Skill India
कौशल भारत-कुशल भारत

कौशल विकास और उद्यमशीलता मंत्रालय
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP
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Economic Research

METHODOLOGY FOR ASSESSING SKILL SHORTAGES AND GAPS

March 2025

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NATIONAL SKILL GAP STUDY FOR HIGH GROWTH SECTORS

Ministry of Skill Development & Entrepreneurship Govt. of India,
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कौशल विकास और उद्यमशीलता
राज्य मंत्री (स्वतंत्र प्रभार) एवं
शिक्षा राज्य मंत्री
भारत सरकार
Minister of State (Independent Charge)
Skill Development and Entrepreneurship;
Minister of State for Education
Government of India

MESSAGE

I extend my congratulations to the Ministry of Skill Development and Entrepreneurship (MSDE) and the National Council of Applied Economic Research (NCAER) for developing *'Methodology for Assessing Skill Shortages and Gaps'*, which provides comprehensive unified framework and methodology to assess and anticipate skill shortages, as well as a report on the *'National Skill Gap Study for High Growth Sectors'*.

This innovative framework marks a significant step forward in enabling State Skill Development Missions (SSDMs) and Sector Skill Councils (SSCs) to adopt a common approach to skill assessment.

In a country as large and diverse as ours, the need for a unified, yet flexible approach to skill gap analysis cannot be overstated. This framework will not only bridge existing informational gaps but also help generate timely and actionable insights to support targeted skilling interventions. Adoption of a unified and standardized framework will also ensure comparability between skill gap studies conducted by SSCs and SSDMs.

I am confident that stakeholders across the States and Sectors will find this framework valuable and will actively utilize it to build a stronger, data-driven skill development ecosystem.

(Jayant Chaudhary)

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भारत सरकार
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MINISTRY OF SKILL DEVELOPMENT
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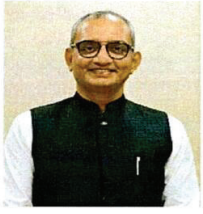

MESSAGE

Under the World Bank-aided Skill Acquisition and Knowledge Awareness for Livelihood Promotion (SANKALP) project, the Ministry of Skill Development and Entrepreneurship (MSDE), in collaboration with the National Council of Applied Economic Research (NCAER), undertook a significant initiative of *National Skill Gap Study for Seven High-Growth Sectors*. One of the critical elements of the study was to design a dynamic and standardised framework for skill gap assessment across sectors and States/UTs. Such a framework is aimed at enabling regular and robust assessment and analysis of evolving skill needs in response to changing economic and technological landscapes.

Skill demand is inherently linked to demand for goods and services. Also, as industries transform and new technologies emerge, the nature of work and required skills shift accordingly. Anticipating these changes requires a forward-looking, evidence-based approach.

To address this need, the MSDE-NCAER study has developed a unified *'Methodology for Assessing Skill Shortages and Gaps',* that combines both quantitative and qualitative techniques bringing together traditional and modern approaches. Importantly, it offers a standardised framework that can be applied across States and Sectors, helping to align skill development efforts as per needs and fill a long-standing gap in both policy and practice. Using the framework developed by NCAER, a report on *'National Skill Gap Study for High Growth Sectors'* has also been prepared by NCAER.

I complement SANKALP team at MSDE, and the experts at NCAER for their collaborative effort in developing this framework and for identifying skill gaps across seven high-growth sectors. This work provides a valuable tool for policymakers, training institutions, and Sector Skill Councils to plan effectively and respond strategically to emerging skill needs.

(Atul Kumar Tiwari)

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आज़ादी का अमृत महोत्सव

Foreword

The National Council of Applied Economic Research (NCAER) in collaboration with the Ministry of Skill Development and Entrepreneurship (MSDE) has developed a methodology to assess and anticipate skills shortage and gaps at the State and Sectoral levels. It is a dynamic and unified framework for skill gap assessment that can be regularly updated to predict skill requirements in line with the evolving economic landscape.

This framework has been developed based on a study of seven high growth sectors including agriculture (growing of cereals (including rice), leguminous crops and oil seeds); animal husbandry (raising of cattle and buffaloes); textiles(weaving of textiles); auto industry (manufacturing of motor vehicles and parts and components of motor vehicles and maintenance and repair of motor vehicles); power generation (electric power generation of solar energy and other non-conventional sources); retail (retail sale of food, clothing, footwear, leather articles in specialised stores); and, (computer programming activities. This report titled '*National Skill Gap Study of Seven High-Growth Sectors*' encapsulates the learnings based on a combination of quantitative & qualitative methodologies from these sectors. It is a rich report which examines these sectors using both available secondary data, current forecasts for jobs and also future skill gaps based on detailed stakeholder interactions.

And, the seven-part unified methodology, titled, '*Methodology for Assessing Skill Shortages and Gaps*' presents the methodological framework in a simplified format for the ease of policymakers, Sector Skill Councils and State Skill Development Missions.

I hope this study serves as a significant contribution in terms of better understanding and designing of skill initiatives at the national and State levels.

Anil K Sharma

Secretary and Operations Director

National Council of Applied Economic Research

Acknowledgements

In January 2018, the Ministry of Skill Development & Entrepreneurship (MSDE), Government of India (GoI) had launched a World Bank-assisted programme – Skills Acquisition and Knowledge Awareness for Livelihood Promotion (SANKALP). Under the above programme the MSDE undertook the 'National Skill Gap Study for High Growth Sectors' with the objective of developing a framework and methodology for conducting skill demand assessments at the sectoral and state level. The study was undertaken by National Council for Applied Economic Research (NCAER).

I am grateful to the MSDE for reposing trust in us to carry out the important study. I am especially obliged to the Honourable Secretary, MSDE, Shri Atul Kumar Tiwari and the Senior Economic Advisor, Shri Nilambuj Saran for their constant encouragement, support and guidance at every stage of the work. Their keen involvement in the work made the research that much richer. We are also grateful to the Director of Sankalp, Shri V S Arvind for his enthusiastic support and participation in the work. We are appreciative of the rest of the SANKALP team and MSDE officials for their critical comments and enthusiastic cooperation which enriched the work.

I acknowledge all stakeholders whom we met during the course of the study, which included relevant officers from various Ministries, representatives from Sector Skills Councils (SSCs), Industry Associations, Training Centres, firms, and academia, for sharing their invaluable information and insights. All of them took out a significant time out of their busy schedules to talk to us and give us critical comments on the report.

I thank the State and Union Territory government representatives for participating in the national and regional workshops, sharing their findings with us and also giving us critical insights in the report.

I am grateful to the NCAER Director General Dr Poonam Gupta and Dr Anil K. Sharma for their active support and guidance. Support of the IT team led by Mr Rakesh Srivastava is also highly acknowledged.

I thank our Senior Advisors Dr Aradhna Aggarwal, Dr Shish Pal Bansal, Dr Shashanka Bhide, Prof Sonalde Desai, Dr G C Manna, Dr Sudipto Mundle, and Prof Sanjib Pohit for their constant support, guidance and critical comments. I am also especially beholden to Mr Devender Pratap for his guidance on input-output modelling.

It has been a humbling and learning journey. However, this journey would have been incomplete without my colleagues who led the sectoral research namely Dr Saurabh Bandyopadhyay, Dr Ashish Desai, Dr Laxmi Joshi, Dr Charu Jain, Mr Ajaya Sahu and Dr Isha Dayal. I also thank the editorial team of Dr Renu Gupta, Mr Pradip Bagchi, Ms Mini Narayan and Mr Jagbir S Punia. Lastly, I deeply appreciate the administrative team who are the backbone of this work including Ms Poonam Dhawan, Mr Praveen Sachdeva and Ms Shalini Aggarwal.

Bornali Bhandari
Professor
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Abbreviations

ACABC	Agri-Clinics and Agri-Business Centers
AI	Artificial Intelligence
ASC	Australian Skills Classification
ASDC	Automotive Skills Development Council
ASI	Annual Survey of Industries
ASUSE	Annual Survey of Unincorporated Sector Enterprises
BPM	Business Process Management
CEDEFOP	European Centre for the Development of Vocational Training
DAP	District Agriculture Plan
DCS	Dairy Cooperative Societies
DPIIT	Department for Promotion of Industry and Internal Trade
ESCO	European Skills, Competencies, Qualifications and Occupations
ETF	European Training Foundation
EY	Ernst and Young
FGD	Focus Group Discussion
FPOs	Farmer Producer Organisations
GCF	Gross Capital Formation
GDP	Gross Domestic Product
GVA	Gross Value Added
GVO	Gross Value of Output
GDVA	Gross District Value Added
GSVA	Gross State Value Added
ICAR	Indian Council of Agricultural Research
ILO	International Labour Organization
IT	Information Technology
KPMG	Klynveld Peat Marwick Goerdeler
LMIS	Labour Market Information System
MCA	Ministry of Corporate Affairs
MoLE	Ministry of Labour and Employment
MoSPI	Ministry of Statistics and Programme Implementation

MSDE	Ministry of Skill Development and Entrepreneurship
NAS	National Accounts Statistics
NASSCOM	National Association of Software and Services Companies
NCAER	National Council of Applied Economic Research
NCO	National Classification of Occupations
NDDB	National Dairy Development Board
NIC	National Industry Classification
NSDC	National Skill Development Corporation
NSQF	National Skills Qualification Framework
O*NET	Occupational Information Network
OECD	Organisation for Economic Co-operation and Development
OWES	Occupational Wage Employment Survey
PACS	Primary Agricultural Credit Society
PLFS	Periodic Labour Force Survey
RA	Result Areas
RAS	Relative Actual Shift
RASCI	Retailers Association's Skill Council of India
RBI	Reserve Bank of India
SAIDP	State Agriculture Infrastructure Development Plan
SANKALP	Skills Acquisition and Knowledge Awareness for Livelihood Promotion
SAP	State Agriculture Plan
SMEs	Small and Medium Enterprises
SST	Singapore Skills Taxonomy
SSCs	Sector Skill Councils
SUTs	Supply-Use Tables
SWOT	Strengths, Weaknesses, Opportunities, and Threats
TLPD	Thousand Liters Per Day
TVET	Technical and Vocational Education and Training
WDRA	Warehousing Development and Regulatory Authority

Executive Summary

In the present era, characterised by an overwhelming pace of technological changes, especially with Artificial Intelligence (AI) likely to come into play in every sector, skilling, reskilling and upskilling will be key to address the changing nature of goods and services in demand. The objective of the present exercise is to evolve a dynamic and flexible methodology which can be applied uniformly across various sectors of the economy to identify skill shortages and skill gaps.

The model is aimed at assessing, anticipating and adapting skills at both national, state and local levels at regular intervals to enable the skilling eco-system to also evolve with technology to ensure the employability of the existing and future workforce.

Several rounds of studies were carried out earlier to assess skill shortages and gaps, but every such exercise was carried out using a different methodology, making it challenging for the policymakers to have a holistic view on the skill demand and supply. Further, while individual sectors are able to make forecasts for their sectors, there are occupations that are in-demand across sectors. It is necessary to capture those occupations that cut across sectors.

This document contributes towards developing a uniform and standardised methodology to help assess skill shortage and gaps across sectors.

What are Skills?

"Skills are personal qualities with three key features – (i) productive: using skills at work are productive of value; (ii) expandable: skills are enhanced by training and development and; (iii) social: skills are socially determined" (Green, 2013). NCAER (2018) delineated three types of skills and they are:

- Cognitive skills are basic skills of literacy and numeracy, applied knowledge and problem-solving aptitudes and higher-order skills such as experimentation, reasoning, and creativity.
- Technical and vocational skills are the physical and mental ability to perform specific tasks using tools and methods in any occupation.
- Social and behavioural skills include working well with others, communicating and listening well, and being agreeable and outgoing.

What is Skill Shortage?

Skill shortage describes the situation where a job vacancy is hard to fill because of a lack of applications with the required skills. For example, one is looking for accountants but is unable to find any with the appropriate degree, qualifications, experiences, and skills.

What is Skill Gap?

A skill gap occurs where an employee's competence to do the job is called into question (typically by his/her manager). For example, one is looking for accountants and find several with the appropriate degree & qualifications but not the appropriate skill set.

Methodologies to Assess Skills Shortages and Gaps

Step 1: Map the sectors (industries) as per National Industrial Classification codes.

Further, the NIC classifications may not explicitly capture modern sub-sectors such as renewable energy, information technology, and technical textiles. The key message is that the NIC codes have to be disaggregated further into sub-sectors. These sub-sectors

are recommended to be periodically updated. The economic classifications (NIC) and sectoral classifications have to be able to dovetail with each other. This will enable the policymaker/s to track sectors and sub-sectors at the desired level of aggregation.

Step 2: Map the Occupations

The National Classification of Occupations (NCO) 2015 is the key starting point for this exercise.

- Update mapping of NCO 2015 job roles with job roles identified by the Sector Skill Councils.
- Due to technological changes, new job roles have emerged and some would have retired. It is important to update the mapping of the occupations given in the NCO 2015 with the occupations identified by the Sector Skills Councils.
- Codify these job roles appropriately at all levels of NCO–2015.
- Of the 3,600 occupations identified in NCO–2015 and those that will be identified in the previous stage, one needs to select occupations that will be used for analysis for all the components of assessing skills shortages and gaps by all stakeholders–Central, State and sectors.
- The 8-digit-level occupations will be used in demand projections using the occupational wage employment survey.

Methodologies

India needs to adopt multiple methodologies to understand both the on-going & anticipated changes and challenges. The methodology consists of seven components to assess skills shortages and skills gaps. The Centre and States have to work in a collaborative manner for a holistic assessment.

The seven components are:

1. Macro Analysis of Sectoral Shares of Gross Value Added (GVA) and Workforce; Identification of Geographical Clusters; and Sectoral Workforce Characteristics using secondary data.
2. Simulations to forecast jobs and opportunities. This may be implemented both at the Central and State levels. NCAER has used input-output analysis to understand occupational trends.
3. Demand projections of jobs of non-agricultural sectors using occupational-wage employment survey (OWES) of non-agricultural enterprises. The OWES will be a detailed database of selected occupations which will give wages rates, number of workers, gender, other social background characteristics, qualifications and skills across geographies. The data will be representative at the district level.
4. Assess skill shortages and gaps of non-agricultural sectors using survey of non-agricultural firms for data on vacancies and skills: Vacancy rates across sectors needs to be estimated along with identification of occupations and associated qualifications that are vacant for more than a defined period of time.
5. Analysis of jobs in sub-sectors of non-agricultural sectors using big data methodologies. Analysis of job roles being advertised across web will inform about the real-time trends on the demand-side especially sub-sectoral trends and differences across geographies.
6. District-level analysis of jobs in the agriculture & allied sectors. A bottom-up strategy is adopted for analysis of agriculture & allied sectors. Secondary data analysis methods are used to understand district-wise trends. FGDs and stakeholders' analysis coupled with surveys will help identify job trends.
7. Stakeholder interactions to understand economic and technological changes that are anticipated but may not show up quantitatively. Focus Group Discussions and structured interviews are tools that will be used for consultations with all stakeholders across the value-chain of the sector and the skilling/training process in that sector. This strategy informs us about new and evolving sectoral technologies; emerging job roles; upcoming job trends; identify changing skills needed for job roles; academia-industry partnerships; best practices; internships/apprenticeships; recruitment practices; upskilling/reskilling needs; and what firms are doing to encourage female workers or attract female workers, etc.

1. Introduction

1.1 Introduction

Demand for workers and therefore skills is an indirect demand. When there is demand for a particular good or service, demand for workers employed in that sector goes up along with the need for skills in that particular job role. The nature of skills evolves with technological changes in production. The type of goods & services in demand may itself change over time and therefore need for particular sets of workers may decline in some sectors and rise in another. One needs a dynamic approach to anticipate such rise and fall in the demand for workers, and therefore skills, in particular sectors.

While the Government of India has scaled up the supply-side eco-system, it has to match the demand-side. India needs a model on **'anticipating and adapting'** skills regularly at the national and sub-national level.[1] There is a need to understand what skills are in demand now and what will be needed in future to adapt our skilling eco-system accordingly. What are the core skills; what are transferrable skills and what skills need to be regularly updated?

In January 19, 2018, the Ministry of Skill Development & Entrepreneurship (MSDE), Government of India (GoI) had launched a World Bank-assisted programme – Skills Acquisition and Knowledge Awareness for Livelihood Promotion (SANKALP). The programme aims to improve short-term skill training qualitatively and quantitatively through strengthening institutions, bringing in better market connectivity and inclusion of marginalised sections of society. The key result areas (RA) under SANKALP are: institutional strengthening (RA1); enhancing market relevance and quality (RA2); and inclusion and access of marginalised communities (RA3).

In the rapidly changing world, it is vital to maintain an agile and responsive skill ecosystem. This requires continuous monitoring of global and local economic and job market trends to identify emerging industries, evolving job roles, and new skill requirements. The consistent evaluation of the emerging trends of the global and local economy and job markets can help in adopting better skill development initiatives to ensure that the workforce possesses the necessary skills to succeed in the dynamic labour market.

"A skill gap study is often the Achilles' heel of skilling efforts. Identifying these gaps is crucial for targeting training and educational programmes effectively. Challenges such as outdated data, regional disparities, the evolving technological landscape, and various economic factors underscore the need for a continuously evolving framework" (Tiwari, 2024).[2]

Assessing skill gaps has evolved over time in India. NSDC had conducted sector-wise skill gap studies for 19 high priority sectors in 2008–09.[3] In 2012, the National Skills Development Corporation, in partnership with KPMG, had carried out detailed assessment for human resource and skill requirements in 25 sectors and key States. The mandate included sector and sub-sector level analysis; demand-supply

[1]National Council of Applied Economic Research (NCAER). 2018. Skilling India: No Time to Lose. https://ncaer.org/publication/skilling-india-no-time-to-lose/. New Delhi, India.

[2]Tiwari, A.K. 2024. National Skill Gap Study for High Growth Sectors. Inaugural Speech. July 19.

[3]National Skills Development Corporation website. https://nsdcindia.org/nsdcreports.

projection; estimation of incremental man-power requirement between 2013–2017 and 2017–2022; identification of key-employment clusters; and Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis of each sector. The pandemic would have affected all forecasts.

This was followed by skilled gap assessments by States and other sectors later.[4] MSDE (2021) did a study on assessment and anticipation of current and future skill requirement in the Indian manufacturing sector. NSDC also had carried out assessments in 2022. ASDC and EY carried out an assessment for the auto sector in 2022 and forecast requirements for 2026.[5] The NASSCOM and RASCI have also carried out human skill requirement studies for the IT and retail sectors, respectively.[6]

The difference between 2012 assessments and the current round of assessments starting 2021 was that each study was carried out using a different methodology, making it challenging for the policymaker to have a holistic view on assessing skills demand. Moreover, it is ambiguous what were measured by each of these studies and whether they were in line with what the policymakers want. Further, while individual sectors are able to make forecasts for their sectors, there are occupations that are in demand across sectors. It is necessary to capture those changes. Plus, given the rapid technological changes, one is not sure how long will these forecasts hold, if at all.

This document contributes towards developing a single methodology which will help assess skills shortage and gap across sectors.

1.2 Objectives of the Study

The specific objective of this project is to develop a prototype for 'anticipating and adapting' skills at the national level, essentially a labour market information system (LMIS) at the national level which will assess current skill shortages and anticipate future skills. The prototype will provide a dynamic framework for skill demand assessment that can be regularly updated in alignment with the emerging needs of the economy. Further, the prototype can be replicated at sub-national and sectoral levels.
The specific objectives of the study include:

1. To identify 7 high growth potential sectors.
2. To analyse industry feedback on identifying industry-specific key skill (cognitive, socio-emotional, technical & vocational, and knowledge) requirements in the 7 identified industries.
3. To map the key job roles/ professions and geographic clusters aligned with the 7 selected sectors along with the qualification and skill requirements associated with these job roles and provide estimates of current employment.
4. To identify the existing and potential job roles for enhancing female workforce participation in the seven identified sectors.
5. To provide projections and forecasts of future skill needs for the 7 selected sectors for a period of 3 years based on anticipated changes in the labour market, technological advancements, and industry trends at the national and international levels.
6. To provide a framework for regular updation of demand assessment results at predefined intervals to provide continuous insights for skill planning for the selected seven sectors.
7. To provide detailed methodology for undertaking skill demand assessment at the sectoral level as also guidelines / methodology for undertaking similar assessments at the state level.

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[4]Ministry of Skill Development and Entrepreneurship. 2021. "Skill Assessment and Anticipation Study: Manufacturing Sector". https://www.msde.gov.in/sites/default/files/2021-06/FINAL%20-%20MSDE%27s%20Skill%20Assessment%20and%20Anticipation%20Study%20Report.pdf. New Delhi.

[5]Automotive Skills Development Council and EY. 2022. Human Resource and Skill Requirements in the Auto and Auto Components Sector in (2026). https://skillsip.nsdcindia.org/sites/default/files/kps-document/skillreqinautomotivesector.pdf. New Delhi.

[6]NASSCOM, Indeed.com and Draup. 2023. India Tech Industry Demand and Supply Analysis 2023. https://nasscom.in/knowledge-center/publications/india-tech-industry-digital-talent-demand-and-supply-2023. March 2.
Wazir Advisors and Retailers Association's Skill Council of India. 2024. Mapping of Employment Scope & Skill Gaps in Retail till FY26. https://www.rasci.in/pdf/RASCI%20Skill%20Gap%20Report%20upto%202026.pdf. Mumbai, India.

8. To seek recommendations for improving the design and effectiveness of the skill programmes.
9. To provide policy recommendations to address systemic issues contributing to skill gaps.
10. To provide recommendations to MSDE on enhancing skill training programmes, curriculum development, and skill initiatives to align them with the identified skill gaps; sector-wise upskilling or reskilling initiatives; apprenticeships, vocational training, or on-the-job training; areas of collaboration with industry including opportunities for establishing partnerships; industry-led training programmes, internships, or mentorship programmes to bridge the gap between industry needs and the skills possessed by the workforce.

1.3 Literature Review

The 2015 Policy of the Ministry of Skill Development and Entrepreneurship notes, "our country presently faces a dual challenge of paucity of highly trained workforce, as well as non-employability of large sections of the conventionally educated youth, who possess little or no job skills."[7]

1.3.1 Skill Mismatches

India has skilling, upskilling & reskilling challenges. Green (2013) points out that mismatches between supply and demand occur due to imperfect adjustments, whether through prices or quantities.[8] The potential consequences of a mismatch are lost productivity, lower pay and reduced well-being. Mismatches can be of various types and can occur due to a variety of reasons (Box 1.1). In this research work, the focus is on skills shortage. The objective is to develop a labour market information system (LMIS) model for India, which can assess and anticipate skills shortage and eliminate or minimise any present/future skills shortage.

How is skill gaps/mismatch measured? It is still a new and evolving topic. Skill mismatch can exist both at the macro and micro level (Pellizzari and Fichen 2017).[9] Pellizzari and Fichen describe macro mismatch as "aggregate mismatch as the existence of an allocation of workers to jobs that could improve the realized equilibrium in terms of either employment levels or output. The same definition could be applied to other (or multiple) dimensions of heterogeneity, such as workers' skills and jobs' requirements. It is the concept of an aggregate notion of mismatch which is a feature of the joint distribution of workers' and jobs' characteristics." In macro, one is modeling skills shortage. Skills shortage is a macro term (Box 1.1).

Box 1.1: Types of Mismatches

Skills Shortage describes the situation where a job vacancy is hard to fill because of a lack of applications with the needed skills.

A skill gap occurs where an employee's competence to do the job is called into question (typically by his/her manager).

Skills underutilisation occurs when a worker has work-related skills not used (or used at too low a level) in the job.

Unemployment occurs where workings are not employed yet available and looking for a job, indicating that all their skills are unused.

Workers' training barriers occurs when individuals are unable to form and achieve a demand for learning that would be best for them, given their circumstances, e.g. lack of information, lack of access to credit, etc.

Employer training barriers occurs when employers lack sufficient information or capacity to assess the benefits of training for their organisation or if external providers are unavailable.

Source: Green, F. 2013. Skills and Skilled Work: An Economic and Social Analysis. Pages: 31-32. Oxford University Press, United Kingdom.

[7]Ministry of Skill Development and Entrepreneurship (MSDE). 2015. National Policy for Skill Development and Entrepreneurship 2015. http://www.msde.gov.in/National-Policy-2015.html.

[8]Green, F. 2013. Skills and Skilled Work: An Economic and Social Analysis. Oxford University Press, United Kingdom.

[9]Pellizzari, M., Fichen, A. 2017. A new measure of skill mismatch: theory and evidence from PIAAC. *IZA J Labor Econ* 6, 1. https://doi.org/10.1186/s40172-016-0051-y.

The micro definition of skill mismatch "is constructed by comparing the skills (or qualifications) of an employed worker with the skill (or qualification) requirements of her job (hence, the non-employed and vacancies are completely disregarded). In the micro concept, one is assessing skill gaps. Then, any given job-worker pair can be classified as a good match if the skills (or qualifications) of the employee are compatible with the requirements of the job. If the worker is more skilled (or qualified) than required, she is classified as over-skilled (over-qualified) and under-skilled (or under-qualified) in the opposite case" (Pillizzari and Fichen, 2017). For measuring the micro mismatch, there is need to conduct employer-employee studies. Skills can be measured by education or actual skills of workers. There is a substantial literature which shows skills as a better measure of human capital than education (Hanushek and Woessmann, 2008 and Hanushek, 2013).[10]

There are various indicators of skill mismatch/ gap (Green 2013; pp. 52).[11]

1. "*Perceived under-utilisation: Skills under-utilisation".*
2. "*Difference between highest education required and completed: This measures over-education/under-education and education-subject mismatch"*.
3. "*Managers' assessment of employees' competence to measure skill gaps"*.
4. "*Hard-to-fill vacancies for skills reasons: This measures skill shortages"*.
5. "*Unemployment and indicators of discrimination, lack of capacity, and self-esteem: These measures learning barriers"*.
6. "*Absence of formal training needs analysis; perceived lack of information training/ capacity measures employer training barriers"*.
7. "*Benchmarking against other similar countries/regions: This measures skill deficit"*.

1.3.2 International Evidence on Labour Market Information System

Anticipating and building skills for the future are essential in rapidly changing markets. The International Labour Organization (ILO), Organisation for Economic Co-operation and Development (OECD), European Centre for the Development of Vocational Training (CEDEFOP), and European Training Foundation (ETF) conducted a joint survey on governance mechanisms and institutional frameworks that steered relevance of training provisions to the labour market needs in over 60 countries in 2017.[12] The survey was conducted among key stakeholders in skill governance: ministries of labour and of education, worker unions and employer associations. This report collates empirical evidence generated through the survey. Skill anticipation relies on various methods that collate and summarise labour market information (LMI) to analyse skill shortages and labour market imbalances. They are often forward-looking and can be combined to provide a more detailed and multifaceted picture of the labour market.

ILO, OECD, CEDEFOP and ETF (2017) document the various instruments, data sources and surveys that are used for LMIS. The report also documents the best practices of countries like the Netherlands (Box 1.2).[13] There are many methods to do this including qualitative

[10]Hanushek, E.A. 2013. "Economic Growth in Developing Countries: The Role of Human Capital". *Economics of Education Review*. 37: 204–212.

Hanushek, E.A. and L. Woessmann. 2008. "The Role of Cognitive Skills in Economic Development". *Journal of Economic Literature*, 46(3): 607–668.

[11]Green, F. 2013. Skills and Skilled Work: An Economic and Social Analysis. Oxford University Press, United Kingdom.

[12]International Labour Organization (ILO), the Organisation for Economic Co-operation and Development (OECD), the European Centre for the Development of Vocational Training (CEDEFOP), and the European Training Foundation (ETF). 2017. Skill Needs Anticipation: Systems and Approaches: Analysis of stakeholder survey on skill needs assessment and anticipation. https://www.cedefop.europa.eu/files/2223_en.pdf. ILO, Geneva.

[13]International Labour Organization (ILO), the Organisation for Economic Co-operation and Development (OECD), the European Centre for the Development of Vocational Training (CEDEFOP), and the European Training Foundation (ETF). 2017. Skill Needs Anticipation: Systems and Approaches: Analysis of stakeholder survey on skill needs assessment and anticipation. https://www.cedefop.europa.eu/files/2223_en.pdf. ILO, Geneva.

methods, sector studies, employer-employee surveys, enterprise surveys, quantitative forecasting models, graduate surveys/tracer studies and vacancy surveys. Data can be collected also in myriad ways. Analysis can be done using formal, national level, quantitative model-based projections using econometric techniques or computable general equilibrium or similar models or partial quantitative-based projections. Sectoral-based models can also be done. Foresight methods includes focus groups/roundtable, Delphi style methods, scenario development analysis, sectoral/ occupational/regional (sub-national) studies and/or Observatories (using both quantitative and qualitative evidence).

Box 1.2: LMIS in Netherlands

Skills assessment in the Netherlands includes various instruments and data sources, some based on surveys from statistical offices.

- Regular surveys are conducted with graduates entering the labour market.
- Administrative data from Public Employment Services, education ministry and social security insurance contributions.
- Various bodies and skills councils contribute qualitative (and additional quantitative) material to help understand detailed problems.
- Long and medium-term forecasting models assess skills imbalances by detailed occupation and qualification (combination of field and level) using survey data.
- There are also tracer studies of all major training programmes that elicit school-to-work transitions from recent graduates (one to two years after graduation).
- Several sector studies are also conducted within the same organisation.
- The PES generates several short-term specific labour market forecasts and analyses, including of vacancies.
- Within sector councils, ministries and tripartite policy groups, labour market or education and training system responses are discussed and incorporated into recommendations.

Source: International Labour Organization (ILO), the Organisation for Economic Co-operation and Development (OECD), the European Centre for the Development of Vocational Training (CEDEFOP), and the European Training Foundation (ETF). 2017. Skill Needs Anticipation: Systems and Approaches: Analysis of stakeholder survey on skill needs assessment and anticipation. https://www.cedefop.europa.eu/files/2223_en.pdf. ILO, Geneva.

The Bureau of Labour Statistics has one of the most sophisticated LMI systems. It is dynamic and online. https://www.onetonline.org/. The O*NET Programme is the nation's primary source of occupational information. Valid data are essential to understanding the rapidly changing nature of work and how it impacts the workforce and U.S. economy. From this information, applications are developed to facilitate the development and maintenance of a skilled workforce. Table 1.1 shows examples of various national and regional taxonomies (at the end of the chapter).

The Content Model is the conceptual foundation of O*NET. The Content Model provides a framework that identifies the most important types of information about work and integrates them into a theoretically and empirically sound system. The Content Model was developed using research on job and organisational analysis. It embodies a view that reflects the character of occupations (via job-oriented descriptors) and people (via worker-oriented descriptors). The Content Model also allows occupational information to be applied across jobs, sectors, or industries (cross-occupational descriptors)

and within occupations (occupational-specific descriptors). These descriptors are organized into seven major domains, which enable the user to focus on areas of information that specify the key attributes and characteristics of workers and occupations.

1.4 Definitions

"Skills are personal qualities with three key features – (i) productive: using skills at work are productive of value; (ii) expandable: skills are enhanced by training and development and; (iii) social: skills are socially determined" (Green, 2013; pp. 10).[14] NCAER (2018) delineated three types of skills and they are:[15]

- **Cognitive skills** are basic skills of literacy and numeracy, applied knowledge and problem-solving aptitudes and higher-order skills such as experimentation, reasoning and creativity.
- **Technical and vocational skills** are the physical and mental ability to perform specific tasks using tools and methods in any occupation.
- **Social and behavioural skills** include working well with others, communicating and listening well, and being agreeable, and outgoing.

The detailed list of skills is shown in Table 1.2. (at the end of this chapter). The study develops methodology to assess skills shortage at sectoral level and skill gap at the worker level in a particular sector.

Skills shortage describes the situation where a job vacancy is hard to fill because of a lack of applications with the needed skills.[16] For example, one is looking for accountants but is unable to find any with the appropriate degree, qualifications, experiences and skills.

A skill gap occurs where an employee's competence to do the job is called into question (typically by his/her manager).[17] For example, one is looking for accountants and find several with the appropriate degree & qualifications but not the appropriate skill set.

1.5 Objectives

The objective is to assess skill shortages and gaps. Given that 46 per cent of the workers in India were still employed in the agriculture & allied sector in 2023–24, one cannot use the standard international methods to analyse this work.[18] Further unlike the United States model, the O*NET, India cannot afford to ignore the self-employed workers or the unincorporated enterprises.[19] In 2023–24, 39 per cent of workers were self-employed in India with only three per cent as employers.[20]

India collects and publishes vast data – national accounts, household survey, and enterprise data for both organised and unorganised sectors. However, organised data are only collected for the manufacturing sector. Further, there are administrative data across various ministries.

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[14]Green, F. 2013. Skills and Skilled Work: An Economic and Social Analysis. Oxford University Press, United Kingdom.

[15]NCAER. 2018. Skilling India: No time to lose. http://www.ncaer.org/publication_details.php?pID=300, New Delhi, India.

[16]Green, F. 2013. Skills and Skilled Work: An Economic and Social Analysis. Oxford University Press, United Kingdom.

[17]Ibid.

[18]MoSPI, Government of India. 2024b. INDIA-Periodic Labour Force Survey (PLFS), July, 2022 - June,2023. https://microdata.gov.in/nada43/index.php/catalog/210/related_materials. November 8.

[19]"The Occupational Employment and Wage Statistics (OEWS) program of the Bureau of Labour Statistics Department, United States produces employment and wage estimates for approximately 830 occupations based on a survey of business establishments (employers). The OEWS survey covers wage and salary workers in nonfarm establishments and does not include the self-employed, owners and partners in unincorporated firms, household workers, or unpaid family workers."

BLS website. https://www.bls.gov/oes/oes_emp.htm.

[20]MoSPI, Government of India. 2024b. INDIA - Periodic Labour Force Survey (PLFS), July, 2022-June,2023. https://microdata.gov.in/nada43/index.php/catalog/210/related_materials. November 8.

Ideally, to assess skill shortages and gaps, India should have started with occupational wage employment survey of pre-identified occupations across sectors. The Labour Bureau under the Ministry of Labour and Employment does conduct occupational wage surveys on a periodic basis but the associated employment & skills data are not available.[21] Even the wage data are not available spatially. Unit level data are also not available for further analysis.

Given the data constraints and a lack of theoretical construct, the Centre has to design the exercise, which will be implemented in coordination with States and Sector Skill Councils.

In order to assess skill shortages and gaps in the short-run (less than one year), medium-run (3 to 5 years) and long-run (more than 15 years), what does India need to do? Looking at international literature, India needs to adopt multiple methodologies to understand both the on-going & anticipated changes and challenges. The methodology consists of seven components to assess skills shortages and skills gaps. The Centre and States have to work in a collaborative manner for a holistic assessment.

The seven components are:

1. Macro Analysis of Sectoral Shares of Gross Value Added (GVA) and Workforce; Identification of Geographical Clusters; and Sectoral Workforce Characteristics using secondary data.
2. Simulations to forecast jobs and opportunities. This may be implemented both at the Central and State levels. NCAER has used input-output analysis to understand occupational trends.
3. Demand projections of jobs of non-agricultural sectors using occupational-wage employment survey (OWES) of non-agricultural enterprises. The OWES will be a detailed database of selected occupations which will give wages rates, number of workers, gender, other social background characteristics, qualifications and skills across geographies. The data will be representative at the district level.
4. Assess skill shortages and gaps of non-agricultural sectors using survey of non-agricultural firms for data on vacancies and skills: Vacancy rates across sectors needs to be estimated along with identification of occupations and associated qualifications that are vacant for more than a defined period of time.
5. Analysis of jobs in sub-sectors of non-agricultural sectors using big data methodologies. Analysis of job roles being advertised across web will inform about the real-time trends on the demand-side especially sub-sectoral trends and differences across geographies.
6. District-level analysis of jobs in the agriculture & allied sectors. A bottom-up strategy is adopted for analysis of agriculture & allied sectors. Secondary data analysis methods are used to understand district-wise trends. FGDs and stakeholders' analysis coupled with surveys will help identify job trends.
7. Stakeholder interactions to understand economic and technological changes that are anticipated but may not show up quantitatively. Focus Group Discussions and structured interviews are tools that will be used for consultations with all stakeholders across the value-chain of the sector and the skilling/training process in that sector. This strategy informs us about new and evolving sectoral technologies; emerging job roles; upcoming job trends; identify changing skills needed for job roles; academia-industry partnerships; best practices; internships/ apprenticeships; recruitment practices; upskilling/reskilling needs; and what firms are doing to encourage female workers or attract female workers, etc.

The Standard Operation Procedures for Central, State, and Sector Skill Councils are delineated in second, third and fourth chapters. At the end, the summary is presented.

[21]Labour Bureau website. https://www.labourbureau.gov.in/occupational-wage-survey.

Table 1.1 Examples of National and Regional Taxonomies

	Occupational Information Network (O*NET)	European Skills, Competencies, Qualifications and Occupations (ESCO)	UK Skills Taxonomy	Singapore Skills Taxonomy (SST)	Australian Skills Classification (ASC)	Canada Skills and Competency Taxonomy
Approach	Quantitative and Qualitative	Quantitative and Qualitative	Quantitative (Data driven)	Quantitative and Qualitative	Quantitative and Qualitative	Quantitative and Qualitative
Data source	Analysts' input; Surveys to job incumbents and employers	Collaboration between sectoral and occupational experts, review of existing classifications and qualifications, desk research by main trend by sector, job adverts and CVs	Online job adverts in the UK	Collaboration between stakeholders from various sectors on vision, transformation, occupation and skill needs, education institutions, unions and Government In progress Development of Job Skills Repository using data from foresight exercises, online job adverts and CVs, census, Skills Frameworks, training consumption and supply data	O*NET; Australian Employability Skills Framework; Employer surveys; Job adverts; Education and training course documentation	Career handbook, Skills and Knowledge Checklist, Essential Skills profiles, O*NET, Stakeholder consultations; Surveys to job incumbents and employers; Online job adverts
Developer / Owner	US Bureau of Labor Statistics	European Commission, DG EMPL	Nesta (Private company)	SkillsFuture Singapore	National Skills Commission	Employment and Social Development Canada
Granularity	1016 occupations, 177 elements covering skills, knowledge, abilities, work activities and work styles, and around 18,000 tasks	3008 occupations, 13,890 skills/ competence, knowledge	41 million adverts, 10,500 skills	1,692 occupations, 10,000 skills (Critical core skills, Technical skills and competencies)	857 occupations, 10 core competencies, 2,136 specialist tasks and 70 technology tools	900 occupations, around 250 elements covering skills, abilities, attributes, knowledge, interests, work context, work activities and tools and technologies.
Structure	6 domains (occupation-specific information, occupational requirements, workforce characteristics, experience requirements, worker requirements, worker characteristics)	3 pillars (occupations, skills/ competence, qualifications)	4 layers (Broad clusters, skills groups, skills clusters, and unique skills)	5 layers (Level 1-4 clusters, branching out to "unique skills")	3 layers (Cluster family, Cluster, task)	8 domains (Skills, Abilities, Personal attributes, Knowledge, Interests, Work context, Work activities, Tools and technologies)

(*Contd.*)

Table 1.1: (Contd.)

	Occupational Information Network (O*NET)	European Skills, Competencies, Qualifications and Occupations (ESCO)	UK Skills Taxonomy	Singapore Skills Taxonomy (SST)	Australian Skills Classification (ASC)	Canada Skills and Competency Taxonomy
Skills "level" rating (i.e. What level of skill is required for an occupation)	Level (1-7)	N/A	N/A	Technical skills and competencies (Proficiency Level 1-6) Critical core skills (Basic, Intermediate, Advanced)	Scale of 1-10 and respective 3 levels (Basic 1—3, Intermediate 4-6 and High 8-9)	Currently being
Link with qualifications	No direct link	Yes (to rely on Europass for information at the EU level, pilot project in 2019 of linking learning outcomes of qualifications with skills)	No direct link	Yes in terms of levels (Technical skill levels correspond to Singaporean qualification levels)	No direct link	No direct link
Data dissemination	Website (Interactive interface, Excel format, API)	Website (Hierarchical structure, API)	Website (Interactive interface)	Website (Interactive interface) By industry, sector information, career pathways, occupation and job roles, existing and emerging skills, training programmes for skills upgrading and mastery	Website (Interactive interface, Excel format)	Forthcoming Website (Interactive interface)
Updates	Regularly	Regularly	Ad-hoc	Regularly	Regularly	N/A
Cost implications	High	High	Low	High	High	High

Source: Directly sourced from ILO and OECD. 2023. "Global skills gaps measurement and monitoring: Towards a collaborative framework". Technical paper prepared for the 1st meeting of the Employment Working Group under Indian presidency. https://labour.gov.in/sites/default/files/iloissaoecd_global_skills_gaps_measurement_and_monitoring.pdf. January.

Table 1.2 List of Skills

Foundational Cognitive Skills	Advanced Cognitive Skills	Foundational socio-emotional Skills	Advanced socio-emotional skills	Knowledge	Sector/Job-specific Skills
Reading Literacy	Learning Strategies	Civic and Digital Citizenship	Instructing	General	Occupational
Writing	Critical Thinking	Seek and Value Diversity	Negotiation	Sectoral	Technical
Speaking	Creativity	Conscientiousness (including attitude towards work)	Persuasion		Innovation
Communication	Independent research	Openness to Experiences			Physical
Language Skills 1	Judgement and Decision-making	Extraversion			
Language Skills 2	Systems Analysis	Agreeableness			
Numeracy/ Mathematics	Systems Evaluation	Neuroticism/ Emotional stability			
ICT Literacy to Skills	Financial Resources	Social Skills at Work			
Self-learning to Active (Independent) Learning	Material Resources				
Active Listening	Personnel Resources				
Science	Time Management				
Problem Solving					

Source: Bhandari, B. 2021. "Policy for the Full Range of Employability Skills". NCAER Working Paper No. 123. https://www.ncaer.org/wp-content/uploads/2022/09/1623156388WP-123_NCAER_Skill_Working_Paper.pdf. NCAER, New Delhi, India.

2. Standard Operating Procedures for the Central Government

2.1 Introduction

The Central Government has to provide the overarching design to assess skill shortages and gaps. The focus here is on assessing demand of skills.[1] The design for assessing demand for skills and assess skills shortage & gaps is driven by seven components, six of them designed by the Centre and are listed below:

1. Macro-analysis of sectoral shares of GVA and workforce, identification of geographical clusters and sectoral workforce characteristics at the All-India and State levels.
2. Simulations to forecast jobs and opportunities.
3. Demand projections of jobs of non-agricultural sectors using occupational-wage employment survey of non-agricultural enterprises:
    a. Design of questionnaires, sampling strategy based on universal company data sourced from Ministry of Corporate Affairs (MCA).
4. Assess skill shortages and gaps in non-agricultural sectors using survey of non-agricultural firms for data on vacancies and skills:
    a. Design of questionnaires and sampling strategy.
5. District-level analyses of jobs in agriculture & allied sectors:
    a. Create surveys and conduct Focus Group Discussions (FGDs) of farms, cooperatives and other stakeholders.
6. Stakeholder interactions.

Data for the analysis and design will come from available databases. It is important to use publicly available, verifiable and credible data sources.

- The key Ministry of Statistics and Programme Implementation (MoSPI) publications include Periodic Labour Force Survey (PLFS), Annual Survey of Industries (ASI), Annual Survey of Unincorporated Sector Enterprises (ASUSE) and Situation Assessment of Farmers.
- Publications by Central Ministries may be used to substantiate MoSPI data, for example, Agriculture Census, Handloom Census, Animal Husbandry Statistics and Livestock Census.
- Annual Reports of Ministries.
- States' statistical publications.

The focus of all the components is job/role occupation within specific industries. Therefore, the analysis starts from that point of identifying industries, occupations within those industries and occupations across industries.

2.2 Identification of Sectors (Industries) and Occupations

Step 2.2.1: Map the Sectors (industries)

Use the National Industry Classification (NIC)[2] codes to map the industries. The NIC codes go

[1]The supply-side estimates have to come from household surveys, training information and aspirations demand. Typically, many focus on one or the other. However, then these estimates will give biased results.

[2]"The National Industrial Classification (NIC) is an essential statistical standard for developing and maintaining comparable data base according to economic activities. Such classifications are frequently used in classifying the economically active population, statistics of industrial production and distribution, the different fields of labour statistics and other economic data such as national income. Comparability of statistics available from various sources, on different aspects of the economy, and usability of such data for economic analysis, are prerequisite for standardization of a system of classification."

Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India. National Industrial Classification 2008. https://www.ncs.gov.in/Documents/NIC_Sector.pdf.

from 2-digit to 5-digit depending on the level of disaggregation.

MoSPI also publishes supply-use tables.[3] It uses the NIC codes to publish data for 64 sectors. However, the National Accounts Statistics (NAS) published by MoSPI gives data for more sectors.[4] These sectors are combinations at various digits of NIC and the sectors from each analysis may not match. Therefore, it is important to identify sectors at the desired level of aggregation that will be used for analysis.

Further, the NIC classifications may not explicitly capture modern sub-sectors such as renewable energy, information technology and technical textiles. The key message is that the NIC codes have to be disaggregated further into sub-sectors. These sub-sectors are recommended to be periodically updated.[5] The economic classifications (NIC) and sectoral classifications have to be able to talk to each other. This will enable the policymaker/s to track sectors and sub-sectors at the desired level of aggregation. A few examples are given below:

- The wind energy sector is a new and upcoming sector in India, but it is not captured separately. NIC code 35106 captures electric power generation using other non-conventional sources and the wind energy sector is subsumed under this.
- The Information Technology (IT) sector has only NIC code, 6201, for 'computer programming activities. But IT has several sub-sectors—IT Services (ITS), Business Process Management (BPM), Engineering and Research & Development (Er&D), Software Products (SPD), Future Skills, etc.
- A new emerging area in 'weaving, manufacturing of man-made fiber and man-made mixture fabrics' (NIC code 13124) is the technical textiles sector. It can be produced using either powerloom or shuttle-less technologies, which may require new job roles.

Step 2.2.2: Map the Occupations

The National Classification of Occupations (NCO) 2015 is the key starting point for this exercise.[6]

Step 2.2.2.1: Update mapping of NCO-2015 job roles with job roles identified by the Sector Skill Councils (SSCs).

Due to technological changes, new job roles have emerged and some would have become obsolete. It is important to update the mapping of the occupations given in the NCO-2015 with the occupations identified by the Sector Skills Councils. It is important to codify these job roles appropriately at all levels of NCO-2015.[7]

Step 2.2.2.2: Of the 3,600 occupations identified in NCO-2015 and those new ones that will be identified in the previous stage, one needs to select occupations that will be used

[3]A supply and use table (SUT) is a statistical model that shows how an economy produces and uses goods and services. SUTs are a key part of national accounting systems.

[4]The latest National Accounts 2024 are available here: https://www.mospi.gov.in/publication/national-accounts-statistics-2024.

[5]It is recommended that these sub-sectors are evaluated annually in case new ones need to be created and older ones retired.

[6]"The NCO-2015 is a compendium for occupational information available in the Indian economy. The document gives an insight into the occupational framework, nature of duties involved and the level of skill requirement to perform the activities in a real-time work situation. The NCO -2015 has also been mapped with the National Industrial Classification (NIC) and Qualification Packs National Occupational Standards (QP-NOS) to cater to the structural changes in the labour market. The current volume of NCO details out the job description of 3,600 civilian occupations covering 52 sectors."

National Career Services. 2016. National Classification of Occupations 2015. https://www.ncs.gov.in/Documents/National%20Classification%20of%20Occupations%20_Vol%20I-%202015.pdf. Directorate General of Employment, Ministry of Labour and Employment, Government of India, New Delhi.

[7]"The NCO-2015 has 8-digit coding structure which was mapped and aligned to ISCO-2008 with the addition of 2 digits. There is one to one correspondence between ISCO-2008 and the NCO-2015 with the first digit representing the Division (Major Group), second digit representing Sub-Division (Sub-Major Group), third digit representing the Group (Minor Group) and the fourth digit representing the Family (Unit Group), a decimal is introduced after the first four digits in order to create a distinction between the Families and individual Occupations."

National Career Services. 2016. National Classification of Occupations 2015. https://www.ncs.gov.in/Documents/National%20Classification%20of%20Occupations%20_Vol%20I-%202015.pdf. Directorate General of Employment, Ministry of Labour and Employment, Government of India, New Delhi.

for analysis for all the components of assessing skills shortages and gaps by all stakeholders – Central, State and sectors. For example, as Table 1.1 shows, the US is tracking 1,016 occupations. These selections need to be updated on a periodic basis.

Step 2.2.2.3: The selected occupations will be tracked at the 3-digit and 8-digit levels.

- The 3-digit-level occupations will be used in macro analysis & simulations since the Periodic Labour Force Survey, the national household survey data, tracks data at the 3-digit NCO-2015 level.

- The 8-digit-level occupations will be used in demand projections using the occupational wage employment survey.

2.3 Macro Analysis of Sectoral Shares of Gross Value Added (GVA) and Workforce, Identification of Geographical Clusters and, Sectoral Workforce Characteristics

The macro analysis estimates the contribution of the sector (or sectors) to GVA and employment. The analysis is divided into four sections: (a) calculation of the sector's share in GVA and employment, (b) identification of value-chain of sector, (c) identification of geographical clusters, and (d) sectoral workforce characteristics."

A. Calculate sectoral shares in GVA and workforce

Step 2.3.1: Conduct macroeconomic analysis

The macroeconomic analysis is done in three stages.

Step 2.3.1.1 Compute the sectoral shares of GVA and workers contribution across NICs. One can do it either using the 64 sectors identified in the supply-use tables or the sectors identified by NAS. NCAER used the 64 sectors as a starting point.

For the same years and the same sectors, compute the sectoral shares of GDP and workers using these formulas.

a. To compute the sectoral share of GVA,

$$Sectoral\ Share\ (\%) of GVA = 100 \times \frac{Nominal\ Sectoral\ GVA\ in\ a\ particular\ year}{Nominal\ All-India\ GVA\ in\ a\ particular\ year}$$

b. To compute the sectoral share of the workers, use data from the annual Periodic Labour Force Survey.

$$Sectoral\ Share\ (\%) of\ workers = 100 \times \frac{No.\ of\ workers\ employed\ in\ a\ sector\ in\ a\ particular\ year}{All-India\ workers\ employed\ in\ a\ particular\ year}$$

Step 2.3.1.2 Use input-output analysis to assess which sectors have the highest interlinkages with the rest of the economy either through output, income or employment.

Compute the income, output and employment multipliers using input-output analysis.

- An income multiplier is the total income generated in the economy due to one unit of output generated in the sector. Income is measured by the Gross Value Added (GVA). GVA is the value of all final goods and services produced in a in a given accounting period.
- An output multiplier is the total output generated in the economy due to one unit of output generated in the sector. Output in an economy is measured by the Gross Value of Output (GVO). GVO is a measure of the value of production of new goods and services during an accounting period. It represents the total value of sales by producing enterprises (their gross revenue or turnover) in an accounting period, before subtracting the value of intermediate goods used up in production from the value of sales.
- An employment multiplier is the total direct and indirect employment generated in the economy due to change in one unit of final demand in that sector.

Input-output analysis, which was invented by Wassily W. Leontief in 1951, is used to compute interdependencies. No sector is stand-alone in the economy; all sectors are inter-dependent. This methodology captures the interlinkages and indirect jobs created across the economy due to output change in a particular sector. Therefore, this is a better measure than just estimating the direct impact. Use the national input-output tables, which are derived from the Supply-Use Tables (SUTs) produced by MoSPI, at that level of aggregation. Chaudhary, Pratap, and Pohit (2024) have converted the supply-use tables into input-output tables for 2018–19, which were used by NCAER to illustrate the concept.[8]

Step 2.3.1.3 Select the Sectors (industries)

Ideally, all sectors should be analysed. However, if the choice is to carry out the analysis for selected sectors, follow the following selection process may be adopted.

a. Rank sectors based on share of GDP

b. Rank sectors based on sectoral share of workers

c. Estimate and then rank the income and employment multipliers. If input-output analysis cannot be implemented, then skip this step.
   - If this step is skipped, it is recommended that one uses disaggregated sectors from NAS.
   - Other than the four variables mentioned above (shares of GDP, workers, income multiplier and employment multiplier) many other variables were also examined to support the analysis and give a holistic perspective. However, after a rigorous examination of feasibility, they were dropped because many of those would not be available at the State-level or sectors would not be 'consistently' measured. These variables were ten-year average share of Gross Value Added (GVA), ten-year average growth rate of GVA, ten-year average ratio of GVA to GVO, ten-year average growth of Gross Capital Formation (GCF), ten-year average share of GCF to GVA, ten-year average share of GCF to GVO, five-year average share of workers (Periodic Labour Force Survey is available from 2017–18 onwards on an annual basis), five-year average share of labour inputs to GVO, percentage share of female workers, average intensity of work (average hours worked in a week), auto-regressive integrated moving forecasting model, merchandise exports, service exports and foreign direct investment, (Department for Promotion of Industry and Internal Trade (DPIIT) and Reserve Bank of India (RBI)).
   - In the simplest case, four variables were used to select sectors - share of GDP, share of workers, income multiplier and employment multiplier.

d. There are four rankings for each sector (derived from steps a, b and c)

e. Choose sectors that appear in the top 25 lists of share of GVA, share of jobs, income multiplier and employment multiplier.

f. Identify sunrise/key future sectors from policy documents and map them to the sectors being used for analysis.

g. Integrate steps e and f to identify sectors.

   - One can also select sectors such that there is equal representation across primary, secondary and tertiary sectors.[9]

[8]Chaudhary, C., Pratap, D., and Pohit, S. 2024. "Estimation of SAM for India: An Application for India's Energy Transition Targets". *Margin: The Journal of Applied Economic Research*. 18(1-2): 74–133. https://doi.org/10.1177/00252921241284278. NCAER, New Delhi, India.

[9]As per NAS, the sectoral definitions are:

Primary Sector: Agriculture, Livestock, Forestry & Fishing and Mining & Quarrying.

Secondary Sector: Manufacturing, Electricity, Gas, Water supply & Other Utility Services and Construction.

Tertiary Sector: Trade, Hotels, Transport, Communication and Services related to Broadcasting, Financial, Real Estate & Professional Services and Public Administration, Defence & Other Services.

h. Policymakers' inputs lead to the finalisation of the sectors.

i. The sectors may be further disaggregated.

For example, in the NCAER analysis, seven sectors were selected through this process-agriculture, livestock, trade, computer-related services, manufacturing of textiles plus cotton ginning, manufacturing of transport and electricity. Then these sectors were deemed as too broad for assessment. Therefore, they were further sub-disaggregated. Those sub-sectors with the highest share of workers were selected for assessment. The final seven sectors selected were growing of cereals (including rice), leguminous crops and oil seeds, raising of cattle and buffaloes, retail sale of food, clothing, footwear and leather articles in specialised stores, computer programming activities, weaving of textiles, manufacturing of motor vehicles, manufacturing of parts & accessories of motor vehicles, maintenance & repair of motor vehicles and electric power generation using solar energy and electric power generation using other non-conventional sources.

B. Identify value-chains of (selected) sectors

The value chains of each of these sub-sectors need to be delineated.

C. Identify geographical clusters of sectors

There can be three types of sectoral clusters: primary, secondary, and tertiary. Further, it is recommended that clusters are defined in two ways: (i) as concentration of units, institutions etc. and (ii) as concentration of workers. This will also help in identifying spatial mismatch, if any

a. Primary Sector[10]

I. Agglomeration of institutional, business, human resources and government support: The framework to identify geographical clusters in the primary sector is adapted from Sutawi et al. (2022) and is shown in Figure 2.1.[11] See Annexures 2.2 and 2.3 for examples. The simplest and most replicable approach, the step-wise ranking method was used to identify clusters in primary sectors.

[10]Clusters are defined as non-random (Ellison and Glaeser, 1997) geographical agglomeration of firms with comparable or closely complementary capabilities (Richardson, 1972)[10]. Precisely, in the geographical concentration of enterprises, specific suppliers, service providers, associated institutions and organisations settled themselves in a certain arena that competes with each other but also co-operates themselves. The geographical proximity of units gives rise to specialised labour, develops subsidiary industries, stimulates state-of-the-art activity, and enables technological spillovers that makes the economic and non-economic inter-firm linkages feasible.

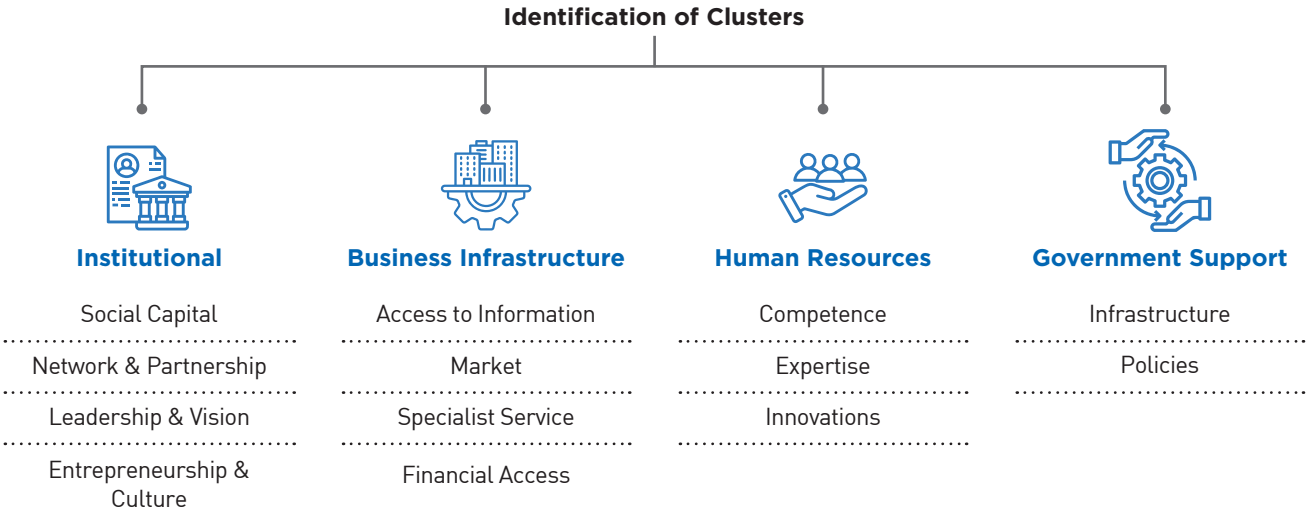
Annexure 2.1 shows different definitions and different ways of estimating agriculture & allied sectors' clusters. The one that is used here is the mentioned in the ToR – geographical clusters. Geographical clusters in India arise due to specific agro-ecological conditions and resource availability. For instance, the Western Ghats region hosts geographical clusters of spice cultivation, including pepper, cardamom, and cinnamon, owing to its tropical climate and hilly terrain.

Ellison, G., & Glaeser, E. L. 1997. "Geographic concentration in US manufacturing industries: a dartboard approach". Journal of Political Economy, 105(5): 889–927.

Richardson. G. B. 1972. "The Organisation of Industry". *The Economic Journal*, 82(327): 883–896. September.

[11]One recommendation was to take production as a variable. It is another way of defining clusters but it may give misleading results. Size of production in one State may be large because of its size but its productivity may be low. Therefore, it is recommended not to look at production as an indicator to measure clusters.

Figure 2.1 **Framework to Identify Agricultural Clusters**



Source: Adapted from Sutawi, Prihartini I., Zalizar L., Wahyudi A., Hendraningsih L. 2022. "The Success Indicators of a Dairy Farming Cluster in Indonesia: A Case in Malang Regency of East Java Province". Asian Journal of Dairy and Food Research. 41(1): 22-27. doi: 10.18805/ajdfr.DR-242.

II. Workforce Clusters: Analyse the distribution of workers across States using the PLFS for that specific sector/sub-sector using NIC codes.

b. Secondary Sector[12]

I. Agglomeration of manufacturing units: To calculate geographical clusters for secondary sectors, follow these steps:

- Count the number of plants across States to estimate clusters across NIC codes. Data may be sourced from both ASI, ASUSE, Central Electricity Authority, Sectoral Ministry data, NITI Aayog, etc.[13,14]

- One can also identify clusters across sub-sectors or stages of the value-chain using other data sources.

II. Workforce Clusters: Analyse the distribution of workers across States using the PLFS, ASI and ASUSE for that specific manufacturing sector/sub-sector using NIC codes. Only the PLFS data may be used for construction, electricity, gas, water supply & other Utility Services and construction sectors. The PLFS data may not be precise for the renewable energy sector and needs to be examined with caution.

c. Tertiary Sector

I. Agglomerations: The framework proposed in Figure 2.1 is used here. The examples below show how this was achieved in our case studies.

Examples

a. Specialised retail in food & clothing

Data on the number of units were used. This is available only for the unorganised sector in the ASUSE database. For the organised sector, memberships by State are taken from

[12]"Clusters are geographic concentrations of interconnected companies and institutions in a particular field", encompassing "an array of linked industries", including for instance "suppliers of specialised inputs such as components, machinery, and services, and providers of specialised infrastructure." (Porter 1998, p.78).

Porter 1998, Clusters and the New Economics of Competition, Harvard Business Review, November-December 1998. Available at: https://backonline.apswiss.ch/6001/porter_clusters_and_the_new_economics_of_competition.pdf

[13]Annexure 2.4 shows the data sources for estimating clusters in the 'weaving of textiles' sector.

[14]In the NCAER work for estimating geographical clusters for generation of solar and wind energy, State-level installed capacity of all renewable energy sources was arrived at by summing the installed capacity of NITI Aayog's plant-level data (as on 31st March 2024), which matches the State-wise installed capacity data released by the Ministry of New and Renewable Energy.

the Retailers Association of India. Finally, to measure innovation, one takes the data on number of start-ups from DPIIT.

b. Computer Programming Activities
There are four pillars – infrastructure, innovation, business environment, human resources (skills). A simple rank was computed for each indicator and then a step-wise average was computed resulting in a final averaging of all the rankings from each pillar. See Table 2.1.

Table 2.1 Geographical Cluster Framework for IT Sector

Pillar	Indicator	Source	Link	State	District
Infrastructure	Electricity Energy Sale for Commercial Purposes	Central Electricity Authority	https://cea.nic.in/dashboard/?lang=en	✓	X
	Teledensity	Telecom Regulatory Authority of India Performance Indicators/ Annual Report	(https://www.trai.gov.in/release-publication/reports/performance-indicators-reports)	✓	X
	Internet Density			✓	X
Innovation	No. of start-ups	DPIIT	https://www.startupindia.gov.in/digital-map/maps	✓	X
Business Environment	Number of STPs	STPI Annual Report	https://stpi.in/en/stpi-annual-reports	✓	X
Human Resources/Skills	No. of colleges specialising in engineering & technology	ASHIE	https://aishe.gov.in/aishe-final-report/	✓	X

Source: Author's conceptualisation from literature.

II. Workforce Clusters: Analyse the distribution of workers across States using the PLFS for that specific sector/sub-sector using NIC codes.

D. Analysis of Sectoral Workforce Characteristics

Conduct sector-wise time series analysis (5-10 years) of labour market characteristics for either all or selected sectors across the following categories using mainly PLFS.

a. Educational qualifications (general, technical & vocational education)
b. Engagement
c. Occupation (NCO 3-digit)
   - More detailed data are not available in PLFS
d. Gender of workers.

2.4 Simulations to Forecast Jobs and Occupations

Simulations can be used to forecast jobs and occupations by using input-output analysis. This is an optional step, but it captures the interlinkages across sectors and can show the direction a country is going towards. In contrast, a linear forecasting methodology may give biased results.

Example

Input-output analysis was used to project the total number of jobs in 2026–27 and the top 5 occupations that will find maximum employment. Base year numbers are derived from NAS and PLFS. National Accounts data (which gives disaggregated GVO data) are available until 2022–23.

Steps for projecting employment and occupation

1. Calculate GVO/Output multiplier
   i. Output generated in the entire economy due to one unit of output generated in the said sector.
   ii. 2018–19 I-O was used to estimate the output multiplier.
2. Calculate employment multiplier
   i. Number of (direct & indirect) jobs created in the entire economy due to one unit of output generated in the said sector.
   ii. 2018–19 output multiplier was multiplied with 2022–23 labour-output ratio to estimate the employment multiplier for 2022–23.
3. Use average annual growth rates to make forecasts.
   i. Make sectoral GVO growth assumptions based on past years' growth rates (this can be treated as the baseline).
   ii. Alternative growth scenarios may be developed.
   iii. Alternative growth assumptions may be made based on these alternative growth scenarios.

   Chaudhary, Pratap and Pohit (2024) use the alternative NITI Aayog assumptions to simulate the impact of net zero transition on employment.[15] Similarly, if assumptions, policy priorities, goals and targets have to be modelled for either all 64 or selected sectors, one can tentatively estimate both the overall & sectoral impact on jobs & occupations.
4. Estimate number of (direct & indirect) jobs.
5. Estimate jobs for the sub-sectors by taking the job shares of the sub-sectors in the main sectors.
   i. The same shares are used to estimate jobs for 2026–27.
   ii. Find the distribution across occupations of ONLY direct jobs based on share of occupations for the base year.
   iii. Using the same shares, projections for occupations may be done.

2.5 Demand Projections for Jobs in Non-agriculture Sectors using Occupation-Wage-Employment Survey (OWES)

The Ministry of Skill Development and Entrepreneurship (MSDE) and the Ministry of Labour and Employment (MoLE), along with MoSPI, should carry out an OWES survey.[16]

1. Occupations identified at the beginning of this exercise (step 2.1) should be followed over time.
   a. Start with the occupations already identified by the SSCs.
2. Design the sampling strategy. Firms should be sampled across size, ownership and region and sub-sectors.

Note:

a. The designations of respondents is critical and quality checks need to be maintained.
b. The MCA data has to be the universe because no other enterprise data are available.
c. The sectoral data and the estimates have to be representative across all-India, states, districts, urban, rural and Tier 1 cities.

3. The survey should capture the following details on the identified occupations

a. Job roles
b. Number of people employed
c. Wage rates across different geographies

[15]Chaudhuri, C., Pratap, D. & Pohit, S. 2024. "Effect of Energy Transition Under Net-Zero Target on Employment." *Ind. J. Labour Econ*. https://doi.org/10.1007/s41027-024-00528-y. November 30.

[16]The MoLE does conduct an occupational wage survey. However, it gives average wages for the sector instead of giving wages at the State and district level. This is important. Further, the occupations that are tracked should be in sync with the identified occupations in the first stage (2.1). Also, number of workers are not given. Lastly, occupations and skills required for that occupation are not identified.

d. Qualifications

e. Skills required

f. Technical skills

g. Anticipated demand for number of jobs in a particular job role.

Table 2.2 Representative Questions for OWES

Job Role	NCO/ NSQF Code	Stage of Value Chain	Tasks	Educational Qualifications sought by the firm	Knowledge (technical and theoretical knowledge relating to the job role)	Technical Skills (Computer applications and software)	Years of Experience	Skills (Full list of Skills-Annexure 2.3)	Geographic identifier

2.6 Assess Skill Shortages and Gaps in Non-agriculture Sectors using Vacancy Data

The Centre should design a sampling strategy and questionnaires for SSCs to assess skill shortages and gaps. This is for non-agricultural sectors that can collect the data on vacancies and skills. Firms should be sampled across size, ownership, regions and sub-sectors that have been identified previously. Vacancy data may be analysed in the short run.

MCA maybe used as the universe. A proper replacement strategy should be used because otherwise the responses suffer from selection bias. The occupations list should be the same as that identified at the beginning.

The Centre should define skill shortage. For example, if vacancies last for more than three months, then it should be defined as a skill shortage. Using this definition, SSCs can use a common assessment framework to feed into MSDE policymaking.

The following questions may be asked.

a. How many employees do you have currently?

b. How many job roles are currently vacant that you are actively looking to fill?

c. Please fill in details about the current vacant position/s (Table 2.3)

Table 2.3 Details about Vacancies

Job Role	Name	No. of positions that are vacant	Years of Experience 1. 0 years 2.1 to 5 years 3.5 to 10 years 4.10 to 15 years 5.More than 15 years	How long have these job roles being vacant? 1. ≤3 months; 2.>3 months & ≤ 6 months 3.>6 months & ≤9 months-3 4.9 months & ≤12 month; 5.>12 months-5	Qualifications required	Skills Required	Please give reasons for vacancy. 1. We advertised only recently. 2. We (firm) didn't try much; if we get someone that is fine but otherwise it is okay 3. We wanted to try out the market 4. Wages did not match-expectations of wages were higher by prospective employees 5. Didn't find people with the required qualification 6. Find people but they do not have the skill set that we require for the job 7. Others

***Source*:** NCAER Conceptualisation.

Note: You can add more rows if required.

2.7 District-level Analysis of Jobs in Agriculture & Allied Sectors

The Centre may design a template for district level analysis of agriculture and allied sectors. The States may undertake a district-level analysis to assess the labour market situation in their district. To do this, they can perform a secondary data analysis using the Agriculture Census, Livestock Census, Situation Assessment Survey, Animal Husbandry Statistics, soil health, land use statistics, rainfall & groundwater statistics and their own statistics. This will help them identify labour market clusters for each agriculture & allied sector in the district. The Centre may use the secondary analysis from the States.

The States should design a survey and focus group discussions of farms, cooperatives, other stakeholders in the value chain etc. Since value chains for each product will be identified, the stakeholders can also be identified (Annexure 2.5). All of them should be interviewed in a structured manner to assess and anticipate evolving jobs.

2.8 Stakeholder Interactions

The MSDE should design detailed stakeholder interactions including FGDs and structured questionnaires. This will provide information not only about jobs that are hard to fill but also about economic and technological changes that the sector is undergoing, the firms' own practices in hiring, skilling, etc., and perceptions about the sector. An illustration is attached as Annexure 2.6, which was designed for the auto sector. The feedback received here will feed into identifying new and emerging sub-sectors and new occupations, which will then be used in further analyses.

3. Standard Operating Procedures for State Governments

3.1 Introduction

The objectives for the State Government is to assess demand for skills and assess skill shortages and gaps at the State and district levels. At the State-level, the design for assessing demand for skills and assess skills shortage & gaps is driven by four components:

1. Macro-analysis of sectoral shares of Gross State Value Added (GSVA), Gross District Value Added (GDVA) and workforce, identification of geographical clusters and sectoral workforce characteristics at the State and district level.
2. Simulations to forecast jobs and occupations at the State-level.
3. Cooperation in collecting data for occupational-wage-employment survey at the district level.
4. District-level analyses of jobs in agriculture & allied sectors
    a. Secondary data analysis.
    b. Conducting surveys and Focus Group Discussions (FGDs) of farms, cooperatives and other stakeholders.

Data for the analysis and design will come from available databases. It is important to use publicly available, verifiable and credible data sources.

- The key Ministry of Statistics and Programme Implementation (MoSPI) publications include Periodic Labour Force Survey (PLFS), Annual Survey of Industries (ASI), Annual Survey of Unincorporated Sector Enterprises (ASUSE) and Situation Assessment of Farmers.
- Publications by Central Ministries may be used to substantiate MoSPI data, for example, Agriculture Census, Handloom Census, Animal Husbandry Statistics and Livestock Census.
- Annual Reports of Ministries.
- States' statistical publications.

3.2 Macro Analysis of Sectoral Shares of GSVA, GDVA and workforce, Identification of Geographical Clusters, and Sectoral Workforce Characteristics

The macro analysis estimates contribution of the sector (or sectors) to GSVA, GDVA and employment. The analysis is divided into four sections: (a) calculation of the sector's share in GSVA, GDVA and employment; (b) identification of where the State lies in the value-chain of the product; (c) identification of geographical clusters; and (d) sectoral workforce characteristics.

A. Calculate sectoral shares in GSVA, GDVA and workforce

Step 3.2.1: Conduct macroeconomic analysis
The macroeconomic analysis is done in three stages.

Step 3.2.1.1 Compute the sectoral shares of GSVA, GDVA and workers across National Industrial Classifications (NICs) at both State and district levels. This can be done by either using the 64 sectors identified in the supply-use tables or the sectors identified by NAS State Directorate of Economics and Statistics. NCAER used the 64 sectors as a starting point.

For the same years and same sectors, compute the sectoral shares of GSVA, GDVA and workers (at State and district level) using these formulas:

a. To compute the sectoral share of GSVA (GDVA),

$$Sectoral\ Share\ (\%) of\ GSVA\ (GDVA) = 100 \times \frac{Nominal\ Sectoral\ GSVA\ (GDVA)\ in\ a\ particular\ year}{Nominal\ GSVA\ (GDVA)\ in\ a\ particular\ year}$$

b. To compute the sectoral share of the workforce, use data from the annual Periodic Labour Force Survey.

$$Sectoral\ Share\ (\%) of\ workers\ in\ a\ State\ (district) = 100 \times \frac{No. of\ workers\ employed\ in\ the\ state\ (district)\ in\ a\ sector\ in\ a\ particular\ year}{Workers\ employed\ in\ a\ particular\ year\ in\ that\ State\ (district)}$$

Step 3.2.1.2 Use input-output analysis to assess sectors which have the highest interlinkages with the rest of the economy in the State, either through output, income or employment.

Compute the income, output and employment multipliers using input-output analysis.

- An income multiplier is the total income generated in the economy by one unit of output generated in the sector. Income is measured by the GSVA.
- An output multiplier is the total output generated in the economy by one unit of output generated in the sector. Output in an economy is measured by the GSVO.
- An employment multiplier is the total direct and indirect employment generated in the economy due to change in one unit of final demand in that sector.

Input-output analysis, which was invented by Wassily W. Leontief in 1951, is used to compute interdependencies. No sector is stand-alone in the economy; all sectors are inter-dependent. This methodology captures the interlinkages and indirect jobs created across the economy due to output change in a particular sector. Therefore, this is a better measure than just estimating the direct impact.

The State Directorate of Economics and Statistics are recommended to develop input-output tables at the State level. This then can be used for further analysis. For example, Munjal et al. (2022) computed the input-output transactions table for the state of Himachal Pradesh.[1]

Step 3.2.1.3 Select the Sectors (industries)

Ideally, all sectors should be analysed. However, if the choice is to carry out the analysis for selected sectors, follow the selection process below:

a. Rank sectors based on share of GSVA (GDVA).

b. Rank sectors based on sectoral share of workers in the State (District).

c. Estimate and then rank the income and employment multipliers. If input-output analysis cannot be implemented, then skip this step.
    - If this step is skipped, it is recommended that one uses disaggregated sectors, either available from States or (MoSPI).[2]
    - Other than the four variables mentioned above (shares of GDP, workers, income multiplier and employment multiplier), many other variables were also examined to support the analysis and give it a holistic perspective. However, after a rigorous examination of feasibility, they were dropped because many of those would not be available at the State-level or sectors would not be 'consistently' measured.

d. There are four rankings for each sector (derived from steps a, b, and c).

e. Choose sectors that appear in the top 25 lists of share of GVA, share of jobs, income multiplier and employment multiplier.

f. Identify sunrise/key future sectors from policy documents and map them to the sectors being used for analysis.

[1]Munjal, P., Siddiqui, K.A., Pratap, D., Baruah, P. and Alam, A. 2022. Input-Output Transactions Table 2017-18 Himachal Pradesh. https://ncaer.org/publication/input-output-transactions-table-2017-18-himachal-pradesh/. NCAER, New Delhi, India. July 1.

[2]The MoSPI also publishes Gross State Value Added and Net State Value Added data by economic activities. MoSPI website. https://www.mospi.gov.in/GSVA-NSVA.

g. Integrate Steps e and f to identify sectors.
    - One can also select sectors such that there is equal representation across primary, secondary and tertiary sectors.[3]

h. Policymakers' inputs lead to the finalisation of the sectors.

i. The sectors may be further disaggregated.

For example, in the NCAER analysis, seven sectors were selected through this process-agriculture, livestock, trade, computer-related services, manufacturing of textiles plus cotton ginning, manufacturing of transport and electricity. Then these sectors were deemed as too broad for assessment. Therefore, they were further sub-disaggregated. Those sub-sectors with the highest share of workers were selected for assessment. The final seven sectors selected were growing of cereals (including rice), leguminous crops and oil seeds; raising of cattle and buffaloes; retail sale of food, clothing, footwear and leather articles in specialised stores; computer programming activities; weaving of textiles; manufacturing of motor vehicles, manufacturing of parts & accessories of motor vehicles, maintenance & repair of motor vehicles; and electric power generation using solar energy and other non-conventional sources.

B. Identification of the State (District) in value-chain of the sectors (selected sectors)

Identify which part of the sectoral value-chain is located in the State (District) i.e. what is the State's contribution to the value-chain.

C. Identify geographical clusters of sectors

There can be three types of sectoral clusters: primary, secondary, and tertiary. Further, it is recommended that clusters are defined in two ways: (i) as concentration of units, institutions, etc., and (ii) as concentration of workers. This will also help in identifying any spatial mismatch.

a. Primary Sector[4]

I. Agglomeration of institutional, business, human resources and government support: The framework to identify geographical clusters in the primary sector is adapted from Sutawi, et al. (2022) and is shown in Figure 2.1.[5] See Annexures 2.2 and 2.3 for examples. A step-wise rank approach is recommended to identify sectoral clusters at the State (District) level in the primary sector. This approach is recommended for simplicity and replicability.

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[3]As per NAS, the sectoral definitions are:

Primary Sector: Agriculture, Livestock, Forestry & Fishing and Mining & Quarrying.

Secondary Sector: Manufacturing, Electricity, Gas, Water supply & Other Utility Services and Construction.

Tertiary Sector: Trade, Hotels, Transport, Communication and Services related to Broadcasting, Financial, Real Estate & Professional Services and Public Administration, Defence & Other Services.

[4]Clusters are defined as non-random (Ellison and Glaeser, 1997) geographical agglomeration of firms with comparable or closely complementary capabilities (Richardson, 1972) . Precisely, in the geographical concentration of enterprises, specific suppliers, service providers, associated institutions and organisations settled themselves in a certain arena that competes with each other but also co-operates themselves. The geographical proximity of units gives rise to specialised labour, develops subsidiary industries, stimulates state-of-the-art activity, and enables technological spillovers that makes the economic and non-economic inter-firm linkages feasible.

Annexure 2.1 shows different definitions and different ways of estimating agriculture & allied sectors' clusters. The one that is used here is the mentioned in the ToR – geographical clusters. Geographical clusters in India arise due to specific agro-ecological conditions and resource availability. For instance, the Western Ghats region hosts geographical clusters of spice cultivation, including pepper, cardamom, and cinnamon, owing to its tropical climate and hilly terrain.

Ellison, G., & Glaeser, E. L. 1997. "Geographic concentration in US manufacturing industries: a dartboard approach". *Journal of Political Economy*, 105(5): 889–927.

Richardson. G. B. 1972. "The Organisation of Industry". *The Economic Journal*, 82(327): 883–896. September.

[5]One recommendation was to take production as a variable. It is another way of defining clusters but it may give misleading results. Size of production in one State may be large because of its size but its productivity may be low. Therefore, it is recommended not to look at production as an indicator to measure clusters.

II. *Workforce Clusters:* Analyse the distribution of workers across districts for that specific sector/sub-sector using NIC codes. The PLFS data cannot be used as it is not representative at the district level. If available, state-level data may be used.

b. Secondary Sector[6]

I. *Agglomeration of manufacturing units:* To calculate geographical clusters for secondary sectors, follow these steps:

1. Count the number of plants across districts to estimate clusters across NIC codes. Data may be sourced from ASI, ASUSE, Central Electricity Authority, Sectoral Ministry data, NITI Aayog etc.[7,8]
2. One can also identify clusters across sub-sectors or stages of the value-chain using other data sources.

II. *Workforce Clusters:* Analyse the distribution of workers across districts for that specific manufacturing sector/sub-sector using NIC codes. The PLFS data cannot be used as it is not representative at the district level. If available, state-level data may be used.

c. Tertiary Sector

I. Agglomerations: The framework proposed in Figure 2.1 is used here. The examples below show how this was achieved in our case studies.

Examples

a. Specialised retail in food & clothing

Data on the number of units were used. This is available only for the unorganised sector in the ASUSE database. For the organised sector, memberships by State are taken from the Retailers Association of India. Finally, to measure innovation, one takes the data on number of start-ups from Department for Promotion of Industry and Internal Trade (DPIIT).

b. Computer Programming Activities

There are four pillars – infrastructure, innovation, business environment, human resources (skills). A simple rank was computed for each indicator and then a step-wise average was computed resulting in a final averaging of all the rankings from each pillar. See Table 2.1.

II. Workforce Clusters: Analyse the distribution of workers across districts for that specific sector/sub-sector using NIC codes. The PLFS data cannot be used as it is not representative at the district level. If available, state-level data may be used.

D. Analysis of Sectoral Workforce Characteristics

Conduct sector-wise time series analysis (5–10 years) of labour market characteristics for either all or selected sectors across the following categories using mainly PLFS:

a. Educational qualifications (general, technical & vocational education)

b. Engagement

c. Occupation (NCO 3-digit)

- More detailed data are not available in PLFS

d. Gender of workers.

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[6]"Clusters are geographic concentrations of interconnected companies and institutions in a particular field", encompassing "an array of linked industries", including for instance "suppliers of specialised inputs such as components, machinery, and services, and providers of specialised infrastructure." (Porter 1998, p. 78).

Porter 1998, Clusters and the New Economics of Competition, Harvard Business Review, November-December 1998. Available at: https://backonline.apswiss.ch/6001/porter_clusters_and_the_new_economics_of_competition.pdf

[7]Annexure 2.4 shows the data sources for estimating clusters in the 'weaving of textiles' sector.

[8]In the NCAER work for estimating geographical clusters for generation of solar and wind energy, State-level installed capacity of all renewable energy sources was arrived at by summing the installed capacity of NITI Aayog's plant-level data (as on 31st March 2024), which matches the State-wise installed capacity data released by the Ministry of New and Renewable Energy.

3.3 Simulations to Forecast Jobs and Occupations

Simulations may be used to forecast jobs and occupations by using input-output analysis. This is an optional step, but it captures the interlinkages across sectors and can show the direction a State is going towards. In contrast, a linear forecasting analysis may give biased results.

Example

NCAER used input-output analysis to project the total number of jobs in 2026–27 and the top 5 occupations that will find maximum employment. Base year numbers were derived from National Accounts Statistics (NAS) and Periodic Labour Force Survey (PLFS). National Accounts data (which gives GVO data) are available until 2022–23. Gross value of output (GVO) is the value of the total sales of goods and services + value of changes in the inventories.

Steps for projecting employment and occupation

c. Calculate GVO/Output multiplier
    a. Output generated in the entire economy due to one unit of output generated in the said sector.
    b. 2018-19 I-O was used to estimate the output multiplier.
d. Calculate employment multiplier
    a. Number of (direct & indirect) jobs created in the entire economy due to one unit of output generated in the said sector.
    b. 2018-19 output multiplier was multiplied with 2022–23 labour-output ratio to estimate the employment multiplier for 2022–23.
e. Use average annual growth rates to make forecasts
    a. Make sectoral GVO growth assumptions based on past years' growth rates (this can be treated as the baseline)
    b. Alternative growth scenarios may be developed.
        i. Alternative growth assumptions may be made based on alternative growth scenarios in the first step.
        ii. Chaudhary, Pratap and Pohit (2024) use the alternative NITI Aayog assumptions to simulate the impact of net zero transition on employment.[9] Similarly, if assumptions, policy priorities, goals and targets have to be modelled for either all 64 or selected sectors, one can tentatively estimate both the overall & sectoral impact on jobs & occupations.
f. Estimate number of (direct & indirect) jobs.
g. Estimate jobs for the sub-sectors by taking the job shares of the sub-sectors in the main sectors.
    a. The same shares are used to estimate jobs for 2026–27.
    b. Find the distribution across occupations of ONLY direct jobs based on share of occupations for the base year.
    c. Using the same shares, projections for occupations may be done.

3.4 Occupational-Wage Employment Survey (OWES)

States need to cooperate with the Centre in collecting data for occupational-wage-employment survey, which is representative at the district level.

[9]Chaudhuri, C., Pratap, D. & Pohit, S. 2024. "Effect of Energy Transition Under Net-Zero Target on Employment." *Ind. J. Labour Econ*. https://doi.org/10.1007/s41027-024-00528-y. November 30.

3.5 District-level Analysis of Jobs in the Agriculture and Allied Sectors

States may use secondary data such as Agriculture Census, Livestock Census, Situation Assessment Survey, Animal Husbandry Statistics, soil health, land use statistics, rainfall & groundwater statistics and their own statistics etc. to undertake a district-level analysis to assess the labour market situation. Using this information, the labour market clusters for each agriculture & allied sector in the district can be identified.

The States should design a survey and focus group discussions of farms, cooperatives, other stakeholders in the value chain etc. Since value chains for each product will be identified, the stakeholders can also be identified (Annexure 2.5). All of them should be interviewed in a structured manner to assess and anticipate the evolving jobs.

4. Standard Operating Procedures for Sector Skill Councils

4.1 Introduction

In order to fulfil the objective of assessing skill shortages and skill gaps, Sector Skill Councils (SSCs) are recommended to do the following:

- Assess skill shortages and skill gaps of non-agricultural sectors through survey of firms for vacancies;
- Analysis of jobs in sub-sectors of non-agricultural sectors through big data analysis of advertised jobs; and
- Stakeholder interactions.

4.2 Assess Skill Shortages and Gaps of Non-agricultural Sectors using Survey of Non-agricultural Firms for Data on Vacancies and Skills

While the design of the survey may be implemented at the Ministry of Skill Development and Entrepreneurship (MSDE), SSCs will actually have to carry out the Survey. One-page telephone/online survey for a month should yield results about vacancies and their associated qualifications and skills. It is also important as to who is being interviewed i.e. the designation. Only Human Resource Managers should be interviewed for this. Analysis of that data should feed the MSDE policymaking to understand on a regular basis where the skill gaps/shortages exist.

4.3 Analysis of Jobs in Sub-sectors of Non-agricultural Sectors: Big Data Analysis of Advertised Jobs

The SSCs should undertake, within their sub-sectors, big data analysis of advertised job positions on an annual basis. They should design the work and collect data across various job sites. The sub-sectors should be in sync with other definitions in the large schema of work. The data should be collected across sectors and across various geographies/clusters, especially cities -Tier 1 and Tier 2 cities-to understand the dynamics of the skill markets, spatial needs, sub-sector specialisation in particular clusters etc.

A web scraping / Big Data methodology is given below (Figure 4.1).

Step 4.3.1.1: Start with defining specific goals, such as identifying crucial information like job titles, skills, locations, or sectors.

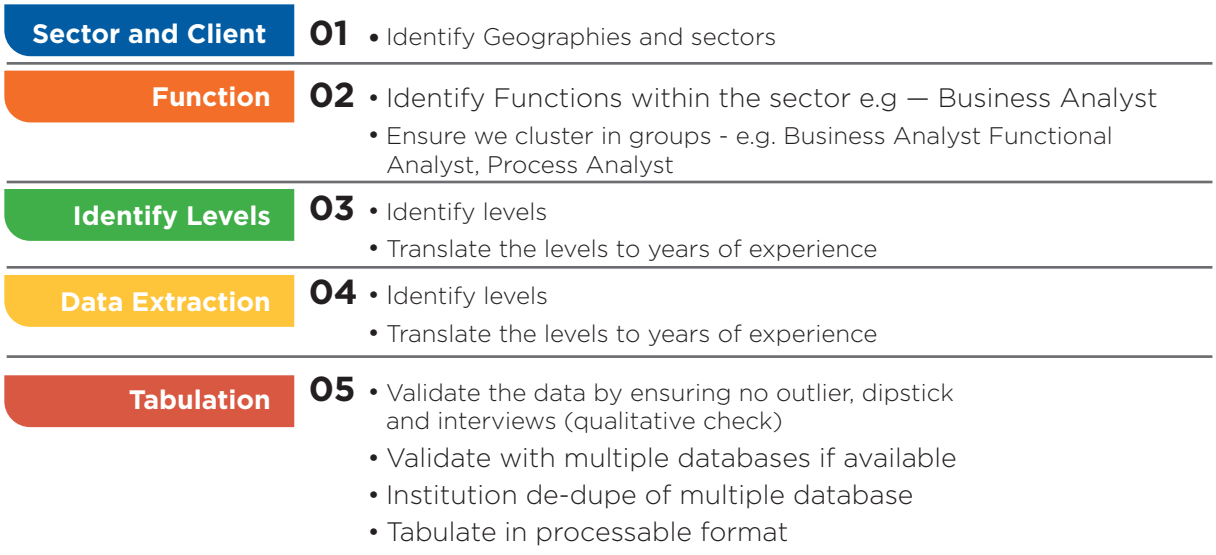
Step 4.3.1.2: Using technologies like Python libraries (e.g., BeautifulSoup, Scrapy, Selenium) or no-code solutions (e.g., Octoparse, ParseHub), scripts should be configured to navigate job boards and retrieve pertinent data. Following scraping, the raw data is cleaned to assure accuracy by removing duplicates and extraneous information.

Step 4.3.1.3: The organised data is then saved in forms such as CSV or databases for analysis.

Step 4.3.1.4: Analyse trends with tools like Pandas or Tableau to analyse and visualise employment trend patterns.

Note: It is crucial to follow ethical procedures throughout the process, including honouring website terms of service and avoiding anti-scraping methods such as CAPTCHAs. It is also essential to determine if multiple databases are used, and if yes, they need to be deduped. This approach can deliver actionable insights into changing job demands in specific industries.

Figure 4.1 **Analytics using Web Data**



4.4 Stakeholder Interactions

The SSCs should carry out detailed stakeholder interactions, including Focus Group Discussions and structured questionnaires. This will inform not just about jobs but also about economic and technological changes that the sector is facing.; the firms' own practices in hiring, skilling etc; and perceptions about the sector. An illustration of that is attached as Annexure 2.6, which was designed for the auto sector.

5. Summary

In the present era, characterised by unprecedented technological changes, especially with progressive implementation of Artificial Intelligence (AI), skilling or upskilling will be key to cater to the changing nature of goods and services in demand. The objective of the present exercise is to evolve a dynamic methodology which can be applied uniformly across sectors to identify skill shortages and skill gaps.

The model will serve in assessing, anticipating and adapting skills at both national and state levels at regular intervals to enable the skilling eco-system to evolve with technology while ensuring the employability of the existing and potential workforce.

Table 5.1 summarises the various methodologies for India to assess skill gaps and skill shortages. The first place to understand our variable of interest is occupations and those have to be mapped and identified properly. There is a lot that can be done with existing data but a lot needs to be accomplished with newer data. There are seven alternatives, combination of which should yield insights. But while the OWES takes time, low-hanging objectives-analysis of secondary data, vacancies survey and big data analysis can get started to yield insights. There has to be federal cooperation to get sensible results and give direction to policymaking.

Table 5.1 Objectives and Methodology

S. No.	Type of Analysis	Study Lead in Design	Objectives and methods	Implementing Agency		Frequency of Analysis
1.	Macro Analysis of Sectoral Shares of GVA, GSVA, GDVA and workforce across geographies; Identification of Geographical Clusters across geographies and; Sectoral Workforce Characteristics across geographies	MSDE	• Calculation of the sector's share in GVA, GSVA, GDVA and workers across geographies • Identification of value-chain of sector • Identification of geographical clusters and • Analysis Sectoral workforce characteristics.	MSDE	All-India and State-level analysis	Annual Basis
				State	District-level analysis	
2.	Simulations to forecast jobs and opportunities (optional)	MSDE	(3 to 5 year) forecasts of occupations accounting for stated policy goals, technological changes (and simulations for scenario building)	MSDE	All-India	3 to 5 years
				State	State-level analysis	

(*Contd.*)

Table 5.1: (Contd.)

S. No.	Type of Analysis	Study Lead in Design	Objectives and methods	Implementing Agency	Frequency of Analysis
3.	Demand projections of jobs of non-agricultural sectors	MSDE & MoLE (design of questionnaires, sampling strategy based on universal company data sourced from MCA)	Occupational-wage employment survey of non-agricultural enterprises (panel data)	MoSPI with district-level participation	3 to 5 years
4.	Assess skill shortages and gaps of non-agricultural sectors	MSDE (design of questionnaires, sampling strategy based on universal company data sourced from MCA)	Survey of non-agricultural firms for data on vacancies and skills	Sector Skill Councils	Annual
5.	Analysis of jobs in sub-sectors of non-agricultural sectors	Sector Skill Councils	Big Data Analysis	Sector Skill Councils	Annual
6.	Analysis of agriculture & allied sectors	State Government	District-level secondary data analysis	State Skill Missions	Annual
		MSDE (design of questionnaires, identification of stakeholders etc.)	Survey, FGDs of farms, cooperatives, other stakeholders in the value chain etc.	State and District Skill Missions	Annual
7.	Stakeholder Interactions	MSDE	Focus Group Discussions & Structured interviews for anticipating economic & technological changes	Sector Skill Councils	Annual

Annexures

Annexure 2.1: Agricultural Clusters

Clusters in Agriculture in India

Agricultural clusters represent geographically proximate networks of interconnected farms, markets, research institutions, and support organisations within the agricultural sector. These clusters are characterized by shared resources, knowledge, and collaborative opportunities, embodying the concept of the "Economy of Agglomeration" (Silvis et al., 2002)[1].

Determinants of National Competitive Advantage

In the context of India, several factors contribute to the nation's competitive advantage in agriculture, shaping the landscape of agricultural clusters across the country:

1. **Factor Conditions:** India's competitive advantage in agriculture is influenced by various factor conditions such as technological advancements, availability of skilled labour, and infrastructure development. For instance, the adoption of modern agricultural practices and the availability of skilled labour contribute to increased productivity in states like Punjab and Haryana, known for their advanced farming techniques and irrigation infrastructure (Kumar et al., 2018)[2].

2. **Demand Conditions:** The demand conditions within India's diverse and populous market significantly impact the growth and innovation in the agricultural sector. For example, the demand for rice and wheat in states like Uttar Pradesh and West Bengal, with large populations and high consumption rates, drives the production and innovation of these crops to meet local dietary preferences (Joshi et al., 2017)[3].

3. **Related and Supporting Industries:** India's agricultural sector benefits from the presence of related and supporting industries such as agri-input suppliers, food processing units, and agricultural machinery manufacturers. For instance, the establishment of food processing industries in states like Maharashtra and Gujarat enhances value addition to agricultural products, fostering the development of integrated agricultural clusters (Sharma et al., 2020)[4].

4. **Firm Strategy, Structure, and Rivalry:** The competitive dynamics among agricultural firms in India influence the strategies, structures, and overall performance of the sector. For example, the presence of numerous agricultural cooperatives in states like Gujarat and Maharashtra fosters

[1]Silvis, H., Slangen, L. H. G., Bremmers, H., Heijman, W., & Jongeneel, R. 2002. "Handboek agrarische economie en beleid: bedrijven, ketens en groene ruimte (Handbook of agricultural economics and policy: companies, chains and green space)". Groningen: Wolters-Noordhoff. ISBN 90-207-3175-0.

[2]Kumar, P., Dhillon, R. S., & Kaur, G. 2018. "Agricultural Development in India: A District Level Analysis". *International Journal of Agricultural and Statistical Sciences*, 14(1): 169–180.

[3]Joshi, P. K., Birthal, P. S., & Minot, N. 2017. "Sources of agricultural productivity growth in India: The role of globalization". *Agricultural Economics*, 48(1): 51–65.

[4]Sharma, S., Anand, P., & Pandey, A. 2020. "Impact of food processing industry on Indian Agriculture". *Journal of Public Affairs*, 20(2): e2122.

collaboration among farmers and enhances bargaining power, leading to better market access and improved profitability (Srivastava et al., 2019)[5].

Role of Clusters in the Context of India

1. **Increasing Static Productivity:** Agricultural clusters in India contribute to enhancing static productivity through several mechanisms. Firstly, they provide access to specialised inputs and skilled labour, which is essential for efficient agricultural production. For example, clusters focusing on horticulture in regions like Maharashtra and Karnataka benefit from access to specialised seeds, fertilizers, and agri-technologies, leading to higher yields and improved productivity (Gupta et al., 2019)[6]. Additionally, clusters facilitate the flow of information and knowledge among participants, enabling farmers to adopt best practices, innovative techniques, and technological advancements. This exchange of knowledge often occurs through farmer cooperatives, agricultural extension services, and research institutions linked to the clusters. Furthermore, clusters foster complementarities between different agricultural activities, such as crop cultivation, livestock rearing, and agro-processing, thereby optimizing resource utilisation and enhancing overall productivity. Lastly, clusters provide access to essential institutions and public goods, including agricultural research centres, irrigation facilities, and market infrastructure, which further support productivity enhancement efforts (Saxena et al., 2020)[7].

2. **Increasing Capacity for Innovation**: Agricultural clusters serve as hubs for innovation by facilitating collaboration, knowledge sharing, and joint marketing initiatives among stakeholders. These clusters often bring together farmers, agri-businesses, research institutions, and government agencies, creating fertile ground for innovation diffusion and adoption. For instance, clusters specialising in organic farming in states like Sikkim and Uttarakhand promote innovation in sustainable agricultural practices, soil conservation techniques, and organic certification standards through collaborative research and knowledge exchange platforms (Sharma & Singh, 2018)[8]. Moreover, the presence of agri-start-ups and entrepreneurial ventures within clusters encourages experimentation with novel technologies, value-added products, and market-driven solutions, thereby fostering a culture of innovation and entrepreneurship in the agricultural sector.

3. **Stimulation of New Business Formations:** Agricultural clusters in India stimulate the entry of new firms by providing various incentives and reducing barriers to entry. Firstly, they serve as information hubs, signalling market demand, emerging trends, and business opportunities to potential entrants. For example, clusters focusing on high-value crops like spices in Kerala or floriculture in Tamil Nadu attract new entrepreneurs by highlighting the demand for these products in domestic and international markets (Saravanan et al., 2019)[9].

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[5]Srivastava, A. K., Singh, R., & Bhagat, R. B. 2019. "Impact of agricultural credit on agriculture and allied sector in India: A spatial analysis". *International Journal of Agricultural and Statistical Sciences*, 15(2): 557–566.

[6]Gupta, R. K., Kumar, A., & Gaurav, K. 2019. "Role of Agricultural Clusters in Sustainable Agriculture Development: Evidence from India". *Indian Journal of Agricultural Economics*, 74(4): 549–562.

[7]Saxena, A., Singh, M., & Tiwari, S. 2020. "Agricultural clusters in India: Current status, opportunities and challenges". *Agriculture and Food Security*, 9(1): 11.

[8]Sharma, V. & Singh, S. 2018. "Organic Farming Clusters: A Sustainable Pathway for Agricultural Development in India". *Indian Journal of Agricultural Economics*, 73(3): 312–325.

[9]Saravanan, S., Sharma, P., & Bhagat, R. B. 2019. "Growth Dynamics of Agricultural Clusters in Tamil Nadu, India: An Economic Analysis". *Asian Journal of Agricultural Extension, Economics & Sociology*, 35(1): 1–10.

Additionally, the collaborative ecosystem within clusters lowers entry barriers by providing access to shared infrastructure, technical expertise, and financial resources. This collaborative environment fosters mentorship, peer learning, and risk-sharing among existing and new businesses, thereby encouraging entrepreneurship and fostering the growth of small and medium enterprises (SMEs) in the agricultural value chain.

Types of Clusters in Indian Agriculture

1. Types of Clusters by Knowledge

- **Factor Endowment Clusters:** In India, factor endowment clusters emerge in regions with abundant natural resources, fertile land, and favourable agro-climatic conditions. For instance, the Punjab-Haryana belt is renowned for its wheat and rice cultivation, benefiting from rich alluvial soil and well-irrigated fields (Singh et al., 2017)[10]. Similarly, regions like Andhra Pradesh and Telangana exhibit factor endowment clusters for horticultural crops like mangoes and bananas due to favourable soil and climatic conditions.
- **Techno Clusters:** India boasts techno clusters in agricultural biotechnology, precision farming, and agri-informatics, often cantered around premier research institutions and technology parks. For instance, the Biotech Park in Hyderabad serves as a hub for biotechnology start-ups and research organisations, driving innovation in crop genetics, bioinformatics, and agri-biopharmaceuticals (Sujatha & Reddy, 2018)[11].
- **Historic Knowhow-Based Clusters** Historic knowhow-based clusters in India are exemplified by traditional agricultural practices passed down through generations. Regions like Kerala's Kuttanad and Tamil Nadu's Cauvery delta have thriving rice cultivation clusters, benefiting from centuries-old knowledge of paddy farming techniques, water management, and crop rotation (Kumar et al., 2019)[12].

2. Types of Clusters by Form of Development

- **Geographical Clusters:** Geographical clusters in India arise due to specific agro-ecological conditions and resource availability. For instance, the Western Ghats region hosts geographical clusters of spice cultivation, including pepper, cardamom, and cinnamon, owing to its tropical climate and hilly terrain (Balasubramanian et al., 2019)[13].
- **Sectoral Clusters:** Sectorial clusters in India are prevalent across diverse agricultural domains, such as dairy farming, floriculture, and sericulture. For example, the dairy clusters in Gujarat's Anand district, home to the Amul dairy cooperative, represent a sectorial cluster renowned for its milk production and dairy processing capabilities (Patel & Prajapati, 2020)[14].
- **Horizontal and Vertical Clusters:** Horizontal clusters in India foster collaboration and resource-sharing among agri-businesses operating at the same level of the value chain. An example is the collaboration

[10]Singh, S., Singh, B., & Kumar, A. 2017. "Wheat Crop Production and Its Future Prospects in India". *International Journal of Current Microbiology and Applied Sciences*, 6(6): 3925–3933.

[11]Sujatha, P., & Reddy, S. 2018. "Technological Clusters in India: A Case Study of Agricultural Biotechnology Industry in Hyderabad". *Economic Affairs*, 63(2): 315–326.

[12]Kumar, P., Jain, P. K., & Prasad, R. K. 2019. "Traditional Rice Cultivation in Kuttanad Region: A Sustainable Farming Practice in Kerala, India". *International Journal of Current Microbiology and Applied Sciences*, 8(6): 1092–1098.

[13]Balasubramanian, S., Murali, K. S., & Ramakrishnan, B. 2019. "Clusters and Spices Sector: A Study in Western Ghats Region". *Journal of Agribusiness in Developing and Emerging Economies*, 9(2): 188–203.

[14]Patel, D. & Prajapati, J. (2020). Dairy Clusters: A Boon for Rural Development in Gujarat. Indian Journal of Dairy Science, 73(3), 301-305.

between multiple small-scale organic farms in Uttarakhand, collectively marketing their produce under a unified brand, thereby leveraging economies of scale and enhancing market access. Vertical clusters, on the other hand, involve integration along the agricultural supply chain, such as the linkage between contract farming companies, agro-processing units, and retail chains in the fresh fruit and vegetable sector (Gupta et al., 2020)[15].

Methods for Identifying Agricultural Clusters

1. **Shift share analysis:** This method evaluates regional competitiveness by examining changes in employment and associated competitiveness over time. In India, it can provide insights into the dynamic nature of agricultural clusters across different states and regions.

   a. Actual Total Shift:

$$\textit{Actual Total Shift} = \sum \Delta E_{ij} - \Delta E_{ti}$$

ΔE_{ij}: Change in employment per sector i in region j from year o to year t

ΔE_{ti}: Change in employment per sector i in the total economic area from year o to year t

   b. Relative Actual Shift (RAS):

$$\textit{Relative actual shift} = \sum (\frac{E_{ij}}{E_{ti}})$$

E_{ij}: Employment per sector i in region j from year o to year t

E_{ti}: Employment per sector i in the total economic area from year o to year t

2. **Location quotient analysis:** Location quotient analysis helps assess the relative economic strength of specific agricultural industries within regions compared to the national average. By comparing employment data, it highlights areas where certain agricultural sectors are particularly concentrated, indicating potential cluster formations.

$$\textit{Location Quotient} = \frac{\frac{E_i^j}{E_i^N}}{\frac{E^j}{E^N}}$$

E_i^j : Employment in activity i in region j

E_i^N : Employment in activity i in the nation

E^j : Total employment I region j

E^N : Total employment in the nation

3. **Clustering based on number of farms:** Analysing the distribution of farms across regions offers another perspective on agricultural clustering. By comparing the prevalence of specific agricultural sectors in different areas, researchers can identify clusters based on the concentration of farming activities.

$$\textit{Percentage of farms in the sector} = (\frac{C_j}{C}) \times 100$$

C_j : *Number of farms of a sector in region* j

C : *Number of farms of a sector in nation*

4. **Clusters based on machinery usage per capita:** Clusters based on machinery usage per capita refer to geographically concentrated areas where agricultural machinery is extensively utilized relative to the population engaged in agricultural activities. These clusters often indicate regions where mechanization plays a significant role in agricultural production and where there is a high density of machinery use per agricultural worker or per capita. This concept is important in understanding the spatial distribution of agricultural mechanisation and its impact on agricultural productivity, labour efficiency, and overall economic development within specific regions or countries.

$$\textit{Machinery usage per capita} = \frac{\textit{Total Agricultural Machinery Usage}}{\textit{Population engaged in Agricultural activities}}$$

[15]Gupta, R. K., Yadav, R. K., & Sharma, A. 2020. "Contract Farming: A Case Study of Fruit and Vegetable Growers in Jharkhand, India". *International Journal of Agriculture, Environment and Biotechnology*, 13(5): 637–644.

Annexure 2.2: Indicators of Cereals (including Rice), Leguminous Crops and Oilseeds Producing Clusters

Pillars	Sub-Pillars	Indicators	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
Institutional	Social Capital	Primary Agricultural Societies	National Cooperative Database, Ministry of Cooperation, Government of India, 2023 https://cooperatives.gov.in/en/home/cooperative-sector-wise-list-reports/sector/77	Yes	Yes
		% of farm households where any of the household member is a member of registered farmer's organisation	MoSPI: Situation Assessment Survey Agricultural Households		
	Network & Partnership	FPOs	Directory of Farmer Producer Organisations of India (https://ccsniam.gov.in/images/pdfs/Directory_of_Farmer_Book_NIAM.pdf) Or https://fpo.tci.cornell.edu/dashboard http://www.sfacindia.com/PDFs/Tenders/State%20wise%20list%20of%20registered%20FPOs%20details%20under%20Central%20Sector%20Scheme%20for%20Formation%20and%20Promotion%20of%2010,000%20FP-Os%20by%20SFAC%20as%20on%2031-12-2023.pdf	Yes	Yes
	Leadership and Vision	State Agricultural Marketing Boards/ Directorates	https://enam.gov.in/NAMV2/home/usefullinks.html#	Yes	Not Applicable
		National Agricultural Federation	National Cooperative Database, Ministry of Cooperation, Government of India, 2023 https://cooperatives.gov.in/en/home/federation-reports	Yes	Not Applicable

(*Contd.*)

Annexure 2.2: (Contd.)

Pillars	Sub-Pillars	Indicators	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
	Entrepreneurship and Culture	No. of agri tech-start-ups	https://www.startupindia.gov.in/digital-map/maps	Yes	Not Available
	Competition	Not relevant in Indian Agricultural Scenario	Not Applicable	Not Applicable	Not Applicable
Business Infrastructure	Information Access	% of crop growers who are accessing technical advise	MoSPI: Situation Assessment Survey of Agricultural Households	Yes	Yes
	Market Access	Access to market sources for selling their produce	MoSPI: Situation Assessment Survey of Agricultural Households	Yes	Yes
		Market information System: Number of APMC Market registered in e_NAM portal/000 farmers	https://enam.gov.in/NAMV2/home/mandis.html#	Yes	Yes
	Specialist Service	Soil Testing Laboratories	https://soilhealth.dac.gov.in/soil-lab https://pib.gov.in/PressReleseDetail.aspx?PRID=1988294	Yes	Yes
		Custom Hiring Centres Established	https://agrimachinery.nic.in/ https://agrimachinery.nic.in/GraphReport/SMAMFmtti/SMAMFmtti.aspx https://sansad.in/getFile/annex/263/AU835.pdf?source=pqars	Yes	Yes
		State-wise Storage capacity: State-wise list of the Warehouses Registered with the WDRA	https://wdra.gov.in/web/wdra/registered-warehouses	Yes	Yes
		State -wise seed Testing Laboratories	https://seednet.gov.in/Material/SeedTestingLabs.aspx	Yes	
		State Seed Corporations	https://seednet.gov.in/Material/State_SeedCorporation.aspx	Yes	
		Seed Certification Agencies	https://seednet.gov.in/Material/SSCA.aspx	Yes	
		State-wise number of Fertilizer sale points	Page I-66 Table 5.02 https://fertiliserindia.com/wp-content/uploads/2023/05/Fertiliser-Stat-Book-2021-22.pdf	Yes	
	Specialist Service	State-wise number of fertilizer quality control Laboratories	Pages I-191 Table 9.03 (b) and I-192 https://fertiliserindia.com/wp-content/uploads/2023/05/Fertiliser-Stat-Book-2021-22.pdf	Yes	No
	Financial Access	State wise number of operative KCC	Page II-98 Table 9.04 https://fertiliserindia.com/wp-content/uploads/2023/05/Fertiliser-Stat-Book-2021-22.pdf	Yes	

(*Contd.*)

Annexure 2.2: (Contd.)

Pillars	Sub-Pillars	Indicators	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
Human Resources	Competence & Expertise	% of workers who are employed in growing of cereals, pulses and oilseeds industry	PLFS	Yes	Yes, but not reliable
	Innovation	Training Institutes **Seeds:** National Seed Research and Training Centre, Varanasi No. of Farm Machinery training institutes National Centre for Organic and Natural Farming (Regional Training Stations)	http://nsrtc.nic.in/seed_testing.html https://agrimachinery.nic.in/ https://agrimachinery.nic.in/GraphReport/SMAMFmtti/SMAMFmtti.aspx https://nconf.dac.gov.in/	Yes	Could be adapted to district level
		R & D Investment in Agriculture (Crops)	https://niap.icar.gov.in/pdf/PP44.pdf Table 5.3. Percent share of sub-sectors in agricultural R&D in states, 2011-2020	Yes	
		% of ICAR institutes and State Agricultural Universities devoted to crop sciences	https://icar.org.in/state-agricultural-universities, https://icar.org.in/institutes# and https://icar.org.in/state-agricultural-universities	Yes	Could be adapted to district-level
		Agriclinics And Agribusiness Centers (Acabc)	https://acabcmis.gov.in/ACABC_dashboard_Chart.aspx https://acabcmis.gov.in/ACABC_dashboard_Chart.aspx	Yes	
Government Support	Infrastructure	No. of PACS by State	PACS https://pib.gov.in/PressReleasePage.aspx?PRID=1946740	Available	Available
		State -wise seed Testing Laboratories	https://seednet.gov.in/Material/SeedTestingLabs.aspx	Yes	
		% of (Agriculture) capital expenditure to total government expenditure	RBI https://rbi.org.in/Scripts/PublicationsView.aspx?id=22323	Yes	Not Applicable
	Policies	Agri-tech	https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2003181		
		State Agriculture Infrastructure Development Plan (SAIDP) State Agriculture Plan (SAP) District Agriculture Plan (DAP)	https://rkvy.nic.in/	Yes	

(*Contd.*)

Annexure 2.2: (Contd.)

Pillars	Sub-Pillars	Indicators	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
Government Support		National Agriculture Infra Financing Facility	https://agriinfra.dac.gov.in/Home/FundAllocation https://agridashboard.dac.gov.in/	Yes	Yes, but not reliable
		https://agriinfra.dac.gov.in/Home/FundAllocation https://agridashboard.dac.gov.in/	https://extensionreforms.da.gov.in/DashBoard_Statusatma.aspx		

Source: NCAER Compilation of Indicators and framework adapted from the Paper by Sutawi, I. Prihartini, L. Zalizar, A. Wahyudi, L. Hendraningsih (The Success Indicators of a Dairy Farming Cluster in Indonesia) in *Asian Journal of Dairy and Food Research*, March, 2022).

Annexure 2.3: Indicators of Raising Cattle and Buffalo Clusters

Pillars	Sub-Pillars	Indicators	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
Institutional	Social Capital	Affiliated Dairy Cooperative Societies (DCS)	National Cooperative Database, Ministry of Cooperation, Government of India, 2023 Link	Yes	Yes
	Network & Partnership	FPOs	MCA data but not publicly available	MCA data but not publicly available	MCA data but not publicly available
		Membership of Dairy Cooperatives	National Cooperative Database, Ministry of Cooperation, Government of India, 2023 Link	Yes	Yes
		No. of private dairy farms	Secondary data not available	No	No
	Leadership and Vision	Dairy Federations	National Cooperative Database, Ministry of Cooperation, Government of India, 2023 Link	Yes	Not Applicable
	Entrepreneurship and Culture	Dairy Cooperative Brands	NDDB database	Yes	Not Applicable
		Percentage of employers in the specific NIC code	PLFS	Yes	Yes, but not reliable
	Competition	No. of private dairy farms	No secondary data available	Not Available	Not Available
	Information Access	% of dairy farmers who are accessing technical advice			
Business Infrastructure	Market Access	Procurement volume of milk across India -% of dairy farm households who are selling to the market	MoSPI: Situation Assessment Survey of Agricultural Households	Yes	Yes
	Specialist Service	Artificial insemination centres	DHAD Annual Report 2019-20	Yes	No
		No. of Artificial inseminations done	Basic Animal Husbandry Statistics	Yes	Infrequently available about the no. of artificial inseminations done
		Fodder farms	Basic Animal Husbandry Statistics	Yes	No

(*Contd.*)

Annexure 2.3: (Contd.)

Pillars	Sub-Pillars	Indicators	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
Business Infrastructure	Bulk Cooling Units	Bulk cooling units	Bimonthly Report on State Dairy Profile	Yes	No
		Liquid Milk Plants			
	Milk Processing Centre (No.)	Capacity of milk processed (TLPD)	Basic Animal Husbandry Statistics	Yes	No
Business Infrastructure	Financial Access	% of dairy farm households who have a bank account	MoSPI: Situation Assessment Survey Agricultural Households	Yes	Yes
		% of dairy farm households who have a bank account			
		% of dairy farm households who have accessed institutional credit			
		% of dairy farm households who accessed credit for capital expenditure in farm business			
Human Resources	Competence & Expertise	% of workers who are employed in dairy industry and who have technical/ vocational education	PLFS	Yes	Yes, but not reliable
		No. of training institutes	NDDB Training Institutes	Yes	Could be adapted to district-level
		State-wise no. of patents in dairy industry	Not Available	Not Available	Not Available
	Innovation	% of ICAR institutes and State Agricultural Universities devoted to dairy or veterinary	https://icar.org.in/state-agricultural-universities, https://icar.org.in/institutes# and https://icar.org.in/state-agricultural-universities	Yes	Could be adapted to district-level

(*Contd.*)

Annexure 2.3: (Contd.)

Pillars	Sub-Pillars	Indicators	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
Government Support	Infrastructure	No. of PACS by State	PACS	Available	Available
		No. of Gram Panchayats covered by Dairy Cooperatives	National Cooperative Database, Ministry of Cooperation, Government of India, 2023 Link	Yes	Not Applicable
		% of (dairy development plus animal husbandry) capital expenditure to total government expenditure or total agriculture	RBI	Yes	Not Applicable
	Policies	Dairy Progeny Programme	Not Available	Not Available	Not Available

Source: NCAER Compilation of Indicators and framework adapted from the Paper by Sutawi, I. Prihartini, L. Zalizar, A. Wahyudi, L. Hendraningsih (The Success Indicators of a Dairy Farming Cluster in Indonesia) in *Asian Journal of Dairy and Food Research*, March, 2022)

Annexure 2.4: List of Data Sources for the 'Weaving of Textiles' Sector

S. No.	Dimension/Pillar	Indicator	Source of data	State-wise data available (Yes/No)	District-wise data available (Yes/No)
1.	Institutional/ Government	Number of Factories	Annual Survey of Industries 2021-22, MoSPI, Govt. of India	Yes	No
2.	Institutional/ Government	Number of Weaving Units	Enterprise Survey of Unincorporated Enterprises, 2021-22, MoSPI, (GoI)	Yes	No
3.	Institutional/ Government	No of units of handloom / powerloom	Ministry of Textiles, GoI	Yes	No
4.	Gender/ Government	No of women workers for handloom	Ministry of Textile, GoI	Yes	No
5.	Government	List of mega clusters-handloom / powerloom	Ministry of Textiles, GoI	Yes	District names given
6.	Government	State wise list of clusters 2015-23[16]	Ministry of Textiles, GoI	Yes	District / cluster given
7.	Institutional/ Government	State-wise list of products for Handlooms	4th Handloom Census 2019-20, office of DC Handlooms, Ministry of Textiles, GoI	Yes	No

Source: NCAER Conceptualisation.

[16]State-wise number of Clusters sanctioned under National Handloom Development Programme (NHDP) & Comprehensive Handloom Cluster Development Scheme (CHCDS) during 2015-16 to 2021-22 (till date)

https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fhandlooms.nic.in%2Fassets%2Fimg%2FHandloom%2520Clusters%2F2500.xlsx&wdOrigin=BROWSELINK.

Annexure 2.5: Various Stages of Agriculture Value Chain, Activities, and Stakeholders

Stage	Activities	Stakeholders
Crop Planning	Which crops to cultivate, determining the acreage for each crop, and allocating them to specific plots, and weather conditions	Farmers, Krishi Vigyan Kendras, Agriculture Ministry at National and State Level, ICAR Institutes and State Agricultural Universities, Soil Testing Labs, Seed Testing labs, Agritech Start-ups
Cultivation	Preparation of soil, access to credit, sowing of seeds, irrigation, and application of manure, pesticides, and fertilisers to the crops.	Farmers, Seed companies/dealers; Fertiliser Companies/dealers; Farm Machinery companies/ dealers; Irrigation Pump Manufacturers/dealers; Custom Hiring centres, Credit Institutions, Farmer Producer Organisations, Agritech Startups
Harvesting	Cutting, collecting, cleaning, sorting, grading	Farmers, Custom hiring Centres, Farm machinery dealers/ operators, Farmer Producer Organisation, Agritech Startups
Storage and Transport	Grading and sorting, storage, transportation	Warehouses/cold storage, Transporter, Farmer Producer organisation, Agritech Startups
Marketing	Marketing and commodity pricing	APMC Mandis, Farmer Producer Organisations, State Marketing Federations, Procurement Agencies, Farmer Producer organisation, Agritech Startups

Source: NCAER Conceptualisation.

Annexure: 2.6 National Skill Gap Study for High Growth Sectors

Questionnaire for Firms

Manufacturing of Motor Vehicles

July, 2024

National Council of Applied Economic Research

Parisila Bhawan, 11 Indraprastha Estate, New Delhi 110002

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National Council of Applied Economic Research

National Skill Gap Study for High Growth Sectors

QUESTIONNAIRE

The Ministry of Skill Development and Entrepreneurship (MSDE), Government of India, is undertaking the 'National Skill Gap Study for High Growth Sectors' and NCAER is the implementing agency for the said study. The overall objective of this work is to develop a Labour Market Information System. The specific objective of this questionnaire is to understand the present and future demand for jobs roles/ occupations and associated skills. This study is sponsored by the Ministry of Skill Development and Entrepreneurship.

Your identity would be held confidential while discussing your suggestions and views on the subject.

Please email your responses directly to .....

1. Respondent's Name: .....
2. Respondent's Company Name and Address:

   .....
3. Respondent's Designation: .....
4. Respondent's Phone: .....
5. Respondent's Email: .....

FIRM PROFILE

1. What is the firm's ownership type? (Please select one)

☐ Public Sector

☐ Public Limited

☐ Private Limited

☐ Partnership/Individual Ownership

☐ Multinational Company

☐ Limited Liability Partnership

☐ Cooperative

☐ Others, please specify:

.....

2. What was the annual turnover range in FY 2023-24? (Please select one)

☐ ≤ Rs 5 crore (Micro)

☐ > Rs 5 crore & ≥ Rs 50 crore (Small)

☐ > Rs 50 crore & ≤ Rs 250 crore (Medium)

☐ > Rs 250 crore (Large)

3. How many manufacturing plants does the firm have in India? Information on plant locations (States, Districts, Clusters) will help in understanding the spatial spread of the industry.

3.1 Number of plants: .....

3.2 States and Districts: .....

3.3 Are the plants located in an auto cluster? Yes / No: .....; If 'Yes', which cluster:

.....

4. What was the investment in plant and machinery in FY 2023–24?
(Please select one)

- ☐ ≤ Rs 1 crore
- ☐ > Rs 1 crore & ≤ Rs 10 crore
- ☐ > Rs 10 crore & ≤ Rs 50 crore
- ☐ > Rs 50 crore
- ☐ No investment

5. What type of motor vehicles does the firm manufacture?
(Multiple selections possible)

- ☐ Passenger vehicles; what type (SUV/ hatchback/etc):

  .....

- ☐ Commercial vehicles; what type (trucks/ buses/etc):

  .....

- ☐ Trailers / semi-trailers; what type (flatbed/ refrigerated/etc):

  .....

- ☐ Other, please specify:

  .....;

  what kind:

  .....

6. Which technologies do the motor vehicles adhere to?
(Multiple selections possible)

- ☐ Internal combustion engine (ICE: Petrol / Diesel)
- ☐ Electric vehicles (EV)
- ☐ Compressed Natural Gas (CNG)
- ☐ Bio-fuel, please specify:

  .....

- ☐ Hydrogen fuel
- ☐ All technologies
- ☐ Other, please specify:

  .....

7. Which markets do you sell to?

7.1 Domestic / Foreign / Both:

.....

8. Overall, what is the percentage of female employees in the firm?
(Please select one)

- ☐ 0%
- ☐ ≤ 20%
- ☐ > 20% & ≤ 40%
- ☐ > 40% & ≤ 60%
- ☐ > 60% & ≤ 80%
- ☐ > 80%

UNDERSTANDING HIRING, SKILLING, GENDER-BASED ROLES, AND SKILL SHORTAGES

9. What are the mediums used for hiring employees?
(Multiple selections possible)

- ☐ Employment agency
- ☐ Online job sites/advertisements; Please specify:

  .....

- ☐ Own website advertisements
- ☐ Campus recruitment; Please mention institutions:

  .....

- ☐ Vocational training institutes
- ☐ Sector Skill Council / Sector Skill Council affiliated institutes
- ☐ Newspaper advertisements
- ☐ Internships/apprenticeships
- ☐ Networks and referrals
- ☐ Others, specify:

  .....

10. Do you provide on-the-job training within the firm, either before or after deployment?

10.1 Yes/No:.....

10.2 If 'Yes', what is your policy? .....

10.3 Should this training rather be provided by India's education and skilling system?

.....

11. Does the firm run its own skilling institution, or have any tie-up / informal-association with another institution / Automotive Skill Development Council (ASDC) for skilling purposes?

11.1 Yes/No:.....;

Is it owned by the firm? Yes/No:

.....

11.2 If 'Yes', please mention which institutions:

.....

12. What kind of association(s) does the firm have with the skilling institution(s) identified in Q.11?
(Multiple selections possible)

- ☐ We offer apprenticeships/internships for trainee students
- ☐ We send our staff to take visiting classes or other classes
- ☐ We offer inputs to the course curriculum
- ☐ We sponsor lab facilities in TVET or other institutions
- ☐ We sponsor fresh skilling programmes to absorb the students later
- ☐ We sponsor re-skilling/upskilling programs for our employees
- ☐ No associations
- ☐ Other; please specify:

.....

We have collated a list of occupations from the National Classification of Occupations (NCOs) and job roles from Automotive Skills Development Council (ASDC), associated with the full automotive value chain (white and blue collar), including manufacturing, and repair and maintenance, in **Table 1**.

13. For all types of motor vehicle manufacturing that the firm is involved in (Q.5), do the job roles (Annexure 1) cover the relevant activities undertaken by the firm?

13.1 Yes / No:.....

13.2 What other occupations/job roles should be included? Please specify:

.....

14. As regards gender ratio, which job roles?

14.1 Employ majority women (>50% of all workers in the job role):

.....

14.2 Employ some women (20% to 50% of all workers in the job role):

.....

14.3 Employ no women (0% of all workers in the job role):

.....

15. How easy or difficult was it to fill the job roles (including the number of positions) advertised by the firm in the last three years (FY 2021-22 onwards)? (Add rows if necessary. If the firm advertised many job roles, you can specify job roles at two extremes: those which were easiest to fill, and those very difficult/un-filled)

S. No.	Job Roles advertised	Please Specify the Level: Entry level/intermediate or mid-level/ senior level/managerial level/director level/executive level	Difficulty of filling jobs (rank) 1. Very easy; 2. Easy; 3. Average; 4. Difficult; 5. Very difficult; 6. Not filled at all
1.			
2.			
3.			
4.			
5.			

16. In Q. 15, for the job roles with rank 3–6 on 'difficulty of filling jobs', can you please detail the skills, knowledge and education sought by the firm – in the form of a detailed job description? (Please refer to **Table 2.** Request you to provide the details, for each of the relevant job roles, within the format of **Table 2).**

We are seeking the following information:

Job Role	Stage of Value Chain	Tasks	Educational Qualifications sought by the firm	Knowledge (technical and theoretical knowledge relating to the job role)	Technical Skills (Computer applica-tions and software)	Years of Experience	Skills (refer to Table 3)	Geographical areas/spatial clusters (existing or emerging) where it is most difficult to fill the role (mention States and Districts)

17. Who is presently providing education and skilling for these 'hard to fill' job roles in Q.16, if any?

17.1 Nobody/formal education system/ vocational education system? Please specify:

.....

17.2 Is the formal/vocational education system run by the government/private parties/ NGOs? Please specify:

.....

17.3 Please list the formal and vocational training institutions for these job-roles:

.....

18. For the motor vehicle manufacturing the firm is involved in (Q. 5 and Q .6), what are the upcoming technological developments?

18.1 Please specify: .....

19. Does the firm have its own R&D and design division, or plan to develop one?

19.1 Have R&D unit/Plan to set up R&D unit/ no R&D and no plan:

.....

20. In view of the developments (Q. 18 and Q. 19), which job roles will be in-demand in the next three years by the firm? (Please refer to **Table 2.** Request you to provide the details, for each of the relevant job roles, within the format of **Table 2).**

We are seeking the following information:

Job Role	Stage of Value Chain	Tasks	Education	Knowledge	Technical Skills	Years of Experience	Skills (refer to Table 3	Geographical areas/spatial clusters where needs are highest (mention States and Districts)	Difficulty of finding workers 1. Not at all difficult 2. Somewhat difficult 3. Difficult 4. Very Difficult 5. Extremely difficult

GENDER DIVERSITY AND CAREER PATH AT WORKPLACE

21. In the next three years, do you perceive a demand for women in particular job roles, either among the existing job-roles or those which will be in-demand in future?

21.1 Yes/No:.....

21.2 If 'Yes', please specify which ones:

.....

22. Does the firm have hiring policies to encourage female employment, especially in non-traditional job roles?

22.1 Yes/No:.....

22.2 If 'Yes', please explain the policy in detail:

.....

22.3 Does the firm provide creche on plant/ office premises: Yes/No:

.....

23. Has the firm defined sexual harassment policies, prevention systems, procedures and service rules for employees (prevention of Sexual Harassment at Workplace or POSH)?

23.1 Yes/No:.....

24. Does the firm offer a career-path to all its employees? (for instance, has anyone at the firm risen from being at a 'technician level position' to a 'managerial level position')?

24.1 Yes/No:.....

24.2 Does the firm fund the employee's education / upskilling / re-skilling, as may be required for higher level job roles? Yes/No:

.....

EMPLOYMENT BACKGROUND

25. How many people are employed at the firm?

S. No.	Particulars	Number of people employed	
		Managerial Staff (No.)	Workers (No.)
Total Employees (in numbers)			

26. With reference to the total employees identified in Q. 25, what is the educational background of the employees (as percentage (%) of total employees)?

Below Class X (%)	Above Class X and Below Class XII (%)	Class XII pass (%)	Vocationally Educated (ITI, PMKVY, RPL, etc.)	Bachelor's degree and above (%)

Table 1 List of Job Roles

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
112 - Managing Directors and Chief Executives	1120.1700	Working Proprietor, Manufacturing/ Proprietor, Manufacturing	
	1120.1800	Director Manufacturing	Automotive Smart Manufacturing Head
	1120.3500	Working Proprietor, Other Services	
	1120.3600	Director, Other Services	
	1120.9900	Managing Directors and Chief Executives, Others	
121 - Business Services and Administration Managers	1211.9900	Finance Managers, Others	
	1212.0100	Personnel Manager	
	1212.9900	Personnel and Industrial Relations Managers, others	
	1213.0100	Manager, Automotive Service	
	1213.0101	Quality Assurance Standards In-Charge	Automotive Quality Control Lead Inspector
	1213.0200	Manager, Automotive Service Station	
	1213.0201	Area Service Manager	
	1213.0202	Territory Service Manager	
	1219.0100	Manager, Import and Export	
122 - Sales, Marketing and Development Managers	1223.0102	Manager Material Testing	Automotive Robotics System Integrator/Planner
	1223.0101	Manager Testing Facility	Automotive Robotics and Automation Manager
			Automotive Robotics and Automation Simulation Engineer
132 - Manufacturing, Mining, Construction and Distribution Managers	1321.0600	Manager, Manufacturing	
134 - Professional Services Managers	1349	Professional Services Managers Not Elsewhere Classified	
142 - Retail and Wholesale Trade Managers	1420.0100	Manager, Wholesale Trade	
	1420.0200	Manager, Retail Trade	
143 - Other Services Manager	1439	Services Manager Not Elsewhere Classified	
212 - Mathematicians, Actuaries and Statisticians	2120.0300	Statistician	Automotive Manufacturing Data Science Specialist
214 - Engineering Professionals (Excluding Electrotechnology)	2141.0100	Works Inspector, Engineering/ Inspection Engineer	
	2144.0301	Equipment Designer	Automotive Production Equipment Design Engineer
	2144.0700	Mechanical Engineer, Automobile	
	2144.0800	Automobile Designer	
	2144.0803	Product Design Engineer	Electric Vehicle Product Design Engineer;
			Automotive Product Design Lead Engineer

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
214 - Engineering Professionals (Excluding Electrotechnology)	2141.2500	Safety Engineer	Automotive Design Safety Specialist
	2144.0801	Product Design Manager	Automotive Additive Manufacturing Technician
			Automotive IIOT Application Engineer
			Automotive IIOT Application Technician
	2144.0804	Prototyping Manager	Automotive Automation and Robotics Engineer
			Advanced Driver Assistance System (ADAS) Engineer
	2145.0900	Technologist, Fuel	Automotive Flex Fuel Engine Designer
215 - Electrotechnology Engineers	2151.9900	Electrical Engineers, Other	
	2151.0602	Systems Designer (PCB Design)	Automotive IIOT Application Specialist
			Automotive Manufacturing Data Analyst
	2152.0902	Testing and Validation Engineer	Automotive Material Testing Incharge
232 - Vocational Education Teachers	2320	Vocational Education Teachers	
241 - Finance Professionals	2411	Accountants	
	2412.9900	Financial and Investment Advisors, Other	
	2413	Financial Analysts	
242 - Administration Professionals	2421.0101	Analyst-Research	
	2424.0401	Sales Training Manager	
	2424.0402	Sales/Service Trainer (Dealer)	Automotive Sales Trainer
243 - Sales, Marketing and Public Relations Professionals	2431.0100	Market Research Analyst	
	2431.0201	Product Brand Manager (Automotive)	
252 – Database and Network Professionals	2521.0100	Database Design Analyst	Automotive Data Science Head
			Automotive Dealership Data Analyst
			Automotive Dealership Data Science Specialist
	2523.9900	Computer Network Professionals, Other	Automotive Cyber security Engineer
			Automotive Cyber security Specialist
264 - Authors, Journalists and Linguists	2642	Journalists	

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
311 - Physical and Engineering Science Technicians	3113.0102	Maintenance Technician Electrical	Automotive Maintenance Technician-Electrical
			Electric Vehicle Maintenance Technician
	3113.0401	Machine Maintenance Technician	
	3115.0102	Maintenance Technician – Mechanical	Automotive Maintenance Technician-Mechanical
	3115.0103	Maintenance Technician Assistant – Mechanical	Automotive Prototype Manufacturing Lead Technician
	3115.0104	Body Shop In-Charge	
	3115.0105	Workshop Manager	
	3115.0201	Automotive Engineering Technician/ Testing Manager	
	3115.0202	Test Engineer Product/Vehicle	
	3115.0301	Executive, Proto Manufacturing	
	3115.0501	Manager Maintenance Mechanical and Electrical	Automotive Maintenance Lead Technician-Electrical
			Automotive Maintenance Lead Technician-Mechanical
	3115.0601	Master Auto Service Technician/Auto Service Technician	
	3115.0602	Auto Service Technical Manager/Auto Service Technician	Heavy Commercial Vehicle Service Technician
			Automotive Detailer Assistant
			Automotive Detailer Technician
			Bicycle Mechanic
			CNG Kit Fitment Technician
			Electric Vehicle Service Assistant
			Electric Vehicle Service Lead Technician
			Electric Vehicle Service technician
			Fabrication and Service Technician
			Four Wheeler Service Assistant
			Four wheeler Service Lead Technician
			Four Wheeler Service Master Technician
			Four Wheeler Service Technician
	3115.1302	Tool Room Supervisor	Automotive Tool Room Lead Technician
	3118.0301	Draftsman	Automotive CAD Technician
			Computer Aided Product Design
			Product Reverse Engineering

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
312 - Mining, Manufacturing and Construction Supervisors	3122.0601	Assembly Line Supervisor	Automotive Assembly Lead Technician;
	3122.2200	Plastic Moulding Shop Supervisor	
	3122.4200	Supervisor and Foreman, Welding and Flame Cutting	
	3122.4401	Casting Line In-Charge	
	3122.4501	Forging Shop Shift In-Charge	
	3122.4502	Forging Shop Supervisor	
	3122.4601	Press Shop Shift In-Charge	
	3122.4602	Press Shop Supervisor	
	3122.4701	Welding Machine Setter	Automotive Welding Machine Master Technician
	3122.4702	Welding Supervisor	Automotive Welding Machine Lead Technician
		Welding Supervisor	Automotive Welding Machine Trainer
			Manufacturing and Mechatronics Lead Technician
	3122.5300	Supervisor and Foreman, Motor Vehicle Repairing	Fleet Telematic Executive
	3122.6502	Product Development Manager	Automotive Smart Manufacturing Engineer
			Automotive Smart Manufacturing Specialist
			Automotive Sustainability Engineer
313 - Process Control Technicians	3139.1400	Robotic Machine Operator	Industrial Robotic System Integration
			Industrial Robotic System Planning
	3139.1501	Auto component Assembly Fitter	
	3139.2001	Assembly Supervisor	
	3139.5001	Quality Control Inspector	Automotive Quality Control Assistant
			Automotive Quality Control Inspector
			Electric Vehicle Quality Control Inspector
	3139.5002	Quality Controller	Automotive Service Quality Controller
	3139.9900	Industrial Robot Operators, Other	

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
332 - Sales and Purchasing Agents and Brokers	3321.0101	Sales Officer (Auto Insurance)	
	3321.0102	Sales Consultant (Auto Finance)	
	3322.0801	Area Manager (Auto Components)	
	3322.0802	Sales Officer (Auto Components)	
	3322.1001	Territory Sales Manager	
	3322.1002	Territory Sales Manager (Used Vehicles)	
	3322.1101	Customer Relationship Manager	Automotive Customer Relationship Manager
	3322.1201	Regional Sales Manager (Pre-Owned Vehicles)	
	3322.1202	Sales Lead (Pre-Owned Vehicles)	
	3322.1203	Sales Consultant (Pre-Owned Vehicles)	
	3322.1301	Sales Manager	
	3322.1303	Sales Consultant (Retail)	Automotive Sales Consultant
			Automotive Sales Leader
	3322.1304	Sales Consultant	Automotive Sales Executive
	3322.1501	Regional Sales Manager (RSM)	
	3322.2501	Service Supervisor	Automotive Service Supervisor
	3322.2502	Service Advisor	Automotive Service Advisor
411 - General Office Clerks	4110.0100	Clerk, General	
	4110.0200	Clerk, Enquiry	
	4110.0500	Time Keeper	
413 - Keyboard Operators	4131	Typists and Word Processing Operators	
	4132	Data Entry Clerks	
422 - Client Information Workers	4226.0201	Showroom Hostess/Host (This NCO appears only in NIC 45200 - maintenance & repair of vehicles - occupation does not match industry)	Automotive Showroom Host
431 - Numerical Clerks	4311	Accounting and Bookkeeping Clerks	
	4312	Statistical Finance and Insurance Clerks	
	4313	Payroll Clerks	
432 - Material Recording and Transport Clerks	4321.0101	Spare Parts Operations Executive	Automotive Spare Parts Operations Assistant
	4321.0501	Store Ops Assistant	
	4321.0601	Warehouse Picker	
	4321.0701	Warranty Processor	Automotive Warranty Processor
441 - Other Clerical Support Workers	4413	Coding, Proofreading and Related Clerks	
	4415	Filing and Copying Clerks	
	4416	Personnel Clerks	
	4419	Clerical Support Workers Not Elsewhere Classified	

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
512 - Cooks	5120.0200	Cook, Institutional	
515 - Building and Housekeeping Supervisors	5151.0201	Janitor/Housekeeping Attendant	
516 - Other Personal Service Workers	5165	Driving Instructors	Driver Trainer-LMV (NCO-2015/5165.0101)
521 - Street and Market Salespersons	5211.0300	Telemarketing Sales Person/ Telemarketing Sales Operator	
	5211.0301	Sales Executive – Dealership	Automotive Sales Assistant
	5211.0302	Telecaller	Automotive Telecaller
522 - Shop Salespersons	5223.0105	Trainee Associate	
524 - Other Sales Workers	5242.0102	Sales Associate	
	5242.0201	Customer Care Executive (Relationship Centre)	
	5242.0301	Customer Care Executive (Repair Centre)	
	5242.0401	In-Store Promoter	
	5244.0103	Customer Relation Executive	
	5249.0101	Key Account Service Manager	
	5249.0201	Commercial Manager (Zonal/ Regional)	
	5249.0202	Commercial Executive/Officer	
	5249.0301	Salesman, Retail Trade	
541 - Protective Service Workers	5411	Fire Fighters	
	5414	Security Guards	
	5419	Protective Services Workers Not Elsewhere Classified	
713 - Painters, Builders, Structure Cleaners and Related Trades Workers	7132.0202	Auto Spray Painter/Painter	
	7132.0203	Auto Body Painting Technician – Surface Treatment	Automotive Body Painting Technician
			Automotive Body Painting Operator
	7132.0204	Automotive Body Painting Technician	
	7132.0205	Auto Spray Painter Assistant/Painter	
	7132.0300	Metal Sprayer	Automotive Paint Repair Assistant
			Automotive Paint Repair Technician
	7132.0901	Automotive Paint Shop Assistant	Automotive Paint Shop Assistant

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
721 - Sheet and Structural Metal Workers, Moulders and Welders, and Related Workers	7211.0101	Press Shop Operator	Automotive Press Shop Technician
	7211.0102	Press Shop Assistant/Helper	Automotive Press Shop Assistant
	7211.0201	Casting Technician – Sand Moulding	Automotive Casting Technician
	7212.0301	Welder	
	7212.0302	Welding Technician	Automotive Welding Machine Technician
	7212.0303	Gas Metal Arc Welder/Metal Inert Gas/Metal Active Gas/Gas Metal Arc Welder (MIG/MAG/GMAW)	Automotive Welding Machine Operator (Manual and Robotics)
	7212.0801	Welding Assistant	Automotive Welding Machine Assistant
	7213.0201	Auto Engine Repair Technician	Automotive Engine Repair Technician
			Automobile Lead Technician (Diagnostics)
			Automobile Technician (Diagnostics)
			Automotive Open System (AUTOSAR) Engineer
			Automotive Unified Diagnostics Engineer
			End of Life Vehicle Dismantler
	7213.0301	Dent Remover/Auto Body Repair Technician/ Denter	Automotive Body Repair Assistant
	7213.0302	Auto Body Technician/Denter	Automotive Body Repair Technician
722 - Blacksmiths, Tool Makers and Related Trades Workers	7221.0301	Forging Operator	Automotive Forging Technician
	7222.0200	Tool Maker	Automotive Tool Room Technician
	7223.0401	Assembly Line Machine Setter	Automotive Assembly Master Technician
	7222.0500	Die Maker	
	7223.0501	Machine Shop Master Technician/ Setter	Automotive Machining Master Technician
			Automotive Machining Trainer
	7223.0502	Machine Shop Supervisor	Automotive Machining Lead Technician
	7223.0601	Turner/Conventional Turning	Automotive Conventional Machining Technician
	7223.5001	Machining Technician/CNC Operator	Automotive Machining Operator
	7223.5002	CNC Operator – Machining Technician	Automotive CNC Machining Technician
	7223.5003	CNC Operator-Machinist	

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
723 - Machinery Mechanics and Repairers	7231.01	Mechanic, Automobile	
	7231.0101	Maintenance Technician – Service Workshop	Automobile Jr. Technician (Service and Maintenance)
	7231.0102	AC Specialist	Automotive AC Technician
	7231.0103	Automotive Body Technician Level 3	
	7231.0104	Automotive Body Technician Level 4	
	7231.0105	Brake Specialist	
	7231.0106	Clutch Specialist	
	7231.0107	Auto Service Technician – Mechanic	
	7231.0108	Auto Service Technician – Helper	
	7231.0200	Engine Tester	
	7231.0201	Test Technician	Automotive Product Testing Technician
			Electric Vehicle Test Engineer
	7231.0400	Fitter Automobile	
	7231.0501	Auto Service Technician (Two and Three Wheelers)	Two Wheeler Service Assistant
			Two Wheeler Service Technician
	7231.0900	Cleaner Motor Vehicle	
	7231.9900	Motor Vehicle Mechanics, Other	
	7233.1200	Millwright	
	7233.2901	Fitter: Hydraulic and Pneumatic System	
731 - Handicraft Workers	7316.1200	Sign Writer, Decorative Painters, Engravers and Etchers, Other	
741 - Electrical Equipment Installers and Repairers	7412.0101	Automation Specialist	Automotive Automation Specialist
			Automotive Additive Manufacturing Operator
	7412.0701	Electrician, Automobile	Automotive Electrician
	7412.0801	Maintenance Assistant/Helper	Automotive Maintenance Assistant
	7419.0500	Battery Servicing Man	
742 - Electronics and Telecommunication Installers and Repairers	7421.0101	Iron and Steel Fitter: Electronic Assembly	
752 - Wood Treaters, Cabinet Makers and Related Trades Workers	7522.0600	Body Builder, Automobile	
753 - Garment and Related Trades Workers	7534.0300	Upholsterer, Vehicle	
754 - Other Craft and Related Workers	7543.0701	Incoming QC Technician	
	7543.2001	Quality Inspector-forged, casted or machined components	
811 - Mining and Mineral Processing Plant Operators	8111.0200	Driller, Machine	

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
812 - Metal Processing and Finishing Plant Operators	8121.3701	Heat Treating Furnace Operator	Automotive Heat Treatment Technician
	8121.3801	Assistant Casting Technician	Automotive Casting Operator
	8121.4200	Die Casting Machine Operator	
	8121.4201	Pressure Die Casting (PDC) Operator	
	8121.4300	Casting Machine Operator (Non-Ferrous Metal)	
813 - Chemical and Photographic Products Plant and Machine Operators	8131.2200	Heat Treater	
814 - Rubber, Plastic and Paper Products Machine Operators	8141.1703	Tyre Building Operator – Passenger Vehicles	
	8141.1801	Tyre Moulding Operator	
	8141.2100	Tyre Repairer	
	8142.1100	Printing Machine Operator	Automotive Additive Manufacturing Engineer
	8142.1301	Plastic Moulding Technician or Operator	Automotive Plastic Moulding Assistant; Automotive Plastic Moulding Technician
815 - Textile, Fur and Leather Products Machine	8153.0101	Sewing Machine Operator, General	
817 - Wood Processing and Papermaking Plant Operators	8172.9900	Wood Processing Plant Operators and Related Workers, Other	
818 - Other Stationary Plant and Machine Operators	8183.0100	Building Insulator, Machine	
821 - Assemblers	8211.1000	Mechanist, General/Machinist	Front line Production Resourse
	8211.1200	Assembler, Automobile	Automotive Assembly Assistant
			Machining and Assembly Technician
			Electric Vehicle Assembly Operator
			Electric Vehicle Assembly Technician
			Automotive Assembly Operator
			Automotive Assembly Technician
	8211.1201	Vehicle Assembly Fitter	
	8212.0100	Battery Assembler	Automotive Battery Management System (BMS) Engineer
			Automotive Electric Vehicle BSS (Battery Swapping System) Planning Engineer

(*Contd.*)

Table 1: (Contd.)

3 Digit NCO	Four/Eight Digit NCO	NCO Description	Automotive Skills Development Council Job Role
832 - Car, Van and Motorcycle Drivers	8321.0101	Driver Auto Rickshaw	Auto Rickshaw Driver
			E-rickshaw Driver
	8321.0201	Delivery Associate/Two Wheeler Delivery Associate	Two Wheeler Delivery Associate
	8322.0102	Chauffer, Cab Driver	Chauffeur
			Commercial Vehicle Driver
	8322.0201	Driver, Taxi	Taxi Driver
	8322.0301	Driver, Ambulance	Ambulance Driver
	8322.0501	Light Motor Vehicle Driver	Light Motor Vehicle Driver
833 - Heavy Truck and Bus Drivers	8331.0500	Driver Road Test	
	8331.0501	Test Driver	
	8332	Heavy Truck and Lorry Drivers	
834 - Mobile Plant Operators	8344.0201	Fork Lift Truck Operator	Forklift Operator/Driver
	8344.9900	Lift Truck Operator, Other	
835 - Ships' Deck Crews and Related Workers	8350.0500	Driver, Launch/Tug Master	
911 - Domestic, Hotel and Office Cleaners and Helpers	9112.0100	Dusting Man, Office; Farash, Office/ Housekeeping Attendant	
	9112.9900	Helpers and Cleaners in Offices, Hotels and Other Establishments, Other	
912 - Vehicle, Window, Lanundry and Other Hand Cleaning Workers	9122.0201	Washer	Automotive Washer
	9122.0301	Driving Assistant	Driving Assistant
	9122.9900	Vehicle, Window and Related Cleaners, Other	
932 - Manufacturing Labourers	9321.0101	Packer, Hand	Automotive Packing Assistant
	9321.1401	Machining Assistant or Helper	Automotive Machining Assistant
	9321.9900	Hand Packers, Others	
	9329.0701	Accessory Fitter	Automotive Accessory Fitter
	9329.0801	Parts Picker	Automotive Material Handling Operator
933 – Transport & Storage Labourers	9331.0300	Hand Cartman	
	9333.0101	Loader/Loading and Unloading Operator	Automotive Material Handling Assistant
951 - Street and Related Service Workers			
961 - Refuse Workers	9611.9900	Garbage Collectors, Other	
	9613	Sweepers and Related Labourers	
962 – Other Elementary Workers	9623.0401	PUC Attendant	
	9623.0501	Tyre Inflation Attendant	
	9623.0601	Quick Care Point Attendant	

Source: NCAER Conceptualisation.

(Request you to provide the details, for each of the relevant job roles, in the format as given below)

S. No.: _____

Job Role: _____

Table 2 **Job Descriptors**

Descriptors		**Firm's Answer**
Alternative job titles in the industry		
Stage of automobile value chain: 1. Design and R&D 2. Manufacturing 3. Sales 4. After sales service: Repair and Maintenance 5. Support services (Procurement, Finance, HR, etc; please specify)		
Is this job role: 1. 'Difficult to fill' at present (Q.16), or 2. Will be in-demand in next 3 years by the firm (Q.20)		
How many do you need to hire at the 'present moment'/now, or you will need to hire 3 years from now?		
Tasks to be performed in the job role (please include specific systems / components / technologies / personnel required to be dealt or interacted with, if any)		
Education: School (up to what level?) / ITI/ Short-term vocational training programme/ Bachelors/ Masters)		
Knowledge	General? What knowledge? Specialised (Sector, Occupational, and Trade)	
Technical Skills: Software languages required, or maybe required in the near future		
Years of Experience, if any		
Skills required and level of competence (refer to framework of skills in Table 2 below)		
Difficulty of finding workers in the job role, with the above requirements and the skills as detailed below: 1. Not at all difficult 2. Somewhat difficult 3. Difficult 4. Very Difficult 5. Extremely difficult		
Geographical areas/spatial clusters (existing or emerging) where it is most difficult to fill the role** (mention States and Districts)		

Source: NCAER Conceptualisation.

** Please explain the reasons behind skill shortage in the specified states and districts: Are there demand side factors (such as low salary, demanding work conditions, absence of platforms to advertise jobs, non-acceptability of workers from conventional labour markets, competition from other sectors to hire the same candidate, etc.) and/or supply side factors (such as course not offered by Indian institutions, specialised skilled people not available, absence of and/or proximity to training centres, poor quality of skilling and training programs, lack of programs for re-skilling/upskilling workers from traditional sectors, high salary expectations, non-aspirational job role, availability of other work avenues, etc.)?

Table 3 List of Skills

Please think whether the person in the above job profile would need the following skills to do their job. (Please choose the relevant skills and indicate the level of competence required for those skills)		
Skills Required	**If required, what is the degree of competence needed in the employee?** **1. Beginner** **2. Intermediate** **3. Competent** **4. Advanced** **5. Very Advanced**	**Indicators**
Reading Literacy: Would they need to read and understanding written sentences and paragraphs in work related documents?		
Writing: Would they need to communicate effectively in writing as per their audience for their job?		
Speaking: Do they need to talk to others to convey information effectively?		
Communication: Would they need to provide information to supervisors, co-workers, and subordinates by telephone, in written form, e-mail, or in person?		
Language Skills 1: Is knowledge of the structure and content of the language including the meaning and spelling of words, rules of composition, and grammar required for the job?		
Language Skills 2: Any specific language requirement for the job? If Yes, which one?		
Numeracy/Mathematics: Would they need to work with numbers for their job?		
ICT Literacy to Skills: Would they need to use mobile phones/ tabs/computers etc. to do their job? For example, Arts & Graphics, Desktop Publishing, Presentation, Spreadsheet, Word Processing, Programming, Client Server/ Networking/Hardware, Operating Systems, Database/Statistics, Engineering Software and Web Page Design etc.		
Self-learning to Active (Independent) Learning: Would they need to understand new information for both current and future problem-solving and decision-making at their job? Are they expected to do on their own for the job or self-learn, if the material is provided to them?		
Active Listening: Do they need to listen for their job, like taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times?		
Science: Do they need to use scientific rules and methods to solve problems at work?		
Problem Solving: Do they need to identify problems and review related information to develop and evaluate options and implement solutions?		
Learning Strategies: Do they need to select and use training/ instructional methods and procedures appropriate for the situation when learning or teaching new things?		
Critical Thinking: Would the worker need to use logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems?		
Creativity: Do the workers need to develop, design, or create new applications, ideas, relationships, systems, or products, including artistic contributions?		
Independent research: Would the worker need to conduct literature review, undertake data collection, cleaning etc., develop research plan?		

(*Contd.*)

Table 3: (Contd.)

Skills Required	If required, what is the degree of competence needed in the employee?	Indicators
Judgement and Decision-making: Would the worker need to consider the relative costs and benefits of potential actions to choose the most appropriate one?		
Systems Analysis: Would the worker need to determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes?		
Systems Evaluation: Would workers need to identify measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system?		
Financial Resources: Would the worker need to determine how money will be spent to get the work done, and accounting for these expenditures?		
Material Resources: Would the worker need to obtain and see to the appropriate use of equipment, facilities, and materials needed to do certain work?		
Personnel Resources: Would the worker need to motivate, develop, and direct people as they work, identifying the best people for the job?		
Time Management: Managing one's own time and the time of others		
Seek and Value Diversity: Do workers need to work with people (as colleagues/clients etc.) from other cultures/States/ socio-economic backgrounds etc? Is it important for their job performance? Is it likely to be important for their job performance?		
Gender Diversity: Do workers need to work with female colleagues/clients etc.? Is it important for their job performance? Is it likely to be important for their job performance?		
Conscientiousness (including attitude towards work): Will the worker need to be organised, responsible, and hardworking or have any one of the following traits-Competence (efficient)". organised, dutiful (not careless), ambitious, self-discipline (not lazy), and not impulsive?		
Openness to Experiences: Will the worker need to be open to new aesthetic, cultural, or intellectual experiences or have any one of the following traits-Imaginative, artistic, excitable, wide interests, curious and unconventional?		
Extraversion: Will the worker need to show the following traits-warmth (friendly), sociable, self-confident, energetic, excitement seeking (adventurous), and enthusiastic?		
Agreeableness: Will the worker need to work in a team in a cooperative, unselfish manner?		
Neuroticism/Emotional stability: Will the worker need to show emotional stability i.e. predictability and consistency in emotional reactions, with absence of rapid mood changes?		
Does the worker need social skills at work?		
Instructing: Does the worker need to teach others how to do something?		
Negotiation: Does the worker need to bring others together and try to reconcile differences?		
Persuasion: Do workers need to persuade others to change their minds or behaviour?		
Occupation-specific skills		
Physical skills, including job-specific complex psychomotor skills		
Global Competence: Globally competent workers		
Any other? Please specify:		

Source: NCAER Conceptualisation.

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