DRAUP
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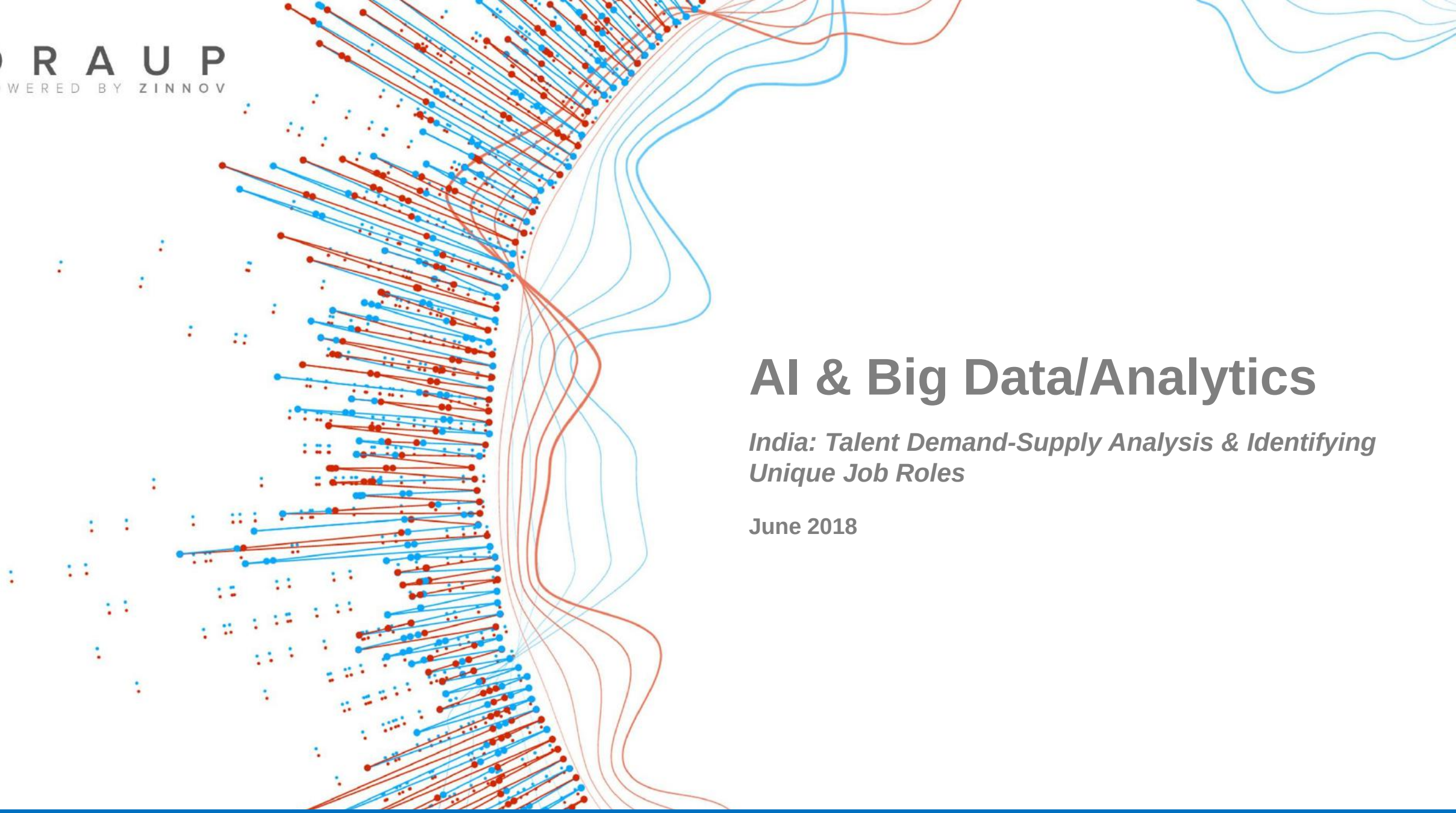


# AI & Big Data/Analytics

***India: Talent Demand-Supply Analysis & Identifying Unique Job Roles***

**June 2018**

# AGENDA

1

## KEY TRENDS

Trends and impact of AI and BD&A across Industries | Impact of Startups on AI and BD&A ecosystem

2

## DEMAND SUPPLY ANALYSIS

Methodology for estimating Demand and Supply | Global Demand for AI and BD&A | Supply for AI and BD&A talent from India

3

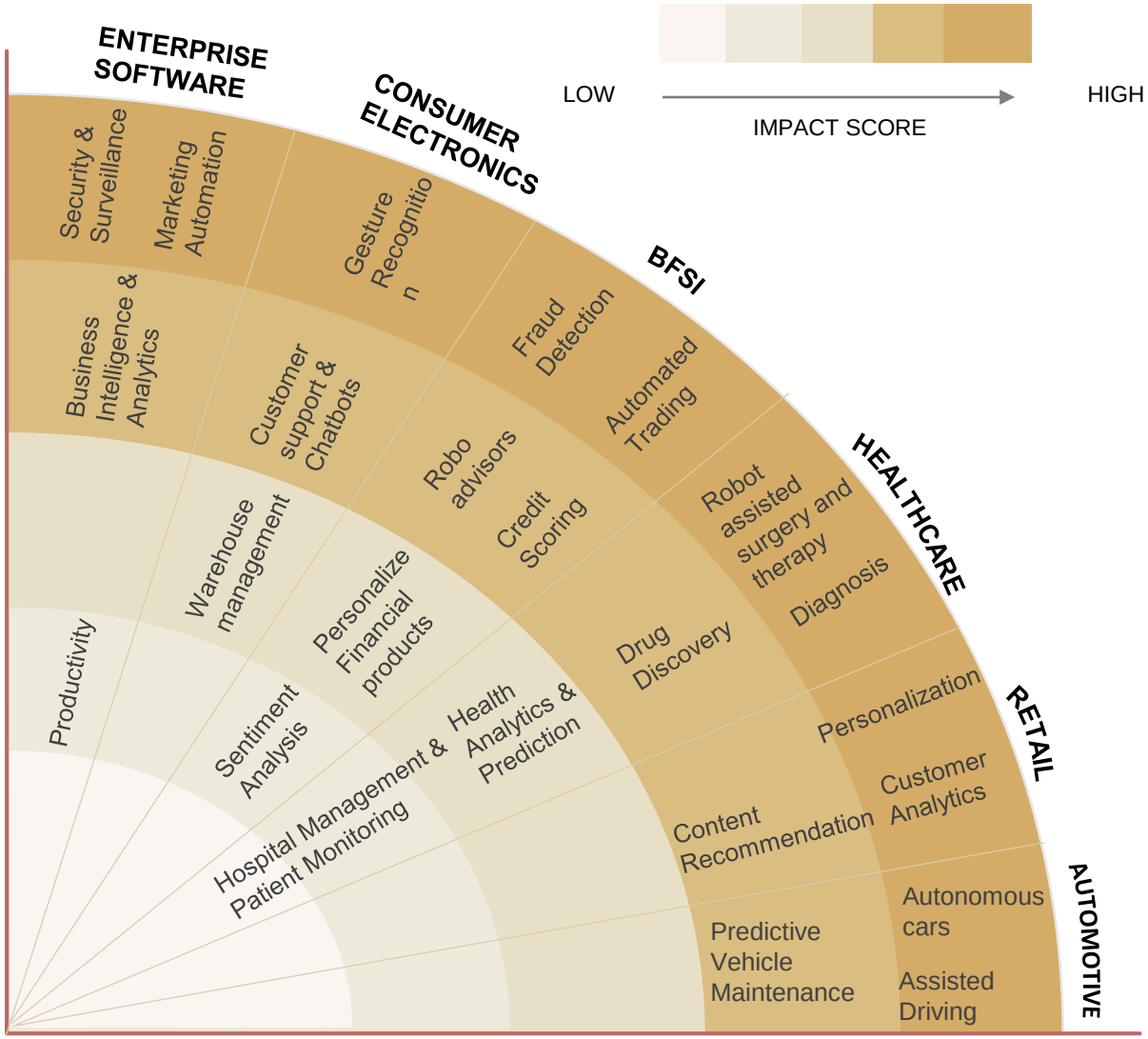
## UNIQUE JOB ROLES

Methodology to identify unique roles | List of Unique job roles along with a description & technical skills | Demand and Supply per job role

4

## APPENDIX

# AI & Big Data/Analytics (BDA) has the propensity to enable multiple use cases …



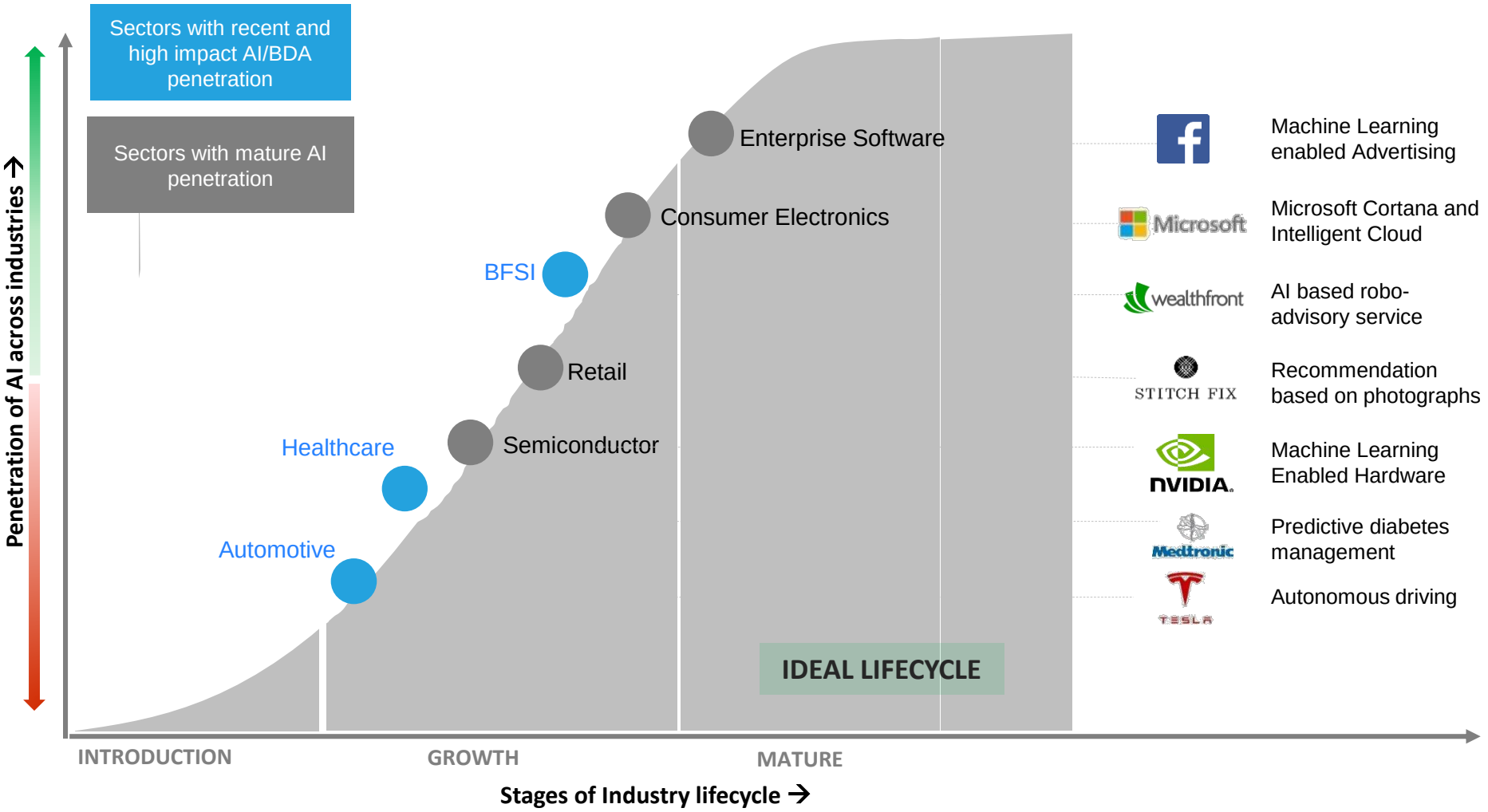

Research is spread across various industry value chains. Industries such as Enterprise Software, Consumer Electronics and Automotive are focusing more on R&D whereas Retail and BFSI industry verticals are focusing more on customer journey.

- The Healthcare market for AI is expanding at a 40% growth rate and expected to reach $6 Bn by 2020. Global Clinical Data Analytics In Healthcare market is expected to reach 14+ Billion USD by 2022 growing at a CAGR of +33% from 2017
- Software-driven approach for drug discovery has increased accuracy, decreased cost and made R&D timelines shorter.
- In BFSI, a large number of companies (Mastercard, Sift Science etc.) are exploring Fraud detection solutions leveraging AI & BDA.
- Automated Trading has become widespread. As a result a lot of companies are mushrooming to master the intricacies of stock trading

Note - *Impact score is the function of industry digital penetration, data access and availability for application of AI
Source : DRAUP Analysis as well as primary inputs from interviews with digital stakeholders and DRAUP's existing customers

# …and thus, has a high potential to penetrate across industries

## AI penetration in different industries




- Industries such as Enterprise Software and Consumer Electronics have adopted AI-aided technologies for some time and are focusing on implementing advanced deep learning based technologies
- The retail industry (both online and offline) has seen major AI innovations such as store foot print optimization, personal shopping assistant and personalization, omnichannel shopping.
- BFSI, Healthcare and Automotive industries are witnessing a massive increase in the number of AI applications due to greater digitization and access to data

Note : Y – Axis depicts Intensity of AI applications incorporated in different industries
Source : DRAUP Analysis as well as primary inputs from interviews with digital stakeholders and DRAUP's existing customers

# While G500 & Tech Giants dominate the Platforms and Infrastructure space, start-ups have a more significant presence in the Applications layer

## APPLICATIONS

### Enterprise Software
Microsoft Azure
Google for Work
salesforce

### Semiconductors
cerebras
GRAPHCORE

### Retail
InfiniteAnalytics
optoro

### BFSI
zest finance
wealthfront

### Consumer Electronics
anki
jibo

### Healthcare
ARTERYS
lumiata

### Automotive
CRUISE
MOBILEYE
ZOOX

## PLATFORMS

### MACHINE INTELLIGENCE
TensorFlow™

### NLP
amazon alexa
wit.ai
IBM

### COMPUTER VISION
EMOTIENT

### DEEP LEARNING
Google DeepMind
Baidu 百度

### ADAS
TESLA
Google Self-Driving Car Project

### GESTURE CONTROL
Microsoft Cognitive Services
Nintendo

## INFRASTRUCTURE

### Hardware
NVIDIA
intel

### Data Platforms
TRIFACTA
amazon web services
tamr
ORACLE
vmware

Intensity

**Applications – The Start-up Zone**

**Platforms – Tech Giants' Playground**

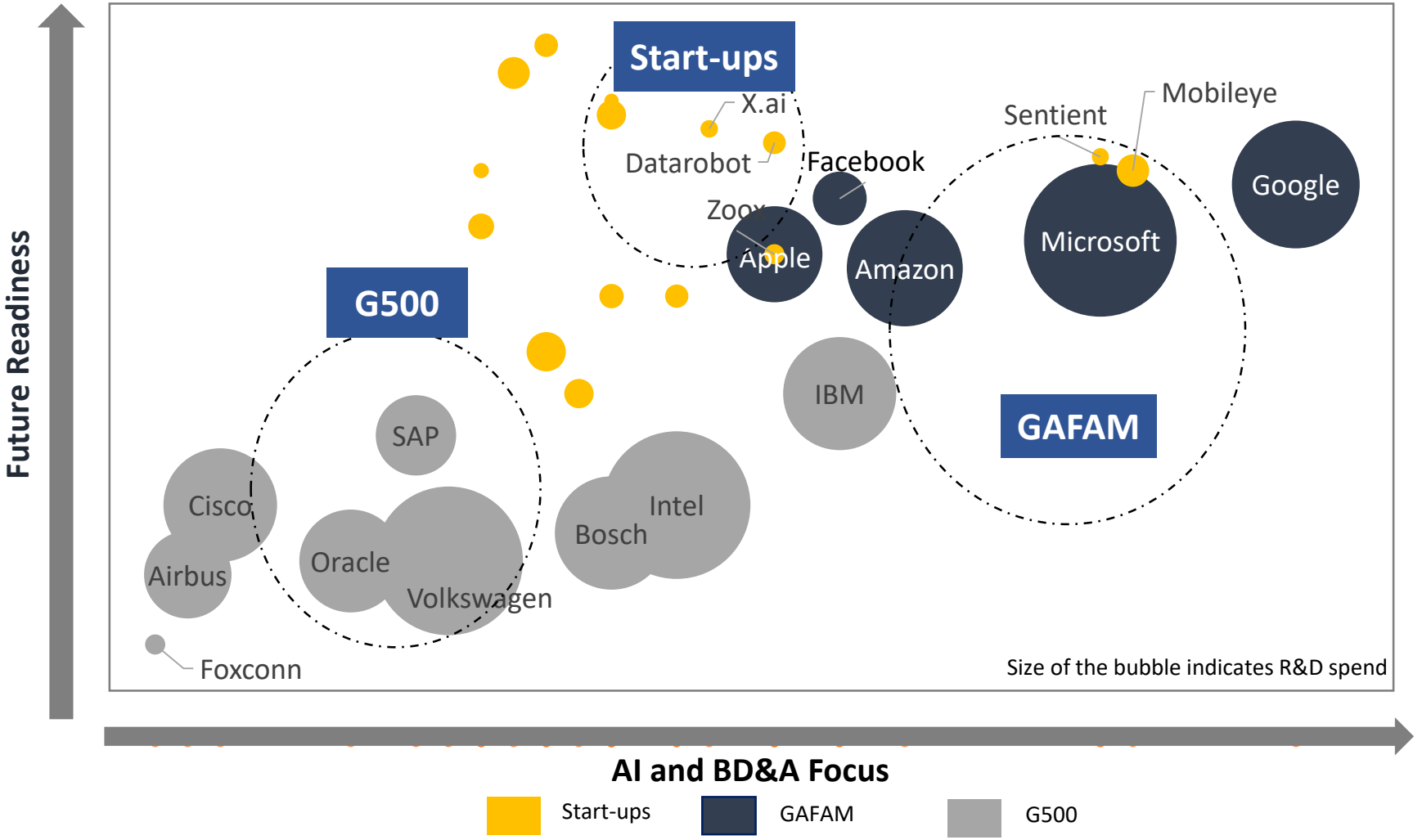
**Infrastructure – G500 Domination**

Start-ups | GAFAM | G500

*G500 Companies - Top 500 R&D spenders

GAFAM – Google, Amazon, Facebook, Apple, Microsoft

# GAFAM and leading start-ups have a significant lead over other top R&D spenders




Leveraging ML for network threat products – Cognitive Threat Analytics

To release Xeon Phi processor line for AI applications-~$400M investments

Invested $5B in building an AI powered Gigafactory.

$1B investment to establish the Toyota Research Institute for AI

$500M investment in a 200 member AI R&D lab in Sillicon Valley

1 : Investment in terms of Talent & Acquisition or Funding raised (for start-up)
2 : Focus on Emerging vs. Traditional Technologies. Focus on Ecosystem creation and Platform adoption/maturity

# Global Service Providers have a large talent share of Big Data Analytics talent and have accelerated investments in building AI platforms / solutions

| | TCS | Wipro | Infosys | HCL |
|---|---|---|---|---|
| | ignio | WIPRO HOLMES ARTIFICIAL INTELLIGENCE PLATFORM | Infosys Mana | DRYiCE by HCL Technologies |
| KEY FOCUS AREAS | • Reposition to serve 'Heart of Business'<br>• Technology / AI Advantage | • Broad based (BPM Focus) | • Broad based (including engineering, ADM & BPM) | • Broad based (Infrastructure services) |
| DEPLOYMENT & PLATFORM OVERVIEW | • Plug and play deployment requiring customization and learning<br>• Stand alone platform for core infrastructure services | • Plug and play deployment requiring customization and learning<br>• Stand alone platform offering a menu of multiple cognitive services | • Bespoke deployment<br>• AI capabilities bolt-on to existing automation architecture (IIP, IKP, IAP framework) | • Bespoke deployment<br>• AI modules bolt-on to existing automation platform; collaboration with Watson, S-Now, Dynatrace, Splunk |
| STATED DOMINANT USE CASES | • End to end infra services such as<br>  • Infra blueprint<br>  • Self healing<br>  • Deployment<br>  • Predictive maintenance | • Digital Virtual Assistants<br>• Prediction systems<br>• Robotics & Drones | • Engineering (aircraft floor beam development)<br>• Forecasting as a service | • Detect and correct Infra and App issues<br>• Watson power chat agent |

Note: Above analysis is based on the DRAUP's proprietary engineering services deals database

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# Methodology for estimating the Demand for AI and Big Data/Analytics talent

## 1 Employed Talent

*Employed talent with AI and Big Data/Analytics skills*

| Step-1 | Step-2 | Step-3 |
|---|---|---|
| Identifying skills associated with AI and Big Data/Analytics | Estimating talent installed across companies | Tagging talent with company size, industry, location |

## 2 Open Positions Analysis

*Open Job roles across AI and Big Data Analytics*

| Step-1 | Step-2 | Step-3 |
|---|---|---|
| Identifying unique job roles across AI and Big Data/Analytics | Mining open positions in AI/BD&A from Job portals and skilling platforms for all companies leveraging DRAUP | Mapping open positions across geographies, company sizes, Industries |

---

### Global analysis includes

G500 companies

Service providers

Start-ups

### India analysis includes

Global Capability Centers (GCCs)

Service providers

Start-ups

Sources - Job portals/ platforms include LinkedIn, Naukri, Monster, Indeed, Kaggle & Hackerearth
Note - There are 3 size groups: Small (1-200 employees), Mid (201-1,000 employees) and Large (>1,000 employees)

# The demand for AI and Big Data/Analytics talent across G500 companies, Startups and Service providers is estimated to be ~1.2M

| | Y 2018 |
|---|---|
| **Global Demand** | **~1.2 M** |
| 1 Total Employed AI & BD/A talent pool | ~650,000 |
| G500 companies – Installed Talent | ~265,000 |
| Global Start-Ups – Installed Talent | ~270,000 |
| Service Providers | ~120,000 |
| 2 Unmet AI & BD/A talent demand in 2018 – Job Openings | ~515,000 |

| | Y 2018 | Y 2021 |
|---|---|---|
| **India Demand** | **~224k** | **~390k** |
| 1 Total Employed AI & BD/A talent pool | ~152,000 | ~250,000 |
| GCC companies – Installed Talent | ~52,000 | ~90,000 |
| Start-Ups – Installed Talent | ~18,000 | ~40,000 |
| Service Providers | ~82,000 | ~120,000 |
| 2 Unmet AI & BD/A talent demand in 2018 – Job Openings | ~72,000 | ~142,000 |

*G500 Companies - Top 500 R&D spenders. Note: All values are approximated

# In India, Bangalore has a significant lead over other cities in availability of AI and BD&A talent

## NCR — 15,300

| Skills | GCCs | IT SP | Start-up | Total |
|---|---|---|---|---|
| Big Data/ Analytics | 5850 | 3450 | 3900 | 13,100 |
| AI | 1520 | 470 | 140 | 2,200 |

## Mumbai — 11,500

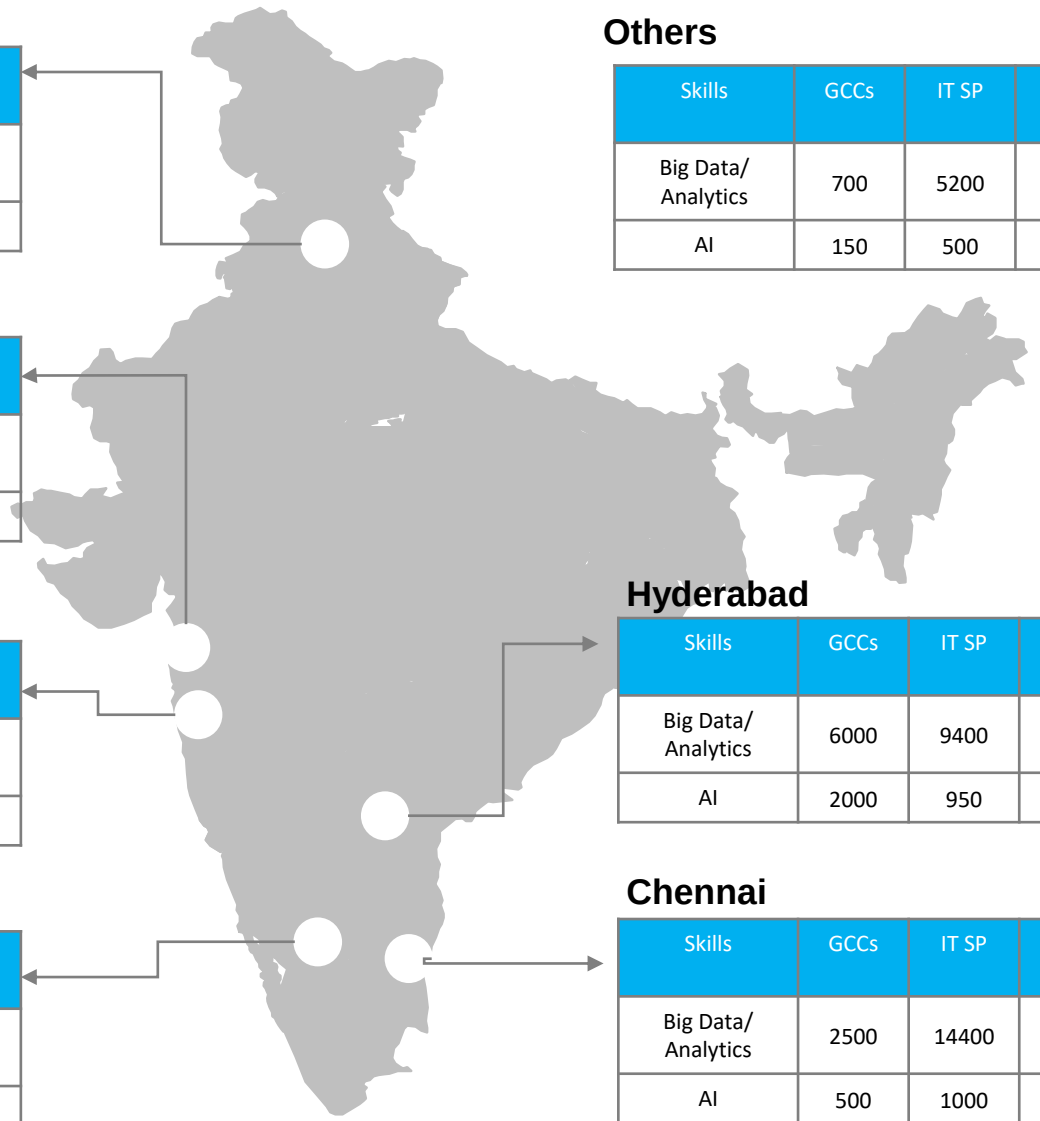
| Skills | GCCs | IT SP | Start-up | Total |
|---|---|---|---|---|
| Big Data/ Analytics | 2600 | 5350 | 2400 | 10,500 |
| AI | 350 | 600 | 100 | 1,000 |

## Pune — 15,800

| Skills | GCCs | IT SP | Start-up | Total |
|---|---|---|---|---|
| Big Data/ Analytics | 4200 | 9100 | 500 | 13,800 |
| AI | 900 | 1050 | 50 | 2,000 |

## Bangalore — 61,100

| Skills | GCCs | IT SP | Start-up | Total |
|---|---|---|---|---|
| Big Data/ Analytics | 18930 | 26493 | 4800 | 51,000 |
| AI | 5800 | 3041 | 1100 | 10.100 |



## Others — 8,300

| Skills | GCCs | IT SP | Start-up | Total |
|---|---|---|---|---|
| Big Data/ Analytics | 700 | 5200 | 1700 | 7,600 |
| AI | 150 | 500 | 50 | 700 |

## Hyderabad — 20,500

| Skills | GCCs | IT SP | Start-up | Total |
|---|---|---|---|---|
| Big Data/ Analytics | 6000 | 9400 | 2000 | 17,400 |
| AI | 2000 | 950 | 150 | 3,100 |

## Chennai — 19,500

| Skills | GCCs | IT SP | Start-up | Total |
|---|---|---|---|---|
| Big Data/ Analytics | 2500 | 14400 | 900 | 17,800 |
| AI | 500 | 1000 | 100 | 1,700 |

## INDIA EMPLOYED TALENT

**~152,000 → ~250,000**

2018 — 2021

CAGR: **18%**

- India features amongst the top locations for AI and BD&A globally alongside US and China.
- The talent available in the US will be expensive to meet the future demand for emerging skillsets. Organizations are hence reacting by globalizing their talent pool and engaging with local eco-systems.

### Top Employers

IBM, Cisco, Adobe, amazon, ORACLE, Microsoft, SAMSUNG, TATA, wipro, Cognizant, Mindtree, HCL, Infosys, accenture

Note : DRAUP Talent module Analysis
All Values are approximated

# India has the second largest unmet demand for AI and Big Data/Analytics, driven primarily by large service providers, GCCs and the start-up ecosystem

**NCR** 9,800

| Skills | Talent |
|---|---|
| Big Data/ Analytics | 7,900 |
| AI | 1,900 |

**Mumbai** 10,400

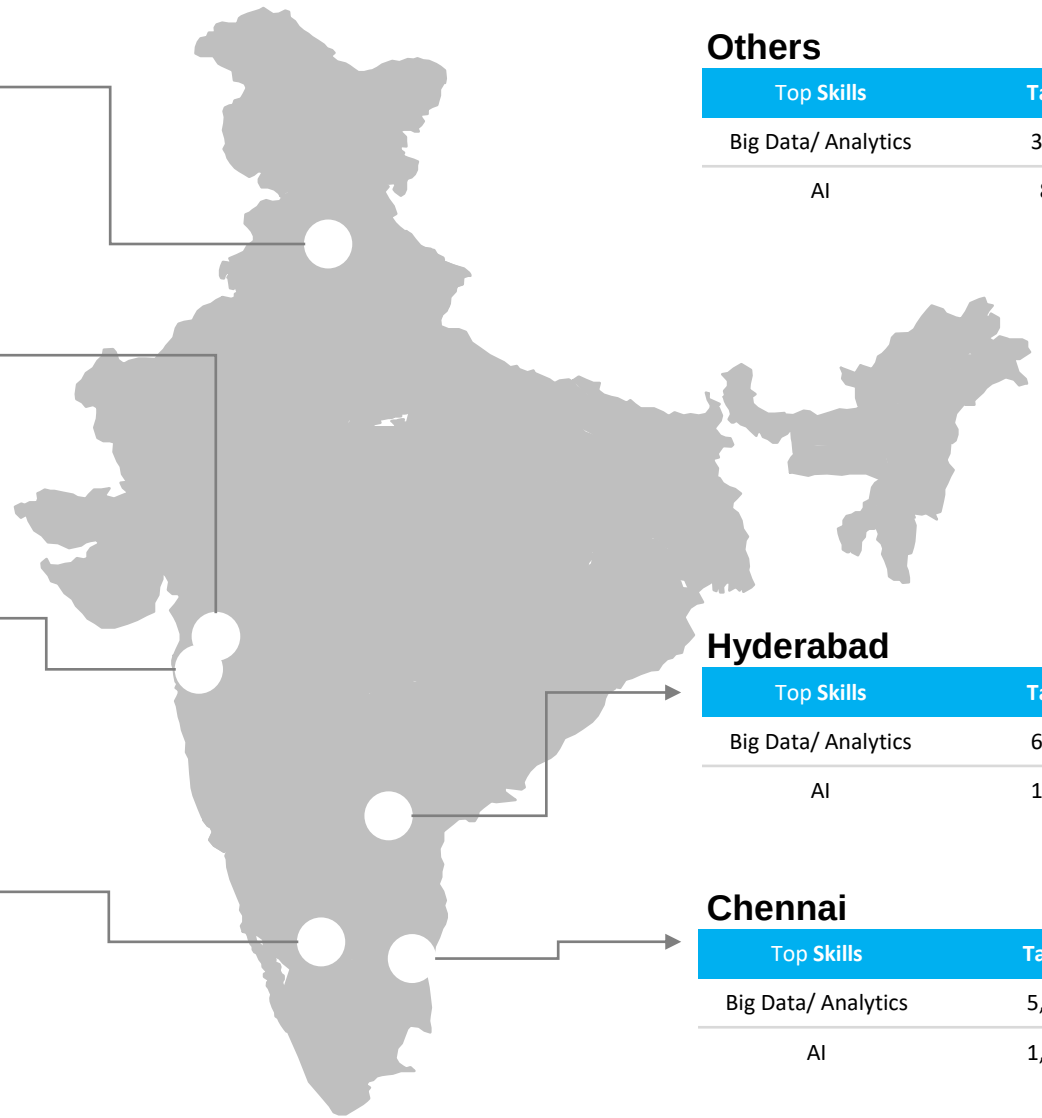
| Top Skills | Talent |
|---|---|
| Big Data/ Analytics | 8,300 |
| AI | 2,100 |

**Pune** 7,000

| Top Skills | Talent |
|---|---|
| Big Data/ Analytics | 5,800 |
| AI | 1,200 |

**Bangalore** 26,500

| Top Skills | Talent |
|---|---|
| Big Data/ Analytics | 19,100 |
| AI | 7.400 |



**Others** 4,000

| Top Skills | Talent |
|---|---|
| Big Data/ Analytics | 3,200 |
| AI | 800 |

**Hyderabad** 8,100

| Top Skills | Talent |
|---|---|
| Big Data/ Analytics | 6,300 |
| AI | 1,800 |

**Chennai** 6,400

| Top Skills | Talent |
|---|---|
| Big Data/ Analytics | 5,200 |
| AI | 1,200 |

## INDIA UN-MET DEMAND

~72,000 → ~142,000

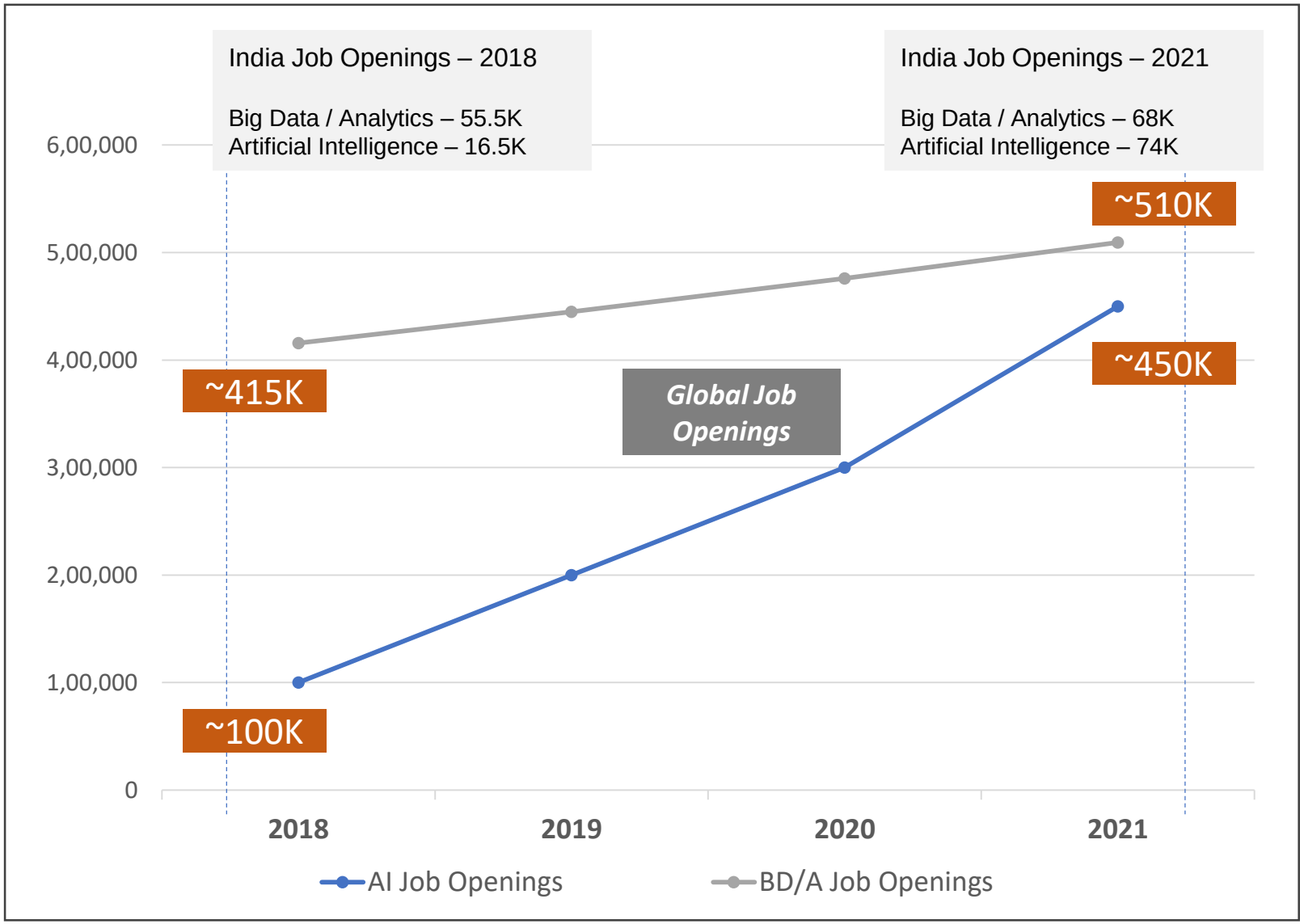
2018 2021

CAGR: **25%**

- Unmet demand for BD&A roles in India stands at ~55K, primarily coming from Indian service providers
- Demand for AI in India has increased over the past few years, driven primarily by Startups and Platform development by Service Providers
- Many MNC are also planning to establish AI/Big Data/Analytics COEs in India

Note : DRAUP Talent module Analysis
All Values are approximated

# About 1 Million jobs are expected to be created in AI and Big Data/Analytics roles in 2021




- Globally, Job Creation for AI and Big Data Analytics roles will reach 960K in 2021 with an average CAGR of 23%
- India is expected to grow at a faster rate (~25%) compared to the rest of the world
- The Job Creation for Big Data/Analytics roles will grow at a much lower rate (~7%) compared with AI over the next 3 years

Note : DRAUP Talent module Analysis

# Methodology for estimating the Supply for AI and Big Data/Analytics talent in India

## 1 Employed Talent

*Employed talent with AI and Big Data/Analytics skills*

| Step-1 | Step-2 | Step-3 |
|---|---|---|
| Identifying skills associated with AI and Big Data/Analytics | Estimating talent installed across companies | Tagging talent with company size, industry, location |

**Analysed Companies**
**GCCs**
**Indian Startups**
**Service Providers**

## 2 Fresh Graduate Analysis

*Estimating fresh graduates from Indian universities employable in AI and Big Data/Analytics*

| Step-1 | Step-2 | Step-3 |
|---|---|---|
| Classifying universities across tiers and mapping enrolments data | Identification of relevancy of streams and levels for AI and BD&A roles | Estimating the employability ratios and validating them with SMEs |

**Analysis done for 40K Universities**

## 3 Adjacent Skills

*Estimating talent employed across companies in India which can be upskilled*

| Step-1 | Step-2 | Step-3 |
|---|---|---|
| Identifying neighbourhood skills for AI/BD&A, validate them with SMEs | Mapping talent mined from job portals/ upskilling portals with these skills | Estimating the coverage and validating to finalize the talent number |

**Analysed Companies**
**GCCs**
**Indian Startups**
**Service Providers**

Sources: University Database: All India Survey of Higher Education (http://aishe.nic.in)
National Institute Ranking Framework developed by Ministry of Human Resource Development (https://www.nirfindia.org/)

# Employable talent for AI and Big Data/Analytics present in India is estimated to be around ~485K

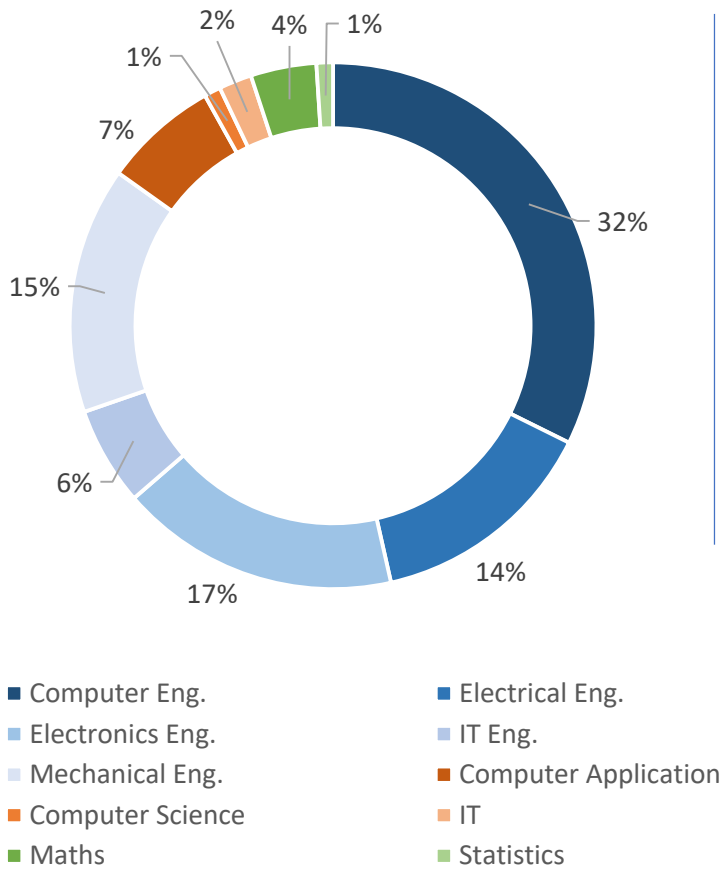
| | | | Supply in 2021 | CAGR |
|---|---|---|---|---|
| **Indian Talent Supply in 2018** | **~185K** | **Talent Supply for AI and Big Data/Analytics from India in 2018** | **~ 285 k** | **13%** |
| 1 **Fresh Graduates from Universities** | **~33K** | **Talent supply graduating from Indian Universities** | **~ 35 k** | **1.5%** |
| 2 **Installed Talent In India** | **~152K** | **Talent supply skilled in AI and Big Data/Analytics** | **~ 250 k** | **18%** |
| **Indian Startups** | **~19K** | **Installed Talent in Indian Startups** | ~ 40 k | 30% |
| **GCCs** | **~52K** | **Installed Talent in GCCs in India** | ~ 90 k | 20% |
| **Service Providers** | **~81K** | **Installed Talent in ITeS Service Providers (SPs)** | ~ 120 k | 13.5% |
| 3 **Adjacent Talent Pool Supply** | **~300K** | **Talent that can be upskilled to work on AI and Big Data Analytics** | **~ 420 k** | **12%** |

Note: While adjacent talent pool is ~300K, they need to be trained in AI & BDA to satisfy the demand; All Values mentioned are approximated

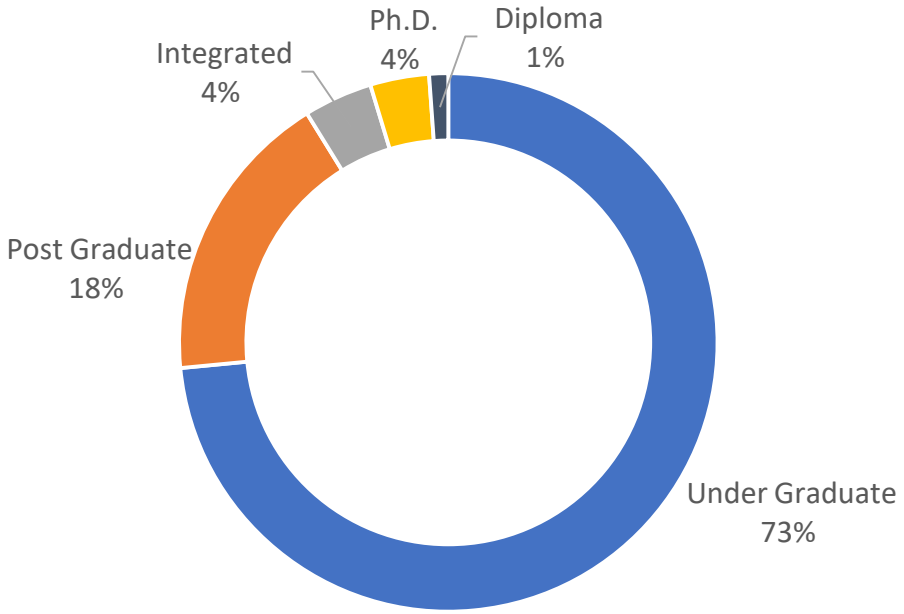
# University Graduates: India produces about ~33K employable fresh university talent annually

Total Employable University Talent: 33,100

## By Education Streams




## By Education Level




- About 84% of the total employable talent pool is graduating with B.E and B.Tech. degrees.
- About 48% of the employable talent pool are graduating with computer science and IT majors
- Under-graduate students constitute 73% of the total employable talent
- Post-graduate students constitute 18% of the employable talent for AI & Big Data/Analytics
- Ph.D enrolment is expected to grow at 7% for the next 3 years; UG & PG is expected to grow slower at 1% for the next three years
- Density of employable talent in tier 1 is the highest
- Number of employable students in tier 2 and tier 3 university are the same since tier 3 universities witness a much higher enrolment

Note : DRAUP Talent module Analysis

# University Graduates: Tamil Nadu, NCR, Karnataka, Andhra Pradesh and Uttar Pradesh are the top 5 hubs for fresh university graduates with AI & Big Data / Analytics skills

**Delhi NCR (3,350)**

| Streams | Talent % |
|---|---|
| Engg. – CS / IT | 47% |
| Engg. – Others | 38% |
| IT & Computer | 10% |
| Science | 5% |

| Levels | Talent % |
|---|---|
| UG | 70% |
| PG | 18% |
| Integrated / Ph.D | 12% |

**Andhra Pradesh (1,650)**

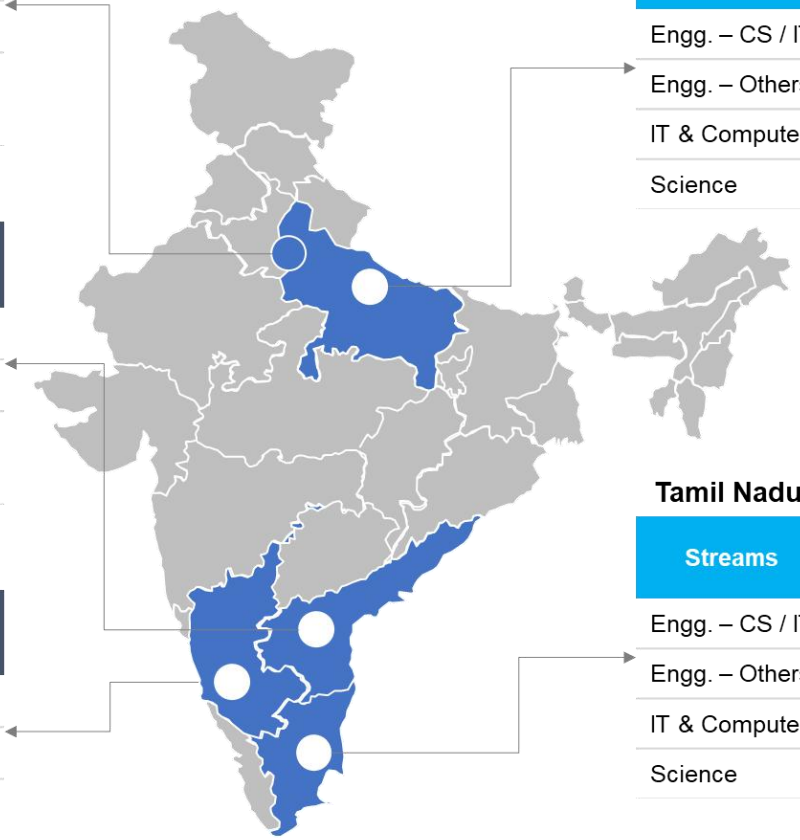
| Streams | Talent % |
|---|---|
| Engg. – CS / IT | 46% |
| Engg. – Others | 47% |
| IT & Computer | 5% |
| Science | 2% |

| Levels | Talent % |
|---|---|
| UG | 86% |
| PG | 13% |
| Integrated / Ph.D | 1% |

**Karnataka (2,360)**

| Streams | Talent % |
|---|---|
| Engg. – CS / IT | 39% |
| Engg. – Others | 43% |
| IT & Computer | 1% |
| Science | 17% |

| Levels | Talent % |
|---|---|
| UG | 62% |
| PG | 32% |
| Integrated / Ph.D | 6% |



**Uttar Pradesh (1,520)**

| Streams | Talent % |
|---|---|
| Engg. – CS / IT | 33% |
| Engg. – Others | 48% |
| IT & Computer | 7% |
| Science | 12% |

| Levels | Talent % |
|---|---|
| UG | 61% |
| PG | 25% |
| Integrated / Ph.D | 14% |

**Tamil Nadu (8,010)**

| Streams | Talent % |
|---|---|
| Engg. – CS / IT | 47% |
| Engg. – Others | 44% |
| IT & Computer | 9% |
| Science | 1% |

| Levels | Talent % |
|---|---|
| UG | 83% |
| PG | 11% |
| Integrated / Ph.D | 6% |

- The top 5 states (Tamil Nadu, Delhi NCR, Karnataka, Andhra Pradesh and Uttar Pradesh) constitute ~62% of the total employable talent graduating from top 100 universities
- The Maturity of talent is higher across Uttar Pradesh (39%) and Karnataka (38%), owing to a higher number of PG/PHD/Integrated talent
- While Tamil Nadu produces the maximum number of employable talent, the maturity is comparatively low owing to a very high percentage (83%) of undergraduate talent.
- Uttar Pradesh and Karnataka have a higher percentage of employable talent graduating with Mathematics and Statistics degrees

Note: Top 100 universities across India considered for analysis

# Installed Talent: Bangalore, Hyderabad and Chennai have the highest number of installed talent pool across GCCs, IT Service Providers & Start-ups

## GCCs

- Total AI & Big Data / Analytics talent within GCC firms in India is about 52,300. *Big Data / Analytics HC*: 40,970 | *AI HC*: 11,330
- Over 45% of the AI & Big Data/Analytics talent across GCCs is located in Bangalore.
- NCR and Hyderabad are the next top locations, each employing 15% of the total AI & Big Data/Analytics talent pool.

## IT Service Providers

- Total AI & Big Data / Analytics talent within IT service providers in India is about 81,650. *Big Data / Analytics HC*: 73,930 | *AI HC*: 7,720
- After Bangalore, Chennai is the 2nd biggest hub for Big Data & Analytics for SPs.

## Start-ups

- Total AI & Big Data / Analytics talent within IT service providers in India is about 18,190. *Big Data / Analytics HC*: 16,470 | *AI HC*: 1,720
- India constitutes about 10% of the global Big Data / Analytics talent and ~ 4% of the global AI talent
- Within India, Bangalore commands about 75% of the Indian AI talent working across Start-ups, followed by Mumbai at 15%
- Among the start-ups, Big Data/Analytics talent is more widely dispersed as it is a relatively mature skill compared to AI.

Note : DRAUP Engineering module and Start-up module analysis

# India has a pool of ~300K engineers that can be upskilled to become AI and Big Data/Analytics professionals

IT Service providers and GCCs have built digital capabilities that require talent adept with software development, databases and analytics skills. Such talent has the required complementary skills and could be trained for AI & Big Data/Analytics requirements

## IT Service Providers

**~170,000 to ~190,000**
**Trainable Employees**

**(Total Headcount in India: 1.5 million)**

**Top Employers**

TATA CONSULTANCY SERVICES, wipro, Cognizant, Mindtree (Welcome to possible), HCL, Infosys, accenture (High performance. Delivered.)

## GCCs

**~110,000 to ~130,000**
**Trainable Employees**

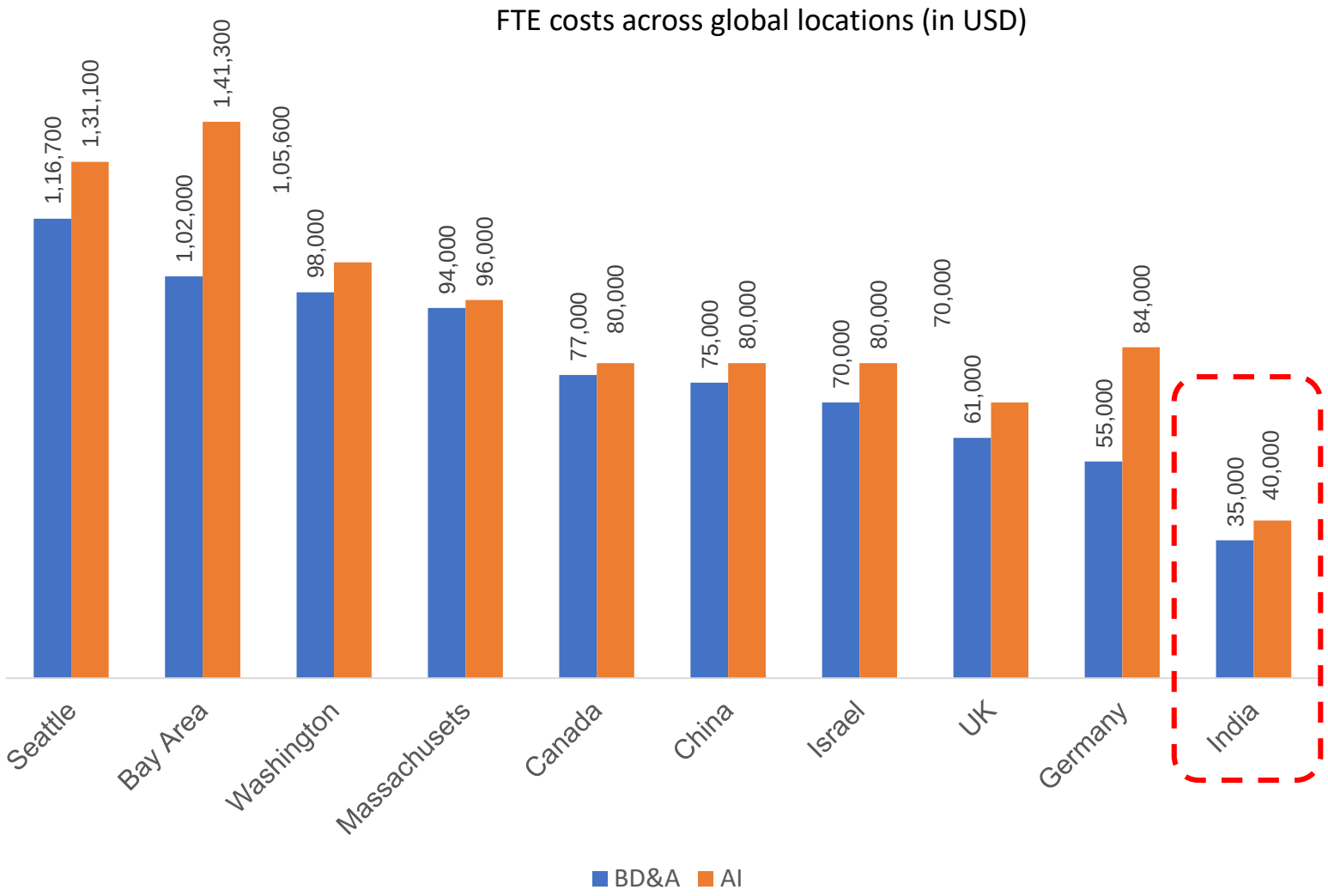
**(Total Headcount in India: 810,000)**

**Top Employers**

IBM, CISCO, Adobe, amazon, ORACLE, Microsoft, SAMSUNG

Note : DRAUP Engineering module

# With FTE cost for AI & Big Data / Analytics talent less than half of the FTE cost across global hubs, India has huge potential to supply to the growing global demand



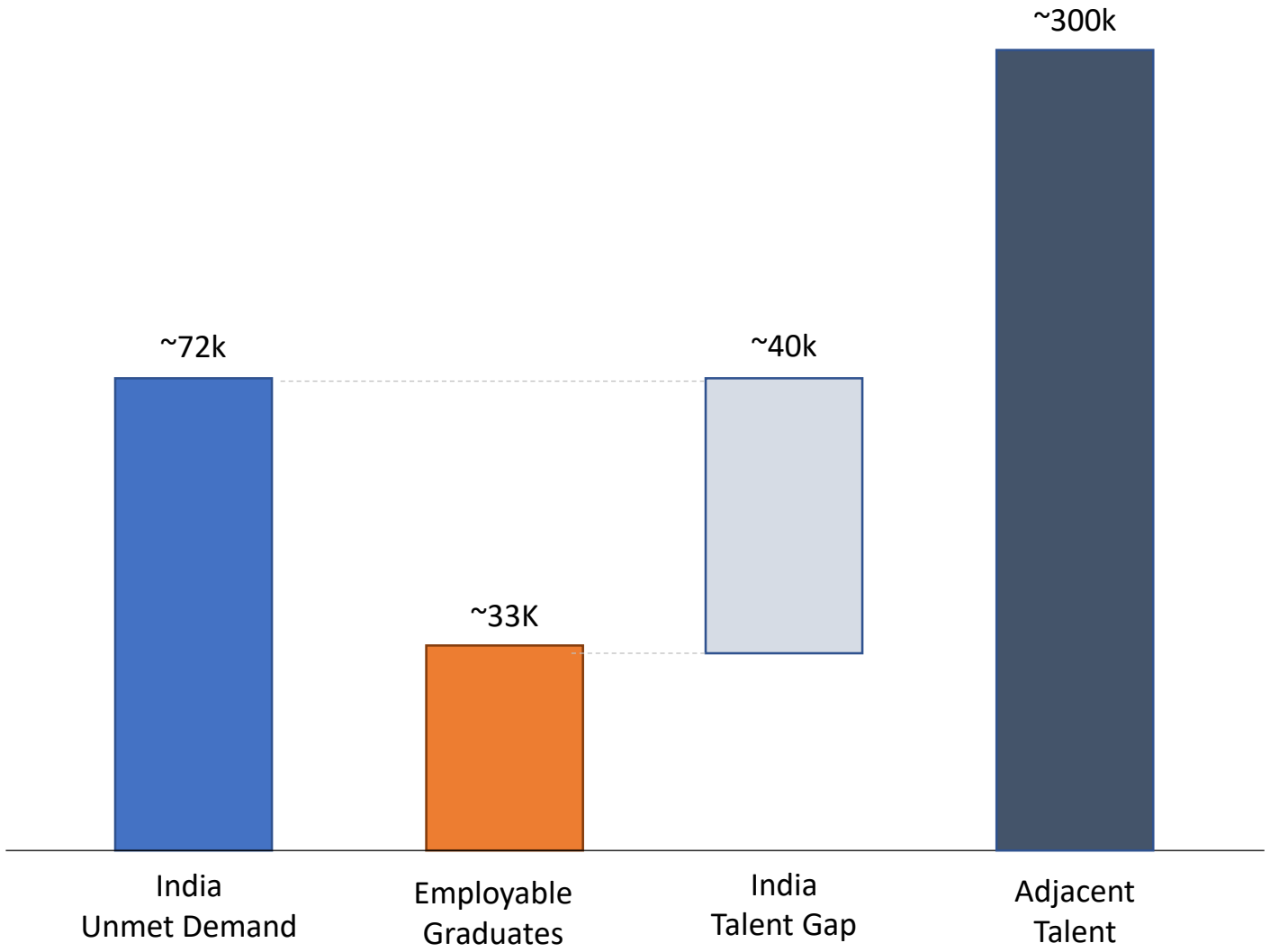

**Key Insights**

The average FTE for talent (AI & Big Data / Analytics) in the Silicon Valley Bay Area costs about 50% more than that of talent in Massachusetts

Globally, Machine Learning talent costs around 15-25% more than Big Data/Analytics talent

For both AI and Big Data/Analytics, talent in India costs only around a third of the talent in Bay Area

# Demand & Supply Analysis 2018




**Key Insights**

India faces a talent gap of about 40,000 AI & Big Data / Analytics talent.

The talent gap can be addressed by cross skilling adjacent talent through collaborations between corporations and universities and government initiatives.

Consistent cross skilling of adjacent talent would enable India to position itself as a AI and Big Data / Analytics hub that caters only to India demand but also to global demand

Advantages of hiring talent in India include

- higher quality at scale,
- lower cost compared to other global locations and
- robust ecosystem comprising of Start-ups, Service Providers and Global Capability Centres (GCC).

Note : DRAUP's proprietary talent module analysis

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# 14 unique roles were determined across AI & BDA as part of the BCG analysis done in 2017

## 6 Big Data / Analytics roles

- Business Analyst
- Solutions Architect
- Data Integrator
- Data Architect
- Data Analyst
- Data Scientist

## 12 Artificial Intelligence roles

- Business Analyst
- Solutions Architect
- Data Architect
- Data Scientist
- AI Research Scientist
- AI Research Scientist - NLP
- AI Research Scientist – Image & Video
- Hardware Integration Engineer
- Software Engineer, Applications, Platforms, AI
- Software Engineer, Testing
- DevOps Engineer
- Information Security Analyst

Note : DRAUP's proprietary talent module was used to analyse jobs by job roles and skill type

# Methodology to determine unique job roles

## Phase-1

Harvesting relevant job descriptions

| Step-1 | Step-2 | Step-3 | Step-4 |
|---|---|---|---|
| Extracting job descriptions | Filtering job descriptions | Creating title library | Classifying JDs based on the title library, using a **random forest** algorithm |

## Phase-2

Extracting technical & conceptual skills

| Step-1 | Step-2 | Step-3 |
|---|---|---|
| Using existing skill library to fine-tune **spaCy** model<br><br>Using **spaCy** to locate relevant section(s) within JD | Using **spaCy** to extract list of technical and conceptual skills | Cleaning list of skills and refining **spaCy** model |

## Phase-3

Clustering extracted skills to identify unique roles

| Step-1 | Step-2 | Step-3 | Step-4 |
|---|---|---|---|
| Estimating the semantic similarities between each skill using a **word2vec** model | Developing clusters of skills commonly found together using **k-means** clustering | Optimizing, tagging and validating skill clusters | Identifying unique job roles |

## Phase-4

Primary validation

| Step-1 |
|---|
| Identifying industry SMEs<br><br>Outreach<br><br>Conducting primary interviews to validate findings |

▲ **QC and validation checkpoints**

▲ Manual QC on output

▲ Manual QC on output

▲ Primary validation

▲ Primary validation

[1] Each of the methodology phases have been detailed much further in the subsequent sections

Note: Draup Methodology

# Developing a JD corpus for analysis

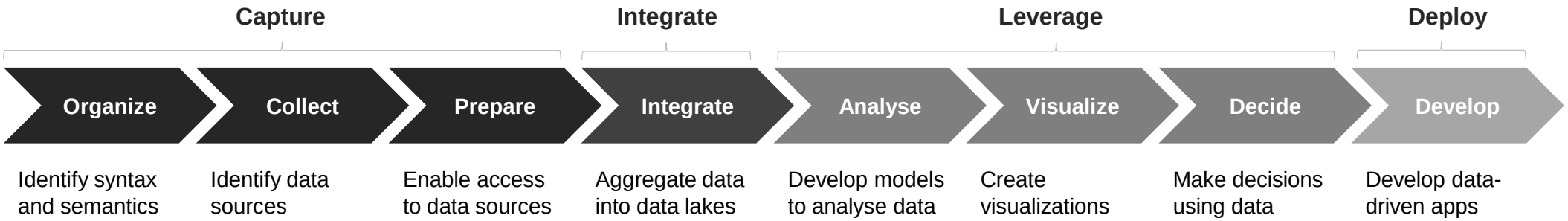
| Step No. | Harvesting Funnel | Steps Involved |
|---|---|---|
| **Step-1: JD Extraction** | **28 million** | • Total number of job descriptions extracted (Sources: Indeed, LinkedIn & Glassdoor) |
| **Step-2: Language Filtering** | **15 million** | • Job descriptions filtered on the basis of language<br>• Only JDs typed in English were filtered out from the total set |
| **Step-3: Title Library Creation** | **TITLE LIBRARY[2]** = | **Titles unique to data science:** Core Data Science Titles (Data Scientist, Data Engineer, Data Architect, Applied Scientist, ADAS Engineer, etc.) + **Titles similar to data science:** Adjacent / Intersecting Titles (Business Analyst, Data Analyst, Financial Analyst, Risk Analyst, Marketing Analyst, etc.) - **Titles that may create noise:** Negative Titles (Data Entry Operator, Data Center Technician, EHRS, Clinical Scientist, etc.) |
| **Step-4: JD Corpus Creation** | **~600,000** | • Relevant job descriptions filtered using a **random forest** algorithm that classified job descriptions on the basis of the title corpus |

Manual QC to test exhaustiveness of title library

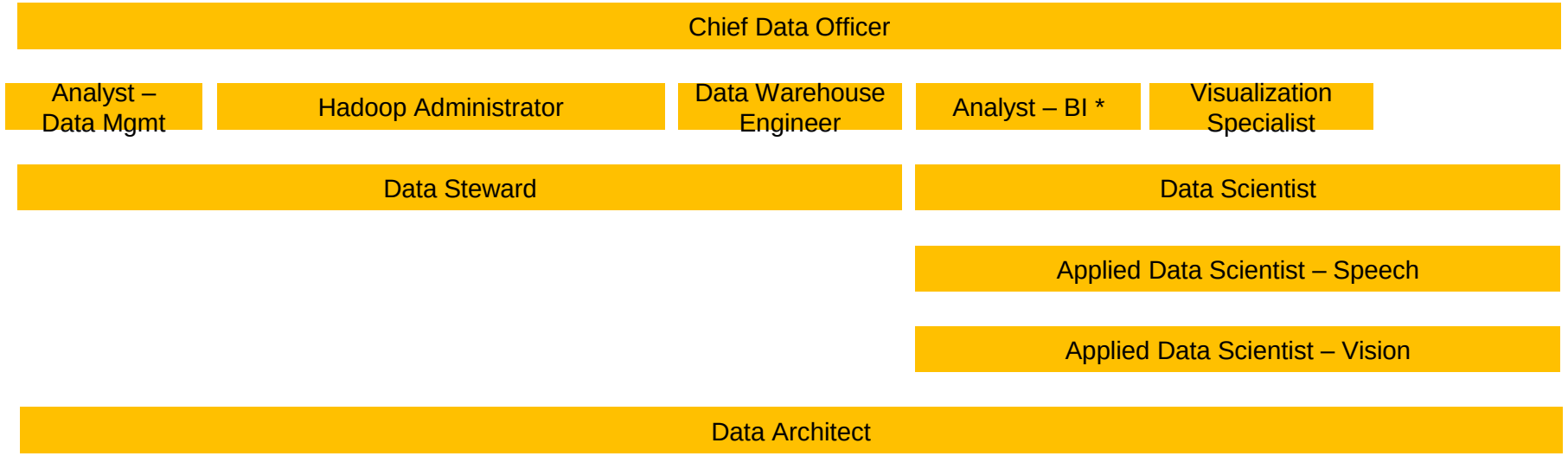
[2] Title library developed using data extracted from LinkedIn, Naukri and Indeed

# 18 unique roles were discovered in AI and Big Data/Analytics

**Data and Analytics Process [1]**




**Breakdown of Roles by Process [2]**




**Auxiliary Roles ****

- Solution Architect
- Software Engineer – Autonomous Systems
- Autonomous Systems Integration Engineer
- Infrastructure Engineer
- Test Engineer
- Product Manager
- Analyst – Information Security

* Business intelligence analysts can be part of varied functions, e.g. ops, finance, marketing, or project planning

** Auxiliary roles include those which may not form part of the data science function, but are essential to productize data platforms or autonomous systems

Source: [1] H. Gilbert Miller, Peter Mork, "From Data to Decisions", IT Professional, vol 15, no.1, pp. 57-59, Jan-Feb 2013, [2] Indeed, Naukri, LinkedIn, StackExchange, GitHub





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# Zinnov Analysis for AI & Big Data / Analytics roles

Roles have been segregated in categories and 5 additional roles have been added. 1 role has been redefined, 2 roles have been merged

## 7 Big Data / Analytics roles

- Analyst – Data Quality Management
- Analyst – Business Intelligence
- Data Warehouse Engineer
- Big Data / Hadoop Administrator [DevOps Engineer Renamed]
- Data Architect
- Data Steward
- Visualization Specialist

## 3 Artificial Intelligence roles

- Data Scientist [AI Research Scientist merged with Data Scientist]
- Applied Data Scientist - Vision
- Applied Data Scientist – Speech

## Leadership role

- Chief Data Officer

## 7 Auxiliary roles

- Solutions Architect
- Infrastructure Engineer
- Product Manager
- Software Engineer – Autonomous Systems
- Systems Integration Engineer – Autonomous Systems [Hardware Engineer Redefined]
- Test Engineer
- Information Security - Analyst

New role added | Redefined role | Merged role with BCG analysis

# List of unique job roles and definitions – Big Data / Analytics Roles

| Unique Role | Description | Technical or Conceptual Skills | Demand | |
|---|---|---|---|---|
| | | | 2018 | 2021 |
| Data Architect | Designs and implementing the technical architecture | apache, azure, distribute systems, flume, google cloud, gradle, integrations, java j2ee, | 4,900 | 10,000 |
| Visualization Specialist | Develops visualizations and animations | tableau, d3js, alteryx, python, rstudio | 200 | 3,000 |
| Analyst - Data Quality Management | Maintains and manages the quality of the database | database architecture, relational databases, data cleaning, data manipulation, tableau, power bi, excel | 49,000 | 52,000 |
| Big Data / Hadoop Administrator | Supports the hadoop infrastructure and ensures availability | hadoop, flume, YARN, mongodb, dynamodb, mapreduce, devops, hbase, hdfs, AWS | 3,200 | 8,000 |
| Data Warehouse Engineer | Creates data pipelines to move and transform data | hbase, amazon web service, kafka, spark, cassandra, dynamodb, flume, gradle, graph, hadoop, jmeter, json | 21,300 | 41,000 |
| Analyst - Business Intelligence | Analyzes data (usually structured) and generates descriptive insights | alteryx, cognos, dashboards, data interpretation, data manipulation, oracle sql, postgresql, | 107,400 | 110,000 |
| Data Steward | Implements and enforces data policies, processes, procedure, and standards. | database architecture, relational databases, data quality, excel | 500 | 3,500 |

Note : DRAUP's proprietary talent module was used to analyse jobs by job roles and skill type

# List of unique job roles and definitions

## Leadership Role

| Unique Role | Description | Technical or Conceptual Skills | Demand |
|---|---|---|---|
| Chief Data Officer | Responsible for enterprise level governance and utilization of data as an asset | - | - |

## Artificial Intelligence Roles

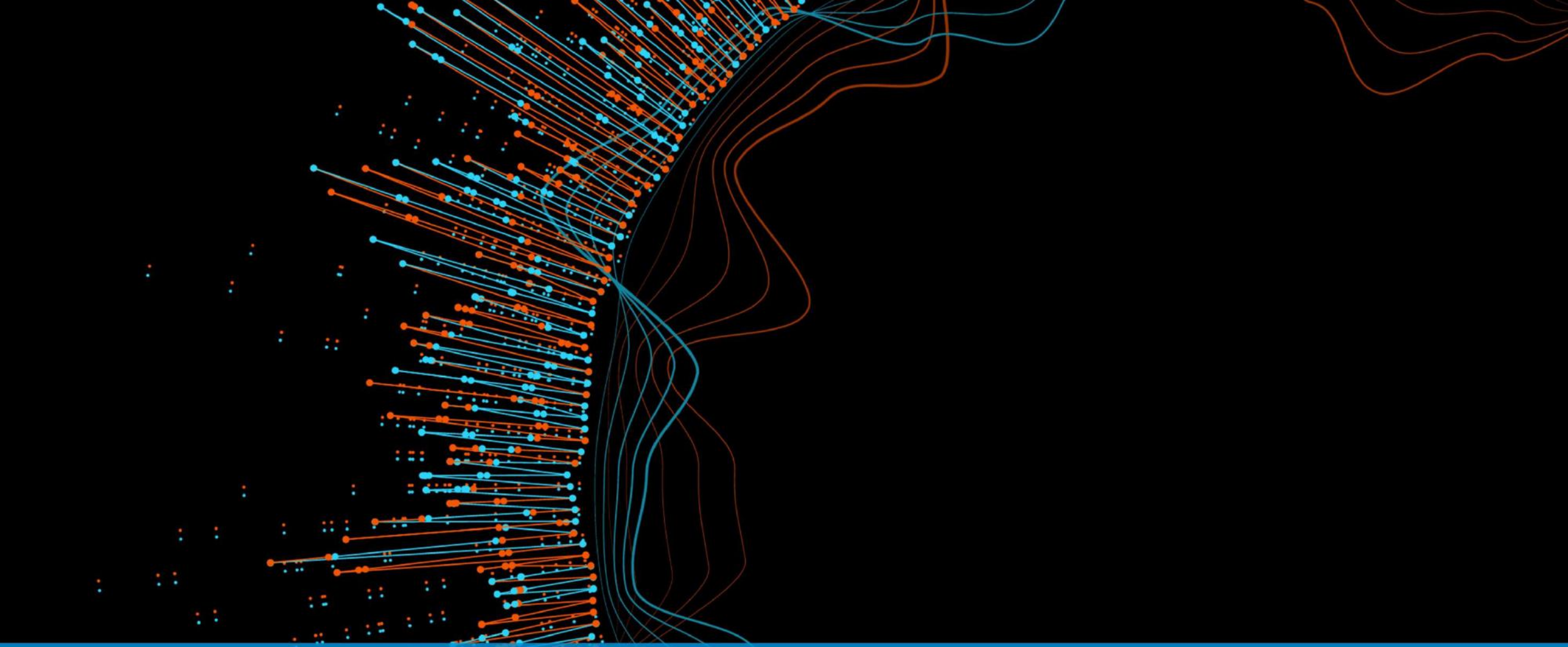
| Unique Role | Description | Technical or Conceptual Skills | Demand | |
|---|---|---|---|---|
| | | | 2018 | 2021 |
| Data Scientist | Analyzes and interprets data (both structured and unstructured) and generates prescriptive and predictive insights | Classification, clustering, decision trees, dimensionality reduction, logistic regression, SVM, natural language process, predictive analytics, | 36,500 | 129,000 |
| Applied Data Scientist - Vision | Develops algorithms for vision-based applications such as image or object recognition applications. | OpenCV, Tensorflow, Pandas, 3D Modelling, Adaptive Thresholding, Caffe, Convolutional Neural Network | 800 | 25,000 |
| Applied Data Scientist – Speech | Develops algorithms for conversational interfaces such as chatbots | Dialogflow, API.ai, Wit.ai, Microsoft Bot Framework, Bayes Rule, Bidirectional RNN, Chomsky Hierarchy | <500 | 10,000 |

Note : DRAUP's proprietary talent module was used to analyse jobs by job roles and skill type

# List of unique job roles and definitions – Auxiliary

| Unique Role | Description | Technical or Conceptual Skills |
|---|---|---|
| Solutions Architect | Responsible for architecture and design implementations for data platforms and autonomous systems | SOA, Redshift, EC2, EMR, Shell Scripting, Security Design, Athena, Glue, Elastic Search |
| Infrastructure Engineer | Engineers and maintains large scale environments specifically for solving large scale data science and AI problems | AWS, Azure, GPU hardware, Docker, Kubernetes, server systems, networking, security infrastructure |
| Product Manager | Identifies customer and market requirements, and develops the product roadmap | Product Roadmap, Wireframe, Bootstrap, Distributed Systems, Tableau, Data modelling |
| Software Engineer - Autonomous Systems | Develops the software backend for autonomous systems | Kalman filtering, Python, C, C++, Linux, Matlab, probabilistic filtering, pose estimation, LIDAR processing |
| Autonomous Systems Integration Engineer | Integrates hardware and software elements of autonomous systems, ensuring safety | DFMEA, HARA, FTA, kalman filtering, pose estimation, inertial measurement, system design, hardware design |
| Test Engineer | Tests data platforms and autonomous systems | Selenium, JUnit, regression testing, load testing, black box testing, sanity testing, smoke testing |
| Analyst - Information Security | Identifies potential threats and vulnerabilities, and developing solutions to intervene | anti virus, bluecoat, digital forensics, firewall management, fisma, gsec, incident response |

Note : DRAUP's proprietary talent module was used to analyse jobs by job roles and skill type



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# AGENDA

1

## KEY TRENDS

Trends and impact of AI and BD&A across Industries | Impact of Startups on AI and BD&A ecosystem

2

## DEMAND SUPPLY ANALYSIS

Methodology for estimating Demand and Supply | Global Demand for AI and BD&A | Supply for AI and BD&A talent from India

3

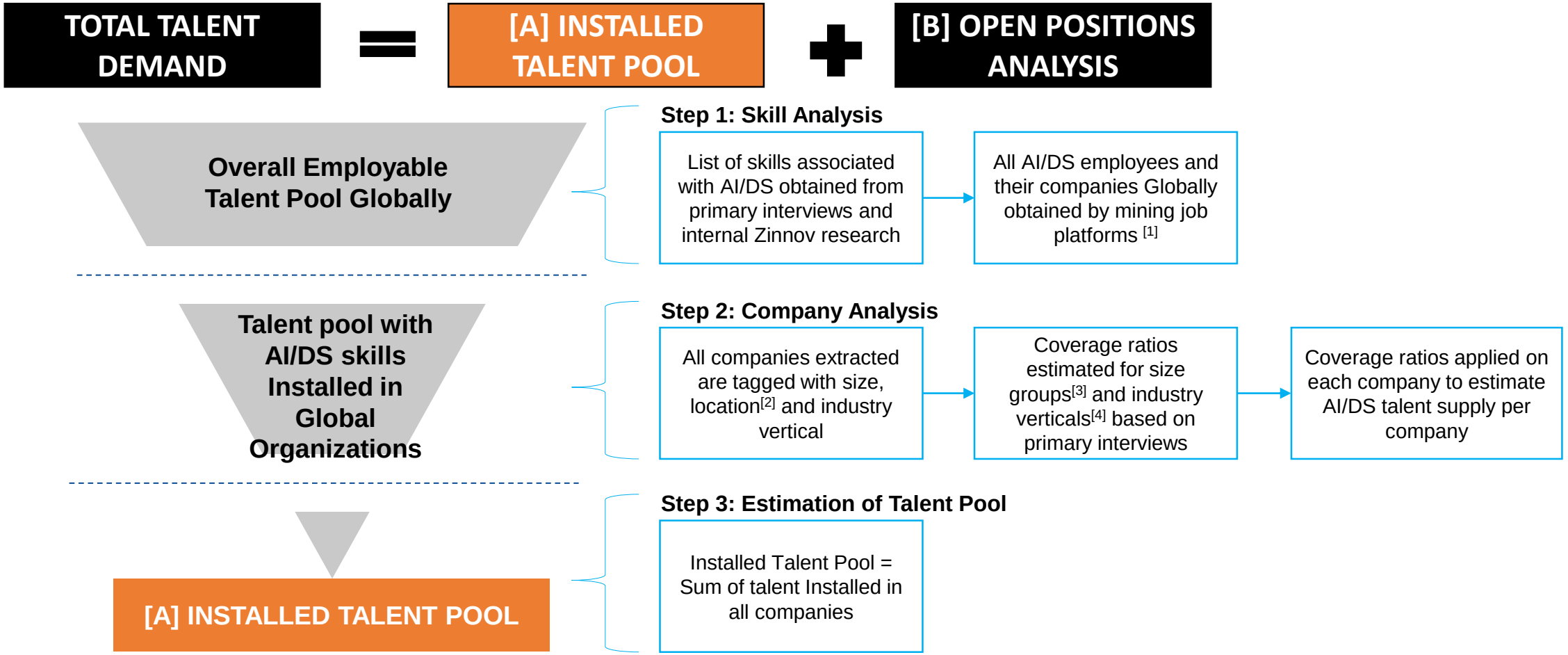
## UNIQUE JOB ROLES

Methodology to identify unique roles | List of Unique job roles along with a description & technical skills | Demand and Supply per job role

4

## APPENDIX

# Methodology for estimation of global talent across organization




*[1] Job platforms include LinkedIn, Naukri, Monster and Indeed*
*[2] Location includes both the city and the corresponding hotbeds across globe*
*[3] There are 3 size groups: Small (1-200 employees), Mid (201-1,000 employees) and Large (>1,000 employees)*
*[4] List of industry verticals include ITeS, ER&D and SPD*

# Methodology for estimation of Open positions globally

**TOTAL TALENT DEMAND** = **[A] INSTALLED TALENT POOL** + **[B] OPEN POSITIONS ANALYSIS**

**Mining Open Positions for Companies Globally**

- List of skills associated with AI/DS obtained from primary interviews and internal Zinnov research
- Global AI/DS open positions in the past 3 years obtained by mining job platforms [1]
- Open positions for all companies are tagged with size group [2], location [3] and industry vertical [4]

**Demand Growth Rate Estimation**

- Quarterly growth for open positions captured per size group, location and vertical (Parameters 1, 2, 3)
- Parameters 1, 2, 3 are validated and benchmarked with primary interviews

**Projecting Future Demand**

- Estimating Future growth in Job openings and estimating the Demand in AI/DS technology area

**[B] OPEN POSITIONS ANALYSIS**

*[1] Job platforms include LinkedIn, Naukri, Monster and Indeed*
*[2] There are 3 size groups: Small (1-200 employees), Mid (201-1,000 employees) and Large (>1,000 employees)*
*[3] Location includes both the city and the corresponding country*
*[4] List of industry verticals include ITeS, ER&D and SPD*

# Estimation of Talent Supply in India

**TOTAL TALENT SUPPLY** = **[A] University Talent Pool** + **[B] Directly Relevant Talent Pool** + **[C] Neighbourhood Talent Pool**

**Overall Graduating University Talent Pool**

**Step 1: University Analysis**

- Enrolments in over 43,000 Indian universities obtained from AISHE[1] databases
- Universities clustered into 4 tiers (1,2,3 and others)[2] as per NIRF[3] rankings
- Employability ratios for each tier estimated based on primary interviews

**Talent pool with skills suitable for AI/DS technologies**

**Step 2: Program Analysis**

- Identification of streams[4] that could produce AI/DS talent
- Employability ratios for each program w.r.t AI/DS estimated through primary interviews and historical placement data

**[A] University Talent Pool**

**Step 3: Estimation of Talent Pool**

- University Talent Pool = Sum of employable talent across all identified streams

*[1] All India Survey of Higher Education (http://aishe.nic.in)*
*[2] List of universities in all 4 tiers provided in Annexure*
*[3] National Institute Ranking Framework developed by Ministry of Human Resource Development (https://www.nirfindia.org/)*
*[4] Streams identified include Computer Engineering, Electrical Engineering, Electronics Engineering, Information Technology, Mechanical Engineering, Computer Application, Computer Science, Electronics, Mathematics and Statistics*

# Methodology for Estimating Installed Talent Pool Across GCCs, SPs & Start-ups

**TOTAL TALENT SUPPLY** = **[A] University Fresh Talent Pool** + **[B] Directly Relevant Talent Pool** + **[C] Neighbourhood Talent Pool**

**Overall Employable Talent Pool in India**

**Step 1: Skill Analysis**

List of skills associated with AI/DS obtained from primary interviews and internal Zinnov research → All AI/DS employees and their companies in India obtained by mining job platforms [1]

**Talent pool with skills suitable for AI/DS technologies**

**Step 2: Company Analysis**

All companies extracted are tagged with size, location[2] and industry vertical → Coverage ratios estimated for size groups[3] and industry verticals[4] based on primary interviews → Coverage ratios applied on each company to estimate AI/DS talent supply per company

**[B] Directly Relevant Talent Pool**

**Step 3: Estimation of Talent Pool**

Directly Relevant Talent Pool = Sum of talent supplied by all companies

*[1] Job platforms include LinkedIn, Naukri, Monster and Indeed*
*[2] Location includes both the city and the corresponding state in India*
*[3] There are 3 size groups: Small (1-200 employees), Mid (201-1,000 employees) and Large (>1,000 employees)*
*[4] List of industry verticals include ITeS, ER&D and SPD*

Source: DRAUP Methodology

# Methodology for Adjacent talent estimation

**TOTAL TALENT SUPPLY** = **[A] University Fresh Talent Pool** + **[B] Directly Relevant Talent Pool** + **[C] Neighbourhood Talent Pool [1]**

**Overall Employable Talent Pool in India**

**Step 1: Skill Analysis**

List of AI/DS neighbourhood skills [2] obtained from primary interviews and internal Zinnov research → Talent pool skilled in neighbourhood technologies (**Parameter 1**) obtained by mining job platforms [3]

**Talent pool skilled in neighbourhood technologies**

**Step 2: Analysis of up-skilling portals [2]**

Up-skilling portals [4] are scanned. Number of registered Indians are extracted (**Parameter 2**) → Number of AI/DS – relevant projects (**Parameter 3**) by Indian users is extracted → 'Up-skill ratio' calculated based on Parameters 2 & 3

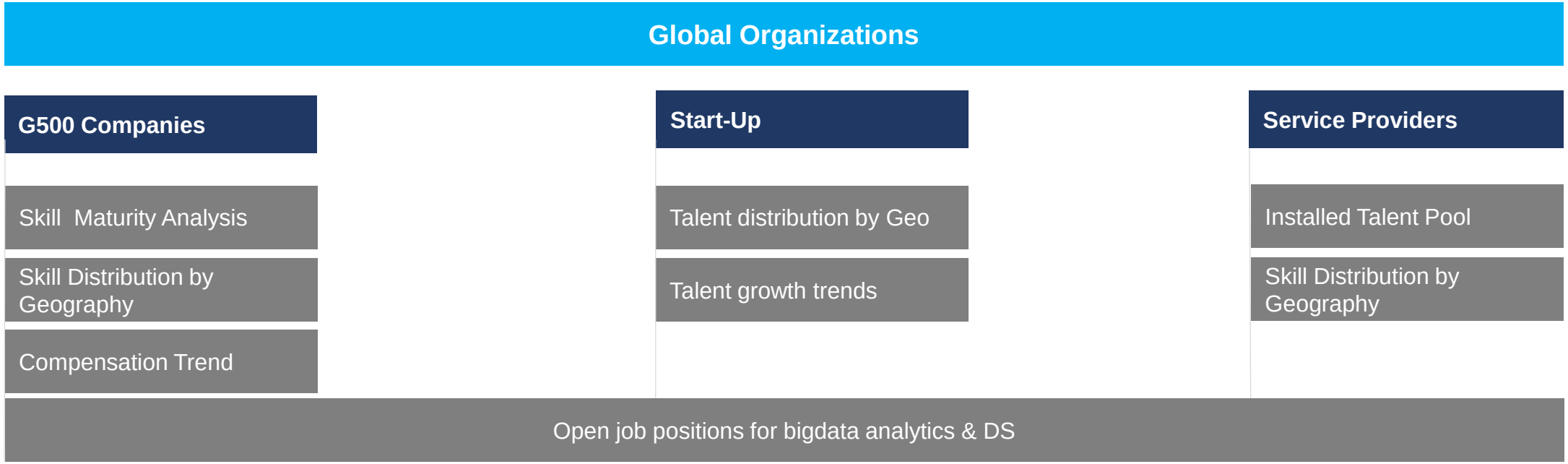
**[C] Neighbourhood Talent Pool [1]**

**Step 3: Estimation of Talent Pool**

'Up-skill ratio' is applied on Parameter 1 to obtain Neighbourhood Talent Pool

*[1] Neighbourhood Talent Pool refers to the talent pool which can be trained and up-skilled to be employed in AI/DS roles*
*[2] Neighbourhood Skills refers to the list of skills a person needs to possess to qualify for the Neighbourhood Talent Pool*
*[2] Job platforms include LinkedIn, Naukri, Monster and Indeed*
*[3] Up-skilling portals include Kaggle, CodeChef and Hacker Earth*

# Global AI and Big Data/Analytics workforce was analysed across 3 types of companies

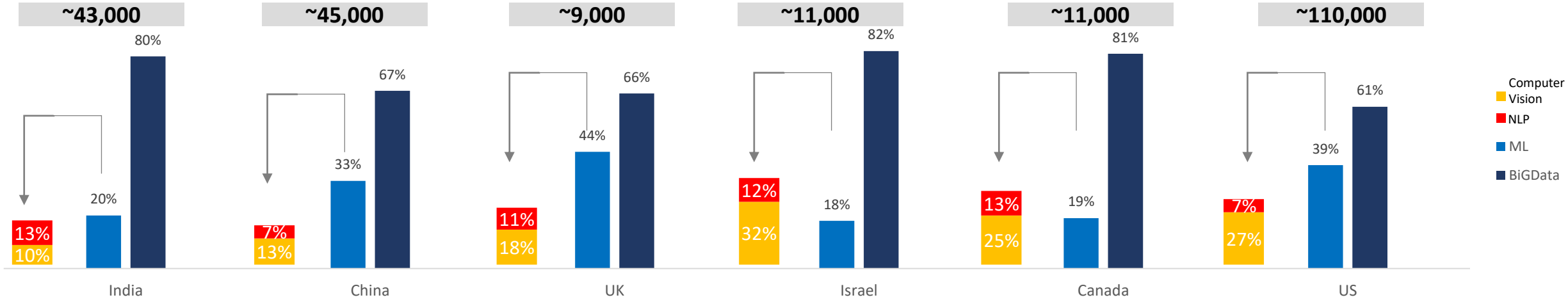


# Majority of G500 organizations have employed Big Data/Analytics talent across geographies; Computer Vision & NLP talent is employed majorly by tech giants (Microsoft, Apple, Google, Amazon, Facebook)

**Total AI and BD&A talent in G500 companies** **~100K**

## AI and bigdata analytics Global G500 Talent distribution

### Geo-Wise G500 Talent Distribution across skills




Presence of heavyweights like **IBM, GE, Microsoft, Amazon**, etc. has helped create an AI/BD ecosystem in India. **Amazon India, Walmart Labs** have invested heavily on analysing Big Data sets generated by customer interactions across Retail, Seller Services and leverage **NLP** algorithms to predict customer buying behaviour

China's AI & Big Data Talent is employed predominantly in large companies, both local and MNCs, such as **Baidu, Tencent, Alibaba**, **EBay, Amazon** etc. Baidu is investing heavily in **Vision** for Autonomous Driving and fleet route optimization by analyzing Mn of vehicle datasets

UK AI & Big Data talent is significantly is engaged in large companies such as **Google DeepMind group**, **IBM**(Watson Health) and **Microsoft** (Big Data Analytics for Bing and Skype) etc..

**Microsoft** Israel technical centre works **on Medical Imaging** for predictive Eyecare.

**Automotive OEM's** like Renault, Volkswagen partnering with Autonomous start-ups like Mobileye

MNCs such as **Google DeepMind group, Microsoft and IBM Watson** group have large scaled AI and Big Data labs in Canada.

Automotive OEMS such as Ford, GM have set-up large AI labs in Montreal and Toronto to expand autonomous driving research

Traditional Hubs for Engineering for the **Tech Giants** –Google, Amazon, Facebook, Apple and Microsoft hold ~35% of global G500 Big Data Machine learning to NLP & Computer vision talent

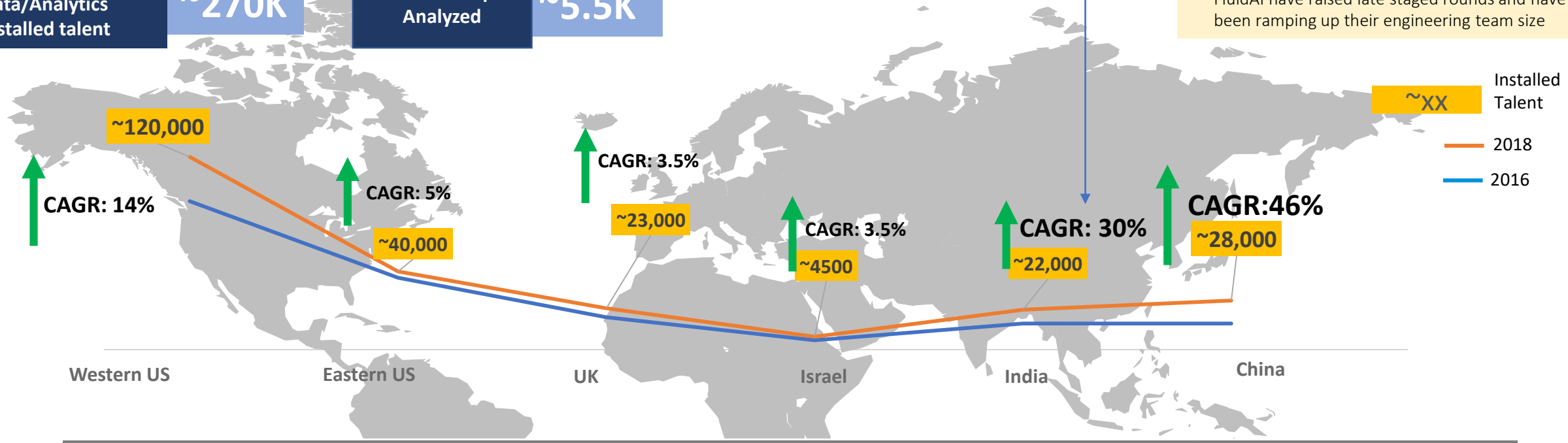
Driverless Cars, Drones, Predictive medicine, Cyber Security are the hot areas

# Indian and Chinese AI & Big Data/Analytics start-ups have rapidly scaled their engineering talent over the last 2 years

**Total AI & Big Data/Analytics installed talent** ~270K

**Total Startups Analyzed** ~5.5K

- Indian start-ups such as Netrdyne, niki.AI and FluidAI have raised late staged rounds and have been ramping up their engineering team size




## Key AI & Big Data Start-ups across global locations

- sentient — Massively scaled deep learning
- anki — AI based consumer robotics start-up
- ATTIVIO — Data cataloguing and cleaning
- DARKTRACE — ML based threat detection
- ARRIA — NLP API
- blueyonder — ML for retail
- MOBILEYE — Vision based advanced assistance system
- belong — ML based recruitment solution
- icarbonx — ML for personalised healthcare

# Service Providers have a sizeable share of Big Data/Analytics talent, with a majority based out of India

**Total AI & Big Data installed talent by delivery locations** **~120K**

**India**
**~82K**

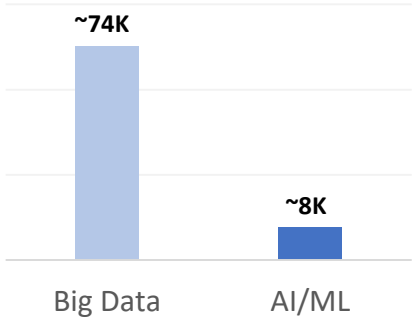
**US & Canada**
**~11K**

**China**
**~2.5K**

**Europe**
**~23K**

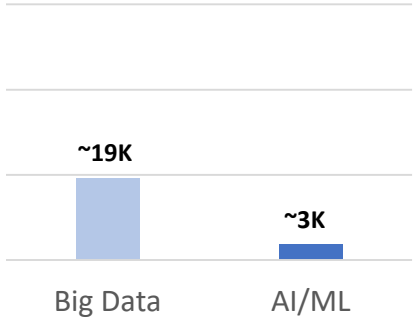
## Geo-Wise Talent Distribution across skills

Installed Big Data and ML/AI talent in **India**



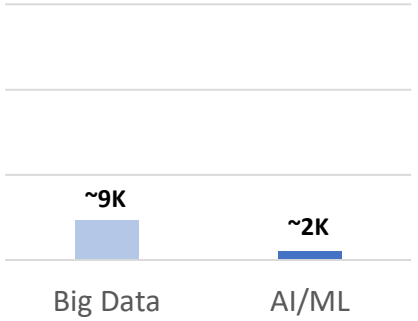

- India accounts for more than **50%** of the available talent in service providers.
- Service providers like TCS are setting up **CoE** in collaboration with Intel to speed up adoption of AI.
- TCS and Infosys have developed their own AI platforms to serve global customers
- Infosys provides **mandatory training** on Artificial Intelligence to new joiners.
- Tech Mahindra has tied up with **Edx** to reskill **117K** employees in areas like Big Data, IoT, Machine Learning etc.

Installed Big Data and ML/AI talent in **Europe**



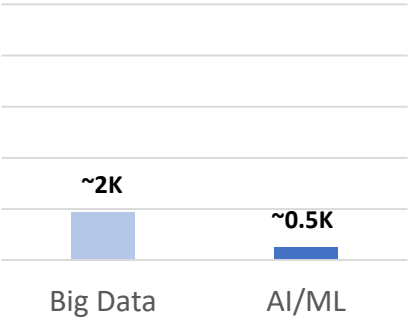

- Capgemini bagged the European Commission data infrastructure project.
- Insurance firm Direct Line Group appointed Capgemini for IT restructure.
- Atos has partnered Google Cloud to create secure enterprise business solutions in Artificial Intelligence, Machine Learning, Hybrid Cloud, data analytics and the digital workplace.
- Atos and Siemens have committed 100M pounds for R&D in AI, Big Data, IoT and Cybersecurity.

Installed Big Data and ML/AI talent in **US & Canada**




- DXC Technology launched an Agile Process Automation (APA), which combines cloud and robotic process automation (RPA) with embedded artificial intelligence (AI) to enhance a company's business processes.
- Cognizant has tied up with Goodwill University to impart training in Digital technologies and other IT courses.
- Avanade has tied up with Microsoft to create new Ai-based solutions
- Avande collaborated with Hortonworks to provide big data solutions to enterprises.

Installed Big Data and ML/AI talent in **China**

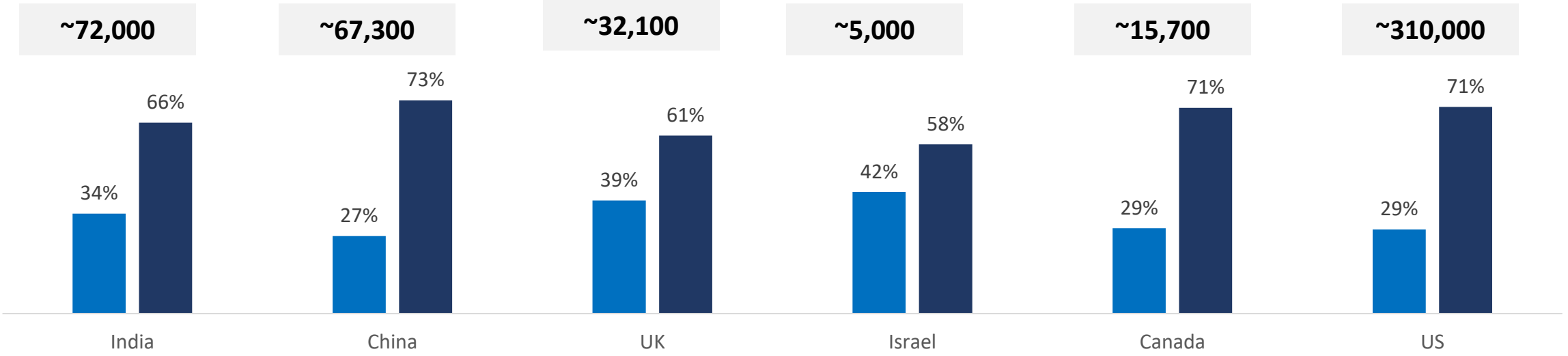



- **Pactera** launched an innovation outpost called **Moonshot** to lead global clients through the next era of digital products with a heavy emphasis on artificial intelligence, data and continuous software delivery paired with next generation human-centered experience design

# US, India, China, and UK have the most number of job openings in AI & Big Data/Analytics

**~515,000**

## AI and Big data Analytics Global Job Opening distribution




### Top Recruiters

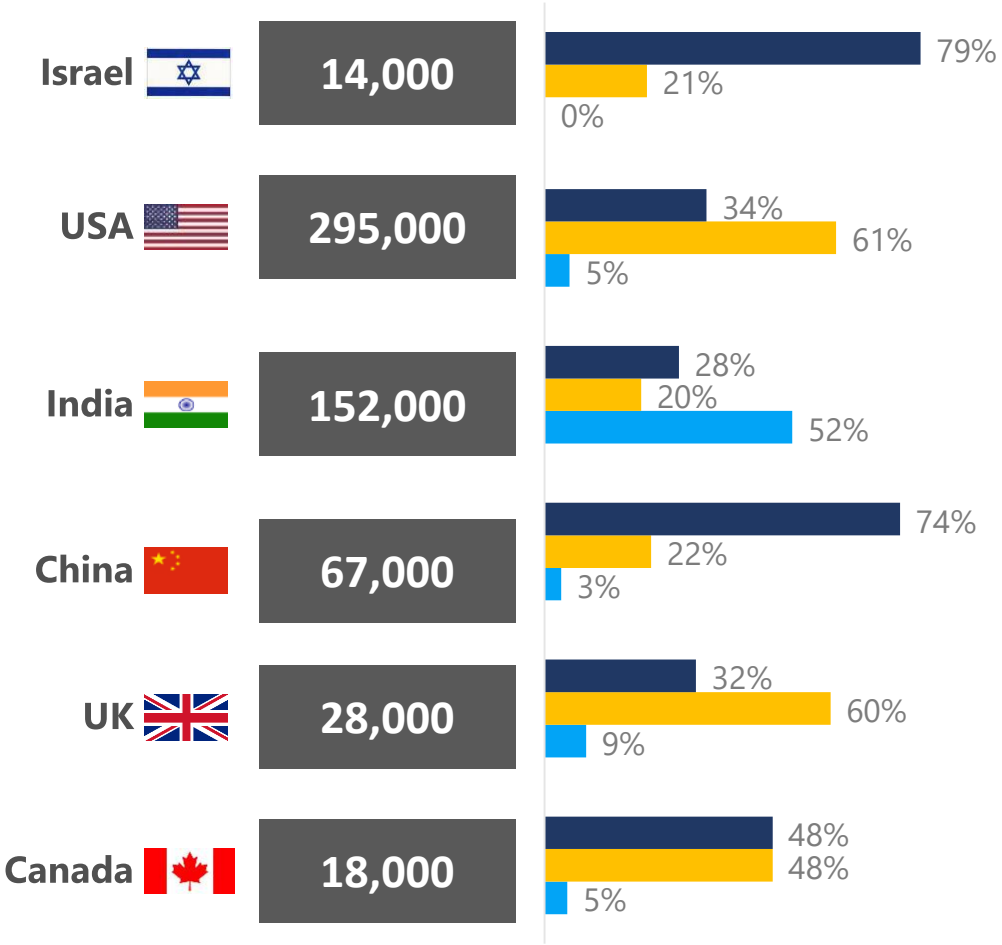
| India | China | UK | Israel | Canada | US |
|---|---|---|---|---|---|
| **ML -** Flipkart, Amazon, Accenture, Intel, Citi, Amazon<br>**Big Data -** HP, HSBC, Citi, Accenture, Zebra Technologies, Lead Squared | **ML -** State street, Net ease, Google, Intel, HSBC, Teradata<br>**Big Data -** Accenture, Intel, Baidu, Career International, NetEase, Michael Page, JD Group | **ML -** Hamham, Guardian Jobs, Amazon, Microsoft, Barclays, Hitachi, Expedia Group<br>**Big Data -** Burberry, Office of National Statistics, Olivier Bernard | **ML -** Citi, Amazon, Google, Intel, General Motor, Nike, Cisco<br>**Big Data -** Outbrain, Verac, Outbrain, Kenshop, Midlink | **ML -** Google, EY, Deloitte, Mark's, Synopsys, Uber, Capital One<br>**Big Data -** RBC, CIBC, Citi, Intact, Newfound Recruiting | **ML -** JP Morgan, Intel Amazon, Google, Microsoft, NVIDIA, Facebook<br>**Big Data -** IBM, Google, Microsoft, JP Morgan, Amazon Home Depot, Mclane Company, Ring Central, Sirius XM |

### Job Titles

| India | China | UK | Israel | Canada | US |
|---|---|---|---|---|---|
| **ML -** Data Scientist, Revolution Analytics, Test Architect, Research Scientist-Computer Vision<br>**Big Data -** Applications Developer, Cloud Architect | **ML -** NLP Leader, Principal Software Engg, Chief Research Scientist<br>**Big Data -** Data Management Engg, Test Automation Engg | **ML -** Senior data scientist, Full stack web develop, Data Analyst, Robotics Engg<br>**Big Data -** Data Scientist, Data Development Officer | **ML -** Full stack Developer, Software Engineer, System Team Lead<br>**Big Data -** Business Research Analyst, Data Scientist | **ML -** Software Developer, Full stack Innovation Tech lead, Generalist Software developer, Data Scientist<br>**Big Data -** Software Engineer | **ML -** Software Engineer, Applied Scientist, Manager, Product Design Engineering, Algorithm Engineer<br>**Big Data -** Senior Data Architect, Senior Technical Architect |

# USA, India and China have the largest share of AI and Big Data/Analytics talent employed by global organizations

## BIG DATA & AI INSTALLED TALENT 2018 SPLIT BY COMPANY TYPE




## INSIGHTS

US AI and Big Data talent is predominantly split between large companies and start-ups. Companies such as **Google, Microsoft, Facebook IBM, Etc**. have large installed talent bases for AI & Big Data in US, led by Google with nearly ~doing almost all its Big Data Analytics work out of US. Notable small and medium companies have come up such as **Splunk, Cloudera, MongoDB** who are becoming key infrastructure developers

India's AI and Big Data talent is predominantly in **large service provider companies** involved in solutions deployment and support (IBM, Infosys, TCS etc..). **Amazon, Microsoft and IBM** Watson have significant AI talent pool. Notable medium and small companies are into analytics such as **InMobi, Musigma use Big Data Analytics** for Performance tracking of Mobile Ads

China's AI and Big Data Talent is employed predominantly in large companies, both local and MNCs, such as **Baidu, Tencent, Alibaba, EBay, Amazon etc**.. The presence of start-ups and mid-sized companies are low, but there are upcoming success stories such as AppAnnie, which provides performance and market analytics for mobile apps across devices

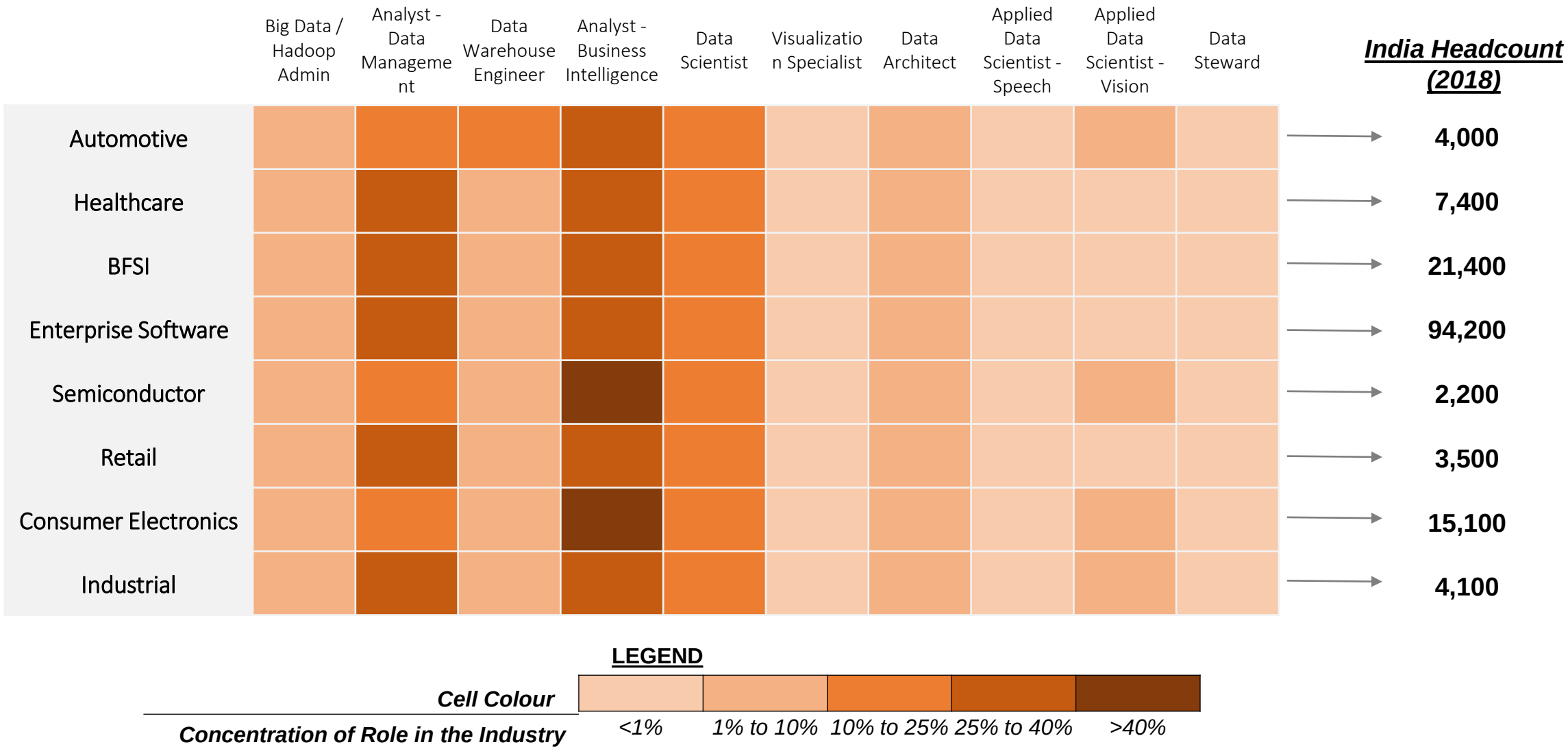
Legend

- G500 Companies (Top 500 R&D spenders)
- Start-Ups Companies (0>Headcount>5000)
- Service Providers



43

# Over 80% of the AI and Big Data/Analytics employed talent is distributed across Enterprise Software, Consumer Electronics and BFSI




*Note: For each vertical Map has to be read left to right*

# Companies and government bodies use three different strategies to upskill talent to meet the demand in AI & Big Data / Analytics

## Corporate Initiatives

***Companies are using various strategies to upskill their workforce***

A Partnership with Institutes

B In – house Training

C Massive Open Online Courses

**35** employees trained in Software Systems

Samsung has partnered with **BITS Pilani** to upskill its employees at their R&D center in Noida.

**100k** HC trained in AI & Automation

TCS has developed a social learning platform to train its employees in Automation and AI.

## Online Learning Platforms

### Learning Platforms

| | Enrolment | Programs | Partners |
|---|---|---|---|
| UDACITY | 8Mn + | Google's Deep Learning<br>Intro to ML | IBM<br>SAP<br>Nvidia |
| coursera | **30Mn +** | ML, Neural Network | The World Bank, University of Zurich & Virginia |

### Online Competitions

| | |
|---|---|
| hackerearth | **0.8Mn +** |

- **MakeMyTrip** Data Science Hiring Challenge
- **Epsilon** Data Science Hiring Challenge
- Machine Learning Codesprint - Euristica'18

## Government / Industry bodies

### Online Learning Platforms

futureskills — A NASSCOM initiative

This is an initiative by NASSCOM for developing skills across 9 technologies – Artificial Intelligence, VR, RPA, IoT, Big Data Analytics, 3D Printing, Cloud Computing, Social & Mobile and Cybersecurity

### Investments & Partnerships

simplilearn

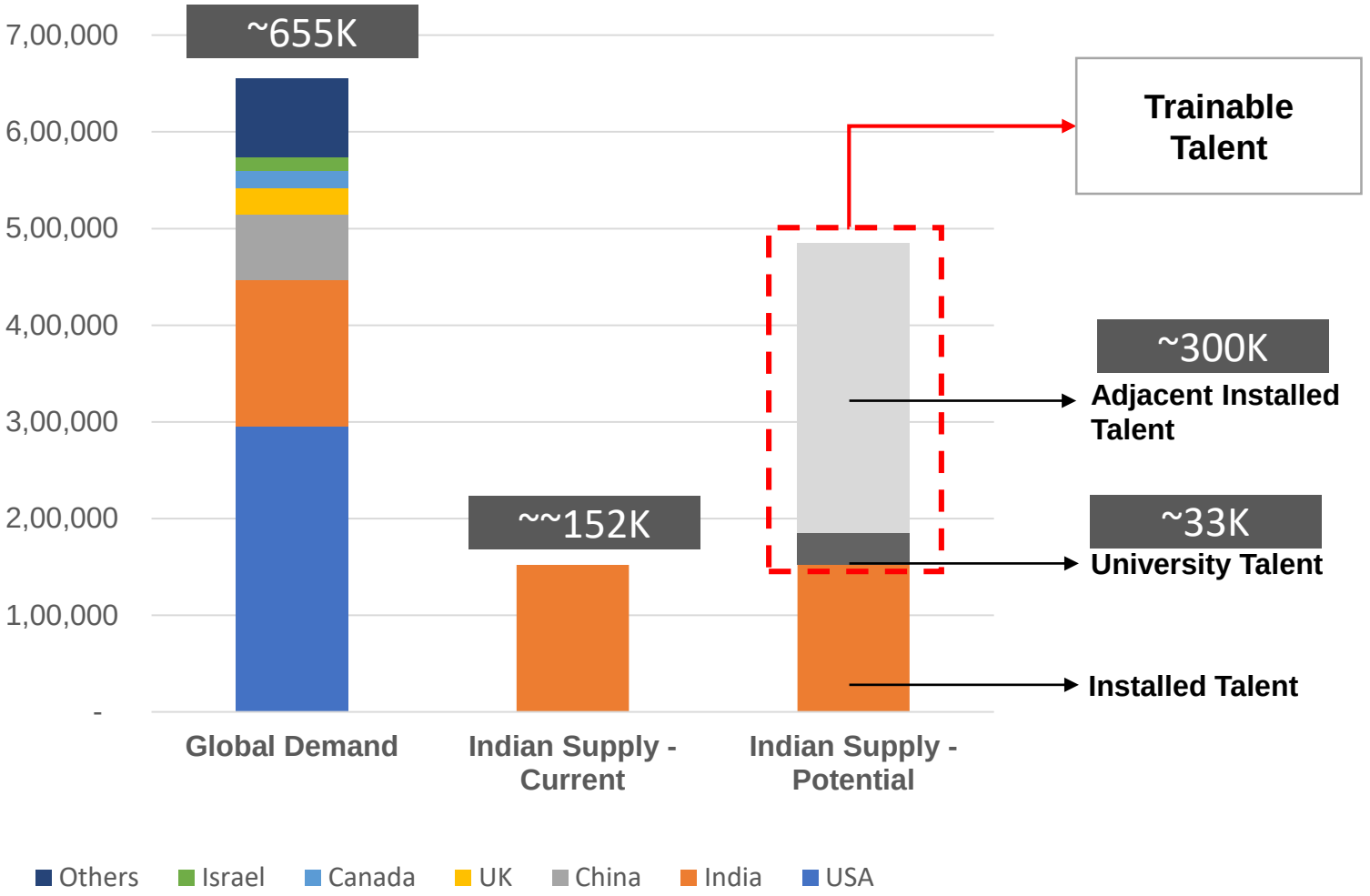
Simplilearn partnered with the **Digital India initiative**'s **National E-Governance Division** to reskill government employees across new-age technologies such as cloud computing, **data science, Big Data and analytics**, and project management, using courses on their platform

# The Indian government has been taking efforts to add momentum to the AI revolution with a variety of initiatives

| | | |
|---|---|---|
| 1 | **Artificial Intelligence Workshop - Ministry of Electronics & Information Technology** | - Discussion on current situation of AI in India and steps that should be taken to strengthen India's AI capabilities.<br>- AI based pilot projects<br>  - Use of AI for increasing the income of farmers<br>  - Handling of Traffic violation cases<br>  - AI for Language Learning & Technology Development |
| 2 | **Technical Institutions Initiatives - Ministry of Electronics and Information Technology** | AI based initiatives<br>- Image Processing (searching/Matching)- Microsoft Cognitive Services<br>- Service Delivery/ServiceDesk - Audio Assistance to caller-Google APIs |
| 3 | **Niti Aayog initiatives** | - In the process of formulating a national policy on AI outlining the scope for research, adoption and commercialisation<br>- Organised 2 international hackathons and a national level case competition to explore the application of AI in agriculture<br>- Partnered with Google and ABB to speed up the research and adoption of Artificial Intelligence in India |
| 4 | **AI Task Force** | - The Commerce and Industry Ministry set up an 18 membered AI task force for development of AI in various fields<br>- The Task force is to explore possibilities and submit recommendations to government, industry and research institutions |
| 5 | **India's first AI institute** | - The Indian government has set up **India's first AI institute** in Mumbai university's campus by collaborating with California based Wadhwani Institute for Artificial Intelligence<br>- The institute has been set up to develop AI based solutions for the general public. |

**Importance of training Initiatives:** India will be able to capture a higher share of the total global demand by investing in training its university and adjacent installed talent

## Talent demand-supply gap analysis




Over the last 2 decades, India has evolved from being a low-cost outsourcing centre to becoming a strategic engineering location for various industries.

India currently caters to about **23%** of the total AI & Big Data/Analytics talent pool installed across global locations.

By training its university and adjacent installed talent, India has the potential to cater to the increasing global demand

Advantages of hiring talent in India include higher quality at scale, lower cost compared to other global locations and a robust ecosystem comprising of Start-ups, Service Providers and Global Capability Centers (GCC).

# Next Steps

| | | |
|---|---|---|
| 1 | **Refining unique job roles** | 1. Mapping behavioural and domain skills to unique job roles<br>2. Using consultant research to refine results<br>3. Validating results with industry SMEs |
| 2 | **Occupational analysis** | 1. Mapping experience to unique roles to create job titles<br>2. Understanding hierarchy and career progression to develop **Occupational Maps** |
| 3 | **Functional analysis** | 1. Mapping primary and secondary responsibilities to each job title, thereby developing **NOS**<br>2. Identifying generic and domain based performance and knowledge criteria for each NOS<br>3. Defining performance outcomes for the role for each NOS<br>4. Aggregating NOS to develop **Qualification Pack** for each job role |
| 4 | **Curriculum development** | 1. Curriculum development for each QP<br>2. Developing evaluation metrics and other requirements for each QP |

NOTE: Across each of the steps, validation with industry experts and clearances from QRC/NSDA shall be obtained as required

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