Evaluation the Sustainability of Agricultural Work in Greenhouses to Address the Challenges Faced by Agricultural Employees in Nineveh Province

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Abstract

The study aimed to identify the foundations for evaluating agricultural work in plastic greenhouses in Nineveh Governorate, to identify the problems faced by agricultural employees working in plastic greenhouses in the governorate, and to develop a model for assessing the quality of agricultural extension agents' performance in greenhouse work in Nineveh. The study population included all those working in agricultural extension in the Nineveh Directorate of Agriculture, the Nineveh Agricultural Units, and the Extension Center, totaling 93 individuals. The entire population was surveyed at a rate of 100%. A questionnaire was prepared as a tool for data collection from the respondents, consisting of two parts.

The first part included a set of problems limiting the continued expansion of plastic greenhouses in Nineveh Governorate. It consisted of four domains: economic problems (6 indicators), environmental problems (9 indicators), administrative problems (7 indicators), and technical problems (8 indicators), totaling 30 indicators. The second part consisted of four domains measuring the proposed interventions by agricultural extension workers to overcome these challenges in order to achieve sustainable development: organization (6 indicators), planning (9 indicators), implementation (7 indicators), and follow-up (8 indicators), also totaling 30 indicators.

The results showed that the overall level of problems was moderate tending toward high. This indicates that training centers pay attention to functional training for agricultural extension workers in accordance with their job-related training needs. The level of proposed interventions suggested by the workers was also moderate tending toward high, indicating the significant and influential role of functional training in developing and improving workers' performance. The evaluation of administrative problems achieved a high level regarding job performance among agricultural extension workers, which indicates that employees engaged in administrative tasks receive functional training that enhances and develops their performance, reducing the problems that hinder their work in carrying out assigned tasks.

The researcher recommended the continued development of training programs and activities by training centers for agricultural extension workers in the field of plastic greenhouses due to their importance in achieving the desired change, addressing climate change and drought, Align training with job-related needs, and achieving sustainable development in a way that enhances the efficiency of job performance, Evaluate the effectiveness of training programs regularly.

Keywords: **Evaluation, Plastic Greenhouses, Agricultural Problems, Agricultural Employees, Sustainable Development.**

Introduction and Research Problem:

To disseminate agricultural technologies and develop agricultural practices, it is essential to issue judgments and make decisions regarding the extent to which projects, activities, and programs succeed. This involves a continuous and comprehensive process that includes all parties managers, target individuals, organizations, and the extension system itself in order to develop the knowledge, skills, and

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attitudes of those responsible for dissemination as well as the intended beneficiaries. The process focuses on the efforts exerted, the activities carried out, and the outcomes achieved, while employing appropriate methods and tools that require interaction, coordination, and integration among all parties to achieve optimal results [1]. It is important to note the existence of certain obstacles that hinder the transfer of agricultural technologies and influence farmers' orientations when integrating these technologies into their agricultural systems to confront the climate changes that the rural community has generally suffered from. This requires working to utilize the available resources [2] to achieve social, economic, and agricultural development in order to realize the desired transformation, therefore we should identify the roles of stakeholders involved in this process as should on Nineveh agricultural moderate holding training courses according to their needs, that to strengthen the objective statement regarding the enhancement of agricultural practices , also improve sentence structure for better readability and logical flow.

Therefore, it is essential to identify their training needs as supervision to planning in the greenhouse ,agricultural method , fertilizer, irrigation that to help them cope with work pressures related to time management, organization of ideas, and decision-making [3].

Accordingly, attention must be given to all individuals within the extension organization as active participants in the process of disseminating agricultural technologies at all levels of job performance, in order to meet farmers' needs and expectations, achieve their satisfaction, and improve the services and programs provided to them in a manner that ensures food security. This, in turn, enables the enhancement of these extension programs through evaluating their dissemination [4].

Furthermore, it is necessary to conduct an evaluation of the process of transferring a specific agricultural technology, crop, or new production method, as well as assessing the extent of the technology's dissemination, its level of application, its results, and farmers' reactions that to achieving food security Hence it returns positive on the farmers [5].

Therefore, it is important today that programs for disseminating agricultural technologies receive their share of evaluation, as such evaluation contributes to developing these programs and determining the extent to which results and objectives have been achieved at each stage of dissemination. Hence, the present study adopts this type of evaluation within a context that indicates the absence of any evaluation processes for crop dissemination in light of the intended goals and outcomes.

The anticipated outcomes, as well as understanding the changes that have occurred to advance agriculture in Nineveh Governorate which has spent five years implementing dissemination programs aimed at agricultural development necessitate a shift toward serious efforts to enhance efficiency and effectiveness. This also requires conducting practical and scientifically rigorous evaluation studies of the dissemination process, the core of which depends on diagnosing the actual status of dissemination domains (organization, planning, implementation, follow-up, and evaluation).

Evaluation is considered an essential process in any developmental work or program. It accompanies the program from the early stages of conceptualization through post-implementation to determine its feasibility and appropriateness for the target group, identify weaknesses in its various components, propose remedies, and assess the extent to which results or objectives have been achieved. This, in turn, supports making sound decisions regarding the program and its development [6].

Therefore, it is very important that agricultural development work receive its share of evaluation as an administrative tool that contributes to its improvement and to determining the results or objectives achieved at each of its stages. Evaluation can take

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manyforms, including scientific evaluative studies. Accordingly, the current research falls within this type of evaluation.

Despite the fact that the development work related to combating the white jasmine fly has been implemented for nearly four years, the available information indicates the absence of a precise scientific evaluation of this agricultural development effort. Conducting such an evaluation is essential to determine the extent of progress achieved by the adopted practices, as well as to provide additional indicators that ensure the work is proceeding in the right direction and to understand the degree of change that has occurred in farmers' behavior and the knowledge they have acquired as a result of learning correct methods for controlling the white jasmine fly. This conclusion aligns with findings from several studies, including those conducted in Mali.

Evaluation was defined by Stufflebeam as the process of outlining broad guidelines and obtaining useful information for the concerned parties to guide them in making judgments regarding alternative decisions [7]. It is a continuous process of measuring and objectively determining the changes that have occurred as a result of implementing extension activities and programs. Evaluation both formative and summative is considered one of the administrative tools, but the first one concentrate on procedures step by step used to ensure the effectiveness of extension work and to improve the performance of its practitioners [8].

Plastic greenhouses are cultivated during the winter season in the months of December, January, February, and March, when the shortage of vegetables due to cold weather occurs. This helps create a balance in market prices. Crops grown in these greenhouses include tomatoes (both creeping and upright varieties), cherry tomatoes, hot and sweet peppers, eggplants, cucumbers, cowpeas, green beans, okra, and others. Accordingly, countries around the world seek to advance the agricultural sector, as it is considered one of the important economic sectors [8]. This advancement is achieved through extension organizations, as a strong extension system is the key to the desired change in addressing agricultural challenges by enabling farmers and stakeholders to overcome these challenges.

Despite the importance of evaluation and its focus on identifying weaknesses in order to correct them, modify behavior, and support and reinforce strengths, there are certain constraints that prevent proper implementation of evaluation. This is necessary to ensure the continuity of agricultural work in plastic greenhouses, guaranteeing their ongoing dissemination and operation in Nineveh Governorate.

The present study focuses on achieving the following objectives:

First: To identify the foundations for evaluating agricultural work in plastic greenhouses in Nineveh Governorate.

Second: To identify the problems faced by agricultural employees in working with plastic greenhouses in Nineveh Governorate.

Third: To identify the proposed solutions for the problems encountered by agricultural employees in working with plastic greenhouses in Nineveh Governorate.

Fourth: To develop a model for assessing the quality of performance of agricultural extension agents in working with plastic greenhouses in Nineveh Governorate.

Research Hypothesis: There is a decrease in the level of problems faced by agricultural employees in transferring and disseminating greenhouse farming technology

Research Methodology: The study relied on a questionnaire administered to agricultural extension agents to collect data, as it is suitable for the nature of the data required. The questionnaire is considered an appropriate tool for data collection due to its higher objectivity compared to other research data collection tools, serving the purpose of achieving the study's objectives [9].

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The initial draft of the questionnaire was reviewed through a survey of relevant literature, bulletins, and scientific sources related to the topic, in addition to the opinions of experts and specialists in the field of greenhouse agriculture.

For measuring the first objective, the questionnaire consisted of four domains with the following number of items respectively: 3, 5, 5, 7, 5, 5, and 4, totaling 34 items.

These domains were designated for the agricultural extension agents and include: Economic Problems Domain, Environmental Problems Domain, Administrative Problems Domain, Technical Problems Domain.

The validity of the questionnaire was then assessed. After completing the questionnaire requirements, its initial draft was presented to experts to measure face validity and content validity, in order to determine their agreement on the clarity of the items and their relevance to the respective domain.

A three-point scale was used: Agree, Agree with modification, and Disagree, with suggested modifications noted. The weights assigned were 2, 1, and 0, respectively. The experts' opinions were collected, analyzed, and consolidated. The purpose of presenting the questionnaire to experts was to complete the procedures for examining content and face validity, as these are considered the most appropriate types of validity for use. Validity, in all its forms, is regarded as an important element for ensuring the objectivity of the questionnaire [10].

The mean agreement scores of the experts were then calculated, and a cut-off criterion (approval threshold) was determined. The cut-off threshold refers to the score at which the domains, axes, and items of the proposed questionnaire are considered sufficient or insufficient to remain in their final form [11]. The cut-off threshold was set at 75%, in accordance with scientific recommendations in the social sciences [12]. After preparing the final version of the questionnaire for scientific research purposes and to complete the scientific procedures for the problems scale, the items were assigned weights of (5, 4, 3, 2, 1) corresponding to the five-level scale: **"present to a very large extent," "present to a large extent," "present to a medium extent," "present to a small extent,"** and **"not present,"** respectively.

Since the total number of items is 69, the highest possible score a respondent could obtain is 276, while the lowest possible score is 0. Thus, the range of values is (0–276), as shown in Table (1).

Table (1): Score Ranges of the Problems Scale for the Dissemination of Plastic Greenhouses, Distributed by Domains.

S	Domains	Number of Items	Value Ranges
1	**Economic Problems Domain**	18	(0–72) points
2	**Environmental Problems Domain**	14	(0–56) points
3	**Administrative Problems Domain**	13	(0–52) points
4	**Technical Problems Domain**	10	(0–40) points
Total		69	(0–276) points

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Pre-Test of the Questionnaire: The purpose of conducting a pre-test is to ensure the clarity of the questionnaire items for the research participants, to identify and address difficult or weak items for improvement or modification, and to determine the time required for respondents to complete the entire questionnaire [7]. After finalizing the questionnaire, it was applied to a pilot sample (outside the final research sample) to verify its suitability for collecting research data.

The split-half method was used on the scale items to calculate the reliability coefficient of the questionnaire [7]. To obtain the full correlation between the two halves of the scale, the Spearman–Brown formula was applied to calculate the overall reliability coefficient. The results of the questionnaire were as follows:

It is evident from the table above that the reliability coefficients ranged between 0.76 and 0.92, while the overall reliability of the questionnaire ranged between 0.80 and 0.83. All of these coefficients are considered good and meet the purposes of the research, indicating that the final form of the scale is suitable for field application.

The reliability values ranged between 0.76 and 0.92, all of which are regarded as good and appropriate for the objectives of scientific research. Therefore, the final form of the scale can be judged as suitable for practical field application.

Research data were then collected from agricultural extension agents using the questionnaire through personal interviews. Interviews with individuals in rural communities are considered an appropriate method for obtaining research data, especially for those with limited literacy skills, and are among the most important and effective data collection tools [7].

The data collection period extended from October 1, 2025, to November 12, 2025. Minitab V.13.5 and SPSS statistical programs were used to analyze and process the research data. The following statistical methods were employed:

-Simple Correlation, Mean, Percentage (%), Frequency, Weighted Mean, and Standard Deviation

Research Results:

First: Identifying the Foundations for Evaluating Agricultural Work in Plastic Greenhouses in Nineveh Governorate:

The main foundations for evaluating agricultural work in plastic greenhouses in Nineveh Governorate include research and development, scientific and technological planning, training and qualification, centralization of information, discoveries and patents, and participation in scientific and professional associations and organizations [13].

Therefore Given the important role played by agricultural extension agents in the Nineveh Agriculture Directorate, it is necessary to assess the level of their performance: are they performing their duties correctly, poorly, or averagely? This can be determined through performance evaluation, highlighting the importance of evaluating the role of agricultural extension agents in achieving sustainable development in greenhouse agriculture, and it is an essential condition for achieving quality, particularly in institutions, is continuous improvement. Continuous improvement means consistently introducing new and better practices, as innovation and excellence symbolize distinction, sustainability, and continuity. Maintaining outdated methods, on the other hand, leads to obsolescence. Improvement is considered the lifeblood of quality management and does not have a fixed limit [14].

When implementing a quality system, management should ensure that the system facilitates and supports continuous quality improvement to enhance effectiveness, increase the productivity of activities and processes, and provide additional benefits for both organizational structure and beneficiaries. To create an environment conducive to quality improvement, the following should be observed: encouraging initiative, promoting values that emphasize improvement, setting

clear objectives for quality enhancement, fostering genuine communication and teamwork, and providing training and education aimed at improvement [15].

Key requirements for applying quality management methodology include support from senior management, a focus on beneficiaries, collaboration and team spirit, appropriate leadership practices, the existence of measurement systems, and effective communication systems. Ensuring these elements helps create a suitable environment for implementation. Without them, the organization's management must work on changing its culture and adjusting its organizational structure to align with the application of the new quality concept [16].

Second: Identifying the Problems Faced by Agricultural Employees in Working with Plastic Greenhouses in Nineveh Governorate:

Then to identify the Problems Faced by Agricultural Employees in Working with Plastic Greenhouses in general, results showed that the lowest evaluation value was 1 and the highest was 5, with a mean of 60.77 and a standard deviation of 18.36. The respondents were divided into three categories using the range formula. The highest percentage of respondents fell within the medium category, followed by the high and then the low category, as shown in Table (2) and Figure (1):

Table (2): Distribution of Respondents According to the Overall Level of Problems.

Categories	Frequency	%	Category Mean
Low Category (20–46)	18	19.35	30.77
Medium Category (47–73)	44	47.32	60.091
High Category (74–100)	31	33.33	79.161
Total	93	%100	----------

MEAN =60.77 **SD. 18.362**

It can be concluded from this that training centers pay attention to the functional training of agricultural extension workers to address the problems they encounter in their work, in a manner that aligns with their training needs for job-related tasks. This result is consistent with the studies by Al-Shammari (2014) [17] and Al-Jubouri (2013) [18], but it differs from the research hypothesis that was proposed.

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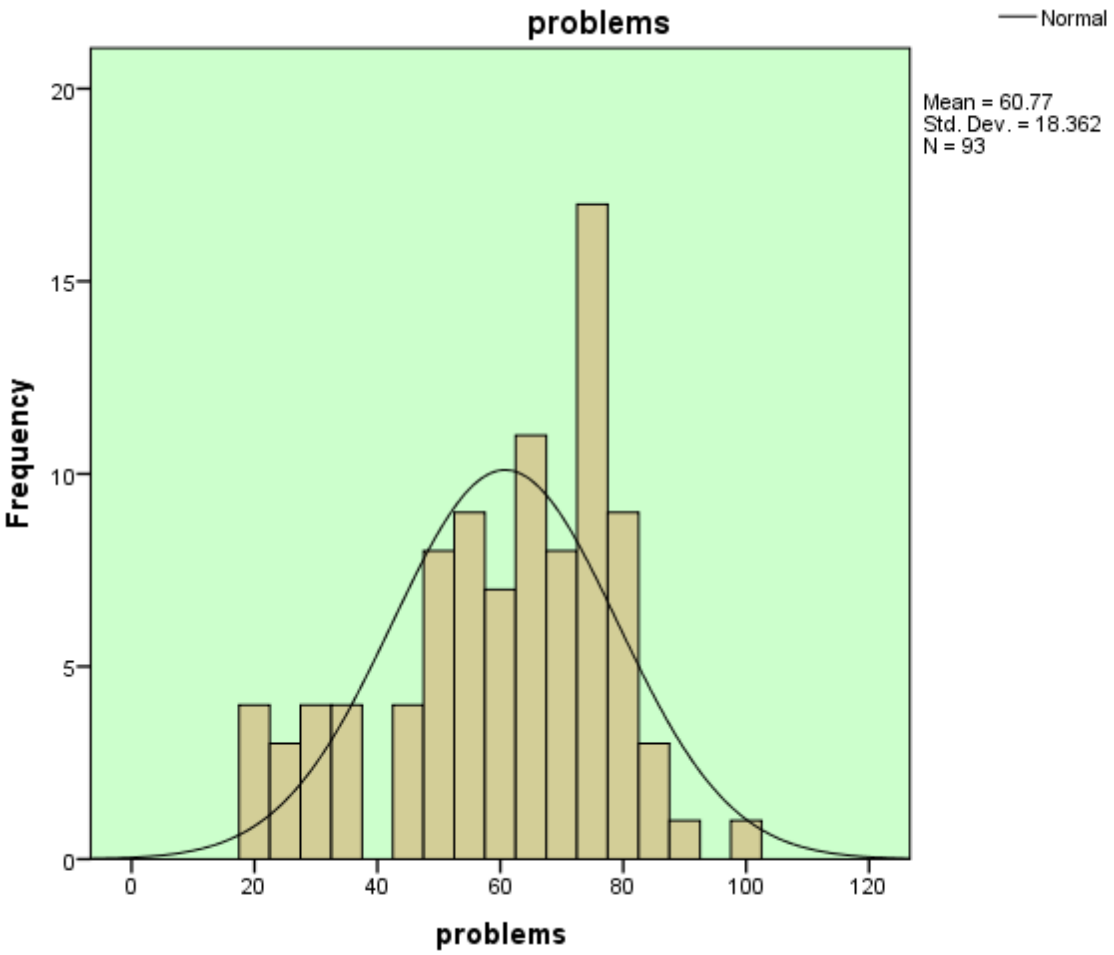

Figure (1): Distribution of respondents according to the problems.

Then to Identifying the Problems Faced by Agricultural Employees in Working with Plastic Greenhouses in Nineveh Governorate in each field of the study, the research results showed that the lowest arithmetic mean in the Weak establishment of support funds specifically for greenhouse farmers domain was **2.88** and the highest mean in Lack of provision of soft loans for farmers to adopt greenhouse technology domain was **3.45** with the level of acceptance ranging between **(moderate to high),** as presented in Table (3,4,5,6).

Table (3): Ranking of Items in the Economic Problems Domain by Importance

S	Items	Mean	Percentage Weight	Rank	Maximum Score
1	• Lack of provision of soft loans for farmers to adopt greenhouse technology.	3.45	69	**1**	**5**
2	• Insufficient support for the prices of agricultural production inputs (plastic, fertilizers, seeds).	3.04	60.8	**6**	

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3	• Weak establishment of support funds specifically for greenhouse farmers.	2.88	57.6	**9**	
4	• Absence of fair marketing mechanisms that ensure stable profits for farmers.	3.24	64.8	**5**	
5	• Low number of greenhouses, resulting in limited economic returns.	3.26	65.2	**4**	

Table (4): Ranking of Items in the Environmental Problems Domain by Importance

S	Items	Mean	Percentage Weight	Rank	Maximum Score
1	• Lack of use of organic fertilization and biological control.	**2.95**	59	**9**	**5**
2	• Heavy reliance on chemical pesticides.	**3.07**	61.4	**8**	
3	• Lack of knowledge about the impact of greenhouses on soil and water, and absence of sustainable solutions.	**3.24**	64.8	**6**	
4	• Absence of environmentally friendly practices in greenhouse management.	**3.47**	69.4	**2.5**	
5	• Difficulty in overcoming frost or freezing problems during winter.	**3.53**	70.6	**1**	

Table (5): Ranking of Items in the Administrative Problems Domain by Importance

S	Items	Mean	Percentage Weight	Rank	Maximum Score
1	• Absence of a clear government plan to expand the use of greenhouses.	3.16	63.2	**7**	**5**
2	• Lack of coordination between the Directorate of Agriculture and farmers' associations.	3.44	68.8	**2**	
3	• Absence of associations or unions specifically for greenhouse farmers.	3.20	64	**5.5**	
4	• Weak monitoring of the implementation of agricultural programs related to protected agriculture.	3.42	68.4	**3**	
5	• Failure to establish model experimental stations to transfer experience to farmers.	3.28	65.6	**4**	
6	• Lack of awareness campaigns on the benefits and principles of protected agriculture.	3.45	69	**1**	

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Table (6): Ranking of Items in the Technical Problems Domain by Importance

S	Items	Mean	Percentage Weight	Rank	Maximum Score
1	• Lack of training courses on greenhouse management.	3.16	63.2	**7**	**5**
2	• Limited availability of modern technologies in irrigation, cooling, and ventilation systems.	3.44	68.8	**2**	
3	• Absence of improved seeds and varieties resistant to diseases and pests.	3.20	64	**5.5**	
4	• Weak modern communication channels (electronic platforms, WhatsApp/Telegram groups) for interaction with farmers.	3.42	68.4	**3**	

Third: Identifying the Proposed Solutions for the Problems Faced by Agricultural Employees in Working with Plastic Greenhouses in Nineveh Governorate:

Then to identify the Proposed Solutions for the Problems Faced by Agricultural Employees in Working with Plastic Greenhouses in general, results showed that the lowest evaluation value for the proposed solutions was 1 and the highest was 5, with a mean of 70.30 and a standard deviation of 20.297. The respondents were divided into three categories using the range formula. The highest percentage of respondents fell within the medium category, followed by the high and then the low category, as shown in Table (7).

Table (7): Distribution of Respondents According to the Overall Level of Proposed Solutions

Categories	Frequency	%	Category Mean
Low Category (0–32)	7	7.53	21.43
Medium Category (33–65)	22	23.65	53.23
High Category (66–100)	64	68.82	81.70
Total	93	%100	----------

MEAN =70.30 **SD. 20.297**

In general, it was found that the most important problems faced by agricultural employees in disseminating greenhouses in Nineveh Governorate are:

1. Limited accurate diagnosis and treatment of viral diseases in greenhouses.
2. Insufficient financial and moral support for agricultural employees.
3. Scarcity of research laboratories and ELISA technology for diagnosing various greenhouse diseases.
4. Limited educational and training courses for agricultural employees, particularly regarding greenhouses.
5. Low participation of agricultural employees in extension seminars, scientific conferences, and official assignments in general.
6. Weak collaboration between agricultural departments and universities to support greenhouses.

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7. Insufficient support from the Ministry of Agriculture in providing information resources.
8. Limited availability of internet access in laboratories and agricultural departments.
9. Weak cooperation between agricultural departments and farmers' associations for greenhouse development.
10. Lack of attention to facilitating the transportation of employees to and from sites of viral infection (fields).
11. Limited provision of pesticides for controlling insect vectors of diseases within greenhouses.

Fourth: Developing a Model to Assess the Quality of Agricultural Extension Agents' Performance in Working with Plastic Greenhouses in Nineveh Governorate:

The DMAIC model was developed as a tool to achieve quality, with some modifications and additions to make it suitable for enhancing the performance quality of agricultural extension agents in Nineveh Governorate. It is structured around the following seven points, therefore we ensure in this discussion connects back to the overall objective of improving performance quality within the context of agricultural extension.

Measuring the Problem: In the DMAIC approach, the problem is not merely defined; rather, its definition must be supported by factual evidence to ensure its validity.

1. **Focusing on the Beneficiary:** The beneficiary serves as the foundation and primary target of all extension efforts.
2. **Verifying the Root Cause of the Problem:** It is essential to present the facts that led to the problem, identify weaknesses, and investigate its underlying causes.
3. **Eliminating Previous Practices:** Solutions derived from this approach should generate real change, not merely minor adjustments, by relying on new agricultural and technological ideas to produce innovative results.
4. **Risk Management:** Solutions must be selected carefully; rapid or hasty solutions should be avoided, with choices based on logical and scientifically grounded studies.
5. **Measuring Results:** The actual impact of the solutions should be assessed using factual evidence, through field questionnaires to survey beneficiaries' opinions regarding the quality of programs and the benefits received, along with pre- and post-tests to compare their responses.
6. **Continuous Improvement:** Even the best solutions achieved using DMAIC may become obsolete quickly unless they are continuously reinforced and monitored through periodic training courses for agricultural extension agents [19].

Recommendations:

For continuous quality improvement, there must be an ongoing quality planning program throughout the life and future trajectory of the organization. The intense competition today requires sustained planning and implementation efforts to achieve high quality and distinguish the organization from others, as follows:

1. Commitment of the top management of the extension organization to quality and adoption of it as a working methodology, assuming full responsibility.
2. The necessity of having a defined and integrated system for implementing programs and plans related to quality, applicable to all relevant personnel.
3. The necessity of having systems, regulations, and instructions for contracting methods within an overall plan.
4. Establishment of a design management department, including planning and development sections.
5. Establishment of a documentation department responsible for certification, securing documents, and carrying out any necessary processes for document replacement if required.
6. Establishment of a procurement department possessing information about

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suppliers, subcontractors, all procurement items, and relevant personnel.
7. Establishment of departments to control production processes.
8. Establishment of a department or personnel responsible for inspection and examination.
9. Periodic inspection and calibration of equipment and machinery used in production processes according to specified conditions.
10. Establishment of a mechanism to control products that do not meet quality standards during production.
11. Establishment of a corrective mechanism for production after identifying deficiencies, if any.
12. Establishment of mechanisms for handling, storage, packaging, and distribution, with accurate documentation records for all processes.
13. Documentation of control and quality assurance operations.
14. Establishment of a mechanism for internal self-monitoring of quality.
15. Establishment of a mechanism for training staff in quality departments.
16. Establishment of a mechanism for applying statistical techniques and sciences.
17. Setting improvement objectives.
18. Identifying material and human requirements for improvement in the form of an action plan.
19. Provision of continuous and sustained support by top management.
20. Formation of a senior committee to coordinate improvement operations.
21. Keeping communication channels open for all personnel involved in improvement activities.
22. Continuous motivation and encouragement of human resources.

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