

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 12; December 2025; Page No. 175-183

Received: 27-09-2025
Accepted: 30-10-2025

Indexed Journal
Peer Reviewed Journal

The role of evaluation smart agriculture technology to improve climate changes management in Salah al-Din Governorate

¹Asmaa Zuhir Al-Hafdh and ²Waleed Sabar Ayed

¹Assistant Professor, Department of Agricultural Extension & Technology Transfer, College of Agriculture and Forestry, University of Mosul, Iraq

²Lecturer Department of Economics and Agricultural Extension, College of Agriculture, Tikrit University, Iraq

DOI: <https://www.doi.org/10.33545/26180723.2025.v8.i12c.2746>

Corresponding Author: Asmaa Zuhir Al-Hafdh

Abstract

This research, aims to explain differences in the role of evaluation smart agriculture technology to improve climate changes management in Salah al-Din Governorate; comprise climate change forecasting implementation; intelligent watering implementations; insect threat & disease regulation implementations regional yield & sustainable promotion implementations, & crop management implementations. Survey was split into: two divisions first addressed personal factors; whereas latter included 40 statements throughout five scale. This study including 78 farming staffs with 20 respondent in the initial trial (our study group). Consistency of all the metrics concerning were high indicating robust soundness, the main result propose The role of evaluation smart agriculture technology to improve climate changes management in Salah al-Din Governorate, that to get Mean score 98.25 also SD 7.49. Institutional indicator obtaining highest score; with mean of 35.35. Significantly academic qualifications have significance variations at 0.05; most variables were being considered unimportant & didn't considerably contribute to make improve climate changes management in Salah al-Din Governorate between agricultural personnel

Keywords: Management, agricultural evaluation, implementations, climate, agriculture technology

Introduction

Increasing in an awareness to environmental is changing a highlight its significance, makes it crucial that face it's many effects. Those effects current challenges throughout different areas; especially in agricultural. Applying proactive approaches can reduction these difficulties, encouraging more secure food ecological regionally and worldwide, a key approach to control climate change is via advanced agrarian operations. The chief role in these variations is ascribed to modern innovations, which present numerous methods such as smart agriculture; effecting many farming extension areas (Al-Hafidh, 2019) ^[4]. Water lack in Iraq has deteriorated over the periods; with per person water share reducing from 5,000 m³ in 1980 to under 1,000 m³ after 2020, primarily due to initiatives by riverside states in the Tigris and Euphrates river basins. (Najam & Khalaf, 2025) ^[29], this emphasizes the pressing requirement for adaptive farming innovations like smart agriculture to enhance resource utilization and environmentally sound; especially in drought-prone areas like Salah al-Din province.

Those ecological & economic challenges lead to requirement of effective agricultural. This due to an increasing nutrition demand, land-dwelling degradation, land degradation; dryness, & fluctuating precipitation endangering global nutrition security (Noori *et al.*, 2024) ^[30]. The innovations enhancement the output and support eco-

friendly source management; chiefly of Salah al-Din, under rising ecological stresses, climate change had been lead to severe dryness; inundations, and extreme heat events endangering agriculture & food safety (Yusuf *et al.*, 2025) ^[37], in vulnerable area as Salah al Din; adaptive innovations been promptly need, smart farming can reduction the hazards by improved sources controlling & evidence-based results.

Climate smart agriculture C.S.A.: aiming to enrich adaptability to farming frameworks those to funding food safety via incorporation adaptation requirements & balances for decrease in the enduring agriculture improvement policies (Lipper *et al.*, 2014) ^[23]. Explanation of Climate_Smart agriculture stresses a need to develop agriculture structure in tackle growing difficulties Climate Change contributions, Smart agriculture have increased wide recognition by administrations, local & universal institutions, public society and private area. Recent international & local organizations been creating models for stakeholder involvement and collaboration (Zecca, 2019) ^[38]. To emphasize the significance to Climate-Smart agricultural & focus to international researching on these domain, figure 1 (barasa *et al.*, 2021) ^[11] depicts most commonly appearing key terms in relevant global publications. Intensity of connection among ideas as: Climate Change agriculture; food safety; corn; & adaptation as well as demonstrates complex nature of it topic.

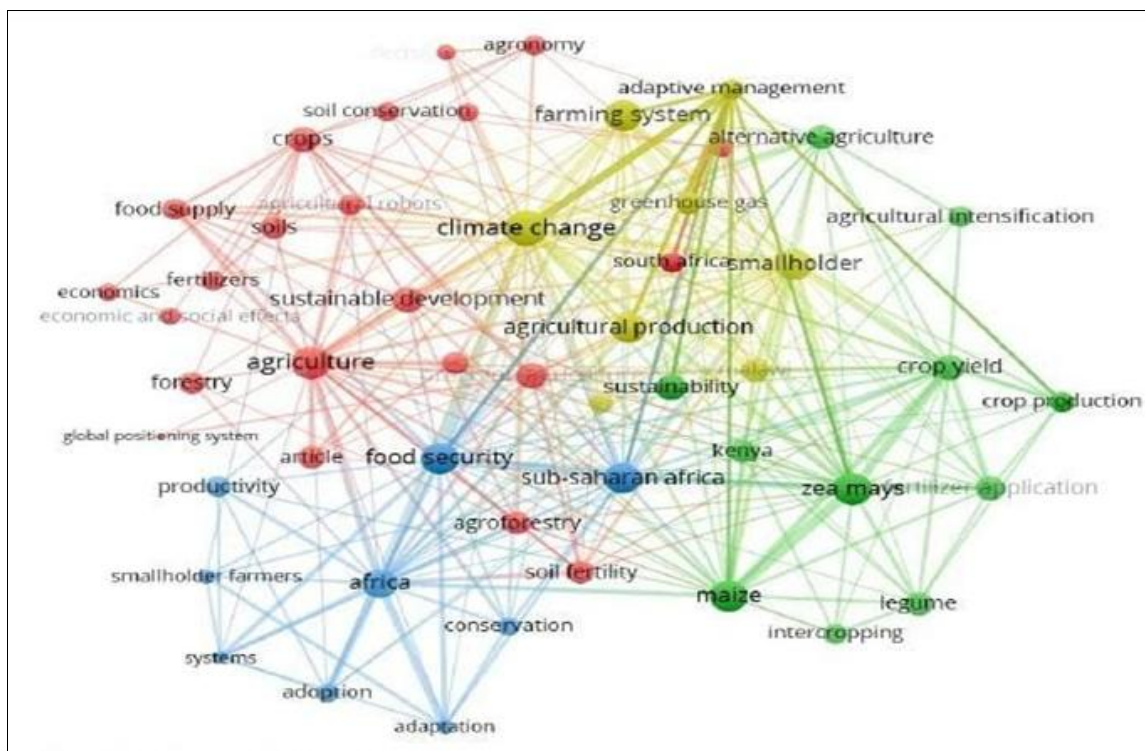


Fig 1: Main term simultaneous occurrence system of main topics in climate-smart agriculture literature

Figure 1. Representations of how climate Smart agriculture study is linked to main topics, with output, food chains, and climate adjustment, all of which correspond by the goals of this research (Pacillo *et al.*, 2022) ^[31]. As systematic approach for handling agriculture during climate change (Kalhory *et al.*, 2024) ^[19]. Every effort assists in equipping staff with essential information and expertise; therefore, understanding and practice and evaluation needs are critical in all domains overseen through subsequent activities (Al-Hafidh *et al.*, 2020) ^[5] within numerous progressing nations, farming often forms for over 30% of total national output (World Bank, 2019) ^[36]. Hence, the domain has substantial capacity to influence the attainment of the 2030 Agenda for Sustainable Development, because of its extensive societal and financial and ecological effects (FAO, 2019) ^[13]. Numerous fields intersect alongside the farming sector (Wiek *et al.*, 2011) ^[35]. Profiting through community's increasing attention on social and ecological sustainability is generally shown in public and non-public domain pledges to these areas; we should improve cooperation & interaction among study organizations and extension initiatives that depend on organized local directives instead of unorganized regulations (Al-Hafidh, 2019). Agriculture advisory institution be accountable of organization accountable of qualifying of a negative effects the climate change in agriculture. This organization is essential in encouraging ecologically sound agriculture approaches & ensuring essential elements obtainability (Al-Taïy *et al.*, 2020) ^[8]. The farming extension activities is a crucial factor that sustains farming growth by improving economic productivity via practice, training, and knowledge sharing (Hussein and Mohammad, 2023) ^[17]. Previous researches show agrarian extension programs considerably influence farmers' adoption of modern innovations; acting as motivators that speed up

implementation levels and regulate change in farming (Mume, 2021) ^[27]. Trial at Kirkuk presented that white aborigines yielded double the amount as dark items. However, farmers there generally do not cultivate white aubergines (Mohammed and Mahmood, 2022) ^[26]. Within location-targeted agriculture, extension workers are essential in connecting the divide among modern techniques and field needs; especially in resource-limited regions such as Salah al-Din Governorate.

In the current scenario, agrarian extension is vital as Iraq adopts smart agriculture to confront natural assets and climate issues. Extension programs necessity to adjust via providing applied advice and practical guidance. Creating governmental bodies, along with new degree holders enhance their competencies, is essential for agrarian development (Kalhoriy *et al.*, 2024). So; reinforcing agriculture extension institution & equipping staff correlated of instruments also data been vital of improving smart in area like Salah al- Din; where is conservational challenges & administrative deficiencies occur.

Agrarian extension's main duty should include disseminating study findings and methods to farmers and instruction them in the implementation of effective extension and communication speed acceptance of the new concepts as well as techniques; that comes from inherent diffusion among people (Al-Hafidh, 2019) ^[4]. Thus, Agrarian Extension Agency's aims are to enhance the cultivated area via enhancing agriculturalists' competencies and knowledge (Ashwaq & Saadoun, 2019) ^[10]. Its duty emphases on disseminating knowledge, expertise, and ideas while encouraging farming innovations. Moreover, it makes accessible the findings of agrarian study, mainly concerning climate change, by targeted actions and initiatives tailored for farmers (Jihad & Ridh, 2017) ^[18]. Climate Smart agriculture is gaining acknowledgment as a strategy for

adjusting agricultural practices in response to changing climate conditions while also implementing reduction measures.

Climate Smart agriculture has achieved acknowledgment

from state authorities and institutions. A conceptual diagram (Barasa *et al.*, 2021) ^[11] illustrates in figure 2. a review of studies of primary terms associated with these topics, indicating they global study scope.

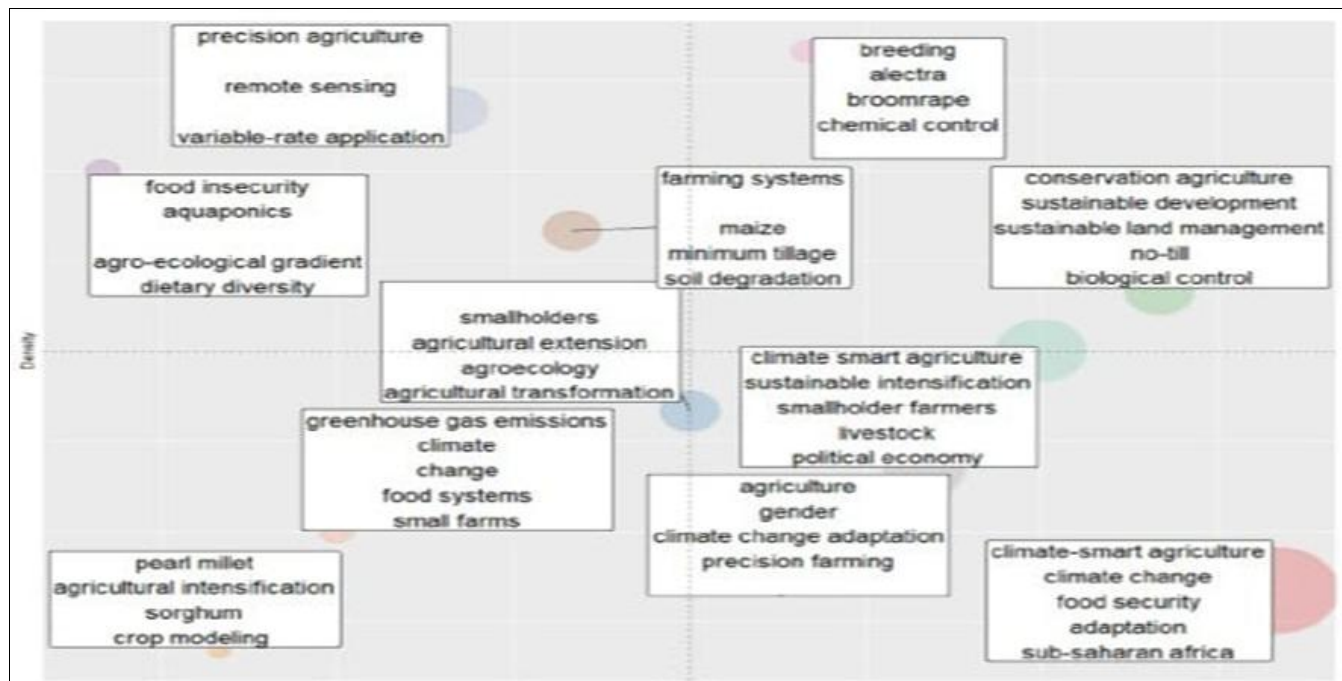


Fig 2: Thematic graph of the emerging topics in the climate smart agriculture

figure (2) shows a degree to non-physical intersect among concepts such as " climate change," "food safety," & "adaptation," highlight integrated character the domain & its near connections to objective-driven to sustainable long-term improvement, the research objective to examine in local setting of Salah al Din.

It be essential to the highlight of the climate smart farming which include (3) chief aims: responsibly improving farm production and earnings, but ensuring to food safety, adapting to the climate change & strengthening resilience against the stresses on environmental resources (Nitin Punit *et al.*, 2023) ^[39] and contributing to the decrease also remove (Greenhouses Gas) GHG gas releases since agricultural sector, forest management, fishery sector, and aquaculture (FAO, 2017) ^[12], climate smart agriculture increases output, enhances agriculturalists' flexibility & resilience, & enhances farm output during altering weather stressors. (Habtewold; 2021) ^[15], Agreements in a rural regions be vital aimed at modern agriculture, they improving livelihoods to small group farmers worldwide through assisting him bypass marketplace obstacles & market produces international. Furthermore, also support new agricultural methods to increase crop & financial stability (Adah *et al.*, 2024) ^[2].

Climate smart agricultural including numerous innovations, operations, & support intended to reduce the intended of climate change on farming (Khatri-Chhetri *et al.*, 2020) ^[20]. These measures vary start from minor modifications in cultivation practices to complete reforms of farming schemes tailored for certain climatic patterns.

Climate smart agriculture boosts adaptability and output by

lowering greenhouse gas emissions per unit of output (Teklewold *et al.*, 2019) ^[33]. The three stable foundations_ output, flexibility; and mitigation form the core for securing food security and supporting sustainable advancement (Makate *et al.*, 2019) ^[24]. One of the characteristics of climate change is that it impacts the capacity and productivity of the soil, and its impacts appearing on the earth in an accumulation of the strata, maker it dense & dominated through argillaceous minerals; clay structures compress strata; that hinder vegetative source growth (Alfaris *et al.*, 2025) ^[9]; one of an appropriate approaches & experiments that to prevent climate change, through aiming which effort integrated increases environmental viability & output (Sadam *et al.*, 2025) ^[32]. Must taking into account the close linkage among climate Smart cultivation & Sustainable progress Aims, assessing the climate smart agriculture's effect on enduring Progress Aims crucial to assist choice authorities grasp the complementarities and potential compromises related to climate-smart farming funding. Applying climate-smart cultivation chief elements influences numerous Sustainable Development Aims in different modes, often requiring compromises via representatives. That emphasizing a significance of an accurate & thorough models to evaluate & track climate smart agriculture effect on a Sustainable Progress aims (FAO, 2019) ^[13]. Multiple innovation had been evaluated for this effectiveness & effect at attaining climate Smart farming aims. figure 3. (Khatri_Chhetri *et al.*, 2019) ^[21] demonstrations digital indicator founded on stakeholder evaluations, highlighting best efficient intrusions.

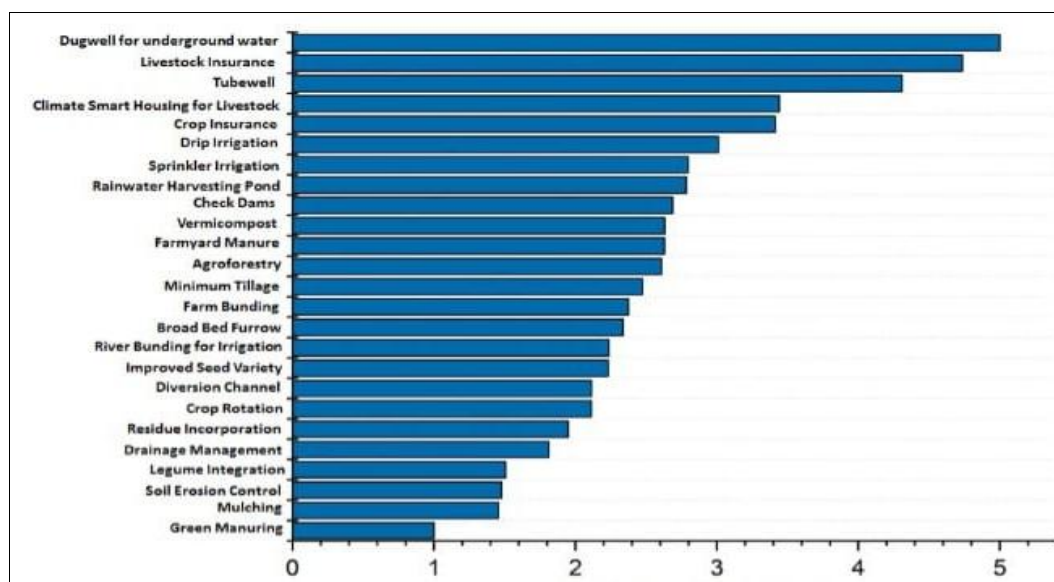


Fig 3: Level bar participants assessing of climate agriculture technology founded on performance measurement

These evaluation highpoints the impact for applying data-driven methods in evaluating climate smart agricultural interventions; especially within regions experiencing extreme climate challenges like Salah al-Din Governorate.

Evaluation is vital for enhancing farming methods; farmers regard it a very essential factor of their work; but they frequently face difficulties like a lack of time and restricted funding for thorough monitoring and evaluation (Mume, 2021) [27]. Therefore; this research was conducted to evaluate adaptive farming techniques to improve reactions to climate change via past; current, and forthcoming farming models, the primary goal of this research is to examine and evaluate the impact of climate-smart agricultural innovations on agricultural risk management and climate change mitigation, precisely within the Salah Al Din Governorate, Iraq. This study evaluates the effect of climate smart agriculture innovations on the agricultural risk management and their role in reducing impact of weather change at Salah al-Din Province; to achieve these necessitates, backed by our objectives:

Research Objectives

1. Evaluation climate smart agriculture technologies role to improve agri. risk managing & decreasing the effects the climate changes at generally in Salah l_Din Governorate
2. Arrangement main scales based on whited Mean of climate smart agriculture technologies in Salah ad-Din Governorate are: climate forecasting instrument, smart irrigation technologies application, best management systems; local harvest & green marketing applications; & crop management application.
3. Describe Categorise standards smart agriculture technology advance agriculture danger administration & reduce climate effects.
4. Comprehend distinctions in the evaluation in what way smart agriculture technology improve risk management & mitigate change impact created the many factors, agriculture extension, type of qualifications, length of

service, educational experience, participation in the smart cultivation, & output progresses from the smart farming

The Materials and Methods

method of descriptive was used that methodically analyses the smart agricultural technology enhancing control & mitigate effects of ecological alteration, were organized based on these evaluation procedures, in order to achieving all these goals; survey form distributed for gathering information the current research; which included two parts: first part focused at individual characteristics and specifically the field the agricultural outreach: (1) Expert within agriculture extension (2) don't an expert in agriculture extension service, form of credential (1) Qualification beginning an institute (2) A credential from faculty (3) Credential at Master's level (4) Ph. D. credential. Service period of in position (1) Limited period (2) Intermediate periods (3) Major periods, office grade & role (1) Deputy Agriculture engineer (2) Agriculture engineers. [3] Lead agriculture engineers (4) Deputy to president of engineers (5) President of the engineers (6) lead president of the engineers (7) expert, activities associated to smart farming of the output improvements in smart agriculture: (0) no output improvements, (1) Small (2) Medium (3) Large efficiency benefits at the smart agricultural (0) No production (1) Small (2) Medium (3) Large; data of this reason collected through calculation amount the days of the participation level at respectively activity; then next phase involving divided data in 4 classes, then following unit organises for identifying best evaluation purpose of the climate -Smart agriculture technology in the ornamental agricultural risk management; these includes five indicators: management & decrease effects of the climate change in Salah Al_Din Province: climate change prediction tools; intelligent irrigation applications; pest management tools applications; community collection & ecological promotion applications and cultivation management applications each of them involved pentagon scale mentioning to judgement on opportunity of application (very highly relevant, highly

relevant, appropriately relevant, not highly relevant, not very highly relevant) Each choice is assigned values ^[5, 4, 3, 2, 1] correspondingly forming (55) criteria in early formula, however the final formula consisting (40) indicators that removed this due to misappropriate accuracy criteria, accuracy test applied by using next type: superficial validity in a pilot trial sample; was 20 agricultural staff out of final sample in research community contained 78 staff randomly, selected unique populace 385, constituting 14.54% degrees of reliability had been evaluated using split Part, Mean adjusted by Jut man equilibrium of 5 scales, leading the score (0.81) showing consistent & highly dependable variables. thus values exceed required value allowed to us rely on these in this research in last sample gathering, statistical procedures it using comprise Weighted- Mean tool, Kruskal Wallis tool, Ratio, Z Score, Frequency& Mann Whitney

The Results and Discussion: First main objective-Evaluation climate_smart agriculture technologies role to improve agri. risk managing & decreasing the effects the climate changes at generally in Salah Al_Din Governorate. As clear in the table 1 only (73.07)% of employees at the lowest set that require a significant an enhancement in evaluation, in these technologies role. Therefore since comparison; while the second category (21.79)% while the last category been comprises (5.12)%. This research differs from study (Al-Hafidh & Ahmed, 2023) ^[7] highlighting of need diverse by studies programs to reinforce optional services unceasingly, these efforts should be explicitly address agricultural operation deemed national importance; necessitating of a change the conventional practices that aren't longer than. A significant difference were observed to use different information source; it illustrated that all of methods employed by employees proved very useful.

Table 1: Distribution employees based on their evaluation climate_smart techniques

(z) standard score	Classification	Numbers	Rat.
Further than +1	Big	4	5.12%
(-1_ +1)	Average	17	21.79%
Fewer than -1	Few	57	73.07%

Total = 78 Mean = 98.25 S.D = 7.49 Min = 72 Max = 122

The information had been categorized and performed using this test: Z _Scores that to Minimize measurement inaccuracies, it sorted in three classes; first one " Great " holds value above +1 next " Middle " comprises value ranged from -1 to +1 as well as third "Little" included value

below -1 as presented in figure 1, " Great " Category indicating of high performance. At any way since evaluation the climate_smart technology been vital for enhancing users' competencies & awareness about smart agricultural technology (see Figure 4)

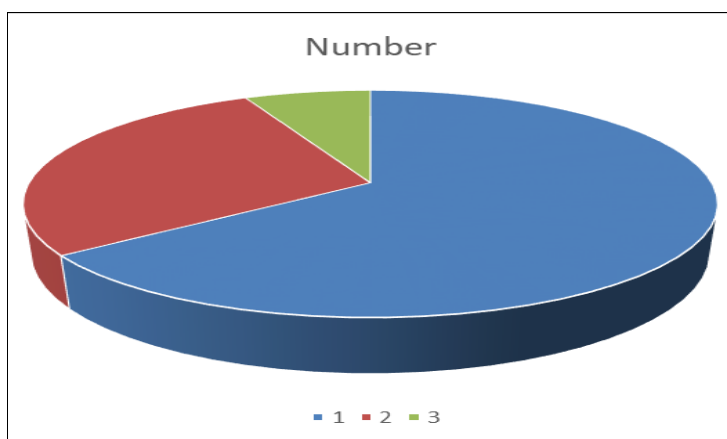


Fig 4: Ratio the distribution the agricultural employees concerning with evaluation role climate_smart

The second Arrangement main scales based on whited Mean of climate smart agriculture technologies in Salah ad-Din Governorate are: climate forecasting instrument, smart irrigation technologies application, best management systems; local harvest & green marketing applications; & crop management application.

In table 2, clarifies the main approaches using evaluation how climate smart farming technology to develop agricultural management & thus reduction effects the climate change in Salah ad Din Province

Top value in the crop management tools field been shown evaluating climate_smart agricultural technology, of mean 35.35 which was ranged first as shown in the table 2

Table 2: Arrangement main scale based on Whited Mean

Main Scales	Rank of Scales	Whited Mean
EE Applications Crop management	Rank 1	35.35
CC Control applications Pest and disease	Rank 2	23.10
BB Applications Smart irrigation	Rank 3	20.42
DD Applications of Local harvest & green marketing	Rank 4	17.05
AA Applications of Climate change prediction	Rank 5	14.50

As well as domain of climate prediction tool was been least score in evaluation climate_smart agriculture innovations, with a mean of 14.50, which is ranked in the final Third main objective- Describe Categorise standards climate_smart agriculture technologies advance agricultural danger management & reduce climate change effects Then establishing criteria in Table 3, and it was related factors follow to the metrics described by Mean, consistent with results of the previous researches; including reference (Kifle, 2021) ^[22] that compares with various many norms &

data-gathering methods, in additionally to this study agreement with study which conducted by Al-Hafidh & Laftah (Al-Hafidh & Ahmed,2023) ^[7] showing several areas pertinent of evaluating also enhancing the smart Innovations, the conclusion obtained in this study recommended with that most of relevant evaluation criteria & corresponding elements has been properly matched at all the implementation of intellectual farming within Iraq's cultivated systems; although with restricted effectiveness

Table 3: Rearrangements Norms Which Related on measurements

Se.	The norms & their items followed measurements	Average	R.
1-AA	Institutional work Organizing	5. 98	3
aa1	Assignment Organizing	3. 00	1
aa2	assignment committee	2. 98	2
3-AA	Objectives the organizational institution	17.91	1
aa1	Assignment clear objectives	4. 55	1
aa2	Assignment provided objectives	4. 50	2
aa 3	Assignment of research objectives	3. 01	3
aa4	Collection of information about organization objective	2. 54	4
aa5	Farm systems adapted to organization objectives	2. 53	5
2-AA	Structure of organizational	11. 46	2
aa1	Assignment of clear structure	2.96	1
aa4	Putting communication platform among participating parties	2. 85	2
aa2	Participating in duties and tasks	2. 82	3.5
aa3	Recognized database	2. 82	3.5
2-BB	Objectives of plan	12.05	1
4bb	Alignment sustainable development goals with goals	3. 05	1
1bb	Aligning of meet needs with publishing objectives	3.00	3
2bb	Range of clear objectives when assignment sub plan	3.00	3
3bb	Range of clear objectives when assignment main plan	3. 00	3
1-CC	Determined activities according to number and type	2.51	3
4cc	Suitability characteristics of the planting of activities	2. 51	4
3cc	preparation area and research guidance to the activities	2.50	2
1 cc	included enough activity in the agricultural smart	2. 48	3
2 cc	Variety of the activities which included agricultural smart	2. 45	4
5 cc	up-to-date of the activities included agricultural smart	2. 39	5
1_BB	Taking plan	11. 05	2
3 bb	determined commitment that to specified time	2. 92	1.5
4 bb	Communication of integrated and plans interconnected	2. 92	1.5
2 bb	assignment of a clear plan	2. 60	3
1 bb	plan assignment written	2. 58	4
3_CC	Application date	2. 97	1
1 cc	Application appropriate dates for actual plan	3. 01	1
2 cc	Application appropriate date on farmer's time empty	2. 96	2
2_CC	Application of site	2. 82	2
2 cc	Application appropriate of exact site	2. 74	1
1 cc	survival all tools & materials	2. 72	2
1_DD	following _up the institute	2. 890	1
1 dd	development institute	2. 870	1
2_DD	following -active	2. 760	2
1 dd	skill &efficacy of the people succeeding	2. 750	1
2 dd	followers numbers enough	2. 67	2.5
3 dd	Financial requirement in the follow-ups sufficient	2. 67	2.5
4 dd	range of sufficient material requirement to follow-ups	2. 66	4
1_EE	Organizing of evaluation	3. 01	1
1 ee	range of the being organized to the estimation	2. 610	1
2-EE	Surveyors	17. 410	1
1 Ee	Existence assessors from outside organizations & enter it	3. 07	1
2 Ee	Range of resident of enough numbers	3.00	2
3 Ee	making a continuous training of evaluators	2. 91	3.5
4 Ee	range of existence specific criterion evaluators relies on	2. 91	3.5
5 Ee	financial suitable of requirement of evaluation	2. 80	5
6 Ee	calendar suitable of material requirement	2.71	6

Fourth aim objective- determining to awareness the variations involved: in evaluating the function of Climate Smart agricultural technology in strengthening & improving farm hazard management & reducing effects of climate - change based on the many elements, the field of farm outreach are revealing agricultural personnel which classified according to specialized domains, results indicate that: proportion 60.25% of staff are specialists in agricultural extension; whereas 39.74% aren't. Furthermore that there isn't be meaningful variation exists of climate-smart agricultural technologies role among agricultural workers basing on these element as evidenced by calculated Man Whitney tool value 601.3 at 5% significance level, these finding aligned with initial study hypothesis, regarding type of the credential between employees, data showed that a significant share on the academic qualification from faculty (39.74)% tracked by advanced diploma (17.94)%, & a master's qualifications ratio (15.38)% the score gotten from Kruskal Wallis test 9.22 was a significant since 5% level, this result supports with study (Mizik, 2021) & (Abd Elsalam and Elnagar, 2021) ^[1, 25] also contrasts with study hypothesis, this difference may be attributed to acquiring of a new identifications resulting to development the new understandings; that through different phases of the change; increased their awareness regardless of increase in the academic credentials these results are inconsistent with putted suggested hypothesis.

Through duration of the service in the position, personnel distribution been carried out based on categorization middle period it was at ratio with 48.71% following then classification showed that a small fraction of 28.20% while employment period in the office roles was ratio 23.07% the shortest period was in the two yearly periods; whereas maximum of it was 36 yearly cycles, Mean lease noted Mean (15.35) standard deviation (7.67); furthermore to

evaluate the function of climate - Smart technology showed a negligible variances experiential at 5% significance level, determined using Kruskal Wallis tool, calculated h value was (0.25) result showed difference among instances (ainembabazi & mugisha, 2014) ^[3] and (wang *et al.*, 2022) ^[34] consistent by hypothesis proposed of this study.

Office degree:- Personal assignment between a different categories are follows

1. Given to agriculture engineer assistant 2. Given to senior agricultural Engineer 3. Given to the assistant chief of engineering 4. Given to engineer Chief 5. Given to seniors engineer chief; according to position of the degree statistics, percentage of distribution be first period 23.07% second period 19.23% third period 17.94% fourth period 15.38% fifth period 14.10% and finally sixth period 10.25%. Especially that isn't significant difference in the evaluation role of climate-smart technology as related with level of an office effort, when calculated kruskal_Wallis test was 7.41 with significance level 5% at any way result supports with research hypotheses proposed; participation tasks of the intelligent agriculture, maximum score 7 minimum be 2 mean 3.82, and standard deviation 1.56 once agricultural engineers were evaluated based according of their duties regarding climate_smart technologies it discovered 26.92% engaged in the minor duties 37.17% in moderate duties 35.89% in the large duties. Also showed No significance differences noticed in evaluation of climate_smart technique roles contrasted of levels the participation in the farming Applying climate-Smart technology, the worth of (H) was calculated 0.72 kruskal-Wallis test showed therefore this result wasn't statistical a significant of 5% level. in any way finding contrasts with research conclusions derived in the reference (Hassan and Asran, 2022) ^[16] but; aligns with research hypotheses

Table 4: Difference of Role evaluation the Climate Technique Affording some Variable

Variable	Category / Level	No.	Ratio (%)	Median	Average Rank	H Value	P Value	Significance
Type of agricultural extension	Did not professional extension	31	39.74	21	21.05	601.3	0.25	N.S
	Professional extension	47	60.25	21	19.89	-	-	-
Certificate	Ph.D.	4	5.12	21	24.3	9.22	0.040	*
	Master	12	15.38	21	41.5	-	-	-
	High diploma	14	17.94	20	20.6	-	-	-
	College	31	39.74	21	27.3	-	-	-
	Institute	11	14.10	19	24.31	-	-	-
	Preparatory	6	7.69	21	33.1	-	-	-
Period of service in office	Big (26 years & more)	18	23.07	21	30.1	0.25	0.92	N.S
	Medium (14-25 years)	38	48.71	21	27.9	-	-	-
	Few (2-13 years)	22	28.20	21	29.2	-	-	-
Office degree	Oldest Engineers President	8	10.25	21	38.8	7.41	0.22	N.S
	Engineers President	12	15.38	18.5	28	-	-	-
	Engineers President Assistant	18	23.07	21	24.2	-	-	-
	Former Engineers President	14	17.94	21	30	-	-	-
	Agricultural Engineer	15	19.23	19	22	-	-	-
	Agricultural Engineer Assistant	11	14.10	21	27	-	-	-
Smart cultivation participation activities	Large (6-8 & more)	28	35.89	21	32.2	0.72	-	N.S
	Medium (3-5)	29	37.17	21	27.4	-	-	-
	Small (0-2)	21	26.92	21	27.7	-	-	-

N.S.No significant * significant 5%

The conclusion

Evaluation of role climate farming innovation has carried out in an inadequate level; thus it is a crucial requirement due to apply those technique as well as updated data &

contemporary tools to the enhance of farming risk management & decrease effects in climate changes, of Salah al-Din Governorate; most of factors be considered lacking & don't add significantly to wanted results.

The conflict of interest

Researchers are announcing that, it is no disputes the interesting regard with release with these papers; enhancing educational program in climate_smart agricultural technology will substantially increasing of the quantity of the agricultural engineers, moreover that, it is be necessary to convey a creative concepts to this expert through attending capacity building lectures & utilizing website. Then these approaches intends to reach these innovations application; deployment; and implementation, while guaranteeing effective operational processes.

Acknowledgments: The authors be expressing gratitude to agricultural department of the province Salah al-Din & the agricultural extension Centre to support in enhancing a quality of this study.

- **Supplementary Materials:** None

Author Contributions

- **A.Z. Al-Hafidh:** writing original draft preparation, W.S. Ayyed: writing review & editing. Both authors have read & agreed to published version of this manuscript.
- **Funding:** This study received that no external funding

Institutional Review Board Statement

This study conducted according to protocol approved by Head of the Ethics Committee in College of Agriculture University of Tikrit; Iraq

- **Informed Consent Statement:** None.
- **Data Availability Statement:** None.
- **Conflicts of Interest:** The authors declare no conflict of interest.

Acknowledgments

Authors of this research gratefully acknowledge these assistance of the Directorate of Agriculture of Salah al-Din province & Agricultural Extension Centre in enhancing quality of these effort.

Disclaimer/Journal's Note

The statements, opinions, data contained at all publications are solely those of individual authors & contributors and not of AJAS and/or the editor(s). AJAS and/or the editor(s) disclaim responsibility of any injury to the persons or property resulting from any idea; methods instructions; or products referred to the content.

References

1. Abd Elsalam MF, Elnagar MF. Measuring adoption, farmers of good agricultural practices in Assuit Governorate. *Al-Azhar J Agric Res.* 2021;46(1):178-187. doi:10.21608/ajar.2021.218474
2. Adah CO, Raji SA, Shaibu U, Oluyomi MS. Analyzing the adoption of improved production technologies among cassava contract and non-contract farmers in Kogi State, Nigeria. *Tikrit J Agric Sci.* 2024;24(3):161-181. doi:10.25130/tjas.24.3.14
3. Ainembabazi JH, Mugisha J. The role of farming experience on the adoption of agricultural technologies: Evidence from smallholder farmers in Uganda. *J Dev Stud.* 2014;50(5):666-679. doi:10.1080/00220388.2013.874556
4. Al-Hafidh A. Evaluation of the training course carried out by ICARDA in the conservation agriculture for some agricultural employees in the northern region-Iraq. *Tikrit J Agric Sci.* 2019;19(1):18-29. doi:10.25130/tjas.19.1.2
5. Al-Hafidh AZ, Mal Alla LL, Abd Al Qader S, Husain AH. The knowledge level of employees working in Nineveh Agriculture Directorate with the viral diseases of Solanaceae family. *Diyala Agric Sci J.* 2020;12(1). doi:10.52951/DASJ.20120107
6. Al-Hafidh AZY, Lafta AH. Suggestion patron to diffusion evaluation the fodder agricultural technologies in Ninevah Province. *IOP Conf Ser Earth Environ Sci.* 2023;1259(1):012136. doi:10.1088/1755-1315/1259/1/012136
7. Al-Hafidh AZ, Lafta AH. Evaluation of the diffusion results of the Azolla fodder crop in Nineveh Governorate. In: *International Conference on Environment and Sustainability.* Cham: Springer Nature Switzerland; 2023. p. 359-369. doi:10.1007/978-3-031-57054-4_26
8. Al-Ta'iy HK, Al-Salhi ATH, Al-Mashadani ALJ. Development extension service to meeting the requirements of buffalo breeders in Iraq. *Iraqi J Agric Sci.* 2020;51(1):432-442.
9. Alfaris MA, Abdulla AA, Ramadhan MN. Evaluation of the performance of developed combined plowing machine under different operation circumstances. *Tikrit J Agric Sci.* 2025. doi:10.25130/tjas.25.1.2
10. Ashwaq AR, Saadoun HQ. The role of the agricultural initiative and the supporting devices in developing palm groves in the governorates of Diwaniyah and Muthanna. *Iraqi Agric Sci J.* 2019;50(4).
11. Barasa PM, Botai CM, Botai JO, Mabhaudhi T. A review of climate-smart agriculture research and applications in Africa. *Agronomy.* 2021;11(6):1255. doi:10.3390/agronomy11061255
12. FAO. Overview: Climate Smart Agriculture Sourcebook. 2017. Available from: <http://www.fao.org/climate-smart-agriculture-sourcebook/en>
13. Food and Agriculture Organization of the United Nations. Climate-smart agriculture and the Sustainable Development Goals: Mapping interlinkages, synergies and trade-offs, and guidelines for integrated implementation. Rome: FAO; 2019.
14. FAO. Agriculture: Key to achieving in the 2030 Agenda for Sustainable Development. Rome: FAO; 2016.
15. Habtewold TM. Impact of climate-smart agricultural technology on multidimensional poverty in rural Ethiopia. *J Integr Agric.* 2021;20(4):1021-1041. doi:10.1016/S2095-3119(21)63637-7
16. Hassan MEA, Asran GSA. Dissemination and adoption of climate-smart agriculture among farmers in a village of Giza Governorate. *Menoufia J Agric Econ Soc Sci.* 2022;7(12):231-258. doi:10.21608/mjabes.2022.370796
17. Hussein EA, Mohammad KA. Diffusion of agricultural ideas through the website of the agricultural extension and training department on the social networking "YouTube". *IOP Conf Ser Earth Environ Sci.*

- 2023;1158(9):092003. doi:10.1088/1755-1315/1158/9/092003
18. Jihad IS, Ridh BA. The reality of some specialized tasks of human resources management in agricultural extension system in middle region provinces of Iraq. *Iraqi J Agric Sci.* 2017;48(1):310.
 19. Kalthory DA, Hasan TML, Sakinaa MO. The attitude of full-time extension workers towards supervising the work of private agricultural projects in Sulaymani Governorate. *Anbar J Agric Sci.* 2024;22(1):28-40. doi:10.32649/ajas.2024.183694
 20. Khatri-Chhetri A, Regmi PP, Chanana N, Aggarwal PK. Potential of climate-smart agriculture in reducing women farmers' drudgery in high climatic risk areas. *Clim Change.* 2020;158(1):29-42. doi:10.1007/s10584-018-2350-8
 21. Khatri-Chhetri A, Pant A, Aggarwal PK, Vasireddy VV, Yadav A. Stakeholder prioritization of climate-smart agriculture interventions: Evaluation of a framework. *Agric Syst.* 2019;174:23-31. doi:10.1016/j.agry.2019.03.009
 22. Kifle T. Climate-smart agricultural (CSA) practices and its implications to food security in Siyadebrina Wayu District, Ethiopia. *Afr J Agric Res.* 2021;17(1):92-103. doi:10.5897/AJAR2020.15100
 23. Lipper L, Thornton P, Campbell BM, *et al.* Climate-smart agriculture for food security. *Nat Clim Change.* 2014;4:1068-1072. doi:10.1038/nclimate2437
 24. Makate C, Makate M, Mutenje M, Mango N, Siziba S. Synergistic impacts of agricultural credit and extension on adoption of climate-smart agricultural technologies in southern Africa. *Environ Dev.* 2019;32:100458. doi:10.1016/j.envdev.2019.100458
 25. Mizik T. Climate-smart agriculture on small-scale farms: A systematic literature review. *Agronomy.* 2021;11(6):1096. doi:10.3390/agronomy11061096
 26. Mohammed KA, Mahmood ET. Attitude of Al-Qasimia village farmers in Hawija district/Kirkuk Province toward cultivation and consumption of white eggplant. *IOP Conf Ser Earth Environ Sci.* 2022;1060(1):012147. doi:10.1088/1755-1315/1060/1/012147
 27. Mume ID. Assessment, monitoring and evaluation of climate smart agriculture: A review. *Int J Food Sci Agric.* 2021;5(3). doi:10.26855/ijfsa.2021.09.022
 28. Murad HS. Level of knowledge in the main domains of agricultural practices among pepper farmers in Zakho City. *Anbar J Agric Sci.* 2025;23(1):728-743.
 29. Najam AA, Khalaf MA. Economic analysis of the impact of irrigation method and factors affecting its adoption in wheat farms in the 2023-2024 season: The Anbar Governorate as a study model. *Anbar J Agric Sci.* 2025;23(1):806-820.
 30. Noori NS, Hameed BH, Mohammed MK. An economic evaluation of the performance efficiency of conservation agriculture and food security projects using logistic regression in Iraq for the 2022-2023 season. *Anbar J Agric Sci.* 2024;22(2):1033-1049.
 31. Pacillo G, Kangogo D, Madurga-Lopez I, Villa V, Belli A, Läderach P. Is climate exacerbating the root causes of conflict in Mali? A climate security analysis through a structural equation modeling approach. *Front Clim.* 2022;4:849757. doi:10.3389/fclim.2022.849757
 32. Sadam M, Hassan M, Rashid MS, *et al.* Using the diverse vegetables as filtration plants in aquaculture intensive system. *Tikrit J Agric Sci.* 2025;25(1):1-15. doi:10.25130/tjas.25.1.1
 33. Teklewold H, Gebrehiwot T, Bezabih M. Climate smart agricultural practices and gender differentiated nutrition outcome: An empirical evidence from Ethiopia. *World Dev.* 2019;122:38-53. doi:10.1016/j.worlddev.2019.05.010
 34. Wang SL, Hoppe RA, Hertz T, Xu S. Farm labor, human capital, and agricultural productivity in the United States. 2022.
 35. Wiek A, Withycombe L, Redman CL. Key competencies in sustainability: A reference framework for academic program development. *Sustain Sci.* 2011;6:203-218. doi:10.1007/s11625-011-0132-6
 36. World Bank. Agriculture, forestry, and fishing, value added (% of GDP). 2019.
 37. Yusuf OJ, Olatinwo LK, Aiyedun OE. Assessment of the effects of climate change on the livelihoods and adaptation strategies of rural women in Kwara State, Nigeria. *Anbar J Agric Sci.* 2025;23(1):791-805.
 38. Zecca F. The use of Internet of Things for the sustainability of the agricultural sector: The case of climate smart agriculture. SSRN. 2019.
 39. Punit N, Singh R. A statistical analysis of human and environmental indicators to measure development process: A case study. *Int J Geogr Geol Environ* 2023;5(1):168-176. DOI: 10.22271/27067483.2023.v5.i1b.158