Journal Of the Iraqia University (73-4) February (2025)

ISSN(Print): 1813-4521 OnIine ISSN:2663-7502
Journal Of the Iraqia University
available online at: https://www.mabdaa.edu.iq

ASSESSMENT OF THE COLLABORATION BETWEEN AGRICULTURE RESEARCH AND EXTENSION WORKERS

Snoor Haydar Ababakr
Department of Soil and water, College of Agriculture Engineering Sciences, Salahaddin University-Erbil
Correspondence: snoor.ababakr@su.edu.krd
ORCID 0009-0007-0191-5797

ملخص

تدرس هذا البحث مشاركة العاملين في مجال الإرشاد كمدربين في محافظة أربيل والسليمانية ودهوك . تمتلك دهوك أعلى نسبة من العاملين في مجال الإرشاد الذين لم يتلقوا أي تدريب (٥٣.٣٪)، تليها أربيل ٣٣.٣٪و السليمانية ٢٦.٧٪، مما يشير إلى وجود فجوات محتملة في بناء القدرات وتخصيص الموارد، وخاصة في دهوك. كما تقود السليمانية جلسات تدريبية محدودة (٥٣.٣٪)، مع أ بنسبة ٤٦.٧٪ و دهوك بنسبة ٤٠٪، مما يعكس مشاركة تدريبية نشطة نسبيًا ولكن منخفضة المستوى. تسلط النتائج الضوء على نقص نشاط التدريب المكثف، مما يشير إلى وجود قيود منهجية في خدمات الإرشاد. تُظهر السليمانيةأعلى تفضيل للزراعة (٤٠٪)، تليها دهوك (٢٦.٧٪) و ٢٠٪ أربيل، مما يشير إلى التركيز الإقليمي على تقنيات الزراعة الحديثة. في تنفيذ هذه التقنيات، تمتلك السليمانية أعلى نسبة من العاملين في مجال الإرشاد الذين يعملون كمدربين (٤٦.٧٪)، مقارنة بـ في محافظة أربيل٣٣٪ و في محافظة دهوك٢٦.٧٪، مما يعكس مستويات مشاركة متباينة. كما سجلت محافظة السليمانية عن أعلى نسبة (٥٣.٣٪) من المشاركين الذين لديهم ١–٥ تفاعلات سنويًا، بينما أبلغت ٦٠٪ من محافظة أربيل و في دهوك٦٦.٧٪ في المقام الأول عن تفاعلات لمرة واحدة، مما يشير إلى أنظمة مشاركة أضعف. تختلف الجهود التعاونية حسب المنطقة، حيث أظهرت السليمانية أعلى وتيرة للتعاون (٦–١٠ مرات سنويًا)، مما يشير إلى نهج شراكة أكثر فعالية. أسفر اختبار t الذي قارن أربيل وسليمانية عن إحصائية t –٠.٥٥٤ وقيمة p ٠.٥٩٢، مما يشير إلى عدم وجود فرق كبير . أسفرت مقارنة أربيل ودهوك عن إحصائية t –٠.٢٣٨ وقيمة p ٠.٨١٦، مما يدل أيضًا على عدم وجود فرق كبير . وأخيرًا، أنتجت مقارنة السليمانية مع دهوك إحصائية t بلغت ٠.٣٦٦ وقيمة p بلغت ٠.٧٢٢، وهو ما يؤكد عدم وجود فروق ذات دلالة إحصائية بين هذه المناطق. ويتطلب التصدي لهذه التحديات استراتيجيات خاصة بكل منطقة، بما في ذلك بناء القدرات، وتعزيز التواصل، وتنويع التدريس لتحسين الاستدامة والإنتاجية في الزراعة في إقليم كردستان العراق.

الكلمات المفتاحية :الاستدامة الزراعية؛ خدمات الإرشاد؛ المرشد الزراعي؛ بناء القدرات؛ استراتيجيات التواصل؛ إقليم كردستان العراق.

Abstract

This study examines the engagement of extension workers as trainers in Erbil (ER), Sulaymaniyah (SU), and Duhok (DU). DU has the highest percentage of extension workers who did not conduct any training (53.3%), followed by ER (33.3%) and SU (26.7%), indicating potential gaps in capacity-building and resource allocation, particularly in DU. SU also leads in limited training sessions (53.3%), with ER at 46.7% and DU at 40%, reflecting relatively active but low-level training involvement. The findings highlight a lack of intensive training activity, suggesting systemic constraints in extension services. SU shows the highest preference for agriculture (40%), followed by DU (26.7%) and ER (20%), indicating a regional focus on modern farming techniques. In implementing these techniques, SU has the highest proportion of extension workers serving as trainers (46.7%), compared to ER (33%) and DU (26.7%), reflecting varied engagement levels. SU also reports the highest percentage (53.3%) of participants with 1–5 interactions annually, while EU (60%) and DU (66.7%) primarily report one-time interactions, indicating weaker engagement systems.

Collaborative efforts vary by region, with SU demonstrating the highest frequency of collaborations (6–10 times annually), suggesting a more effective partnership approach. The t-test comparing ER and SU yielded a t-statistic of -0.554 and a p-value of 0.592, indicating no significant difference. The ER versus DU comparison resulted in a t-statistic of -0.238 and a p-value of 0.816, also showing no significant difference. Finally, the SU versus DU comparison produced a t-statistic of 0.366 and a p-value of 0.722, further confirming no statistically significant differences among these regions. Addressing these challenges requires region-specific strategies, including capacity-building, enhanced outreach, and diversified teaching to improve sustainability and productivity in KRI's agriculture.

Key words: Agricultural sustainability; extension services; farmer collaboration; capacity building; outreach strategies; Kurdistan Region of Iraq (KRI).

1. Introduction:

The evaluation of agricultural extension services is crucial for understanding their effectiveness in addressing obstacles, fostering collaborations, and engaging farmers, particularly in the context of the KRI (Ababakr, 2017). The variety of insights into agricultural extension approaches and their impacts on productivity and knowledge dissemination, which can be instrumental for shaping effective policies and practices in the region. In the study by (Akuno et al., 2014), The influence of alternative extension approaches on agricultural productivity. The Farmer Field Schools, On-Farm Research, and Focal Area approaches each play distinct roles in enhancing knowledge and skills among farmers. The multi-tiered political structure and the significance of agriculture in the national economy, with a focus on the government's commitment to strengthening extension services(Osman Moffereh Salm et al., 2016). further contribute to the discourse by examining the development stages of agricultural extension services in Bosnia and Herzegovina. Their work illustrates efforts to improve the capacity of agricultural institutions through targeted training and strategic development documents (Rokvić & Vaško, 2017) . the sustainability of the agricultural extension system in Turkey, highlighting that only 7% of farmers accepted extension suggestions. The traditionalism, insufficient farmer circumstances, and low education levels as significant barriers to adoption (Murat Boyaci, 2010).Building on this foundation,(Lopokoiyit et al., 2013) further explored the competency needs of agricultural extension agents in Kenya, emphasizing the importance of enhancing technical and material capacities. Their findings suggest that such initiatives can serve as a model for the KRI, particularly in fostering collaboration and engaging farmers. Many agents lack vital skills in communication, technology, and stakeholder engagement. Training programs must address these gaps while adapting to the diverse agricultural contexts, especially in KRI(Mbo'o-Tchouawou & E. Colverson, 2014). Well-trained extension agents can greatly enhance farmers' adoption of innovative and sustainable practices, crucial for KRI's economic growth and food security (Lopokoiyit et al., 2013). A systematic capacity-building approach should focus on both technical skills and the broader context of extension services, which is essential for effective farmer engagement and collaboration (Murat Boyaci, 2010). Agricultural extension services, an informal educational system, involve the sharing of information among various organizations and scholars (Landini, 2021). The effectiveness of this educational tool depends on its ability to utilize capacity for delivery, good administration, strong ties with farm management, and the potential and limitations of the extension workers (Maulu et al.2021). Effective farming extension services typically incorporate a teaching approach focused on personal contact, individual guidance, and community meetings, with the goal of improving the technical performance of farming practices (Nyarko & Kozári, 2021; Mapiye et al., 2021). In KRI, agriculture is a significant contributor to the local economy, but the progress of the third largest employment support system in the country has been hindered by various obstacles (Mahmud, 2021). Efforts to address these limitations have focused on fostering cooperation and links with local farm owners (Kalhory et al., 2022; Toptancî, 2024). Agriculture plays a significant role in the Kurdish economy, providing livelihoods for people in rural areas, and technical guidance through extension services is expected to enhance sustainable agricultural practices and productivity for small-scale farmers (Kalhory et al., 2022; Tahir & Harun, 2022). As rural populations decline in the face of socioeconomic shifts, strategies and organizational changes in agricultural extension services have become essential to support rural and agricultural development (Qadir et al.2023). The challenges faced by the farming community in the region, such as social, cultural, and technological stagnation, are also addressed, highlighting the need for a more efficient extension system to benefit both farmers and the local economy (Yass & Mhaibes, 2023). This study

aims to identify the obstacles faced by farmers and explore the changes necessary to complement current policy directions in the agricultural sector (Suleimany & Aziz). Efforts to address the challenges facing agriculture in the Kurdistan Region of Iraq require collaboration among stakeholders (Muramalla & Gurram2021), and this study aims to investigate the potential for cooperation and collaboration among institutions in the region. The research aims to identify challenges in the sector, assess barriers to solutions, and pinpoint areas needing support. It emphasizes the need for customized extension services tailored to community requirements to improve agricultural outcomes in the KRI. The aim is to foster sustainable development goals through stakeholder collaboration. Furthermore, the study explores barriers to effective agricultural extension services and their impact on local engagement, advocating for the use of villages as platforms for technology transfer and knowledge sharing, promoting localized approaches in Kurdistan's agricultural extension.

2. Methodology

To evaluate the impact of agricultural extension services in overcoming barriers and promoting collaboration between research and interaction with farmers in the Kurdistan Region of Iraq, a combined research approach integrating qualitative and quantitative methods has been implemented. A diverse set of data concerning these activities was collected using various data collection techniques (Campbell et al. 2020). Initially, information was gathered from 45 farmers and scholars through surveys and interviews involving 15 participants selected through stratified sampling, comprising both farmers and senior and junior staff. Furthermore, a case study and a focus group discussion were conducted with a cooperative farmer. To ensure the credibility of our findings, three criteria were utilized to enhance the validity of our results.

2.1 Study Design

A cross-sectional design was employed, and data were collected through structured questionnaires, supplemented by interviews and focus group discussions. The study adopted a mixed-methods approach, integrating quantitative and qualitative data collection techniques (Kassem et al.2021). Data were gathered from farmers and extension workers across three provinces: ER, SU, and DU. The Sampling Strategy for the Target Population involved the use of Stratified sampling to achieve proportionate representation across the three provinces. Purposive sampling was then employed within each province to select participants based on their engagement in farming and extension services. In total, 45 respondents took part in the study, comprising 30 farmers (10 from each province) and 15 extension workers (5 from each province). The data was collected using Kobo Toolbox.

2.1.1 Creation of Questionnaire

Utilizing Kobo Toolbox's form builder, presents a well-structured questionnaire designed to collect comprehensive demographic information.The questionnaire effectively segments data collection into distinct sections, targeting critical variables such as age, gender, education level, and relevant experience in farming or extension services. This structured approach is essential for ensuring that the data collected is both relevant and actionable (Gracia, 2010). The questionnaire was divided into sections that gathered information on age, gender, education level, and experience in farming or extension services. It also focused on identifying obstacles such as resource constraints, administrative barriers, and the absence of structured collaboration mechanisms (Himeur et al., 2022). The questionnaire also aimed to assess training sessions, knowledge application, and outreach activities, as well as to evaluate the frequency and quality of interactions between farmers and extension workers (Suryawati et al.2020).

2.1.2 Data Collection Process: The Kobo Toolbox, conducted in-person data collection using tablets and smartphones. Farmers were surveyed at community centers, farms, or during agricultural events, while extension workers were surveyed at extension offices or through pre-arranged visits (Jordan et al.2024). In areas with limited internet connectivity, Kobo Toolbox's offline functionality was utilized, and the collected data were synchronized to the server once connectivity was restored (Ozdemir et al.2024).

2.1.3 Data Analysis: The data exported from Kobo Toolbox in CSV format were subjected to analysis using statistical software such as Excel. Descriptive statistics, including frequencies and percentages, were used to

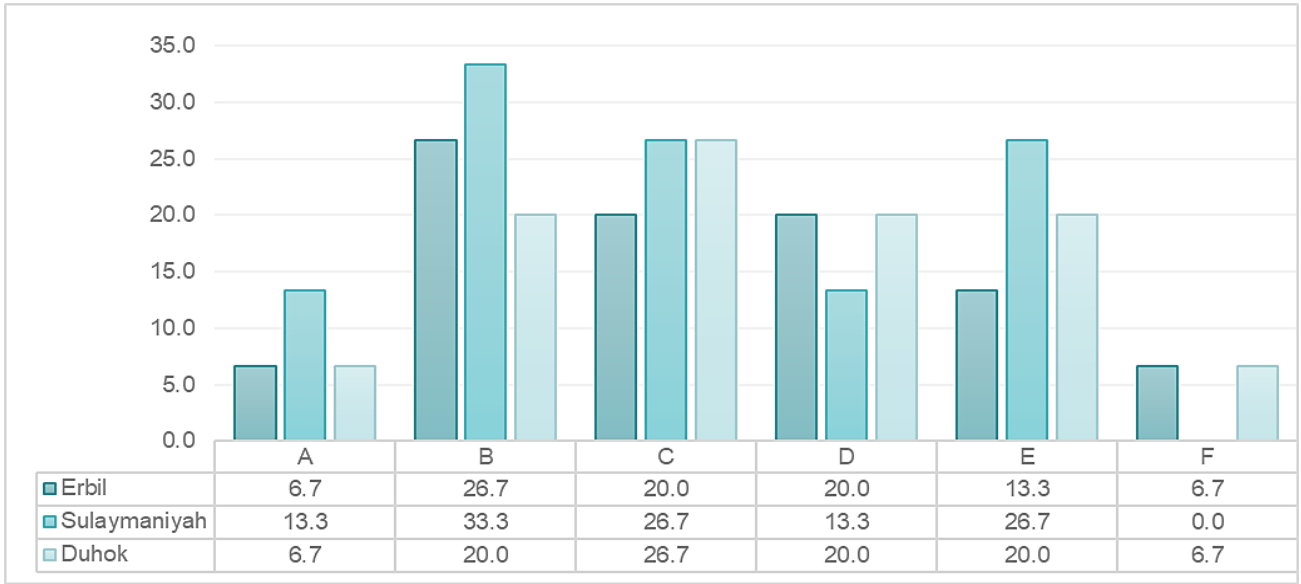
summarize responses, and comparative analysis was conducted across provinces to highlight regional disparities.

3. **Result and Discussion**

3.1 Challenges and Limitations in Connecting Extension and Research

Figure 1 depicts the main obstacles and limitations impacting the partnership between research institutions and extension services in the KRI, specifically in the ER, SU, and DU areas. The provided data and bar chart highlight the challenges and limitations in linking extension and research across three locations: Erbil, SU, and DU. These challenges are categorized into six distinct areas, labeled A to F, each addressing specific aspects of the research-extension relationship. In category A, which pertains to research and extension duties not being complementary, SU experiences the highest challenge, with a reported value of 13.3%. In contrast, both Erbil and DU face equal challenges at a lower rate of 6.7%. This indicates that the lack of complementary duties is perceived more critically in SU compared to the other two regions. Category B, which focuses on the absence of a mechanism to regulate the relationship between research and extension, reveals that SU is the most affected, with a challenge rate of 33.3%. Erbil follows with 26.7%, while DU faces a slightly lesser challenge at 20.0%. These findings suggest that regulatory mechanisms are perceived as a significant gap, particularly in SU. Regarding category C, the need to organize the research-extension relationship is equally challenging for both SU and DU, each reporting a rate of 26.7%. Erbil, however, reports a lower challenge level of 20.0%, indicating that organizational efforts might be slightly better established in Erbil compared to the other regions. Category D addresses administrative processes between research and extension, with Erbil and DU both reporting a challenge level of 20.0%, whereas SU reports a slightly lower value of 13.3%. This suggests that administrative challenges are felt more strongly in ER and DU. In category E, which deals with insufficient physical and financial resources for joint activities, SU once again reports the highest challenge at 26.7%. DU follows at 20.0%, and Erbil experiences the least impact at 13.3%, indicating varying levels of resource constraints across the regions. Finally, category F, which focuses on the lack of incentives to promote collaboration between research and extension, shows that SU faces no reported challenge (0.0%), whereas ER and DU both report minor challenges at 6.7%. This suggests that incentives might be more effectively implemented in SU compared to the other regions.

Overall, the data reveals notable regional differences in the perceived challenges of linking extension and research. Sulaymaniyah appears to face the most significant challenges across multiple categories, particularly regarding regulatory mechanisms and resource constraints. Meanwhile, Erbil and Duhok exhibit similar patterns in several categories, with minor variations.



	A	B	C	D	E	F
Erbil	6.7	26.7	20.0	20.0	13.3	6.7
Sulaymaniyah	13.3	33.3	26.7	13.3	26.7	0.0
Duhok	6.7	20.0	26.7	20.0	20.0	6.7

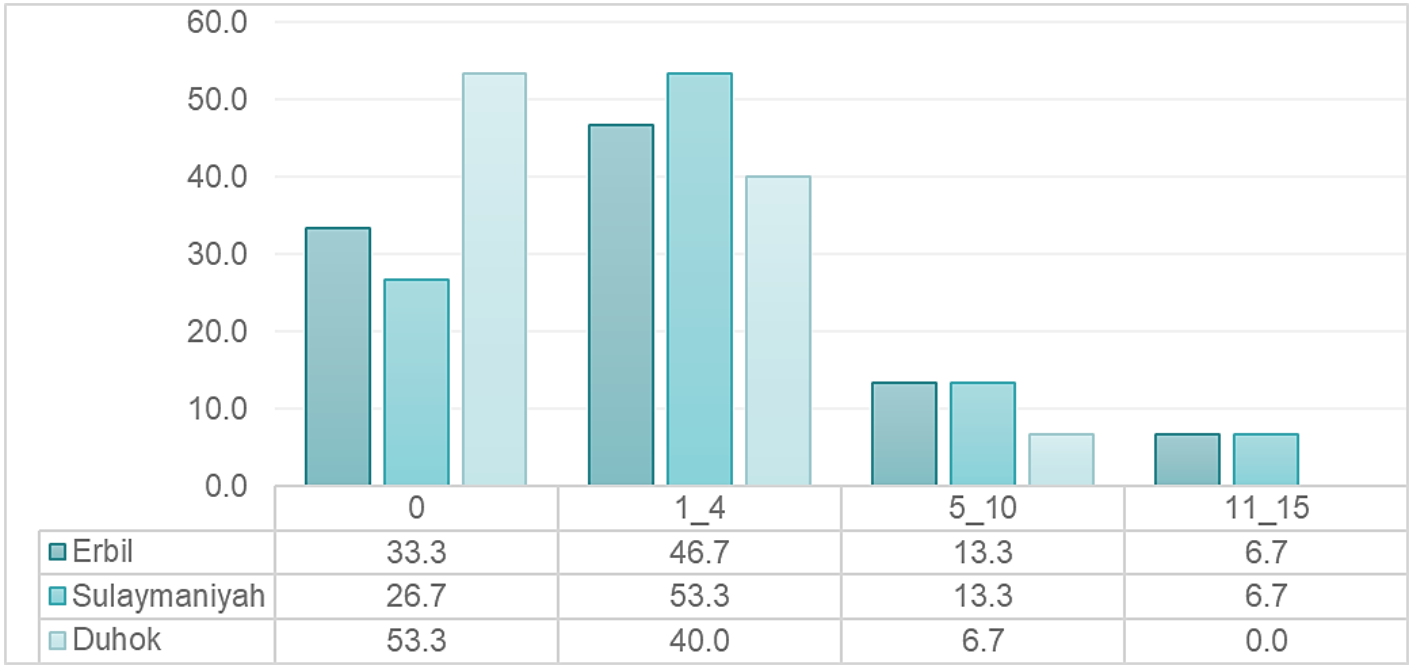
Figure1: Challenges and Limitations in Linking Extension and Research.(A. Research and Extension duties are not complementary., B. Absence of a mechanism to regulate their relationship., C. Need to organize the research-extension relationship., D. Administrative processes between research and extension., E. Insufficient

physical and financial resources for joint activities., and F. Lack of incentives to promote collaboration between research and extension.

3.2 Engaging extension workers as trainers.

The Figure 2 depicts the frequency with which extension workers served as trainers in three regions: ER, SU, and DU. The data is divided into six ranges based on the number of training sessions conducted by extension workers: 0, 1–4, 5–10, 11–15, and >15 sessions. The percentages represent the proportion of extension workers in each category for the respective regions. DU has the largest percentage of extension workers who did not conduct any training sessions (53.3%), followed by ER (33.3%) and SU (26.7%). This indicates a significant number of extension workers, particularly in DU, who did not participate in training activities, potentially indicating gaps in capacity-building initiatives or resource allocation. SU leads in this category with 53.3%, followed by ER (46.7%) and DU (40%). This shows that a majority of extension workers in SU and ER conducted a limited number of training sessions, suggesting a relatively active but low-level involvement in training roles.

This suggests a lack of consistent, intensive training activity, potentially reflecting systemic constraints in extension services. With the highest percentage of extension workers not conducting any training (53.3%), DU demonstrates significant limitations in engaging extension workers as trainers. This could be due to insufficient resources, lack of training programs, or inadequate incentives to encourage participation in training activities. The disparities between regions, particularly the higher inactivity in DU, suggest uneven resource distribution, training opportunities, or management practices. The limited role of extension workers as trainers may hinder the effective dissemination of agricultural knowledge and technologies to farmers, reducing the overall impact of extension services (Murad et al.2022). Inconsistent engagement across regions highlights the need for targeted interventions to standardize training efforts and improve performance (Midhas et al.2021;Mohammedn & Hassan2021). It is essential to develop structured training programs to equip extension workers with the skills and knowledge required to serve as effective trainers. Ensure equitable distribution of resources (financial, material, and human) to support training activities across all regions, with particular attention to DU. Introduce incentives, such as financial rewards, professional recognition, or career development opportunities, to motivate extension workers to participate in training roles. Implement monitoring systems to track the performance of extension workers as trainers and identify areas for improvement (Health Organization, 2021). Facilitate collaboration between regions to share best practices, resources, and strategies for enhancing training efforts (Jinping2022).



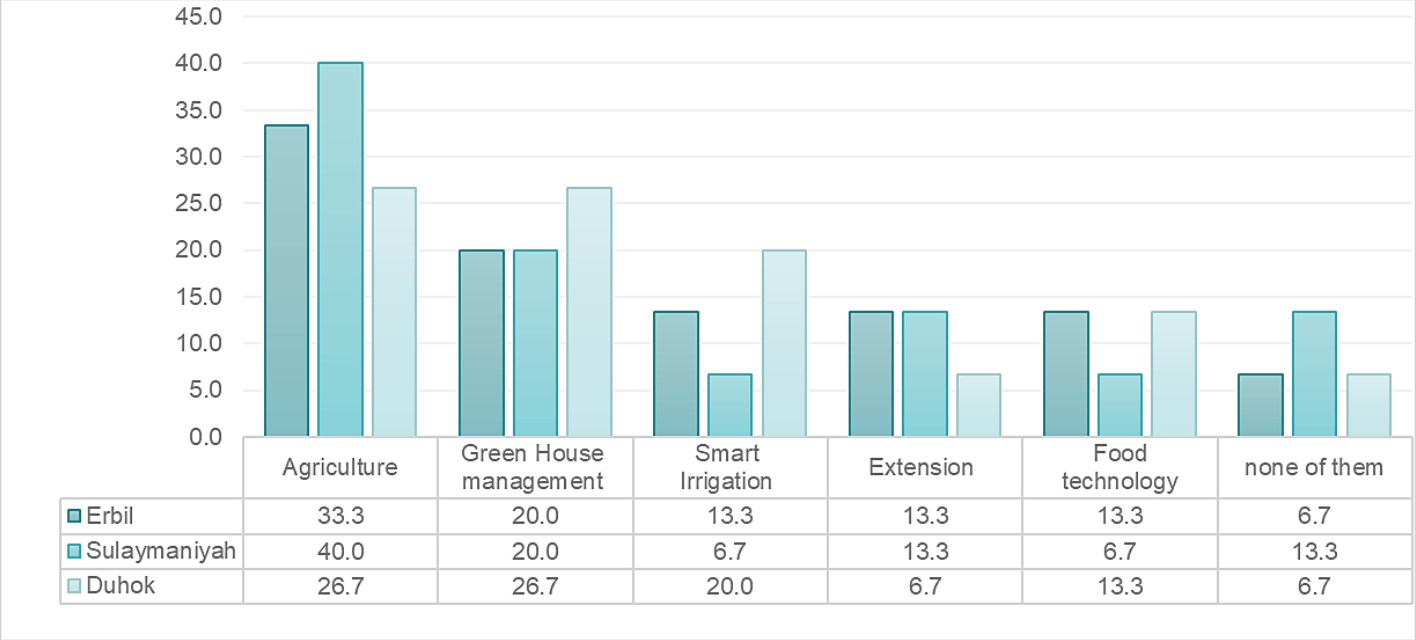
	0	1_4	5_10	11_15
Erbil	33.3	46.7	13.3	6.7
Sulaymaniyah	26.7	53.3	13.3	6.7
Duhok	53.3	40.0	6.7	0.0

Figure2: Engaging in workshops conducted domestically.

3.3 Training subject

The graphical representation depicted in figure 3 showcases the most advantageous training topics, as determined by participants in workshops held across three distinct regions: ER, SU, and DU. These topics encompass Agriculture, Greenhouse Management, Smart Irrigation, Extension, and Food Technology. The percentages displayed indicate the proportion of participants from each region who identified these topics as most beneficial. Among these regions, SU demonstrates the highest percentage (40%) of participants favoring agriculture-focused training. Both DU and SU report 26.7% of participants deeming this topic beneficial, while ER slightly trails at 20%. This signifies an inclination toward modern farming techniques, particularly in DU, potentially in response to limited arable land or climate-related challenges. The prominent preference for agriculture highlights a focus on enhancing traditional farming practices. The lack of enthusiasm for Smart Irrigation may indicate a limited exposure to or awareness of advanced water management systems. Conversely, the strong preference for Smart Irrigation and Greenhouse Management implies a focus on cutting-edge solutions to address environmental challenges like water scarcity and limited arable land.

The across-the-board low interest in Extension services may point to a lack of understanding of their role in bridging research and practical farming applications. The disparities in preferences underscore the necessity for region-specific training programs tailored to local agricultural challenges and priorities (Elahi et al., 2022).. Despite its potential for adding value, food technology only garners moderate interest, indicating untapped opportunities in this area (Ashraf et al., 2020). Tailoring training programs to accommodate these discrepancies and promoting awareness of contemporary methods can notably bolster the efficiency of workshops, leading to enhanced agricultural results in the Kurdistan Region of Iraq (Antwi-Agyei & Stringer, 2021).



	Agriculture	Green House management	Smart Irrigation	Extension	Food technology	none of them
Erbil	33.3	20.0	13.3	13.3	13.3	6.7
Sulaymaniyah	40.0	20.0	6.7	13.3	6.7	13.3
Duhok	26.7	26.7	20.0	6.7	13.3	6.7

Figure3: The most advantageous training topic for participation.

3.4 Implementing modern farming techniques

This figure 4 illustrates the proportion of extension workers serving as trainers in ER, SU, and DU, divided into two categories: "Yes" (those who served as trainers) and "No" (those who did not). The percentages reflect the distribution of extension workers in these roles across the three regions.

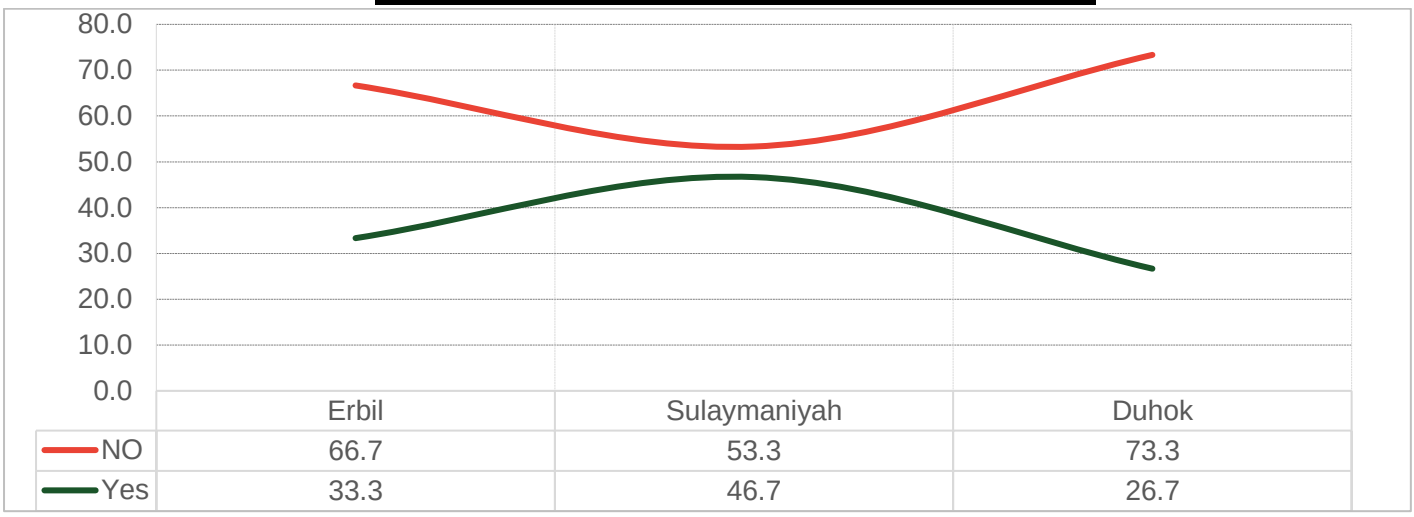


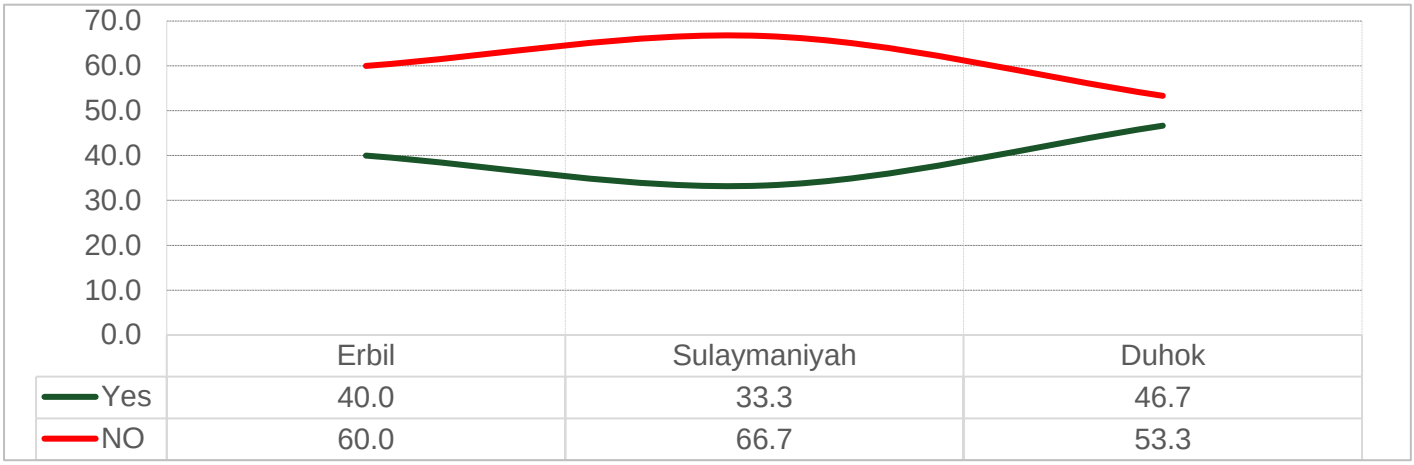
Figure 4: Extension workers functioned as trainers.

The Figure 4 displays the percentage of extension workers that served as trainers in the regions ER, SU, and DU. This is divided into two categories: "Yes" (those who served as trainers) and "No" (those who did not). Implementing modern farming techniquesThe percentages reflect the distribution of extension workers serving in these roles across the three regions. In the ER region, 33.3% of extension workers reported serving as trainers, while 66.7% did not engage in training roles. This indicates potential underutilization of their expertise in training. In the SU region, 46.7% of extension workers served as trainers, the highest among the three regions, with 53.3% not serving as trainers. This suggests relatively better engagement of extension workers in training roles, possibly due to a stronger emphasis on knowledge transfer activities. In the DU province, only 26.7% of extension workers acted as trainers, with 73.3% not engaging in training roles, indicating a significant gap in utilizing extension workers for training purposes in this region. SU leads in utilizing extension workers as trainers, potentially due to better resource allocation, training programs, or administrative support in this region.

Extension workers show a moderate level of engagement, but face challenges in taking on training roles due to limited opportunities or organizational barriers. The region designated as DU has the lowest participation of extension workers as trainers, potentially due to a lack of demand, fewer training programs, or systemic issues. Many extension workers in DU and ER are not serving as trainers, indicating missed opportunities for capacity building and knowledge dissemination. There are differences in participation rates across regions, suggesting inconsistent implementation of training programs. Limited financial, logistical, or administrative support may be hindering the ability of extension workers to serve as trainers. This low engagement may negatively impact knowledge transfer to farmers, affecting agricultural productivity and innovation adoption. On the other hand, SU's higher engagement points to the potential benefits of well-structured training systems and serves as a potential model for improving participation in other regions. It is recommended to develop region-specific training programs, provide necessary training and resources, and allocate sufficient resources to support extension workers in training roles, especially in DU and ER. Collaboration between government, NGOs, and international organizations is encouraged to design and implement comprehensive training programs, and mechanisms to monitor participation and evaluate impact should be established. Figure 4 highlights significant disparities in the utilization of extension workers as trainers, with SU showing higher engagement while ER and DU require targeted interventions. Addressing these gaps can enhance knowledge dissemination and capacity building, contributing to agricultural development and sustainability. Collaboration is essential for agricultural research and development, and creating effective partnerships with various stakeholders can lead to the sharing of resources, knowledge, best practices, and expertise. Although achieving effective collaboration can be challenging, it offers many rewards and benefits in agricultural extension work. (Morandini et al.2023)

More power in collaboration adds quality to connectedness, reinforcing one's capacity to achieve shared goals through partnership and share resources as a more inclusive and distributed process (Mohammed & Hassan 2021). An operation or endeavor that gives all stakeholders a chance to have their say and influence ensures

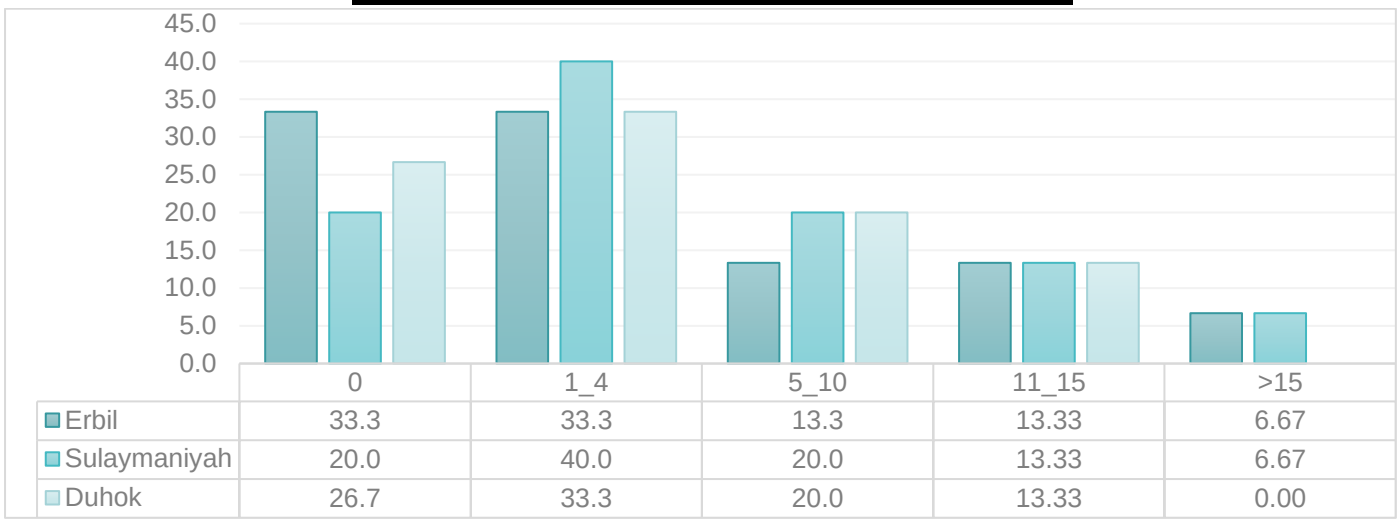
that no one who governs or makes the final decisions finds fault or takes credit for the blowback or outcomes (Burhan et al.2021).



	Erbil	Sulaymaniyah	Duhok
Yes	40.0	33.3	46.7
NO	60.0	66.7	53.3

Figure5 : Extension workers who have implemented the learning from their trainings in their daily activities.
The figure 5 represents the proportion of extension workers across ER, SU, and DU who have applied the learning from their training programs to their daily work activities. More power in collaboration adds quality to connectedness, reinforcing one's capacity to achieve shared goals through partnership and share resources as a more inclusive and distributed process (Mohammed & Hassan 2021). One of the truest benefits of collaborative partnerships lies in the future, namely increased political capacity of an organization to obtain all available resources and have a seat at the table. In fact, this creates the value of relationships for decision-making politics, which has a better chance of yielding results in the future. An operation or endeavor that gives all stakeholders a chance to have their say and influence ensures that no one who governs or makes the final decisions finds fault or takes credit for the blowback or outcomes (Burhan et al.2021). The 40% of extension workers have reported that they have put the skills and knowledge gained from their training programs into practice. However, 60% have not incorporated their training into their daily work. This suggests that a significant number of extension workers have not been able to apply their training to practical situations, indicating challenges in using the knowledge they have gained. Only 33.3% of extension workers have been able to apply their training in their daily activities, while a majority (66.7%) have not utilized their training in practice, showing a limited integration of knowledge into routine tasks. Implementation disparities suggest issues with training relevance and follow-up mechanisms. Low implementation rates hinder knowledge transfer and limit agricultural productivity. To improve training initiatives for extension workers, align programs with their needs, include practical components, provide resources and mentorship, establish support networks, address systemic challenges, monitor and assess application of training, and promote a culture that values implementation. (Hussein & Nori, Berzinji, 2020, Ahmed et al., Hassan, 2024). Figure 5 data shows disparities in training application by extension workers across regions. DU performs better, while SU faces significant obstacles. Customized training, support systems, and institutional dedication are needed to close the education-practical use gap. Improved training implementation will enhance extension services and agricultural productivity in Kurdistan. (Sulaiman, 2021).

Figure 6 displays the frequency of visits made by extension workers to farmers in the ER, SU, and DU regions. In the ER province, 33.3% reported no visits, while another 33.3% visited 1-4 times. Visits in the 5-10, 11-15, and >15 intervals occurred less frequently. In the SU province, only 20% reported no visits, with the majority having 1-4 visits. Higher visit frequencies dropped significantly. In the DU province, 26.7% reported no visits, and 33.3% fell within the 1-4 visits range. Visits in the 5–10 range consistent with other regions (20%), but none reported visiting more than 15 times, highlighting minimal frequent interactions. High percentage of workers in ER (33.3%) & DU (26.7%) reported no visits, highlighting gap in farmer outreach. Administrative constraints, workload imbalances, or inefficiencies may limit ability to interact. Most common range is 1–4 visits, with SU having highest percentage (40%). Efforts made for outreach, but low frequency suggests limited capacity for support or follow-up. Smaller percentage engage in moderate (5–10 visits) or high-frequency visits (11+ visits), with SU highest in 5–10 visits (20%). Visits >15 category almost nonexistent across regions, suggesting rare intensive engagement.

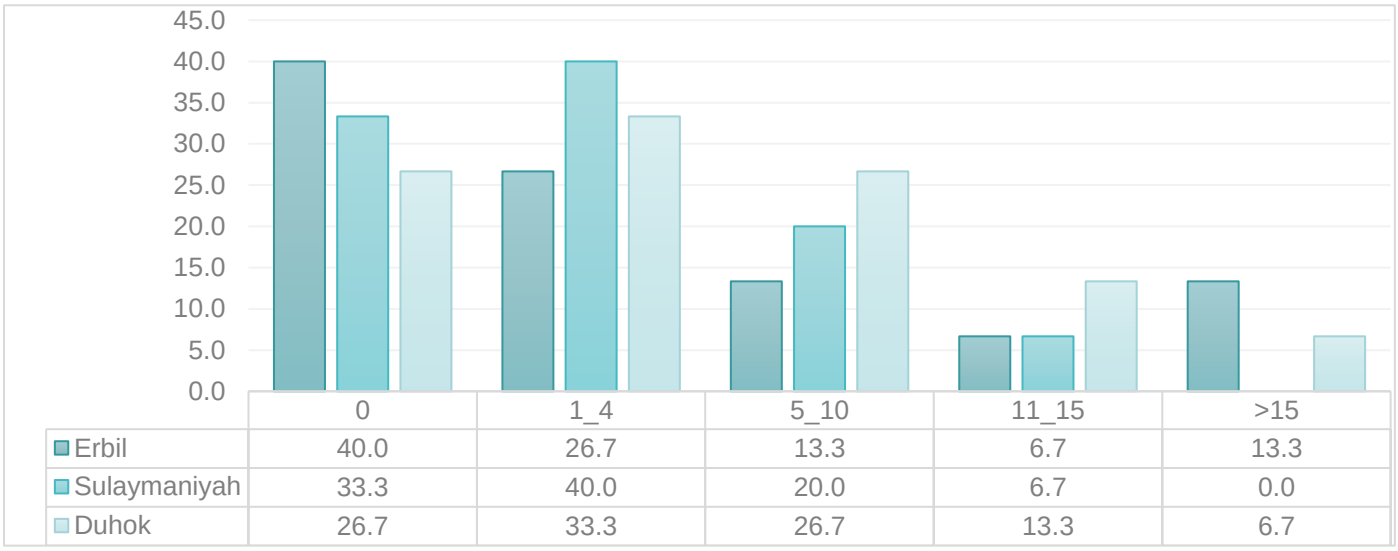


	0	1_4	5_10	11_15	>15
Erbil	33.3	33.3	13.3	13.33	6.67
Sulaymaniyah	20.0	40.0	20.0	13.33	6.67
Duhok	26.7	33.3	20.0	13.33	0.00

Figure 6: Visiting farmers by the extension workers

Limited communication hinders knowledge sharing between extension workers and farmers. Lack of visits undermines the impact of extension services, with challenges like transportation and understaffing hindering outreach. Providing tools and transportation enables more visits and setting targets ensures accountability.

The data presented in figure 7 displays the frequency with which farmers have sought the advice of agricultural advisors in the ER, SU, and DU governorates over the course of the past year. The information is broken down into six distinct frequency categories: 0 visits, 1–4 visits, 5–10 visits, 11–15 visits, and >15 visits. In ER Province, 40% of farmers did not visit agricultural advisors at all, which represents the highest percentage among the three governorates. Additionally, 26.7% of farmers visited 1–4 times, 13.3% visited 5–10 times, 6.7% visited 11–15 times, and 13.3% reported visits exceeding 15 times. This distribution indicates limited engagement between farmers and advisors, with a significant portion of farmers reporting no interaction at all. In SU Province, 33.3% of farmers did not visit agricultural advisors, slightly better than ER but still a significant percentage. The highest proportion (40%) falls within the 1–4 visits range, indicating more frequent interaction compared to ER. Additionally, 20% of farmers reported moderate engagement (5–10 visits), and 6.7% visited 11–15 times, with no farmers reporting visits exceeding 15 times. In DU Province, 26.7% of farmers did not visit agricultural advisors, representing the lowest percentage across the three regions. Furthermore, 33.3% of farmers visited 1–4 times, with 26.7% reporting 5–10 visits, the highest in this range among the regions. Additionally, 13.3% of farmers visited in the 11–15 range, while 6.7% had over 15 visits. This data illustrates that DU shows better engagement compared to the other regions, with fewer farmers in the 0 visits category and higher percentages in the moderate and frequent visit ranges. The high percentage of farmers who did not visit agricultural advisors in ER (40%) and SU (33.3%) is an area of concern, possibly indicating a lack of awareness about the availability or role of agricultural advisors among farmers.



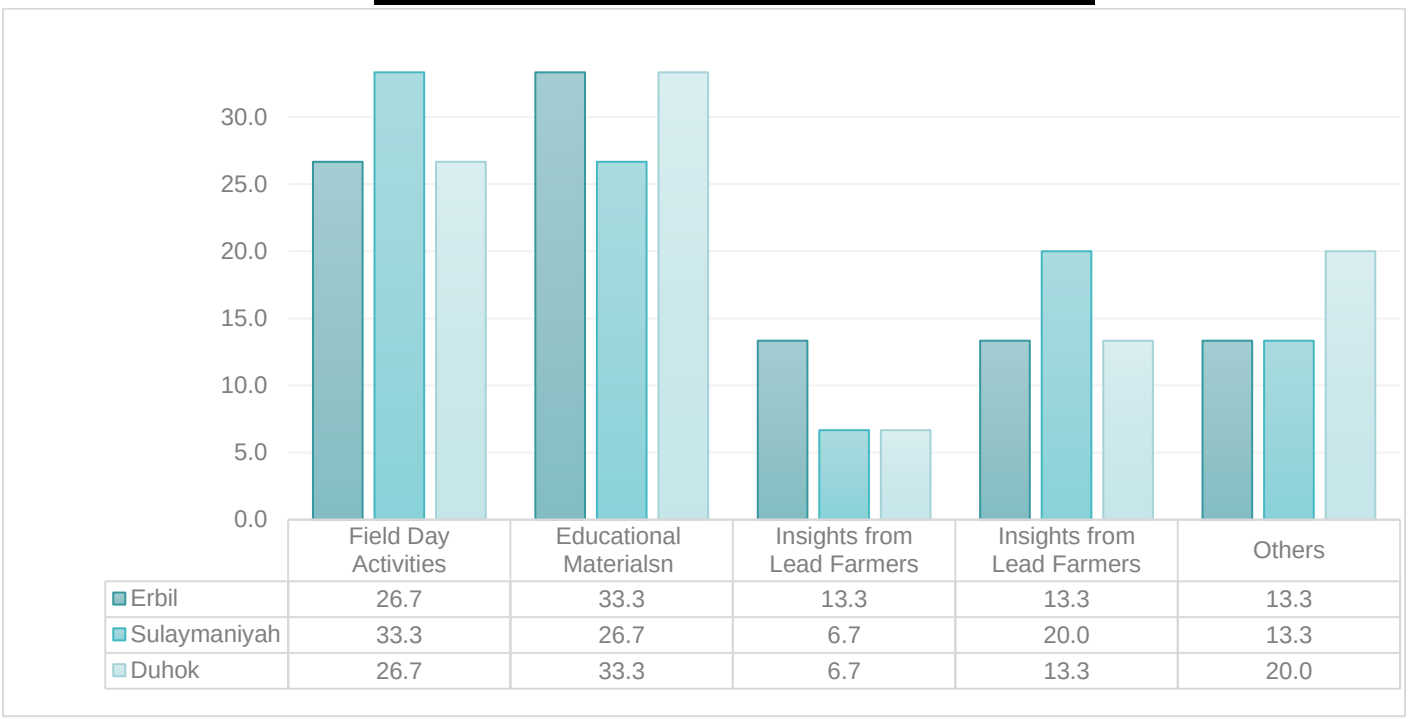
	0	1_4	5_10	11_15	>15
Erbil	40.0	26.7	13.3	6.7	13.3
Sulaymaniyah	33.3	40.0	20.0	6.7	0.0
Duhok	26.7	33.3	26.7	13.3	6.7

Figure7: The visits from farmers to agricultural counselors in three governorates (ER, SU, DU) last year.

Geographical distance, inadequate infrastructure, or limited transportation options may impede farmers from seeking advice from advisors. Farmers may perceive the advice as irrelevant and rely on traditional knowledge instead. DU displays a more even distribution, with fewer farmers reporting no visits and more farmers engaging in moderate or high-frequency visits, possibly due to better infrastructure, proactive advisory services, or stronger relationships between farmers and advisors. The prevalence of the 1-4 visits category suggests that although some farmers are engaged, the interaction is not consistent or frequent enough to drive significant change. Farmers who do not visit advisors miss out on opportunities to learn about modern agricultural practices, access new technologies, and receive guidance on improving productivity. Customized approaches are needed to tackle difficulties in different regions. Increase farmer awareness through workshops, local media, and community gatherings. Establish satellite advisory centers or mobile services for remote farmers (Layeeq et al. 2023). Encourage visits to farmers who haven't been contacted. Address obstacles in ER to reduce farmers not visited. Increase engagement in SU. This figure shows disparities in farmer engagement with advisors in Kurdistan. Addressing barriers and fostering relationships can support sustainable agricultural development in the region. (Abdulrahman et al. 2020).

3.5 Training sessions for agricultural workers

The Figure 8 illustrates the inclinations for educating farmers on research findings and agricultural information in the ER, SU, and DU regions through five different methods: Field Day Activities, Educational Materials, Insights from Lead Farmers (categorized into two), and Others. ER and DU both share a preference rate of 26.7% for field day activities, with SU slightly ahead at 33.3%. This indicates the consistent value given to this method across all three regions, underlining its efficacy in providing practical demonstrations and hands-on learning experiences. Field day activities offer firsthand exposure to research findings and agricultural methods, increasing trust and confidence through direct engagement and witnessing technique implementation. Lead farmers are trusted and credible sources of information due to their local knowledge and practical experience. SU's increased preference within the second category may suggest robust networks of key farmers exchanging knowledge and influencing agricultural practices. SU relies on various methods, with a focus on learning from lead farmers. ER and DU show similar trends, with field day activities and educational resources being significant. Recommend using field day activities, educational resources, and peer learning for thorough knowledge dissemination. Enhance the role of lead farmers by providing additional training and support to serve as knowledge intermediaries (Khidhir, 2024; Alawadi2024; Darweesh et al.2024). The Figure 8 is indicative of the choices made for the dissemination of agricultural research findings and information to farmers in three regions: ER, SU and DU. These options encompass Printed Materials, Videos/Animations, Digital Tools, Interactive Materials, and Other. SU displays the greatest preference for printed materials (33.3%), whereas ER and DU exhibit significantly lower levels (13.3% each). This indicates a higher value for printed materials in SU due to accessibility and potential use as reference materials, but less impact in the other regions perhaps due to literacy or distribution challenges. ER shows the highest preference for videos/animations (40%), followed by DU (33.3%) and SU (26.7%). This suggests that visual and engaging formats are particularly effective in ER and DU, where farmers may prefer dynamic, easy-to-understand content over static resources. DU leads in the preference for digital tools (33.3%), followed by ER (26.7%) and SU (20%).

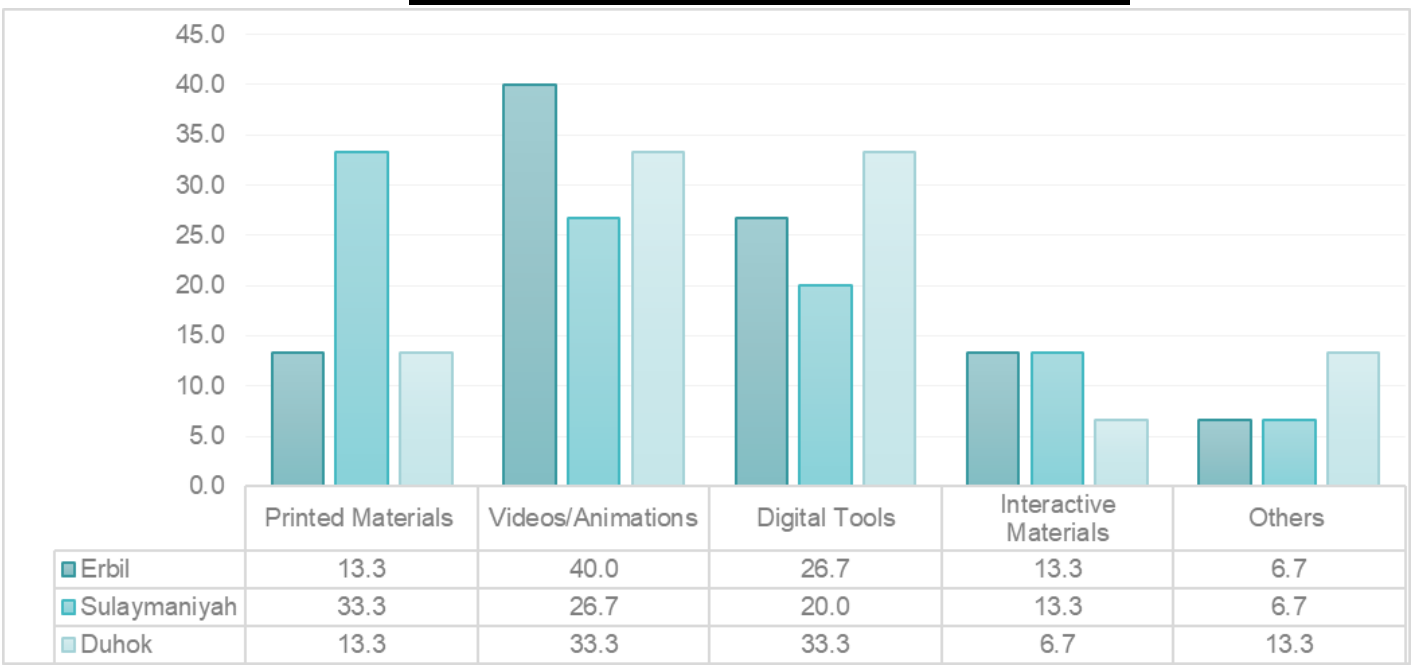


	Field Day Activities	Educational Materialsn	Insights from Lead Farmers	Insights from Lead Farmers	Others
Erbil	26.7	33.3	13.3	13.3	13.3
Sulaymaniyah	33.3	26.7	6.7	20.0	13.3
Duhok	26.7	33.3	6.7	13.3	20.0

Figure 8: Most effective method for educating farmers about agriculture findings and information.

Figure 9 illustrates the choices for a variety of resources utilized in dispensing agricultural information to farmers in the regions of ER, SU, and DU. The options consist of Print materials, Videos/Animations, Digital Tools, Interactive Materials, and Others. SU exhibits the greatest preference for printed materials (33.3%), while ER and DU have notably lower preferences (13.3% each). Printed materials appear to be highly valued in SU, potentially due to their accessibility and function as a dependable reference for farmers who may lack access to digital technologies. ER demonstrates the highest preference for videos/animations (40%), followed by DU (33.3%) and SU (26.7%). This indicates that visually engaging content is highly effective in ER, where farmers may rely on dynamic, easy-to-understand resources. In terms of digital tools, DU shows the highest preference (33.3%), followed by ER (26.7%) and SU (20%). The preference in DU may reflect a more robust digital infrastructure or an increasing technology adoption among farmers. Preferences for interactive materials are relatively low in all regions, with ER and SU at 13.3%, and DU at 6.7%. This suggests limited awareness or access to interactive resources such as workshops, hands-on training, or group discussions. DU has the highest percentage in the "Others" category (13.3%), compared to SU and ER (6.7% each). This suggests there may be specific or unconventional methods specific to the region not classified among the primary options.

Ongoing or new Meetings and Seminars bring individuals together to exchange ideas and develop concepts. Collaborative Ventures explore potential partnerships, while Alliances establish connections within the Linkage system to offer support and promote partnerships. Strengthening capabilities improves stakeholders' effectiveness in these partnerships (Antwi-Agyei & Stringer, 2021). Norton & Alwang (2020) found that obstacles hinder collaboration between stakeholders in agricultural extension services. They have identified potential solutions and highlighted key themes and concerns for further discussion. Challenges to collaboration include lack of recognition of staff and providers' abilities, skills, and roles, professionals' reluctance to share authority or adapt to user needs, as well as issues of equity, negotiation methods, risk assessment in advisor/client relationships, and formalizing agreements and organizational structures. Fieldsend et al. (2021) provide recommendations for addressing challenges such as institutional culture, policy, and regulatory environments that connect organizations in the research report's research recommendations section. Connection and delivery services can improve agricultural practices in rural areas by disseminating information and technology to farmers. Extension services use various methods, including ICT, to establish management guidelines and transfer knowledge.



	Printed Materials	Videos/Animations	Digital Tools	Interactive Materials	Others
Erbil	13.3	40.0	26.7	13.3	6.7
Sulaymaniyah	33.3	26.7	20.0	13.3	6.7
Duhok	13.3	33.3	33.3	6.7	13.3

Figure9: Resources for providing farming knowledge to agricultural workers.

3.6 The result of the Chi-Square analysis.

Notable disparities in Interaction Frequency, Collaboration Efforts, and Training Preferences were indicated by high Chi-Square statistics. Green bars in the charts depicted regional differences. Resource Utilization and Information Sharing had lower Chi-Square values, shown by gray bars. Categories with p-values below 0.05, such as Interaction Frequency, Collaboration Efforts, and Training Preferences, were deemed statistically significant. Resource Utilization and Information Sharing had p-values above 0.05, indicating no significant differences. These findings point to systemic inefficiencies across all regions in non-significant categories. The Chi-Square analysis used a significance threshold of $p=0.05$. A result with $p<0.05$ is deemed significant, indicating that the observed differences are unlikely due to chance. Conversely, a result with $p\geq0.05$ is not significant, suggesting that the observed differences may have occurred randomly. The significant results from this analysis affirm the necessity for targeted interventions in the highlighted categories.

Table 1, Figure 10, and Figure 11 show a Chi-Square statistic of 23.33 with a p-value of 0.0001, indicating a significant result. The frequency of interactions between researchers and extension workers varies significantly across different regions. SU has the highest percentage (53.3%) of participants reporting 1–5 interactions annually, showing a high level of engagement. On the other hand, EU (60%) and DU (66.7%) primarily reported one-time interactions, indicating weaker engagement systems. Establishing regular interactions is crucial for knowledge transfer and effective program implementation. Therefore, efforts in ER and DU should be focused on promoting more frequent interactions through structured engagement programs, scheduled meetings, or incentives for collaboration. The chi-square statistic is 17.91, with a p-value of 0.0013, indicating statistical significance. There are notable variations in collaborative efforts across different regions. Notably, SU stands out with the highest frequency of collaborations (6–10 times annually), suggesting a more effective partnership approach. Conversely, Erbil has the highest percentage (73.3%) of participants reporting no collaboration, indicating significant obstacles to forming partnerships. Collaboration is crucial for tailoring research to local agricultural conditions. To address the disparities, it is imperative to strengthen institutional frameworks, adopt successful practices from SU, and implement incentives to encourage collaboration in Erbil and DU.

The Chi-Square Statistic was calculated to be 12.67, with a corresponding p-value of 0.027, indicating significance. There was a notable variance in training preferences among participants from different regions. SU showed the highest preference for agriculture-focused training at 40%, reflecting its strong engagement in agricultural activities. Conversely, DU exhibited the lowest preference at 26.7%, potentially due to distinct regional priorities or challenges. Topics such as smart irrigation and food technology garnered minimal interest across all regions, highlighting a gap in awareness or perceived relevance. Tailored training programs for each region are crucial in effectively addressing local needs.

Table1: The outcomes of the Chi-Square statistical test.

Category	Chi-Square Statistic	p-value	Degrees of Freedom
Interaction Frequency	23.33	0.0001	4
Collaboration Efforts	17.91	0.0013	4
Resource Utilization	4.75	0.314	4
Information Sharing	3.98	0.409	4

For instance, offering smart irrigation training in DU, given its water scarcity issues, and greenhouse management training in SU, can effectively tackle pressing challenges while capitalizing on regional strengths. Conversely, the Chi-Square Statistic for non-utilization rates yielded a value of 4.75, with a p-value of 0.314, indicating non-significance. Non-utilization rates were uniformly high across all regions, with DU recording the highest rate at 66.7%. This lack of significant differences suggests systemic challenges in access and awareness. Lastly, the Chi-Square Statistic for communication gaps produced a value of 3.98, with a p-value of 0.409, also indicating non-significance. There were persistent communication gaps across all regions, with SU showing marginally better engagement in monthly communication at 46.7%. However, none of the regions demonstrated frequent communication practices.

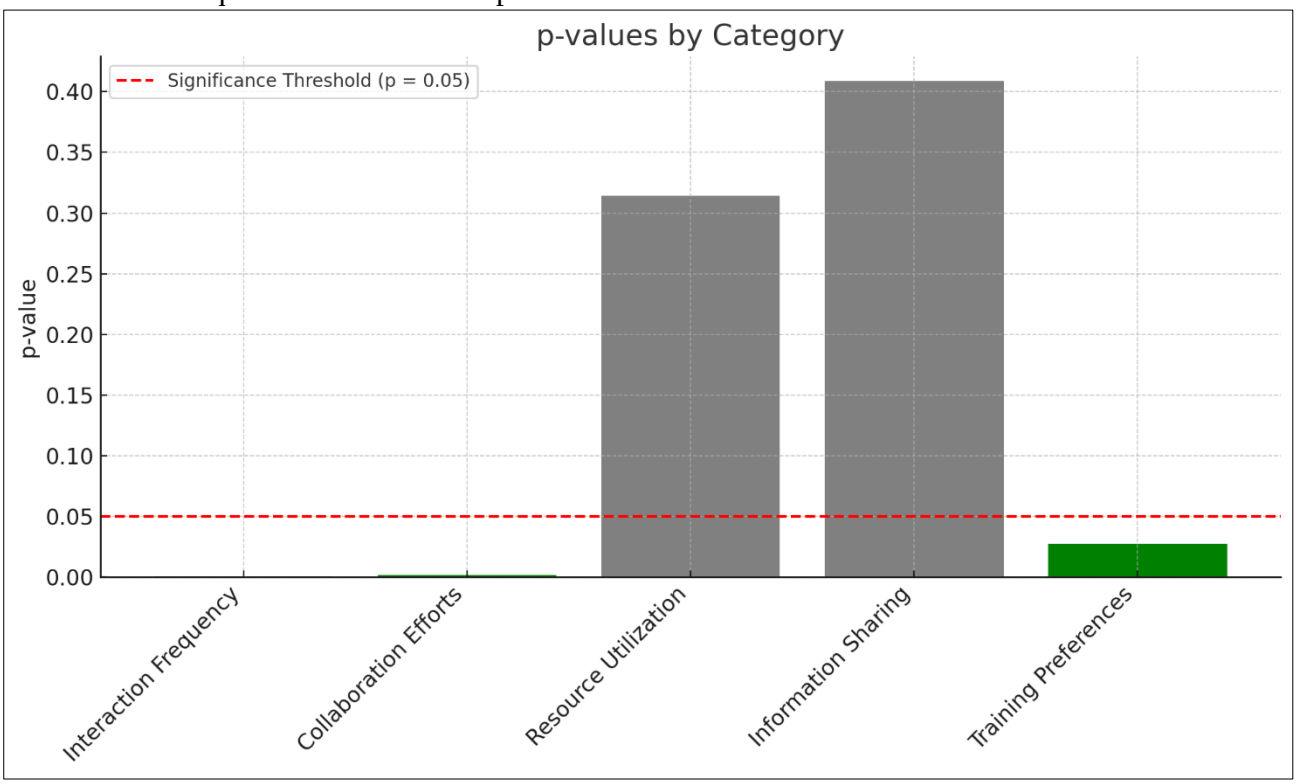


Figure 10 The results of the Chi-Square Test, specifically the p-values for each category.

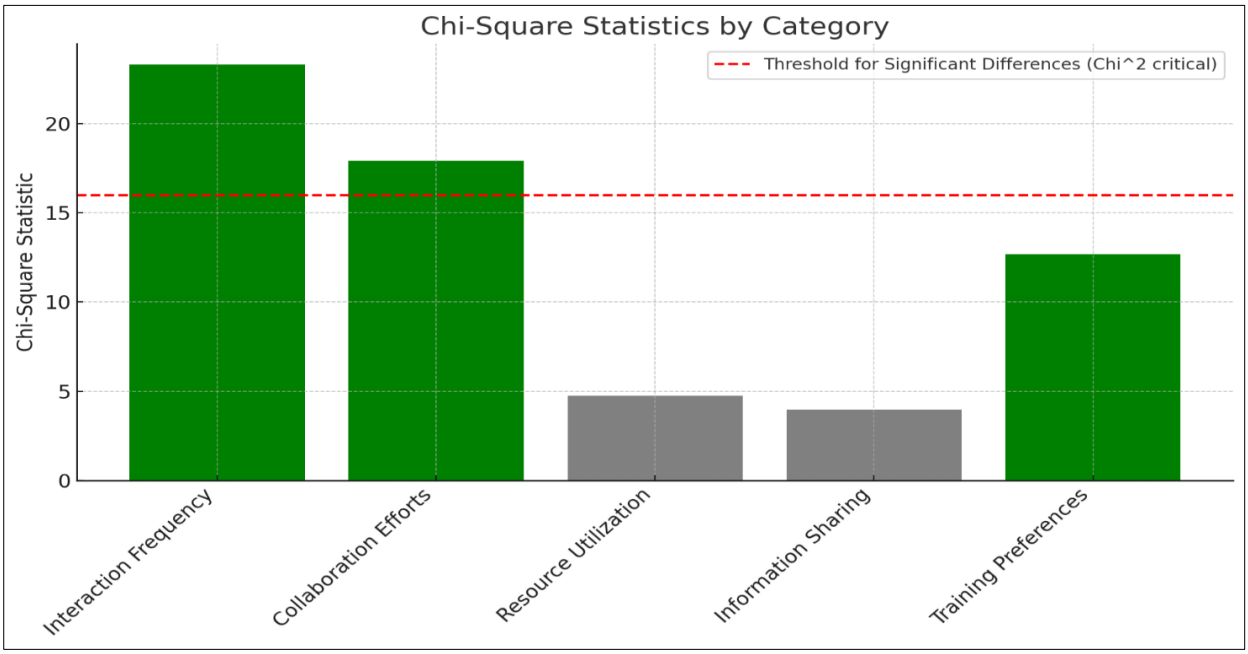


Figure 11 Displays the Chi-Square statistics organized by category.

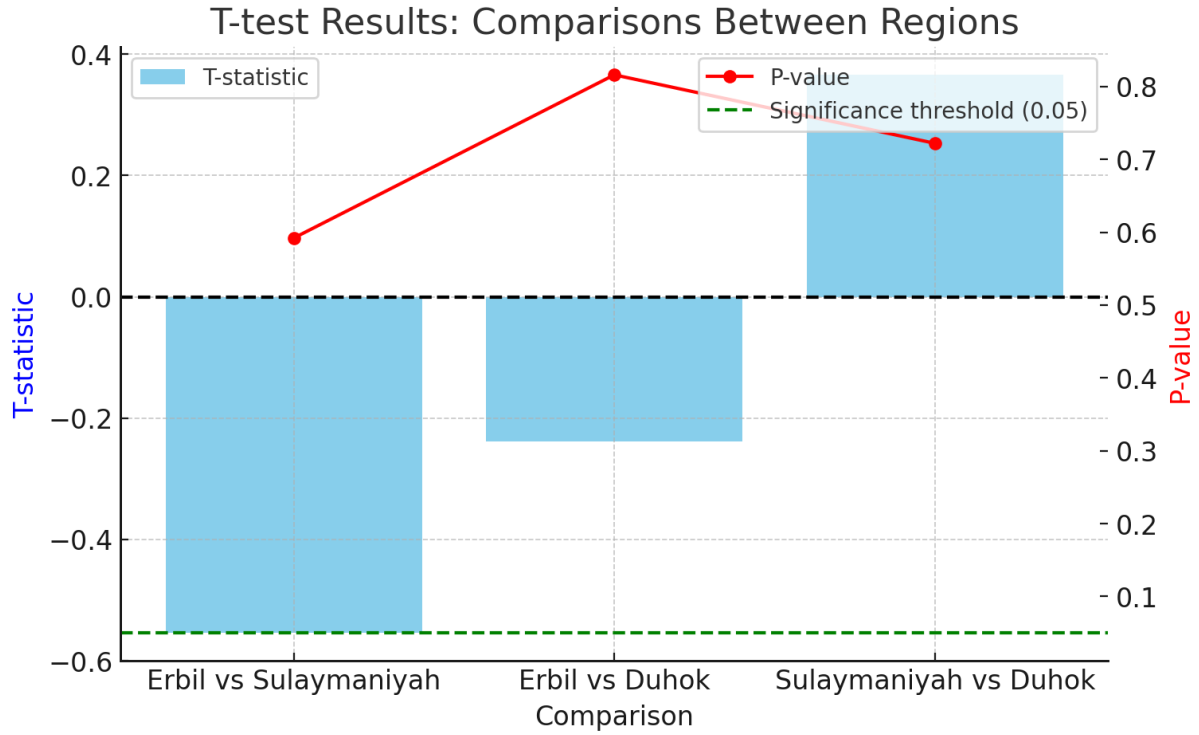


Figure 12 T-Test Results (Pairwise comparisons) of Challenges and Limitations in Linking Extension and Research.

Figure 12 illustrates the Chi-square test conducted on two datasets to evaluate the differences between observed and expected frequencies. In the first dataset, with categories A to F, T-tests were used to compare mean responses among three groups: Erbil, Sulaymaniyah, and Duhok. The t-test for Erbil versus Sulaymaniyah showed a t-statistic of -0.554 and a p-value of 0.592, indicating no significant difference. The comparison of Erbil and Duhok produced a t-statistic of -0.238 and a p-value of 0.816, also suggesting no significant difference. Finally, the comparison between Sulaymaniyah and Duhok resulted in a t-statistic of 0.366 and a p-value of 0.722, further confirming no statistically significant difference among

these regions. In all comparisons, the p-values indicate that any observed variations in responses are likely due to random chance rather than systematic differences.

4. Conclusion and Recommendations

This study focused on Iraqi policymakers determining the role of agricultural extension in the KRI. International and local research studies supported these findings. Involvement of local leaders and staff, along with face-to-face interviews, can provide valuable data. Addressing limitations of the official system is essential to improve services for farming families.

This can be achieved by institutionalizing mechanisms that enable stakeholders to work more effectively, collaborate better, and increase families' engagement with official extension services (Abdullah & Haji, 2020). The empirical study verified the initial findings and confirmed five hypotheses regarding engagement with farmers through official agricultural extension and cooperative relationships. The study provides both practical and theoretical contributions, recommending future peer reviews for an extension of farmers' values and farm orientations as an explanatory variable (Kalhory et al., 2022; Mahmud, 2021). The research identified a significant need and willingness for network agents to collaborate with limited resources, but also recommends revisiting the situation in the future to evaluate and adapt these potentialities under different external impacts on the Kurdistan Region and Iraq in general (Toptancî, 2024; Tahir & Harun, 2022). Future evaluations should consider broader meaningful engagements and prioritize their institutionalization as significant actions in reviewing them under future studies when significant links are prioritized and institutionalized in agricultural production development plans (Hadfield, 2020; Yass & Mhaibes, 2023).

The research findings offer fresh evidence on the factors that have a significant impact on collaboration among multiple stakeholders, while also providing new insights and conducting a detailed analysis of the dynamics at play. It highlights the crucial connection mechanisms essential to extension services that assist farmers in engaging with research, markets, and resources. The findings outline successful strategies and challenges in collaboration, and propose new recommendations for developing strategies to support collaboration. The research takes a systems approach, suggesting that various actors, including extension services, should collaborate to create an environment for agricultural economic growth and poverty reduction. The specific nature of the agricultural sector necessitates a comprehensive assessment framework, with the initiator of the initiative being the main driver for necessary change. The inclusive approach also facilitates the engagement of a wide range of stakeholders, enabling them to better understand its significance and how to leverage results for advancing discussions. Stakeholder engagement played a crucial role in shaping and prioritizing the response to the study, ensuring the delivery of focused empirical work. In conclusion, a summary of the research findings is presented, along with guiding questions relevant at both local and national policy levels, to guide possible actions for progress. While these are general guidelines, the system should remain adaptable, and a more detailed and context-specific case study would be necessary to further examine this policy.

References:

1. Ababakr, S.H., The agricultural extension role of rural women participation in agricultural development in Erbil province of Iraq.This thesis submitted in candidature for the degree of master of science At the Department of Bioengineering and Sciences. KAHRAMANMARAŞ -TURKEY 2017.
2. Abdullah, A. A. & Hameed, T. S., 2024. Extension Tasks for Agricultural Employees in the Field of Combating Desertification in Nineveh Governorate. Pakistan Journal of Life & Social Sciences.
3. Abdullah, B.J., 2023. 8. The obstacles that persons with disabilities face in working contexts in DU Governorate. From Challenges to Opportunities: Outcomes of the research project “Counselling in the Field of Disability”, p.137.
4. Abdullah, S. & Gray, T., 2022. Political constraints on economic diversification in the Kurdistan Region of Iraq. Energy Policy.

5. Abdulrahman, Y., Kholodenko, A. and Ivantsova, E., 2020. Natural, historical and cultural recreational resources as the basis of the ecological tourism development in the Iraqi Kurdistan ER region. International Multidisciplinary Scientific GeoConference: SGEM, 20(5.1), pp.583-590.
6. Abdulrahman, Y., Kholodenko, A. and Ivantsova, E., 2020. Natural, historical and cultural recreational resources as the basis of the ecological tourism development in the Iraqi Kurdistan ER region. International Multidisciplinary Scientific GeoConference: SGEM, 20(5.1), pp.583-590.
7. ALI, P. A., 2021. Energy reduction through architectural passive designs in SU, Northern Iraq: Building's material assessment.
8. Antwi-Agyei, P. & Stringer, L. C., 2021. Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. Climate Risk Management.
9. Antwi-Agyei, P. & Stringer, L. C., 2021. Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. Climate Risk Management. sciencedirect.com
10. Antwi-Agyei, P. & Stringer, L. C., 2021. Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. Climate Risk Management.
11. Ashraf, E., Sarwar, A., Junaid, M., Baig, M.B., Shurjeel, H.K. and Barrick, R.K., 2020. An Assessment of In-service Training Needs for Agricultural Extension Field Staff in the Scenario of Climate Change using Borich Needs Assessment Model. Sarhad Journal of Agriculture, 36(2). researchgate.net
12. Burhan Ismael, N., Jabbar Othman, B., Gardi, B., Abdalla Hamza, P., Sorguli, S., Mahmood Aziz, H., Ali Ahmed, S., Sabir, B.Y., Ali, B.J. and Anwar, G., 2021. The role of training and development on organizational effectiveness. Ismael, NB, Othman, BJ, Gardi, B., Hamza, PA, Sorguli, S., Aziz, HM, Ahmed, SA, Sabir, BY, Ali, BJ, Anwar, G.(2021). The Role of Training and Development on Organizational effectiveness. International Journal of Engineering, Business and Management, 5(3), pp.15-24.
13. Campbell, S., Greenwood, M., Prior, S., Shearer, T., Walkem, K., Young, S., Bywaters, D. and Walker, K., 2020. Purposive sampling: complex or simple? Research case examples. Journal of research in Nursing, 25(8), pp.652-661.
14. Elahi, E., Khalid, Z., & Zhang, Z., 2022. Understanding farmers' intention and willingness to install renewable energy technology: A solution to reduce the environmental emissions of agriculture. Applied Energy. [HTML]
15. Fieldsend, A.F., Cronin, E., Varga, E., Biró, S. and Rogge, E., 2021. 'Sharing the space'in the agricultural knowledge and innovation system: multi-actor innovation partnerships with farmers and foresters in Europe. The Journal of Agricultural Education and Extension, 27(4), pp.423-442.
16. Gracia, S., 2010. Characteristics and Predictors Associated with Teacher and Faculty Use of Online Data Collection in Teacher Preparation Settings.
17. Hadfield, C., 2020. Research economic development of Kurdistan region through the telescope of diversification oil. Tennessee Research International of Social Sciences.
18. Health Organization, W., 2021. … for an equitable and resilient recovery towards the health-related sustainable development goals: 2021 progress report on the global action plan for healthy
19. Himeur, Y., Rimal, B., Tiwary, A., & Amira, A., 2022. Using artificial intelligence and data fusion for environmental monitoring: A review and future perspectives. Information Fusion.
20. Hussein, J. M. A. & Nori, A. J., . Examining the Significance of Civil Society in Augmenting and Empowering Youth within the Context of Iraqi Kurdistan. irep.iium.edu.my.
21. Jinping, X., 2022, October. Hold high the great banner of socialism with Chinese characteristics and strive in unity to build a modern socialist country in all respects. In Report at the 20th national congress of the communist party of China. Qiu Shi (Vol. 21).
22. Jordan, K., Myers, C., Damani, K., Khagame, P., Mumbi, A. and Njuguna, L., 2024. Supporting equitable access to learning via SMS in Kenya: Impact on engagement and learning outcomes. British Journal of Educational Technology.
23. Kalhory, D. A. S., Layeeq, T. M., & Sakinaa, M. O., 2022. The role of agricultural extension to facing agricultural risks in Sulaymani Governorate-Kurdistan Region-Iraq.

24. Kassem, H.S., Alotaibi, B.A., Muddassir, M. and Herab, A., 2021. Factors influencing farmers' satisfaction with the quality of agricultural extension services. Evaluation and Program Planning, 85, p.101912.
25. Kayhan Pusane, Ö, 2024. Turkey's emerging dichotomy between ER and Sulaimaniyah, Iraqi Development Road project and the fight against the PKK. SRTC.
26. Landini, F., 2021. How do rural extension agents learn? Argentine practitioners' sources of learning and knowledge. The Journal of Agricultural Education and Extension.
27. Layeeq, T.M., Hamasalih, C.M. and Smail Shexani, N.Z., 2023. Organizational Obstacles for extension workers and Their Impact on the Effectiveness of Agricultural Extension Management in Sulaymani Governorate-Kurdistan Region Iraq. Journal of Kirkuk University for Agricultural Sciences, 14(4).
28. Lopokoiyit, M., Onyango, C., & K. Kibett, J., 2013. Extension Management Competency Needs of Agricultural Extension Agents in Kenya.
29. Mahmud, S. F., 2021. Opportunities and challenges of sustainable agricultural development in Iraq. International Journal of Social Relevance & Concern.
30. Mapiye, O., Makombe, G., Molotsi, A., Dzama, K., & Mapiye, C., 2021. Towards a revolutionized agricultural extension system for the sustainability of smallholder livestock production in developing countries: The potential role of icts. Sustainability.
31. Maulu, S., Hasimuna, O.J., Mutale, B., Mphande, J. and Siankwilimba, E., 2021. Enhancing the role of rural agricultural extension programs in poverty alleviation: A review. Cogent Food & Agriculture, 7(1), p.1886663.
32. Mbo'o-Tchouawou, M. & E. Colverson, K., 2014. Increasing access to agricultural extension and advisory services: How effective are new approaches in reaching women farmers in rural areas?
33. Midhas, A.A.H., Abdul-Faraj, D.M. and Hasan, A., 2021. The level of performance of agricultural staff working in the headquarters of the DU directorate for the planning and executives tasks and its relationship to some variables. International Journal of Agricultural & Statistical Sciences, 17.
34. Mohammed, S.M.O. And Hassan, A.A.A., 2021. Agricultural Extension Training Problems In Kurdistan Region/Iraq During The Period Of (2013–2017) From The Trainees'point Of View. Zanco Journal of Pure and Applied Sciences, 33(s1).
35. MOHAMMEDN, S.M.O. and HASSAN, A.A.A., 2021. Influence Some Independent Factors on Agricultural Extension Training Problems in Kurdistan Region-Iraq from the Employees' Point of View. Journal of Kurdistani for Strategic Studies, (10).
36. Morandini, S., Fraboni, F., De Angelis, M., Puzzo, G., Giusino, D. and Pietrantoni, L., 2023. The impact of artificial intelligence on workers' skills: Upskilling and reskilling in organisations. Informing Science, 26, pp.39-68.
37. Murad, H., 2020. Knowledge Level Of Agricultural Employees In DU Directorate On Integrated Pest Management. Mesopotamia Journal of Agriculture.
38. Murad, H.S., Amin, S.J., Al-Chalabi, R.A.M., Wasmi, M.K. and Salim, S., 2022. The knowledge level of agricultural extension workers in the climatic changes filed and their effects on agriculture in DU Governorate, Iraq. Sarhad Journal of Agriculture, 38(5), pp.279-288.
39. Muramalla, V.S.S.R. and Gurram, N.K., 2021. Entrepreneurship Opportunities And Challenges In The Kurdistan Region Of Iraq (Kri). Nveo-natural volatiles & essential oils journal nveo, pp.406-413.
40. Murat Boyaci, A., 2010. How can Agricultural Extension System in Turkey be Sustainable?.
41. Norton, G.W. and Alwang, J., 2020. Changes in agricultural extension and implications for farmer adoption of new practices. Applied Economic Perspectives and Policy, 42(1), pp.8-20.
42. Norton, G.W. and Alwang, J., 2020. Changes in agricultural extension and implications for farmer adoption of new practices. Applied Economic Perspectives and Policy, 42(1), pp.8-20.
43. Nyarko, D. A. & Kozári, J., 2021. Information and communication technologies (ICTs) usage among agricultural extension officers and its impact on extension delivery in Ghana. Journal of the Saudi Society of Agricultural Sciences.
44. Ozdemir, S., Quaife, M., Mohamed, A.F. and Norman, R., 2024. An Overview of Data Collection in Health Preference Research. The Patient-Patient-Centered Outcomes Research, pp.1-13.

45. Qadir, B.M., Abdullah, S.Z. and Majeed, H.L., 2023. Diversification and economic growth in emerging economies: The Kurdistan of Iraq experience. Eurasian Journal of Management & Social Sciences, 4(2), pp.33-60.
46. Sulaiman, Z. B., 2021. Technological Developments And Their Effects On Architecture: Aluminium Composite Panels In Northern Iraq As A Case
47. Suleimany, J. M. S. & Aziz, S. Q., . Issues of Water and Climate Change in the Kurdistan Region and Iraq. A Review Study. researchgate.net.
48. Suryawati, E., Suzanti, F., Zulfarina, Z., Putriana, A.R. and Febrianti, L., 2020. The implementation of local environmental problem-based learning student worksheets to strengthen environmental literacy. Jurnal Pendidikan IPA Indonesia, 9(2), pp.169-178.
49. Tahir, T. & Harun, R., 2022. Challenges for Sustainable Rural Water Management in Sulaimani Governorate in Kurdistan Region of Iraq: A Review Study. ProEnvironment Promediu.
50. Toptancî, A., 2024. A Macroeconomic Research on the Development of Agricultural Economy in the Kurdistan Region within the Scope of 2030-2050 Sustainable Development Goals
51. Yass, B. E. & Mhaibes, H. A., 2023. Strategic Analysis of Water Resources Management in Iraq. Kurdish Studies.