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ROLE OF AI IN CREATING SUSTAINABLE AGRICULTURE INDUSTRY

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Abstract

Urbanization is continuing, and the world's population is increasing. Consumption patterns are shifting, and disposable income is increasing. Farmers need to find a strategy to boost output since they are under a lot of pressure to satisfy the rising demand. There will be more people to feed in 30 years. Also, since there is a limited supply of fertile soil, standard farming methods will need to be modified. We must seek for methods to lessen or at the very least control the dangers faced by farmers. One of the most interesting possibilities is the global application of artificial intelligence in agriculture. AI has the ability to transform the way we think about agriculture by bringing about numerous advantages and allowing farmers to produce more with less work. Yet, AI is not a self-contained technology. Artificial intelligence (AI) is the next phase in the transition from conventional to creative farming. AI can support already-used technology.

AI isn't a magic bullet, and agribusinesses need to be aware of it. But, it can significantly improve modest, everyday tasks and greatly ease farmers' lives. So how can artificial intelligence be used for sustainable agriculture? What opportunities does AI present for farming, and how might it assist us in overcoming current problems? Our paper is divided into following sections:

Introduction: The study highlights the importance of the inclusion of AI-based models in the agriculture industry.

Literature review: The literature review contain the categorization of AI and the partitions of AI in performing the different task of harvesting processes.

Methodology: 55 respondents are selected for performing the survey analysis

Findings: All the hypotheses are met as the sig value is lower than 0.05.

Discussion: AI is involved in improving the effectively of all the tasks performed in the harvested field.

Conclusion: AI is helpful for enhancing the sustainability of all the procedures followed fir harvesting.

Key words: *AI based program, disease detector, harvesting crops*

Introduction

This study involved in reflecting on the responsibilities of AI in terms of developing sustainability in the agriculture industry. Moreover different types of applications that are developed with the help of AI are also incorporated in this project and along with that role of all AI-based technology are also discussed as well.

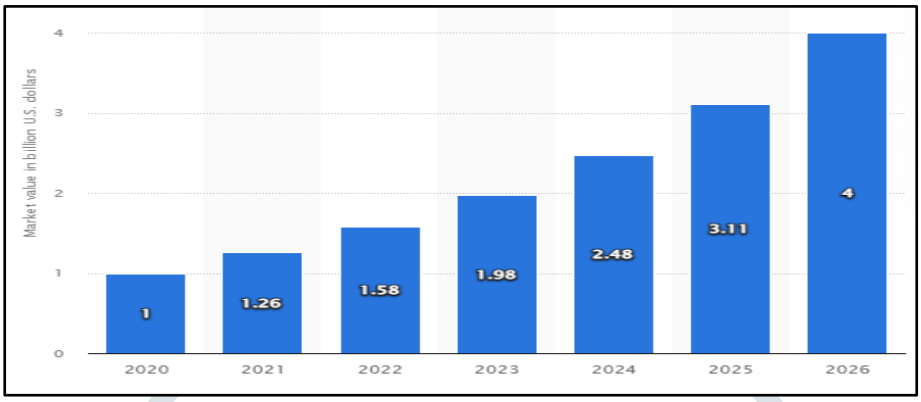

Figure 1: Impact of AI on developing the sustainable agriculture industry

(Source: Statista 2023)

As per the bar diagram, the utilization of artificial intelligence is increased and along with this the positive effect of AI on the economical growth of the agriculture industry is increasing as well (Statista 2023). The market value of the agriculture industry is 1.26% in the year 2021 and the value enhances and reaches up to 4% until the year 2026 (Statista 2023).

The main issues related to the utilization of several kinds of AI-based programs are high budgeting issues. All the AI-based programs cost too high a price and as a result of this situation, the farmers and the organizations of the agriculture industry experience financial issues while affording the high-cost AI-based programs (Sood, Sharma & Bhardwaj, 2022).

The significance of the study states the role of AI in the usability of agriculture industry.

Aim

The main motivation for developing a study is to highlight the roles of AI-based technology in incorporating sustainability in the agriculture business.

Research Objectives

- To recognize the role of AI for evolving sustainability in the work pattern of agriculture business
- To examine the positive impact of AI-based technology on maintaining sustainability in the environment
- To evaluate the other factors that influence the business culture of the agriculture firms
- To detect the necessity of formulating sustainability in the working procedures of agriculture companies

Research Questions

- What is the role of AI for evolving sustainability in the work pattern of the agriculture business?

- What is the positive impact of AI-based technology on maintaining sustainability in the environment?
- What are the other factors that influence the business culture of agriculture firms?
- What is the necessity of formulating sustainability in the working procedures of agriculture companies?

Literature Review

Overview of AI

AI refers to artificial intelligence that develops the capability of remembering all the memories the user put in a program. Therefore the program developed with the help of AI is involved in remembering the search options made by the user and performing suggesting other information on the basis of the previously searched information.

Figure 2: Categorisation of AI

(Source: Eli-Chukwu, 2019)

Among different categories, the most popular and demanding AI-based programs are reactive mechanisms that are involved in giving different types of reactions to the changes in the external environment of the mechanisms (Ampatzidis, Partel & Costa, 2020). Apart from this another category of AI is limited memory and as the name of this AI pregame suggests the limited capacity of AI. That means the users of this AI cannot put extra load on this AI program (Jha et al. 2019). Theory of mind is another category of AI technology that is involved in understanding the requirement of AI programs as well (Javaid et al. 2022). Therefore utilization of this AI was observed at an increased level as compared to the other AI-based programs.

AI-based applications are playing an effective role in developing sustainability in the agriculture industry. This is because AI-based instruments are involved in the resulting minimum amount of harmful effects on the environment. Therefore this lowering of harmful effects on the environment resulted in the accomplishment of the sustainable goal in the agriculture industry (Du, Wang & Hatzenbuehler, 2023).

AI in agriculture

The incorporation of AI-based technology in different processes of performing the harvesting process is helpful for making the process easier to perform for farmers (Qazi et al. 2022). Along with this farmers are getting the advantage of performing the same task by utilizing less time period than the previous one.

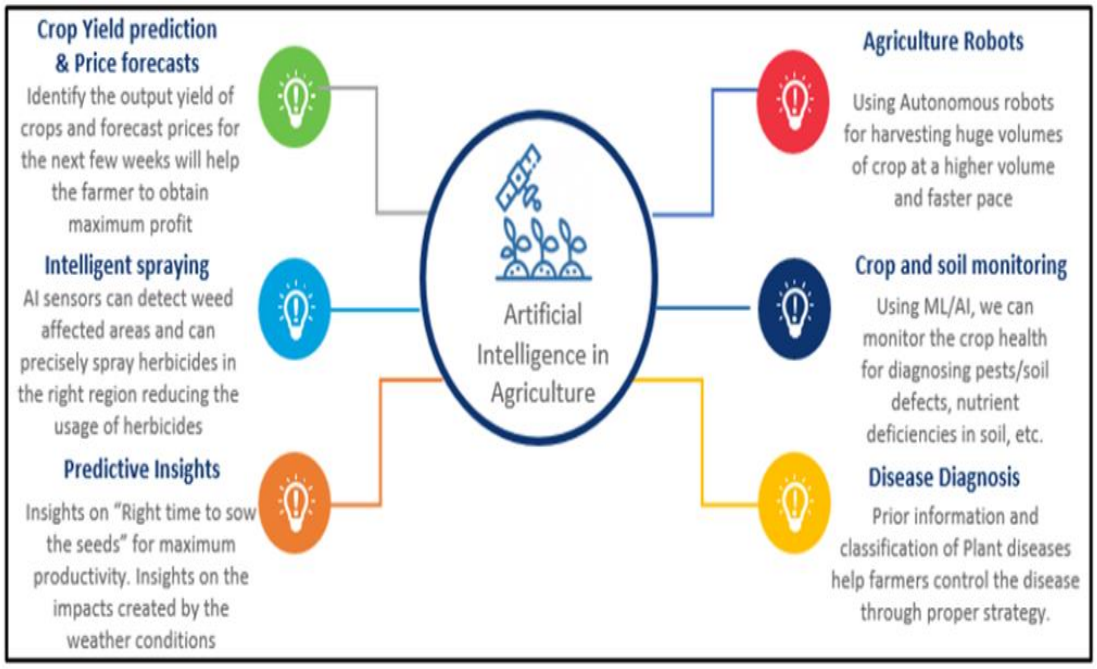

Figure 3: AI in agriculture

(Source: Khandelwal & Chavhan, 2019)

AI-based software is used to monitor as well as examine the quality of the soil and crops that are harvested by the farmers (Vincent et al. 2019). This help to evaluate the quality of the ultimately harvested crops. Along with this with the help of an AI detector, the farmers can detect the underlying plant diseases and the presence of indent in the growing crops (Jung et al. 2021). This help to maintain a superior quality of the crops. Heath monitoring of livestock is also performed by engaging different kinds of AI gadgets. Aerial surveys of the total field are performed with the help of different surveillance cameras and drones that are also operated with the help of AI-based technology (Misra et al. 2020).

General Theory of AI

The AI-based theory mainly involves the development of a network system that further contains different key elements (Nie et al. 2022). These key elements are involved in remembering all the temporary memories which help to modify the system. These systems are further involved in helping the user by remembering their key requirements. Therefore the general theory of AI is involved in developing the scope for the users and by utilizing those scopes the user can be able to utilize the AI in different aspects and modify the framework by incorporating the AI as well.

Methodology

Primary quantitative is chosen by the researcher for combining all the numerical information from the respondents of the people who took part in the survey procedure. 55 candidates are selected for asking 10 survey questions. As per the asked question, the survey candidates are given their feedback which is further gathered for analyzing procedure. The SPSS program is used in order to analyze the perception of the respondents that are provided in the

form of a feedback on survey questions (Marinoudi et al. 2019). It is a cost-effective strategy for collecting numerical data for a research work (Singh & Singh, 2020).

Findings

4.1 Demographic data

4.1.1 Gender

What is your gender?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	8.3	8.3	8.3
	Female	11	18.3	18.3	26.7
	Male	33	55.0	55.0	81.7
	Prefer not to say	11	18.3	18.3	100.0
	Total	60	100.0	100.0	

Table 4.1: Gender

(Source: SPSS)

Male Candidates of the survey procedure are involved in giving 55.0% feedback. Alternatively, female candidates also participated in the survey program and 18.3% feedback is given by them.

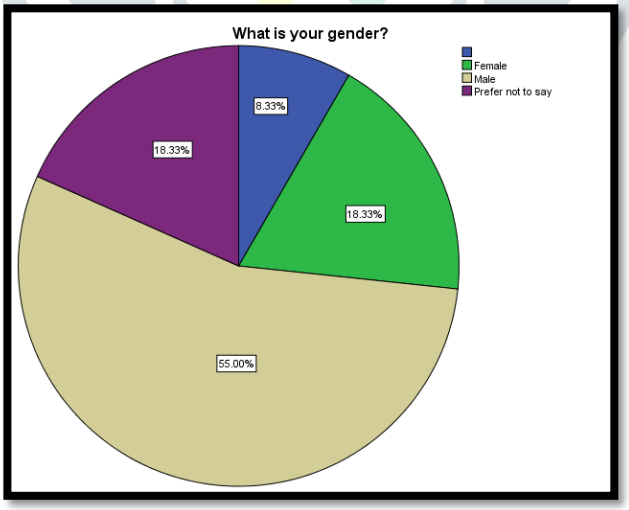

Figure 4.1: Gender

(Source: SPSS)

The upper limit of feedback is combining the male candidates of the survey procedure.

4.1.2 Age group

What is your age?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	8.3	8.3	8.3
	Between 25 to 35 years	11	18.3	18.3	26.7
	Between 36 to 45 years	22	36.7	36.7	63.3
	Between 46 to 55 years	22	36.7	36.7	100.0
	Total	60	100.0	100.0	

Table 4.2: Age group

(Source: SPSS)

25 to 35 years old Candidates of the survey procedure are involved in giving 18.3% feedback. Alternatively, 36 to 45 years old candidates also participated in the survey program and 36.7% of feedback is given by them.

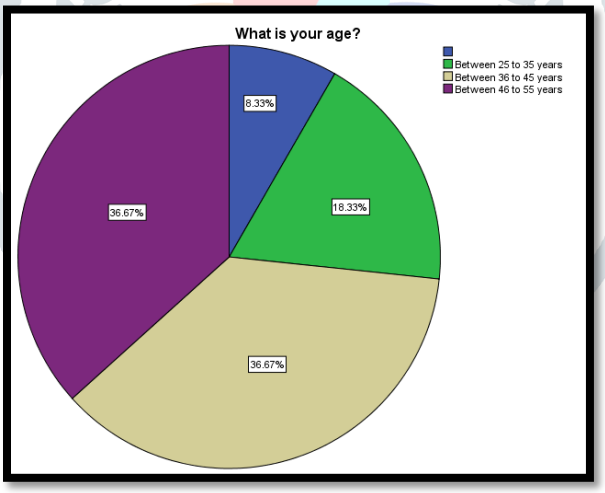

Figure 4.2: Age group

(Source: SPSS)

The upper limit of feedback is combining the 36 to 45 year old candidates of the survey procedure.

4.1.3 Income level

What is your income level?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		5	8.3	8.3	8.3
	Below Rs. 20000	11	18.3	18.3	26.7
	Between Rs. 21000 to Rs. 30000	11	18.3	18.3	45.0
	Between Rs. 31000 to Rs. 40000	33	55.0	55.0	100.0
	Total	60	100.0	100.0	

Table 4.3: Income level

(Source: SPSS)

Candidates earning a level of below Rs. 20000 of the survey procedure are involved in giving 18.3% feedback. Alternatively, the Rs. 21000 to 30000 income range of candidates also participated in the survey program and 18.3% of feedback is given by them.

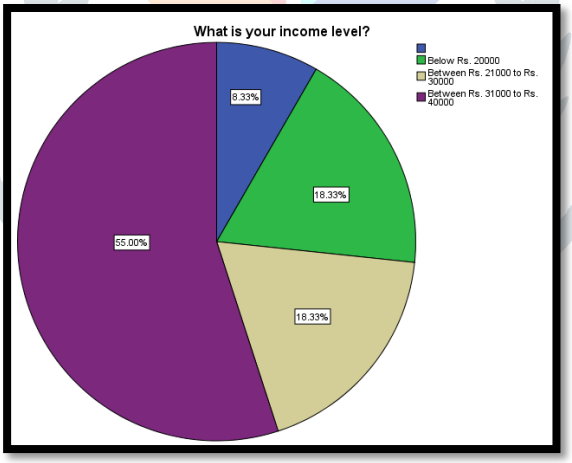

Figure 4.3: Income level

(Source: SPSS)

The upper limit of feedback is combining the candidates of Rs. 31000 to 40000 income range the survey procedure.

4.2 Descriptive data analysis

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
IV1	55	1	3	2.00	.638	.000	.322	-.431	.634
IV2	55	1	5	2.60	1.369	.771	.322	-.580	.634
IV3	55	1	5	3.00	1.427	.000	.322	-1.309	.634
IV4	55	1	4	2.80	1.177	-.373	.322	-1.388	.634
DV	55	4.00	13.00	7.0000	3.37749	.889	.322	-.620	.634
Valid N (listwise)	55								

Table: 4.4: Descriptive data analysis

(Source: SPSS)

The descriptive method of analyzing the data involved providing the mean, median and maximum ranges of different variables. Therefore the computed mean value is 2.00 to 3.00

4.3 Hypothesis 1: Relation between corporate policies and financial condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.189[a]	.036	.018	3.34777	.036	1.963	1	53	.167	2.744

Table 4.5: Model Summary

(Source: SPSS)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	22.000	1	22.000	1.963	.167[b]
	Residual	594.000	53	11.208		
	Total	616.000	54			

Table 4.6: ANOVA

(Source: SPSS)

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	5.000	1.497		3.340	.002
	IV1	1.000	.714	.189	1.401	.167

Table 4.7: Coefficient

(Source: SPSS)

The acquired sig value is minor as compared to the range of 0.05 therefore in this case the hypothesis is met.

4.4 Hypothesis 2: Linkage between inflation rate and financial condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.485[a]	.235	.220	2.98210	.235	16.268	1	53	.000	3.215

Table 4.8: Model Summary

(Source: SPSS)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	144.674	1	144.674	16.268	.000[b]
	Residual	471.326	53	8.893		
	Total	616.000	54			

Table 4.9: ANOVA

(Source: SPSS)

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.109	.869		11.628	.000
	IV2	-1.196	.296	-.485	-4.033	.000

Table 4.10: Coefficient

(Source: SPSS)

The acquired sig value is minor as compared to the range of 0.05 therefore in this case the hypothesis are met.

4.5 Hypothesis 3: Interrelation between marketing segment and financial condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.676[a]	.457	.447	2.51186	.457	44.632	1	53	.000	2.321

Table 4.11: Model Summary

(Source: SPSS)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	281.600	1	281.600	44.632	.000[b]
	Residual	334.400	53	6.309		
	Total	616.000	54			

Table 4.12: ANOVA

(Source: SPSS)

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.800	.794		14.855	.000
	IV3	-1.600	.239	-.676	-6.681	.000

Table 4.13: Coefficient

(Source: SPSS)

The acquired sig value is minor as compared to the range of 0.05 therefore in this case the hypothesis are met.

4.6 Hypothesis 4: Bonding between stakeholder engagement and financial condition

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.461[a]	.213	.198	3.02496	.213	14.320	1	53	.000	3.239

Table 4.14: Model Summary

(Source: SPSS)

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	131.029	1	131.029	14.320	.000[b]
	Residual	484.971	53	9.150		
	Total	616.000	54			

Table 4.15: ANOVA

(Source: SPSS)

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	10.706	1.061		10.092	.000
	IV4	-1.324	.350	-.461	-3.784	.000

Table 4.16: Coefficient

(Source: SPSS)

The acquired sig value is minor as compared to the range of 0.05 therefore in this case the hypothesis is met.

Discussion

The key roles performed by the AI-based programs for maintaining as well as incorporating the sustainability in different processes that are followed in the agriculture business. Along with that, it has been noted that AI is developed in such a way that it affects the minimum amount of harm to the environment. Moreover, an AI-based system has developed the procedure of purifying the water that helps to improve the harvesting process (Talaviya et al. 2020). Additionally AI systems also help to develop programs that can be run by consuming less energy (Eli-Chukwu, 2019). Therefore AI is involved in lowering energy consumption and generating sustainability in the environment. This work has not highlighted the challenges the users face while incorporating the AI base programs in the agriculture business. Lack of information is the main reason for developing this situation of lowering the scope of incorporating the opportunity of describing the challenges of AI.

Conclusion

Thus it can be concluded that AI-based technology is involved in increasing the effectiveness of each of the processes that are performed in the harvesting process of different crops. Moreover, it has been observed that the involvement of AI-based technology is also helpful for evaluating the quality of the harvested crop product.

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Appendices

Appendix 1: Survey Questions

Q1: What is your gender?

Q2: What is your age?

Q3: What is your income level?

Q4: AI based technology help to enhanced the harvested crop quality

Q5: Soil testing are also done by the utilization of AI based technology

Q6: AI detector is capable to detect the underlying diseased condition of the harvested plants

Q7: Inclusion of AI makes the harvesting process easier than before

Q8: While implementing the AI the farmers experience economical issue

Q9: The agriculture industry require to meet all the sustainability goal for protecting the climate from different changes

Q10: The accomplishing of the sustainability goal is involved in improving the environmental balance