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Occupational Analysis

Engineering and R&D

Occupational Analysis

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Foreword

2013 is an important year for the Indian IT-BPM Industry as global markets struggle to emerge from their economic instabilities and environmental challenges. The situation, though challenging, also presents new opportunities to tap for the Indian IT-BPM Industry. One of the key imperatives for the industry is to continuously seek and develop the 'right' talent to drive its growth.

As per the National Skills Mission, 500 million professionals would need to be skilled by 2022 to make them employable. The Indian IT–BPM Industry currently employs about 3 million people directly and about 9 million indirectly. As per the *NASSCOM Perspective 2020* report, the industry has a potential to contribute to, as much as, 30 million employment opportunities (direct and indirect) by 2020.

The need is to focus on developing ready-to-deploy talent by laying standards for skill requirements in the IT-BPM Industry. These requirements merit defining consistent standards of performance and quality and standardising recruitment procedures. With this in mind, NASSCOM has come up with the Occupational Analysis report for the IT-BPM Industry.

Occupational Analysis report identifies job roles across the IT-BPM industry at the Entry, Middle and Leadership levels. Career Paths for entry-level job roles have been identified for the benefit of the students and academia to facilitate the clear understanding of the career opportunities provided by the industry. Several case studies of successful people have been included to make careers in our industry more attractive.

This Occupational Analysis report is one of the ways in which NASSCOM aims to streamline job roles across the IT–BPM industry and is the first step in the development of Occupational Standards for the industry.

We reaffirm our commitment to facilitate the growth of the industry and trust you will find the report useful.

Som Mittal
President

Acknowledgements

We would like to thank the entire NASSCOM Leadership: Mr Som Mittal, President; Mr Lakshmi Narayanan, Chairman, IT-BPM Sector Skills Council NASSCOM and CEO Cognizant; Ms Sangeeta Gupta, Sr VP; KS Vishwanathan, VP and Head of Industry Relations; Ameet Nivsarkar, VP; Rajiv Vaishnav, VP; Rama Vedashree, VP, for their strategic leadership and support to this important project.

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EXECUTIVE SUMMARY

- Executive Summary
- Summary of Occupations Within Each Sub-sector

Executive Summary

The IT-BPM industry has received global recognition as the growth engine for India and the sectors it services across the world. It has established itself as a pioneer with the range of services it offers, the global customer base it serves and the numerous employment opportunities it has provided to the workforce in India.

As per NASSCOM's **Strategic Review 2013**, the industry aggregated revenues exceeding USD 108 billion and employed more than 3 million people. The industry accounts for almost 25 percent of the total exports and 11 percent of the total service revenues. In order to drive the acquisition of right talent and to ensure the development of an employable workforce for the industry, IT-ITeS Sector Skills Council NASSCOM (SSC NASSCOM) has taken up an initiative to develop Occupational Standards (OS) for all Entry-level (unique) job roles in the IT-BPM Industry. These OS are being developed in close association with the key member companies in the IT-BPM Industry. In the long term, they will provide a foundation for the skill development training and certification programme.

There are four sub-sectors within the IT-BPM Industry. The sub-sectors are as follows:

- IT Services (ITS)
- Business Process Management (BPM)
- Engineering and R&D (ER&D)
- Software Products (SPD)

The current report shall focus on the ER&D sub-sector within the IT-BPM industry.

Occupational Analysis (OA) is the first step in the development of the OS for any industry or sector. It entails an industry scan and a process of identifying different occupations in the various sub-sectors.

Objective

The objective of this document is to describe the main features and characteristics of an occupation, within the IT-BPM industry, specifically the ER&D sub-sector. It provides a high-level overview of an occupation in terms of the types of job roles that exist, workforce characteristics, key talent trends and a review of available education and training. OA, therefore, provides information on the opportunities that exist for progression through a career in a specific occupation.

The OA for IT–BPM industry contributes to the context and background for the development of the OS for the ER&D sub-sector.

Structure of the Occupational Analysis Report

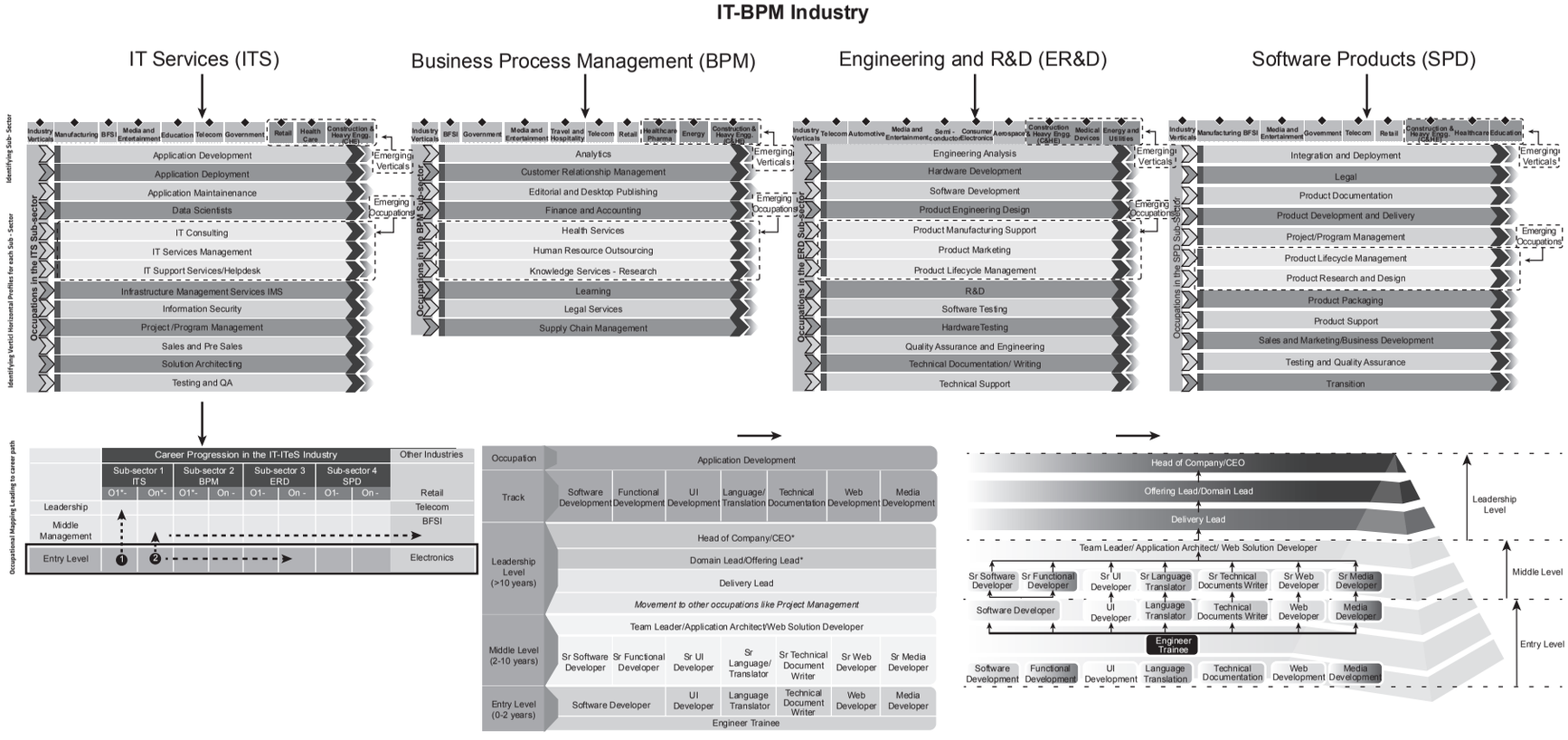
This report consists of the following sections:

- **Background to the Project:** A brief description of the National Skills Mission, Sector Skills Councils and their objectives leading to the process of the development of the OS is given in this section
- **About the IT-BPM Industry:** This section covers the structure of the IT-BPM Industry in terms of the types of organisations within the ecosystem
- **Occupational Mapping and Career Paths for the ER&D sub-sector**

The ER&D sub-sector is structured in the following chapters:

- **Chapter 1: About the sub-sector:** A brief description of the structure, evolution and profile of the sub-sector is given in this chapter. It covers information on the size of the sub-sector, the workforce employed therein, and so on
- **Chapter 2: Talent trends within the sub-sector:** This chapter provides an overview of the key drivers of change that have an influence on the workforce and talent within the sub-sector
- **Chapter 3: Entry-level roles – ER&D:** This chapter provides an overview of the Entry-level roles within the sub-sector
- **Chapter 4: Middle-level roles – ER&D:** This chapter provides an overview of the Middle-level roles within the sub-sector
- **Chapter 5: Leadership-level roles – ER&D:** This chapter provides an overview of the Leadership-level roles within the sub-sector
- **Chapter 6: Occupations and job roles in the sub-sector:** Details of the types of occupational activity included in the scope of the sub-sector, associated occupations, job roles and typical career paths are addressed in this chapter

The steps undertaken to develop Occupation Mapping leading to 'Career Path' are summarised below



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Summary of Key Occupations, Job Roles and Tracks within Each Sub-sector

Figure 1 indicates the key occupations identified in each sub-sector. These are differentiated on the basis of the unique skill-sets required for each occupation. Each occupation is further divided into tracks to highlight the specialisations that exist. Details of the tracks and the unique Entry-level job-roles have been indicated further on in the document. These occupations, tracks, and unique job-roles exist in various organisations under different classifications and level of detail. The list tries to establish a balance between the level of detail and brevity while defining these basic 'distinct' skill-sets

IT Services (ITS)

- Application Development
- Application Deployment
- Application Maintenance
- Data Scientists
- IT Consulting
- IT Support Services/Help Desk
- Infrastructure Management Services (IMS)
- Information Security
- IT Services Management
- Project/Program Management
- Sales and Pre-sales
- Solution Architecting
- Testing and QA

Business Process Management (BPM)

- Analytics
- Customer Relationship Management
- Editorial and Desktop Publishing
- Finance and Accounting
- Health Services
- Human Resource Outsourcing
- Knowledge Services - Research
- Learning
- Legal Services
- Supply Chain Management

Engineering and R&D (ER&D)

- Engineering Analysis
- Hardware Development
- Software Development
- Product Engineering Design
- Product Marketing
- Product Manufacturing Support
- Product Lifecycle Management
- R&D
- Software Testing
- Hardware Testing
- Quality Assurance and Engineering
- Technical Documentation/Writing
- Technical Support

Software Products (SPD)

- Integration and Deployment
- Legal
- Product Documentation
- Product Development and Delivery
- Project/Program Management
- Product Lifecycle Management
- Product Research and Design
- Product Packaging
- Product Support
- Sales and Marketing/Business Development
- Testing and Quality Assurance
- Transition

Figure 1: Occupational Mapping Summary

In each of the four sub-sectors, unique occupations were identified as listed earlier in the section. In each of these occupations based on the specificity of skill requirements, skill based demarcations or tracks have been identified. These tracks define the specific skills that are required to perform a job role within an occupation. In each of these occupations and tracks, Entry, Middle and Leadership level roles have been identified. These job roles identify the unique positions that exist in an organization for fulfilling the functions defined under an occupation. These job roles differ from each other with respect to the competencies, knowledge, skill, attitude and performance criteria requirements for the fulfillment of a role.

Based on our research, we have identified 13 unique occupations in the ITS sub-sector, which are further segregated into 39 tracks with 17, 91 and 25 unique job roles at the Entry, Middle and Leadership levels, respectively. Similarly, we have identified 10 unique occupations in BPM sub-sector, which are further segregated into 27 tracks with 16, 111 and 30 unique job roles at the Entry, Middle and Leadership levels, respectively. For the ER&D sub-sector we have 13 unique occupations, which are further segregated into 15 tracks with 16, 48 and 54 unique job roles at the Entry, Middle and Leadership levels, respectively, while for SPD we have 12 unique occupations, further segregated into 23 tracks with 18, 63 and 21 unique job roles at the Entry, Middle and Leadership levels, respectively.

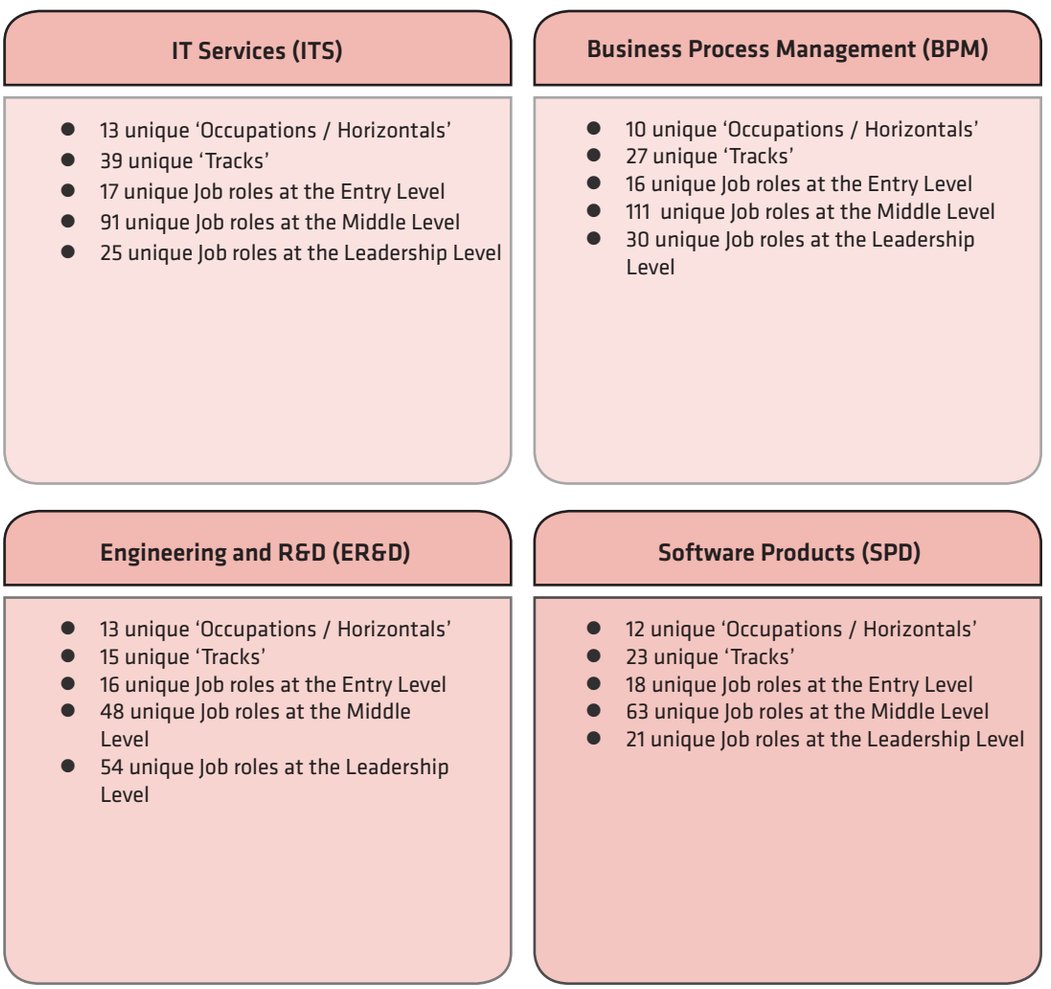

Figure 2: Summary of Findings During Occupational Analysis

BACKGROUND

- Sector Skill Councils
- Occupational Standards
- Occupational Mapping as Part of OS development
- OS Development Framework

BACKGROUND

Background

Sector Skill Councils

The Sector Skill Councils (SSCs) have been established based on the mandate of the National Skill Development Policy (2009). The aim of the SSCs is to complement the existing vocational education system for the industry in meeting the entire value chain's requirements. This includes developing appropriately trained manpower in quantity and quality across all levels on a sustained and evolving basis.

It is important to note that the SSCs in India have been envisaged taking into account the ground realities in India as well as international best practices.

SSCs are national partnership organisations that bring together all the stakeholders – Industry, Labour, and the Academia, for the common purpose of workforce development of particular Industry sectors.

The SSC is envisaged to develop the skill ecosystem in the country as shown Figure 3.

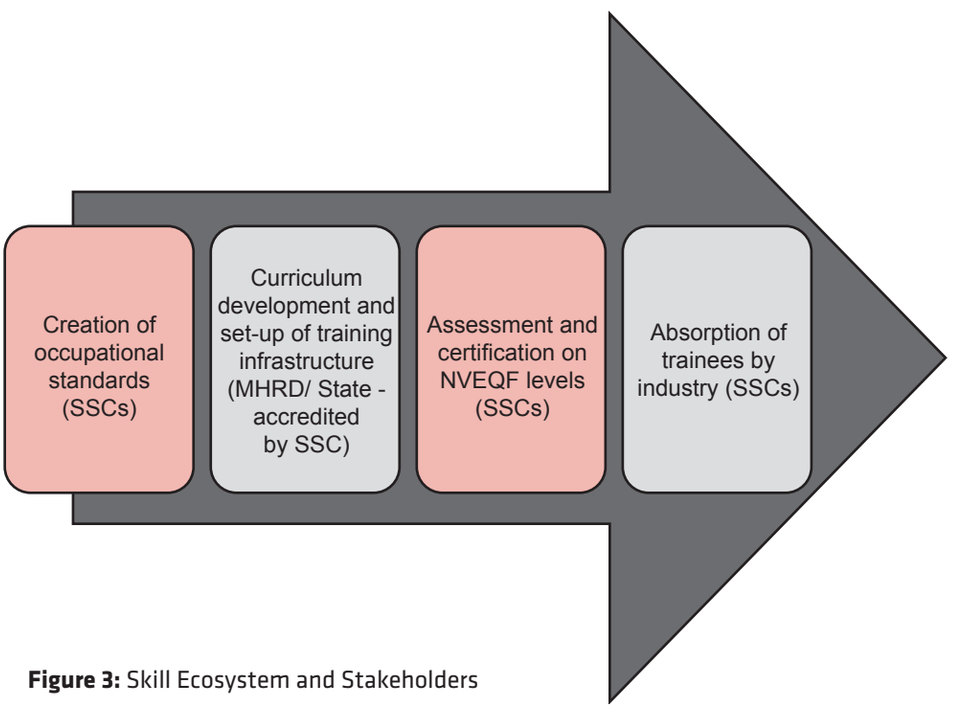

Figure 3: Skill Ecosystem and Stakeholders

Each SSC will create a repository of Occupational Standards (OS) for its respective sectors, which will be an input to develop the relevant content, training infrastructure and other related needs for imparting the training. The SSCs are also responsible for assessment and certification at all the NVEQF levels as described in the next section. It is envisaged that the SSC for a particular sector would be the supreme certification body for that sector. The SSC as an industry/sector body can link the skilling ecosystem to the demands of the industry/sector, to ensure that the content, assessment, certification, etc. is relevant to the Industry. With people trained under this framework, it can be visualised that there would be industry absorption and retention.

Occupational Standards

OS are the statements of the standards of performance individuals must achieve when carrying out functions in the workplace, along with the specifications of the underpinning knowledge and understanding required. OS describe what an individual needs to do, know and understand to carry out a particular job role or function. The OS serve a number of purposes as shown in Figure 4.

Once the OS are developed, it is easy to define a focused training and development ecosystem based on it. The OS will be also helpful in defining a job description for a job role, providing measurable performance outcomes for individual performance appraisals, devising appropriate recognition programmes, defining competency frameworks and providing support for career planning and progression.

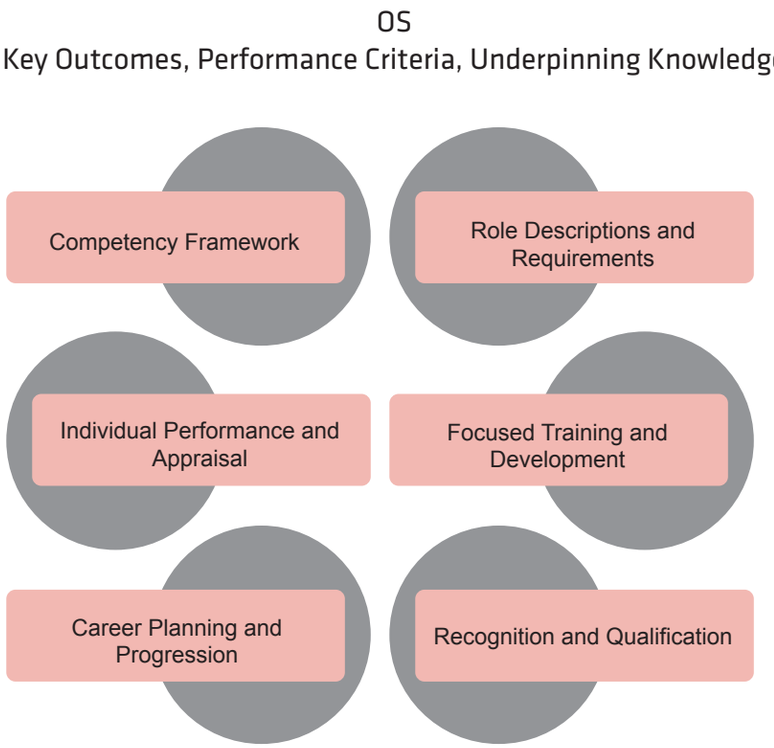

Figure 4: Uses of Occupational Standards

Occupational Mapping as Part of OS Development Process

Occupational mapping is the first step towards the development of OS. It leads to the identification of unique job roles that exist in the industry/sub-sector. In the context of the project, the key outcome of this exercise is the identification of ~67 unique Entry-level job roles for which Functional Analysis and OS are currently being developed. This is represented in Figure 5.

Figure 5: Occupational Mapping as Part of OS Development Process

Approach and Methodology

A step-by-step approach was followed to undertake the Occupational Analysis for the IT-BPM Industry, which is presented in Figure 6.

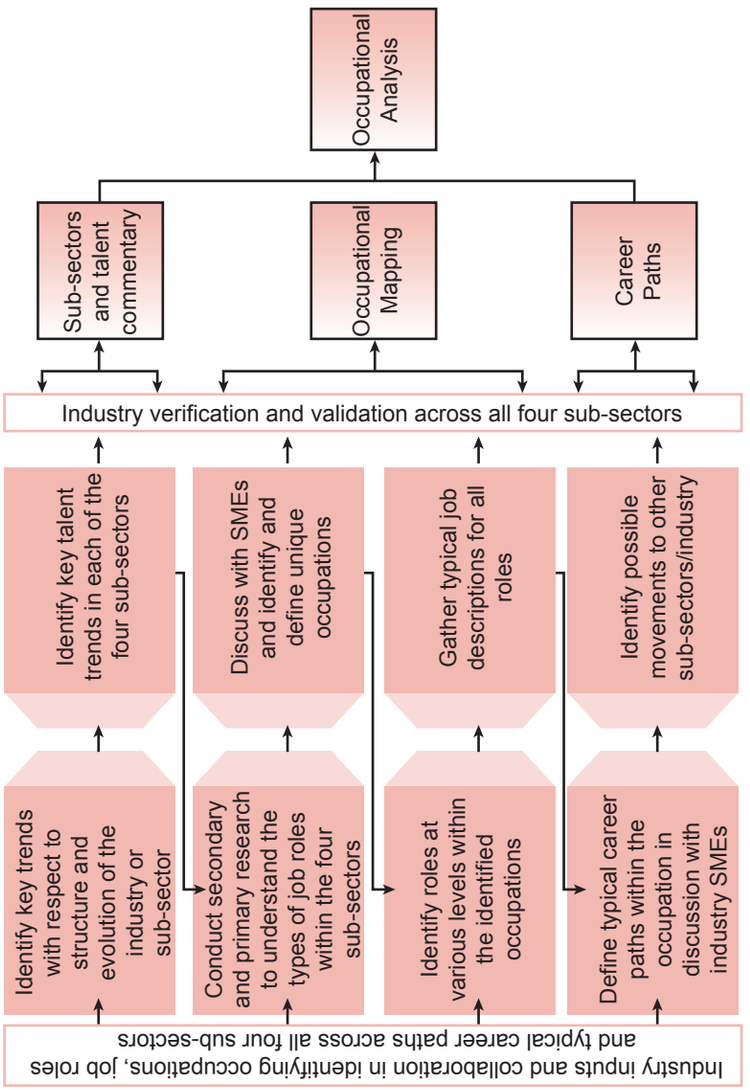

Figure 6: Occupational Analysis: Approach and Methodology

OS Development Framework

The following framework[1] has been used for OS development.

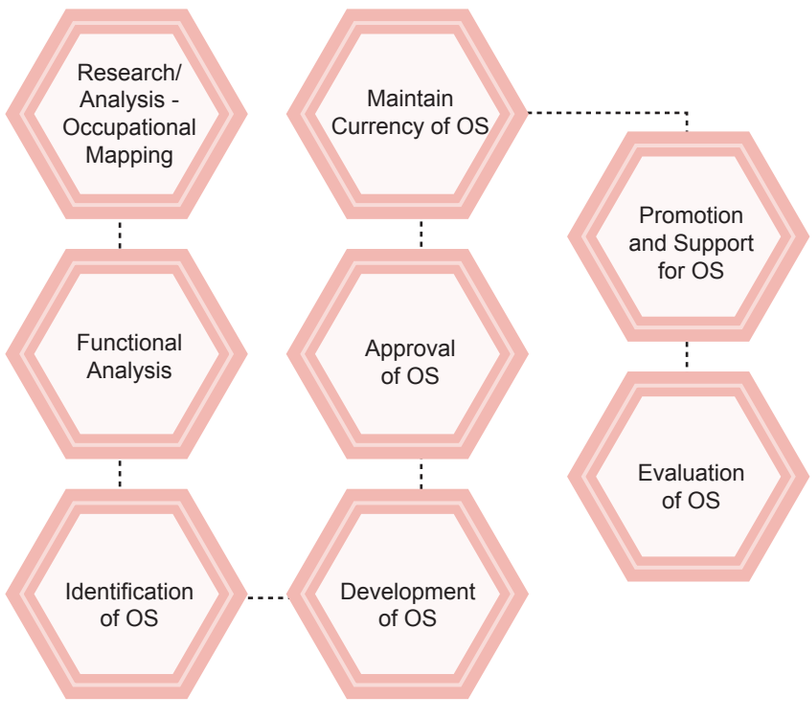

Figure 7: OS Development Framework

As indicated in the OS Development Framework in Figure 7, the outcome of Occupational Mapping will feed into the next steps namely. Functional Analysis and OS Development.

[1] INSSO framework followed globally as a benchmark for OS development

BACKGROUND

ABOUT THE IT-BPM INDUSTRY

- Structure of the IT-BPM Industry
- Impact of the IT-BPM Industry in India
- Sub-sectors Within the IT-BPM Industry

Structure of the IT-BPM Industry

The organisations within the IT-BPM Industry are categorised along the following parameters.

- Sector the organisation is serving
- Type as well as the range of offering the organisation provides
- Geographic spread of operations
- Revenues and size of operations

A broad structure of the industry based on the parameters identified in the Indian context is represented in Figure 8[2].

Multinational Companies (MNCs): MNC organisations have their headquarters outside India but operate in multiple locations worldwide, including those in India. They cater to external clients (both domestic and/or global).

Indian Service Providers (ISPs): ISPs are the organisations that have started with their operations in India. Most of these organisations would have their headquarters in India while having offices at many international locations.

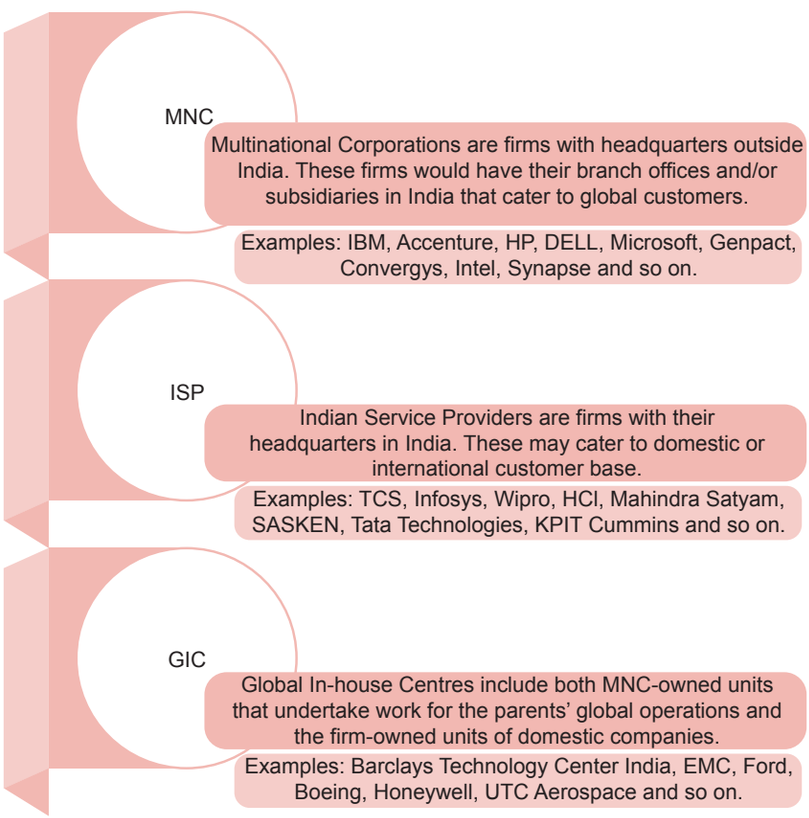

Figure 8: IT-BPM Industry Structure

While most have a client base, which is global as well as domestic, there are some that have focused on serving only the Indian clients.

Global In-house Centres (GICs): GIC organisations cater to the needs of their parent company only and do not serve external clients. This model allows the organisation the option to keep IT operations in-house and at the same time take advantage of expanding their global footprint and offering opportunities for innovation in a cost-effective manner.

[2] NASSCOM Research

Impact of the IT-BPM Industry in India

The IT-BPM industry has been significant in fuelling India's growth story. In addition to contributing to the country's gross domestic product (GDP) and exports, the industry has played a big role in influencing the socio-economic parameters across the country. The industry has helped in providing employment and a good standard of living to millions. It has placed India on the world map with an image of a technological advanced by and knowledge-based economy[3].

The following illustration summarises the contribution and impact of the sector to the Indian economy and employment.

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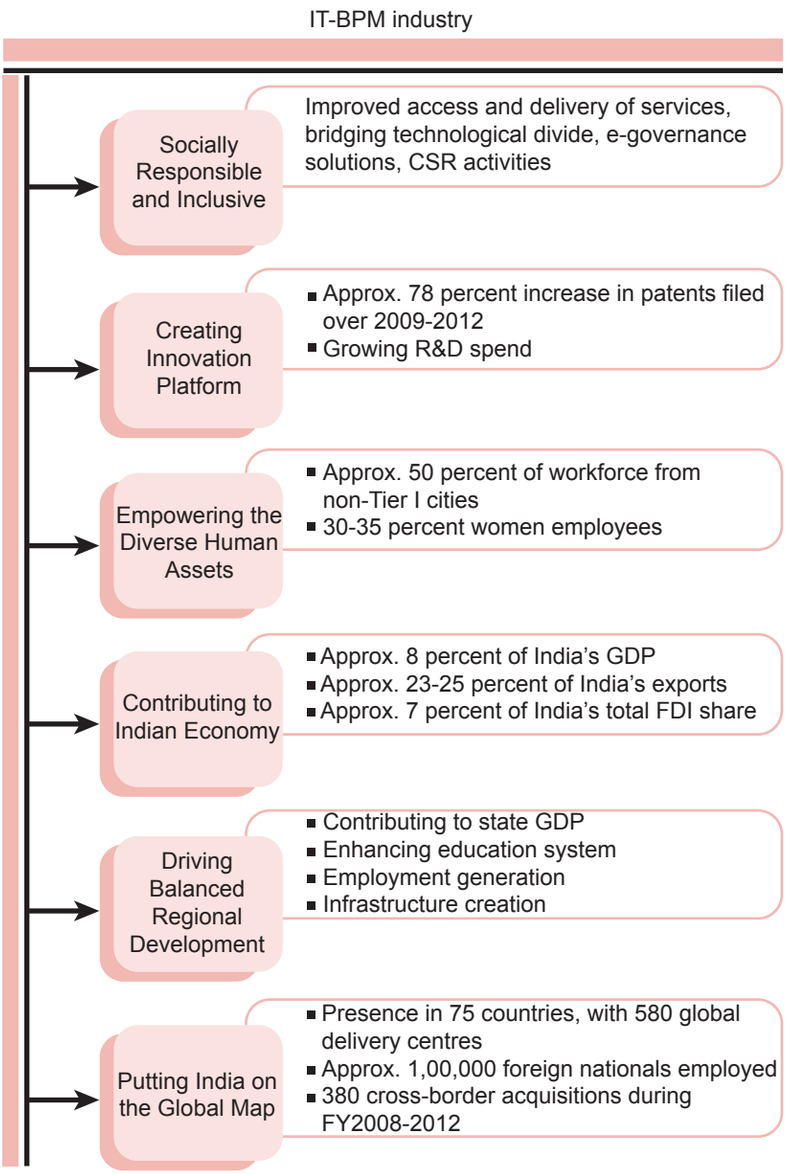


Figure 9: Impact of the IT-BPM Industry

Growth of the IT-BPM industry has provided India with a wide range of economic and social benefits, which include creating employment, raising income levels, promoting exports and significantly contributing to the GDP of the country. This sector attracts amongst the largest investments by venture capitalists and has been credited with enabling the entrepreneurial ventures of many in the country

[3] The IT-ITES sector in India Strategic Review 2012 by NASSCOM

Revenue Growth

The IT-BPM industry has almost doubled in terms of revenue and contribution to India's GDP over the last six years (2008-2013). This growth has been presented in Figure 10.[4]

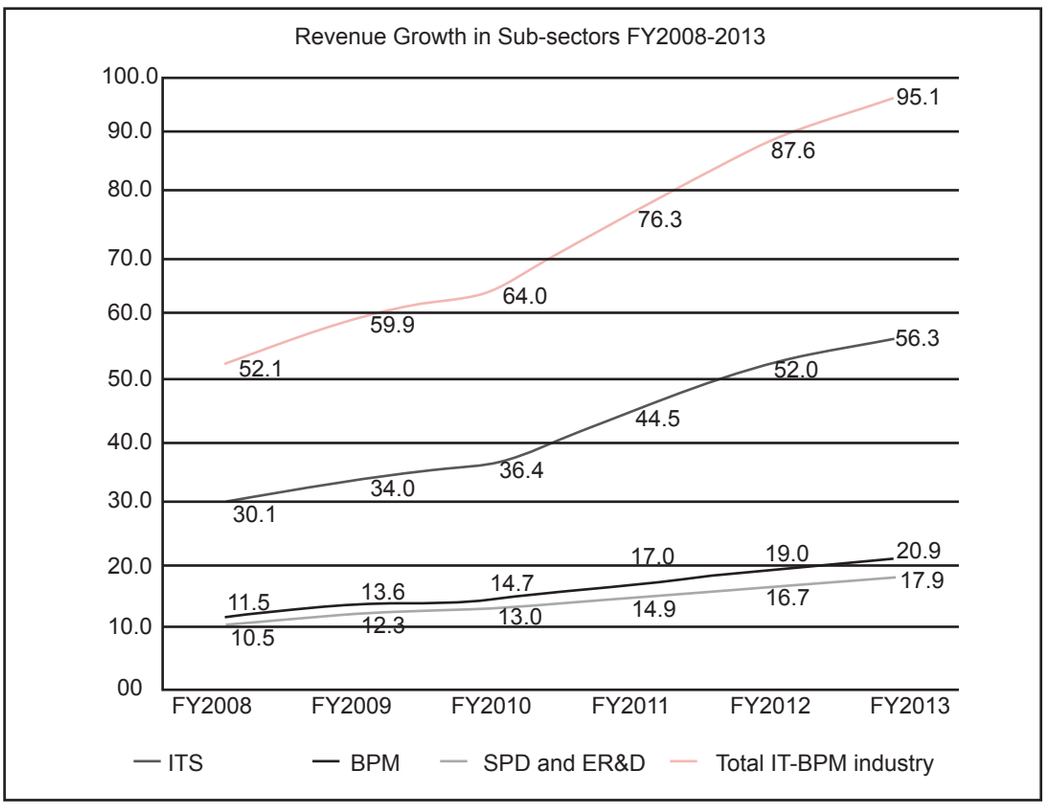


Figure 10: Revenue Growth across the IT-BPM Industry, 2008-2013

[4] The IT-ITeS sector in India Strategic Review 2013 by NASSCOM

Contribution of Different Sub-sectors

The contribution of ITS sub-sector is close to 59 percent of the total revenue for the industry followed by BPM at 22 percent. The contribution of the various sub-sectors has been presented in Figure 11[5].

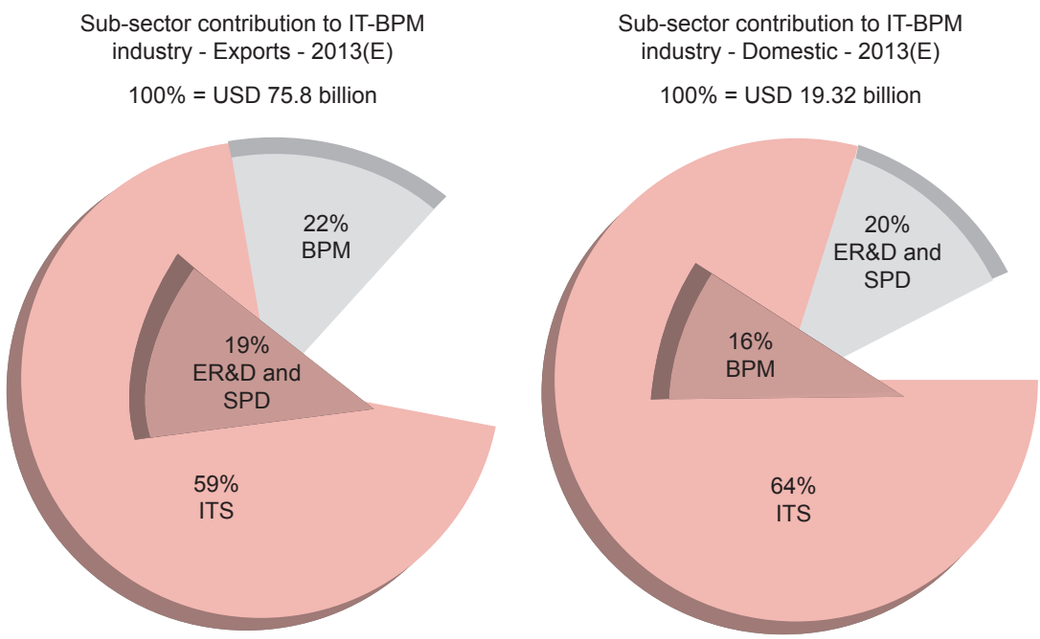


Figure 11: Contribution of Sub-sectors to IT-BPM Industry

Direct Employment Generated

The IT-BPM industry has contributed significantly towards the direct employment generation for the youth. The growth has been presented in Table 1.

Indirect Employment

While, the IT-BPM industry employs about 3 million people directly, it also provides indirect employment opportunities to another 9 million in industries like construction, catering, security services, retail and transport. The increased earnings and employment further drive the spending in services like food, entertainment, telecommunication and healthcare apart from contributing to tax coffers of the country.

[5] The IT-BPM sector in India Strategic Review 2013 by NASSCOM

The indirect-direct employment ratio multiplier has reduced from 3.6 in 2010 to 3.2 in 2012[6].

Table 1: Employment Generation in the IT-BPM Industry

Description	FY2010	FY2012	FY2013
Direct Employment	2.3	2.8	3.0
Indirect Employment	8.2	8.9	9.0
Ratio (Indirect: Direct)	3.6	3.2	3

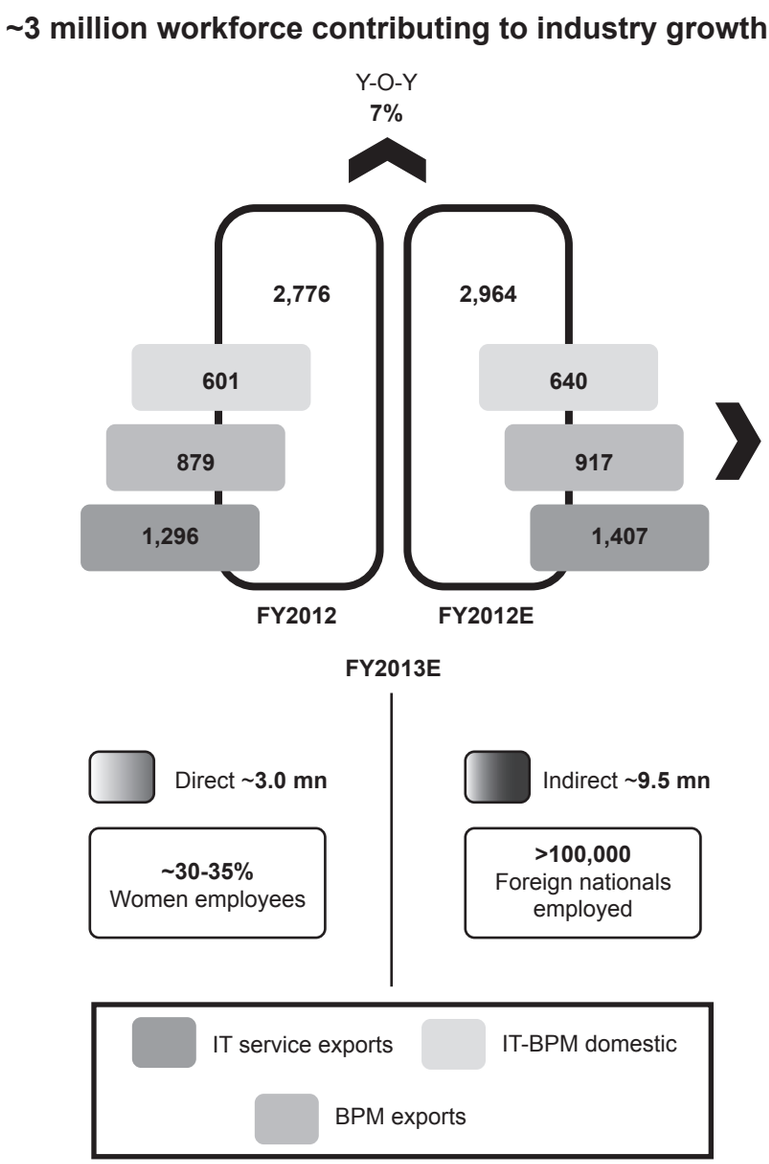


Figure 12: Employment Trends in the IT-BPM Industry

[6] The IT-BPM sector in India Strategic Review 2013 by NASSCOM

Sub-sectors within the IT-BPM Industry

The IT-BPM industry has four sub-sectors. The subsequent sections of the report describe Occupational Analysis conducted separately for the ER&D sub-sector.

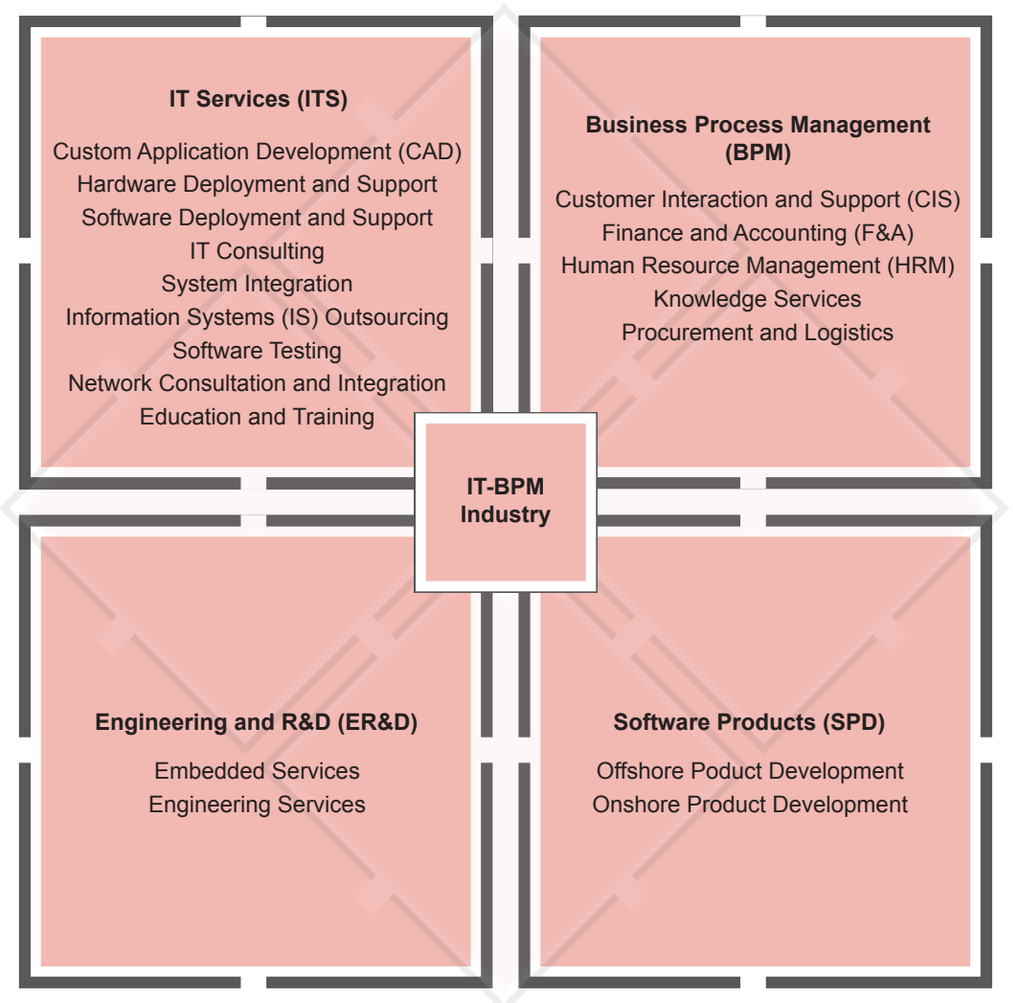


Figure 13: Sub-sectors within the IT-BPM Industry

Each of the four sub-sectors has been defined in detail subsequently. These terms/definitions have been used in discussion with NASSCOM and have been found to be consistent with the definitions used in the industry.

1. **IT Services (ITS):** ITS involves a range of engagement types that include consulting, systems integration, IT outsourcing/managed services/hosting services, training and support/ maintenance.
   a) **Custom Application Development (CAD):** CAD services focus on delivering customised (as per the client requirements) development of software applications and interface as well as enhancements to existing packaged applications or pre-engineered templates and support and provision of custom applications.
   b) **Hardware Deployment and Support:** The Hardware Deployment and Support services pertain to the installation and support of a specific hardware device. The service is focused on the device and its components rather than on software that is running on the device. Installation activities can include hardware staging, configuration, testing and debugging, deployment site preparation and physical installation of the device.

c) **Software Deployment and Support:** The Software Deployment and Support services are activities, expertise and systems providing the customer with proper installation and configuration of all packaged software products, custom applications as well as appropriate ongoing support, access to resources and distribution of software product releases, updates and upgrades.

d) **Information Systems (IS) Outsourcing:** IS Outsourcing services involve a long-term, contractual arrangement in which a service provider takes the ownership of and responsibility for managing all or part of a client's information systems operations or department, based on a service-level agreement. An IS Outsourcing contract usually includes data centre operations and may also include services such as desktop management, local and wide area network operations management, help desk support, application development and maintenance, disaster recovery services and related consulting and systems integration activities.

e) **Infrastructure Management Services (IMS):** IMS encompass all the services that relate to monitoring, managing and enhancing performance of a client's IT infrastructure. These include help desk services, server management, data centre management, network management, asset management, desktop support, IT security services, maintenance services and applications operations.

f) **IT Consulting:** IT Consulting includes IS Strategy, IT and network planning, architectural assessments, IS operational analysis, system and network designs, product-specific consulting, supplier assessment and maintenance planning.

2. **Business Process Management (BPM):** BPM is the management of one or more business processes by an external organisation that, in turn, owns and manages the selected processes based on defined and measurable performance metrics. The evolution of this sub-sector marks the shift in the delivery of business processes from high-cost destinations to low-cost ones. This shift is enabled by advancements in information and communication technologies.

   BPM sub-sector includes the following types of organisations with different horizontal offerings (those that can be leveraged across specific industries):

   a) **Business Process Management (BPM):** Traditional BPM offerings can be categorised into major categories and vertical-specific offerings (those that demand specific Industry vertical process knowledge):

      - **Customer Interaction and Support (CIS):** CIS includes all forms of IT-enabled customer contact; inbound or outbound, voice or non-voice based support used to provide customer services, sales and marketing, technical support and help desk services.
      - **Finance and Accounting (F&A):** F&A includes activities such as general accounting, transaction management (account receivables and payables management), corporate finance (for example, treasury and risk management and tax management); compliance management and statutory reporting and so on.
      - **Human Resource Management (HRM):** HRM services include payroll and benefits administration, travel and expense processing, talent acquisition and talent management services, employee and manager self-service delivery services, employee communication design, and administration.
      - **Supply Chain Management (SCM):** SCM services include the transfer of the ownership of some or all procurement, sales and fulfilment processes or functions to providers, such as an outsourcing agency. These could include administrative, delivery or management-related processes or functions.

   b) **Knowledge Services:** Knowledge Services include services such as business research, market research, data management and analytics.

   c) **Legal Services:** Legal Services include legal and intellectual property services.

3. **Software Products (SPD):** SPD are programmes or code sets of any type, commercially available through sale, lease, rental or as a service. Packaged software revenues typically include fees for initial and continued right-to-use packaged software licenses.
   a) **Offshore Product Development:** This involves offshore development of the customer's product, thereby taking up the responsibility of all aspects of the product lifecycle - R&D, prototyping, development, testing, maintenance and support and development of next generation of the products.

4. **Engineering and R&D (ER&D):** Engineering services are those that augment or manage processes. These processes are associated with the creation of a product or service, as well as those associated with maximising the life span and optimising the yield associated with a product or asset. This not only includes design elements of the product or service itself, but also encompasses the infrastructure, equipment and processes engaged in manufacturing/ delivering them.
   a) **Research and Development (R&D) Services:** R&D services involve providing research and development for hardware and software technologies, as well as development of software running on embedded systems.

Chapter
1

OVERVIEW OF THE ER&D SUB-SECTOR

- Introduction to the ER&D Sub-sector
- Evolution of the ER&D Sub-sector
- Profile of the ER&D Sub-sector
- Key Trends in the ER&D Sub-sector

OVERVIEW

Introduction to the ER&D Sub-sector

Indian Engineering and R&D (ER&D) sub-sector has played a key role in accelerating innovation, and in establishing India as a design and innovation hub. The ER&D exports of the country crossed USD 11 billion in FY2013, which is a growth of about 9 percent over FY2012. [1]This was primarily driven by increased competitiveness and competitive markets, and a gradual decline of skilled engineering workforce in the developed economies.

The ER&D landscape in India has significantly matured and evolved over the last five years, reflecting not just process maturity, but also a focused upward movement in the value chain through service diversification, and enhanced verticalisation with a view to sustain global partnerships and compete globally.

Some of the key factors responsible for this as follows:

- ❒ Continuously expanding services portfolio encompassing the full spectrum of product development value chain
- ❒ Flexible business models ranging from outsourcing services to partnership arrangements with clients
- ❒ Large engineering talent pool
- ❒ Established relationships in either the ITS services or the BPM sub-sectors that can be leveraged.

Growth in local markets and the emergence of new verticals are contributing to the diversity of the ER&D sub-sector. The sub-sector has been growing at a CAGR of ~15 percent over the last five years, and employs more than 220,000 engineers across the country. ER&D services are expected to touch USD 15 billion by FY2016, growing at a CAGR of 10 percent. It is predicted that the Indian ER&D sub-sector will reap between $37 billion and $45 billion by 2020, and is likely to provide livelihood to over one million employees.[2]

A focused strategy, involving key strategic initiatives is expected to see the Indian ER&D sub-sector reach its target of USD 40-45 billion. [3]For this to happen, various stakeholders must together encourage innovation and R&D work, and contribute to emerging areas like defense labs, product engineering, support infrastructure, and so on.

ER&D is strategic to India, and has the potential to bring a steep change in the economy. A strategic bent and focused investment in ER&D have the potential to transform India into an ER&D powerhouse, and make it a key growth driver over the next decade.

[1] The IT-BPM sector in India, Strategic Review 2013; NASSCOM
[2] NASSCOM, Research & Intelligence- Global ERD - Accelerating Innovation with Indian Engineering - May 2010
[3] NASSCOM, Research & Intelligence- Global ERD - Accelerating Innovation with Indian Engineering - May 2010

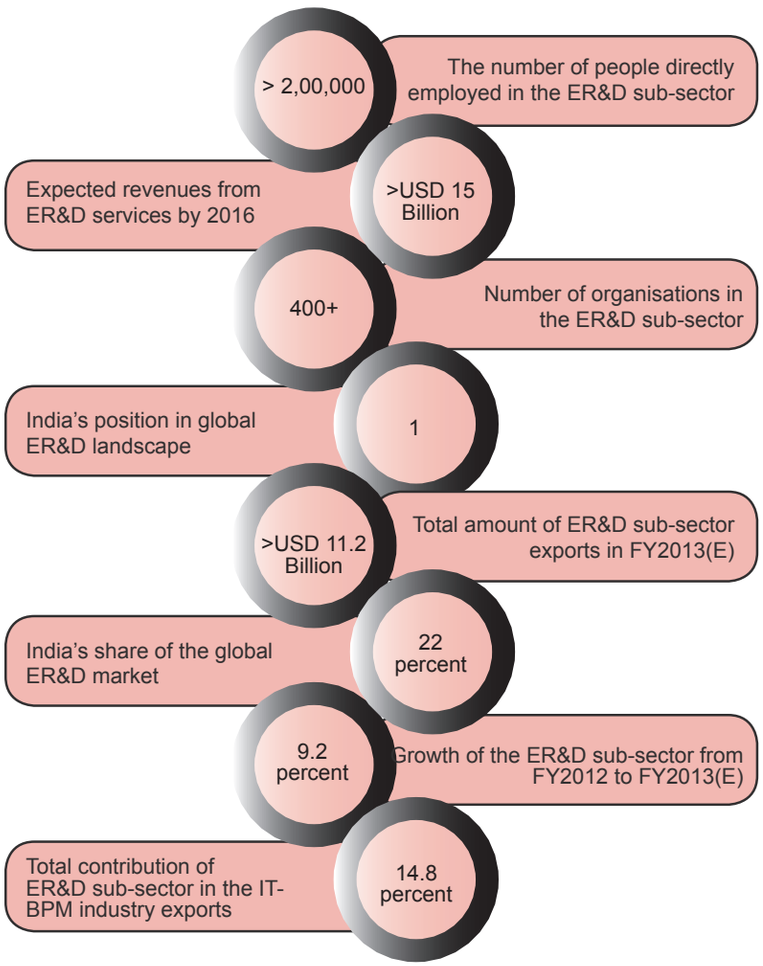


Figure 1: ER&D Sub-sector - Snapshot

Evolution of the ER&D Sub-sector

The evolution of the ER&D sub-sector in India[4] has been captured in the figure below, and explained in detail subsequently.

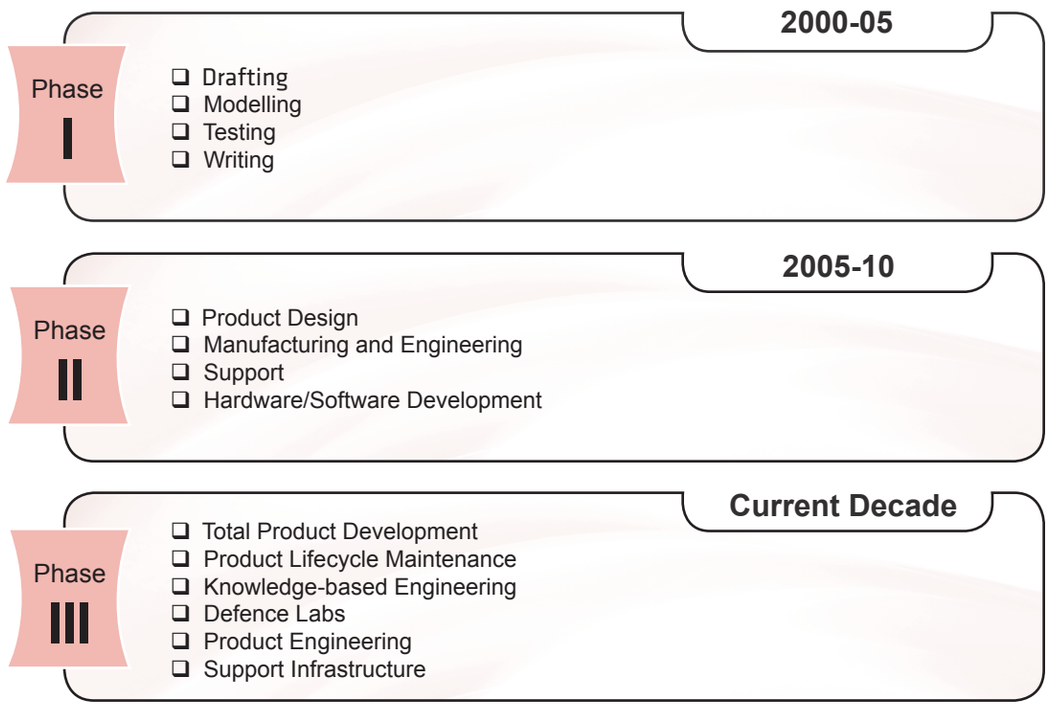


Figure 2: Evolution of the ER&D Sub-sector

The ER&D sub-sector in India started on the basis of cost arbitrage and declining engineering talent in the parent organisations abroad. While those customers still leverage the ER&D sub-sector's skills for sustenance and maintenance of existing products, there is also an increasing trend of treating the offshored centers as innovation hubs as well. The ER&D sub-sector that began its operations with basic services like drafting, modelling and testing, has now evolved and become a value creating service and solution provider. The customer value proposition of the ER&D sub-sector has also evolved from cost arbitrage to a continuous focus on efficiency in quality and capacity.

Over time, with process and product maturity of the ER&D sub-sector, there has been an increasing trend of Indian ER&D organisations showcasing alternative and cost-effective solutions not just in design and testing areas, but also in innovation and productivity. As a result, clients have started offshoring more complex work to Indian organisations, and they are increasingly working across the full spectrum of product lifecycle development.

On the similar lines, the traditional time-material or fixed deal engagement models are now being replaced by partnership models such as revenue sharing, risk sharing and so on. All of these are signs of increasing maturity and client confidence in the Indian ER&D sub-sector.

The ER&D sub-sector in India is a mix of service providers, captive centres and niche start-up organisations. Captives were the first ER&D organisations in the country, and are the most mature in terms of market offerings. Currently, the industry has about 350 captives, out of which about 60% contribute to verticals like Infrastructure and Industrial Automation. These organisations account for almost 47 percent of ER&D exports from India.[5]

Indian IT industry has to move from being service-based to product based. This will mandate significant capability building in R&D space
Ashok Gopinathan, Huawei, Head, Learning and Leadership Development

[4] NASSCOM, Research & Intelligence-Global ERD-Accelerating Innovation with Indian Engineering - May 2010
[5] http://www.nasscom.org/india-shinning-global-erd-space7f9=127464

The engineering services segment consists of around 80-85 players, who are significant contributors to the ER&D exports to the tune of nearly 50 percent and are employing about 1,00,000 engineers. These organisations cater to verticals such as Aerospace, Telecom and Medical Devices.[6]

When the ER&D sub-sector was in its nascent stage during 2005-06, more than 95 percent of the portfolio was dominated by traditional ER&D service offerings that aimed at providing cost arbitrage through mega-deals. By the end of the decade, there was a turn of services, with 20 percent of the sub-sector offerings being in the form of higher-end, non-traditional services like prototyping, manufacturing support, tooling and so on. The complexity of services being offshored to the ER&D sub-sector has progressively gone up – low complexity services like CAD and CAE accounted for 70 percent of the portfolio in 2005-06 and 50 percent in 2009; this is expected to further drop to 40 percent by 2020. [7]It is assumed that high complexity services will account for ~25 percent of the sub-sector revenue by 2020. This proportion will be even higher in hi-tech verticals like Telecom, Semi-conductors, Consumer Electronics, Computing Systems and Medical Devices.[8]

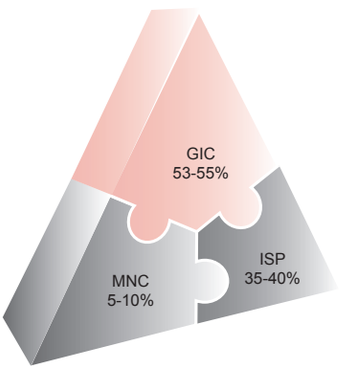


Figure 3:
ER&D Industry Landscape in India

Figure 4 gives a snapshot of how the contribution of various ER&D verticals is expected to look in 2013.

It is predicted that the Indian ER&D sub-sector is expected to reap in anywhere between USD 37 billion and USD 45 billion by 2020, and is likely to provide livelihood to over one million employees.[9]

Talent, business, and technology imperatives are driving the future growth across most verticals. Product engineering in telecom and aerospace segment continues to be the mainstay for Indian service providers. Another future opportunity for expansion is seen through the domestic ER&D market. The current scope of work by domestic customers is in its nascent stage. However, with increasing cost competitiveness and diversified scope of activities that the ER&D service providers are in a position to offer, the domestic market will also become a significant customer.

As the technology industry matures, with increasing use of technology, fuel efficiency norms, convergence of local markets and process and product level maturity seeping in, it is expected that customers will not only seek the cost arbitrage that the ER&D sub-sector offers, but also seek services in the full product ecosystem catering to the services and solutions

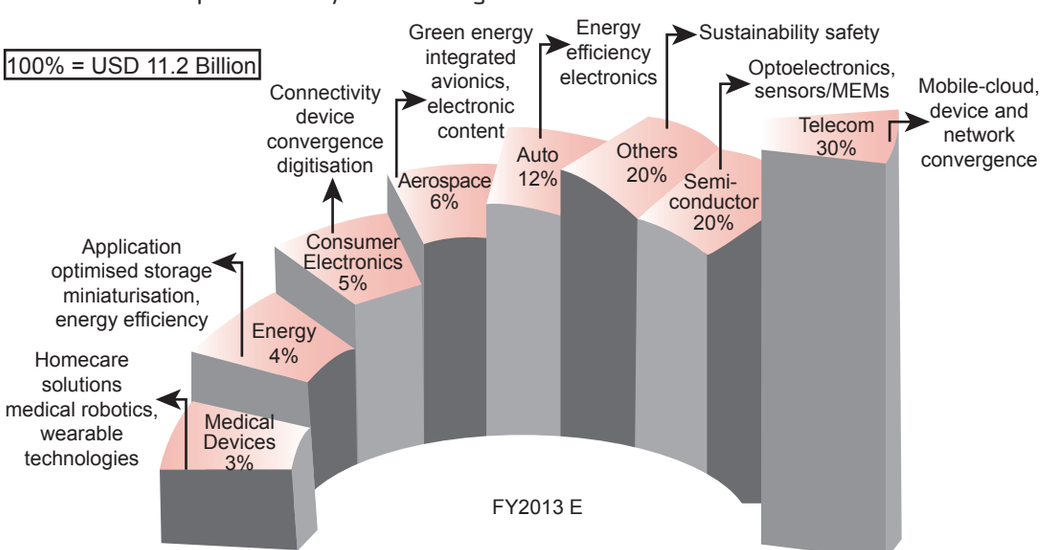


Figure 4: ER&D Verticals - Contribution in 2013

E: Estimate
Includes computing systems, construction theory
Machinery, industry automation, infrastructure
Source: Booz & Company, NASSCOM

[6] The IT –BPO Sector in India – Strategic Review 2012, NASSCOM
[7] Source: NASSCOM BOOZ ERS REPORT, 2012
[8] The IT-BPO Sector in India - Strategic Review 2012, NASSCOM
[9] Source: NASSCOM BOOZ ERS REPORT, 2010

Profile of the ER&D Sub-sector

The ER&D accounts for 15 percent exports in India; the total R&D investment in the country is expected to grow at a CAGR of 14 percent and reaching USD 42 billion by 2020. The ER&D exports in India have increased at 9 percent as compared to FY2012 and crossed USD 11 billion.[10]

Vertical Profile: India's initial foray and success in ER&D was in the traditional verticals like Semi-conductor, Telecom, Automotive and Aerospace, which has now expanded to include other emerging verticals like Medical Devices, Consumer Electronics, Energy and so on all of which are leveraging on India's large base of engineering talent pool and cost arbitrage to reap maximum returns. Engineering-intensive industries such as Telecom (30 percent), semi-conductors (20 percent), and Automotive (12 percent) are the biggest contributors to ER&D sub-sector's revenues, contributing to almost 60 percent of the revenue base.

Horizontal Profile / Service Offerings: There is a broad range of service offerings, including embedded software and hardware design services, testing and verification and validation (V&V), prototype building, engineering analysis and modelling, core product development and design services. Over the years, most of the service providers in India have focused their efforts at proactively investing in developing their people capabilities in order to provide a unique value proposition to their increasingly diverse customer base.

Customer Profile: Globally, there are about 400-500 customers that account for 80 percent of the ER&D market. There is higher spending in the more mature verticals, including Automotive, Semi-conductors and Consumer Electronics as compared to the emerging verticals.

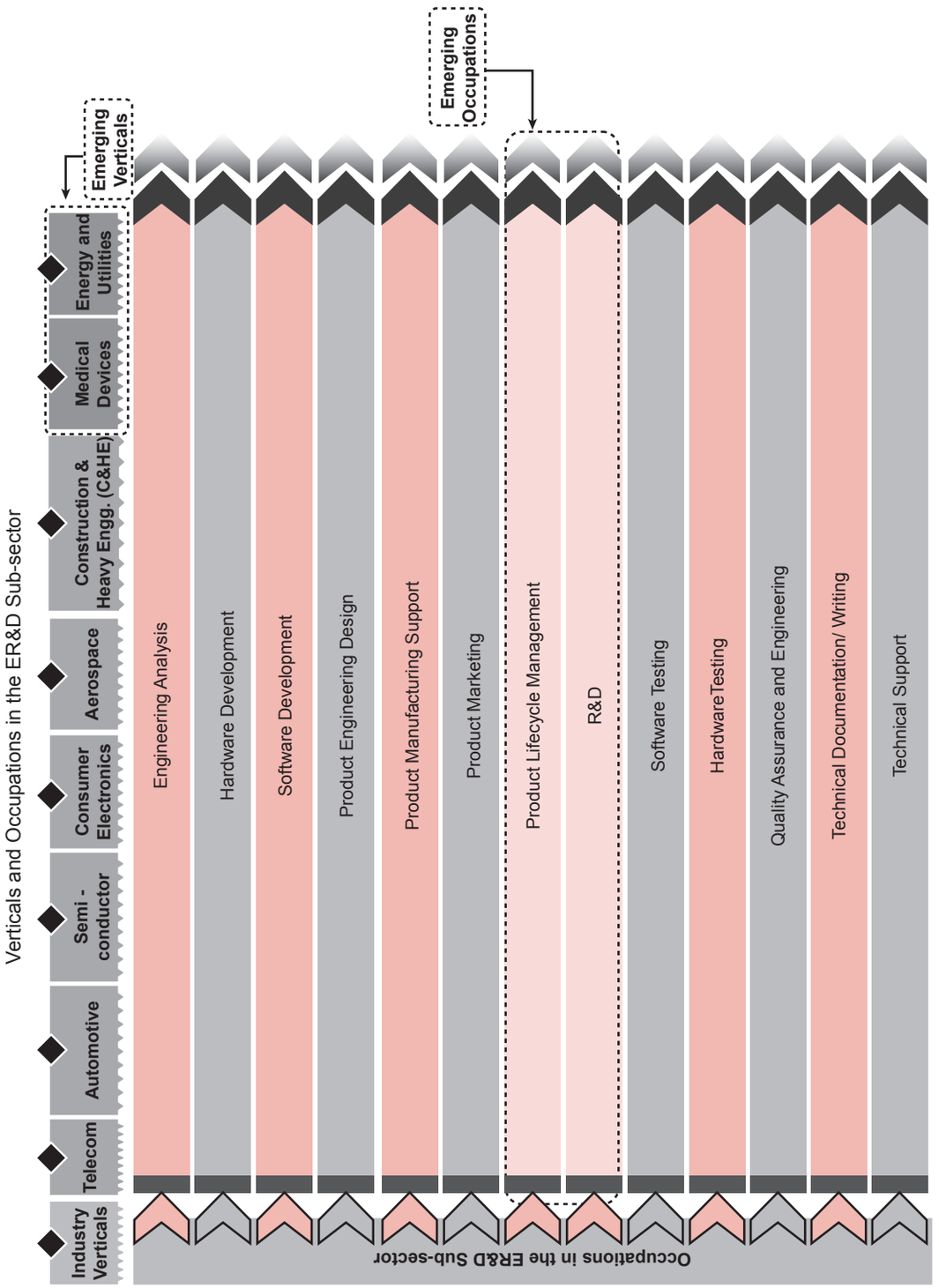
A traditional stronghold customer of the Indian ER&D sub-sector has been the North American market. While it continues its position as the largest customer, in absolute terms, its share with respect to contribution in the total revenue is seen to be gradually declining, from 62 percent in 2009 to about 45 percent in 2020.

Many occupations will merge as the same people will do multiple activities. Clients ask for people who can do design as well as analysis. Mechanical and Electronics will converge to Mechatronics.
—Selvan S.S., EIS Business Head - Fulfillment Excellence Tata Consultancy Services

[10] The IT-BPM Sector in India-Strategic Review 2013, NASSCOM

The emerging European market is expected to be a significant contributor to future revenues, and going forward, is expected to contribute to the tune of 30 percent of the total revenues by 2020. Other new opportunities are expected to emerge from the Japanese market, especially in the automotive segment, which along with the rest of the world is expected to contribute the remaining 25 percent in the coming years.[11]

The major industry verticals and service offerings have been captured in the following table.



This table does not depict any hierarchy

[11] NASSCOM BOOZ ERS Report, 2010.

Key Trends in the ER&D Sub-sector

With the changes evolving in the global manufacturing space, the Indian ER&D sub-sector has become more dynamic and flexible to respond to changing customer needs across the full spectrum of product lifecycle. As a result, organisations are becoming increasingly agile to keep pace with increased competitiveness in the global landscape.

Some of the key trends which are leading to the growth in the sub-sector are depicted in the following figure:

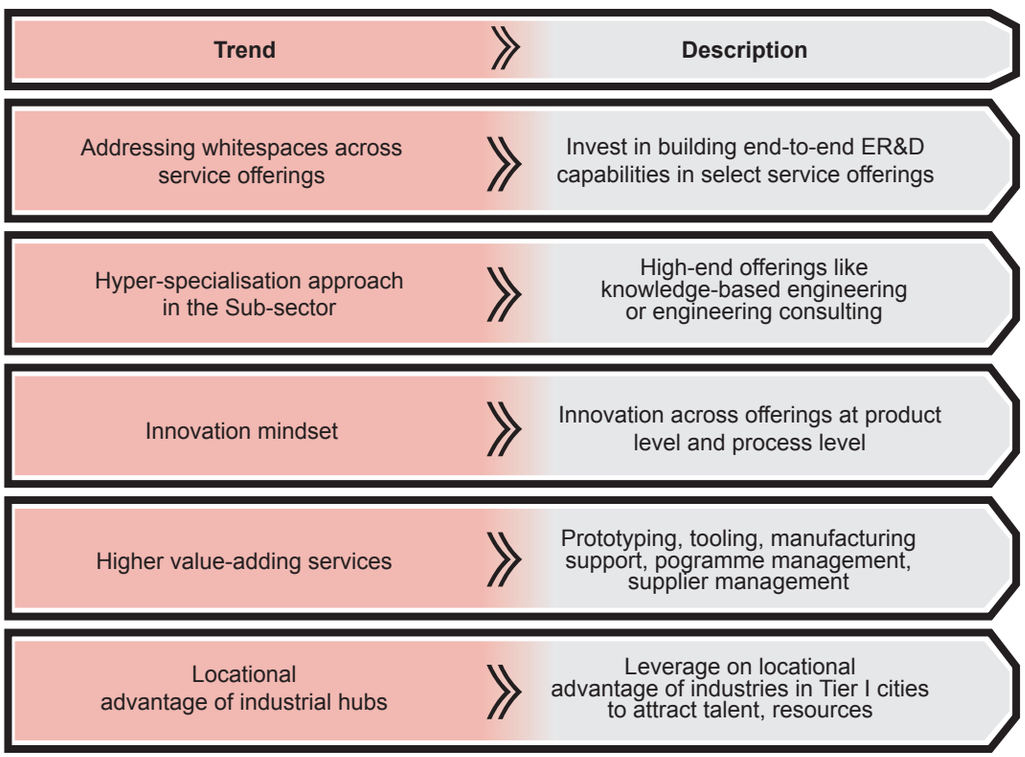


Figure 5: Trends in the ER&D Sub-sector

Addressing whitespaces across service offerings: ER&D organisations are increasingly developing capabilities that are enabling them to participate across all stages of product life cycle, thereby delivering value added services to their customers. The focus is now to invest in building end-to-end capabilities in select specialisations to fill capability whitespaces that exist across service offerings for catering to the needs of specific industries.

Hyper-specialisation approach: Organisations are focusing on a hyper-specialisation approach, which is a specialised approach to building domain capabilities through reorganisation of services and verticals across the sub-sector. Organisations will focus on developing internal capabilities like development of extensive testing and prototyping facilities, test laboratories and centres of excellence, through mutual partnerships with training providers and academia.

Innovation mindset: Organisations are now driving innovation across verticals at two levels – the product level and the process level. The product-level innovation means that organisations are now finding new ways to provide design support for a product, whereas the process-level innovation refers to finding more efficient production processes for the product. The focus of these activities is seen as customer value addition by reducing product life cycles, and enabling flexible capacity to result in increased competitiveness.

Higher value adding services: Increasingly, organisations in the Indian ER&D sub-sector are concentrating at providing services at the higher end of the value chain. As a result, they are targeting areas like prototyping, manufacturing support, supplier management and so on and including them as part of their service offerings portfolio. Another focus area is frugal engineering, which allows clients to compete on cost-effectiveness. The target for all these offerings is to help clients in the optimisation of design, manufacturing and sourcing processes.

Locational advantage of industrial hubs: The ER&D organisations in India will continue to be based near industrial hubs in the Tier I cities in the near future, as they depend on these hubs to provide them with both resources as well as talent. Also, as these organisations expect to cater to the domestic customer in the near future, it becomes imperative that they maintain their locational advantage by being based near these industrial hubs.

Clients are increasingly asking for people with multiple skill sets.
—K.Vayu Nandankumar, HCL, ER&D Services

Chapter
2

TALENT IN THE ER&D SUB-SECTOR

- Emerging Talent Trends
- Qualifications, Knowledge and Understanding
- Skills
- Learning Opportunities

TALENT

Emerging Talent Trends

The ER&D sub-sector in India employs about 3,00,000 engineers across the country. While major part of the workforce is hired locally, 3-4 percent of this is also getting hired at other geographical locations for providing on-site support. The availability of a skilled talent pool with strong communication skills, especially in English language, along with the strong technical skills, especially of Indian engineering graduates, makes them the ideal candidates to work in the offshored ER&D sub-sector.

Over the last five years, India's graduate engineering pool has more than doubled – there are about 9,00,000 engineers in India's engineering talent pool in 2013. [12]Currently, less than 17 percent of the installed base of engineers works in the ER&D sub-sector. Infrastructure engineering, Telecom, Automotive, and Energy are verticals with the highest installed base of Indian engineers.

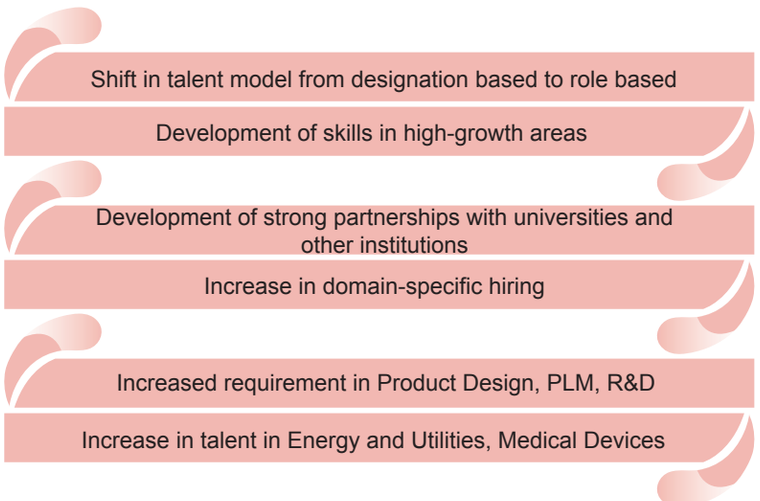


Figure 6: Key Talent Trends within the ER&D Sub-sector

The key talent trends are as follows:

Shift in talent model from designation based to role based: Organisations are now increasingly moving towards flatter structures, where talent is mapped to the roles they perform rather than being designation specific.

Development of skills in high-growth areas: The changing business landscape, maturation of the ER&D sub-sector, as well as industry focus on global service delivery and process excellence, have put pressure on organisations to scale-up their training and development initiatives. Organisations are now providing their employees with a host of industry- and domain-specific certifications across industries and functionalities in an effort to meet the global demand for specialised talent.

Development of strong partnerships with universities, global development forums and MNCs: Sensing the need to increase 'ready-to-deploy', talent, organisations are now increasingly partnering with academia to collaboratively devise a way to increase the pool in the market. Collaboration with educational and training institutes is being undertaken by organisations individually, as well as through industry bodies.

Increased requirement in Product Design, PLM and R&D: As companies add capabilities and customers develop more confidence in the delivery excellence of Indian ER&D sub-sector, high-end occupations will witness growth, and there will be more demand of talent.

Increase in talent in Energy & Utilities, Medical Devices: It is predicted that the Indian ER&D sub-sector is expected to reap in anywhere between USD 37 billion and USD 45 billion by 2020, and is likely to provide livelihood to over one million employees.[13] This is likely to come from new verticals such as Energy and Utilities and Infrastructure (domestic market), and Medical Devices (export market). This is likely to be driven by convergence, efficiencies, localisation, mobility, and digitisation of the industry.[14]

Most organisations are moving towards flat structures.
—MC Parameswaran, Aricent AVP, Business Development

[12] NASSCOM Research & Intelligence - Global ERD - Accelerating Innovation with Indian Engineering - May 2010
[13] NASSCOM BOOZ Report - Global ERD - Accelerating Innovation with Indian Engineering - 2010
[14] The IT-BPM Sector in India, Strategic Review 2013; NASSCOM

Qualifications, Knowledge, and Understanding

The major bulk of hiring happens at the entry level as organisations compete to attract the best talent from engineering colleges. The availability of a skilled talent pool with strong communication skills and English language capabilities is another reason for India being an attractive hub. Hiring happens at both lateral as well as fresher levels. At the entry level, the sub-sector sees hiring from engineering colleges from high-demand disciplines, such as, computer science, mechanical engineering and electronics, owing to the gradual decline in the engineering talent pool of the Western world.

While hiring, other than the educational qualifications, a significant focus is also placed on the analytical ability of the individual. Functional skills and domain expertise are often added through rigorous on-the-job training, and other certifications and training programme. Organisations connect with potential recruits through multiple channels like roadshows, competitions, seminars, internships and so on. Lateral hiring happens at many levels, and movement across organisations is not uncommon.

Another key focus area has been the hiring of experienced professionals from international as well as domestic markets to add to the scarce talent pool in the country.

Many multinationals are also queuing up to hire PhD scholars for their GICs located in India. These organisations are tapping the engineering colleges like Indian Institutes of Technology (IITs), other institutes of national importance and Indian Statistical Institute (ISI), Kolkata, to meet their research requirements. The ER&D organisations usually hire PhDs as interns and groom them accordingly.

> *Professionals are expected to develop/grow in four areas: 1. Domain 2. Technology 3. Process 4. Project Management.* –***KNS*** **Acharya, Infosys, ER&D Services Group Head**

Skills

While the core skill still remains pure engineering, there is an increasing focus on hiring candidates with knowledge of design principles, and work experience in CAD/CAM and CFD.

With the growing process maturity and an increased foray into specialisation of service offerings, people with domain knowledge, in addition to design and engineering knowledge, will certainly see a fast growth.

Key Generic Skills

- Communication
- Analytical skills
- Problem-solving

Key Functional Skills

- Strong knowledge of design principles
- CAD/CAM/CFD
- Simulation and prototyping
- Full product development
- Verification and validation
- Product lifecycle management
- Product design and optimisation

Technical skills are dynamic and will change with the industry, but management skills are the same
Madhura Lanjekar, Tata Technologies, Head - Talent Management

Learning Opportunities

ER&D sub-sector is a very knowledge-intensive sub-sector that requires a lot of specialised skills across an array of occupations like prototyping, tooling, product design and so on. The R&D segment particularly requires the employees to be constantly focused on innovations, especially in the wake of India emerging as a strong contender for a leadership position as an innovation hub.

Therefore, the sub-sector offers its employees learning opportunities through different sources like certifications, training materials (online/class room), focused learning programme and on-the-job learning opportunities. In fact, there is a very heavy emphasis on the job learning, considering the detailed technical specialisation required for the job roles.

With verticalisation, many ER&D organisations are also focusing on domain-specific (Medical Devices, Manufacturing and so on) knowledge. For classroom training and certifications, there are tie-ups with training institutes. Learning opportunities are offered within and outside the organisations. Some of these options include:

- Advanced technical degree courses like MCA, MTech, ME, MSc, PhD and so on
- Advanced business courses like MBA/PGDBM
- Domain-related certifications in the areas of CAD/CAM/CFD, tooling, prototyping and so on
- Industry-related certifications in various verticals

Note: One of the key objectives of the IT-ITeS SSC NASSCOM is to develop avenues for learning and skill development in the IT-BPM ndustry. In pursuit of this, the SSC is planning to set up accreditation process for training providers, and tailor courses on occupational standards that are currently being developed for the industry.

Chapter
3

ENTRY-LEVEL JOB ROLES - ER&D

- Entry-level Job Roles
- Entry-level Job Roles in the ER&D Sub-sector
- ER&D Sub-sector: Occupations, Tracks, Verticals and Entry-level Job Roles

ENTRY

ENTRY-LEVEL JOB ROLES - ER&D

Entry-level Job Roles

Across the IT–BPM industry, there are three levels of management:

- Entry Level
- Middle Level
- Leadership Level

An entry-level job role is the first step to a career in the IT–BPM industry. It is the first level of employment in an organisation, and typically employs candidates with about 0-2 years of experience. The purpose of an entry-level job role is to give the candidate an understanding of the occupation, an opportunity to learn and enhance his experience and serve as a stepping stone to middle-level management.

With an increasing wave of domain and vertical specialisation across the IT–BPM industry, many people are now focusing on acquiring experience through entry level job roles in the industry.
Some of the functions of an entry-level job role are depicted in the following figure.

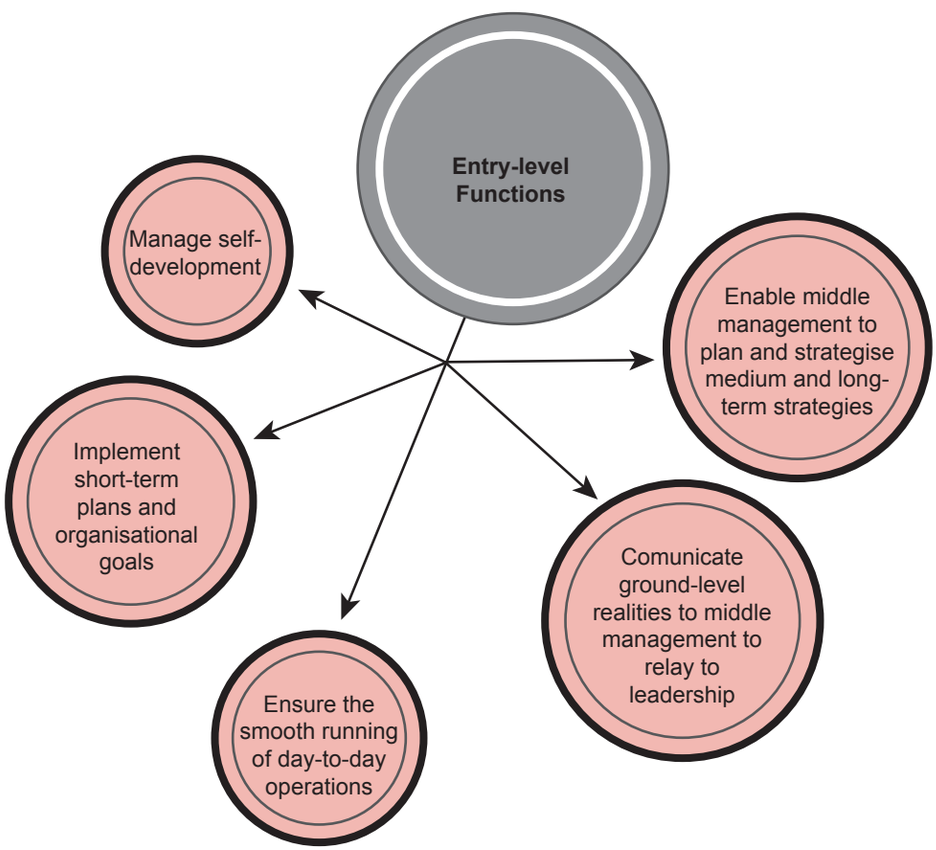
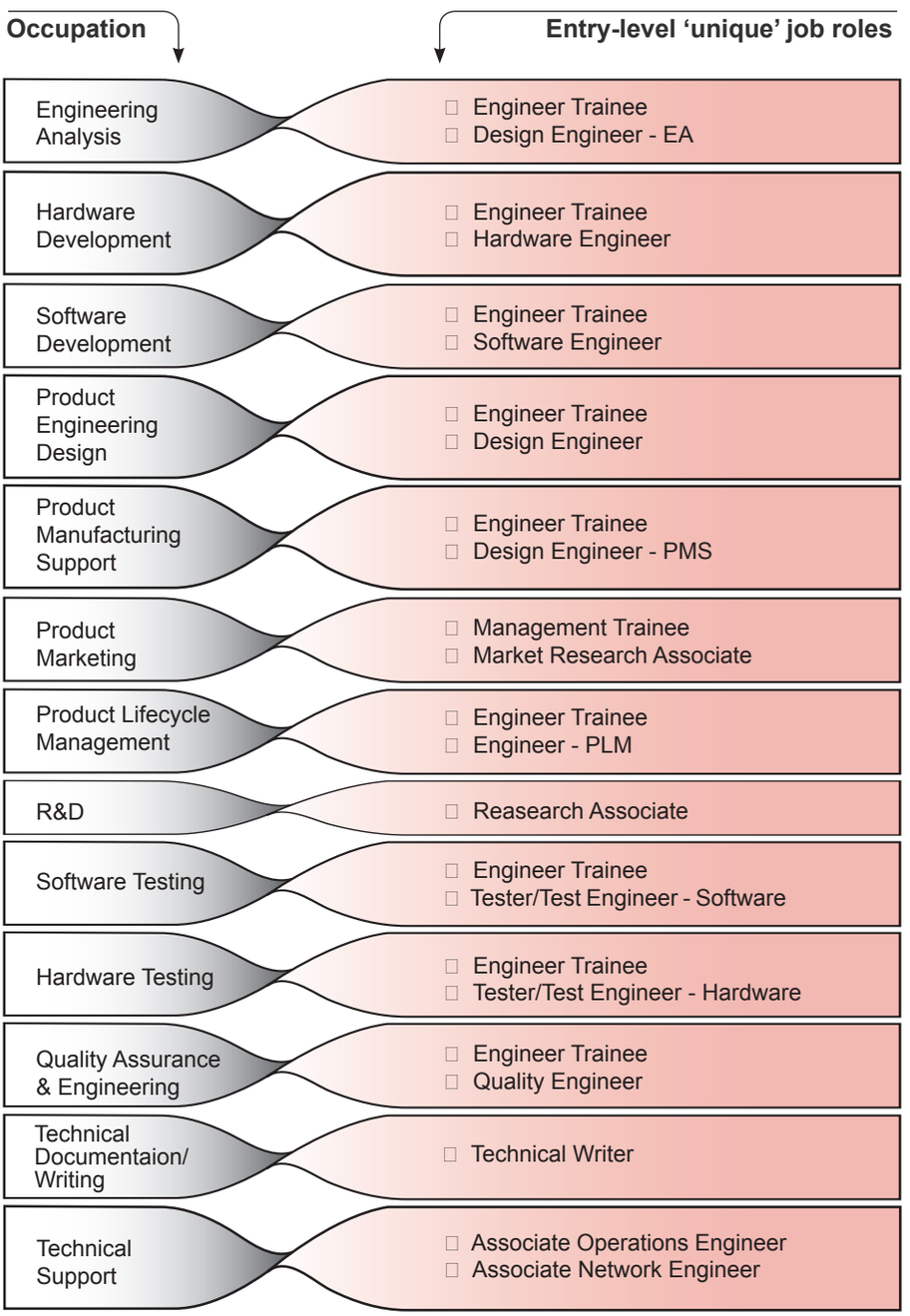


Figure 7: Functions of the Entry-level Job Roles

Entry-level Job Roles in the ER&D Sub-sector

Entry-level job roles in the ER&D sub-sector exist across almost all the occupations. For most of these job roles, the basic qualification remains engineering graduates, preferably from mechanical sciences, though engineering graduates from other disciplines are also hired. These graduates can be seen employed in almost all job roles, including Engineer Trainee, Design Engineer, Design Engineer – EA, Design Engineer – PMS, Test Engineer and so on.

The following table gives a list of different entry-level job roles that exist across each occupation in the ER&D sub-sector.



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ER&D Sub-sector - Occupations, Tracks, Verticals and Entry-level Job Roles

The IT-BPM Industry in India is one of the ever expanding industries in the country, and offers myriad opportunities to fresh graduates for employment. According to NASSCOM estimates, the industry is estimated to aggregate revenues of USD 108 billion in FY2013. During this period, direct employment is expected to reach nearly three million, an addition of 1,88,300 employees, while indirect job creation is estimated at 9.5 million. About 95 percent of this hiring is that of fresh graduates.

The ER&D sub-sector offers a variety of opportunities across occupations like Hardware Development, Software Development, Hardware and Software Testing, Product Documentation, Product Marketing, Product Lifecycle Management and so on.

In total, there are about 13 unique job roles at the entry level across different occupations, tracks and verticals in the ER&D sub-sector.

The subsequent table shows how each of these job roles is mapped to different tracks and occupations in this sub-sector.

Key Definitions
Occupation is a set of job roles, which perform similar/related set of functions in an industry.

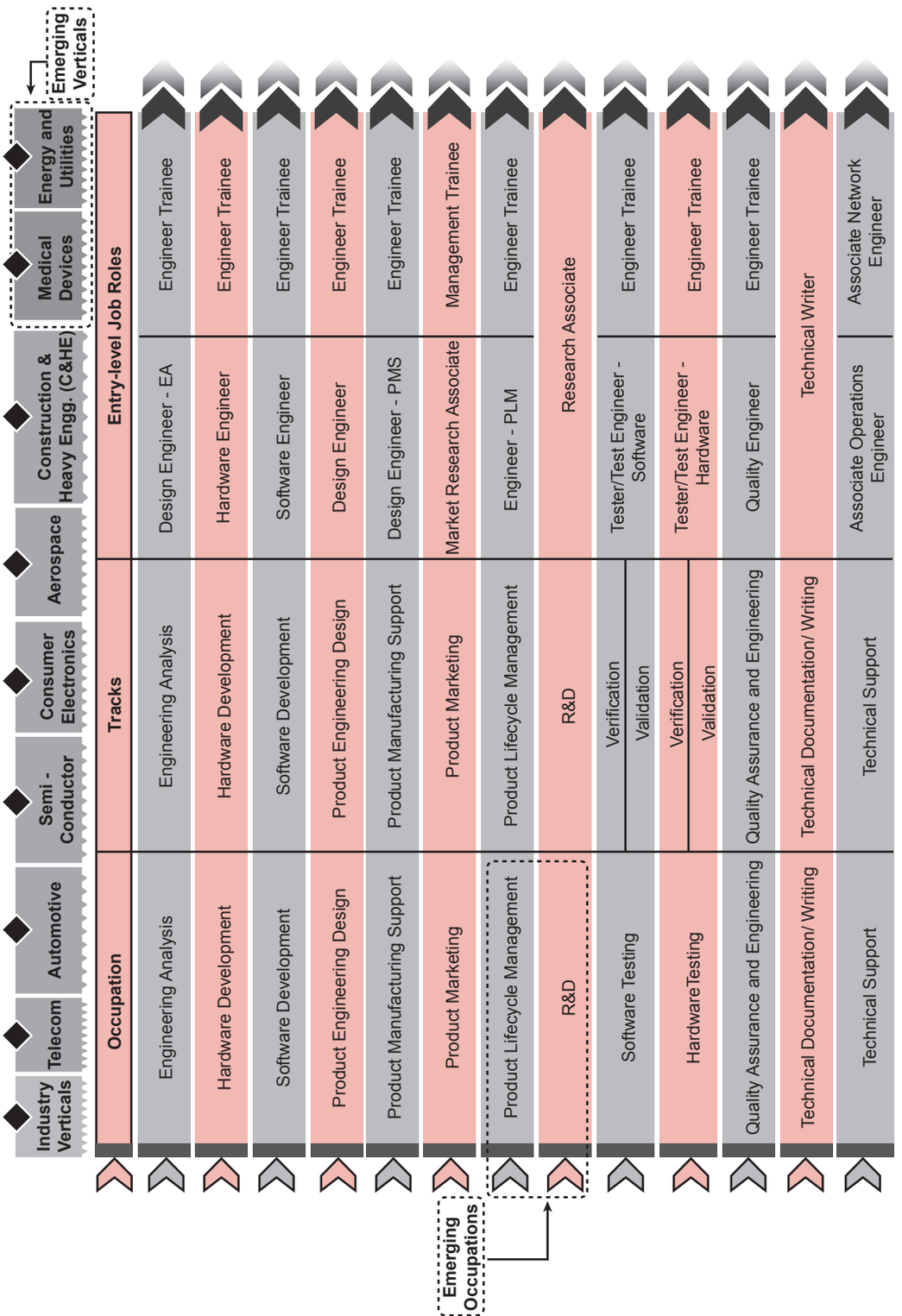
Tracks *are a sub-set of occupations having similar set of functions under the larger gamut of the occupation they belong to.*

Unique Job Roles *defines a set of functions that together form a unique employment opportunity in an organisation.*

Entry Level: *0-2 years*
Middle Level: *2-10 years*
Leadership Level: *>10 years*

ER&D Sub-sector - Occupations, Tracks and Verticals

For most entry level job roles, there is possibility of a vertical or horizontal movement in their tracks, and also into other occupations.



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Chapter
4

MIDDLE-LEVEL JOB ROLES - ER&D

- Middle-level Job Roles
- Middle-level Job Roles in the ER&D Sub-sector
- ER&D Sub-sector: Occupations, Tracks, Verticals and Middle-level Job Roles

MIDDLE

MIDDLE-LEVEL JOB ROLES - ER&D

Middle-level Job Roles

Across the IT– BPM industry, there are three levels of management:

- Entry Level
- Middle Level
- Leadership Level

A middle-level job role is the first step to a management career in the IT–BPM industry. It ranges from first level supervisors to managers who manage supervisors, and sometimes even managers of managers. They are responsible for carrying out and implementing the goals set up by top management. Often they assist and motivate the entry-level employees to achieve business objectives. Their role also includes acting as a liaison between the top level and the entry level by offering suggestions and feedback to both the groups.

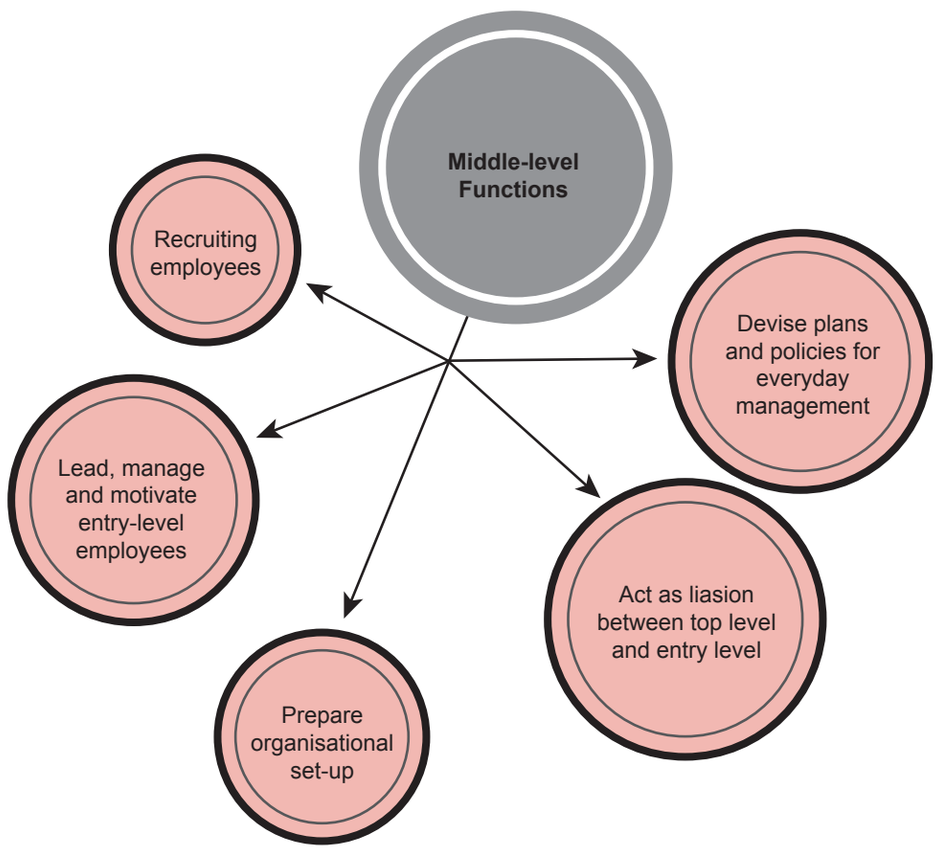
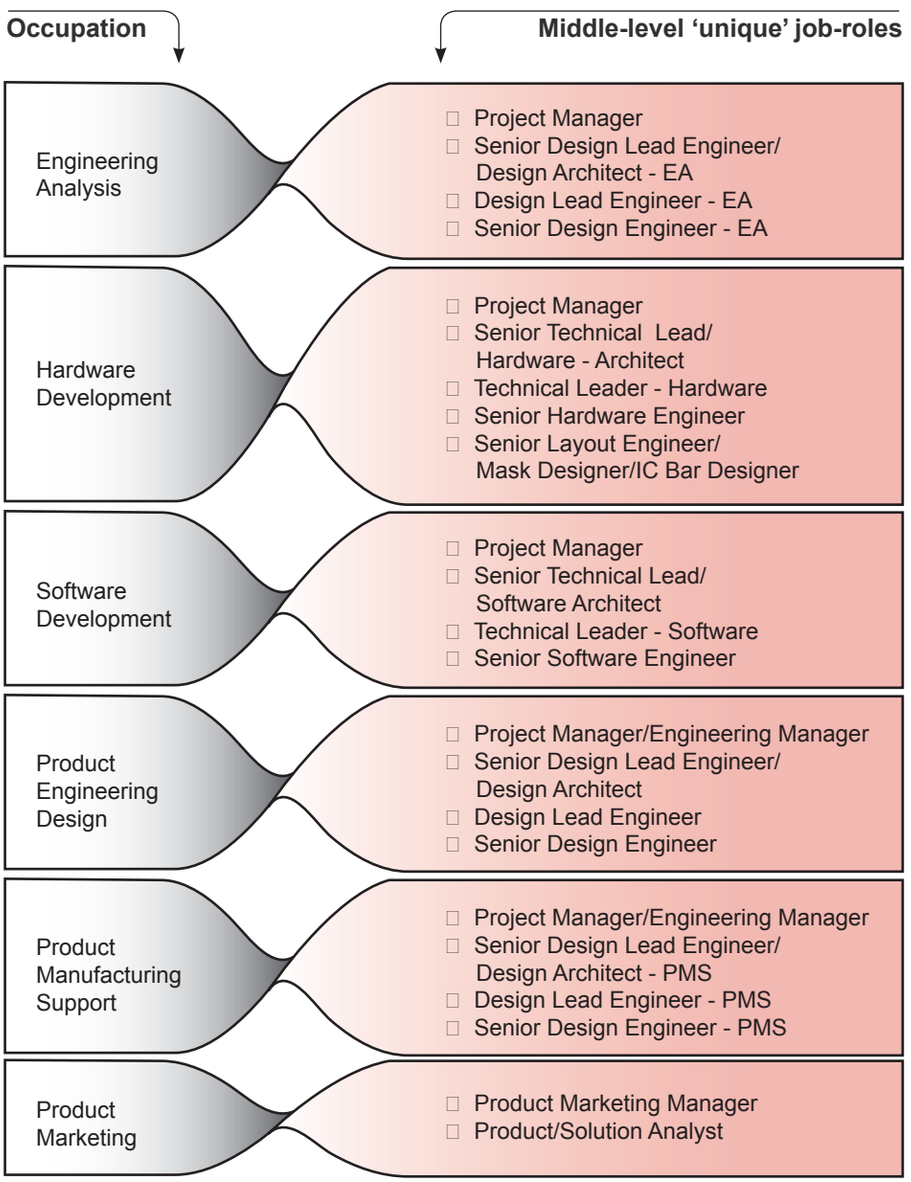


Figure 8: Functions of the Middle-level Management

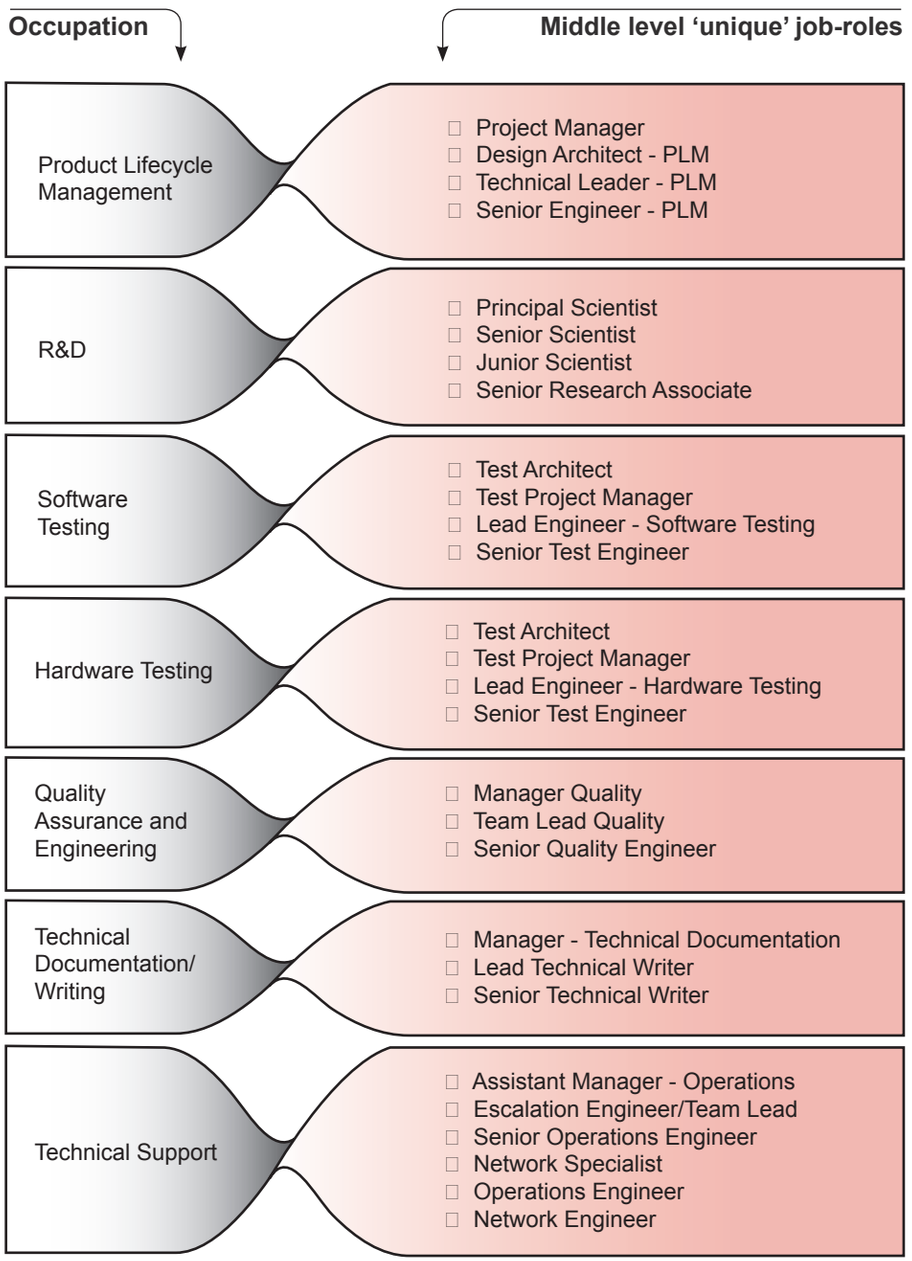
Middle-level Job roles in the ER&D Sub-sector

Middle-level job roles in the ER&D sub-sector include technical and specialist roles like process experts/specialists, first-level supervisors such as team leaders and also employees in the managerial domain with specific occupational specialisations.

The table below lists the unique middle-level job roles in the ER&D sub-sector.



Middle-level and Job roles in the ER&D Sub-sector (Contd)



This table does not depict any hierarchy.

ER&D Sub-sector - Occupations, Tracks, Verticals and Middle-level Job Roles

The IT-BPM industry in India offers unparalleled employment opportunities across the entire spectrum of its service offerings. Middle-level management has the maximum number of job roles as it encompasses people with 2-10 years of work experience. In smaller organisations, there may be only one layer of middle level of management but in larger enterprises, there may be multiple layers of middle-level management. This includes first level supervisors, managers of supervisors and managers of managers as well.

In total, there are about 48 unique job roles at the middle level across different occupations, tracks and verticals in the ER&D sub-sector.

The subsequent table shows how each of these job roles is mapped to different tracks and occupations in this sub-sector.

Key Definitions
Occupation is a set of job roles, which perform similar/related set of functions in an industry.

***Tracks** are a sub-set of occupations having similar set of functions under the larger gamut of the occupation they belong to.*

***Unique Job-roles** defines a set of functions that together form a unique employment opportunity in an organisation.*

***Entry Level:** 0-2 years*
***Middle Level:** 2-10 years*
***Leadership Level:** >10 years*

ER&D Sub-sector: Occupations, Tracks, Verticals and Middle-level Job Roles

This table does not depict any hierarchy.

MIDDLE-LEVEL JOB ROLES - ER&D

Chapter
5

LEADERSHIP-LEVEL JOB ROLES - ER&D

- Leadership-level Job Roles
- Leadership-level Job Roles in the ER&D Sub-sector
- ER&D Sub-sector: Occupations, Tracks, Verticals and Leadership-level Job Roles

LEADERSHIP

LEADERSHIP-LEVEL JOB ROLES - ER&D

Leadership-level Job Roles

Across the IT–BPM industry, there are three levels of management:

- Entry Level
- Middle Level
- Leadership Level

A leadership-level job role is one of the top level job roles in the ER&D sub-sector. The top-level management generally consists of occupation leads as well as Assistant Vice-President (AVP), Vice President (VP), and Senior Vice-President (SVP) level roles. The top-level management determines the objectives, policies and plans of the organisation. They devise long-term strategy, organisational objectives and goals, and are also involved in mobilising resources. The top-level management has the final authority in the organisation. They are directly responsible to the major stakeholders.

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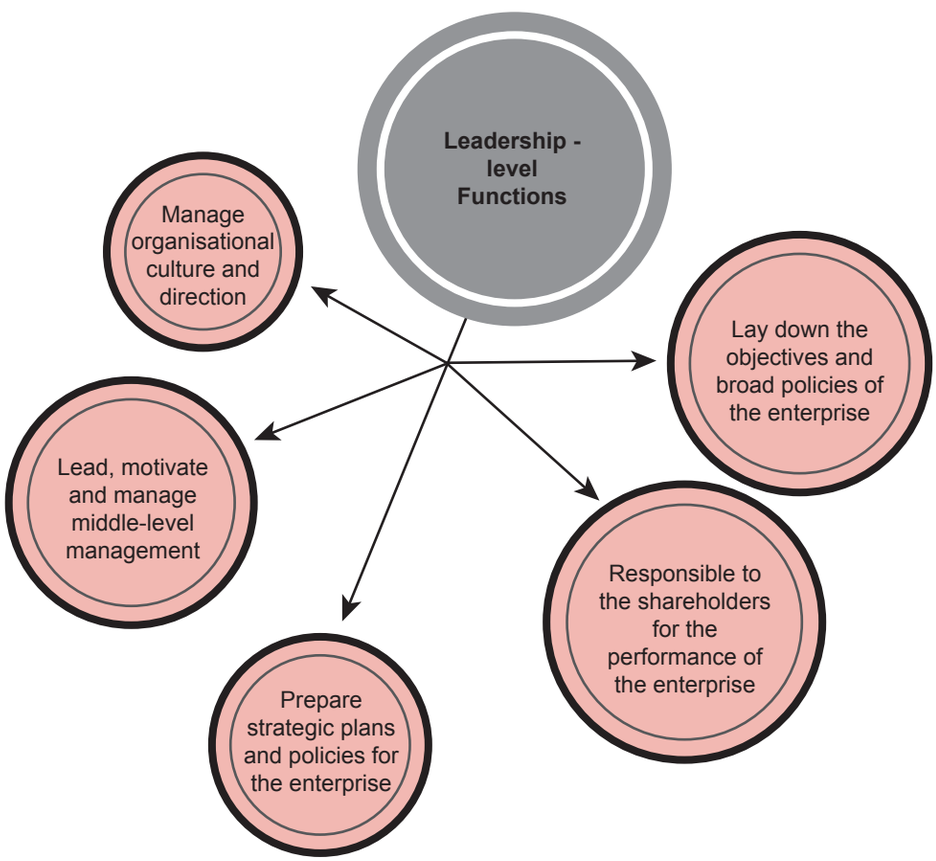
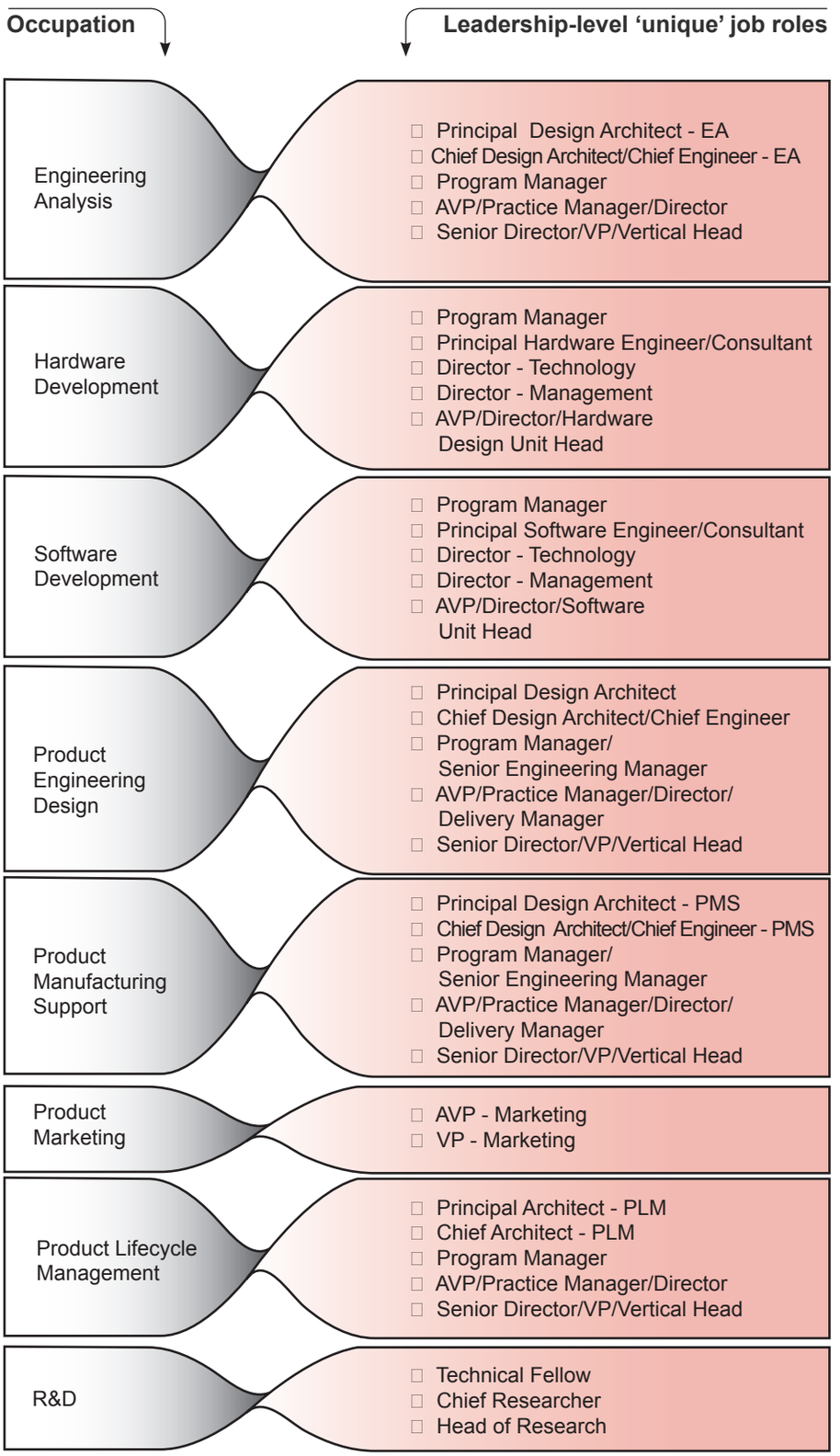


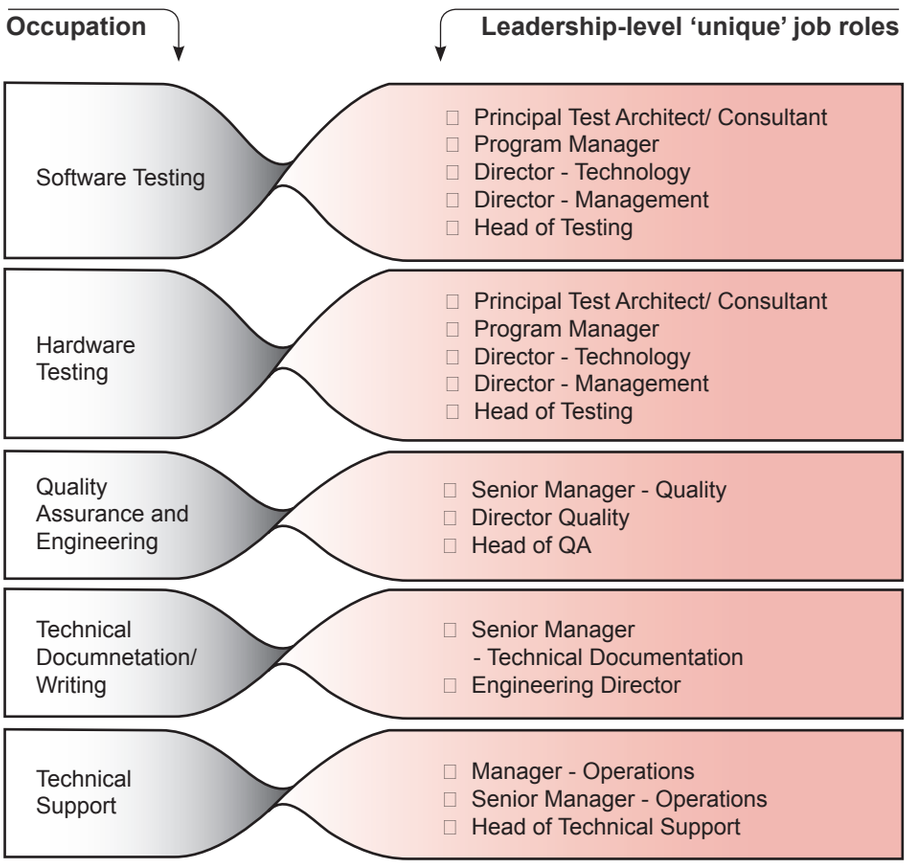
Figure 9: Functions of the Leadership-level Management

Leadership-level Job Roles in the ER&D Sub-sector

Leadership-level job roles in the ER&D sub-sector include Head of Department roles such as Director Technology, Chief Architects and Chief Engineers. The table below lists the unique leadership-level job roles in the ER&D sub-sector.



Leadership-level Job Roles in the ER&D Sub-sector (Contd)



This table does not depict any hierarchy.

ER&D Sub-sector - Occupations, Tracks, Verticals, and Leadership Level Job Roles

The IT-BPM industry in India offers unparalleled employment opportunities across the entire spectrum of its service offerings. The leadership-level job roles are the top-level roles in any organisation, and require managerial and strategic decision-making along with expertise and domain knowledge of the industry. Employees may move up the ranks in the same organisation to reach these levels or may move from one organisation to another, sometimes even from outside the industry at these levels. In total, there are about 54 unique job roles at the leadership level across different occupations, tracks and verticals in the ER&D sub-sector.

The subsequent table below shows how each of these job roles is mapped to different tracks and occupations in this sub-sector.

Key Definitions
Occupation is a set of job roles, which perform similar/related set of functions in an industry.

***Tracks** are a sub-set of occupations having similar set of functions under the larger gamut of the occupation they belong to.*

***Unique Job Roles** defines a set of functions that together form a unique employment opportunity in an organisation.*

***Entry Level:** 0-2 years*
***Middle Level:** 2-10 years*
***Leadership Level:** >10 years*

ER&D Sub-sector: Occupations, Tracks and Verticals

Industry Verticals	Telecom	Automative	Semi - Conductor	Consumer Electronics	Aerospace	Construction & Heavy Engg. (CHE)	Medical Devices	Energy and Utilities	Emerging Verticals
Occupation	**Tracks**	**Leadership-level Job Roles**							
Engineering Analysis	Engineering Analysis	Principal Design Architect - EA	Chief Design Architect/ Chief Engineer - EA	Program Manager	AVP/Practice Manager /Director	Senior Director/VP/ Vertical Head			
Hardware Development	Hardware Development	Principal Hardware Engineer/ Consultant	Director - Technology	Program Manager	Director - Management	AVP/Director/ Hardware Design Unit Head			
Software Development	Software Development	Principal Software Engineer/ Consultant	Director - Technology	Program Manager	Director - Management	AVP/Director/ Software Unit Head			
Product Engineering Design	Product Engineering Design	Principal Design Architect	Chief Design Architect /Chief Engineer	Program Manager/ Senior Engineering Manager	AVP/Practice Manager/Director/ Delivery Manager	Senior Director/ VP/ Vertical Head			
Product Manufacturing Support	Product Manufacturing Support	Principal Design Architect - PMS	Chief Design Architect/ Chief Engineer - PMS	Program Manager/ Senior Engineering Manager	AVP/Practice Manager /Director/ Delivery Manager	Senior Director/ VP/ Vertical Head			
Product Marketing	Product Marketing	AVP-Marketing		VP-Marketing					
Product Lifecycle Management	Product Lifecycle Management	Principal Architect - PLM	Chief Architect - PLM	Program Manager	AVP/Practice Manager /Director	Senior Director / VP/ Vertical Head			
R&D	R&D	Technical Fellow		Chief Researcher		Head of Research			
Software Testing	Verification	Principal Test Architect/ Consultant	Program Manager	Director - Technology	Director - Management	Head of Testing			
	Validation								
HardwareTesting	Verification	Principal Test Architect/ Consultant	Program Manager	Director - Technology	Director - Management	Head of Testing			
	Validation								
Quality Assurance and Engineering	Quality Assurance and Engineering	Senior Manager - Quality		Director Quality	Head of QA				
Technical Support	Technical Support	Manager - Operations		Senior Manager - Operations		Head of Technical Support			
Technical Documentation/ Writing	Technical Documentation/ Writing	Senior Manager - Technical Documentation		Engineering Director					

Emerging Occupations

This table does not depict any hierarchy.

LEADERSHIP-LEVEL JOB ROLES - ER&D

Chapter
6

OCCUPATIONS AND ROLES IN THE ER&D SUB-SECTOR

- In Summary
- Occupations within the ER&D Sub-sector
- Description of each Occupation
- Typical Career Paths

OCCUPATIONS

In Summary

Based on industry research as part of the Occupational Analysis, the occupations in the sub-sector have been classified as follows:

13 unique 'Occupations'

15 unique 'Tracks'

16 unique Job roles at the Entry Level

48 unique Job roles at the Middle Level

54 unique Job roles at the Leadership Level

Occupation *is a set of job roles, which perform similar/related set of functions in an industry.*

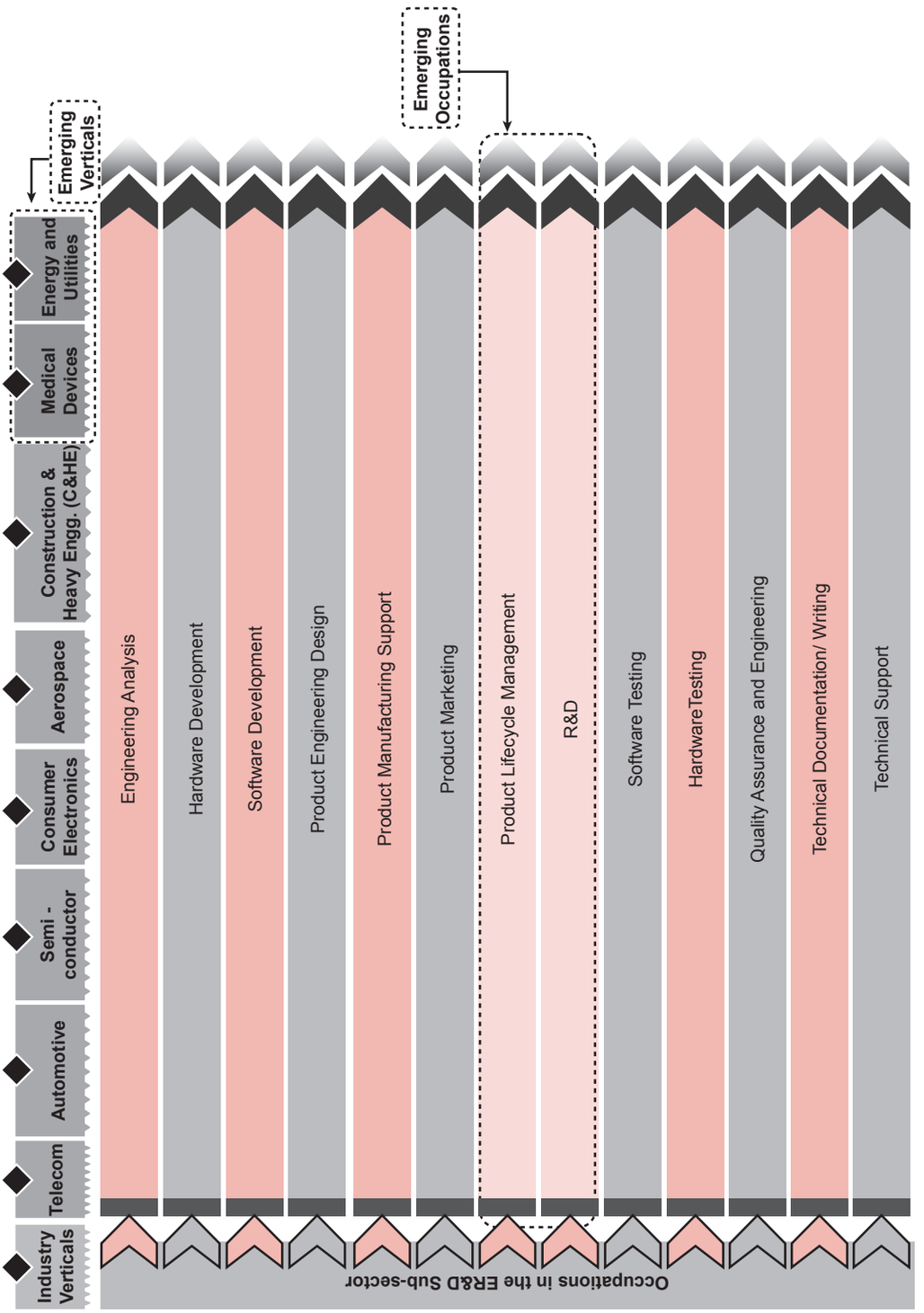
Tracks *are a sub-set of occupations having similar set of functions under the larger gamut of the occupation they belong to.*

Unique Job Roles *are defined a set of functions that together form a unique employment opportunity in an organisation.*

Entry Level: *0-2 years*
Middle Level: *2-12 years*
Leadership Level: *>12 years*

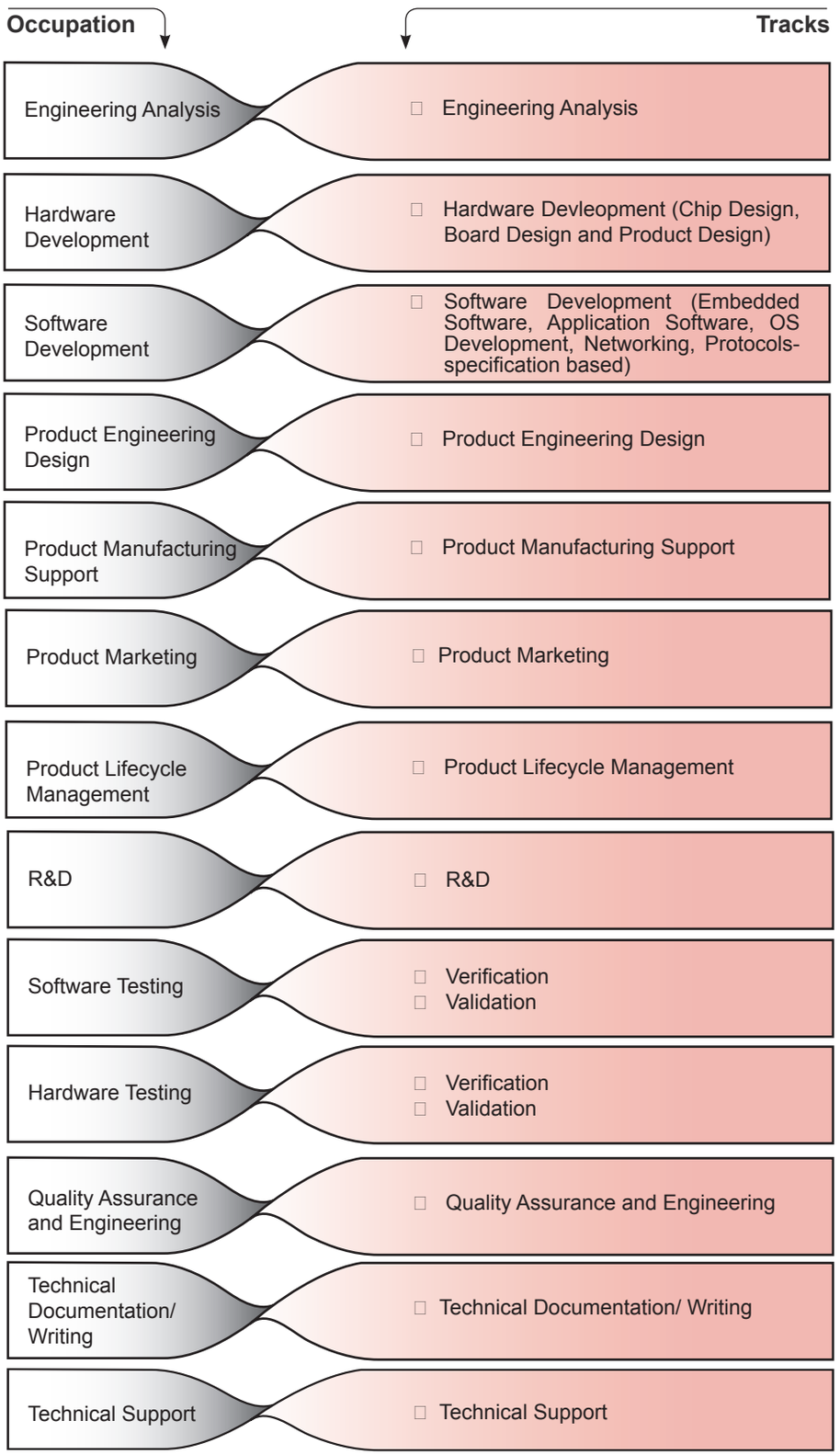
Occupations in the ER&D Sub-sector

The occupations in the ER&D sub-sector are depicted below. Some occupations such as Software Testing and Hardware Testing have tracks within them, i.e. Verification and Validation. Some occupations like Product Engineering Design and Engineering Analysis do not require a further split and hence, they have a single track (same as the occupation name). This has been depicted in the figure below.



This table does not depict any hierarchy.

Occupations have been classified into 'Tracks' to capture further skill-based specialisations



This table does not depict any hierarchy.

Occupational Map – Reading Guide

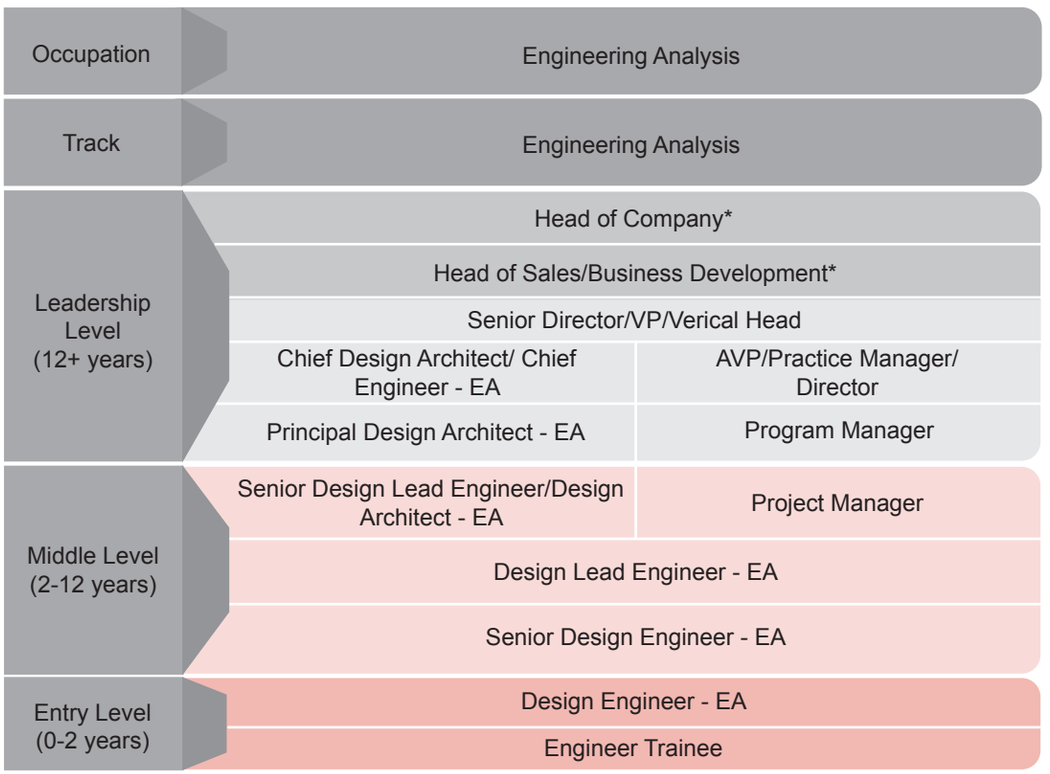
Career Map – Reading Guide

Engineering Analysis

Engineering Analysis involves the application of scientific analytic principles and processes to reveal the properties and state of the system, device or mechanism under study. Professionals in this occupation are responsible for carrying out engineering analysis problems like stress calculations, static and dynamic analysis, thermal analysis, fluid flow analysis, crash simulation, multi-body dynamics, noise, vibration and so on. Engineers in this group perform analysis using standard analysis procedures, finite element codes or commercial packages like Nastran, Patran, Hyperworks, ANSYS and so on.

Role of an EA Professional	❒ Analyses complex static/dynamic/thermal/ fluid-flow problems using software tools in the areas of automotive, aerospace, chemical, energy and so on ❒ Delivers accurate mechanical analysis which is incorporated in the overall design ❒ Performs flow and thermal analysis at component and system level ❒ Conducts finite element analysis of various structural parts ❒ Analyses performance and emissions data and documents and presents the results ❒ Works closely with the design teams to enable reduced time to market the products ❒ Provides support in the assessment and testing of advanced technology systems, sub-systems and components ❒ Plans, organises, conducts and/or monitors engineering activities relating to the analysis, design, development, fabrication, installation and modification of systems or system components ❒ Develops theoretical analysis and system models for current and future developments ❒ Interprets trends, including statistical implications
Qualifications and Skills	❒ BE/BTech/MCA (preferably Mechanical Engineering) ❒ Knowledge of computational fluid dynamics (CFD) packages like ANSYS, ABAQUS, Fluent, KIVA, GT-Power, FLOWMASTER, AMESIM, Gambit, ICEM-CFD, T-Grid and so on

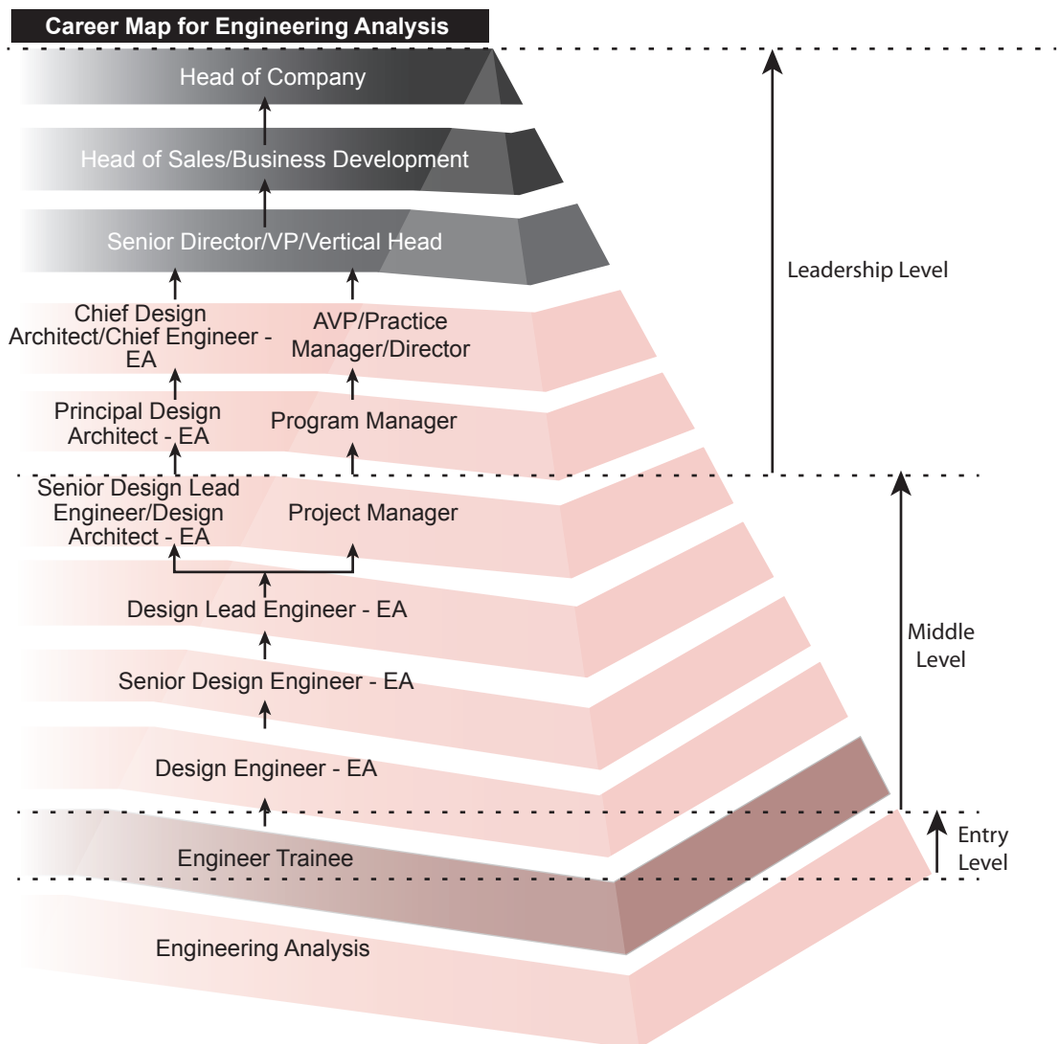
Engineering Analysis - Occupational Map



*Job roles such as 'Head of Company' and 'Head of Sales/Business Development' do not fall under this occupation, but can be a career progression for a person, provided he acquires business knowledge, skills and attributes required for that role through exposure to different occupations. The map does not depict any hierarchy.

Figure 31: Engineering Analysis- Occupational Map

Engineering Analysis - Typical Career Paths



*Note: Career growth across the Leadership Levels is usually governed by cross-functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

Figure 32: Engineering Analysis - Typical Career Paths

Hardware Development

(Includes VLSI - Embedded/Electronics - Hardware and Chip Design)

Hardware Development involves design of integrated circuits, chips, and boards that are incorporated into products and/or product components.

Professionals in this occupation apply broad engineering concepts and research techniques, and undertake VLSI and embedded electronics hardware design. They document research and design specifications. They help facilitate transition of product design, and enhancement to full production/delivery.

Role of a Hardware Development Professional	❒ Undertakes schematic entry, circuit design, circuit debugging, simulation, layout and verification of small to medium non-complex components of a chip block ❒ Designs and develops electronic parts, components or integrated circuitry for electronic equipment and other hardware systems ❒ Works on the problems of limited scope, through the usage of standard design concepts and principles ❒ Uses statistical data analysis and techniques to identify critical performance metrics and limits
Qualifications and Skills	❒ BE/BTech preferably in electrical / mechanical or electronics for Hardware Engineer ❒ Theoretical knowledge of electronic circuitry ❒ Working knowledge of firmware, software and/ or embedded systems ❒ Common skill-sets include Analog, Digital, Mixed Signal, HMOS/MOS/CMOS, PLL, ADC, DAC ❒ Strong skill-set in analytical problem solving ❒ Attention to detail and perseverance are the key skills

Hardware Development - Occupational Map

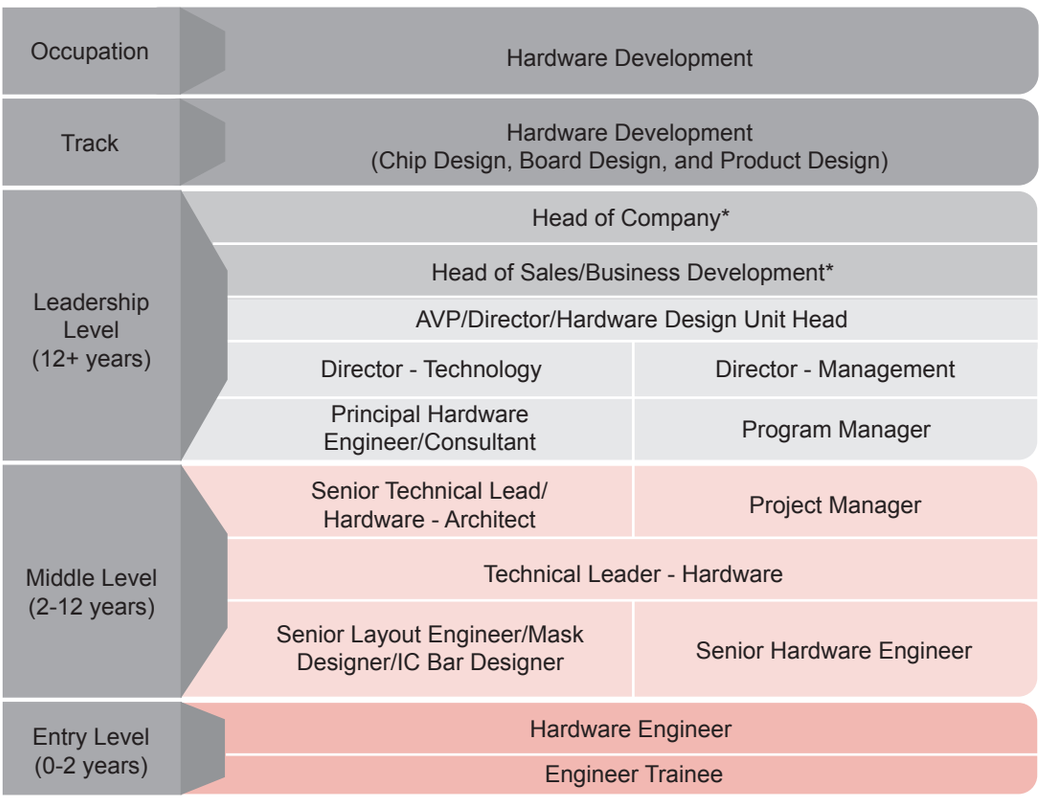


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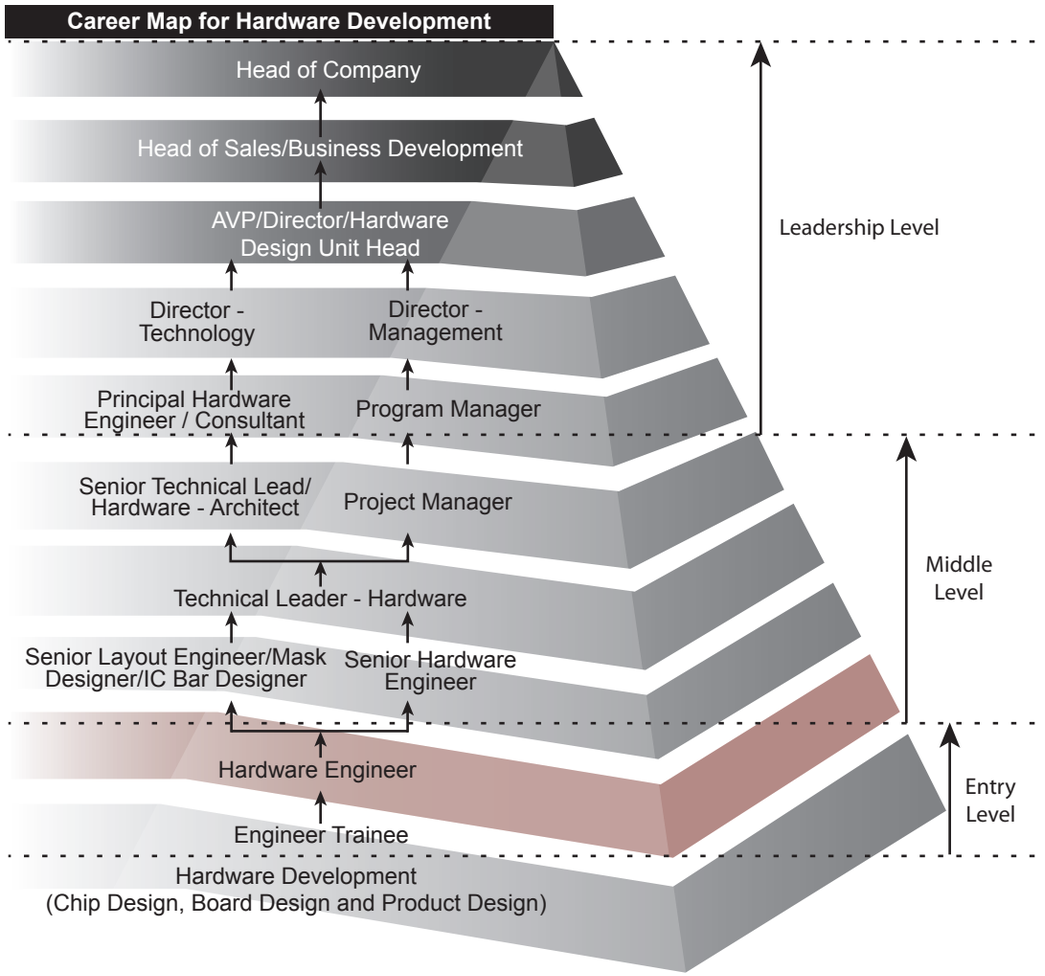
Figure 33: Hardware Development- Occupational Map

Hardware Development - Typical Career Paths



*Note: Career growth across the Leadership Levels is usually governed by cross functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

Figure 34: Hardware Development -Typical Career Paths

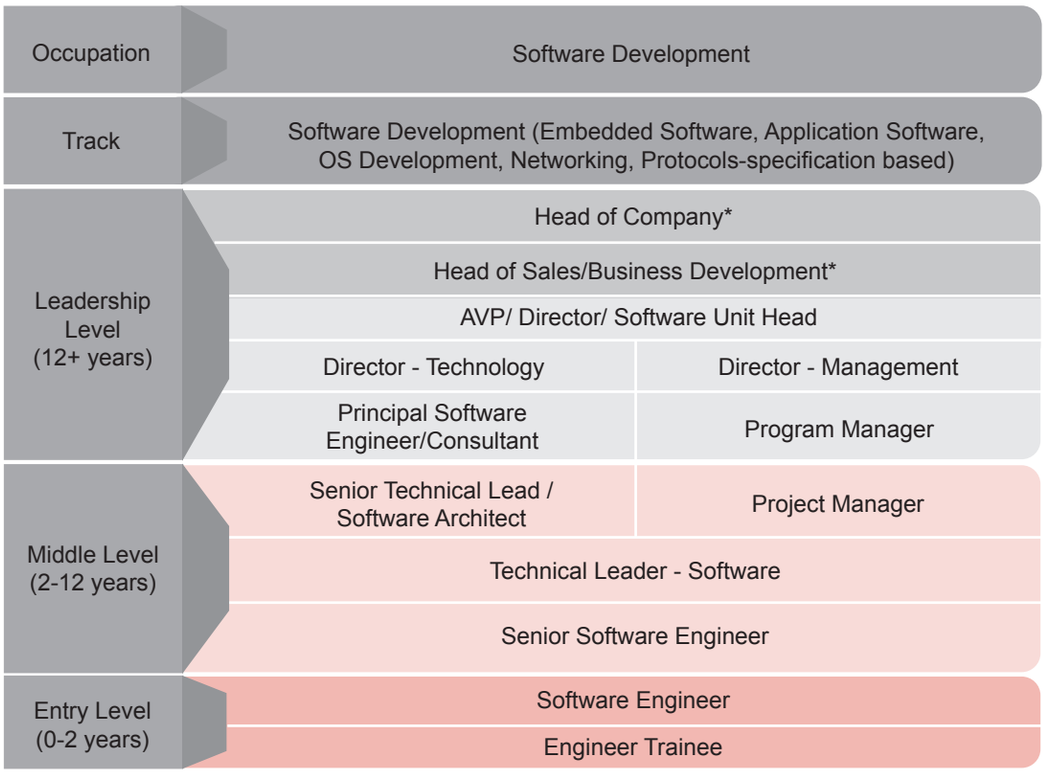
Software Development

(Includes Embedded Software, Application, Operating Systems, Networking, Protocols-specification Based)

Software Development roles are responsible for developing software/device drivers/embedded software/operating systems and so on that operate hardware or network environments. Professionals in this occupation use programming/scripting languages like C, C++, Java, HTML, .Net, PHP, and VB and so on.

Role of a Software Development Professional	❒ Captures data and translates and transforms it into a processing language ❒ Develops codes from relevant information and schedules, processes and monitors them ❒ Develops specifications and usability features of the applications
Qualifications and Skills	❒ BCA/MCA or Engineer with certification in relevant areas ❒ Problem-solving and strong analytical capability ❒ Knowledge of programming logic and SDLC is essential ❒ Functional skills like software languages (Java, C/C++, dot net) are highly essential for professionals in the Software/Functional Development tracks

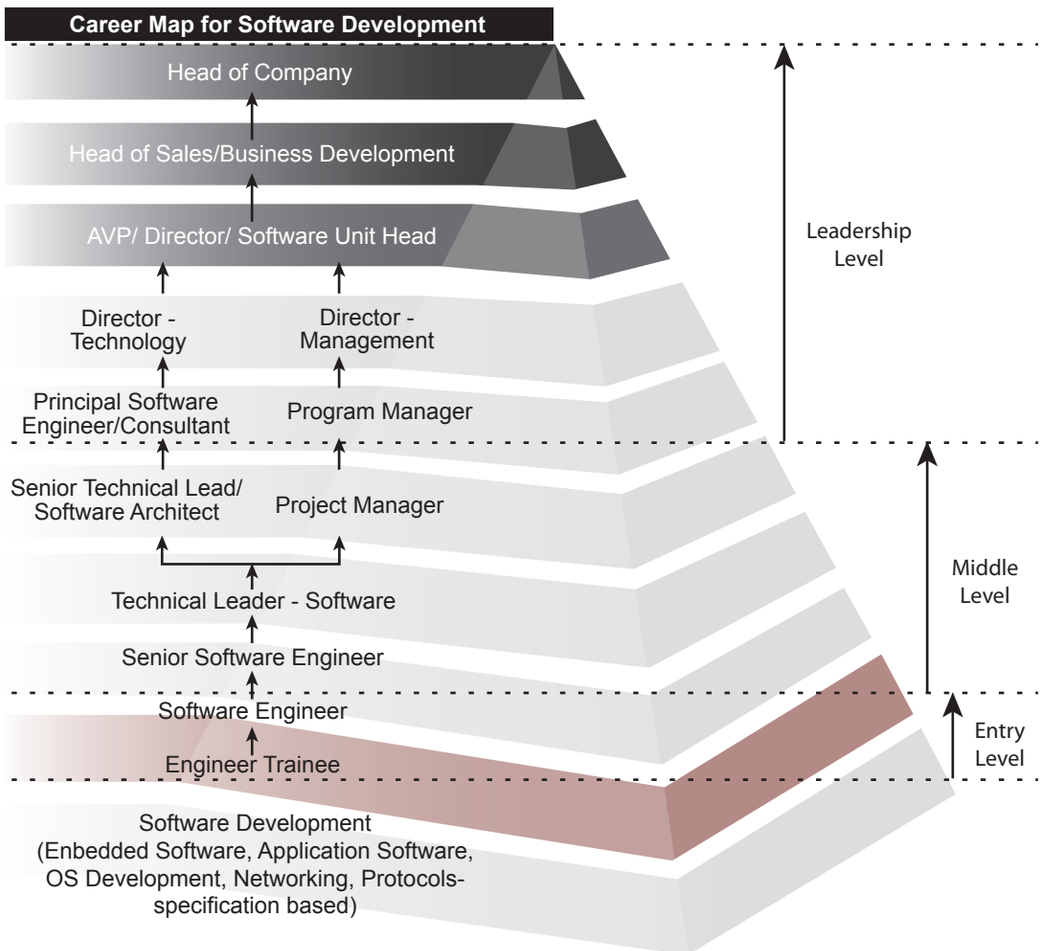
Software Development - Occupational Map



*Job roles such as 'Head of Company' and 'Head of Sales/Business Development' do not fall under this occupation, but can be a career progression for a person, provided he acquires business knowledge, skills, and attributes required for that role through exposure to different occupations. The map does not depict any hierarchy.

Figure 35: Software Development- Occupational Map

Software Development – Typical Career Paths



*Note: Career growth across the Leadership Levels is usually governed by cross functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

Figure 36: Software Development – Typical Career Paths

Product Engineering Design

Product Engineering Design broadly relates to new product development and integration. Professionals in this occupation perform complex assignments pertaining to the design, testing and assessment of mechanical and electrical devices using tools, such as mechanical CAD, electronics CAD and so on. They analyse and design the mechanical systems, components and equipment.

They also develop prototypes for testing; provide feasibility testing on new designs and current designs under modification. They lead cross-functional reviews of product architecture to assure design integrity, and compliance with company specifications and recognised industry design practices.

Role of a Product Engineering Design Professional	❒ Takes responsiblity for the design, usability and aesthetics of a product ❒ Creates and revises designs in CAD system following drawings or designs of actual products ❒ Interfaces with the engineering and usability teams to ensure that the designs incorporate all the aspects of engineering and are tested, practical and implementable ❒ Prepares design specifications, analysis and recommendations for presentation and approval ❒ May be involved in specifying materials, equipment and supplies required for the completion of projects and so on ❒ May be responsible for the design, development and implementation of custom mechanical tooling, fixturing, and associated processes to enable the handling and assembly or disassembly of parts and components throughout the product lifecycle
Qualifications and Skills	❒ BE/BTech/MCA (preferably Mechanical Engineering) for Software Design Engineer ❒ Diploma (preferably Mechanical Engineering) for Draftsman ❒ Proficiency in the use of tools such as CAD, CAE, CATIA ❒ Awareness of various stages in new product development ❒ Working knowledge of mechanical engineering design, mechanics and material science concepts and techniques ❒ Proficiency in solving engineering problems using analytical techniques and engineering knowledge such as measurement control, stress analysis, finite element analysis or system integration ❒ Knowledge of prototyping and testing of products ❒ Expertise in sketch and concept development

Product Engineering Design - Occupational Map

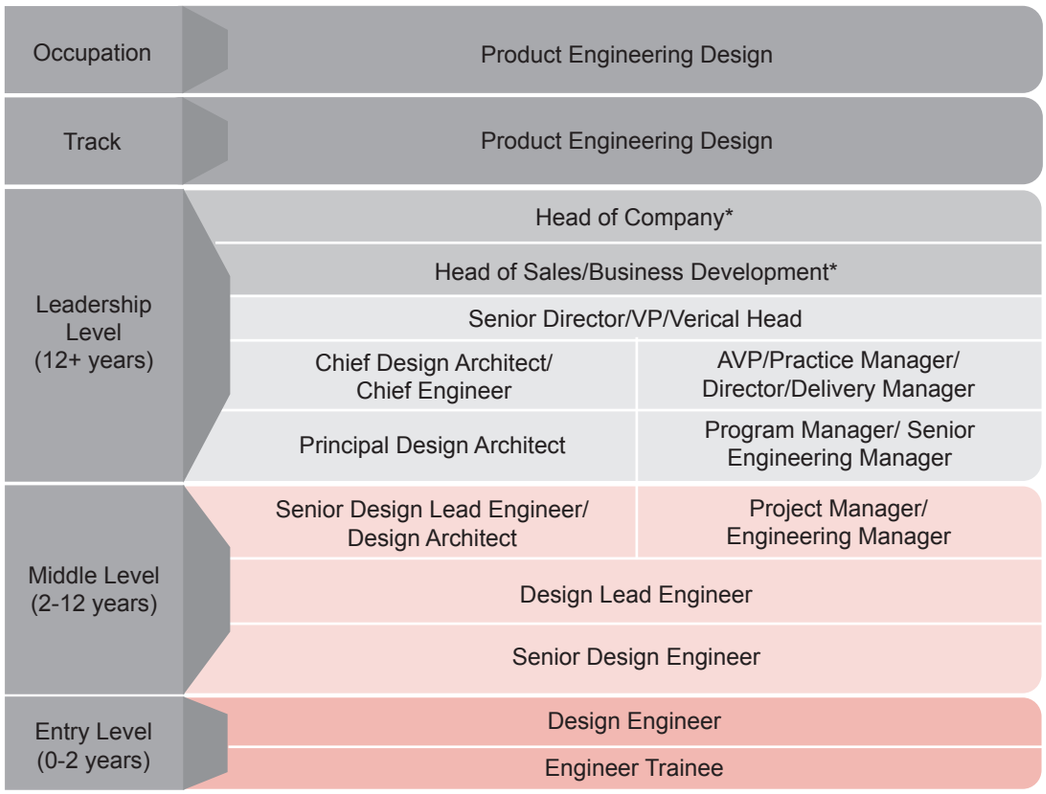


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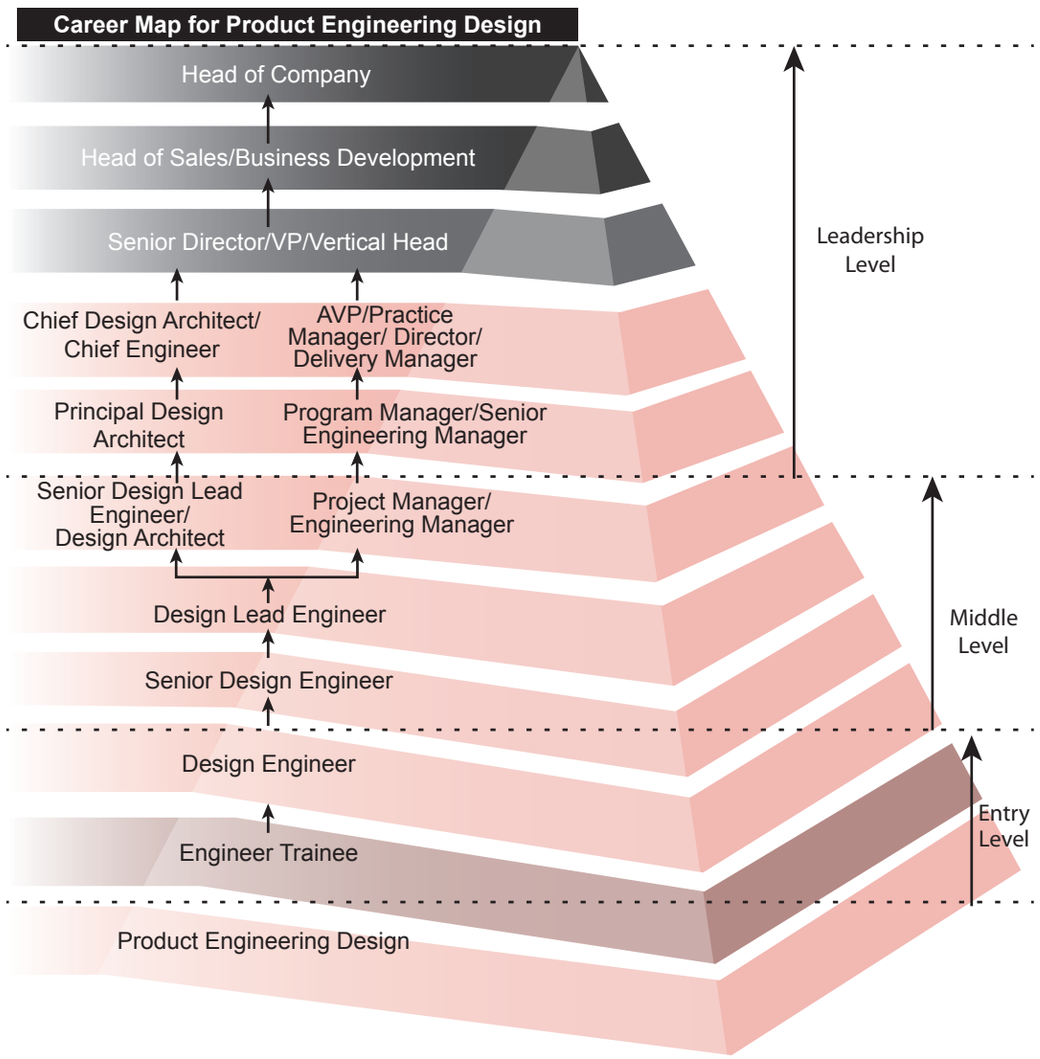
Figure 37: Product Engineering Design- Occupational Map

Product Engineering Design - Typical Career Paths

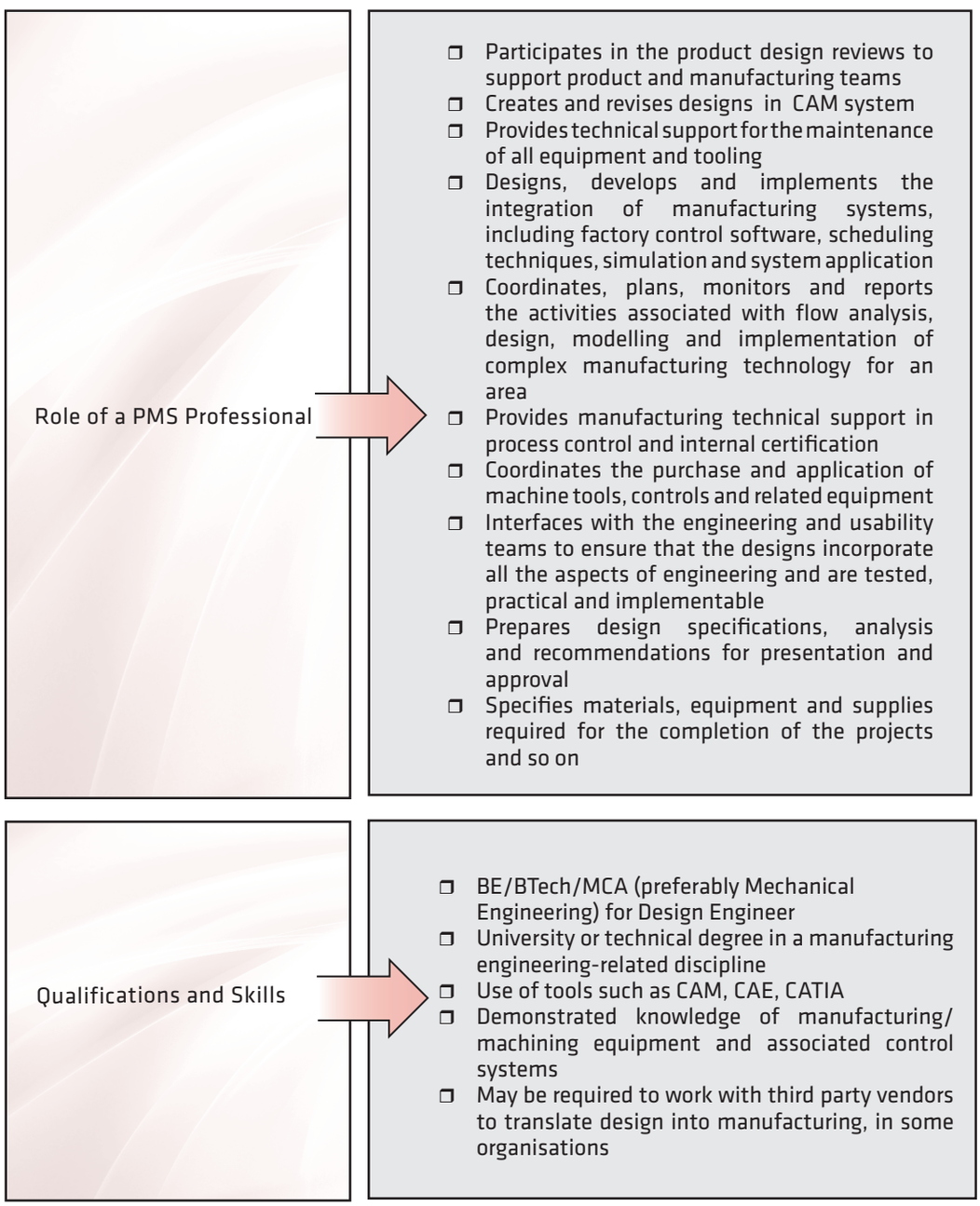


*Note: Career growth across the Leadership Levels is usually governed by cross functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

Figure 38: Product Engineering Design- Occupational Map

Product Manufacturing Support

Product Manufacturing Support occupation covers, broadly, product manufacturing and engineering support. Engineers in this group analyse assemblies, and support manufacturing and engineering. They guide the product design team towards meeting the functional objectives and requirements of the users/customers. They are responsible for manufacturing and other process modelling, digital factory, i.e., plant and facility layout, CNC programming, tooling and equipment design, jigs and fixtures and gages design. Their objective is to improve asset lifecycle management and utilisation, and achieve synchronised production and collaborative manufacturing.



Product Manufacturing Support - Occupational Map

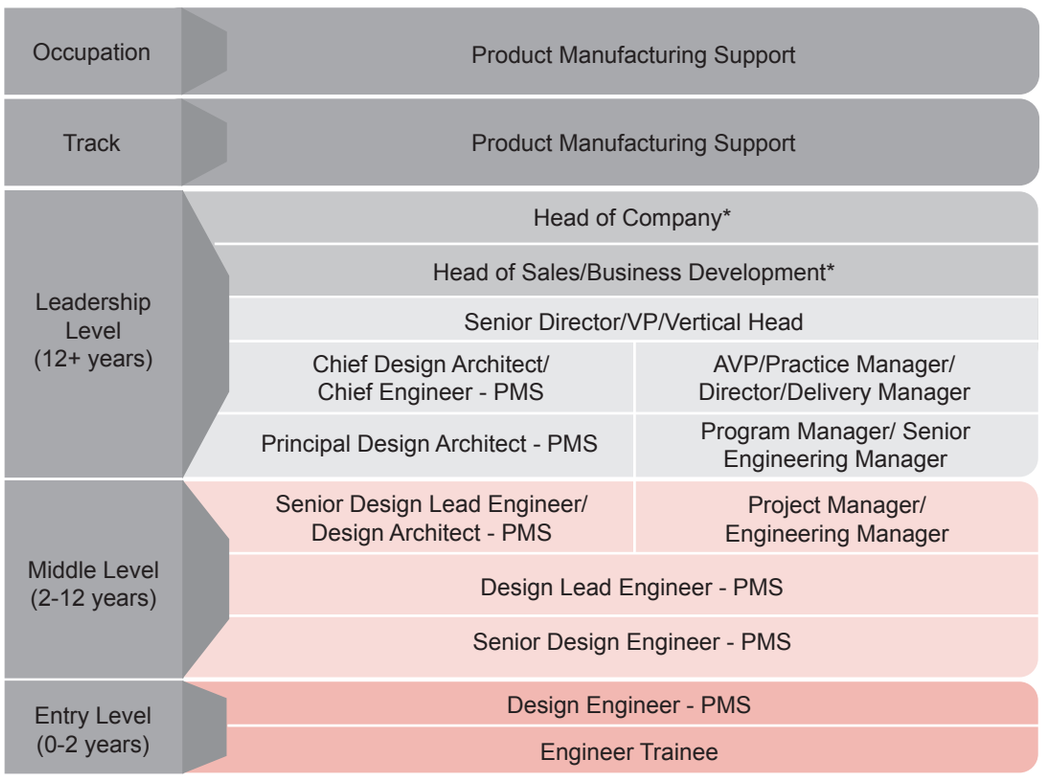


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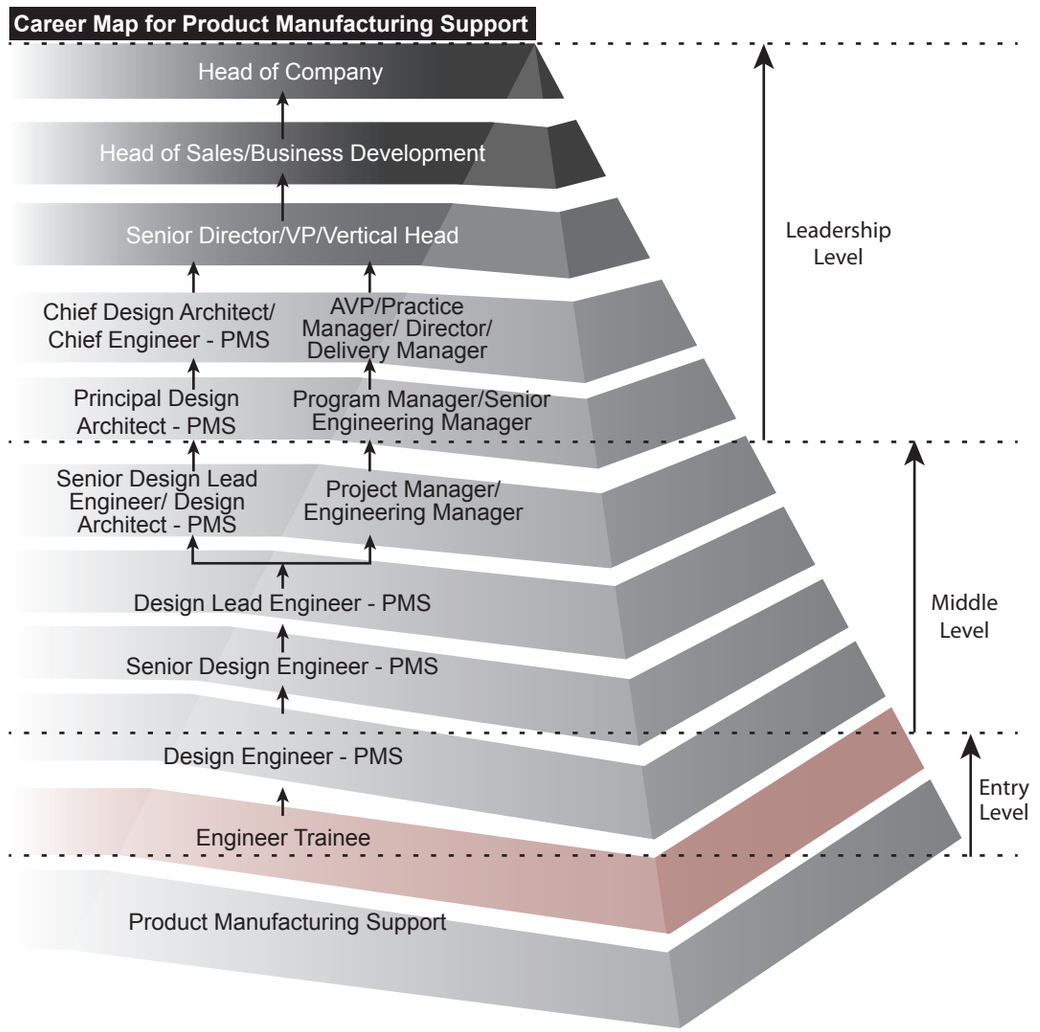
Figure 39: Product Manufacturing Support -Occupational Map

Product Manufacturing Support - Typical Career Paths

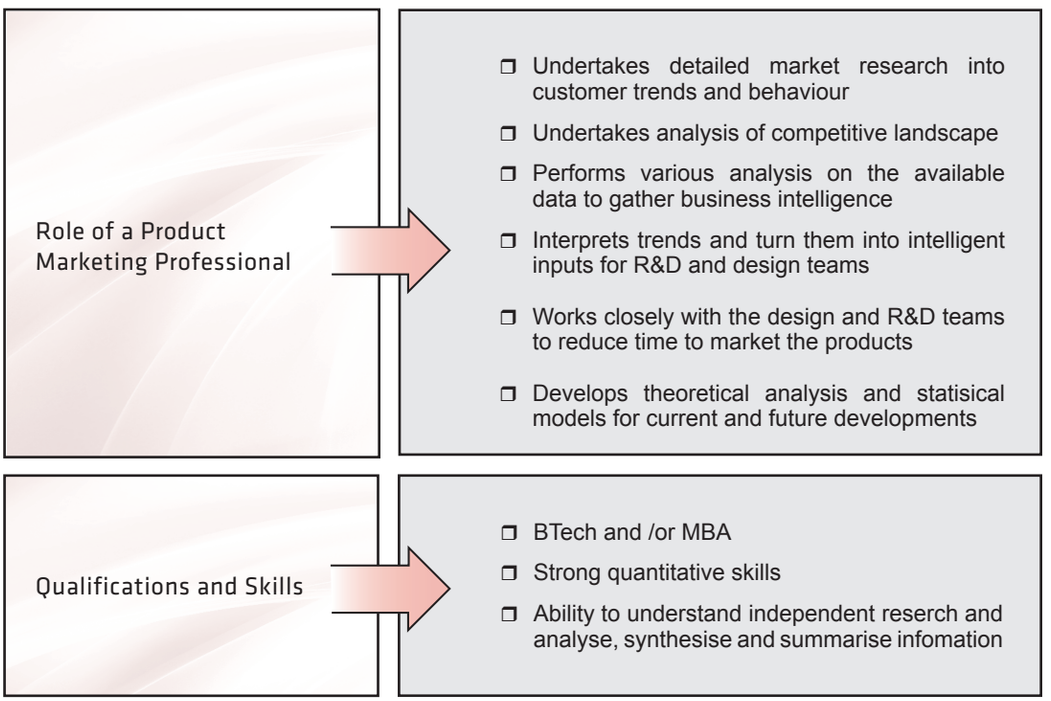


*Note: Career growth across the Leadership Levels is usually governed by cross functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

Figure 40: Product Manufacturing Support - Typical Career Paths

Product Marketing

Product Marketing is the first step of a typical product lifecycle, and hence is a critical aspect of product R&D. This involves product conceptualisation and undertaking detailed market research to create product backlog or product funnel. The professionals work towards collecting data and undertaking exhaustive analysis, including competitive analysis, to gather intelligence and provide inputs to teams involved in design, manufacturing or management of product lifecycle.



Product Marketing - Occupational Map

Unique job roles have been identified hereunder. Please note that they are different from the prevalent designations.

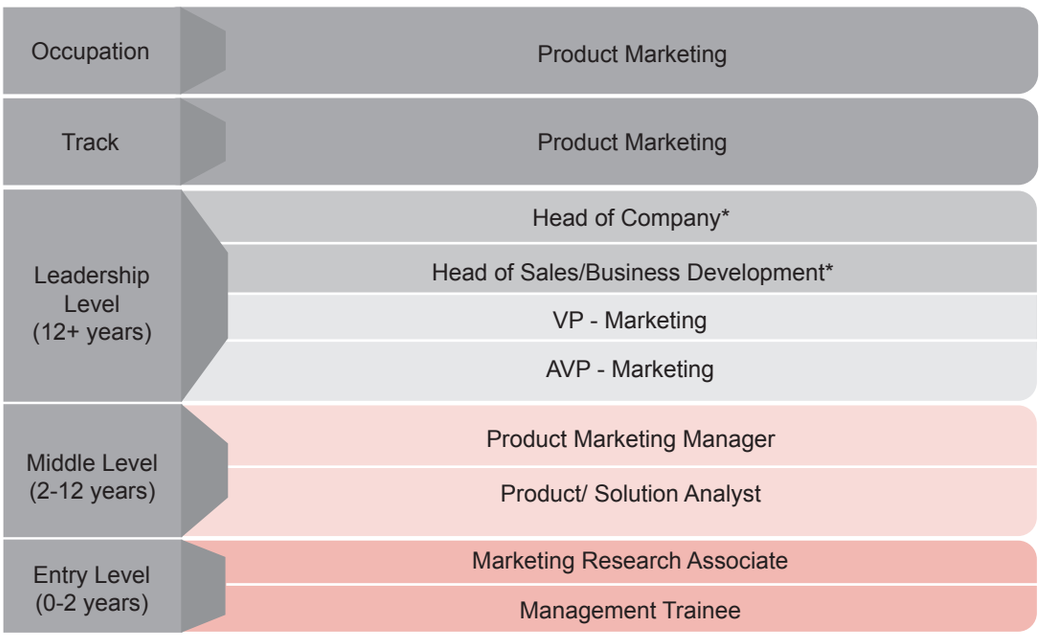


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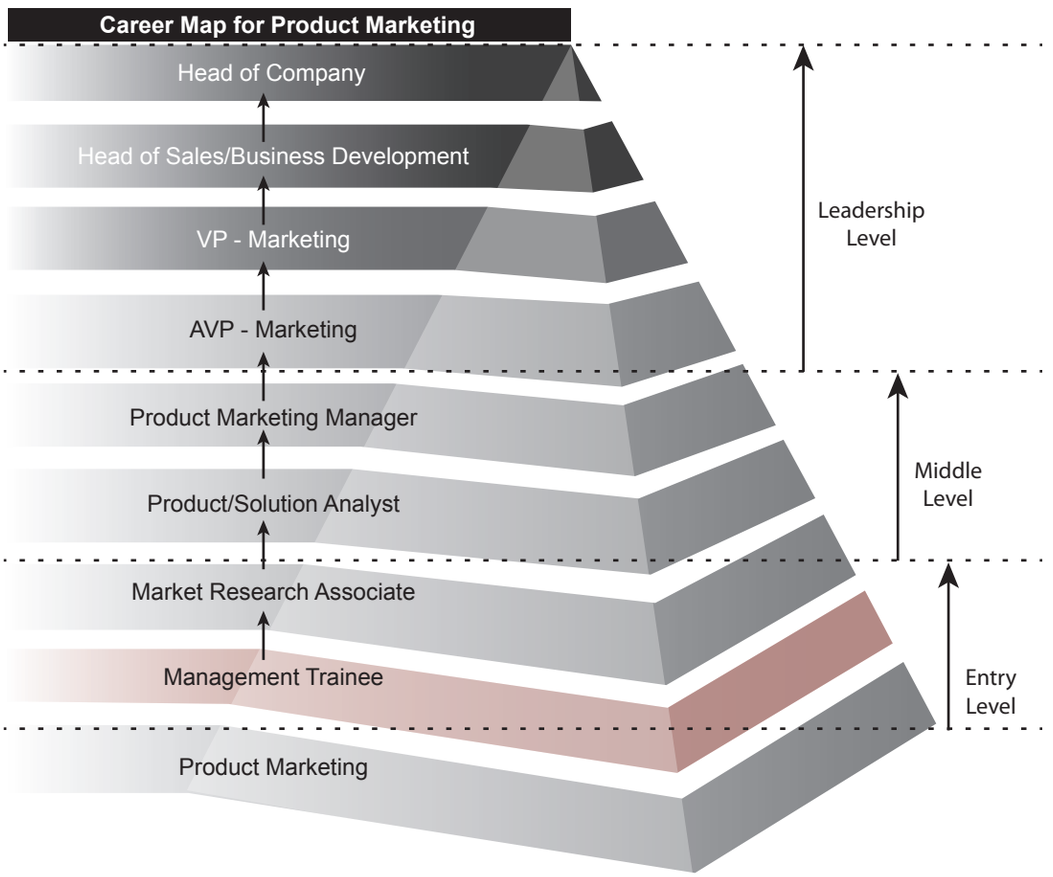
Figure 41: Product Marketing- Occupational Map

Product Marketing - Typical Career Paths

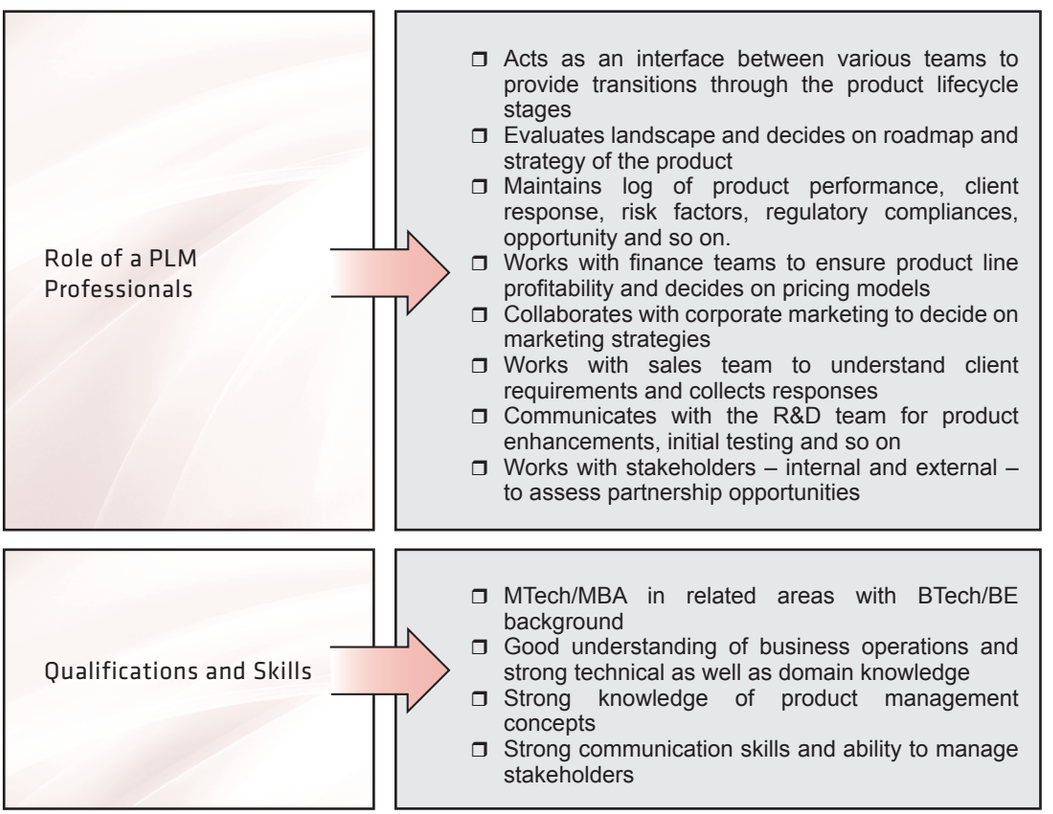


*Note: Career growth across the Leadership Levels is usually governed by cross-functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

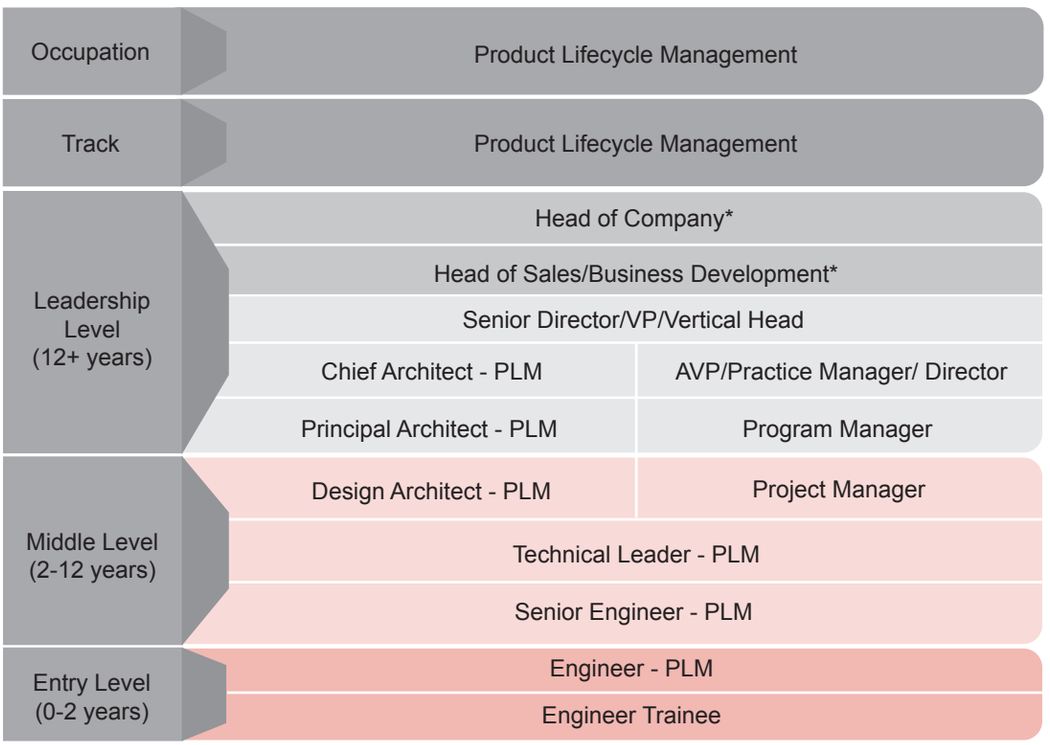
Product Lifecycle Management

Product Lifecycle Management (PLM) at a conceptual level deals with the optimisation of 'creation' processes for product/services or design of production processes across the enterprise. This helps customers to focus on bringing newer, better and more efficient products and services, enables low-risk, high-impact solutions and increases the maturity of the PLM implementation while realising early return on investment (ROI).

People in these roles are responsible for helping implement and manage the appropriate PLM package and strategy for an organisation, using commercial packages like Windchill, Teamcenter, Enovia, SAP-PLM and so on. Engineers involved in PLM manage different versions/releases of products and engage in customer support.



Product Lifecycle Management - Occupational Map



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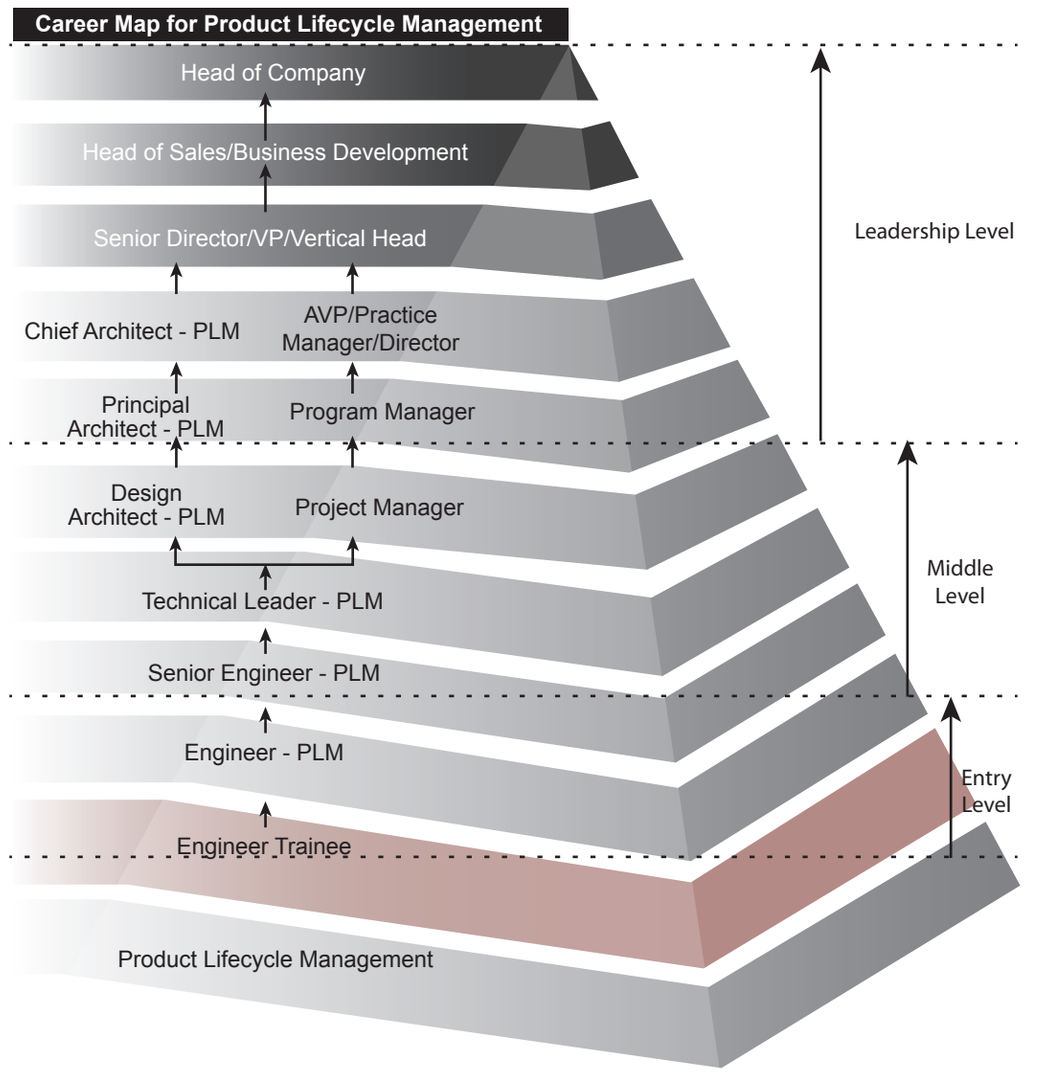
Product Lifecycle Management – Typical Career Paths



*Note: Career growth across the Leadership Levels is usually governed by cross-functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

R&D

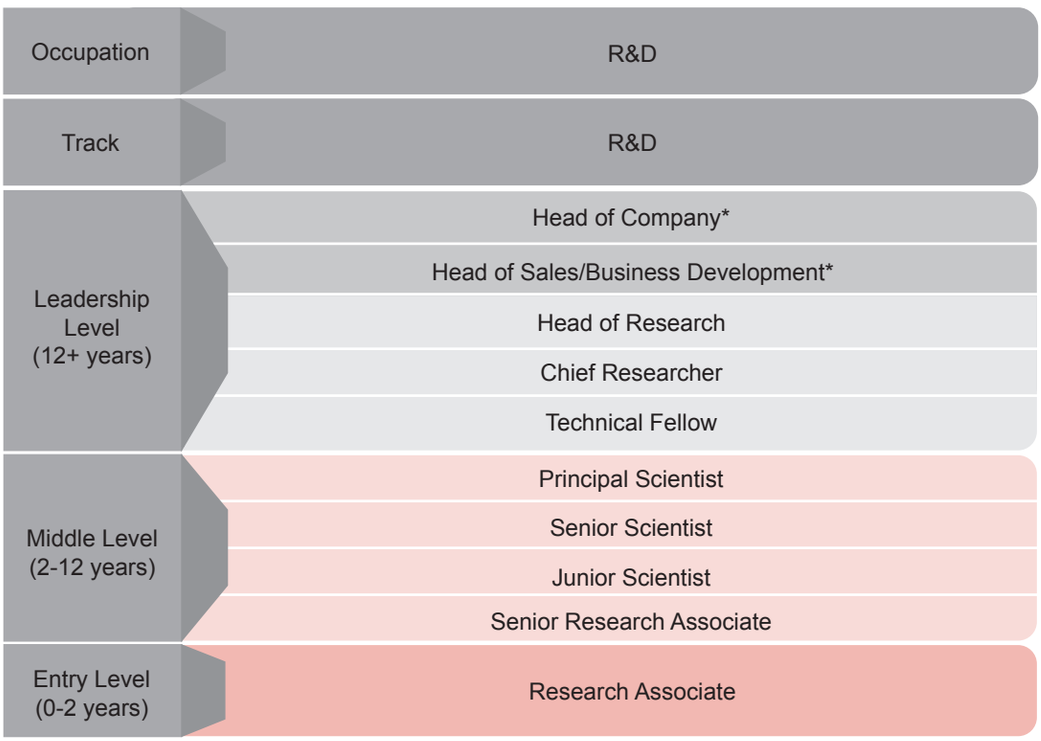
(Includes Fundamental Research and Applied/Mainstream Research)

Fundamental Research: This group of scientists is responsible for undertaking research projects in one or more areas with the goal of breaking new ground, which could lead to new or enhanced products or processes. The research is usually multidisciplinary in nature.

Mainstream Research: They work on product innovations and additional new features. R&D activities typically lead to patents for the company.

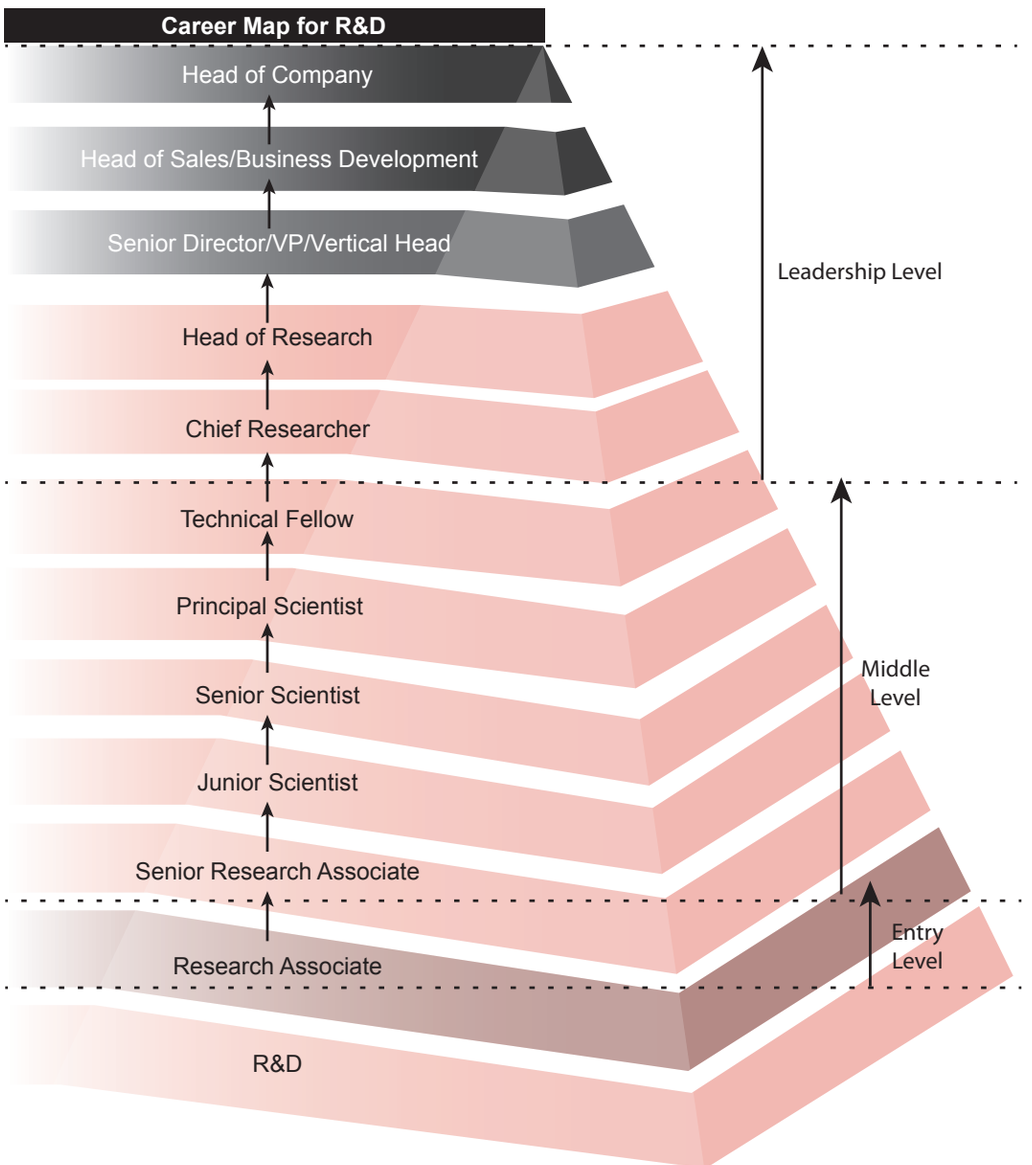
Role of an R&D Professional	❒ Conducts R&D in specialised areas ❒ Works closely with the production, marketing and product management teams to understand the usability and development requirements ❒ Conducts research on techniques that have significant impact on efficiency and effectiveness in product design, cost, performance and standardisation of manufacturing methods ❒ Works on patent analysis and submission ❒ Executes work plans for experimental research and production development runs ❒ Provides technical solutions to a wide range of difficult problems
Qualifications and Skills	❒ MTech / PhD in the areas of specialisation ❒ Needs to be creative and innovative with a problem-solving mentality and hands-on approach to research ❒ Language skills and statistical design skills ❒ Requires superb data analysis skills ❒ Thorough understanding of process development of multidisciplinary systems

R&D - Occupational Map



*Job roles such as 'Head of Company' and 'Head of Sales/Business Development' do not fall under this occupation, but can be a career progression for a person, provided he acquires business knowledge, skills and attributes required for that role through exposure to different occupations. The map does not depict any hierarchy.

R&D - Typical Career Paths



*Note: Career growth across the Leadership Levels is usually governed by cross functional exposure to other occupations. While a possible movement has been indicated in the map, this is usually highly 'person specific' and should not be generalised. The map does not depict any hierarchy.

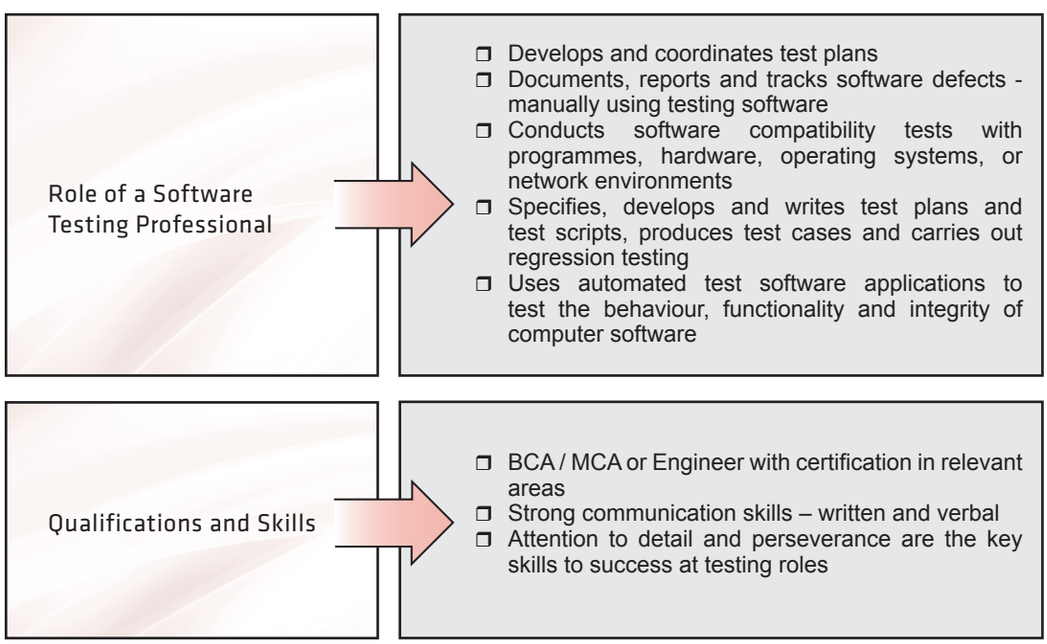
Software Testing

Software Testing is done to check if the product meets the specified requirements, and produces the desired results.

In this process, bugs in software product/project are identified. These professionals perform tests, develop and execute test plans and conduct testing to ensure that quality outputs are generated. Software Testing has two tracks - Validation and Verification.

Validation (Functional) Testing: Professionals in this role test the software/products as end-users. They test all functional features to ensure desired results. These roles may not require an understanding of the code/language, but requires only an understanding of the test plan, common bugs and the 'success' and 'failure' scenarios for the application.

Verification (Technical) Testing: Professionals in this role test the software as developers to find and correct the internal code underlying the software. They develop and automate test cases. They understand the internal code and workings of the software or product, and can resolve and fix bugs.



Software Testing - Occupational Map

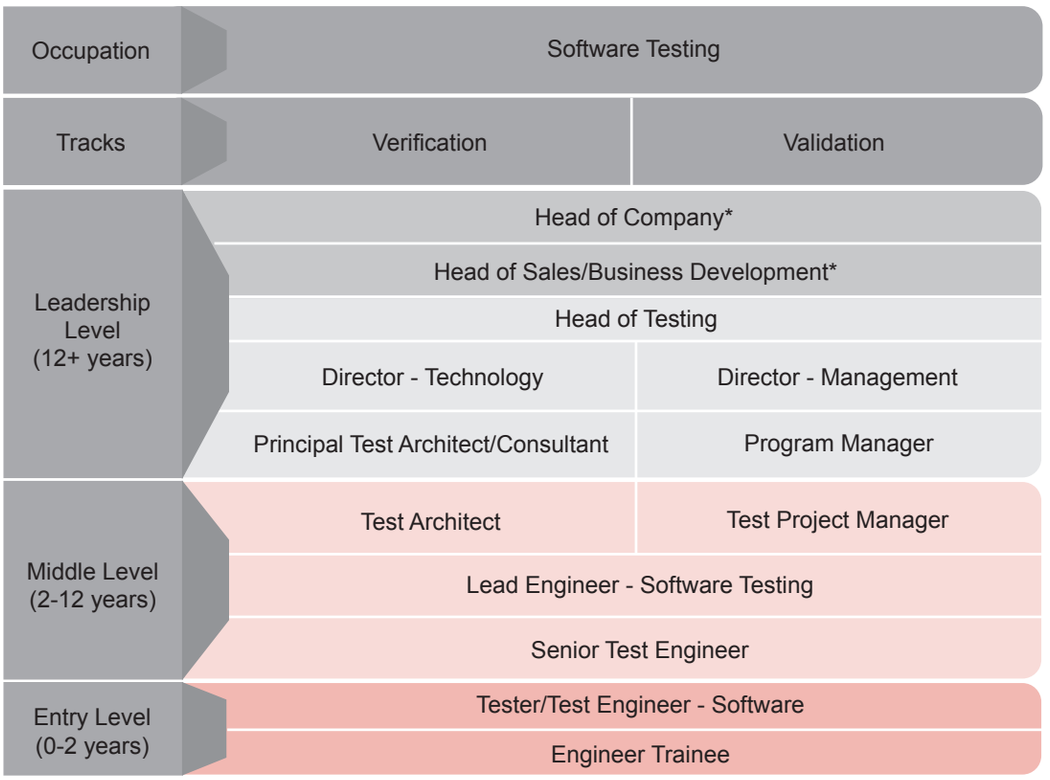


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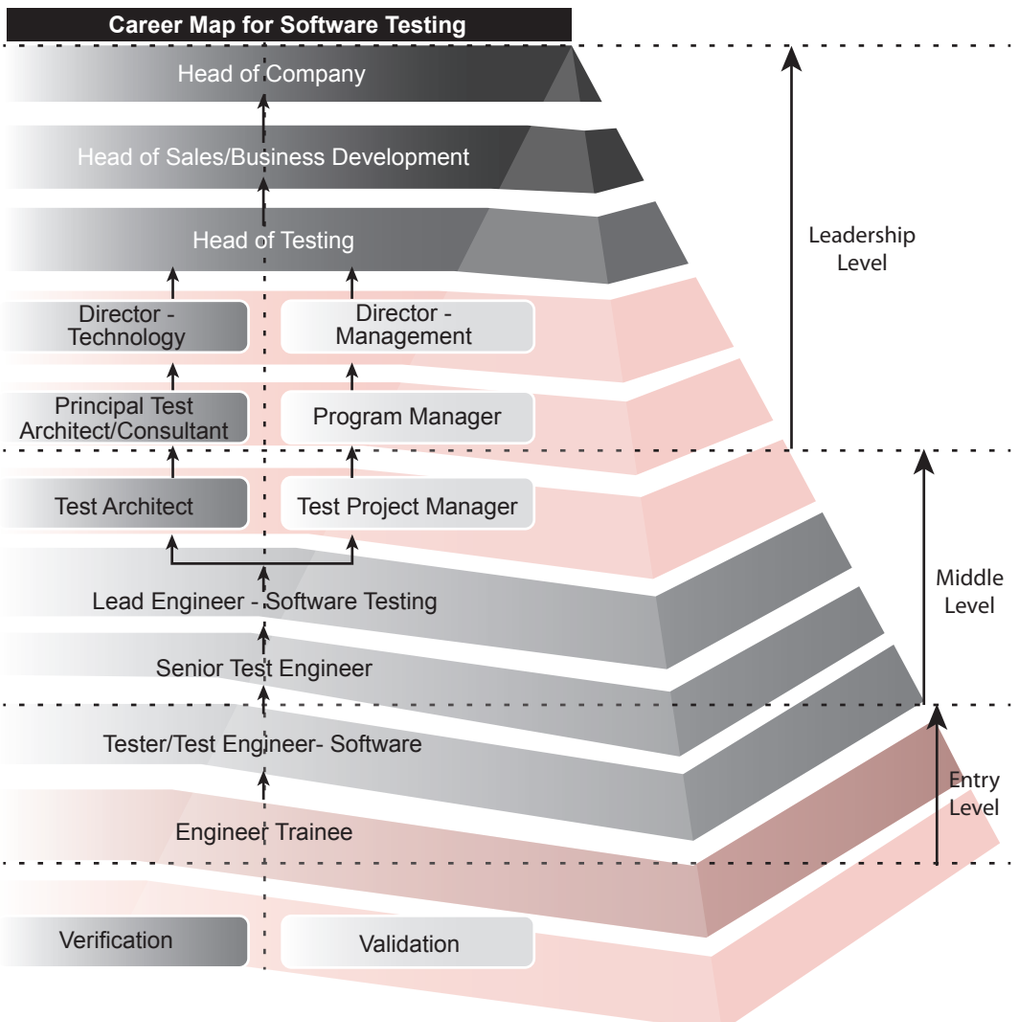
Figure 47: Software Testing -Occupational Map

Software Testing – Typical Career Paths



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Hardware Testing

Hardware Testing constitutes verification that a hardware device operates as expected under defined conditions independently, or as part of a system. This could also expand into interoperability testing, or testing to verify that a device operates as expected when interfacing with other hardware devices. Professionals in this occupation perform tests to see how a newly designed device will interact with another device from another vendor or developer. This group develops and executes test plans, and conducts testing to ensure quality outputs are generated.

Testing has two tracks - Validation and Verification for both software and hardware.

Validation (Functional) Testing: Professionals in this role test the hardware/products as end-users. They test all functional features to ensure desired results. These roles may not require an understanding of the code/language, but requires only an understanding of the test plan, common bugs and the 'success' and 'failure' scenarios for the application.

Verification (Technical) Testing: Professionals in this role test the hardware as developers to find and correct the internal code underlying the hardware functioning. They develop and automate test cases. They understand the internal code and workings of the hardware or product, and can resolve and fix bugs.

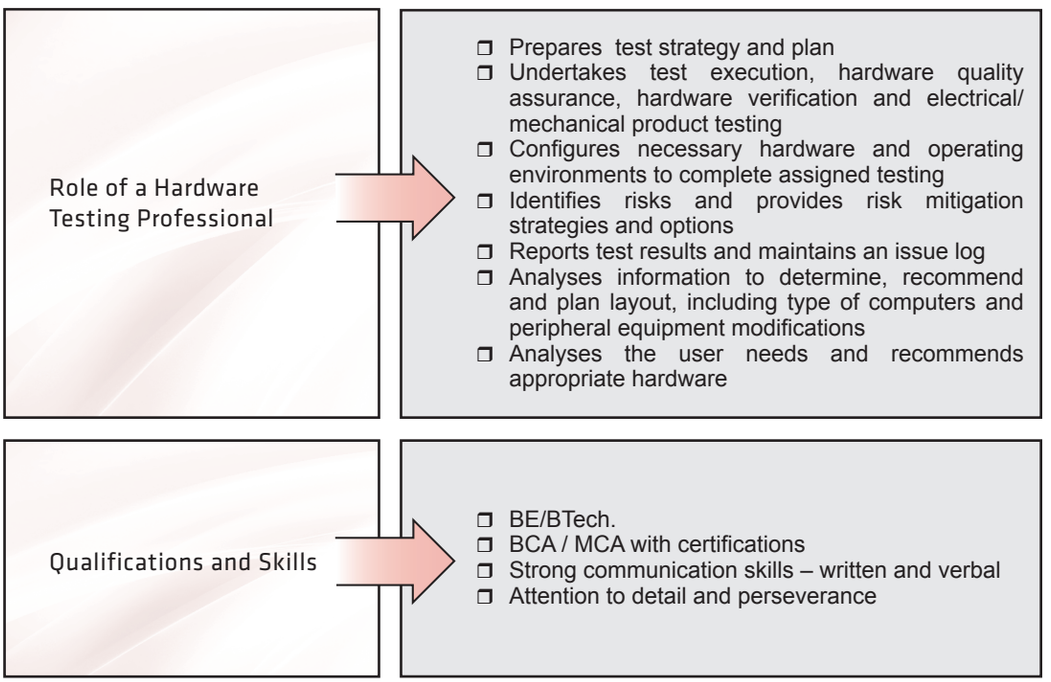

Figure 48: Software Testing – Typical Career Paths

Hardware Testing - Occupational Map

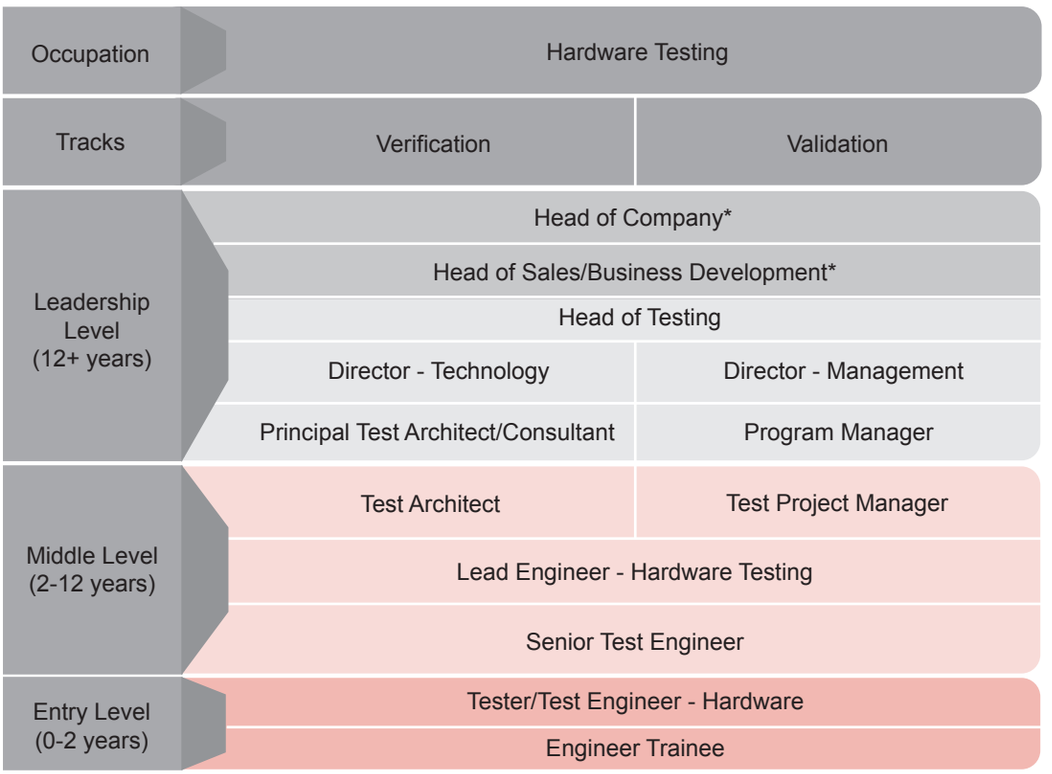

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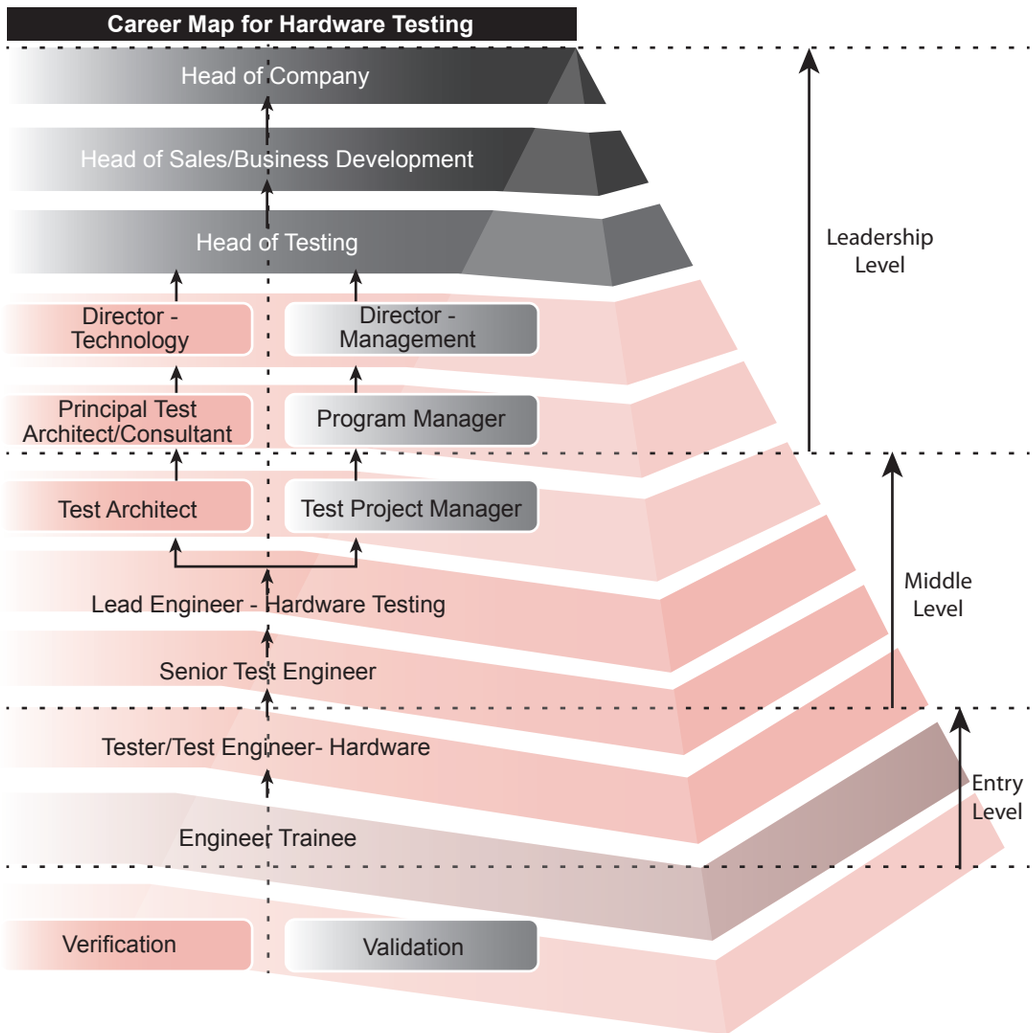
Figure 49: Hardware Testing -Occupational Map

Hardware Testing - Typical Career Paths



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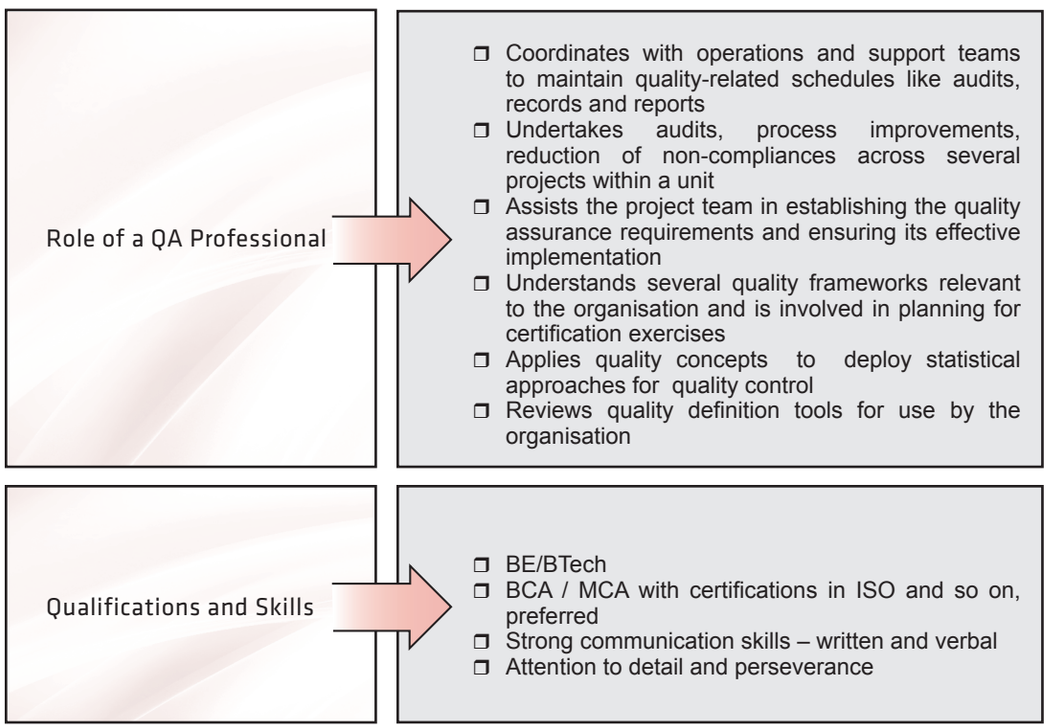
Quality Assurance and Engineering

Quality Assurance and Engineering is the process of designing and implementing the quality focus of the organisation as a whole, and the processes in particular. It involves undertaking several quality assurance initiatives such as process re-engineering, statistical quality control and other quality initiatives such as Six-Sigma, Kaizen and so on.

Professionals in this occupation conduct scheduled and unscheduled tests in the areas of integration, performance and so on. QA professionals act as the final check between the solution developed by the application developers and the teams that deploy these applications.



Quality Assurance and Engineering - Occupational Map

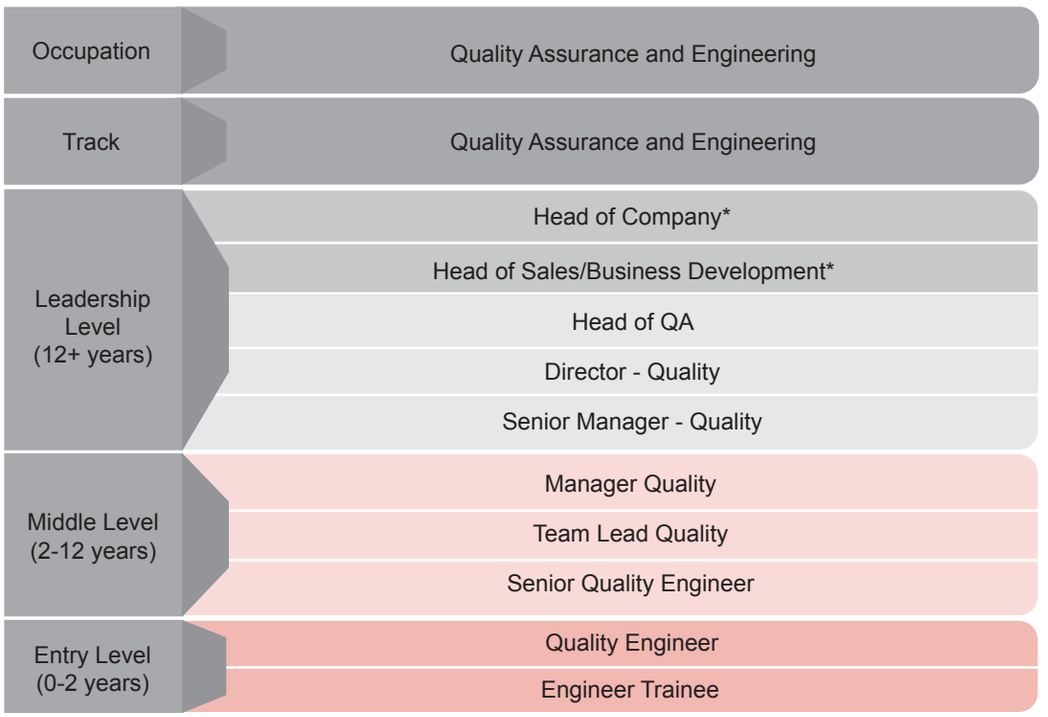


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Figure 51: QA -Occupational Map

Quality Assurance and Engineering – Typical Career Paths

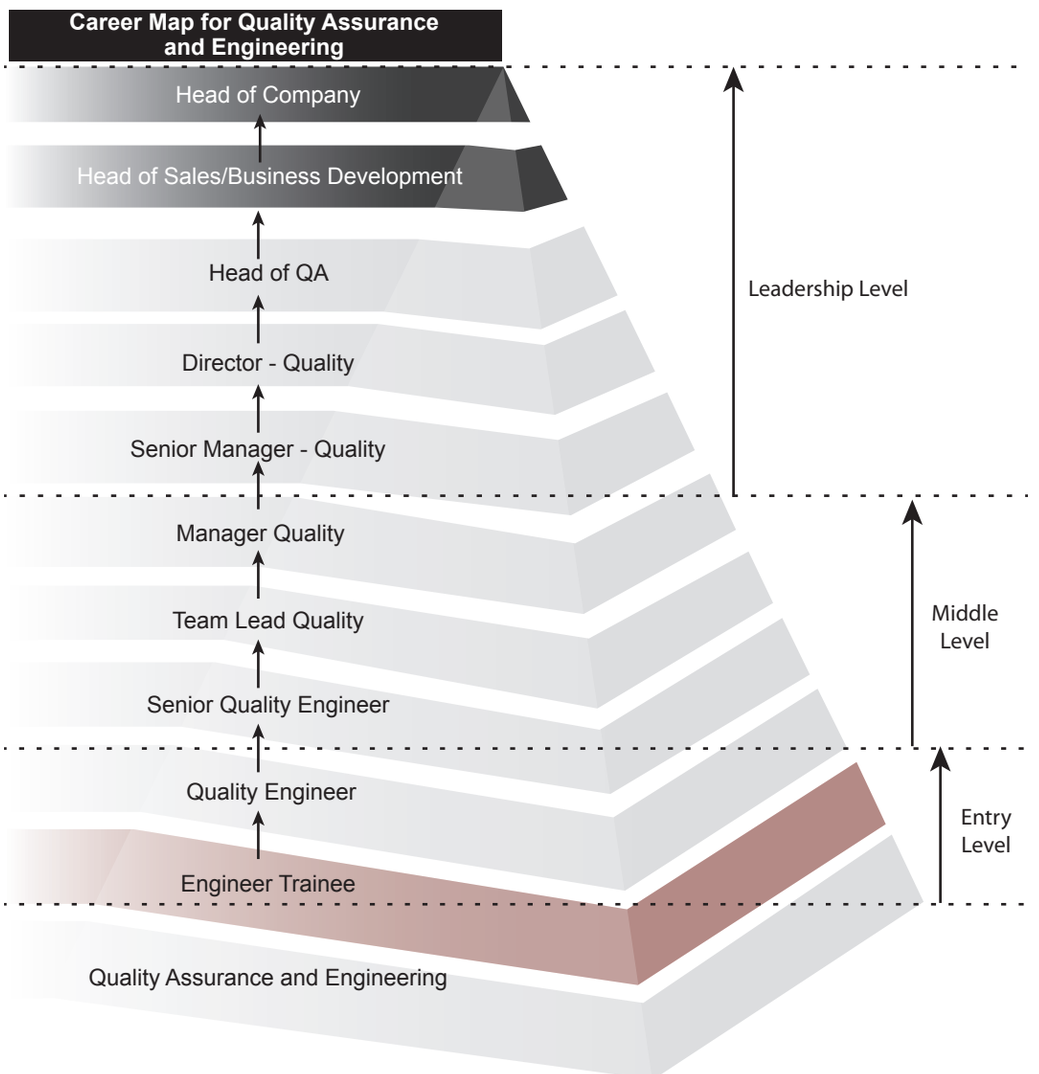

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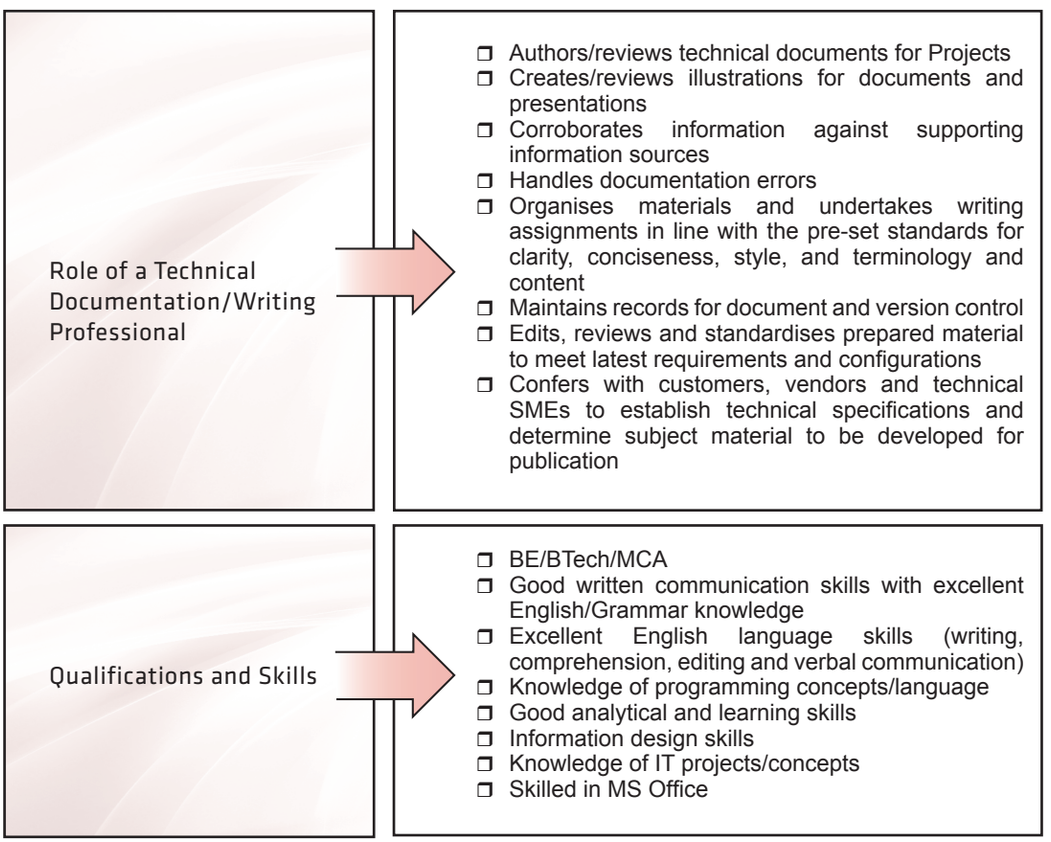
Figure 52: QA – Typical Career Paths

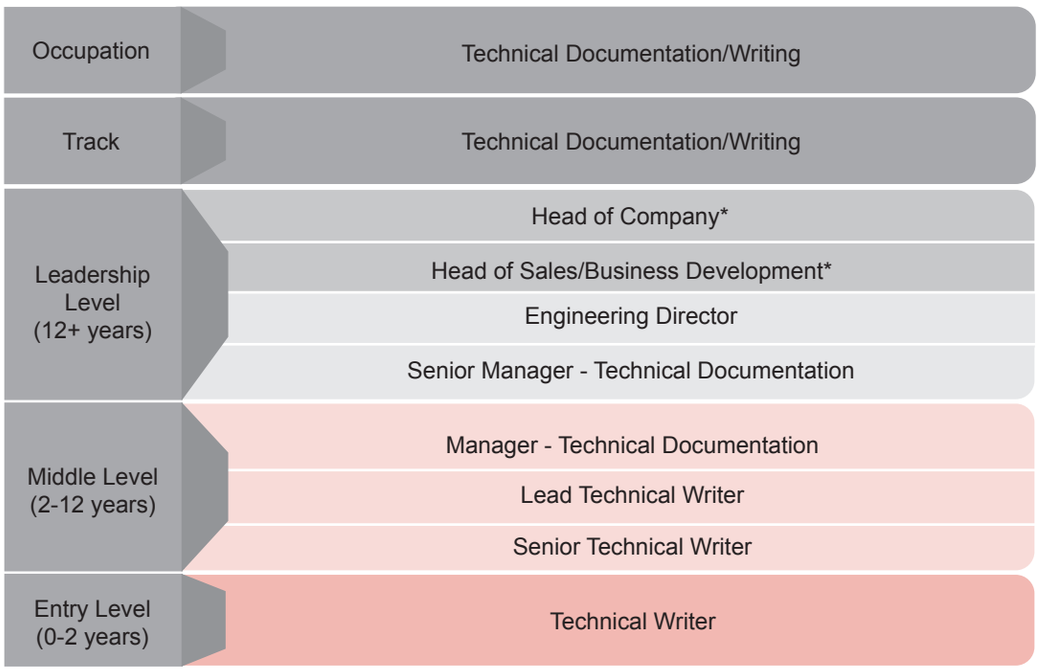
Technical Documentation/Writing

Technical Documentation/Writing involves documenting product or process information, which is technical in nature as per the defined internal and external guidelines/regulations/standards.

Professionals in this occupation will typically write and publish documentation that describes product definition and specification, design, manufacturing, quality assurance, product liability, product presentation, description of features, functions and interfaces, handling, functionality and architecture, intended safe and correct use, service and repair of a technical product or a product under development or use as well as its safe disposal. Activities include writing, designing and editing proposals, manuals, documents, project artifacts, user handbooks, newsletters and so on.



Technical Documentation/Writing - Occupational Map



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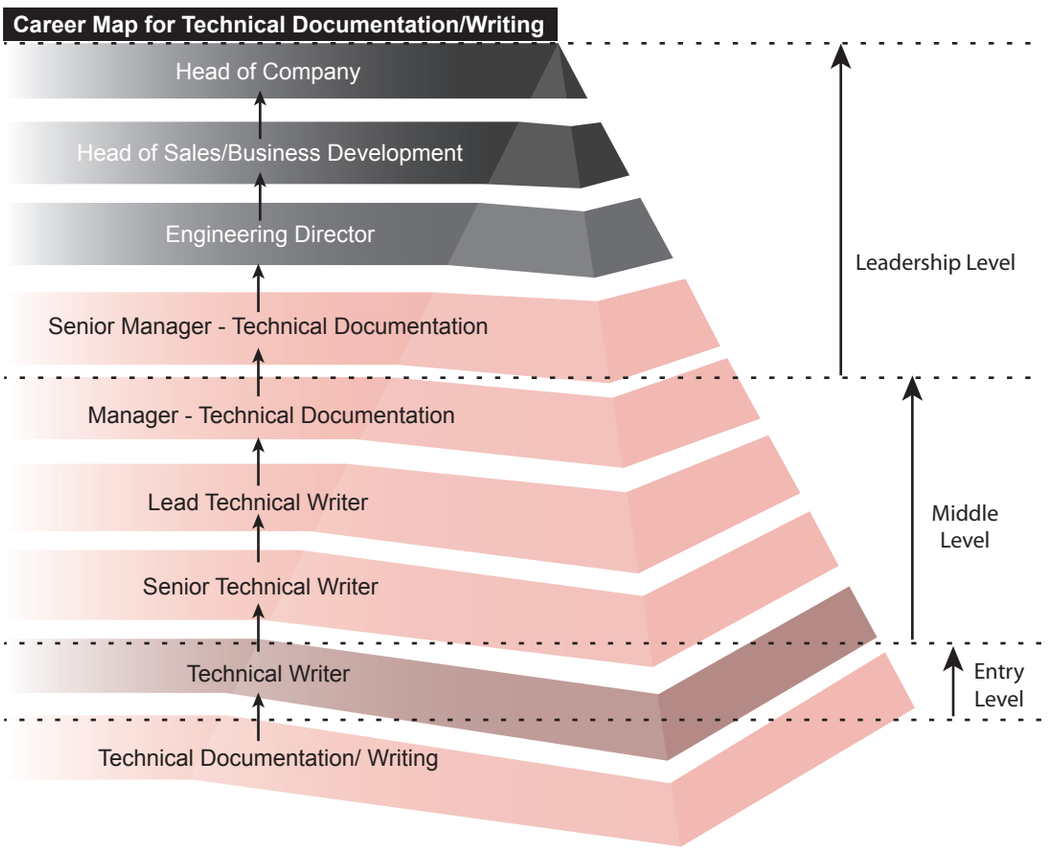
Technical Documentation/Writing - Typical Career Paths



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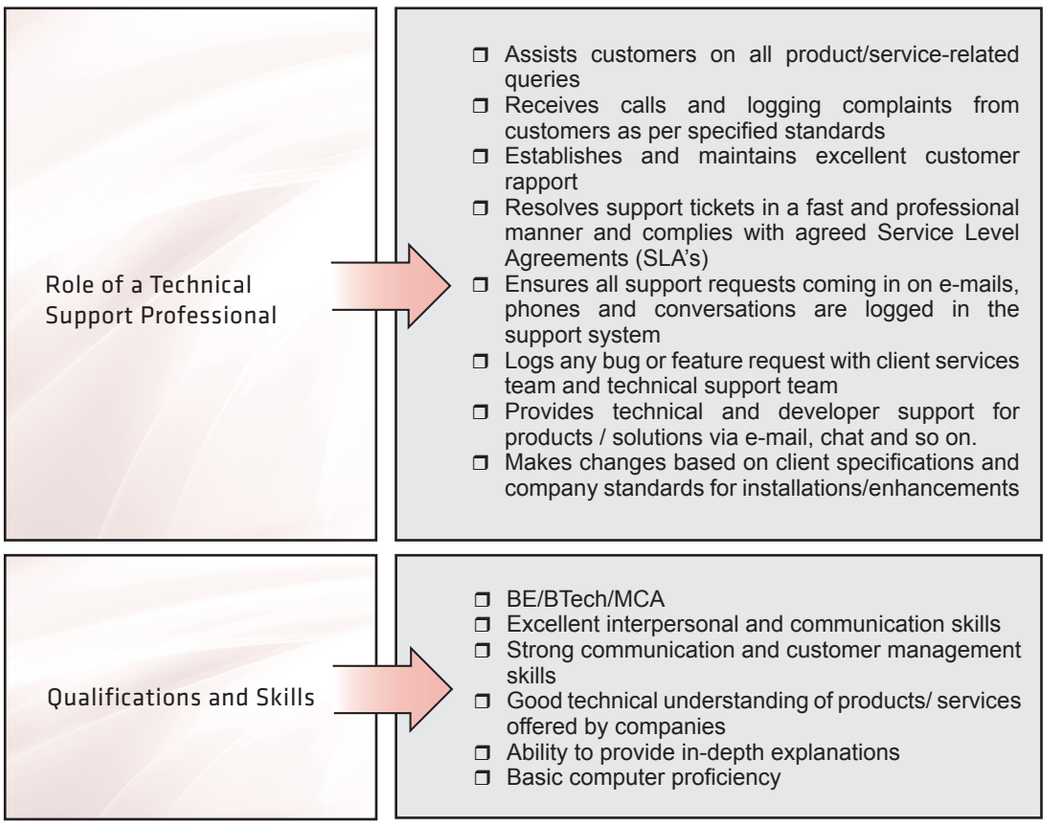
Technical Support

Technical Support involves responding to simple to complex customer queries related to product design, development or services. It ranges from responding to customer queries, diagnosing, and thereby resolving customer issues/ bug fixing, to also acting as a conduit between the customer and the company.

Professionals engaged in this occupation act as an interface between the customer and the teams that have designed/developed the products or have worked on the services project. They may also fix bugs and resolve basic queries or escalate them to the right team.



Technical Support - Occupational Map

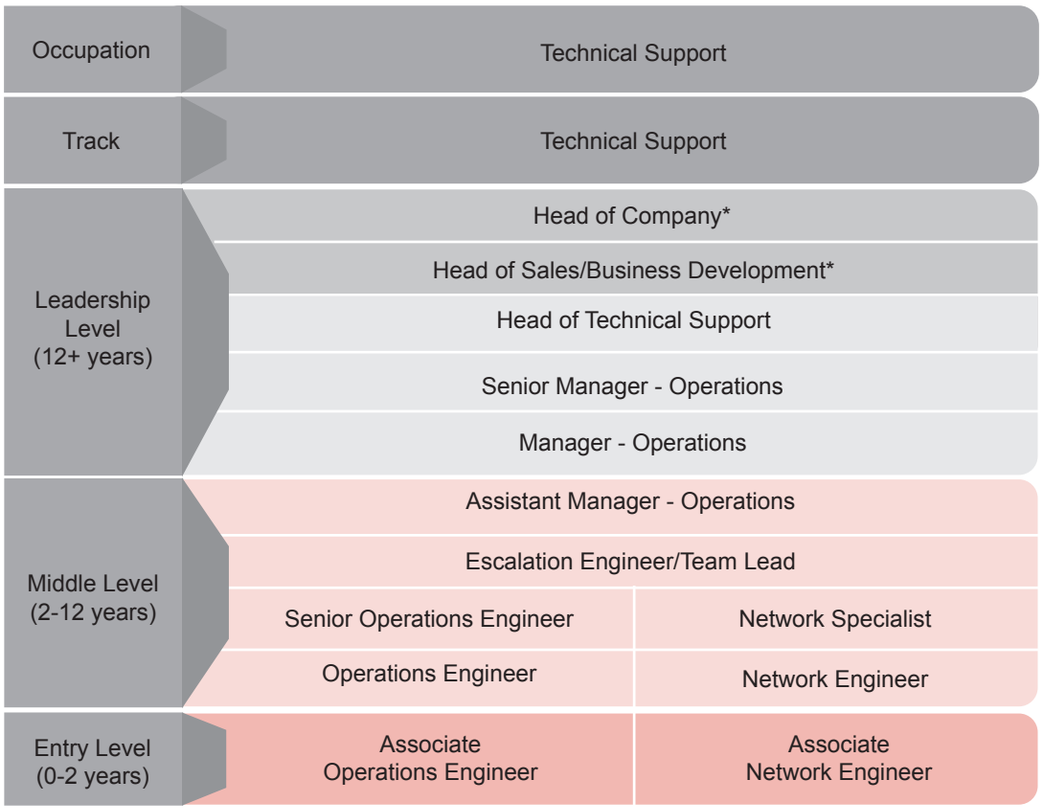


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Figure 55: Technical Support- Occupational Map

Technical Support - Typical Career Paths

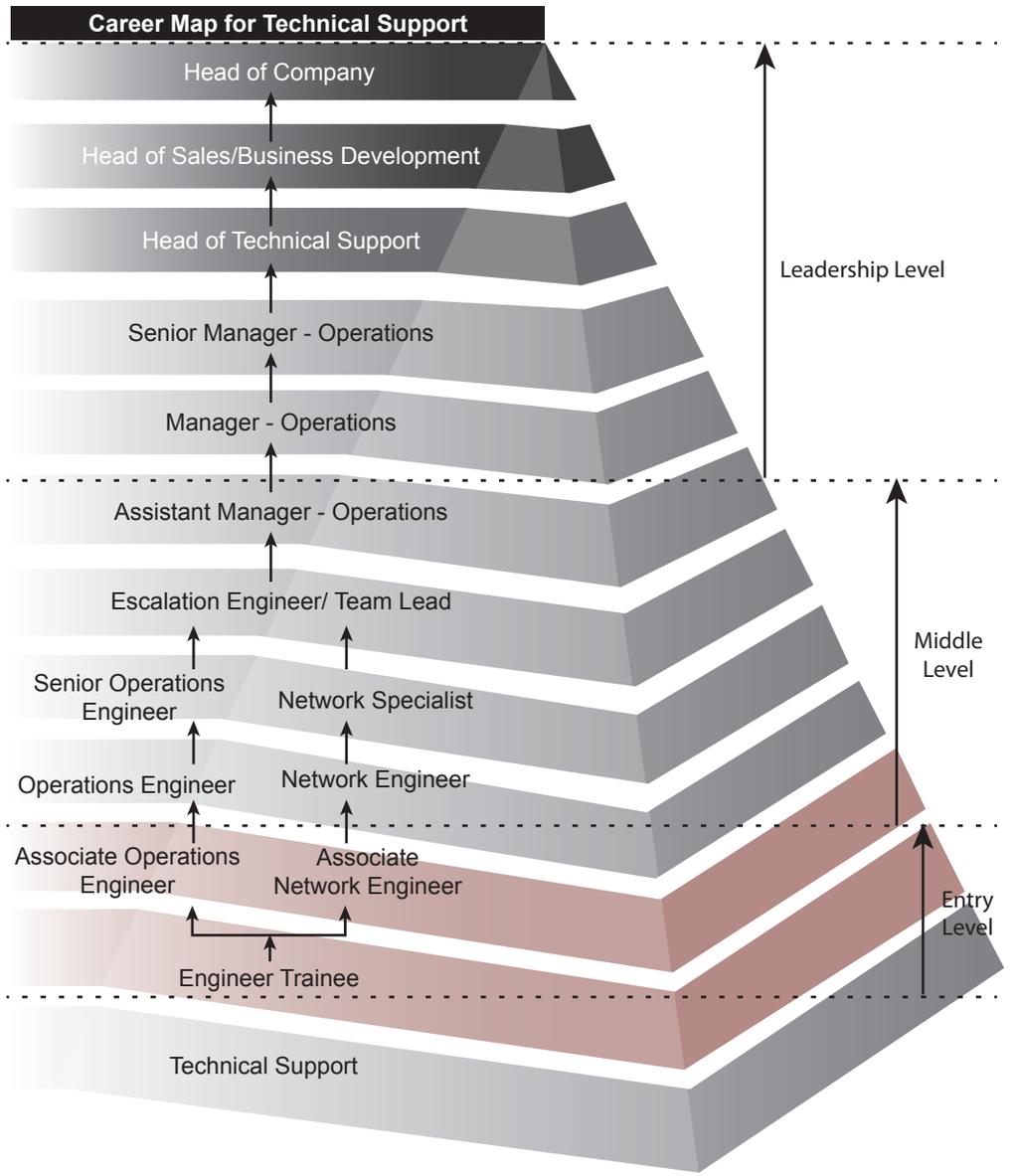

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Figure 56: Technical Support- Typical Career Paths

Movement to Other Occupations, Sub-sectors and Industries

Given the dynamic range of services that the ER&D sub-sector is increasingly offering to its clients across the industries, there are a variety of roles that employees are performing across the entire spectrum of offerings. As such, they become a valuable asset not only to the ER&D sub-sector, but also to all the ancillary industries they are associated with. For example, someone working with the design division of a company specialising in automobile ER&D will be a valuable asset to automotive industry organisations like Ford, Daimler, Mahindra, Tata Motors, Ashok Leyland and so on. Similarly, an employee with the software development occupation can move to specialised roles in software development in the aerospace, automotive or consumer electronics industry.

The horizontal career movements from one occupation to another occupation within the sub-sector, to another sub-sector or to another industry occurs typically at middle or leadership levels after a professional has acquired expertise in one particular occupation or more than one related occupations at the entry level.

However, having said that, since this is a highly specialised industry, most people prefer working within the sub-sector itself. The overall picture for the occupations in the sub-sector is captured in the subsequent table.

There is cross-hiring between industry and engineering services companies as people working in a particular domain develop deep domain/industry knowledge that makes lateral career movements possible
KNS Acharya, Infosys ER&D Services, Group Head

Movement to other Occupations, Sub-sectors and Industries

Occupation	Horizontal Movements		
	To other Occupations	To other sub-sectors	To other industries
Engineering Analysis	Product Manufacturing Support	-	Aerospace, Automobile, Electronics and Hardware
Hardware Development	-	-	Semi-conductor, Consumer Electronics, Telecom
Software Development	-	ITS, SPD	Semi-conductor, Consumer Electronics, Telecom, Automobile
Product Engineering Design	Product Lifecycle Management	-	Aerospace, Automobile, Heavy Machinery
Product Manufacturing Support	Product Lifecycle Management	-	Aerospace, Automobile, Electronics and Hardware, Construction
Product Marketing	-	SPD	Aerospace, Automobile, Telecom
Product Lifecycle Management	-	SPD	Aerospace, Automobile, Electronics and Hardware, Telecom
R&D	-	-	Aerospace, Automobile, Electronics and Hardware, Energy
Software Testing	-	ITS	-
Hardware Testing	-	-	Semi-conductor, Consumer Electronics, Telecom
Quality Assurance and Engineering	Testing	ITS, SPD	-
Technical Documentation /Writing	-	ITS, SPD	-
Technical Support	-	ITS, BPM	-

ANNEXURE

- Annexure A: Glossary of Terms and Abbreviations
- Annexure B : Case Studies of Career Paths

ANNEXURE

ANNEXURE

Annexure A: Glossary of Terms and Abbreviations

Keywords /Terms	Description
IT-ITeS	Information Technology - Information Technology enabled Services
BPM	Business Process Management
BPO	Business Process Outsourcing
KPO	Knowledge Process Outsourcing
LPO	Legal Process Outsourcing
IPO	Information Process Outsourcing
BCA	Bachelor of Computer Applications
BSc	Bachelor of Science
OS	Occupational Standard(s)
NOS	National Occupational Standard(s)
QP	Qualifications Pack
UGC	University Grants Commission
MHRD	Ministry of Human Resource Development
MoLE	Ministry of Labor and Employment
NVEQF	National Vocational Education Qualifications Framework
NVQF	National Vocational Qualifications Framework
BFSI	Banking Financial Services and Insurance
ITS	IT Services
NASSCOM	National Association of Software Services Companies
SSC	Sector Skills Council
BPM	Business Process Management
ER&D	Engineering and Research and Development
SPD	Software Products
CRM	Customer Relationship Management
IMS	Infrastructure Management Services
RIM	Remote Infrastructure Management
SCM	Supply Chain Management
HRO	Human Resources Outsourcing
IP	Intellectual Property
QA	Quality Assurance
F&A	Finance and Accounts
PLM	Product Lifecycle Management
BA	Bachelors in Arts
BCom	Bachelors in Commerce
BTech.	Bachelors in Technology
LLB	Bachelors in Law
MTech.	Masters in Technology
LLM	Masters in Law
UI	User Interface
CEO	Chief Executive Officer
VP	Vice President
AVP	Associate Vice President
SVP	Senior Vice President
GM	General Manager
TL	Team Leader

Annexure B: Case Studies of Career Paths

M. S. RAGHUNATHA
Engineer Manager
Infosys Technology

Entry to IT-BPM Industry

How did you start your professional journey? Which organization and at which designation?
After writing a written aptitude test, I received an offer from Infosys, which I accepted. After first four months of rigorous training in technical, domain, and soft skills, I was in to a project delivering Automotive Designs to a US based client. I spent 1.5Years in entry level. To be frank, I chose this organization due to its reputation.

Certifications/Trainings Undertaken

Did you add to your knowledge base by undertaking any certifications ?
Infosys' internal certifications and trainings have helped me in multiple occasions to quickly acquire the required technical and domain knowledge.

Career Movement and Growth

How have you moved through your chosen career over the years ?

My career grew at a decent pace in Infosys. After my initial 1.5years at entry level, I was sent to client location to lead a relatively low-end project. And the next years, as I continued to build my confidence and pick up more skills, knowledge, and expertise, I took up responsibilities of larger and more complex projects, as well as I started leading and mentoring my younger colleagues. Firsthand exposure at early stage of my career to the full life cycle of the designs I did (conceptualization, detailed design, realization and servicing) was the best thing that has ever happened to me. As I understood the different handlers and users of the product better, I was able to do design better.

Learning for people looking forward to enter the IT-BPM Industry

What were the key things that you learnt along the way ?

While specialization surely helps, one can never be an expert on something and relax if he/she is expecting growth in a service industry. Everything one learns at any point of time is foundation for something more, something bigger. Though in most cases it comes down to it, it isn't always the money. Trustworthiness, credibility, values, and loyalty go a long way.

Annexure B: Case Studies of Career Paths

VIKAS MODI
Senior Engineering Manager
Infosys Limited

Entry to IT-BPM Industry

How did you start your professional journey? Which organization and at which designation?
I graduated as a Mechanical Engineer in 1997 from NIT Kurukshetra and then joined Larsen & Toubro Limited (L&T), Mumbai as Engineer Trainee. I secured job at L&T as a campus placement from my engineering college. I was assigned to Electrical Business Group (EBG). As part of training, I got exposure to manufacturing, design, sales and marketing groups for 1 year before I was finally deployed as a Design Engineer in Tool design department at EBG.

Certifications/Trainings Undertaken

Did you add to your knowledge base by undertaking any certifications?
Diploma in Financial Management from Narsee Monje Institute of Management Studies, Mumbai (NMIMS).

Career Movement and Growth

How have you moved through your chosen career over the years ?

From September 1997 to May 2000 I was associated with Larsen & Toubro where I gained rich experience and knowledge in design of Press Tools. My exposure to different roles in manufacturing, design, sales and marketing during my training days also gave me lot of insight into the functioning of these departments, and the requirement of these roles. I joined Infosys Limited in June 2000 as Design Engineer , have grown in the organization to become Senior Engineering Manager, and I am still going strong with Infosys after 12+ years in the company. My performance coupled with guidance from my managers and internal training mechanisms at Infosys have helped me in scaling up the ladder from Design Engineer to Engineering Analyst to Engineering Lead to Engineering Manager to my current role as Senior Engineering manager.

Learning for people looking forward to enter the IT-BPM industry

What were the key things that you learnt along the way?

In-house behavioral programs at Infosys have helped me grow as an individual, and has enabled me in handling different situations, different individuals during the course of my journey at Infosys for past 12 years. In our industry, the average age is pretty low compared to the construction and manufacturing sector. This means that there are more of generation Y's we interact with, who are more technology focused, have a different view point on the ways.

Annexure B: Case Studies of Career Paths

AMIT UMARANI
Senior Project Manager
Infosys Limited

Entry to IT-BPM Industry

How did you start your professional journey? Which organization and at which designation?
I started my career with The Premier Automobiles Limited (PAL) (Machine Tools Division), Pune in September 2002 as a Graduate Trainee Engineer. My responsibilities included planning and execution of activities on Assembly Line, Testing of Machines, Customer Interaction and Machine Commissioning at customer site. I was part of PAL for duration of 5 months up to January 2003, but those 5 months were full of learning, and I got great exposure to manufacturing & assembly processes.

Certifications/Trainings Undertaken

Did you add to your knowledge base by undertaking any certifications ?
At Infosys, there are various certifications that are mandated at each role. These certifications have helped me in honing my skills at regular interval and are relevant to the kind of activities I am responsible for. The certifications range from technical to soft skills to project management.

Career Movement and Growth

How have you moved through your chosen career over the years ?

In the month of January 2003, I got a call from Infosys for an off-campus event held in Pune. In February 2003, I joined Infosys, Bangalore and underwent a 4 month rigorous training course in Mainframe technology.

After completing my training, I was placed in the Engineering Services unit of Infosys where I started off as a product design engineer.

My responsibilities included design to meet customer specifications, modeling, assembling and drawing creation of various seating components. Currently, I am playing the role of Senior Project Manager responsible for multiple projects across my department.

Learning for people looking forward to enter the IT-BPM Industry

What were the key things that you learnt along the way ?

The most important learning throughout has been flexibility and take on new challenges. Accepting new challenges, and moving across different roles and domains has given me the confidence that I can succeed in anything I venture into.

Annexure B: Case Studies of Career Paths

ISMAIL TP
Engineering Manager
Infosys Limited

Entry to IT-BPM Industry

How did you start your professional journey? Which organization and at which designation?
On completion of my Masters degree in Tool Engineering from NTTF – Bangalore, I joined Harita Infoserve Limited, which is a TVS group company in April 2001 as Post Graduate Engineer Trainee as campus recruit.

Certifications/Trainings Undertaken

Did you add to your knowledge base by undertaking any certifications?
One week training at Ashok Leyland training institute and certification on automotive systems.
Certification on GD &T (Geometric Dimensioning and Tolerance).

Career Movement and Growth

How have you moved through your chosen career over the years ?

At Harita Infoserve Limited, I was part of manufacturing engineering services (MES) group. As post graduate engineer trainee, I had worked on projects, which included activities as detailed engineering design of products from concepts, generation of product drawings with necessary GD&T, tool design and manufacture including its proving, fixture design and development etc. On joining Infosys as 'Senior Design Engineer' in May 2005, I was given the responsibility of managing a team, which supports the design of automotive seat to a major Tier-1 in North America.

Learning for people looking forward to enter the IT-BPM industry

What were the key things that you learnt along the way?

Always work with clear direction and target in mind, and review the same with leaders regularly.
Acquiring knowledge should never stop, when it stops then we will go outdated.
Never estimate a person with his appearance and our first perception.

Annexure B: Case Studies of Career Paths

SWAMINATHAN
Technical
Project Manager
Mindtree Limited

Entry to IT-BPM Industry

How did you start your professional journey? Which organization and at which designation?
My entry into IT profession happened in 2000, when I joined Yukthi Datasoft, a vendor for Aspect development, as a QA engineer. Looking at my performance, I was then hired by Aspect development as "Product Engineer". The roles involved visiting the vendors, and help them with implementing quality process and metrics to get "Right First Time" on the deliverables.

Certifications/Trainings Undertaken

Did you add to your knowledge base by undertaking any certifications?
Scrum, Project management certification from Mindtree.
Product management from Pragmatic marketing,
Executive program from IIMB on "Strategic analysis for Competitive advantage" etc.

Career Movement and Growth

How have you moved through your chosen career over the years?

In April 2001, I joined NextLinx and worked with core team in taking the company towards ISO 9001/2000 certification. I was trained and certified as Internal Quality Auditor (IQA) to help me perform the job better. In September 2004, I joined Mindtree ltd. as a Senior test engineer. Today after 8.5 years here, I have moved from the role of "Senior test engineer" to "Technical product manager". The key aspect in this growth has been the ability to always think beyond just the role demanded. There were cases where the confidence that my manager had in me worked wonders to bring out the best. I travel from ITPL to Global Village – 32 kms commute one way, while I could have easily found another job near to me. The work satisfaction that I get offsets everything else.

Learning for people looking forward to enter the IT-BPM Industry

What were the key things that you learnt along the way?

One important thing that I learnt was – to keep yourself open for any new challenges and opportunities. Adapt yourself to the situation and rise above. My entire journey has taught me that performance is the key to your growth, and no one can take away that from you. The other important aspect is to believe in yourself. If that's not there, growth will be stunted irrespective of the opportunities given.