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engineering value chain - an important dimension for esos

Influence of Engineering Value Chain on Strategic and Operational decisions in ESOs

The definition and scope of engineering services has been steadily changing as service providers continue to spread across (move up) the product development value chain.

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contents

Indian Engineering Services - Industry Overview

The definition and scope of engineering services has been steadily changing as service providers continue to spread across (move up) the product development value chain. This industry is popularly known as Engineering Research & Development (ER&D) Services1, Product Engineering (PE) Services2, Product Development Services (PDS)3. The organisations delivering engineering services are identified as Engineering Service Organisations (ESOs), Engineering Service Providers (ESPs).

Engineering services market in India is addressed by two distinct players - MNC captives and third party vendors. The Indian engineering services industry is expected to be USD 40 billion by FY20204.

Unlike IT Service providers, ESOs are involved in creation and/or sustenance of a product for product companies.

Hence, delivering engineering services requires:

- Unique engineering skills like aeronautics, electronics, electrical, mechanical etc.
- Appreciation of Product Life-cycle stages in a vertical

Some of the verticals seeking engineering services include - Aerospace, Automotive, Telecom, Semiconductors, Consumer Electronics, Construction/Heavy Machinery, Computing Systems, Energy, Infrastructure, Industrial Automation and Medical Devices.

Traditionally, ESOs have delivered low end / non-core tasks and provided manpower to product companies globally. The value proposition was purely cost arbitrage. However, in the last decade clients have demanded more value and ESOs responded by expanding their offering across the width of product value chain. The value proposition largely continued to be cost arbitrage. Today, product companies need capable vendors to address their entire product creation process (product concept to product support till end of its life). The future is expected to be an era of co-innovation and IP creation. All these changes are driving fundamental transformation the way Engineering Services Organisations will operate. The challenges to transformation are quality of talent and delivery models.

Industry bodies (like NASSCOM) and analysts (Forrester Research, IDC, booze) have recommended strategies and investments to enable ESOs to transition from a staff augmentation mindset to being a product development partner. While these recommendations are being adopted to address future requirements, a deeper understanding of 'dominant value chain(s)' in a vertical enables ESOs to develop a pragmatic approach to this transformation journey.

This paper discusses versions of a generic product development value chain, key characteristics of each version and provides guidance to strategists (to prioritise investments) and operation leaders (to build portfolio of offerings).

Product Development Value Chain

A product company's value chain5 is represented in figure 1, the business benefits and engineering actions along the value chain are summarised. ESOs participate (in part or full) in this value chain by delivering design, detailing, simulation, manufacturing engineering and product sustenance services.

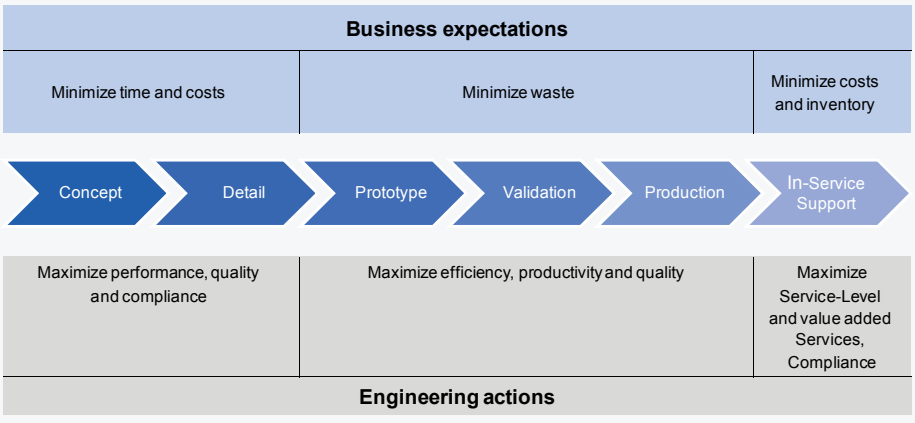

Figure 1: Typical Product Development Value Chain

[1] Term popularly used by NASSCOM to describe Engineering Services
[2] As described by IDC
[3] Term used by Forrester Research, Inc to promote the next generation of Engineering Service offerings
[4] NASSCOM-Booz report, May 2010
[5] Market Analysis – Worldwide and U.S Research and Development / Product Engineering Services 2011-2015 Forecast, Mukesh Dialani, IDC #232197, December 2011.

The product development value chain improvises itself based on core business of product companies. ESOs must develop good understanding of their customer's core business and appropriately position themselves to participate in the value chain.

Three distinct life-cycles that emerge in product organisations are summarised in figure 2 and discussed in the following sections.

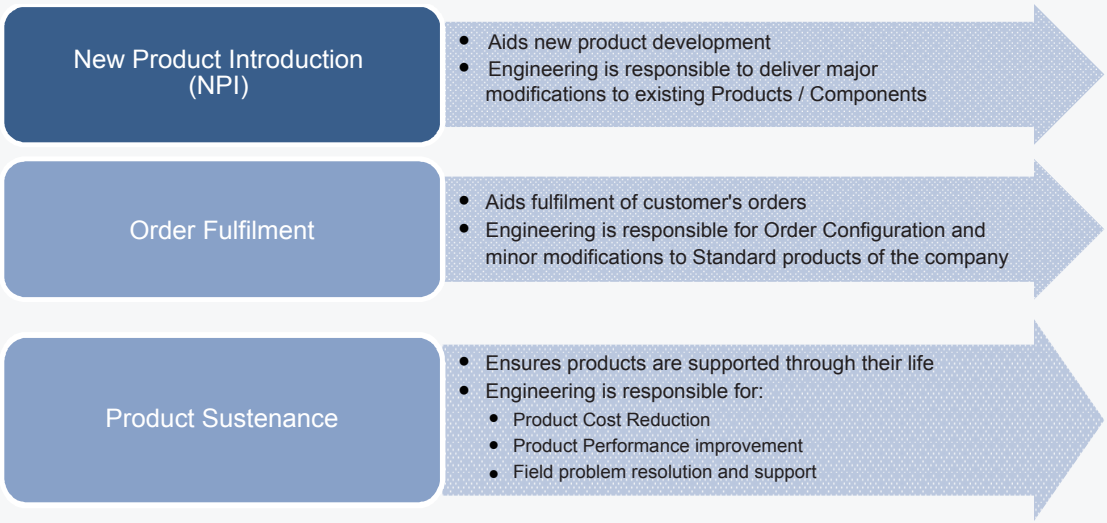

Figure 2: Product Companies and Life-Cycles

New Product Introduction (NPI) Life-cycle

The NPI life-cycle is characterised by the need to have very capable resources and high degree of collaboration with customers during its early phases. Methods for design and validation are developed during the early phases. Complexity reduces as the job progresses to the right but specialist resources must always oversee the product development exercise. A typical NPI life-cycle is shown in figure 3.

Figure 3: Phases of NPI Life-Cycle

ESO's must develop technical specialisation or Centres of Excellence (CoEs) in select modules / systems / components instead of spreading lean across entire product. Examples of CoE are Compressor, Fuselage, and Avionics.

Local-Global is a recommended business model NPI cycles as it ensures right balance of capability and capacity. Capable resources near-site and extended teams offshore ensure best value to customers. Technical interface and program management is near-site and execution is conducted offshore. A typical work share in aerospace vertical is represented in figure 4.

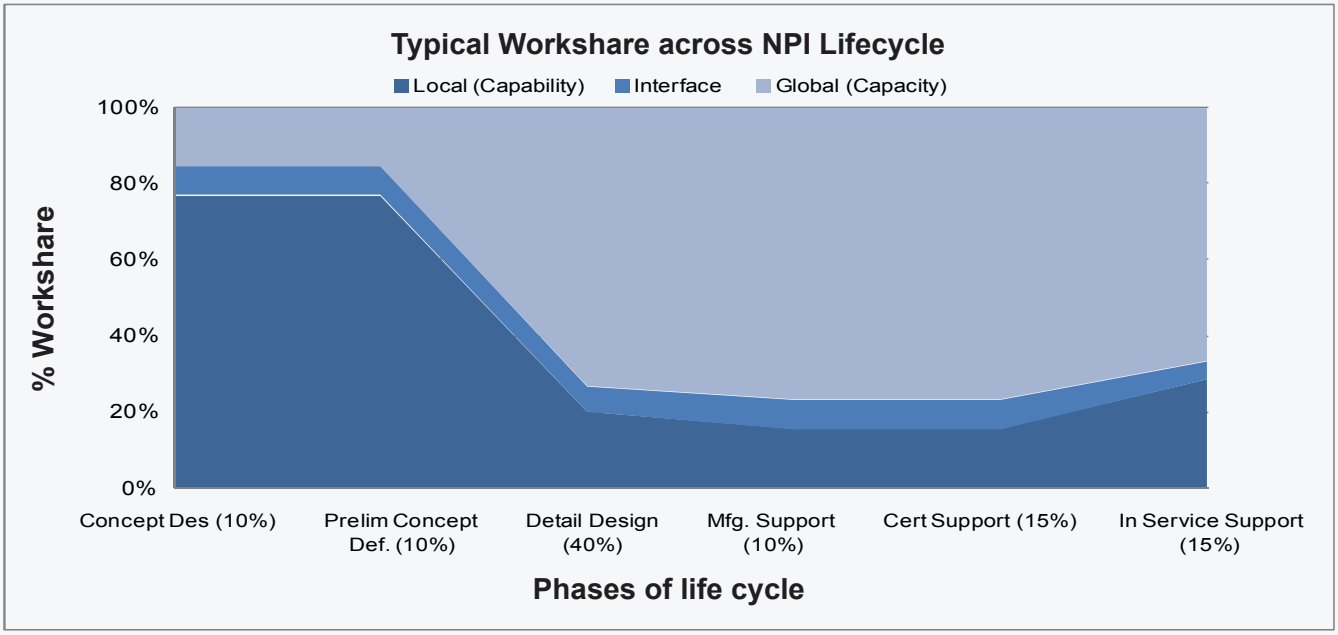

Figure 4: Local Global work share across NPI Life-Cycle

Fixed bid pricing models are common and proven project management skills are critical for ESOs to successfully manage NPI projects.

ESOs can play a significant role in reducing the product development cost. Their ability to provide innovative solutions builds customer confidence.

The NPI life-cycle prevails across all verticals but its intensity varies. Aerospace verticals have a dominant NPI cycle.

Every new product development initiative is identified as a program and lasts for 4 to 6 years before a product enters into service. Other verticals have a relatively less dominant and a cyclic NPI life-cycle.

Key takeaways for Strategic and Operations leaders to support NPI life-cycle are listed in table 1.

Strategic Leaders	Operations Leaders
Look for Capability Acquisitions	Build superior Project Management capabilities
Invest to Build Innovation Culture	Deploy good practices of resource management. Optimise resource mix based on the phase of NPI lifecycle
Invest in building CoEs	Capability building - Develop separate teams to work on NPI type of assignments

Table 1: Key takeaway from NPI life-cycle

Order Fulfilment Life-cycle

A new order is pre-requisite to start this life-cycle. In the capital goods industry, every order is unique! Major portion of an order (sometimes upto 80%) is fulfilled by configuring the approved variants (from Organisation asset library). Knowledge of product and its variants is essential to configure an order. To finalise the remaining bill of material (~20%) it continous requires engineering efforts.

Ability to manage change electronically is a mandatory requirement in order fulfilment business and determines project costs. ESO with the right IT infrastructure can provide benefits to clients. Timely investment by product companies / ESOs in development of design automation tools yields significant advantages to both parties. The phases involved in Order fulfilment life-cycle are summarised in figure 5.

Figure 5: Phases of Order fulfilment Life-Cycle

Familiarity to customer product and ability to manage change are essential. Detailed work instructions will reduce variation of output and bring scalability to operations. Good engineers with application engineering abilities are most suited to participate in Order fulfilment life-cycle.

Product companies in Energy, Construction/Heavy Machinery vertical have a dominant Order fulfilment life-cycle (NPI is cyclic).

Key takeaways for Strategic and Operations leaders to support Order fulfilment life-cycle are listed in table 2.

Strategic Leaders	Operations Leaders
Invest in IT infrastructure	Build Standard Work documents
	Build / Co-Develop Design Automation tools
	Develop Application Engineering capability

Table 2: Key takeaway from Order fulfilment life-cycle

Product Sustenance Life-cycle

The activities in product sustenance life-cycle ensure continued customer satisfaction throughout the life of product. Additionally, product companies always strive to improve the product so that life cycle costs are reduced. The value chain is identical to a NPI cycle but the magnitude of efforts is usually a fraction of NPI.

Figure 6: Phases of Product Sustenance Life-Cycle

The product sustenance life-cycle is characterised by a large number of repetitive tasks of varying degree of complexity. Access to historical data is vital to be responsive. Workstreams in this lifecycle are most favourable for outcome based pricing models.

ESOs have to be highly process oriented to deliver a Workstream. ESOs must have a Services mindset to succeed in this life-cycle. Capability maturity models (like CMMi for Services) provide a ready framework for delivery excellence and continuous improvement of service levels.

Workstreams in this life-cycle render a good opportunity for young engineers to familiarise themselves with customer products and processes. Problems can be very challenging and will need quick turnaround. Examples of Workstream are – Manufacturing non-conformance management, component repair solutions, product cost reduction, engineering change management, field failure resolution.

Key takeaways for Strategic and Operations leaders to support Product Sustenance life-cycle are listed in table 3.

Strategic Leaders	**Operations Leaders**
Explore opportunities to extend process ownership	Delivery excellence through Service management
Focus on Process measurement and Continuous improvement	Develop robust Knowledge base
	Cost Management

Table 3: Key takeaway from Product Sustenance life-cycle

Summary of Requirements Across Life-cycles

The requirements of each life-cycle is summarised in table 4.

		Life-Cycle		
#	Attribute	NPI	Order Fulfilment	Product Sustenance
1	ESO Value Preposition	Innovative Solution	On time fulfilment of Order	Superior Service
2	Dominant Key Performance Indicators (KPI's)	Right first time (Poor quality will impact program schedules and costs)	On time delivery (Delays impact timely fulfilment of orders)	On time delivery (Delays impact cost and reputation with end customer)
3	People Capability (Technical)	Specialist	Generalist having good Product Knowledge	Generalist having good Process Knowledge
4	People Skills	Design Engineering	Application Engineering	Service Management

5	Typical engineering Services offered	1) Design and Detailing - Major modifications 2) Engineering Analysis - Optimisation 3) Manufacturing Engineering - New process development	1) Design and Detailing - Minor Modifications 2) Product Configuration 3) Design Automation	1) Design and Detailing - Minor Modifications 2) Engineering Analysis 3) After Market Services 4) Engineering Change Management
6	Typical duration of ESO involvement on an assignment	Months to Years	Weeks to Months	Years to Decades
7	Applicable Verticals	All (Note: Aerospace programs have longer duration)	Equipments in Energy, Oil & Gas, Industrial Machines, Medical Equipment etc. (Note: Not applicable to Aerospace and Defense programs)	All
8	Recommended Pricing Models for ESO	Fixed Price	Time & Material	Outcome Based
9	Work load	Cyclic - Large teams	Continuous - Small teams	Continuous - Large teams

Table 4: Summary of attributes across life-cycles

Discussions

1) ESOs have historically diversified their business along attributes viz. vertical, services, geography. An additional attribute based on the life-cycles (as discussed in this paper) enables ESOs to efficiently manage investments, cash flows, operational risks (operating costs, people attrition, margins) and maximize profits.

2) Strategic investments in people, process and tools must be based on the portfolio of life-cycle served by ESOs. For example at QuEST, we have embraced the CMMi framework for Services (CMMi-SVC) V1.3 to improve our ability to service projects in Sustenance life-cycle. Investments in Innovation are being made to address the future requirements of projects in NPI lifecycle.

3) By working with more than one life-cycle, organisations can rapidly develop capability in multiple disciplines and integrate it to deliver value to customers. Investments in robust Knowledge Management Systems will ensure learning's are re-used.

4) A portfolio of life-cycles offers flexibility to resource management which is a major challenge for operation leaders. People capability requirements depend on the life-cycle and the phase within the life-cycle. Operation managers in ESOs must be sensitive to these requirements and develop a robust mechanism to optimise costs through effective resource deployment.

5) ESOs working with multiple life-cycles can design technical progression path for engineers. Progressive capability development can become reality. Resource retention improves.

Conclusion

Indian ESOs are poised for an exponential growth over the next decade. Life-cycle based thinking is an important dimension for strategists to transform their organisation into a product development partner for their global clients.

References

a) Global ER&D Report, 2012 Refresh, September 2012, NASSCOM, booze co.

b) The Shift To Product Development Services 2.0 Is On, Forrester, May 2012

c) Transformation in Engineering Services - A Perspective, KPMG, Sept 2008

d) Market Analysis – Worldwide and U.S Research and Development / Product Engineering Services 2011-2015 Forecast, Mukesh Dialani, IDC #232197, December 2011.

Key to Terms

Term	Description
Capability Maturity Models	Capability maturity models provide guidance for developing or improving processes that meet the business goals of an organization. Example is CMMi. A CMMi model may also be used as a framework for appraising the process maturity of the organization.
Design Automation	Integrates component CAD models and its design rules to productively manage design modifications.
Engineering Services	Engineering services are those that augment or manage processes that are associated with the creation of a product or service, as well as those associated with maximizing the life span and optimizing the yield associated with a product or asset. This not only includes design elements of the product or services itself, but also infrastructure, equipment and processes engaged in manufacturing or delivering them.
Local Global	Distributed engineering teams having capable team located near site to client and capacity residing in low cost locations to deliver best value to clients.
NASSCOM	NASSCOM is the industry association for the IT-BPM sector in India. A not-for profit organisation funded by the industry, its objective is to build a growth led and sustainable technology and business services sector in the country.
Outcome based pricing	“Outcome-based model is a mechanism in which the service providers’ fees are linked to business/ technical results achieved by the client attributable to the work done by the service provider. Service provider instead of charging for manhours spent or units of resources deployed, charges on the basis of outcome delivered such as volumes, savings achieved, increased profits, revenue growth, etc.” kpmg.com/in Nov 2010
Standard Work	Standard work is a framework to drive engineering quality and productivity through process control instead of inspection. The framework consists of a clear and prescriptive process that makes work as foolproof as possible and causes learning to be automatic.
Workstream	A progressive series of tasks that make up a process.

Author Profile

Sunil Deshpande

Sunil Deshpande is a Senior Manager with the Technology Excellence Group at QuEST Global.He is based out of Bangalore, India and is responsible for managing initiatives related to capability development, knowledge re-use, engineering processes and development of solutions for specific customer requirements.

Sunil comes with a rich experience of more than 17 years in multiple engineering domains with expertise in design and analysis of engineering components, people and project management capabilities. A veteran in engineering process implementation, he has also been involved in a number of critical business initiatives related to people and process maturity.

Prior to joining QuEST Global, Sunil worked with companies such as Mysore Kirloskar Ltd and Batliboi Ltd.

Sunil holds a Bachelors' degree in Engineering and a Masters' in Business Administration from Karnataka University, Dharwad.

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About QuEST Global

QuEST Global is a focused global engineering solutions provider with a proven track record of over 17 years serving the product development & production engineering needs of high technology companies. A pioneer in global engineering services, QuEST is a trusted, strategic and long term partner for many Fortune 500 companies in the Aero Engines, Aerospace & Defence, Transportation, Oil & Gas, Power, Healthcare and other high tech industries. The company offers mechanical, electrical, electronics, embedded, engineering software, engineering analytics, manufacturing engineering and supply chain transformative solutions across the complete engineering lifecycle.

QuEST partners with customers to continuously create value through customer-centric culture, continuous improvement mind-set, as well as domain specific engineering capability. Through its local-global model, QuEST provides maximum value engineering interactions locally, along with high quality deliveries at optimal cost from global locations. The company comprises of more than 7,000 passionate engineers of nine different nationalities intent on making a positive impact to the business of world class customers, transforming the way they do engineering.

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