besides the major countries – US, Japan, UK, Germany and France – and the emerging countries – Canada and Italy – who outsource EPO services, the other countries/regions from where EPO opportunities may arise are :

- South Korea
- Singapore and Australia
- Spain, Sweden and Netherlands

*(Source : EEPC)*

**(To be continued at next issue)**