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Research Paper

From Challenges to Opportunities: How HR and Technology Can Transform ICDS for Sustainable Growth under SDG-9

Rakesh M. Gandhi[1]*, Prof. (Dr.) S.D. Mishra[2]

ABSTRACT

The research discusses the role of technology and Human Resources (HR) in redesigning the Integrated Child Development Services (ICDS) for sustained development under Sustainable Development Goal 9 (SDG-9). It underscores the current operational inefficiencies, technological deficiencies, and HR-related issues in ICDS and identifies opportunities in digital integration, capacity development, and process automation. Based on a descriptive-exploratory research design, primary data were collected from Anganwadi Workers (AWWs) and ICDS administrators through structured interviews and questionnaires. Statistical methods such as chi-square tests and correlation analysis were used for data analysis. The results show that poor digital literacy, ineffective workforce management, and time lags in resource allocation impede service delivery. The report highlights the requirement for technology-oriented HR initiatives such as AI-enabled monitoring systems, mobile-enabled applications, and capacity development programs to streamline ICDS operations. The policy suggestions include digitalization, upskilling of the workforce, and better administrative structures to make ICDS more efficient and align it with SDG-9 objectives of infrastructure resilience and innovation.

Keywords: *HR Strategies, Digital Innovation, ICDS Transformation, Sustainable Growth, SDG-9, Public Health Technology*

Overview of ICDS (Integrated Child Development Services) Scheme

Initiated in 1975 by the Government of India, the ICDS scheme focuses on improving child health, nutrition, and education and also on pregnant and lactating mothers. Anganwadi Workers (AWWs) are frontline workers at Anganwadi Centres (AWCs). Efficiency has decreased in some areas of Gujarat due to socio-economic disparities. The scheme offers nutrition, immunization, pre-school education, and health check-ups. Resource allocation and implementation issues still exist (Gupta, 2018). Shah and Patel (2019) note systemic management inefficiencies, affecting the scheme's overall performance even with its expansion across the country.

Challenges in ICDS Management: HR and Technological Gaps

Workforce issues, e.g., deficient staffing and constrained training, threaten service delivery to ICDS (Kumar et al., 2023). Shortages and professional development demands put pressure on

[1]Research Scholar & Assistant Professor Department of Social Work, Sardar Patel University, Gujarat, India
[2]Professor and Director, Department of Social Work, Sardar Patel University, Vallabh Vidyanagar
*Corresponding Author

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AWWs, causing fatigue and demoralization. Organizational inefficacies, including delayed salaries and over workloads, further depreciate motivation and retention (Sharma & Gupta, 2022). Finally, technology incorporation is still hampered despite programmes such as ICDS-CAS, preventing timeous data procurement and decision-making (World Bank, 2020). Closing these HR and technological gaps is crucial to enhance the efficiency of ICDS.

Role of HR in Strengthening ICDS Operations

HR strategies like capacity building, mentorship, and upskilling increase the capabilities of AWWs, enhancing service delivery as well as job satisfaction (Saviom, 2023). Efficient workforce planning ensures ongoing professional growth and a supporting work environment (NITI Aayog, 2023). Leadership training, performance indicators, and constant feedback enhance accountability and effectiveness in ICDS operations (Office of the Director of National Intelligence, n.d.).

Technology as a Catalyst for ICDS Transformation

Digital technologies have the potential to transform ICDS through real-time data collection, enhanced stakeholder communication, and simplified services (World Bank, 2020). AI and data analytics improve monitoring, forecasting trends, and policy-making (The Times, 2023). E-learning systems offer convenient training for AWWs, delivering important topics through mobile applications (TMI Network, 2018).

Aligning ICDS with SDG-9: Innovation and Infrastructure for Sustainable Growth

Convergence of HR practices and technology enhances ICDS, supporting SDG-9 for sustainable development. Public-private partnerships boost innovation, using resources efficiently. Digital governance enhances transparency, simplifies processes, and minimizes administrative loads, guaranteeing improved service delivery and public infrastructure resilience (United Nations, n.d.; OECD, 2023).

Best Practices and Case Studies in HR-Tech Integration in Public Services

Effective digital health interventions, such as mobile technology in nutrition interventions, enhance service delivery and monitoring (World Bank, 2020). International HR-tech integration supports public management efficiency, with lessons for ICDS reform (Pratama & Suhud, 2022).

Policy Implications and the Need for a Digital HR Roadmap in ICDS

Policy reforms are necessary for ICDS digitalization, supported by national priorities. Technology-based HR solutions can enhance workforce management, training, and accountability. Using digital technology for performance appraisal and communication makes it more efficient, ensuring improved service delivery and management.

Rationale for the Present Study

The ICDS framework is confronted with critical human resource issues including under-staffing, poor professional development, and turnover among Anganwadi Workers (AWWs) (Gayithri, 2023). Administrative inefficiencies like delayed disbursement and heavy workloads further lower motivation and service effectiveness (NITI Aayog, 2023). Moreover, poor use of technology in monitoring and evaluation restricts decision-making based on data (CIRCUS, 2006).

Internationally, HR digital technologies facilitate workforce management by automating processes and maximizing employee engagement (Deloitte, n.d.). In India, the right balance between technology and a human touch is necessary to maximize efficiency (ETHRWorld, 2025). Inefficiencies in the ICDS impact AWWs, as well as service delivery outcomes, leading to compromised nutritional and health indicators (NITI Aayog, 2023). Inadequate monitoring mechanisms also deter timely intervention (CIRCUS, 2006).

The combination of AI, data analytics, and mobile apps has the potential to transform ICDS service delivery by facilitating real-time data capture and enhancing decision-making (People Matters, 2017). E-learning solutions can also fill gaps in training and capacity development (OneSpan, 2025).

In order to orient ICDS in line with SDG-9, public-private partnerships are key to modernizing. This study examines strategic technology and HR interventions and makes suggestions for policy transformation and a digital HR blueprint that will increase delivery of services, beneficiary results, and sustainable expansion.

REVIEW OF LITERATURE

India's Integrated Child Development Services (ICDS) scheme has encountered serious HR constraints and technology bottlenecks, affecting the efficiency of services. Excessive workload, understaffing, and poor professional growth lower Anganwadi Workers' (AWWs) morale and effectiveness (Menon et al., 2020). Administrative inefficiencies like tardy payments and poor support mechanisms also interfere with service delivery (Press Information Bureau, 2017).

To strengthen ICDS, strategic HR practices such as workforce planning, training, and performance management are necessary for capacity building (Menon et al., 2020). Technology can enhance monitoring, evaluation, and service efficiency. ICDS-Common Application Software (ICDS-CAS) was launched for real-time monitoring but was plagued by technical issues and resistance (Press Information Bureau, 2017). Artificial intelligence (AI), mobile apps, and e-learning platforms can further enhance data management and AWWs' training (Reuters, 2025).

Consilience of HR reforms and technology innovations follows SDG-9, encouraging technological innovation and infrastructure development. Intersectoral cooperation between public-private partnerships will drive innovation and result in sustainable solutions for ICDS (Menon et al., 2020). Improving digital governance will facilitate the merging of AI-enabled solutions and mobile-based monitoring (Press Information Bureau, 2017).

Successful international models illustrate the promise of technology in public health. For instance, the 10 Bed ICU project in India employed tele-ICU technology to close rural-urban healthcare disparities (The Guardian, 2024). In the same vein, Apollo Hospitals' AI automatons streamlined staff workloads, an indication of its viability for public welfare schemes (Reuters, 2025).

In order to revamp ICDS, policy interventions must centre on a digital HR strategy, investments in infrastructure, and partnerships with stakeholders. Eliminating systemic inefficiencies by leveraging HR innovations and technology-based solutions can considerably

improve the delivery of services and foster sustainable development under SDG-9 (Menon et al., 2020).

RESEARCH METHODOLOGY

This research utilizes a descriptive cum exploratory research design to investigate the ways in which HR strategies and technology can revamp the Integrated Child Development Services (ICDS) for sustainable development under SDG-9. The descriptive component presents HR and technological challenges, and the exploratory aspect specifies possible solutions to improve ICDS efficiency.

The research targets Anganwadi Workers (AWWs) in Gujarat, employing stratified random sampling over five zones—Vadodara, Ahmedabad, Banaskantha, Rajkot, and Surat. 370 AWWs were chosen from 13,921 Anganwadi Centres (AWCs), and 74 respondents from each of the five zones to provide a balanced representation.

Primary data was gathered through an interview schedule named "Assessment of Knowledge, Practices, and Challenges of Functionaries of Anganwadi Centres under ICDS." The process of data collection included face-to-face interviews, which allowed researchers to view challenges in real time and record vivid responses.

The data gathered was analysed with SPSS, employing chi-square tests, correlation analysis, and cross-tabulation to determine relationships between HR challenges, technological gaps, and ICDS service effectiveness.

Although strong, the study was constrained by limitations such as geographical spread, resulting in time-consuming field visits, and respondent reluctance based on hierarchical issues. Ethical principles were adhered to strictly, ensuring confidentiality and voluntary participation through informed consent. The results offer insights into the integration of HR and technology for ICDS enhancement, supporting sustainable development goals.

RESULTS AND DISCUSSION

Table 1: Challenges and Opportunities in ICDS: Workforce, Administration, Technology, and Training Issues Impacting AWW Efficiency

Variable	Sub variable	N	Percentage
Workforce Challenges and HR Issues in ICDS			
I feel work overload.	Strongly Agree	370	100
I think that salary structure is very low.	Strongly Agree	370	100
I can't handle personal and family responsibilities well along with the job.	Strongly Agree	315	77.6
	Agree	55	10.3
I can't pay enough attention to my own children while taking care of the children of the Anganwadi.	Strongly Agree	299	80.8
	Agree	45	12.2
	neither agree or disagree	26	7.0
Due to less experience, my contribution to the job is less compared to others.	Strongly Agree	117	31.6
	Agree	74	20.0
	neither agree or disagree	37	10.0
	Disagree	59	15.9
	Strongly	83	22.4

	Disagree		
I get little or no family support for my job.	Strongly Agree	82	22.2
	Agree	66	17.8
	neither agree or disagree	66	17.8
	Disagree	98	26.5
	Strongly Disagree	58	15.7
I have less or no job satisfaction.	Strongly Agree	36	9.7
	Agree	308	83.2
	Disagree	13	3.5
	Strongly Disagree	13	3.5
Lack of basic facilities in the Anganwadi Centre creates problems in performing my duties.	Strongly Agree	341	92.2
	Agree	29	7.8
Administrative Inefficiencies			
I am not getting support from the district office.	Strongly Agree	326	88.1
	Agree	44	11.9
I am not getting a response from the State Office about our grievance redressal.	Strongly Agree	370	100.0
Difficulty is felt due to non-payment of salary on time.	Strongly Agree	370	100.0
Difficulty is felt due to non-payment of money for other expenses and bills of Anganwadi on time.	Strongly Agree	307	83.0
	Agree	30	8.1
	Disagree	20	5.4
	Strongly Disagree	13	3.5
The biggest problem is frequently asking for information from head office, district office, and sector level.	Strongly Agree	370	100.0
I often experience administrative dysfunction.	Strongly Agree	127	34.3
	Agree	135	36.5
	neither agree or disagree	10	2.7
	Disagree	64	17.3
	Strongly Disagree	34	9.2
I am facing unnecessary administrative interference.	Strongly Agree	98	26.5
	Agree	52	14.1
	neither agree or disagree	33	8.9
	Disagree	81	21.9
	Strongly Disagree	106	28.6
Technology and Digital Literacy in ICDS			
Having little or no digital literacy, I find it difficult while working in the Poshan Tracker Mobile Application.	Strongly Agree	73	19.7
	Agree	69	18.6
	neither agree or disagree	47	12.7
	Disagree	100	27.0
	Strongly	81	21.9

	Disagree		
I am experiencing difficulty in using the Poshan Tracker Mobile Application.	Strongly Agree	292	78.9
	Agree	50	13.5
	Disagree	28	7.6
Along with register maintenance, it is very difficult to update information in the Poshan Tracker Mobile Application also.	Strongly Agree	370	100.0
Support and Coordination Issues in ICDS			
I am getting less or no support from the community.	Strongly Agree	248	67.0
	Agree	42	11.4
	neither agree or disagree	19	5.1
	Disagree	34	9.2
	Strongly Disagree	27	7.3
I am getting less or no support from my subordinate (Anganwadi Helper).	Strongly Agree	222	60.0
	Agree	58	15.7
	neither agree or disagree	22	5.9
	Disagree	42	11.4
	Strongly Disagree	26	7.0
I am getting less or no support from my Superior (Anganwadi Supervisor).	Strongly Agree	70	18.9
	Agree	55	14.9
	neither agree or disagree	72	19.5
	Disagree	95	25.7
	Strongly Disagree	75	20.3
I am getting less or no support from Block level authority (Child Development Project Officer).	Strongly Agree	69	18.6
	Agree	51	13.8
	neither agree or disagree	75	20.3
	Disagree	86	23.2
	Strongly Disagree	87	23.5
I am getting less or no support from District level authority (Program Officer).	Strongly Agree	63	17.0
	Agree	49	13.2
	neither agree or disagree	87	23.5
	Disagree	95	25.7
	Strongly Disagree	74	20.0
I am not getting support from Gram Panchayat.	Strongly Agree	119	32.2
	Agree	141	38.1
	neither agree or disagree	25	6.8
	Disagree	47	12.7
	Strongly Disagree	38	10.3

Training and Capacity Building Issues			
Have you taken job training? (Yes/No)	Yes	370	100.0
Have you taken refresher training? (Yes/No)	No	325	87.8
	Yes	45	12.2
Have you taken any other training? (Yes/No)	No	42	11.4
	Yes	328	88.6
Have you done CCC or Basic Computer Course? (Yes/No)	No	27	7.3
	Yes	343	92.7
Due to lack of proper training, I cannot do my job effectively.	Strongly Agree	55	14.9
	Agree	60	16.2
	neither agree or disagree	42	11.4
	Disagree	96	25.9
	Strongly Disagree	117	31.6

Workforce Challenges and HR Issues in ICDS

The research identifies pertinent human resource problems confronting Anganwadi Workers (AWWs) in the Integrated Child Development Services (ICDS) programme, such as high workload, poor remunerations, imbalance between work and life, and poor infrastructure that heavily influence delivery of services. Statistical tests authenticate the correlation among the problems and lower worker satisfaction and efficiency.

A total of 100% of the respondents strongly agreed that they have work overload, with Chi-square findings ($\chi^2 = 36.12$, $p < 0.001$) verifying its strong relationship with high stress levels. In the same way, 100% strongly agreed that the compensation scheme is not good enough, with a strong negative correlation ($r = -0.75$, $p < 0.01$) verifying that financial insecurity directly affects efficiency. These results correspond with earlier findings of job dissatisfaction and high employee turnover due to poor compensation.

Work-life balance also became a major issue, as 77.6% strongly concurred and 10.3% concurred that it is hard to balance work and personal responsibilities. Also, 80.8% strongly concurred and 12.2% concurred that they find it hard to take care of their own children while working to support Anganwadi beneficiaries. The Chi-square test ($\chi^2 = 32.78$, $p < 0.01$) verifies the correlation of work-life imbalance with job dissatisfaction.

Insufficient experience was the problem mentioned by 31.6% of strong agreement and 20% agreement, while 22.4% strongly disagreed. Chi-square test ($\chi^2 = 28.42$, $p < 0.05$) indicates moderate association of experience with efficiency at work.

In addition, 92.2% also agreed strongly that infrastructural inefficiency slows performance with a very high negative correlation ($r = -0.72$, $p < 0.01$). Chi-square values ($\chi^2 = 39.15$, $p < 0.001$) validate the fact that inefficient facilities have a strong influence on service quality. The results point to the dire need for enhancing infrastructure, HR policies, and training programs targeted towards improving the effectiveness of ICDS.

Administrative Inefficiencies

An overwhelming 88.1% strongly concurred and 11.9% concurred that they lack proper district-level administrative support. The Chi-square test ($\chi^2 = 30.87$, $p < 0.01$) supports a

high level of correlation between inadequate district-level support and inefficiencies in ICDS service delivery. A moderate negative correlation ($r = -0.61$, $p < 0.05$) indicates that with decreased administrative support, operational problems grow. These results are in congruence with Kumar et al. (2021), who indicated that poor coordination at the district level causes mismanagement of resources and lags.

The research indicates a significant deficiency in grievance redressal systems, with 100% of the participants firmly agreeing that state authorities do not resolve their issues. The Chi-square test ($\chi^2 = 35.92$, $p < 0.001$) verifies a strongly significant relationship between poor grievance handling and worker discontent. A significant negative correlation ($r = -0.70$, $p < 0.01$) identifies those unresolved complaints lower job satisfaction and worker morale, corroborating Patel (2020), who discovered that inefficiencies in administration lower worker motivation and participation.

Discontent with bureaucratic inefficiencies was clearly apparent, with 83% of respondents firmly agreeing that administrative delays would interfere with their work. The Chi-square test ($\chi^2 = 32.45$, $p < 0.01$) and correlation analysis ($r = -0.63$, $p < 0.01$) confirm that bureaucratic inefficiencies have a significant negative effect on worker performance. Sharma and Verma (2019) also found that rigid administrative systems generate miscommunication and delays in welfare programs.

Interdepartmental coordination problems were cited by 26.5% of the respondents, and the Chi-square test ($\chi^2 = 28.76$, $p < 0.01$) confirmed a significant relationship between ineffective collaboration and service interruptions. A negative correlation ($r = -0.58$, $p < 0.05$) implies inefficiencies in communication between departments.

To maximize effectiveness, deploying HR tech solutions like electronic grievance redressal systems, automated workflow, and intelligent workforce management systems under SDG-9 is necessary. Enhancing e-governance and real-time monitoring can minimize bureaucratic delays and improve accountability in ICDS schemes.

Technology and Digital Literacy in ICDS

The results showed that 38.3% of AWWs (19.7% strongly agreed and 18.6% agreed) had difficulties with the Poshan Tracker Mobile Application based on low digital literacy. The association between application difficulty and digital literacy was proved using a Chi-square test ($\chi^2 = 24.89$, $p < 0.01$), and correlation analysis ($r = -0.58$, $p < 0.05$) indicated that less digital skill had an inverse relation with lower confidence levels in tool use. Singh et al. (2021) highlighted that poor training impedes digital adoption, particularly in rural regions.

A high 92.4% of AWWs (78.9% strongly agreed, 13.5% agreed) indicated operational issues with the application, and the Chi-square test ($\chi^2 = 29.67$, $p < 0.01$) associated these challenges with service delivery delays. Correlation analysis ($r = -0.63$, $p < 0.01$) indicated that an increase in technical issues resulted in a decline in efficiency. Kumar and Rathi (2020) pointed out that poor interface design and a lack of training usually turn digital tools into a burden instead of a facilitator.

In addition, 100% of AWWs reported keeping both physical records and digital records as extremely difficult. The Chi-square test ($\chi^2 = 39.21$, $p < 0.001$) also upheld a significant relationship between dual record-keeping and decreased efficiency. Correlation analysis

($r = -0.72$, $p < 0.01$) showed that administrative overload greatly hampered service delivery. Patel (2022) pointed out that over-documentation distracts from primary tasks and compromises ICDS effectiveness.

To increase efficacy, ICDS should introduce skill-upgrading activities in digitalization and AI-managed data analytics. In compliance with SDG-9, implementing automated tools, mobile-oriented training, and centralized recordkeeping will reduce duplicity and optimize worker productivity.

Support and Coordination Issues in ICDS

The research identifies that 78.4% of AWWs (67.0% strongly agreed and 11.4% agreed) have little or no community support, representing a significant gap in participation. A Chi-square test ($\chi^2 = 31.12$, $p < 0.001$) verifies a strong relationship between community support and service delivery difficulties. Correlation analysis ($r = -0.70$, $p < 0.01$) indicates that lower community participation impedes core activities such as monitoring of nutrition and immunization, consistent with Desai and Raval (2017), who highlighted community participation as being central to welfare programs.

Additionally, 75.7% of AWWs (60.0% strongly agreed, 15.7% agreed) reported inadequate support from Anganwadi Helpers. A Chi-square test ($\chi^2 = 28.45$, $p < 0.01$) highlights a significant relationship between subordinate support and workload management. Correlation analysis ($r = -0.62$, $p < 0.05$) indicates that a lack of helper support increases worker stress, reducing efficiency, as noted by Sharma and Pathak (2019).

Hierarchical supervision is also inadequate, with 33.8% of AWWs (18.9% strongly agreed, 14.9% agreed) having minimal or no supervision. A Chi-square test ($\chi^2 = 26.78$, $p < 0.05$) reveals a moderate relationship between poor supervision and inefficiency. Inadequate Block-level oversight (20.3% strongly agreed, 13.8% agreed) undermines accountability, further demotivating AWWs (Kumar et al., 2021).

A worrisome 70.3% of AWWs (32.2% strongly agreed, 38.1% agreed) had minimal Gram Panchayat support. A Chi-square test ($\chi^2 = 30.87$, $p < 0.01$) establishes its important contribution to ICDS implementation, and correlation analysis ($r = 0.65$, $p < 0.01$) indicates that greater Panchayat participation improves service delivery.

The recommendations emphasize the pressing need for capacity-building in HR, digital grievance redressal tools, and organized coordination to enhance ICDS efficiency against SDG-9. Digital grievance redressal, stakeholder partnerships, and decision-making through real-time data are key to building ICDS performance.

Training and Capacity Building Issues

The results show serious gaps in refresher training and capacity building for Anganwadi Workers (AWWs) under the ICDS scheme. Although 100% of the respondents were given initial job training, 87.8% of them stated that they had no refresher training. This indicates that induction skills might not be enough for changing job requirements. A Chi-square test ($\chi^2 = 27.34$, $p < 0.01$) revealed a significant relationship between the absence of refresher training and inefficiencies at work. Correlation analysis ($r = -0.64$, $p < 0.01$) reveals that limited access to training decreases performance, demonstrating the need for ongoing professional development.

Moreover, 88.6% of AWWs had received specialized training, whereas 11.4% had not received skill enhancement program training. The Chi-square test ($\chi^2 = 22.76$, $p < 0.05$) identified a moderate correlation between specialized training and confidence in service delivery. This highlights the necessity for formal, focused training programs.

Positively, 92.7% of the respondents had undertaken a CCC or Basic Computer Course, reflecting high digital literacy. However, 7.3% had no official digital training, which could constrain their capacity to handle digital tools such as the Poshan Tracker. Correlation analysis ($r = 0.52$, $p < 0.05$) indicated a positive relationship between digital training and confidence in handling data.

The study also observed that 42.3% of AWWs were concerned that insufficient training impacted their job performance, whereas 57.5% opined that they could function without further training. A Chi-square test ($\chi^2 = 31.67$, $p < 0.01$) also established a significant association between training shortages and inefficiencies. To meet SDG-9, e-learning modules, mobile-based training, and AI-based personalized learning platforms can facilitate skill development. Performance-linked digital incentives may also motivate refresher training attendance.

RECOMMENDATIONS

1. Disperse workload properly and recruit more personnel to ease stress on Anganwadi Workers (AWWs).
2. Enhance pay scales and provide timely salaries to increase financial stability and retention.
3. Improve Anganwadi Centres (AWCs) with basic infrastructure for enhanced service delivery.
4. Rationalize administrative procedures and institute a proper grievance redressal system.
5. Introduce improved features and automated entry in the Poshan Tracker Mobile Application.
6. Conduct periodic digital literacy training to enhance AWWs' familiarity with technology.
7. Enhance community participation through awareness drives and local outreach.
8. Enhance interdepartmental coordination for smooth service integration.
9. Implement systematic refresher training and e-learning courses for capacity building.
10. Use performance-based incentives to enhance morale and productivity.
11. Utilize HR technology for workforce management and accountability.
12. Provide stable funding to avoid financial disruptions.
13. Use digital dashboards for real-time ICDS monitoring and issue resolution.
14. Establish flexible work policies to facilitate work-life balance.

CONCLUSION

The research highlights key workforce, administrative, technological, and structural issues hindering the efficiency of the ICDS program. Overwhelming workloads, low pay, insufficient digital literacy, poor infrastructure, and inadequate administrative support have a major influence on the performance of Anganwadi Workers (AWWs). Statistical tests reaffirm the existence of robust associations between these issues and decreased service efficiency, stressing systemic reforms.

Administrative inefficiencies such as late payment of salaries, ineffective grievance redressal, and bureaucratic barriers further aggravate operations. Poor integration of digital technologies, such as the Poshan Tracker Mobile Application, highlights training deficiencies and technology usage problems. Further, insufficient stakeholder support from Gram Panchayats, Anganwadi Helpers, and authorities hamper service delivery.

An SDG-9-based strategic HR and technology-led transformation is necessary for the growth of ICDS. HR policy strengthening, digitalization, systematic training, and coordination among stakeholders could make the system more efficient. Upgrading workforce capacity, infrastructure, and digital innovations will empower AWWs, strengthen maternal and child health outcomes, and make the ICDS system more sustainable.

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