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Employment scope for fisheries professionals in India and Chhattisgarh: A case study

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Abstract

The investigation was conducted to evaluate the potential for fisheries education in Chhattisgarh, India, across both public and private sectors associated with fisheries. The survey involved a thorough examination of existing fish farms, industries, and educational institutions through an extensive venture study. Data analysis techniques including averages and percentages were employed for estimation purposes. The study revealed that a fish seed hatchery with a capacity ranging from 1.0 to 5.0 crore fry would require 8-10 fisheries graduates and 12-24 technicians. Additionally, to ensure genetic integrity conservation and management, an additional 4-5 professionals holding postgraduate degrees and 2-3 with doctorates are deemed essential. In the fish feed industry, a major unit currently producing 10,000 tonnes per annum employs approximately 100 fisheries graduates, with projections indicating an increase to 250 by the year 2025. Furthermore, the fisheries departments of Chhattisgarh have forecasted a need for an additional 2,838 posts by 2025, totaling 7,684 positions. The study underscores the anticipated demand for fisheries professionals, averaging 8,131 per year within the state and 7,598 per year outside the state during the period spanning 2021-2025. This highlights the urgent requirement to expand educational institutions and ensure the recruitment of adequately qualified staff to facilitate the robust growth of the fisheries sector and the sustainable utilization of natural resources in Chhattisgarh.

Keywords: Chhattisgarh, fisheries professional, employment scope, fisheries sector

Introduction

India stands as the sixth largest contributor to global fish production and the second largest in inland fisheries. Approximately 14 million individuals find employment directly or indirectly in the fisheries sector (GOI, 2022). This field generates numerous opportunities, including fish harvesting, post-harvest activities, pharmaceuticals, biofuel production, aqua-clinics, and organic manure production, for each person engaged in capture fisheries and aquaculture.

Over the past five decades, there has been a steady annual growth rate of 4.1% in fish production. However, the demand for skilled manpower remains a significant challenge. By 2025, India is projected to require over 15,457 fisheries graduates annually, while the current supply stands at only 4,570 students per year (Agrawal, 2016) [3]. Research by the Central Institute of Fisheries Education (CIFE) forecasts a need for 10,457 fisheries graduates by 2020, yet the supply remains at 4,570 (Sukham, 1010) [11]. Various studies have addressed the manpower needs in the fisheries sector, with estimates varying widely from a few thousand to several hundred thousand individuals requiring different levels of training, education, and expertise (Chidambaram, 1985; James, 1987; Thakur *et al*., 1997; Kohli, 1998; Ayyappan and Biradar, 2000) [5, 7, 13, 8, 4].

The demand for skilled personnel in the fisheries sector underscores the importance of fostering education and training programs to meet these needs. Efforts to bridge the gap between demand and supply should focus on enhancing the quality and relevance of fisheries education, as well as promoting vocational training initiatives. Additionally, investments in research and development can lead to innovations that improve productivity and sustainability within the industry (Ayyappan and Biradar, 2000) [4]. By addressing these challenges holistically, India can capitalize on its vast potential in the fisheries sector while simultaneously creating more opportunities for employment and economic growth.

Materials and Methods

Data Collection

A comprehensive survey was undertaken to assess the involvement of both public and private entities in the development of fisheries within the state, whether through direct or indirect means. These entities encompassed a diverse range, including the state fisheries department, colleges, institutions, federations, centers, company groups, and individual farmers. The study primarily relied on secondary data gathered from a multitude of sources. These

included official reports such as annual reports from government departments and updates, along with information from various venture sources pertinent to the subject matter. This method ensured a thorough examination of the landscape, drawing insights from multiple perspectives and data repositories.

Results and Discussion

Supply estimation

Chhattisgarh state is home to a singular institution dedicated to fisheries education, located within Dau Shri Vasudev Chandrakar Kamdhenu Vishwavidyalaya in Kawardha (Dist. Kabirdham). This college offers Bachelor of Fisheries Science (B.F.Sc) programs with a capacity to train up to 100 fisheries professionals. However, despite this educational provision, the state's burgeoning fisheries sector faces a considerable shortfall in trained technicians. The recently established Fisheries Polytechnic, which has the potential to contribute to addressing this gap, currently only produces around 30 fisheries technicians. This output falls significantly short of the substantial demand for skilled professionals within the sector, highlighting a pressing need for expanded educational infrastructure and capacity-building initiatives.

Table 1: Average intake and outturn of students in fisheries sciences in Chhattisgarh

	Undergraduate (UG)		Postgraduate (PG)	
	Intake	**Outturn**	**Intake**	**Outturn**
College of Fisheries	100	100	6	6
Fisheries Polytechnic	30	30	-	-

Demand estimation

Practically every sub-sector within the fisheries industry, including Aquaculture, Fish Processing Technology, Fish Genetics and Biotechnology, Fish Health, Aquatic Environment Management, Fish Biology, Fisheries Economics, and Extension, requires a workforce consisting of technicians, as well as skilled and semi-skilled personnel. This diverse category encompasses individuals with diplomas, vocational training, and those educated through on-the-job training programs. Each sub-sector demands a separate assessment of its workforce requirements to ensure that the appropriate skills and expertise are available to sustain and enhance operations effectively. Such a comprehensive approach acknowledges the multifaceted nature of the fisheries industry and facilitates targeted workforce development strategies tailored to the specific needs of each sub-sector.

Aquaculture

Aquaculture emerges as the most promising sub-sector within the fisheries industry, boasting a potential area spanning between 1.9 to 2.4 lakh hectares of water resources. Despite this vast potential, the current landscape reveals a relatively modest number of registered aquaculture units, totaling around 100, alongside a mere 69 hatcheries. To effectively gauge the manpower requirements across the spectrum of fish farms, certain benchmarks have been established. For instance, a farm occupying 10 hectares is estimated to necessitate a workforce of at least twenty graduates, while a medium-sized farm spanning between 2 to 10 hectares would require a minimum of ten graduates. Smaller-scale farms below 2 hectares typically require around four technicians. Given the diversity in farm sizes and operational requirements, it's crucial to account for these variations in estimating the workforce. Presently, approximately 10,000 graduates are projected to be needed, with a significant portion of these roles requiring undergraduate qualifications. This underscores the urgency for targeted education and training initiatives to meet the evolving demands of the aquaculture sector.

Fish seed hatcheries

In the fiscal year 2019-20, fish seed production amounted to approximately 265 crore standard fry, showing a consistent annual growth rate of 10%. Projections suggest this figure will rise to 285 crore standard fry in the upcoming year, indicative of the sector's continued expansion. From 1997-98 to 2017-18, hatcheries have demonstrated a commendable growth rate ranging between 8-10% annually. Presently, there are approximately 69 operational hatcheries, jointly managed by private and government entities. On average, each unit yields around 3.85 crore standard fry. Adhering to government norms, a fish seed hatchery with a capacity between 1.0 to 5.0 crore fry necessitates a workforce comprising 8-10 fisheries graduates and 12-24 technicians. Furthermore, for the crucial task of genetic integrity conservation and management, an additional 4-5 professionals holding post-graduate qualifications and 2-3 individuals with doctorate degrees are deemed necessary. It's anticipated that the number of hatcheries, across all categories, will expand by approximately 5% annually, reflecting the sector's sustained growth trajectory. This underscores the imperative for strategic workforce planning and educational initiatives to meet the evolving needs of the hatchery sector.

The demand for skilled personnel in the fisheries sector is projected to experience significant growth in the coming years. In 2020, the need for 1,330 graduates is anticipated to rise to 2,170 by 2025, representing a substantial increase in workforce requirements. Similarly, the demand for technical personnel is expected to surge from 2,800 individuals in 2020 to 7,000 by 2025. This exponential growth reflects the expanding scope and complexity of the fisheries industry, driven by factors such as increasing production volumes, technological advancements, and evolving regulatory frameworks. Meeting these escalating workforce demands will be essential to sustain the sector's growth momentum and ensure its continued contribution to food security, economic development, and environmental sustainability.

Fish feed industry

The forecast for demand in this particular sub-sector has been derived through a normative approach. Currently, there are approximately four fish feed industrial units operating, boasting a collective installed capacity of 50,000 tonnes per annum. Notably, a significant unit with an annual production capacity of 10,000 tonnes employs around 100 fisheries graduates. Projections indicate that by 2025, this major unit will require an additional 250 graduates to meet operational needs. It is also assumed that the other medium-sized units will have similar demands for fisheries graduates. This highlights the critical role of skilled professionals in sustaining and expanding operations within the fish feed industry. As the sector continues to evolve,

ensuring an adequate supply of qualified personnel will be essential for maintaining productivity and competitiveness.

Fish processing industries

During the XI five-year plan period, the fisheries sector experienced robust growth, averaging 8.95% per annum, surpassing the targeted growth rate of 6% per annum. Despite these advancements, the Ministry of Food Processing Industries aimed for a 20% increase in the fish processing sector's contribution to overall production by 2025. However, in Chhattisgarh, there remains a noticeable dearth of fish processing industries, indicating untapped potential for growth and development in this sector. Nevertheless, it's anticipated that with proper initiatives, the processing sector will expand as envisioned, driving an increase in the volume of fish processing activities. To facilitate this growth, it's estimated that each processing unit handling 2,000 tonnes of fish and fishery products would require approximately 120 employees. Consequently, the targeted volume of fish processing in 2020 is expected to employ around 34,000 individuals, with a corresponding need for approximately 3,000 technical personnel by 2021. This underscores the importance of fostering an enabling environment for the establishment and growth of fish processing industries to capitalize on the sector's potential and create employment opportunities.

Government agencies and industry organizations play pivotal roles in recruiting personnel for various positions within the fish processing industry. These positions range from managerial roles to officers in processing plants, Quality Control Officers, laboratory technicians, biological science technicians, and fish research assistants, among others. The field offers a plethora of career opportunities in both the public and private sectors, particularly in fish and seafood exports and processing plants. Roles such as Fish Processor, Plant Assistant, and Manager are prevalent in this sector. Entry-level positions typically require candidates with undergraduate, master's, or doctoral degrees in processing technology, with specialization in modules such as Fish Processing Technology, Fish Microbiology, Fish Chemistry and Nutritive Value, Technology of Fish Packaging, Value-Added Products of Fish, Technology of Canning for Fishery Products, Technology of Freezing for Fishery Products, Quality Assurance and Quality Control, and By-products Utilization. These specialized skills are essential for ensuring the efficiency, safety, and quality of fish processing operations, highlighting the diverse career pathways available within the industry.

Opportunities for Fresh water Fish processing industries in Chhattisgarh

Establishing a freshwater fish processing industry in Chhattisgarh holds the potential to create numerous job opportunities for fisheries graduates across various processing fields. Moreover, such an industry serves as a vital link between retail customers and fish farmers, providing the latter with a sustainable source of livelihood. Entire economies of port towns often rely heavily on the fish processing industry for their economic sustenance. However, challenges such as the escalation of raw material prices and stringent environmental regulations aimed at protecting fish species could hinder market growth.

Several key drivers fuel the demand for fish processing. Firstly, there's a continuous rise in the demand for fish, driven by factors such as population growth and changing dietary habits. Additionally, consumers are increasingly seeking differentiated and value-added fish products, reflecting evolving preferences and tastes. The accessibility of fish processing industries to fish producers allows them to exert control over the final product's quality and hygiene standards, which is crucial for meeting consumer expectations. Furthermore, the growth of the global fish processing market is facilitated by the increasing availability of fish feed, which supports the aquaculture industry. The development and improvement of distribution channels, coupled with advancements in technology related to fish packaging, processing, and storage, are also significant factors propelling market growth. Therefore, investing in the fish processing industry in Chhattisgarh, along with addressing associated challenges, presents promising opportunities for economic development and meeting the evolving demands of consumers.

Government or private Industries

Candidates in the fisheries sector can explore diverse career paths, including managerial or officer roles in fish or seafood processing and export units, aqua feed plants, fishing gear industries, and pharmaceutical companies. However, there exists a significant shortage of skilled manpower in crucial areas such as designing, construction, manufacturing, and management of processing plants, whether in government or private sectors.

Elaborating further, individuals with expertise in management can oversee the operations of fish or seafood processing and export units, ensuring efficiency and compliance with regulations. Similarly, those with technical skills can contribute to the development and maintenance of aqua feed plants, essential for supporting the aquaculture industry. Additionally, opportunities exist in fishing gear industries, where candidates can be involved in the production and innovation of equipment vital for fisheries activities. Moreover, pharmaceutical companies often require professionals knowledgeable in areas such as fish biology and aquaculture for research and product development.

The deficiency of skilled personnel in the realms of designing, construction, manufacturing, and managing processing plants presents significant hurdles for the fisheries industry's advancement and adaptability. Overcoming this shortfall demands collaborative endeavors from educational institutions, industry stakeholders, and policymakers to foster the creation of comprehensive training programs and initiatives. These programs should aim to equip individuals with the requisite skills and knowledge needed to address the industry's evolving demands effectively.

Investing in the cultivation of a proficient workforce holds the key to bolstering the fisheries sector's competitiveness, productivity, and sustainability. By nurturing skilled professionals who are adept in various aspects of processing plant operations, the industry can optimize its operational efficiency, streamline processes, and innovate new techniques. Moreover, a skilled workforce can facilitate the implementation of advanced technologies and best practices, thereby enhancing the sector's resilience to challenges and fostering continuous improvement.

Table 2: Requirement of fisheries professionals in Fish processing industries

Sl. No.	Name of the Industry	Working areas in industries	No. of profession required
1.	Fish Processing industry	Plant Manager	150
		Assistant plant manager	
		Safety manager	
		Food inspector	
		Food safety inspector	
		Quality assurance manager	
		Food production supervisor	
		Quality control trainee	
		Fish processor	
		Laboratory supervisor	
		Microbiologist	
		Laboratory assistant	
		Instrument maintenance manager	
		Sales manager	
		Production accountant	
		Packaging technician	
		Production operator	
		Packaging designer	
		Packaging development and innovation manager	
		Import export manager	
		Data operator	
		Packaging operation coordinator	
		Business development manager	
		Sales executive officer	
		Quality control manager	
		Working employees	
		Other employees	
2.	Fish meal industry	Nutritionist,	50
		Sales manager/ assistant	
		Site supervisor/ assistant	
		Feed sales executive	
		Marketing executive	
		Project planner	
3.	Ice plant	Plant Supervisor	40
		Plant manger	
		Project assistant	
		Equipment operator	
		Working employees	
4.	Fishing gear industries	Mechanical engineer	50
		Fishing guide	
		Fishing gear sales associate	
		Fisheries technician	
		Net maker and designer	
		Other employees	

Development and extension

Fisheries development primarily falls under the jurisdiction of State Governments, with support from entities like Krishi Vigyan Kendras (KVKs), the National Fisheries Development Board (NFDB), and the Marine Products Export Development Agency (MPEDA) playing pivotal roles in extension activities. As of 2010, State Departments of Fisheries had a sanctioned strength of 4,846 positions, out of which 3,762 were occupied, leaving 1,084 vacancies (Sukham, 2010) [11]. Projections indicate a projected need for an additional 2,838 posts by 2025, bringing the total to 7,684 positions by that year.

Considering recent trends in state government employment, it's improbable that such a substantial expansion will occur. A more realistic expectation is that current vacancies will be filled, with a few additional positions created by 2025, resulting in total employment of around 5,000 fisheries graduates. This reflects the pragmatic approach needed to address workforce needs within the fisheries sector, balancing projected demand with practical constraints and resource availability.

In 2010, MPEDA employed 49 fisheries graduates, a figure that increased to 79 by 2020. Krishi Vigyan Kendras (KVKs) are projected to require around 400 fisheries graduates for the state's extension work. Meanwhile, the National Fisheries Development Board (NFDB) employs approximately 15 executive-level professionals in fisheries as of 2020. Fish Farmers' Development Agencies collectively employ about 2,000 skilled personnel and professionals in fisheries-related roles. Estimates for 2025 suggest that these public-funded organizations will aim to fill 80% of existing vacancies (CIFE, Mumbai).

Furthermore, projections indicate that the demand for fisheries graduates for extension work is expected to reach

6,000 by 2025. These figures reflect the anticipated growth and evolving needs within various organizations involved in fisheries development and extension activities. It underscores the importance of adequately preparing and training skilled professionals to meet the sector's expanding requirements and ensure effective support for fish farmers and other stakeholders.

Table 3: Employment opportunities in Central Government

Sl. No.	Name of organizations	Working areas
1.	Marine Product Export Development Authority (MPEDA):	-Product manager
		-Trainee analyst
		-Quality control Trainees
		-Sample collector
		-Management trainee
		-Trainee analyst
		-Codex trainee
2.	Food Safety and Standards Authority of India (FSSAI)	-Safety officer
		-Quality officer
		-Filed assistant
		-Lab technician
		-Technical assistant
		- Data operator
4.	Export Inspection Agency (EIA)	-Export officer
		-Manager
		-Sales manager
		-Quality control manager
		-Quality assurance manager
		-Technicians

Research and academic

As of 2010, the eight fisheries Institutions in ICAR had a sanctioned scientific strength of 679 (35% vacant), which includes 397 scientists in fisheries discipline (Fish and Fisheries Science 360, Fish Pathology and Fish Processing Technology 36). Thus, with 35% vacancies, ICAR had 270 fisheries scientists in position in 2010. In 2010, SAUs had sanctioned strength of 682 personnel in fisheries disciplines, with 403 in position. Apart from ICAR and SAUs, scope for research in fisheries is much more. Fisheries Survey of India, which had a sanctioned strength of 67 has 20 vacancies and projected their additional needs as 18 to take the total strength to 85 by 2025. Considering these factors, manpower in fisheries research and education has been projected to grow at 2% per annum only through filling up of the vacant posts. The total number of fisheries graduates in research and academic sector needed in this sub-sector of employment is estimated to be 1200 by 2025.

Table 4: Employment status in Academic institutes and State government

Sl. No.	Academic Institutes	Sl. No.	State Government
1.	Professor	1.	Director
2.	Associate Professor	2.	Assistant Director
3.	Assistant Professor	3.	Fisheries Inspector (FI)
4.	Research assistant	4.	Research Assistants
5.	Laboratory Assistant/ Attendant	5.	Programme Assistant
6.	Lab assistant	6.	Assistant Fisheries Development Officer (AFDO)
7.	Microbiologist	7.	Fisheries Extension Officer (FEO)
8.	Biochemist	8.	Fisheries Development Officer (FDO)
9.	Technicians		
10.	Biotechnologist		
11.	Research Associate		
12.	Senior Research Fellow		
13.	Junior Research Fellow		

Financial institutions

In 2008, nationalized banks in India employed approximately 8.38 lakh individuals, with officers constituting 40% of this workforce. According to the primary establishment survey, around 3.9% of total bank employment (equivalent to 10% of officers) consisted of graduates in agriculture and related fields. Projections suggest that the employment of officers in public sector banks would increase by 2.5% annually based on recent trends. Consequently, the number of graduates in agriculture and allied sciences is expected to rise from 5,000 in 2020 to 10,000 by 2025. Assuming a proportional representation, it was estimated that around 300 fisheries graduates were employed in banks in 2010. Additionally, approximately 200 fisheries graduates were employed in financial institutions such as NABARD and insurance companies, totaling 500 in 2020. With a conservative growth rate of 2.5% annually, mirroring the observed trend in overall bank employment, the number of fisheries graduates is projected to increase from 500 in 2020 to 750 by 2025.

Others

Some graduates with expertise in fisheries pursue entrepreneurial ventures in various fields, albeit to a limited extent. For instance, data from April 2002 to September 2010 indicates that a total of 30 agri-clinics were authorized specifically for fisheries-related activities. Moreover, a considerable portion of fisheries graduates secure employment opportunities abroad, notably in regions like Europe, Asia, East Africa, and Gulf countries. It's worth noting that demand for their skills extends beyond traditional sectors, encompassing civil services, the fishing equipment industry, non-governmental organizations (NGOs), agri-clinics, and other avenues for self-employment. Furthermore, there exists a significant global demand for their expertise. This diversified demand from various sectors, both domestic and international, was conservatively estimated at 5% of the total demand assessed across the different sub-sectors.

Table 6: Requirement of Fisheries Professionals in fisheries sub-sectors

Sector	Number of Professional Required	Area	Increased Requirement/Year	Expected Requirement
Aqua Farms	20	>10 ha	10%	29x20=580
	10	2-100 ha		59x10=590
	4	<2 ha		126x5=630
Fish Seed Hatcheries	10	1-5 Crore Standard Fry	10%	69x10=690
	5	1 Crore Standard Fry		09x5=45
Fish Feed Industries	150	10,000 tonnes/Year	13%	4x150=600
Fish Processing Industries	150	2000 tonnes fish products/ Year	20%	1000 for 5% of total production
Fish Meal Industries	50	100 tonnes/Year	10%	300 for 5% of trash fish
Ice Plant	40	100 tonnes/Year	10%	4x40=160
Fishing Gear Industries	50	-	10%	150
Research, Development and Extension				
State Government				
Department of Fisheries	1846	-	3%	1846
Krishi Vigyan Kendra	26	-	3%	26
Assistant Professor	35	-	3%	35
National Level				
MPEDA	79	-	5%	79
Krishi Vigyan Kendra	400	-	3%	400
Assistant Professors	682	-	3%	682
Financial Institutes	5000	-	2.5%	5000
Entrepreneurship	1000	-	5%	1000

Table 7: Requirement of Fisheries Professionals in fisheries sub-sectors 2021-2025

Sector	Expected Requirement	Increased Requirement/Year	2021	2022	2023	2024	2025
Aqua Farms	29x20=580	10%	580	638	702	772	849
	59x10=590		590	649	714	785	864
	126x5=630		630	693	762	839	922
Fish Seed Hatcheries	69x10=690	10%	690	759	835	918	1010
	09x5=45		45	50	54	60	66
Fish Feed Industries	4x150=600	13%	600	678	766	866	978
Fish Processing Industries	1000 for 5% of total production	20%	1000	1200	1440	1728	2074
Fish Meal Industries	300 for 5% of trash fish	10%	300	330	363	399	439
Ice Plant	4x40=160	10%	160	176	194	213	234
Fishing Gear Industries	150	10%	150	165	182	200	220
Total			4745	5338	6012	6780	7656
Research, Development and Extension							
State Government							
Department of Fisheries	1846	3%	1846	1901	1958	2017	2078
Krishi Vigyan Kendra	26	3%	26	27	28	28	29
Assistant Professor	35	3%	35	36	37	38	39
Total			1907	1964	2023	2083	2146
National Level							
MPEDA	79	5%	79	83	87	91	96
Krishi Vigyan Kendra	400	3%	400	412	424	437	450
Assistant Professors	682	3%	682	702	724	745	768
Financial Institutes	5000	2.5%	5000	5125	5253	5384	5519
Entrepreneurship	1000	5%	1000	1050	1103	1158	1216
Total			7161	7372	7591	7815	8049
Grand Total			13813	14674	15626	16678	17851

Conclusion

The fisheries sector has rapidly emerged as a vital area of development in Chhattisgarh. As the sector continues to grow, the demand for fisheries professionals in the state is expected to surge. However, both the private and public sectors in Chhattisgarh are facing a shortage of fisheries professionals compared to the escalating demand. A study conducted on this matter unveiled that the anticipated requirement for fisheries professionals is estimated to average 8,131 per year within the state and 7,598 per year outside the state during the period of 2021-2025. This projected demand underscores the pressing need for a concerted effort to bolster the supply of skilled fisheries professionals to meet the burgeoning needs of the sector in both Chhattisgarh and beyond its borders.

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