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Towards Digitally Enabled Extension Services: ICT Training Directions in Coastal Odisha

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HIGHLIGHTS

- There exists a generational ICT skill divide among public extension functionaries.
- The priority training needs differ hugely with role and exposure.
- ICT training frequency has increased, but the gap persists.

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ABSTRACT

The study was conducted in 2024 to assess the knowledge and accessibility of common ICT tools, training need assessment, and attendance in programs for ICT applications. A total of 248 public extension workers, chosen from four coastal districts, were split into two groups based on their hierarchical responsibilities. While both groups were aware of fundamental ICT tools like PCs and smartphones, there was a notable difference in advanced tools like AI interfaces, drones, and modern digital accessories. While Group 2 (junior officers) demonstrated greater exposure to emerging technology, they were less skilled in basic digital document management, which was prioritized for training. Group-1 members expressed the most prominent training needs in basic troubleshooting and cybersecurity, along with Google tools. There was an overall increasing trend in participation in activities related to ICT applications for years, which showcases a sort of optimism in skills' upscaling efforts.

INTRODUCTION

In any society, knowledge and information are essential to rural development and socioeconomic progress (Chandra et al., 2023). Information management has been easier in recent years due to a number of advancements in information and communication technologies (ICTs) (Angello, 2015). Achieving the Sustainable Development Goals (SDGs) depends on the dissemination and use of knowledge and information, which are increasingly indispensable components of modern life (Panda et al., 2019). However, the number of extension workers has been decreasing while farming families have been increasing (Sethy & Mukhopadhyay, 2020). Extension personnel cannot reach out to every farmer's doorstep because in reality, there is only one extension worker available for 2879 farmers in India (Mukherjee and Maity, 2015). Consequently, the role of information technologies, particularly those that make communication easier, is vital in bringing about the socio-economic revolution (Musungwini et al., 2023). Information and communication technologies are a broad category that includes a variety of devices, networks, services, applications, software, methods, and technologies that are essential for storing, managing, processing, retrieving, and sharing information (Haqyar et al., 2025). Transparencies, slides, tapes, cassette recorders, radios, newspapers, and other traditional and basic audio-visual aids are only a few examples of ICTs. More sophisticated and contemporary tools include computers, smartphones, the internet, satellites, sensors,

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GPS, AI interface-based software and devices, and many more (Khatri et al., 2024).

ICTs are crucial for information sharing among agricultural stakeholders. Using ICT to advance agriculture has enormous promise (Kumar & Prasad, 2017). The importance of information and communication technology (ICT) in agricultural development has increased significantly in the digital age. Nevertheless, despite the expansion of ICT infrastructure in rural regions, extension workers' ability to effectively use ICT tools is still restricted because of capacity gaps along with infrastructural limitations, and a lack of formal training (Gow et al., 2020). Frequently, extension staff are unable to take advantage of interactive media, digital platforms, GIS tools, and mobile applications for information exchange, advisory services, or farmer input (Tata & McNamara, 2018).

The public extension functionaries must therefore be proficient in technology if ICT-based extension is to be more successful (Spielman et al., 2021). Training of extension staff is directly related to the development of necessary competencies among the extension workforce within extension organizations (Ahsan et al., 2022), in which ICT training must be prioritized (Busungu et al., 2019). Chaudhary et al., (2024) suggested that in order to improve usability, information departments and agricultural directorates should modify the contents of contemporary instruments to better suit the demands of farmers and their socioeconomic circumstances. In this regard, an investigative attempt was made for the assessment of the ICT training scenario of extension functionaries in coastal Odisha.

METHODOLOGY

The study was conducted in four districts of Odisha-Bhadrak, Balasore, Jajpur and Cuttack randomly. The respondents were extension functionaries, being classified into two groups: 51 seniors comprising Chief District Agricultural Officers (CDAO), ADO, Block Agricultural Officer (BAO), and 197 junior officials, making a sample of 248 respondents. The questionnaire, formulated after literature review and expertise consultation, was pretested on the officials, supported with explanation in the local Odia dialect, and feedback obtained served insights for finalizing the interview schedule (Jayasingh & Mishra, 2024). Data collection occurred through interviews in their workplace during September 2024 to May 2025 under ex-post facto design.

ICT Awareness and accessibility concerns about the scenario of ICT tools in terms of their awareness and availability for the respondents during their work time. Extension functionaries received a detailed list of ICT tools and rated them based on awareness and accessibility on three three-point continuum, such as 'fully aware', 'partially aware', and 'least aware' with their respective scores of 3, 2, and 1, respectively. The obtained scores were later taken as input in the following:

$$\text{Awareness Percentage} = \frac{\Sigma(f_i \times W_i) \times W_{max} \times 100}{N}$$

$$\text{Accessibility Percentage} = \frac{\Sigma(f_i \times W_i) \times W_{max} \times 100}{N}$$

Where, f_i = Frequency of each category

W_i = Weight assigned to each category

W_{max} = Maximum possible weight for normalisation = 2

Training need was operationalized as the necessity of an extension official to bridge the gap between 'what is' and 'what ought to be'. In this, ten key priority training areas as items were identified after undergoing a literature review, followed by expert advisory with respect to extension functionaries of the state. Then, each item was rated by extension functionaries on a three-point continuum, viz., 'most needed', 'needed', and 'least needed' with their corresponding scores of 3, 2, and 1, respectively. After the responses were transformed to total scores of each item, the training need score as employed by Khan et al., (2023) was obtained as follows:

$$\text{TNS} = \frac{\text{Total score of item}}{\text{Total number of respondents}}$$

This was administered for both the group's total, adding up to 248 respondents. The mean score of each group was calculated. This was followed by finding the higher need interest group. The group with the greatest mean training need score was the one with higher need interest for that particular priority training area. Based on priority area of training the groups were further ranked.

RESULTS

ICT Awareness and accessibility

The result in Table 1 depicts the awareness and accessibility of various ICT tools and techniques amongst both groups of extension functionaries. It was found that mobile phones were well-known as well as easily accessible tools for all the respondents. The likes of computers or laptops, along with a Wi-Fi system, though, were known by all but less accessible for Group-2 personnel. Advanced peripherals like tablets, scanners, laser pointer/ laser pen, and public address system were found to have less than 50 per cent accessibility to both groups. In case of programs, the Group-2 members showcased a greater extent of awareness and accessibility for the programs, excluding the MS Office. Web browsers, search engines, and personal mail were known and used as well by both groups of functionaries.

WhatsApp and YouTube, being the most well-known and accessed applications, were found to be the undisputed social media platforms for all of those extension functionaries, followed by Facebook. In case of other platforms which were of recent applications with the likes of Research Gate, Instagram, etc., the members of Group-2 displayed significant numbers in the parameters of awareness and accessibility in comparison to Group-1 by significant margins. Popular platforms like Zoom and Google Meet were found to be the most well-known and accessible in both groups for conferencing purposes.

In case of financial transaction applications, Google Pay and Phone Pe were used by both groups, but with others, there was more inclination from the side of Group-2 members in comparison to Group-1 counterparts. Under the slot of 'ICT agricultural apps', at first is about the cent percent in availability and accessibility for the 'Agricultural Extension App', and in the second, the

Table 1. Distribution of Extension Functionaries Based on ICT Awareness and Accessibility

Category	Group-1		Group-2	
	Aware-ness (%)	Accessi-bilit (%)	Aware-ness (%)	Accessi-bilit (%)
Tools and Peripherals				
Computer/Laptop	100	100	100	73
Mobile	100	100	100	100
Tablet	64	21	75	51
LCD Projector	87	42	93	84
Printer	100	93	100	83
Scanner	76	42	86	43
External storage	64	58	74	67
Smart TV	76	49	83	61
Camcorder or Digital camera	96	78	100	62
Laser pointer/laser pen	63	32	67	52
Public address system	78	43	79	48
Modems/routers/wi-fi	100	63	100	59
Bluetooth/USB/Headphones	83	51	100	79
Programme				
Microsoft office	87	50	100	79
Adobe reader	23	11	65	53
File explorer	36	24	78	65
Drive PDF viewer	18	04	75	56
Adobe illustrator	13	00	43	15
Web browsers	97	93	100	100
Search engine	94	92	100	100
Personal mails	100	100	100	100
Applications				
Agriculture glossary	54	3	62	32
Google services	58	44	67	53
Dictionaries	65	43	93	78
Grammar check	68	25	94	83
File sharing	64	56	83	79
Social-networking platforms				
ResearchGate	51	11	64	43
Academia	46	07	62	41
WhatsApp	100	100	100	100
Facebook	100	72	100	83
Instagram	57	31	100	76
Twitter	81	22	100	56
YouTube	100	100	100	100
LinkedIn	61	12	73	47
Conferencing				
Google meet	78	66	100	86
Cocubes	21	08	46	32
Zoom	74	68	100	82
Microsoft teams	42	17	62	47
Webex	33	12	54	31
Financial transaction app				
Google pay	92	64	100	100
Phone pay	95	68	100	100
Paytm	88	43	100	71
SBI yono	46	12	100	73
Amazon pay	32	07	73	42
ICT agricultural apps				
MKisan	100	81	100	94
Agrisnet	83	63	887	72
Kisan Suvidha app	76	51	83	71
Agricultural Extension app	100	100	100	100
e-Nam	100	76	100	82
Modern Tools				
Interactive AI	43	08	72	65
DSS	12	02	62	33
Drones	83	32	89	21
Robots	54	00	57	00

percentages were less in values for Group-1 members but with narrowed gaps against Group-2. In the bracket of 'Modern tools', even though both possessed awareness in enough numbers, yet very feeble numbers in terms of accessibility for them.

Training areas and training need interest

The result in Table 2 portrays the priority training areas and need interest of both the groups. Group-1 prioritised areas like 'Basic Troubleshooting and Cybersecurity', 'Google tools for collaboration', 'Use of Microsoft Excel and PowerPoint', 'Financial and e-Commerce app usage' and 'Safe and Effective use of social media'. The items being flagged as higher need interest by the Group-2 were 'File handling and document management', 'Digital communication and conferencing platforms', 'Operation of advanced peripherals', 'Introduction to emerging technologies', followed by 'Usage of mobile applications'. While comparing the gap between the training scores obtained from both the groups, it can be inferred that the gap was wider in case of training areas like File handling and document management', 'Google tools for collaboration', 'Operation of advanced peripherals', 'Introduction to emerging technologies', 'Use of Microsoft excel and PowerPoint' along with 'Usage of Agriculture-specific Mobile Applications'. Upadhyaya et al., (2019) also concurred with the conclusion in their study, analogous to the findings.

Attendance at training/seminar/lecture/webinars

According to the data in Figure 1, the attendance to programs in the likes of training, seminar, lecture or webinars has increased in the timeline from 2014-15 to 2023-24, whereby the Group-2 extension functionaries were in larger numbers on a year-by-year basis in comparison to Group-1 extension functionaries. Initially, the attendance level was very low in the starting period of 2014-15 but it has picked up pace from the next timeline onwards till 2023-24, whereby the eight and nine such events were attended by the extension people from Group-1 and Group-2, respectively. This trend peaked its form during the COVID-19 pandemic in 2020-21 whereby Group-1 had attended nine events, whereas Group-2 had attended thirteen such events, which were the highest participation in their respective groups. Even if attendance decreased a little after the pandemic, it was still higher than it was before 2019, suggesting that ICT was still used in professional development. Group-2 attended 68 events throughout the course of the decade, compared

Table 2. Distribution of extension functionaries based on priority training areas and training need interest

Training Areas	Group-1 Mean TNS	Group-2 Mean TNS	Higher need interest
File Handling and Document Management	1.45	2.45	Group-2
Digital Communication and Conferencing Platforms	2.27	2.29	Group-2
Basic Troubleshooting and Cybersecurity	2.04	2.03	Group-1
Google Tools for Collaboration	2.02	1.30	Group-1
Operation of Advanced Peripherals	1.80	2.29	Group-2
Introduction to Emerging Technologies	1.76	2.12	Group-2
Use of Microsoft Excel and PowerPoint	1.85	1.09	Group-1
Financial and e-Commerce App Usage	1.66	1.61	Group-1
Usage of Agriculture-specific Mobile Applications	1.65	0.91	Group-2
Safe and Effective Use of Social Media	1.25	0.96	Group-1

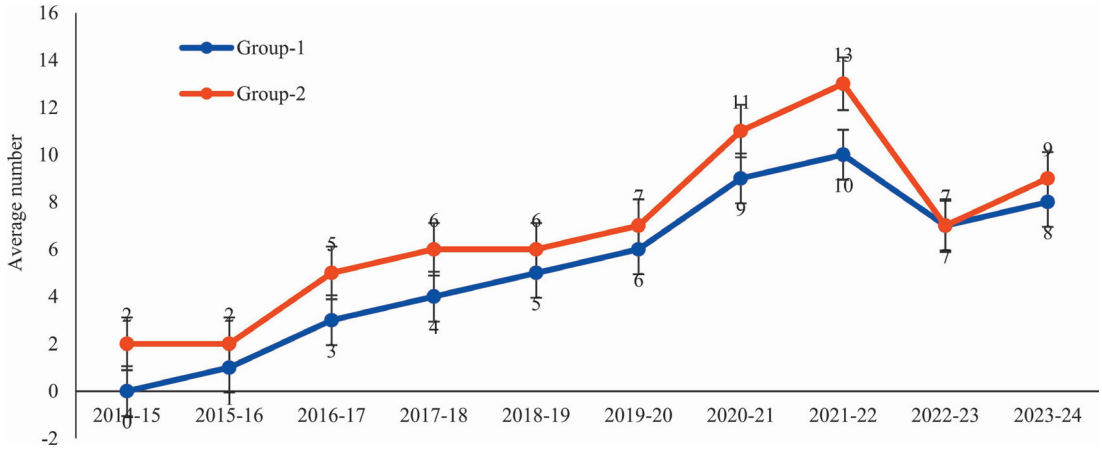

Figure 1. Year-Wise Average Number of ICT Training/Seminar/Lecture/ Webinar attended by extension functionaries

to 53 for Group-1, indicating that Group-2 had more exposure to ICT application scenarios.

DISCUSSION

A fractured digital foundation was indicated by their simultaneous display of notable deficiencies in core digital competencies like file handling, document management, and communication platform utilization. Senior officers (Group-1), on the other hand, were not exposed to newer, collaborative, cloud-based tools, which were becoming more and more important in digital extension ecosystems, despite being reasonably skilled at basic digital operations. Based on factors including age, training exposure, and maybe employment expectations, this generational gap suggests that technology adaptability was evolving. Public extension workers have significant gaps and generational differences in their knowledge of ICT, accessibility, and training requirements. Even though both senior (Group-1) and junior (Group-2) officers were universally aware of and used basic technologies like computers and cell phones, there were noticeable differences in how they used more sophisticated digital peripherals and software. Group 2, which consists of younger and newly hired employees, shows a higher level of expertise with contemporary ICT technologies such as drones, AI interfaces, Google apps, and mobile applications for agriculture (Nyarko & Kozari, 2021).

Experienced and senior agricultural extension workers require training in areas like basic troubleshooting, cybersecurity, Google tools, Microsoft Excel and PowerPoint, financial and e-commerce apps, and social media to bridge digital skill gaps. As digital tools increasingly shape agricultural outreach and communication, such training enhances their efficiency, credibility, and adaptability. It empowers them to handle tech-related issues, present data effectively, access online financial services, collaborate remotely, and safely engage farmers through digital platforms, ultimately improving service delivery in a modern extension system (Asante, 2024). Inexperienced junior extension workers seek training in file handling, digital communication platforms, advanced peripherals, emerging technologies, and agriculture-specific apps to build foundational and job-relevant digital skills (Indraningsih et al., 2023). These areas were essential for managing records, conducting virtual outreach, operating modern devices like projectors or drones, and staying updated with innovations. Familiarity with agriculture apps enables them to provide timely, tech-driven advisories to farmers. Such training ensures they become confident, competent, and future-ready professionals in a digitally evolving agricultural extension system (Umunakwe et al., 2025).

The increasing trend in the participation of all the extension functionaries in the events of trainings, seminars, lectures or webinars, across the significant dip since post COVID-19 pandemic era, it enhances their knowledge base, encouraging knowledge-sharing, fostering professional growth and updates them with modern practices, ultimately improving the quality of agricultural extension services. Over the last decade, particularly after 2016, Group-2 has taken part in more ICT-related events, reaching its climax during the COVID-19 pandemic. This highlights the influence of contemporary professional development techniques on digital exposure in addition to being consistent with their increased

understanding of sophisticated tools (Gow et al., 2020). However, greater involvement has not been translated into proficiency, particularly in fundamental digital skills, highlighting the disconnect between training materials and real-world demands (Badhan, 2020). The results highlight the need for role as well as ICT training, even though digital inclusion in extension services was increasing. In disaster-prone coastal Odisha, strategic planning regarding training content, frequency, and delivery methods can aid in bridging these digital divides and eventually improve the reach, relevance, and resilience of extension services.

CONCLUSION

Training in ICT tools empowers extension workers in India to disseminate timely information, improve farmer outreach, enhance knowledge sharing, and increase the adoption of innovative agricultural practices, boosting productivity and livelihoods. The study emphasizes the value of specialized ICT training programs to improve Odisha's public extension workers' digital proficiency. The training requirements of senior and junior extension officers differ; the former need to improve their skills in collaborative and analytical digital tools, while the latter need to acquire fundamental skills in document management and communication platforms. Inequalities in digital readiness, accessibility, and usage continue to exist despite a rise in involvement in ICT capacity-building initiatives during the past ten years. Adopting a digitally inclusive strategy will guarantee that Odisha's extension services are adaptable, durable, and pertinent to the changing demands of the agricultural sector.

DECLARATIONS

Ethics approval and informed consent: Informed consent was sought from the respondents and their organizations regarding the study during the course of the data collection.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The authors declare that during the preparation of this work, thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

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