Innovations, modern technologies and their role in achieving sustainable development in the AL-Sharqat Agriculture Division

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Abstract

Agricultural advancements and state-of-the-art technologies are indispensable in improving production and productivity, as well as in ensuring sustainable food security. The purpose was to determine the role of new precision agricultural technology in sustainable development, especially on modern and innovative agriculture practiced by farmers in Al-Shirqat District, based on their opinions towards the application of recent agricultural technological innovation. The research investigated three categories of modern agricultural innovations and technology: physical (technological) innovations, biological innovations and chemical innovations. It further aimed to investigate any differences in agricultural employees' attitude types depending on selected personal characteristics (age, gender, educational qualifications and the attitude toward sustainable development) as well as ranking research domains by importance based on the order of the weighted percentage. Information was obtained by means of personal interviews. After coding/categorizing of data, SPSS (13.0) was employed for analysis, and various statistical measures including frequency distribution, range percentage arithmetic mean variance were used for reporting results. The state of the modern agricultural innovations and technologies was medium to high and was still increasing in general, where 82.36% of the collected participants in both questionnaires remained in the medium and high level. The technological innovations were ranked as first, biological and last under the research areas before the chemical innovations. Results: There were also statistically significant differences in agricultural workers' perceptions of modern technologies in agriculture depending on most of the analyzed variables, primarily according to age and sustainable development attitude. On the other hand there were no significant differences according to gender and degree.

Keywords: Agricultural innovations; Sustainable development; Modern; technologies; Agricultural technology.

Introduction and Research Problem

The demand for food is rising on a daily basis with population growth and climate changes that require enormous investments in agricultural innovation and modernization, driving-force technologies that help to ensure sustainability, productivity and production improvement, self-sufficiency as well as the security for food [1]. Introduction Food security is considered one of the most important challenges to the world in general and to Iraq specifically. This demands an expansion of the efforts to adopt modern technologies that will raise crop, livestock and fish production, and to specialize in economic crops which will generate

ISSN 2072-3857

foreign exchange for the nation [2]. The development of modern agricultural innovations has been significantly supported by organizations in advanced countries such as the Food and Agriculture Organization (FAO) and the World Bank, as well as in rich countries' ministries of agriculture. Developing a sound agricultural innovation system is now the focus and the mainstay to achieve sustainable development [3]. Modern agricultural innovations and technologies are indispensable in achieving economic and agricultural development [4]. A strong agricultural innovation system is built if higher institutions, research and development, transfers to the farmers extension services focus on family farming by giving adequate support according to what the needs and inputs are which contribute in providing solutions for their problems. Family farms are generally recognized as the primary source of innovation [5]. The Iraqi agriculture is suffering from a noticeable recession in production and productivity. At the global level, there is an emphasis on the role that agriculture can play in contributing to national inclusive growth and sustainable food production/sustainable food revolution [6]. The presence of up to date innovative agricultural systems and technologies that evolves with the rest of the world is a bedrock in rising to challenges of food security issues in any country [7]. As surprising as it may sound, modern farming and the technological advances in the field of agricultural research and development have an impressive potential to bring the sustainable development in the countries; however, the extent of application and utilization of these technologies in each of the regions is, again, uneven and influenced by the level of awareness and attitudes of people employed in the agricultural sector in addition to the technological aspect. A knowledge gap still exists in the Al-Sharqat district, in particular, with respect to the level of knowledge of agricultural employees on the significance of modern agricultural innovations and technologies and their actual role in ensuring realization of dimensions of sustainable development (economic, environmental and social).

- What challenges face modern agricultural innovations and technologies in achieving sustainable development?
- What is the descending order of the research domains?
- Are there differences in agricultural employees' perspectives regarding modern agricultural innovations and technologies?

Objectives of the Study

This research aims to:

1- Identify how the modern agriculture innovations and technology can be used to bring about sustainable development in Sharqat Agriculture Division.

2- Determine the awareness of the agricultural employees about the significance of modern agricultural technologies (technological, biological and chemical).

ISSN 2072-3857

3- Prioritize the spheres of contemporary agricultural advances in the context of obtaining sustainable development.

4- Determine major differences in the thoughts of agricultural workers concerning modern technologies in agriculture..

Statistical Hypotheses

The following hypotheses were formulated based on the independent variables examined in the study:

1. There are no statistically significant differences between the mean values of determinants according to respondents' age.
2. There are no statistically significant differences between the mean values of determinants according to respondents' gender.
3. There are no statistically significant differences between the mean values of determinants according to respondents' educational attainment.
4. There are no statistically significant differences between the mean values of determinants according to respondents' attitudes toward modern innovations.

Significance of the Study

This study becomes significant as it contributes in promoting sustainable development which will increase production and productivity, makes food secure and self-sufficiency for the farmers have economic returns on their investment through adoption and dissemination of modern agricultural practices/innovations [8]. Sustainable development with advanced agricultural technologies also contributes to the well-being of society and an improvement in living standards, as well as a decline in poverty. This research is therefore relevant for identifying problems and constraints to a better access to modern agricultural innovations required for a sustainable agriculture.

Operational Definitions

- **Agricultural innovations:** Modern tangible and intangible technologies that contribute to increasing agricultural production and productivity.
- **Sustainable development:** Optimal utilization of natural resources while preserving them for future generations.
- **Challenges:** Any obstacles hindering the adoption of modern agricultural innovations in the targeted area.
- **Agricultural employees:** All employees working in the Al-Shirqat Agricultural Division, regardless of specialization.

ISSN 2072-3857

Materials and Methods

Research Methodology

This study employed a descriptive statistical approach, most suitable for personal preferences and survey research [10]. This approach is grounded in the scientific and accurate description of real problems with an attempt to gain solutions through numerical data interpretation, creating a solid background for explanation of phenomena as well as precise scientific conclusions [11].

Study Area

The study was carried out in the mid of Al- Shirqat district, Salah Al-Din governorate, north of Iraq. It is located roughly 325km north of Baghdad, 118km south of Nineveh Governorate, about 122km from Tikrit and around 135 km west of Kirkuk. The district is famous for growing agricultural and vegetable crops including wheat[12].

Study Population and Sample

The study population included all agricultural employees working in the Al-Shirqat Agricultural Division, totaling **136 employees**. A random sample representing **25%** of the population was selected, resulting in a final sample size of **34 respondents**.

Questionnaire Design

The questionnaire consisted of two main parts:

Part One (Independent Variables):
Included questions on personal characteristics: age, gender, educational attainment, and attitude toward sustainable development.

Part Two (Research Domains):
Covered three domains:

1. Technological (physical) innovations
2. Biological innovations
3. Chemical innovations

A three-point scale (high, medium, low) was used for measurement, with a total of **40 items**.

Data Collection

Data were collected between **March 12 and 14, 2025,** through personal interviews with agricultural employees at the Directorate headquarters.

ISSN 2072-3857

Statistical Analysis

SPSS software was used for data analysis, employing variance analysis, range, and weighted percentage to ensure accurate and reliable results [13,14].

Results and Discussion

First Objective: Identifying the Role of Modern Agricultural Innovations and Technologies in Achieving Sustainable Development

The values representing the role of agricultural innovations ranged between **45 and 107**, with a mean value of **66.53** and a standard deviation of **6.30**. Respondents were classified into three categories, as shown in Table (2).

Table (2). Distribution of respondents according to their role in achieving sustainable development

Mean	Percentage (%)	Frequency	Score Range	Category
53.16	17.64	6	45–65	Low
74.87	47.06	16	66–86	Medium
86.11	35.30	12	87 and above	High
	100	**34**		**Total**

Mean = 66.53 SD = 6.30

The results in Table (2) indicate that more than half of the respondents fall within the **medium category**, followed by the **high category**. Accordingly, the role of modern agricultural innovations and technologies, as perceived by agrarian employees in Al-Shirqat District, can be described as **moderate with a tendency toward increase**. This may be attributed to the existence of several challenges related to the adoption of modern agricultural technologies that assist agricultural employees in achieving sustainable development and providing solutions suitable for farmers in the region.

Second Objective: Descending Ranking of Research Domains

The research domains were ranked in descending order based on their weighted percentage. The results are presented in Table 3.

ISSN 2072-3857

Table (3). Ranking of research domains according to weighted percentage

Rank	Weighted Percentage (%)	Maximum Score	Number of Items	Mean Score	Research Domain
1	58.40	45	15	26.28	Technological (Physical) Innovations
2	55.64	39	13	21.70	Biological Innovations
3	51.66	36	12	18.60	Chemical Innovations

Table (3) shows that **technological innovations** ranked first with a weighted percentage of **58.40%**, indicating that agricultural employees lack the capacity to provide modern agricultural machinery and equipment that contribute to food security. **Chemical innovations** ranked last, possibly because these innovations are more available and suitable for the targeted area and the cultivated crops.

Third Objective: Variance in Agricultural Employees' Opinions Regarding Modern Agricultural Innovations and Technologies

Age

Respondents' ages ranged from **20 to 59 years** and were divided into three age groups. The older age group recorded the highest mean score. One-way ANOVA was used to test the significance of differences among means, as shown in Table (4).

Table (4). ANOVA results according to age groups

Significance	Sig. Level	F Value	Mean Score	Percentage (%)	Frequency	Age Group
			25.56	29.41	10	20–32 years
Significant	**0.019**	**4.99**	32.78	35.29	12	33–45 years
			55.75	23.52	8	47 years and above
				100	**34**	**Total**

Since **P<0.05**, the null hypothesis is rejected, indicating statistically significant differences among age groups. To determine the source of variation, the LSD test was applied (Table 5).

ISSN 2072-3857

Table (5). LSD test results according to age groups

The findings suggest that the high differences were primarily between the old and the young respondents. The younger respondents had more capacity to eliminate barriers to sustainable development which can be explained by their more recent contact with modern media, communication technologies, and information sources through internet that increase awareness of modern innovations in the agricultural sphere..

Gender

Respondents were divided into two groups by gender (Table 6).

Table (6). ANOVA results according to gender

Significance	Sig. Level	F Value	Mean Score	Percentage (%)	Frequency	Gender
			57.80	67.64	23	Male
Not significant	**0.92**	**4.84**	44.38	32.35	11	Female
				100	**34**	**Total**

The results show that **P>0.05**, indicating no statistically significant differences according to gender. Therefore, the null hypothesis is accepted.

Educational Attainment

Respondents were classified according to educational level, as shown in Table (7).

Table (7). ANOVA results according to educational attainment

Significance	Sig. Level	F Value	Mean Score	Percentage (%)	Frequency	Educational Level
			23.44	8.82	3	Agricultural Secondary School
Not significant	**0.95**	**5.64**	33.48	17.64	6	Agricultural Institute
			58.33	41.17	14	College of Agriculture
			44.40	32.35	11	Postgraduate Degree
				100	**34**	**Total**

ISSN 2072-3857

Since **P>0.05**, no statistically significant differences were found according to educational attainment.

Attitude Toward Achieving Sustainable Development

Attitude scores ranged from **8 to 22** and were divided into three categories (negative, neutral, positive). One-way ANOVA results are presented in Table (8).

Table (8). ANOVA results according to attitude toward sustainable development

Significance	Sig. Level	F Value	Mean Score	Percentage (%)	Frequency	Attitude Category
			44.61	17.64	6	Negative
Significant	**0.030**	**2.089**	43.63	55.88	19	Neutral
			54.53	26.47	9	Positive
				100	**34**	**Total**

The LSD test result revealed that the significant differences were in favor of respondents with a **positive attitude**, indicating that individuals with positive attitudes are more inclined to believe in and adopt modern agricultural innovations and technologies due to their perceived role in achieving sustainable development.

Conclusions

1. The use of modern agricultural innovations and technologies is one of the crucial steps to attain sustainable development in Sharqat District.
2. Innovation uptake is also imbalanced among farmers because there is lack of knowledge, education and poor infrastructure.
3. The implementation of modern technologies will help to use natural resources reasonably.

Recommendations

1. Increase the spread and use of contemporary farming technologies in such a way that it fits the Sharqat District conditions.
2. Enhance extension and training initiatives in order to make the farmers more efficient in applying agricultural innovations.
3. Cooperation Support Supporting The agricultural sector and research institutions to combine agricultural innovations into sustainable development plans.

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ISSN 2072-3857

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ISSN 2072-3857