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CONSTRAINTS IN DIGITAL SKILL ACQUISITION AMONG FARMERS IN BIHAR: EVIDENCE FROM GARRETT'S RANKING AND KENDALL'S COEFFICIENT OF CONCORDANCE

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ABSTRACT

Digital agriculture is increasingly creating opportunities for farmers to access agricultural information, services and decision-support tools; however, the ability of farmers to effectively engage with such technologies depends on their digital skills. The present study was undertaken to assess and prioritize the constraints perceived by farmers in acquiring digital skills in Bihar. The study was conducted with 240 farmers selected from four districts of Bihar, namely East Champaran, Saharsa, Gaya and Bhagalpur. Thirty constraint statements were assessed under six broad dimensions: Economic, Technical, Institutional, Social, Psychological, and Resource & Infrastructure Constraints. Garrett's Ranking Technique was employed to prioritize individual constraint statements within each dimension, while Kendall's coefficient of concordance was used to assess the agreement among farmers in the ranking of the six broad dimensions. The findings revealed that *low digital literacy of the farmers* was the most prominent technical constraint, while *high cost of digital tools, devices and services* emerged as the leading economic constraint. *Inadequate training programs for the farmers* ranked first among institutional constraints, whereas *low general education* was the most prominent social constraint. Among psychological constraints, *Fear and anxiety about new ICT tools* received the highest rank. Within the resource and infrastructure dimension, *limited device access* was ranked first, followed closely by *Poor connectivity of internet and mobile signal*. At the broader dimensional level, Technical Constraints obtained the highest mean rank (4.55), followed by Economic Constraints (4.54), Social Constraints (3.75), Resource & Infrastructure Constraints (3.13), Psychological Constraints (2.55) and Institutional Constraints (2.47). Kendall's coefficient of concordance was 0.249, with a chi-square value of 298.835 at 5 degrees of freedom and $p < 0.001$, indicating statistically significant but relatively low-to-moderate concordance among the farmers in their ranking of the broad constraint dimensions. The findings indicate that digital skill acquisition among farmers is constrained by interconnected technical, economic, social and access-related factors. Strengthening practical digital literacy and hands-on training, improving affordable access to digital devices and reliable connectivity, and providing appropriate technical support are therefore important for facilitating effective digital skill development among farmers in Bihar.

***Key words*:** Digital agriculture, digital skills, farmers, Garrett's Ranking Technique, Kendall's coefficient of concordance.

Introduction

The integration of digital technologies in agriculture offers significant opportunities to enhance farmers' access to information, market services, and productive resources, thereby supporting more informed and efficient decision-making. However, farmers often face significant barriers in acquiring the digital skills necessary to benefit from these innovations (Choruma *et al*., 2024). Digital agriculture, encompassing tools such as mobile applications, internet-based advisory services, and electronic marketplaces, is increasingly recognized as a strategy to enhance farm productivity and sustainability (Khatri *et al*., 2024). In India, government initiatives (for example, Digital India, the electronic National Agriculture Market (eNAM), and the Kisan Suvidha mobile app) seek to digitize agricultural extension and market services (Beerge *et al*., 2024). These initiatives facilitate access to weather forecasts, market price information, and expert advice. Despite widespread availability of mobile phones, adoption of digital agriculture platforms by farmers remains uneven (Dhir and Mishra, 2026). In India, effective use of digital tools requires farmers to have a basic level of digital literacy and reliable access (Arangurí *et al*., 2025). Common challenges include limited internet connectivity in rural areas, insufficient digital infrastructure (for example, electricity and network coverage), lack of affordable devices or data plans, and inadequate training or technical support (Khan, 2023). Socio-economic factors such as low formal education levels, adherence to traditional farming practices, and resistance to change can further inhibit technology adoption. Cultural and gender dynamics may also play a role; for instance, female farmers might have less access to training opportunities (Prajapati *et al*., 2025).

Bihar is predominantly an agrarian state, with a large rural population dependent on agriculture for their livelihoods. Although mobile phone penetration in Bihar has grown in recent years, internet usage and digital literacy rates remain relatively low compared to national averages (Adeeth Cariappa *et al*., 2024). Many farmers in Bihar still rely on traditional cultivation methods and in-person extension contacts (Munshi *et al*., 2024). Thus, understanding the specific constraints that hinder these farmers from acquiring digital skills is essential for improving outreach and training programs in the region. While previous studies have examined technology adoption among farmers, relatively few have focused on the ranking of constraints to digital skill acquisition, especially at the regional level (Arangurí *et al*., 2025, Gumbi *et al*., 2023). A structured ranking of constraints can help extension services and policymakers prioritize resource allocation (Mallick *et al*., 2023). This study contributes empirical evidence on farmer-perceived barriers in a key state like Bihar, thereby informing targeted strategies to improve digital literacy in agriculture.

In this study, a survey was conducted among 240 farmers across four districts of Bihar (East Champaran, Saharsa, Gaya, and Bhagalpur). Each farmer respondent ranked a set of specific constraint statements related to acquiring digital skills. These constraints were organized into six conceptual dimensions: Economic, Technical, Institutional, Social, Psychological, and Resource & Infrastructure. Garrett's ranking technique was applied to the data within each dimension to calculate mean scores for each constraint item, thereby generating a ranked order of constraints (Saha *et al*., 2022). To assess overall agreement among farmers regarding these six dimensions, Kendall's coefficient of concordance (W) was computed (Kumari *et al*., 2026). Together, these methods yield a detailed prioritization of constraints at both item and dimension levels, an approach that has been effective in similar agricultural studies.

The objective of this study is to identify and rank the specific constraints hindering digital skill acquisition by farmers in Bihar, and to determine the degree of consensus among farmers on broader constraint categories. We address these objectives through a quantitative analysis of survey data from 240 farmers, using Garrett's ranking technique for individual constraints and Kendall's W for dimension-level concordance. The results are intended to inform extension programs and policy measures aimed at enhancing digital literacy in Bihar's agricultural sector.

Materials and Methods

Selection of the Study Locale and Sampling Plan

The present study was conducted in Bihar to identify and prioritize the constraints perceived by farmers in acquiring digital skills. Bihar was selected purposively as the study state. For geographical representation, the state was considered according to its four agro-climatic zones, namely North-West Alluvial Plane (Zone - I), North-East Alluvial Plane (Zone - II), South-East Alluvial Plain (Zone-III A) and South-West Alluvial Plain (Zone-III B) (Robertson *et al*., 2019). One district from each agro-climatic zone was selected through simple random sampling. Accordingly, East Champaran from Zone-I, Saharsa from Zone-II, Gaya from Zone-III A and Bhagalpur from Zone-III B constituted the study area. From each selected district, two blocks were selected randomly, followed by random selection of one village from each selected block. Thus, eight villages were

included in the study. The selected districts were shown in the Fig. 1.

The selected blocks from East Champaran, Saharsa district, were Piprakothi and Chakia. From district, Nauhatta and Satar Kataiya blocks were selected. From Gaya district, Manpur and Nagar blocks were selected. From Bhagalpur district, Goradih and Bihpur blocks were selected. From Piprakothi block the selected village was Belwatia. From Chakia block the selected village was Narayan Pakri. From Nauhatta block the selected village was Hempur. From Satar Kataiya block the selected village was Sisai. From Manpur block the selected village was Sondhi. From Nagar block the selected village was Gopalpur. From Goradih block the selected village was Kharba. From Bihpur block the selected village was Sonbarsa. From each village, 30 farmers were selected through simple random sampling, resulting in a total sample of 240 farmers.

The study employed an *ex-post facto* research design. The present analysis used primary data collected from the selected farmers through a structured interview schedule. The broader research methodology envisaged the use of structured and semi-structured interview schedules and focus group discussions for primary data collection, supplemented by secondary information from research publications, reports and other relevant sources. For the present paper, only the farmer responses pertaining to constraints in acquiring digital skills were considered. For the purpose of this study, constraints in digital skill acquisition were operationally defined as the factors which limit or restrict the farmers and extension functionaries from acquiring Digital Skills. The constraint statements were incorporated into the interview schedule after consideration of the relevant literature and the conceptual requirements of the study. The final instrument presented farmers with specific constraints under six broad dimensions: Economic, Technical, Institutional, Social, Psychological, and Resource & Infrastructure constraints (Fig. 2).

The farmer interview schedule contained five specific constraint statements under each dimension, giving a total of 30 constraint statements.

Statistical Tools used for the Analysis of the Data

To obtain accurate findings from collected data, statistical tools like Garrett's ranking technique and Kendall's coefficient of concordance approach was employed through MS Excel (version 2021) and IBM SPSS software (version 27).

Data Analysis

Garrett's Ranking Technique was employed to prioritize the impediments. Garrett's Ranking Technique allows us to convert the order of constraints and benefits into numerical scores. The main benefit of this method over a simple frequency distribution is how constraints are arranged according to respondents' perceived importance. When the same number of respondents were assigned different ranks for two or more limitations, it is

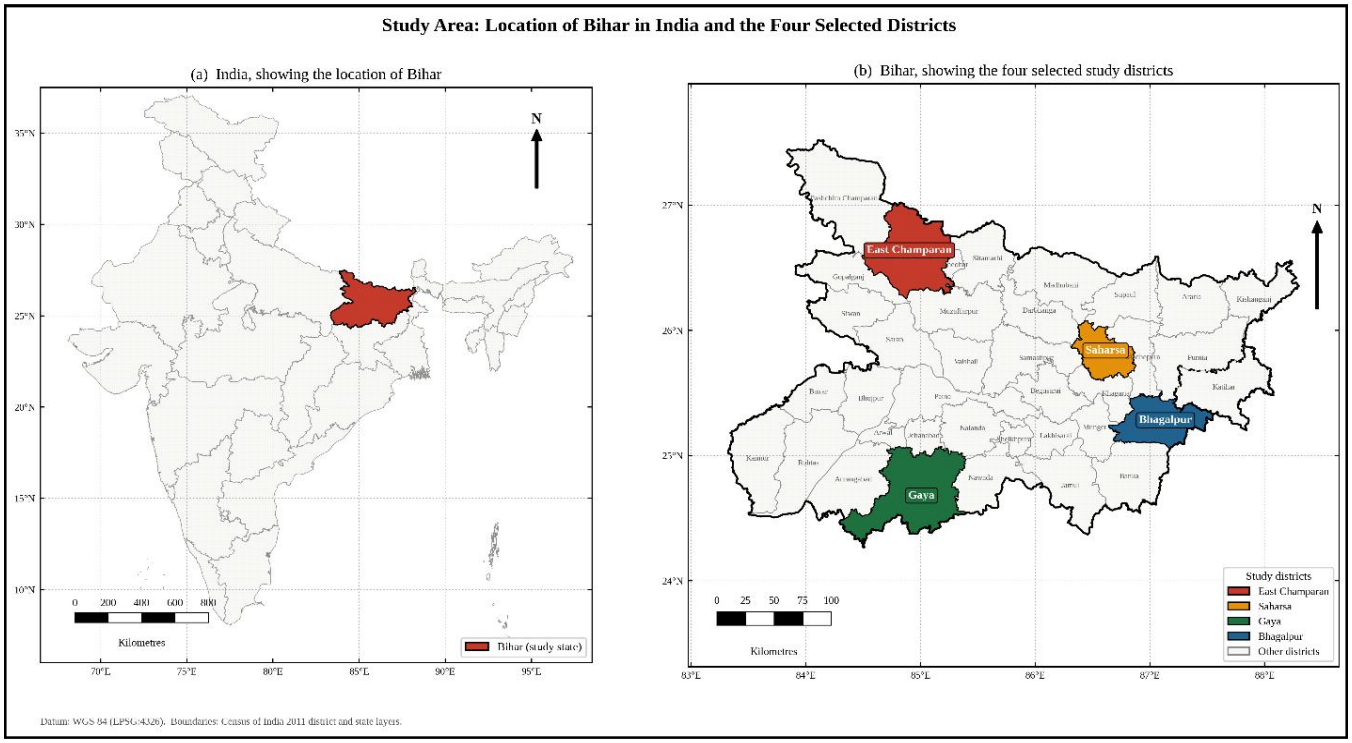


Fig. 1: Locale of the study.

also beneficial (Ankhila *et al*., 2020). At first, the problems which farmers could face during acquisition of digital skills were listed on the basis of extensive review of literature and by asking open-ended questions to farmers. Then, 30 constraints (five specific constraint statements under each dimension) were listed in a semi structured interview schedule which was administered to the respondents. The farmers were asked to identify the major constraints perceived by them and rank them in decreasing order of significance (i.e., I rank for the most important constraint and V rank for the least important constraint). Garrett's formula was employed for converting ranks into percent position. The formula is shown below:

$$\text{Percent Position} = \frac{100(R_{ij} - 0.5)}{N_j}$$

Where,

R_{ij} = the rank assigned to the i^{th} constraint by the j^{th} respondent

N_j = the total number of constraints ranked by that respondent

According to the table provided by Garrett and Woodworth (1969), each rank's percent position was converted into scores. Then the individual respondents' scores were combined together to get total scores for each factor. The total scores were divided by the total number of respondents for whom scores were added to produce mean scores. These mean scores for all the factors were arranged in descending order, ranks were given and the most influencing factors (or constraints) were identified through the ranks assigned.

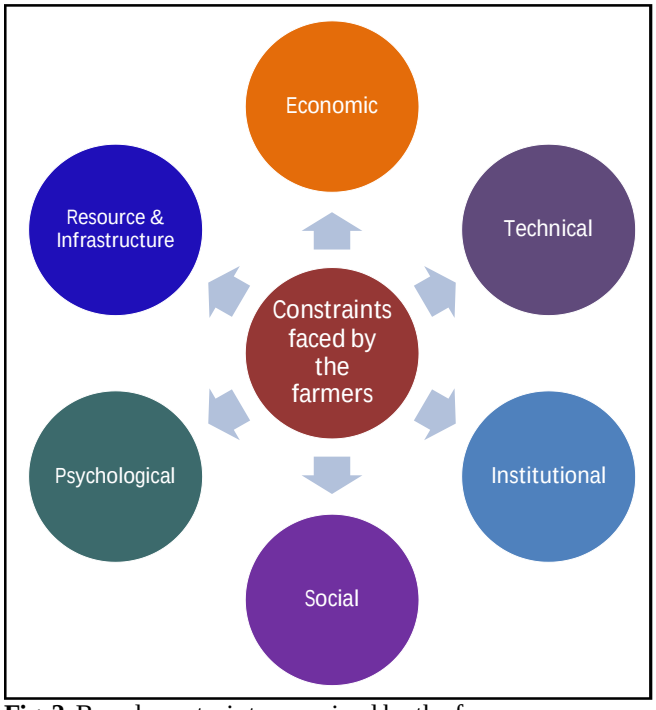


Fig. 2: Broad constraints perceived by the farmers.

At the broader dimension level, Kendall's coefficient of concordance (W) was employed to determine the degree of agreement among the 240 farmer respondents regarding the relative ordering of the six constraint dimensions. Kendall's W is appropriate for assessing the degree of concordance among multiple judges or respondents who rank a common set of objects. The coefficient ranges from 0 to 1, where a value approaching 0 indicates little or no agreement and a value approaching 1 indicates stronger agreement among the respondents. The respondents were requested to assign ranks to different constraints, where rank one represented the least important constraint and the highest rank denoted the most important constraint. A higher mean rank value therefore indicated greater importance of a particular constraint. (Borah *et al*., 2025, Nelson *et al*., 2025, Naik *et al*., 2026,). For the present analysis, the six dimensions—Economic, Technical, Institutional, Social, Psychological, and Resource & Infrastructure—were treated as the objects to be ranked. Kendall's coefficient of concordance (W) is calculated as (Kendall and Smith, 1939, Kendall, 1962, Legendre, 2005):

$$W = \frac{12S}{m^2 n(n^2 - 1)}$$

Where,

W = Kendall's coefficient of concordance

S = the sum of squared deviations of the total ranks from their mean

m = the number of respondents or judges

n = the number of objects being ranked.

When two or more judges/respondents assign the same rank to an object, tied ranks may occur. In such cases, a correction factor is incorporated into the calculation of Kendall's coefficient of concordance. The tie-corrected formula used is:

$$W = \frac{12\sum_{i=1}^{n}(R_i)^2 - 3m^2 n(n+1)^2}{m^2 n(n^2 - 1) - mT}$$

Where:

W = Kendall's coefficient of concordance

n = total number of objects being ranked

m = total number of individuals/judges (respondents)

R_i = sum of the ranks assigned to the ith object across all respondents

T = correction factor for tied ranks

The correction factor for tied ranks is calculated as:

$$T = \sum (t^3 - t)$$

Where,

t = the number of objects receiving the same rank within each group of tied ranks.

The values of $t^3 - t$ are calculated for every group of tied ranks and then summed across all tied groups.

The statistical significance of Kendall's coefficient was assessed using the corresponding chi-square (χ^2) statistic, with the appropriate degrees of freedom, to determine whether the observed concordance among respondents differed significantly from that expected by chance (Amedi, 2014, Ghangale *et al*., 2018, Mohammed, 2018).

The analysis therefore provided two complementary levels of interpretation: Garrett's mean scores identified and prioritized the specific constraints, while Kendall's coefficient of concordance assessed the overall agreement among farmers concerning the six broad constraint dimensions.

Results and Discussion

Economic Constraints

Table 1 presents the ranking of economic constraints perceived by the farmers in acquiring digital skills. All five economic constraints were identified from the literature and included in the interview schedule because each can potentially restrict farmers' access to and effective use of digital technologies. However, the Garrett mean scores indicate their relative severity within the economic dimension. Among the five constraints, *"High cost of digital tools, devices and services"* obtained the highest Garrett mean score of 59.38 and was ranked I, followed by *"Limited credit and low income of the farmers"* with a mean score of 57.58 and rank II. *"Financial risk and uncertain returns of new technology"* ranked III with a mean score of 48.85, while *"Lack of subsidies for the farmers"* (46.42) and *"Small farm size and fragmented landholdings"* (37.77) were ranked IV and V, respectively.

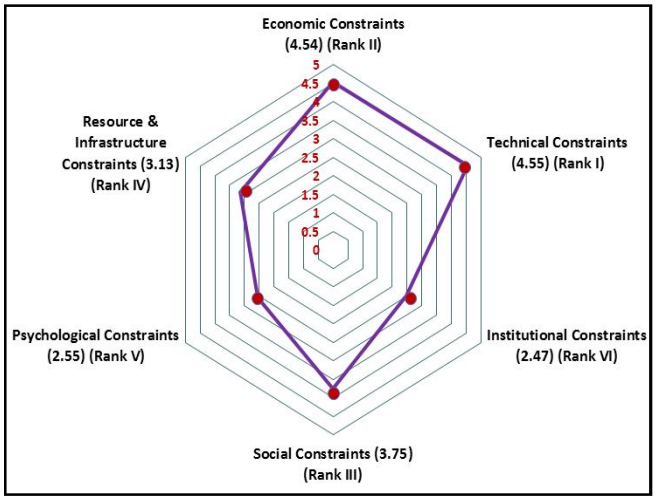


Fig. 3: Comparative ranking of six broad dimensions of constraints perceived by the farmers through Kendall's W mean value.

The constraint *"High cost of digital tools, devices and services"* received the highest Garrett mean score (59.38) and was ranked I. It could be concluded that the relatively high initial and recurring expenditure associated with smartphones, computers, internet services, mobile data and other digital facilities may make digital skill acquisition less accessible to farmers, particularly those operating under limited farm incomes. Acquiring a digital skill is not merely a matter of learning how to operate a device; it also requires regular access to an appropriate device and internet-enabled services for practice and continued use. Thus, farmers who cannot afford suitable digital devices or regular data services may have fewer opportunities to develop and maintain their digital competencies. This finding is supported by Priyanka *et al*., (2025), who reported high cost of ICT gadgets such as smartphones and computers as the foremost financial constraint among paddy growers in Haryana. More recently, Dhakal and Banerjee (2026), in a study of farmers in Rajasthan, also identified technology access and cost affordability as important factors influencing digital agriculture adoption.

The constraint *"Limited credit and low income of the farmers"* obtained a Garrett mean score of 57.58 and was ranked II. It could be concluded that farmers with limited and uncertain disposable income may find it difficult to allocate financial resources towards digital devices, internet subscriptions, repairs and other technology-related expenses. For small and resource-constrained farmers, expenditure on digital technologies may compete with essential farm and household requirements. The finding is consistent with the broader observation that rural smallholders may face affordability barriers in obtaining smartphones, data plans and digital services (Choruma *et al*., 2024). Recent evidence from India also indicates that socioeconomic access and affordability continue to influence farmers' participation in digital agriculture (Dhir and Mishra, 2026).

The *"Financial risk and uncertain returns of new technology"* was ranked III, with a Garrett mean score of 48.85. It could be concluded that farmers may hesitate to invest their scarce financial resources in digital technologies when the direct benefits or economic returns

Table 1: Ranking of Constraints perceived by the farmers through Garrett mean values.

S. No.	Constraints	Mean Score	Rank
1.	**Economic Constraints**		
i.	High cost of digital tools, devices and services	59.38	I
ii.	Lack of subsidies for the farmers	46.42	IV
iii.	Limited credit and low income of the farmers	57.58	II
iv.	Small farm size and fragmented landholdings	37.77	V
v.	Financial risk and uncertain returns of new technology	48.85	III
2.	**Technical Constraints**		
i.	Low digital literacy of the farmers	64.56	I
ii.	Lack of awareness about digital tools, apps or services	59.73	II
iii.	Unfamiliarity with online platforms	48.02	III
iv.	Language and content barriers	38.75	V
v.	Maintenance and repair issues	38.94	IV
3.	**Institutional Constraints**		
i.	Inadequate training programs for the farmers	63.31	I
ii.	Weak extension support	49.25	III
iii.	Poor coordination and implementation of government policies	56.04	II
iv.	Limited incentives for digital adoption	44.83	IV
v.	Insufficient motivation programs	36.56	V
4.	**Social Constraints**		
i.	Resistance to change	46.81	III
ii.	Skepticism and fear of scams or unknown tools	58.98	II
iii.	Gender gap	36.19	V
iv.	Low general education	61.73	I
v.	Weak peer networks and little social encouragement	46.29	IV
5.	**Psychological Constraints**		
i.	Fear and anxiety about new ICT tools	63.54	I
ii.	Lack of self-confidence	49.69	II
iii.	Low motivation	46.10	III
iv.	Age resistance	45.31	V
v.	Psychological preference for familiar practices	45.35	IV
6.	**Resource & Infrastructure Constraints**		
i.	Unstable power supply	46.31	III
ii.	Poor connectivity of internet and mobile signal	57.69	II
iii.	Limited device access	57.73	I
iv.	Lack of cybercafés or digital kiosks	43.98	V
v.	Insufficient telecom infrastructure	44.29	IV

are not immediately visible to them. Digital tools may provide information, advisory services, market access or other benefits, but the monetary returns associated with acquiring digital skills may not always be immediately measurable at the farm level. Consequently, farmers may perceive expenditure on unfamiliar digital technologies as financially uncertain, particularly when they are already operating with limited resources (Vasavi *et al.*, 2025).

The constraint *"Lack of subsidies for the farmers"* received a Garrett mean score of 46.42 and was ranked IV. It could be concluded that although subsidies or other forms of financial assistance may facilitate farmers' access to digital devices and services, farmers perceived the absence of such support as comparatively less severe than the direct cost of digital technologies and their own limited financial capacity. This comparatively lower rank should not be interpreted as indicating that subsidies are unimportant; rather, it indicates that, among the economic constraints examined, farmers placed greater emphasis on the immediate affordability of digital tools and their own income and credit limitations. Studies on the digital divide in Indian agriculture have similarly emphasized financial support, affordability and cost-reduction measures as potential mechanisms for improving farmers' access to digital technologies (Khwidzhilli and Ijatuyi, 2026).

The constraint *"Small farm size and fragmented landholdings"* recorded the lowest Garrett mean score (37.77) and was ranked V among the economic constraints. It could be concluded that although small and fragmented holdings may restrict the economic capacity of farmers and can influence their willingness to invest in new technologies, farmers in the present study perceived this constraint as relatively less severe for acquiring digital skills than the direct cost of digital devices and services, income and credit limitations, financial uncertainty, and lack of subsidies.

Technical Constraints

Table 1 presents the ranking of technical constraints perceived by the farmers in acquiring digital skills. The five technical constraints were identified from the review of literature and included in the study because each may hinder farmers' ability to acquire and effectively use digital technologies. However, the Garrett mean scores indicate their relative severity within the technical dimension. Among the technical constraints, *"Low digital literacy of the farmers"* obtained the highest Garrett mean score of 64.56 and was ranked I, followed by *"Lack of awareness about digital tools, apps or services"* with a mean score of 59.73 and rank II. *"Unfamiliarity with online platforms"* ranked III with a mean score of 48.02, whereas *"Maintenance and repair issues"* and *"Language and content*

barriers" obtained mean scores of 38.94 and 38.75 and were ranked IV and V, respectively.

The constraint *"Low digital literacy of the farmers"* received the highest Garrett mean score (64.56) and was ranked I. It could be concluded that basic digital literacy constitutes a fundamental prerequisite for acquiring further digital skills. Farmers who have difficulty performing basic operations such as navigating a smartphone, accessing the internet, searching for information, downloading or operating applications, or understanding digital interfaces may face difficulties in progressing towards more advanced agricultural uses of digital technologies. Therefore, even when digital devices and services are available, limited operational knowledge can restrict farmers' ability to learn and use them independently.

The constraint "Lack of awareness about digital tools, apps or services" obtained a Garrett mean score of 59.73 and was ranked II. It could be concluded that farmers may not acquire digital skills effectively when they are unaware of the existence, purpose or potential usefulness of relevant digital tools and agricultural applications. Awareness provides the initial stimulus for exploration and learning; without knowledge of available platforms, farmers may have little motivation or opportunity to develop the skills required to use them. Thus, the relatively high ranking of this constraint may be attributed to the fact that farmers cannot be expected to learn or use digital services with which they are unfamiliar. Jena *et al.* (2023) similarly reported lack of awareness about the benefits of ICT in agriculture as one of the prominent problems faced by farmers using digital tools in Madhya Pradesh.

The constraint *"Unfamiliarity with online platforms"* was ranked III, with a Garrett mean score of 48.02. It could be concluded that although farmers may possess basic digital literacy and some awareness of digital technologies, unfamiliarity with specific online platforms can still make it difficult for them to use agricultural portals, mobile applications, online service platforms and other digital interfaces effectively. Different platforms often have different navigation procedures, registration requirements, menus and functional features, and therefore general familiarity with smartphones does not necessarily translate into proficiency with every digital platform. Rawat *et al.*, (2025) reported that inability to operate applications and their complexity constituted the most perceived technical constraint among dairy farmers using livestock-based mobile applications in Uttar Pradesh.

The "Maintenance and repair issues" constraint obtained a Garrett mean score of 38.94 and was ranked IV. It could be concluded that technical problems associated with the maintenance and repair of digital devices may interrupt farmers' continued exposure to digital technologies and consequently affect opportunities for skill development. A damaged smartphone, malfunctioning device or difficulty in obtaining technical assistance can temporarily prevent farmers from practicing the skills they have acquired.

The constraint "Language and content barriers" received a Garrett mean score of 38.75 and was ranked V, the lowest among the five technical constraints. It could be concluded that language and content-related difficulties were perceived as comparatively less severe than the other technical barriers considered in the present study. Farmers may still encounter difficulties when digital agricultural information is presented in unfamiliar languages, contains technical terminology, or is not sufficiently adapted to their level of understanding. Evidence from recent studies supports the continuing relevance of this issue.

Institutional Constraints

Table 1 presents the ranking of institutional constraints perceived by the farmers in acquiring digital skills. All five constraints were identified through the review of literature and included in the study because institutional arrangements play an important role in creating an enabling environment for farmers to acquire and use digital technologies. However, the Garrett mean scores indicate their relative severity within the institutional dimension. Among the five constraints, *"Inadequate training programs for the farmers"* obtained the highest Garrett mean score of 63.31 and was ranked I, followed by *"Poor coordination and implementation of government policies"* with a mean score of 56.04 and rank II. *"Weak extension support"* ranked III with a mean score of 49.25, while *"Limited incentives for digital adoption"* and *"Insufficient motivation programs"* obtained mean scores of 44.83 and 36.56 and were ranked IV and V, respectively.

The constraint *"Inadequate training programs for the farmers"* received the highest Garrett mean score (63.31) and was ranked I. It could be concluded that the farmers perceived the lack of adequate opportunities for structured training and practical learning as the most severe institutional barrier to digital skill acquisition. Digital skills are largely experiential and require repeated practice, demonstrations and opportunities to learn under guidance. In the absence of regular and practically oriented training programmes, farmers may find it difficult to understand digital applications, online agricultural services and other technology-enabled platforms, even when such technologies are physically available. Training can also

reduce hesitation associated with unfamiliar technologies by providing farmers with an opportunity to learn through demonstration and hands-on practice. The finding is supported by Lakshmi *et al.*, (2025), who studied constraints faced by farmers in adapting to climate change in North Bihar and reported lack of training as one of the major technical constraints. Although their study concerned climate-change adaptation rather than digital skill acquisition, the finding demonstrates the broader importance of training opportunities in enabling Bihar farmers to develop competencies required for adopting new agricultural technologies. Similarly, Challa (2024) reported that lack of training and skill in handling ICT devices and services was a major constraint among farm women accessing digital extension services in Telangana.

The constraint *"Poor coordination and implementation of government policies"* obtained a Garrett mean score of 56.04 and was ranked II. It could be concluded that farmers may perceive digital skill acquisition as difficult when programmes, schemes and institutional initiatives related to digital agriculture are not adequately coordinated or effectively implemented at the field level. Digital agriculture involves multiple actors, including government departments, extension agencies, training institutions and technology providers. When information, services and implementation mechanisms are not well coordinated, farmers may experience fragmented information, duplication or gaps in support and difficulty in accessing relevant programmes. The importance of institutional coordination is also reflected in empirical evidence from India. Tanti *et al*., (2022), while examining institutional factors influencing climate-smart technology adoption in Odisha, found that institutional extension services, subsidies and training were important in supporting farmers' technology adoption. The authors emphasized that strengthening institutional support, including extension services, credit, subsidies and field demonstrations, can facilitate technology uptake. Similarly, a recent study by Parihast *et al*., (2026) highlighted fragmented programme design, information asymmetries and weak coordination as institutional capacity constraints affecting the delivery of agricultural extension services in India.

The constraint *"Weak extension support"* was ranked III, with a Garrett mean score of 49.25. It could be concluded that inadequate or irregular extension support may restrict farmers' opportunities to receive guidance when learning to use digital agricultural technologies. Extension personnel can act as intermediaries between farmers and digital services by demonstrating applications, explaining their functions, helping farmers navigate online platforms and resolving basic difficulties during initial use. Where such support is insufficient, farmers may have to learn independently, which can make the process more difficult, particularly for those with limited prior digital experience. Evidence from Bihar provides support for this interpretation. Lakshmi *et al*., (2025) reported poor extension service on climate-risk management as a major institutional constraint among farmers in North Bihar. Although the specific context differed, the finding indicates that limitations in extension support can constrain farmers' ability to acquire and apply knowledge related to emerging agricultural technologies and practices.

The constraint *"Limited incentives for digital adoption"* obtained a Garrett mean score of 44.83 and was ranked IV. It could be concluded that the farmers perceived the absence or limited availability of incentives for adopting digital technologies as a comparatively less severe institutional constraint than inadequate training, poor policy implementation and weak extension support. Financial or non-financial incentives may encourage farmers to experiment with unfamiliar technologies and reduce the perceived risk associated with their initial use. The role of incentives in agricultural technology adoption has also been documented in empirical research from India. Tanti *et al*., (2022) reported that subsidies and other forms of institutional support were relevant to the adoption of climate-smart technologies among farmers in Odisha.

The constraint *"Insufficient motivation programs"* received a Garrett mean score of 36.56 and was ranked V, indicating the lowest relative severity within the institutional dimension. It could be concluded that farmers perceived the lack of specific motivation programmes as comparatively less severe than the other institutional barriers considered in the study. This may be because farmers' immediate difficulties are more closely related to acquiring the necessary skills, receiving institutional guidance and accessing effectively implemented programmes. Once adequate training and support are available, farmers may be able to develop their interest in digital technologies through actual experience and perceived usefulness. Appropriate demonstrations, recognition of successful users, exposure visits, farmer-to-farmer learning and other motivational mechanisms may encourage farmers to experiment with and continue using digital technologies. The evidence on digital agricultural services also suggests that farmers' perceived usefulness, credibility and practical experience influence their willingness to engage with digitally mediated services.

Social Constraints

Table 1 presents the ranking of social constraints perceived by the farmers in acquiring digital skills. All five social constraints were included based on the review of literature and their potential relevance to farmers' digital skill acquisition. However, the Garrett mean scores indicate their relative severity within the social dimension. Among the five constraints, *"Low general education"* obtained the highest Garrett mean score of 61.73 and was ranked I, followed by *"Skepticism and fear of scams or unknown tools"* with a mean score of 58.98 and rank II. *"Resistance to change"* ranked III with a mean score of 46.81, whereas *"Weak peer networks and little social encouragement"* and *"Gender gap"* obtained mean scores of 46.29 and 36.19 and were ranked IV and V, respectively.

The constraint *"Low general education"* received the highest Garrett mean score (61.73) and was ranked I. It could be concluded that limited general educational attainment may reduce farmers' ability to understand written instructions, interpret digital information, navigate unfamiliar interfaces and independently learn new digital applications. Although formal education and digital literacy are not synonymous, basic educational competence can facilitate comprehension and learning when farmers interact with digital agricultural services. Thus, farmers with lower educational exposure may require more time, demonstration and interpersonal support to acquire digital skills. Evidence from Bihar supports this interpretation. Kumar and Jahanara (2023), in their study of farmers in West Champaran, Bihar, reported lack of literacy along with inadequate smartphone proficiency and limited knowledge about agricultural advisory services on mobile phones as major constraints faced by the farmers.

The constraint *"Skepticism and fear of scams or unknown tools"* obtained a Garrett mean score of 58.98 and was ranked II. It could be concluded that farmers may hesitate to explore unfamiliar digital tools when they are uncertain about the credibility, security or consequences of using them. Concerns about online fraud, misleading information, unauthorized transactions, privacy and unfamiliar applications can discourage farmers from experimenting with new digital services. Such apprehension can be particularly relevant when farmers have limited previous experience with digital platforms and lack immediate assistance to verify whether a particular application or online service is trustworthy.

The constraint *"Resistance to change"* was ranked III, with a Garrett mean score of 46.81. It could be concluded that some farmers may prefer familiar methods of obtaining agricultural information and performing farm-related activities rather than experimenting with unfamiliar digital technologies. Acquiring a new digital skill requires a willingness to alter established routines and devote time to learning a different method. Farmers who are accustomed to conventional sources of information may therefore be slower to engage with new digital platforms, particularly when the benefits are not immediately apparent. Comparable findings have been reported among Indian farmers.

The constraint "Weak peer networks and little social encouragement" received a Garrett mean score of 46.29 and was ranked IV. It could be concluded that farmers may have fewer opportunities to learn digital skills when they lack supportive peer networks through which they can observe, discuss and practise the use of digital technologies. In rural communities, farmers often learn new practices through interpersonal communication, neighbouring farmers, farmer groups and informal exchange of experiences. A farmer who observes a peer successfully using a digital application may gain confidence and motivation to try the same tool. Conversely, limited interaction with digitally experienced peers may reduce such opportunities for experiential learning. This interpretation is supported by earlier research on digital agricultural information services. Kumar *et al*., (2017) reported that less networking among farmers was among the social constraints affecting the utilization of information through the Rice Knowledge Management Portal

The constraint *"Gender gap"* obtained a Garrett mean score of 36.19 and was ranked V, indicating the lowest relative severity among the five social constraints considered in the present study. It could be concluded that, compared with the other social constraints included in the analysis, farmers perceived gender-related differences as a comparatively less severe barrier to their own acquisition of digital skills.

Psychological Constraints

Table 1 presents the ranking of psychological constraints perceived by the farmers in acquiring digital skills. All five psychological constraints were included in the study based on the review of literature, as psychological readiness can influence farmers' willingness and ability to engage with unfamiliar digital technologies. The Garrett mean scores, however, indicate their relative severity within the psychological dimension. Among the five constraints, *"Fear and anxiety about new ICT tools"* obtained the highest Garrett mean score of 63.54 and was ranked I, followed by *"Lack of self-confidence"* with a mean score of 49.69 and rank II. *"Low motivation"* ranked III with a mean score of 46.10,

while *"Psychological preference for familiar practices"* and *"Age resistance"* obtained mean scores of 45.35 and 45.31 and were ranked IV and V, respectively.

The constraint *"Fear and anxiety about new ICT tools"* received the highest Garrett mean score (63.54) and was ranked I. It could be concluded that apprehension about unfamiliar technologies may constitute a major psychological barrier because farmers may perceive new ICT tools as difficult, risky or prone to errors. Digital skill acquisition requires farmers to experiment with unfamiliar interfaces, applications and procedures, and fear of making mistakes may discourage them from attempting such activities independently. Farmers who are uncertain about their ability to operate a new technology may also avoid using it regularly, thereby reducing opportunities for practice and skill development. Thus, the first rank obtained by this constraint may be attributed to the psychological hesitation that accompanies the transition from familiar agricultural practices to technology-mediated ways of obtaining information and performing agricultural activities. The finding is supported by Baruah *et al.*, (2025), who used Garrett's ranking technique among farmers using ICT-based agro-met advisory services in Assam. They reported fear of technology among the personal constraints perceived by farmers, although it received a lower rank.

The constraint *"Lack of self-confidence"* obtained a Garrett mean score of 49.69 and was ranked II. It could be concluded that farmers who lack confidence in their ability to operate digital technologies may hesitate to explore unfamiliar applications or perform digital tasks independently. Digital skill acquisition involves trial and error, and a farmer who fears making mistakes may prefer to depend on other persons rather than attempt the activity personally. Consequently, low self-confidence can restrict independent learning and reduce repeated interaction with digital technologies. This finding is consistent with Baruah *et al.* (2025), who identified lack of confidence among the personal constraints faced by farmers in using ICT-based agro-met advisory services.

The *"Low motivation"* constraint was ranked III, with a Garrett mean score of 46.10. It could be concluded that farmers who perceive limited immediate usefulness or benefit from digital technologies may have less motivation to devote time and effort to acquiring new digital skills. Skill acquisition requires continued practice, and motivation is particularly important when farmers encounter difficulties during the initial stages of learning. If digital technologies are not perceived as relevant to their farming needs, farmers may discontinue their efforts before developing adequate proficiency.

The constraint *"Psychological preference for familiar practices"* received a Garrett mean score of 45.35 and was ranked IV. It could be concluded that farmers who are comfortable with established methods of obtaining agricultural information and performing farm-related activities may be comparatively less inclined to invest effort in learning new digital methods. Familiar practices offer a sense of certainty and require less experimentation, whereas digital technologies may require farmers to change established routines and learn new procedures. Therefore, preference for familiar practices can slow the transition towards digitally mediated agricultural activities.

The constraint *"Age resistance"* obtained a Garrett mean score of 45.31 and was ranked V, indicating the lowest relative severity among the five psychological constraints. It could be concluded that although farmers may perceive age-related difficulty in learning and using new digital technologies, they considered it comparatively less severe than the other psychological barriers included in the study. Older farmers may require additional time, demonstrations and repeated practice to become comfortable with digital tools; however, age alone does not necessarily prevent digital skill acquisition. Individual exposure to technology, previous experience, availability of assistance and perceived usefulness may also influence willingness to learn.

Resource & Infrastructure Constraints

Table 1 presents the ranking of resource and infrastructure constraints perceived by the farmers in acquiring digital skills. All five constraints were identified from the review of literature because access to appropriate devices, reliable connectivity and supporting digital infrastructure provides the basic physical environment necessary for farmers to practise and develop digital skills. However, the Garrett mean scores indicate their relative severity within the resource and infrastructure dimension. Among the five constraints, *"Limited device access"* obtained the highest Garrett mean score of 57.73 and was ranked I, followed closely ***by*** *"Poor connectivity of internet and mobile signal"* with a mean score of 57.69 and rank II. *"Unstable power supply"* ranked III with a mean score of 46.31, whereas *"Insufficient telecom infrastructure"* and *"Lack of cybercafés or digital kiosks"* obtained mean scores of 44.29 and 43.98 and were ranked IV and V, respectively.

The constraint *"Limited device access"* received the highest Garrett mean score (57.73) and was ranked I. It could be concluded that inadequate access to suitable

digital devices may constitute the most severe resource-related barrier to digital skill acquisition because regular interaction with a smartphone, computer or other digital device is essential for developing practical competence. Digital skills cannot be acquired effectively through awareness or theoretical exposure alone; farmers require repeated opportunities to operate devices, access applications, navigate online platforms and practise digital transactions or information-seeking activities. When a farmer does not personally possess or regularly access an appropriate device, opportunities for such experiential learning become restricted. This may be particularly relevant for small and marginal farmers for whom purchasing and maintaining a smartphone or other digital equipment may compete with other household and farm expenditures. The finding is strongly supported by Sharma *et al*., (2025), who examined access to digital services among 3,375 farmers across 34 districts in Bihar, eastern Uttar Pradesh, Jharkhand, Odisha and West Bengal. They found considerable disparities in access to agricultural digital services across farm sizes, with marginal farmers lagging in digitalization, and identified easier access to credit for investment in smart devices as an important policy requirement. Their findings demonstrate that ownership and access to digital devices remain an important component of farmers' ability to participate in digital agriculture. Similarly, Baldaniya and Patel (2025) reported that limited digital adoption among small and marginal farmers in Gujarat was associated with several access-related barriers, including poor internet connectivity, affordability and inadequate institutional support. Their study emphasized the need for infrastructural improvement and affordable digital technologies to increase farmers' participation in online agricultural platforms. Therefore, the first rank of limited device access in the present study may be attributed to the fact that a farmer cannot continuously practise digital skills without dependable access to a digital device.

The constraint *"Poor connectivity of internet and mobile signal"* obtained a Garrett mean score of 57.69 and was ranked II, with a score almost identical to that of limited device access. It could be concluded that unreliable internet and mobile connectivity can seriously restrict farmers' ability to acquire digital skills because many contemporary agricultural applications and online services require continuous or sufficiently stable network access. Poor connectivity can interrupt downloading and updating applications, accessing online advisory services, watching training materials, completing online transactions and communicating with extension personnel or other farmers through digital platforms. Repeated interruptions may also discourage farmers from practising digital activities and reduce their confidence in the reliability of such services. Evidence from Bihar directly supports this finding. Kumar and Alamgir (2024), in their study of 210 farmers in Bihar, identified poor or slow internet connections in rural areas and insufficient power supply among the major hurdles to the adoption of digital technologies in agriculture. Their findings demonstrate that connectivity remains an important physical constraint to digital agricultural transformation in Bihar. Further, Mukherjee *et al*., (2023) examined perceived constraints in the utilization of ICT tools among farmers in Purba Burdwan and Birbhum districts of West Bengal. They reported poor internet connectivity as the second-ranked technical constraint in Purba Burdwan and the third-ranked constraint in Birbhum, with Garrett mean scores of 61.38 and 59.06, respectively. They also identified poorly developed ICT infrastructure as another major technical constraint. More recently, Ajesh *et al*., (2025) found limited access to reliable internet connectivity to be the most critical constraint to the adoption of digital tools among groundnut farmers in Banaskantha, Gujarat, with a Garrett mean score of 59.94. These findings closely correspond with the second rank obtained by poor internet and mobile connectivity in the present study.

The constraint *"Unstable power supply"* received a Garrett mean score of 46.31 and was ranked III. It could be concluded that irregular electricity supply may restrict the consistent use of digital devices and digital services, particularly where farmers depend on electricity for charging smartphones, operating computers or accessing other digital equipment. The third rank suggests that farmers considered electricity-related limitations to be less severe than device access and connectivity, but still sufficiently important to affect their digital skill acquisition. The finding is supported by Kumar and Alamgir (2024), who identified insufficient power supply as one of the major hurdles to digitalization in the agricultural sector of Bihar. Similarly, Mukherjee *et al*., (2023) reported erratic electric power supply as a technical constraint among farmers utilizing ICT tools in West Bengal, although it ranked below internet connectivity and ICT infrastructure in their study. Sharma *et al*., (2025) also reported electricity problems among the constraints affecting ICT adoption among farmers in Solan district of Himachal Pradesh, although it received a lower Garrett rank than several other ICT-related barriers. These findings suggest that reliable electricity remains a necessary supporting condition for sustained digital engagement in rural areas.

The constraint *"Insufficient telecom infrastructure"* obtained a Garrett mean score of 44.29 and was ranked

IV. It could be concluded that inadequate telecom infrastructure may restrict the quality, reliability and geographical reach of digital services available to farmers. Even when individual farmers possess smartphones and are willing to use digital agricultural services, limitations in supporting network infrastructure may result in weak signals, slow data transmission or intermittent service. Consequently, the farmer's ability to practise and regularly use digital applications can be constrained by factors beyond the individual's control. Mukherjee *et al*., (2023) reported poorly developed ICT infrastructure as one of the major technical constraints perceived by farmers in both Purba Burdwan and Birbhum. It was ranked third in Purba Burdwan and second in Birbhum, with Garrett mean scores of 57.00 and 59.94, respectively. Likewise, Ajesh *et al*., (2025) identified insufficient infrastructure among the additional barriers to digital-tool adoption among groundnut farmers in Gujarat, alongside poor connectivity and unstable power supply. These findings support the interpretation that the availability of individual digital devices needs to be accompanied by adequate communication infrastructure to enable their effective use.

The constraint *"Lack of cybercafés or digital kiosks"* obtained a Garrett mean score of 43.98 and was ranked V, indicating the lowest relative severity among the five resource and infrastructure constraints considered in the present study. It could be concluded that although the availability of cybercafés, digital kiosks and similar community-level access points may facilitate digital service access for farmers who do not possess suitable devices or lack confidence in performing digital tasks independently, farmers perceived their absence as comparatively less severe than direct limitations related to device access, internet connectivity and electricity. This relatively lower ranking may partly reflect the increasing availability of smartphones, which allows farmers to access many digital services without necessarily depending on a cybercafé or fixed digital service centre. However, the continued relevance of community-level access points should not be overlooked, particularly for farmers who do not own suitable devices or require assistance with complex digital services. Mukherjee *et al*., (2023) reported insufficient access centres for ICTs in villages as a constraint among farmers in both Purba Burdwan and Birbhum, although it received the lowest rank among their listed technical constraints. Similarly, the recent study by Sharma *et al*., (2025) demonstrates that digital access remains uneven across farm sizes in Eastern India and that marginal farmers continue to face greater difficulty in accessing agricultural digital services.

Table 2: Test for Kendall's coefficient of concordance (Kendall's W).

Test Statistics	Values
N	240
Kendall's W[a]	0.249
Chi-Square	298.835
Degrees of freedom (df)	5
Asymptotic Significance	0.000
a. Kendall's Coefficient of Concordance	

Thus, the fifth rank in the present study indicates comparatively lower perceived severity rather than the absence of a need for community-based digital access facilities.

The results presented in Table 2 show the test for Kendall's coefficient of concordance (Kendall's W) among the six broad dimensions of constraints perceived by the 240 farmers. The analysis was used to determine the extent to which the farmers showed agreement in the relative ranking of Economic, Technical, Institutional, Social, Psychological, and Resource & Infrastructure Constraints. The table reports N, Kendall's W, Chi-square, degrees of freedom, and asymptotic significance. The value of N was 240, indicating that the Kendall's W analysis was based on the rankings provided by 240 farmer respondents. The six broad constraint dimensions constituted the common set of objects whose relative ordering was assessed across the respondents.

The Kendall's coefficient of concordance (W) was 0.249. Kendall's W ranges from 0 to 1, where a value closer to 0 indicates little agreement among the rankings and a value closer to 1 indicates stronger agreement (Kumari *et al*., 2026). The obtained value of 0.249 therefore indicates a relatively low-to-moderate degree of concordance among the farmers in their ranking of the six broad constraint dimensions. In other words, there was some commonality in the way farmers perceived and ordered the six dimensions, but the agreement was not strong. This suggests that farmers did not perceive the six dimensions in exactly the same order of severity; their perceptions varied to a considerable extent. The Chi-square (χ^2) value was 298.835 with 5 degrees of freedom. The chi-square statistic provides the basis for testing whether the observed degree of concordance is statistically different from what would be expected under the null hypothesis of no systematic agreement among the rankings. The degrees of freedom (df) were 5, calculated as n - 1, where n is the number of broad constraint dimensions ranked. Since six dimensions were considered in the present study, the degrees of freedom were therefore 6 - 1 = 5. The Asymptotic Significance was 0.000 ($p < 0.001$). Thus, the obtained chi-square

statistic was statistically significant, indicating that the observed pattern of rankings among the six broad constraint dimensions was not attributable merely to random variation. The null hypothesis of no systematic concordance among the rankings can therefore be rejected. In practical terms, although the magnitude of agreement was relatively low-to-moderate as indicated by W = 0.249, the agreement that did exist was statistically significant. A statistically significant Kendall's W does not imply that farmers were in complete agreement; rather, it indicates that the observed concordance was greater than would be expected by chance.

Fig. 3 presents the comparative ranking of the six broad dimensions of constraints perceived by the farmers for digital skill acquisition, based on their Kendall's W mean values. The figure shows a clear variation in the relative prominence of the six dimensions: Technical Constraints (4.55) occupied Rank I, Economic Constraints (4.54) Rank II, Social Constraints (3.75) Rank III, Resource & Infrastructure Constraints (3.13) Rank IV, Psychological Constraints (2.55) Rank V, and Institutional Constraints (2.47) Rank VI.

The Technical Constraints, with a mean value of 4.55, occupied the first rank in Fig. 3. This indicates that farmers perceived technical difficulties as the most prominent broad dimension affecting their acquisition of digital skills. Digital skill acquisition inherently requires farmers to understand, operate and troubleshoot digital devices, applications and online platforms. Thus, limitations in digital literacy, knowledge, practical skills and familiarity with digital tools can directly restrict farmers' ability to develop and use digital competencies. A similar pattern was reported by Satapathy *et al*., (2024) among farmers in Khurda and Bargarh districts of Odisha, where technical constraints were ranked first in both districts, with mean scores of 53.66 and 57.26, respectively. Their study identified insufficient knowledge of accessing ICT platforms, poor ICT infrastructure and inadequate technical support among the prominent technical barriers. Likewise, Mukherjee *et al*., (2023) reported several prominent technical constraints among farmers in West Bengal, including poor internet connectivity, poorly developed ICT infrastructure and lack of region-specific information.

The Economic Constraints, with a mean value of 4.54, occupied the second rank. The very small difference between the technical and economic mean values (4.55 and 4.54) indicates that farmers perceived these two dimensions at almost the same level of severity. Economic limitations can restrict digital skill acquisition by reducing farmers' ability to purchase smartphones or other digital devices, pay for internet services, maintain devices and regularly access digital platforms. This finding is supported by Mukherjee *et al*., (2023), who reported that the high cost of ICT tools such as smartphones and computers was the most important economic constraint among farmers in both Purba Burdwan and Birbhum, followed by internet charges and lack of subsidies. Similarly, Priyanka *et al*., (2025) reported the high cost of ICT gadgets, including smartphones and computers, as the first-ranked financial constraint among paddy growers in both Kaithal and Fatehabad districts of Haryana. Thus, the second position of the economic dimension suggests that farmers' ability to acquire and sustain access to digital technologies is closely linked with their economic capacity.

The Social Constraints obtained a mean value of 3.75 and occupied the third rank. This indicates that social factors constituted an important, though comparatively less prominent, dimension of constraints. Farmers generally acquire and practise digital skills within a social environment involving family members, fellow farmers, extension personnel and other information sources. Social interaction, prevailing practices, peer influence and access to digitally knowledgeable persons can therefore facilitate or restrict digital learning. The findings of Satapathy *et al*., (2024) provide supporting evidence, as social constraints occupied the second position after technical constraints in both Khurda and Bargarh districts. In their study, lack of knowledge regarding ICT applications and the tendency to follow traditional methods of information seeking were among the prominent social constraints. Priyanka *et al*., (2025) also identified social constraints among paddy growers, with confusion arising from the large amount of information obtained through ICT receiving the highest position within this category. The third rank in Fig. 3 therefore indicates that the social environment surrounding farmers remains relevant to digital skill acquisition, although it was perceived as less severe than technical and economic limitations.

The Resource & Infrastructure Constraints, with a mean value of 3.13, occupied the fourth rank. This dimension represents the physical and infrastructural conditions required for farmers to use digital technologies, including access to suitable devices, internet and mobile connectivity, electricity and supporting communication infrastructure. The fourth position does not indicate that infrastructure was unimportant; rather, farmers perceived this broad category as less prominent than the technical, economic and social dimensions. Evidence from Mukherjee *et al*., (2023) shows that poor internet connectivity and poorly developed ICT infrastructure

were important constraints among farmers in West Bengal, while erratic electricity supply and insufficient ICT access centres were also identified as constraints. Similarly, Kumar *et al*., (2017) reported electricity problems and poor connectivity among the important technological constraints faced by farmers in utilizing information through the Rice Knowledge Management Portal. The fourth position of this dimension in the present study consequently suggests that physical access conditions remain important, but farmers perceived their technical and economic limitations as relatively more immediate barriers to digital skill acquisition.

The Psychological Constraints, with a mean value of 2.55, occupied the fifth rank. This indicates that psychological factors such as fear, anxiety, lack of confidence, reluctance and motivation were perceived as comparatively less severe at the broad-dimension level. Nevertheless, psychological readiness can influence whether farmers are willing to experiment with unfamiliar technologies and continue practicing after encountering difficulties. Kumar *et al*., (2017) found that psychological constraints were relevant among farmers using the Rice Knowledge Management Portal; techno-phobia was the most severe psychological constraint, followed by fear of failure and lack of motivation. More recently, Priyanka *et al*., (2025) identified personal constraints, particularly insufficient training and practical exposure towards ICTs, among the important barriers faced by paddy growers. Therefore, the fifth rank in Fig. 3 should be interpreted as a comparatively lower relative position among the six dimensions, rather than as evidence that psychological barriers are absent or unimportant.

The Institutional Constraints obtained the lowest mean value of 2.47 and occupied the sixth rank. This indicates that farmers perceived institutional factors as the least prominent broad dimension among the six categories considered in the present study. Institutional factors may include the availability of institutional guidance, training, extension support and facilitation for farmers to acquire digital skills. The relatively lower position observed here does not imply that institutional support has no role in digital skill development. For instance, Kumar *et al*., (2017) identified lack of institutional support as a significant constraint in farmers' utilization of digital agricultural information. Similarly, Satapathy *et al*., (2024) identified deficiencies in support services as an important component of ICT-related constraints among farmers. The lower position of institutional constraints in the present study therefore indicates that, from the farmers' comparative perception, direct technical, economic, social and infrastructural difficulties were more prominent than institutional limitations in acquiring digital skills.

Conclusion

The present study examined the constraints perceived by farmers in acquiring digital skills in Bihar using Garrett's Ranking Technique at the individual constraint level and Kendall's coefficient of concordance (W) at the broader dimensional level. The analysis was based on responses from 240 farmers selected from East Champaran, Saharsa, Gaya and Bhagalpur districts of Bihar. Thirty constraint statements were assessed under six broad dimensions, namely Economic, Technical, Institutional, Social, Psychological, and Resource & Infrastructure Constraints. The findings indicate that digital skill acquisition among farmers is influenced by multiple and interconnected constraints rather than by a single barrier. Within the individual constraints, *low digital literacy of the farmers* emerged as the most prominent technical constraint, while *high cost of digital tools*, devices and services was the leading economic constraint. *Inadequate training programs for the farmers* ranked first among institutional constraints, whereas *low general education* was the most prominent social constraint. Among psychological constraints, *fear and anxiety about new ICT tools* received the highest rank. Within the resource and infrastructure dimension, *limited device access* was ranked first, followed very closely by *poor connectivity of internet and mobile signal*. These findings indicate that farmers require not only access to digital technologies but also the knowledge, confidence, training and physical resources necessary to use them effectively. At the broader dimensional level, Technical Constraints obtained the highest Kendall's W mean rank (4.55), followed very closely by Economic Constraints (4.54). Social Constraints (3.75) occupied the third position, followed by Resource & Infrastructure Constraints (3.13), Psychological Constraints (2.55) and Institutional Constraints (2.47). Thus, technical capability and economic accessibility emerged as the most prominent broad areas of constraint perceived by the farmers. Kendall's coefficient of concordance was 0.249, with a chi-square value of 298.835 at 5 degrees of freedom and $p < 0.001$, indicating statistically significant but relatively low-to-moderate concordance among the farmers in their ranking of the six broad constraint dimensions. This suggests that although farmers showed a statistically meaningful common pattern in their perceptions, the relative importance attached to different constraint dimensions varied across respondents. Overall, the findings suggest that strengthening digital agriculture among farmers in Bihar requires a multidimensional approach combining digital literacy and hands-on training with affordable devices, reliable connectivity, appropriate technical support and supportive extension interventions.

Priority should particularly be given to improving farmers' practical digital competencies and reducing the economic and access-related barriers that restrict regular exposure to digital technologies. Such interventions can facilitate more meaningful and sustained participation of farmers in the emerging digital agricultural ecosystem.

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