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The Application and Optimization of Extensive Data Analysis in the Evaluation of the Effect of Marketing Strategies on Agricultural Machinery Enterprises

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Abstract

It is well known that one of the most important things for businesses to grow is to make decisions. There are many issues for them, and most of them involve money. AI models will be used to determine how the chosen agroeconomic factors connect to data from digital marketing in this study. Explaining how these measures decide what to do in detail is essential. On the websites of five well-known farming companies, the numbers of the indexes were written down and put together to make a collection. Stress and sadness tests were used to see if the score had anything to do with information about how farming companies use digital marketing. ANN models were used to make these links work so that they could be used. It's important to know where the advertising traffic comes from, the business costs paid and those not. These steps allow this link to work. Many people are telling big farming companies to spend more on the AI and digital marketing data apps they like.

They will learn more about how to get a job in their field and how prices for things like tools, medicines, and farm supplies change over time. After reading this, they can make better choices and business ideas.

Keywords: agroeconomic indexes; big data; AI; ANN; digital marketing; digital transformation; predictive analytics; agriculture; decision support systems (DSS)

1. Introduction

This term, which can also be written as "eco-efficiency," tells us how environmentally harmful the things we make are. To do this, it checks how well the acts boost the economy (by seeing how well they use resources) and the environment. [1] "Optimizing eco-efficiency" means ensuring that work is as eco-friendly as possible while getting the most done. As more and more fields try to be better for the earth, studies have shown this takes place in many ways. This happens in many areas, such as farming, tourism, energy, and mineral research. Being nice to others is an excellent way to learn how to grow over time. In many places, farming is the main way people make money. This is something that should be kept in mind. That's why many academics worldwide have chosen to study the environmental impact of farming (AEE). All over the world, agricultural growth is having a hard time right now [3]. Many people have trouble getting water, and there is not enough land to grow. They have clarified that we need to speed up the rate at which fields make food immediately.

Remember that using a lot of fertilizers, chemicals, farming tools, and other things has made the land dirty and hurt the environment. This is still true even though it has led to more carbon pollution and more food being grown. [4] It has been like this even though they have tried to make fields more useful. In a study, the Intergovernmental Panel on Climate Change (IPCC) said that rising temperatures have caused unusual weather and climate events to happen more often and with more force. This trend will continue in places with moderate to high pollution levels. [5] In the past few years, farming has become a major source of greenhouse gases worldwide. About 23% of all greenhouse gas pollution comes from people who farm, cut down trees, and do other things on land. Carbon dioxide, on the other hand, makes up 75% of all greenhouse gases. Much of the carbon dioxide that enters the air comes from making things, moving them, and farming with chemicals and fertilizers. More and more countries around the world depend on agriculture for their businesses. Also, everyone is under a lot of pressure to cut down on carbon pollution. This is why you should ask AEE.

Farmers worldwide have changed how they work the land to grow food and other crops. Different people live different lives, and more are moving to cities. This means that agri-food things are made and eaten in various ways. Some plants benefit from farming, but there aren't many natural supplies. Because of this, plant farmers and agriculture experts have had to develop new ways to feed everyone. [9] New and valuable tools and technologies have been used in the farming and food businesses. On the other hand, reports say that we need to find and/or improve the farming and food tools already out there to help end hunger and make up for the lack of things by making more. "The question of whether scientific discoveries can sustainably and effectively feed everyone by 2050" is a big deal in the farming and food business because of this [10]. This is true all over the world. Digital technology can be "flexible technology that will revolutionize food production in the world's most important

areas." "Digital Agriculture" (DA) in farming means using new tools, tracking and analyzing data, and solutions that are based on data to make farming better and/or more efficient [11].

For instance, DA can help improve the quality and output of crops, cut down on waste, and stop the spread of diseases and pests. IT (information and communication technology) can gather information in distributed agriculture (DA). You can get this info from many places, like sensors, connected devices, smartphones, storage, and other ways to send data (3G/4G/5G coverage, low-speed terrestrial or satellite networks, clouds). DA could be used in various types of gardens and for varying production amounts. This technology could help farms get better advice on how to grow food. Support services could give new farming advice based on automatically received data, and water management could be done at the territory level [12]. That's not all. It can also improve sources like seeds and the link between the market and output.

"Digital technologies in agriculture" usually refers to getting more information "in the field." Robots, AI, and networking methods are a few of the other important parts.

With these digital tools, planning farming tasks, paying for them, keeping track of them, and monitoring many tasks and results are more accessible. Tech tools like animal care, communication, and farm tools have made farming easier. Interestingly, [13] DA handles many issues connected to agriculture and the food business. Some easy ones include using cell phones to get tech help and monitor farms. When you use satellites and the Global Positioning System (GPS), it's more difficult to guess the weather. A group of tools that try to be smart like people. This lets computers somehow act and think like people to learn, reason, plan, and choose for themselves. "AI" stands for "artificial intelligence." These are tools that try to behave and think like people. ML (machine learning), deep learning, natural language processing, and other technologies are all parts of AI. These technologies could be helpful in many places and areas. "big data" refers to many different types of data from computers, phones, the internet, and other places.

There is both organized and unstructured data in this set. Aside from writing, there is also video, picture, and text. An important thing to remember about these data sets is that they are swift and have a lot of parts. This is why they must be saved, processed, and examined with the latest spoke technologies. These types of tech are now often called "big data technologies." A lot of data can help the food industry figure out what people want, make food safer and better, and improve the flow of goods. It can also help companies compete better and get more new customers. Each tool is handy, but they also work well together. Today, these two tools are essential in the food business. They are changing how the business grows and how new ideas are made. AI is used extensively in many areas, such as banking, transportation, industry, games, healthcare, and processing. AI could simplify things, cut costs, and improve service. Some very big amounts of AI have also been used in the food business.

Large amounts of data, the blockchain, smart devices, expert systems, and ANFIS (adaptive neuro-fuzzy inference system) technology can all help make many things more accessible. They can help you figure out what kind of food something is, make it, sell it, keep an eye on it, make it better, and run the supply chain. Now, it's easier than ever to make food safer and better. Food companies can now use machine learning to help them make better choices about running their businesses and making food. Many things must be done to ensure the food is safe and of good quality. Big data is a useful tool that the food business can't do without. On the other hand, AI is a handy tool that shouldn't be forgotten. A lot of data can be helpful to businesses using tools for "big data analytics." They can use these tools to learn important things, like what customers like and what market trends are. Food businesses could better understand what the market wants by analyzing big data. This would improve supply lines, lower waste, and make production more efficient.

You never know when blockchain technology and big data technology might be able to work together. With blockchain technology, it might be possible to keep track of where food comes from and how good it is. That way, everything would be clear from the farm to the consumer's plate, and people would get better information about what they buy. [15] Perhaps AI and big data will be used more in the food business in the years to come. It's because technology keeps getting better, and people find new ways to use it. Since they are there, the food business will change for the better and get tougher. The food business will have more chances and problems to solve because of this. It is said that certain key magazines are essential sources of information since they show how science and technology are constantly changing.

2. Literature Review

All of these pieces are in this part. First, the main ideas behind "big data" in farming are discussed and broken down. [16] If you read the following line will speak of the leading machine-learning methods used in farming big data. After this part, we'll discuss the main ideas behind data types and store sources.

2.1. Agricultural Big Data

Tech called "Big Data" is used when the data is too complicated to figure out what's wrong. People often use the four measures, also known as the "four V's," to describe it. The first number, V, tells you how much data a data source gets, stores, and works with so that it can be looked at later. The second V represents various data types, as many forms, sizes, and patterns exist. You can get data in two forms: raw and semi-structured. Raw data is not organized, while semi-structured data is. The third thing that can change is how quickly the message is sent. The data needs to be changed and looked over before the job can be finished. The fourth V stands for "veracity," meaning the data can be checked to ensure it is correct. Being honest is the fourth trait. Big Data lets engineers and scientists simultaneously look at a lot of data from various sources. This makes it faster to find patterns and trends. In the past few years, "Big Data science" has become a meaningful way to look at vast amounts of data. [18] There are a lot of different areas of artificial intelligence that work together in "big data."

A lot of these are machine learning. Math, computer science, and statistics are a few of these. It includes many things, like computer systems, machine learning, and distributed systems. Semlali et al. use Big Data methods to keep track of things like what's in the surroundings. It's made up of different parts that work together. They take in data, store it in Hadoop, handle it, put the system together, and watch over it to ensure it's safe. [19] Some of what they knew came from records of how much waste businesses, farms, and cars caused. Writing staff could always check on how the atmosphere was made with the help of remote sensing. Figure 1 shows the steps that need to be taken.

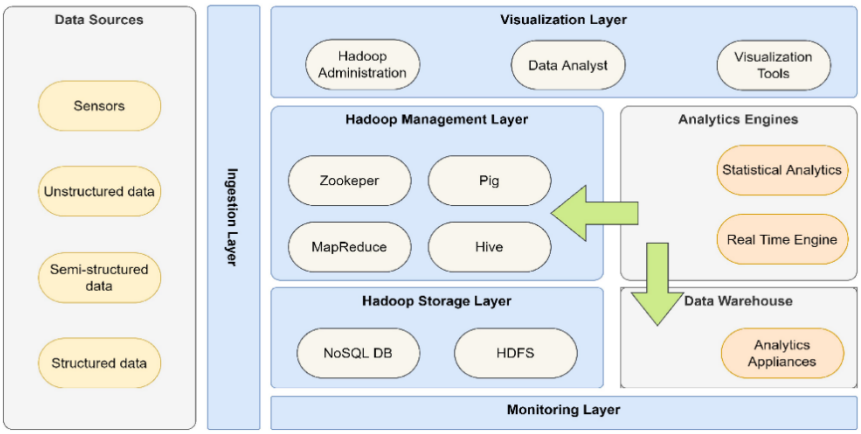


Figure 1. Big Data architecture for atmospheric composition monitoring.

Researchers have been primarily interested in how to make farming more digital since a few years ago. It's good that China is making these changes to become an economic power. Promoting healthy farming growth through technology is an excellent way to ensure farming power grows. [20] Researchers and makers have learned more about making things that people can buy in stores and have made some progress as farming has become more digital. Using computers and the Internet in agriculture has been the subject of many studies in the US and other places.

2.2. Agricultural Digitalization

How well farmers use new technology is a big part of how far they can go. China's farming business is changing and improving significantly in 2020. Digital tools and IT will be essential for making farms more productive. [21] Newer studies have looked at ways to make things use less energy and be better for the environment. They have also looked at ways to make the energy system better. In these books, however, the idea of "digital agriculture" is not talked about. There are many good things about the rise of digital agriculture, which has already begun to change farming. It's smart to go digital with traditional farming to keep up with how farming is becoming more modern. It's also the only way to help rural areas grow and improve farming. Information technology and digital innovation can make farms more efficient, leading to more crops being grown. The most important things that need to be done are to boost harvests, farms, and access to farming information. Some more digital services and facilities can be built and used because of these things.

Supporting the digital growth of good farming is important to bring it into the 21st century, make it more competitive, and improve it all around. A good place has been set up to teach and learn about farming technology because it is quickly changing. This is true regarding robots, AI, and looking at a lot of data.

2.3. Gap in the Development of Agricultural Digitalization

People who don't use digital farming might not be able to eat enough of their food to stay alive. Farmers in Australia are afraid to go digital with their farming because they don't know who owns the data, how to keep it safe, or how to keep safety and trust safe. China is just now starting to think about how going digital could change farms and everyday life in the country. And farming needs to use even more technology. System services, some parts of the system, and the whole thing don't work right. In any case, how most farms make a living still hasn't changed much because technology has helped the economy grow. A big part of making farming more modern and better at what it does is now digitizing it. Farmers still can't go digital [22], but the process is moving forward and getting bigger. In 2020, Luo Junwen talked about technology and skills. She said there aren't enough skilled workers in China, and some parts of the country aren't very tech-savvy. To fully automate farming, much work still needs to be done.

People who work in agriculture don't have enough digital apps, and not enough full-data tools are being made. This makes it take longer to study and make digital technologies. Also, digital agricultural research institutions need a lot of time to turn their scientific and technological findings into digital ones. Besides, there aren't enough fresh ideas for how related services can work together. There could be as more farms switch to digital farming. This is because not every farm has the same computer tools. As technology in farming grows, these problems show the problems that come up with digital infrastructure, digital technology, skills, places that can help, and other things. This slows down digital farming right away.

2.4. Strategies for Implementing Agricultural Digitalization

Some countries have planned how they will digitize their farming. So that people worldwide can help each other, countries like Turkey, Albania, and others have chosen to work with farming groups to make rules for digital agriculture in their own countries. These kinds of deals were made so that help could be given. [23] The United States and Germany have discussed how hard it is to use technology on farms. It will help make ways to process food better for the environment. Sensors will be added to dairy farms to help monitor their health as farming becomes more computerized. As farming has become more digital, tools from many different areas have come together to make new tools. Many things make an ecosystem problem harder to solve, like the temperature of the ecosystem and the fact that many businesses work together. To make the change to digital easier, come up with several excellent, three-dimensional, and one-of-a-kind ways to do things. For example, you could use the industry chain to set up groups working on new ideas.

However, by improving tools and services in rural and poor areas, vital farms and rural areas can easily become more digital. Agriculture is improved in four ways: infrastructure, output, and sales. [is essential 24] The farming business in China should let the market decide how to share more in the process. Digitizing farmland more and more will make it possible to keep track of all of its inputs, outputs, and circulation smartly and correctly. Because of this, agriculture and remote sensing are suggested to become more digitalized, and places that work together get the right amount of growth and scale. You should also change the way you think about the growth of digital farming. Changing how digital agriculture is built and run is one way. One way is to rebuild data about how well output factors are spread. This has to be done.

2.5. Impact mechanism of Big data analysis on marketing strategy

The most critical ways that extensive data analysis has changed how marketers do their jobs are listed below: The more information a company has about its customers, the more it can learn about things like what they like, how they use social media and more. Firms can learn more about their customers' habits this way. This data will help companies decide what goods to make, how much to charge for them, and how much money to spend on ads. They will also learn more about what people want and how the market changes [25]. When businesses look at a lot of data, they can better find the places and groups of people who might buy from them. There are times when this can help a market come together. Companies' information about their customers helps them divide the customer base into market segments and groups. That helps them make ads and plans that reach the right people and determine where to stand in the market. Getting to know the client: To do personalized marketing, you need to look at a lot of data and figure out what it all means.

3. Materials and Methods

3.1. Methodological Framework

The authors used artificial neural network models to find a new way to look at economic factors in agriculture and how businesses in agriculture make decisions. I did this after studying the subject for a long time. One way was to get a lot of information from websites, put it all together, and figure out what it all meant. Then, data and models, like an AI model, were

used to look at the information. The following methodical analytical technique was used to help judge the study ideas in the paper and give more details about how farming companies' big data affects their agroeconomic indexes. getting a lot of data from business websites, organising it, and getting the needed databases: In this step, you can use the DSS website tool to look at data from business websites. This lets you see what the chosen extensive data metrics were worth in the past. This is the step where the data is taken out. has the agroeconomic measures that were used in this study. On November 8, 2023, it was looked at. Things from the past discussed the time between July 1, 2022, and January 31, 2023, were found.

The Mental Modeler website platform DSS lets you do statistical study. Then, you can use Fuzzy Cognitive Mapping (FCM) to make a mental area. So that they could get valuable coefficients for how the factors were related, the writers did the proper statistical work in this step. They used association models, descriptive statistics, and linear regression models. After that, the OLS and descriptive statistics for the factors were added to the FCM model. The FCM result helped this study find a way to show how all the parts that were looked at were connected. Looking at the second model helped them understand the factors in the research and the world in general. The agroeconomic index will change over. A mixed modelling process will be used to show this. The AnyLogic computer modelling DSS will be used to do this. This hybrid model (HM) aims to show how the agroeconomic measures change over the test period when dynamic factors and agent-related variables are present.

An artificial neural network data about how people who visited the farm blog behaved online. This model looked at the behaviour of people who used the website. To go with this guess, it was thought that these digital behavioural measures would show how people behave and how they usually spread. The drill worked because it was done this way over and over: Because the ANN model was set up to be close to a normal distribution, agents (ABM) act on digital behaviour measures found by the model when people visit the farm website. Then, these agents go into the statecharts of the model. Because the model's dynamic variables are dynamic, the numbers of their factors change constantly. Since the agents are moving, this is the case. You need the settings and other information from the step before this one to run the whole HM simulation.

3.2. Research Sample

People in the agricultural business were asked to give a lot of data so that the above study method could be used. The five farming companies that cut were chosen based on how much money they could make in 2023: Olam Group, Corteva, Escorts Kubota, and AGCO. These groups do business all over the world. So, this had to be done so they could do their job well. A lot of the information used in this study came from the websites of the farming companies that were looked at. The index numbers came from Statista and covered the years 2022–2023. From July 1, 2022, to January 31, 2023, the Semrush DSS platform was used to get a lot of data from the picked farming companies. The exact amount of time. In Table 1, you can find out more about the companies picked.

Table 1. Description of study agricultural enterprises.

Firms	Market Cap Q3 2023 USD	Number of Employees	Total Revenue 2023 TTM USD	Fields of Operation	HQ Location(s)
AGRO	8.11B	14,500+	03,065M	Grass and hay, seeding and tilling, smart farming, grounds care, food storage, etc.	The United States, South Africa, China, Australia, Brazil, and Switzerland
Corteva	22,02B	10,000+	06.233M	Seeds, fungicides, herbicides, insects, seed treatments, and other things protect crops.	USA
Kubota's sex life	2.20B	10,000+	0.07B	Agricultural machinery, construction and material handling tools, railroad tools, car parts, etc.	China
Hashetas	37.07B	20,000+	4.15B	Food for plants, seeds, animal health, environmental health, crop defence, etc.	Turkey

Firms	Market Cap Q3 2023 USD	Number of Employees	Total Revenue 2023 TTM USD	Fields of Operation	HQ Location(s)
Olam Group	2.64B	71,000+	13.574B	Farming food items, tech solutions, growth plans for new businesses, packaged food, palm oil, and more.	In Burkina Faso

4. Results

4.1. Statistical Analysis

Stats were used to get the factors the writers needed from the variables' relationships after choosing the research method and sample size. In the first part of Table 2, you can see some basic information about the variables that depend on and those that don't. In this study, Table 3 shows how the factors are linked. These two tests returned with alpha values greater than 0.7, which means they agreed with how the advertising prices variable was made. That number here shows how much cash was used for paid and free ads. In other words, the variable makes sense and can be used for statistical research (Table 4).

Table 2. Data analysis.

	Mean	Min	Max	Std. Deviation	Skewness	Kurtosis
Costs of advertising	135,014.55	036,060.00	315,387,00	78,115.20	0.060	0.605
Sources directly	212,173.46	152,503.00	300,416.00	42,572.06	0.525	−0.552
Sources of Referrals	262,076.32	174,511.00	441,061.00	77,318.20	0.352	0.800
Sources from society	4874.03	1320.00	00,881.00	1885.20	0.620	−0.082
Look for Sources	036,024.18	85,865.00	082,027.00	21,250.05	−0.062	−0.403

Table 3. Analysis of correlation.

	Advertising Costs	Direct Sources	Referral Sources	Social Sources	Search Sources	Bounce Rate	Pages per Visit	Time on Site	New Customers	Old Customers
Costs of advertising	0	086	−038	257	−020	−038	−202	217	140	−006
Sources directly	086	0	320	112	−015	181	642	−114	588	567
Sources of Referrals	−038	320	0	−322	180	504	268	265	647 *	808**
Sources from society	257	112	−322	0	144	−507	−006	016	128	−005
Look for Sources	−020	−015	180	144	0	−376	107	102	253	288

Table 4. Ad cost consistency.

	Cronbach's Alpha	Kaiser–Meyer–Olkin Factor Adequacy
Costs of advertising (costs of free and paid traffic)	670	685

Users of agri-food company websites were asked to rate how often they leave right away and how often they return. Table 5 shows the findings. It's important to note that the p-values are less than 0.05, and the R2 number is 0.708. What this means is that the linear regression model is correct. When both the bounce rate and the number of return customers go up by 1%, it costs agri-food companies 255.4% more to advertise and 376.7% more to advertise. With p-values less than 0.05 and an R2 value of 0.632 (Table 6), the linear regression model of advertising spending, which looks at how long people stay on a website and how many pages they visit, has been proven to be correct. Prices for food and farm product ads go up by −284.8% to 109.7% for every 1% rise in the number of pages viewed and the amount of time spent on the website.

Table 5. Website bounce rate and returning customers affect agri-food advertising expenditures.

Variables	Standardized Coefficient	R^2	F	*p*-Value	D-W stat
Bounce Rate	−1.443	607	1.075	038 *	0.017
Customers Who Come Back	−2.656			010 *	0.883

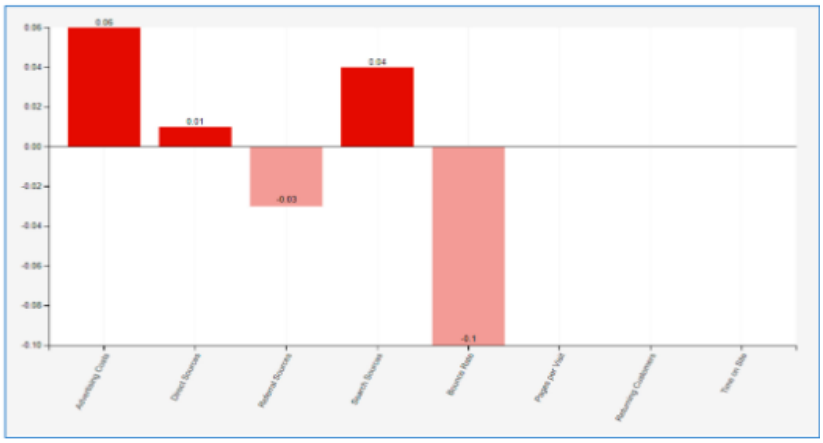
Table 6. Pages per visit and site time affect agri-food advertising expenditures.

Variables	Standardized Coefficient	R^2	F	*p*-Value	D-W stat
Pages per Visit	−1.737	521	0.680	014 *	0.151
How Long on Site	−0.086			036 *	0.878

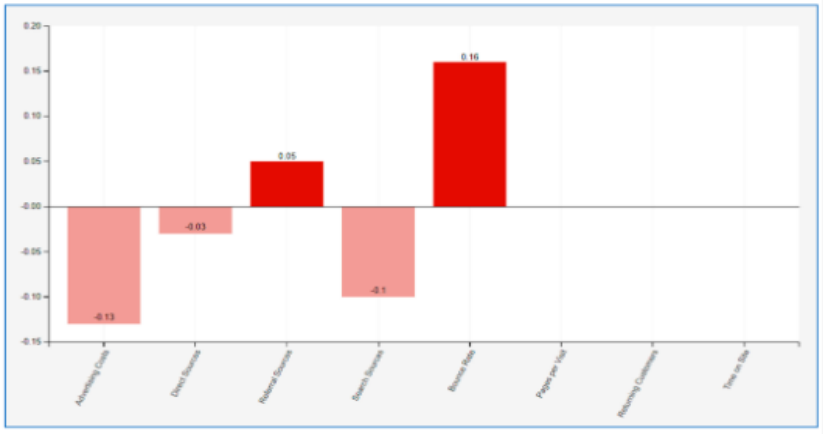
4.2. Fuzzy Cognitive Modeling Scenarios

It is much easier to see how well digital marketing works in the farming and food business with Fuzzy Cognitive Modeling (FCM). It can handle that this place isn't always easy. FCM models how many factors are strongly linked and how they impact each other to analyze real-life cases and help people make good decisions. Market trends, how customers act, and how the supply chain works are a few of these things. In FCM, your thoughts and numbers come together to give you a complete picture of how well marketing is going. This is an excellent way to find signs of big wins that will help you keep growing. Everyone can see and change it, which makes it easy to understand complex deals and improve digital marketing plans. This lets you plan and choose how to use your resources when the market changes. They used FCM models to show that it is possible to stop food waste with the proper rules. It was used in the study by Sarkar et al. to see how useful it is to store food in the food business as a whole.

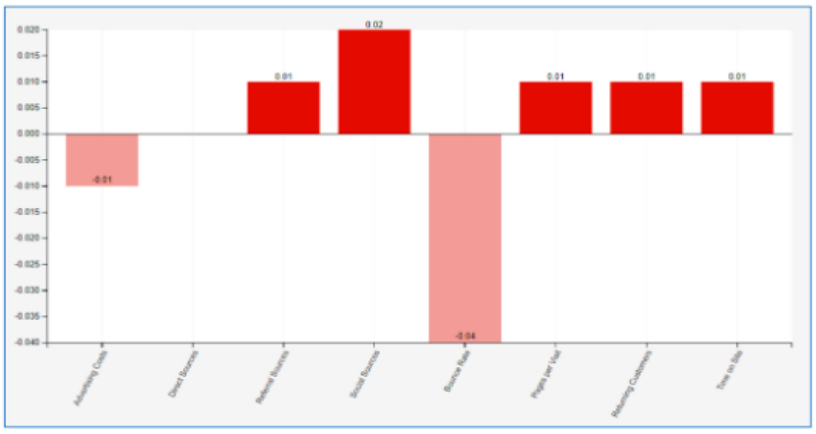
The following five cases are used in the following scenario, which is all about search and social sites. The "social sources" score is worth 100% more in the first case. You can see that there are a lot fewer social sources in the second case. There were 100% more search sites in the third case. It dropped by 100% in the fourth case. At the end of the story, two things change. Search sources become 100% more valuable, while social sources become 100% less valuable. During the process, the other things stay the same. To see how the main KPIs of digital marketing efforts for food and crop businesses change, see Figure 2a–e. It shows the different types of social and search traffic sources that were used.


0.05
0.01
-0.03
0.04
-0.1
Advertising Costs
Direct Sources
Referral Sources
Search Sources
Bounce Rate
Pages per Visit
Returning Customers
Time on Site

(a)


-0.13
-0.03
0.05
-0.1
0.16
Advertising Costs
Direct Sources
Referral Sources
Search Sources
Bounce Rate
Pages per Visit
Returning Customers
Time on Site

(b)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-0.04
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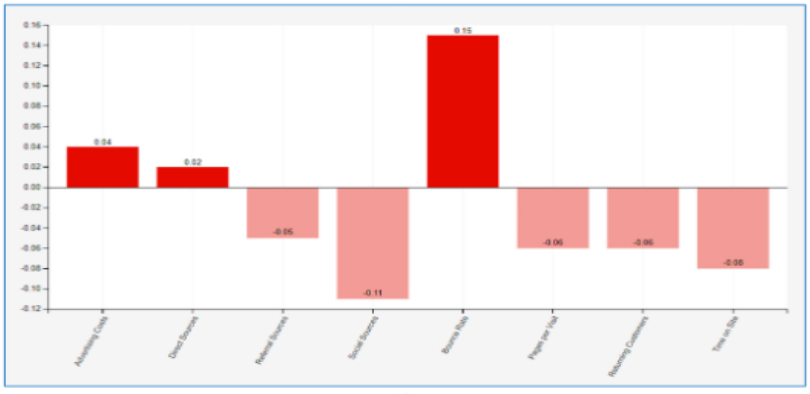
Advertising Costs
Direct Sources
Referral Sources
Social Sources
Bounce Rate
Pages per Visit
Returning Customers
Time on Site

(c)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0.02
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Advertising Costs
Direct Sources
Referral Sources
Social Sources
Bounce Rate
Pages per Visit
Returning Customers
Time on Site

(d)

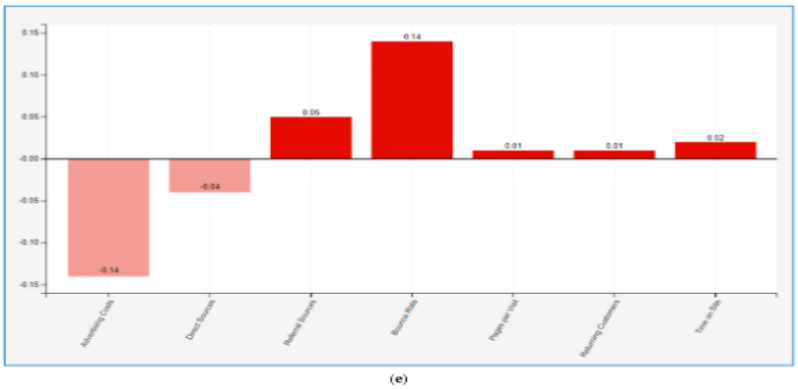

Figure 2. Effect of 100% social sources increase. (b) Impact of a 100% social sources decline. (c) Impact of 100% search source growth. (d) 100% search source reduction impact. (e) Effect of 100% search source increase and 100% social source decrease.

4.2.1. First Scenario: Increase the Social Sources Variable by 100%

Figure 2a shows the first case. In this case, the number of "social resources" keeps increasing by one hundred per cent. Because of this, the downlink decreases by 3%. Because there are 4% more searches and 1% more direct sources, the promotion cost also increases by 6%.

4.2.2. Second Scenario: Decrease the Social Sources Variable by 100%

In the second case, shown in Figure 2b, the social sources variable is split in half. It's 10% less likely that those sources will be search sources and 3% less likely to be straight sources. 5% more links came from those sources, but 16% more people left the page right away, as shown by the bounce rate statistic. Since these changes were made, the number that shows how much it costs to promote has decreased by 13%. This is a big deal.

4.2.3. Third Scenario: Increase the Search Sources Variable by 100%

The third case of the exercise is then run, which you can see in Figure 2c. The search sources button is now 100% bigger than it was before. This makes the referrals and repeat buyers all go up by 1%. For social sources, it's 2% better. Because of these changes, the unknown for the cost of ads goes down by at least 1%. This thing called "bounce rate" also goes down by 2%.

4.2.4. Fourth Scenario: Decrease the Search Sources Variable by 100%

The fourth case halves the search sources variable (Figure 2d). That means people spend up to 8% less time on the site, viewing 11% fewer pages each time and buying 5% less often. Referral sources go down by 5% as well. The "bounce rate" number goes up by 15%, but the "direct sources" number only goes up by 2%. The number shows how much advertising costs rise by 4% when everything is said and done.

4.2.5. Fifth Scenario: Increase the Search Sources Variable by 100% and Decrease the Social Sources Variable by 100%

The fifth case (Figure 2e) happens last but not least. The search sources and social sources factors were both changed at the same time. Bigger search sources and smaller social sources were the changes that were made. The bounce rate goes up by 14%, not the number of link sources, which goes up by 5%. The number of return buyers, the time spent on the site, and the number of pages looked at each time would all go up. But the number of direct sources drops by 4%. This makes the number that shows how much ads cost go down by 14%. In any case, this is the most significant drop that shows how much TV ads cost.

5. Discussion

Table 3 shows that the factors are spread out in several different ways. You can learn new and interesting things from the skewness, which shows how off the spread is. But the prices of advertising, are all going up. There are many numbers, and most of them are near the top. Some farming and food businesses spend much more on ads, programs, and other things that attract new customers and keep old ones interested. On the other hand, the numbers for search sites and pages per visit are skewed lower, which means that many of them are low. Because of this, some parts might need to be changed or improved. The kurtosis is something else you should know. It helps you understand the shape of the spread. A leptokurtic distribution has peaks with longer tails. How much ads cost, how many people tell their friends about your business, how many new customers you get, and

how many old customers return. In these ways, the money and time spent are grouped. Those on the plateau, on the other hand, are flatter and have smaller tails.

The bounce rate, the amount of time people on the site, and the number of pages they look at are all signs of these. This means that these steps are unique to each agri-food business. You should consider skewness and kurtosis when looking at distributional traits and how they might change how agri-food ads work. They looked at how the prices of ads are connected to other things and found what's shown in Table 3. Paid ads constantly change other things that do important things for SEO and SERPs. One thing they don't seem to change is a website's search results. We learn that new customers, social sources, direct sources, and time spent on the site work together to make good things happen. But it has a bad connection with the number of visitors who leave right away, the sources of those visits, the number of pages they look at, and the number of people who buy from you again. There is a strong link between marketing and social networks, so advertising costs more when more marketing resources are put into social networks.

It makes sense that getting new customers would mean spending less on ads generally since more customers means less money spent on ads. The amount of money a website spends on ads is also linked to the number of people returning. This means it might not cost as much to market and sell to get and keep users. On top of that, there is a link between promoting more and getting more people. To get the most out of the money they spend on ads, agri-food companies should consider getting new customers and keeping in touch with the ones they already have. Michel et al. discovered that when it comes to content and social media marketing, an agro-industrial business has a solid and vital link with digital marketing. They also found a critical and essential link to getting new clients. Other studies have found the same things. The cost of ads decreases when you spend more on search ads because the links between search sites aren't excellent. The best way for agri-food companies to use digital marketing is to make their site search engine-friendly.

Business websites can get more people looking for work to visit them in several ways. Word optimization is one way to do this. People will keep returning to your website to look at the goods and services you offer if you improve it. This means ensuring the load is fast, the information is valuable, and the player has a good time. They say that lousy style makes people stay on a website longer. This makes people less likely to buy something. There is less cost for ads when the bounce rate goes up. It means that prices go up when the bounce rate goes down. More people leaving a website is linked to ad prices going down. Ads can save even more money if they can change and improve how people use websites so that more people leave them. When ads cost decreases, people look at more pages during their stay. This is because fewer people visit pages when ads' cost decreases. If sites want people to connect more and maybe even spend less on ads, they should make the sites fun to use. After that, the facts and the ideas from Section 2.4 are examined together.

The standardized estimates and p-values for the factors search and social sources can be seen in Table 4. These two things seem to affect significantly how much ads cost. In this way, the results support Hypothesis H1. Also, when the variable for social sources goes up, the total cost of ads goes up, too. The cost of advertising goes down overall when the variable for search sites goes up. These two things have something to do with the other variable. The model is thought to explain about 68.9 per cent of the changes in the costs of ads from search sources to social sources. It's important to remember that a p-value of 0.05 means it is statistically significant. In other words, there is almost certainly no chance that there is a link. We can say that the Durbin–Watson statistic is correct since the residual differences don't have anything to do with each other. Now, we have even more proof that the model has no links. Ad prices might decrease if more work is put into search engine optimization (SEO) and other similar techniques.

This is because advertising prices and search engine sources are oppositely linked. On the other side, there is a good link with social sources. This means that you'll likely spend more on ads in general if you spend more on ads on social media. Finding a mix between search engine optimization (SEO) tasks like making content better and keywords more relevant to get more free traffic without spending a lot more on ads is essential. If you have a good search engine optimization plan, you can get more free visits and the need for paid ads. What if you want to improve your social media reputation? You might have to spend money on paid ads, making content, and connecting with the community. In the agri-food business world, search engine optimization (SEO) and social media should only be used as much as expected. This will help them get the most out of their digital marketing while also cutting down on the cost of their ads. There is more information about the link between bounce rate and p-value in Table 5. There is a 0.049 per cent chance that this number is correct.

There could be a statistically significant link between the number of unfinished websites and the amount spent on ads. More websites aren't being used, so the negative scaled coefficient shows that even less money is spent on ads. To put it another way, there is a connection between them. The model can also explain why advertising costs change about 70.8% of the time. So

far, we can back up Hypothesis H2, which says there is a link between the number of empty websites and how much agri-food companies spend on ads. Agri-food companies that don't spend as much on ads have higher rates of people leaving their websites. The fact that the p-value is significant and the adjusted coefficient is negative shows this. This shows how vital website interaction is for marketing. A high exit rate usually means that people don't like or find use in the website. So, these examples show how important it is for agri-food companies to work on their website's content, how easy they are to use, or how they target their ads to get lower return rates and maybe even make them work better.

Advertising costs decrease when more people view pages or stay on a website longer (Table 6). The fact that these factors' scaled values are low makes this clear. As the number of page views and time spent on the site changes, some parts of the model can explain about 63.2% of those changes. In other words, the links might be just an accident. A study by Durbin and Watson shows that both factors are very close to the ideal number of 2. That is, the model's residuals don't change meaningfully. There is a strong link between how much food and farming companies spend on ads, how many people read, and how long they stay on their websites. This supports Hypothesis H3. It is known that the number of pages viewed and the time spent on a website are negatively standardized. In other words, ads cost less when either of these comes up. By going to more pages and staying on the site longer, more people will use it, which means the cost of ads will decrease. The ads may cost less because they reach more people or because people are more interested in them.

The findings can be seen in Table 5. It is clear from the negative standardized coefficient for returning buyers that there is a link between the number of people who use a website repeatedly and the cost of advertising going down. It is thought that the model can explain about 70.8% of the difference in the prices of ads. At the 0.05 level, this means that the p-value is statistically significant. This means there's a good chance the link is actual. Based on this, the model's residuals don't have a strong drift. We can say that there is a strong link between how much agri-food companies spend on ads and how many people revisit their websites, which backs up Hypothesis H4. Businesses that sell food and drinks get more return customers, so they don't have to spend as much on ads. The clear p-value and negative scaled coefficient make this clear. This shows how important it is for the food and farming industry to have programs that keep people returning. These tools make marketing cheaper and help businesses make more money.

The fact that the R2 number is about 70.8% also shows that the bounce rate and the number of buyers who come back are essential factors that affect how much these businesses spend on ads. Plans need to be made to improve advertising in the food and agriculture business and the website so that people who use it have a better time. Indicators for digital marketing and the cost of ads are linked. This article's primary goal is to make a digital marketing plan. Getting rid of costs is the primary goal of this plan. During the project, the two main things that were talked about were the search sources and the social sources. These two factors were chosen because they are essential to a complete digital marketing plan aiming to make advertising cheaper. The ANOVA number for this study is 0.048, which means that the results probably didn't happen by chance. Since this is the case, it's clear that there is a solid link to give you a better idea; these new factors affect how well we understand and guess how digital marketing tactics will work.

This made five different situations, each shown in Figure 2. These made-up cases were used to show how significant cost cuts might be possible. This is in line with the policy advice this study made. That agri-food companies that want to spend less on ads should pay attention to search sources instead of social sources was found by this study. The study's primary goal is to help the food and farming industries make the most of the money they spend on digital marketing so they can stay in business and make money. This is the first case, shown in Figure 2a. The social sources variable goes up by 100%, and ads cost 6% more after this. The second case, shown in Figure 2b, comes next. The social sources variable is cut down by 100% in this case. To put it another way, the thing that lowers the cost of ads drops by 13%. The third case, which is about making the search source variable 100%, is shown in Figure 2c. The event is what this story is about. Ads cost 1% less now than they did a year ago. Figure 2d shows the fourth case. This time, the search sources variable is cut in half.

Because of this, the fee for ads goes up by 4%. When everything is over, the fifth event changes both factors simultaneously. This is why the variable for search sources has been made 100% bigger, and the variable for social sources has been made 100% smaller. Picture 2e shows that when the two main variables are changed simultaneously, the variable that shows how much advertising costs decreases by a significant 14%. These cases are made up, but they're meant to show a cheaper way to market than advertising. First, each indicator is looked at independently, and then they are all compared. The fifth option passed the test and is the best digital marketing plan for the business to lower ad costs. The first example clarified that when you add more resources to social media marketing, you almost always have to pay more. This could have happened because of many

things. Social media sites make it harder for businesses to get people's attention, so they must spend more on ads. These sites are significant to companies.

Also, remember that marketing plans must be constantly checked, studied, and changed since social media sites evolve. We need more money and people for this to work. Getting to know people on sites like Facebook is becoming increasingly important if you want them to return. Now more than ever, it's essential to keep these ties strong. Most of the time, social media makes more people visit a website. That doesn't always mean more people buy things or the website makes more money. Also, you have to spend even more money on software and tools that are hard to understand to connect with specific groups of people on social media sites. When using resources for social media marketing, you should be careful not to waste money and make the most of them across several channels. Watch out because bosses may not always do what they say they will do. When less money was spent on search engines, like in the fourth case, more money was spent on ads. It's essential to plan how to use social media for business that works best for the item and the people using it.

Kilgour et al. says that for social media marketing to work, it needs to be aimed at specific groups of people and work with many customers. In the agri-food business, this is important to remember because the people you want to reach might not be on social media sites very often. It's not always the same people who buy agri-food items and the goods themselves. Sharing specific words and data on social media can make it hard for some people. So, selling food and farm products on social media without first researching the online habits and interests of the target audience could waste time and money and not yield the best results. We saw that spending less on ads on social media and more on search engine marketing together is the best way to save money on ads. From what we tested, this is the best way to run a business.

On the other hand, Inegbedion et al. say that using social media sites like WhatsApp can make marketing more effective and cut costs by a lot. This will eventually lead to more farming goods being sold in South-South Nigeria.

After our study, we don't think social media should be used for digital marketing. Still, it's an excellent way to talk to people. Some apps like Facebook, WhatsApp, and Instagram help people talk, share, and work together. My friends and I are looking into how these sites can help more people become interested in farming. This can lead to better marketing and promotion of online goods, which is needed to reach long-term growth goals. It's essential to consider how social media can be used in direct digital marketing tactics based on how the business works and what the target audience wants. Social media can help bring people together and get more people interested in farming. More and more, the farm and agri-food businesses want their supply chains to be open and sustainable. People worldwide eat more food and worry more about food safety and quality. This is because of how quickly industries are growing. As time goes on, provider lines become and open up. Eleven things make the farming and food businesses thrive in a good way for the environment.

The study was done by Mangla and his friends. Handling costs well and understanding how people act is also crucial for this work. Because of these things, it's becoming increasingly critical for companies and the food industry to fully understand how their customers act. Then, you can carefully give money to projects that reduce wasteful resource use and raise the business's costs. This will help long-term growth that lasts. They found that using sustainability drivers in value-chain governance is the best way for a business to make money and have the most minor damage to people and the environment. This plan allows small farmers in developing countries to reach more extensive and better food and farming markets. Businesses in this area can significantly benefit from digital marketing plans to meet online buyers' needs. These tips can cut costs, get more out of their resources, and make their products and services stand out. They can quickly sell their things for more money because of that.

6. Conclusions

Agri-food companies can charge a lot for their goods and still make money, even though it costs them a lot to make them. We will look into what happens when they do this in this study. The study's primary goal is to find out how certain tracking factors in digital marketing are linked to how much ads cost. As part of our study, we also want to find a way to use digital marketing to make ads cheaper. BusinessesBusinesses will be able to use their resources better and grow over time. This will help them make more money and expand. This study discovered an essential link between digital marketing KPIs and the costs of the ads that go with them. The method of linear regression was used to do this. We can think of a digital marketing plan after looking at this study, which looks at search and social sources. The first part talks about the steps that are needed for internet marketing. After that, the FCM model is checked out.

Five different results are looked at after the practice is over.

The following is true based on what we learned: It's clear that where social traffic comes from has much to do with how much money farming businesses spend on ads. If an agribusiness spends more on ads, the range of people who come, the number of pages they look at, and the time they spend on the site will change. Agri-food companies should put more money into search sources than social sources when they plan their digital marketing. This way, they'll get more for their money. This will help them save cash. What does this mean for the Earth? Businesses that use good digital marketing tactics make more money and help the environment by cutting down on the waste of money and resources on ads. Based on this study, farming companies should focus on digital marketing based on search engine optimization (SEO) instead of social networking sites. Food in the trash is terrible at every step of the value chain. We must find better ways to hurt the world, use resources, and make food. This is because the world is getting bigger.

What can people, businesses, and governments do to help with long-term growth? It was said in the Brundtland Report of 1987 that progress is growth that meets the needs of the present without making it harder for future generations to meet their own needs. Since then, this has been the central question about long-term growth. As technology improves and new ways to make and sell things appear, like digital marketing, this is the main question that needs to be considered. It will be hard to achieve sustainable agriculture because climate change and land use change the environment, biodiversity, and the amount of natural resources that can be used. Farm and food businesses should use their internet marketing tools well even if they don't get any new customers. Our study shows that when businesses move from social media to search engines, they can save money and help the environment. Agri-food companies can't do anything about these things. Even though prices and costs are high online, shops can still make money if they know how to use their tools correctly and in the right places.

Only the five largest agri-food companies in terms of market value in 2023 were examined in this study. This is one of its flaws. This means the results might not work for some places or companies worldwide. People will be careful from July 1, 2023, to January 31, 2024, for 180 days. There may not be enough time to see long-term changes or seasonal trends. The fact that the Semrush decision support system (DSS) was used to gather web analytics data makes it more likely that mistakes or biases were made. In other words, the study's findings are not as solid. The agri-food industry's income may change due to digital marketing strategies. To learn more about this, looking at studies from small and medium-sized companies worldwide may be helpful.

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