

Application of Mathematics in Islamic Finance, Marketing, and Social Sciences: A Perspective Study

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Abstract

The application of mathematical tools has played crucial role in measuring the outcomes of Islamic finance, tourism marketing, agricultural and social sciences. In financial, social and agricultural sciences, mathematics applications are crucial to evaluate the given factors relationships as it helps scientists and social science scholars examine the possible link between factors of the chosen frameworks. These mathematical models promote sustainable practices and assist investigators to measure the outcomes. Accurate crop output forecasting is crucial because of the rising demand for food caused by the expanding population. Crop yields are predicted using mathematical models such as biophysical models that take into consideration a variety of factors such as soil type, climate data, and crop characteristics. In order to determine the optimal quantity of water for crops, mathematical models that take into account soil type, temperature, and rainfall are also used in irrigation and water management. Another crucial area of agriculture is pest management and control, where mathematical models are employed to forecast and handle pest populations. Mathematical models can be used to forecast how traits are passed down from one generation to the next in important agricultural fields like genetics and plant breeding. Mathematical models are used to analyses soil and plant data in precision agriculture, which employs technology like GPS and remote sensing to optimize crop production. Scientific decision-making and agricultural production optimization became possible by mathematics, resulting in lower costs and lessening of environmental effect. As agriculture faces climate change and population growth, mathematical models are important for developing sustainable agricultural solutions, making math an essential tool for sustainable practices.

Keywords: Tourism; Islamic finance; Mathematical applications; Marketing research

1 Introduction

The mathematical tools are useful in measuring variables connections and play a fundamental role in determining proposed factors links outcomes in Islamic finance, tourism marketing, agriculture and social sciences. In the financial, social and agricultural sciences, the application of

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mathematics is crucial to assess the relationship between given factors, as it helps scientists and social scientists to examine the possible links between the factors of the chosen research models. These mathematical models promote sustainable practices and help researchers' measure results. The creation of farming practices that ensure sustainability in food security to increase crop yields is important (Balsalobre-Lorente et al. [2023](#); Jaffar et al. [2022](#); Li et al. [2022](#); Shah et al. [2023](#); Zhuang et al. [2022](#)). It has made possible by mathematics applications, which is a key tool in natural and social sciences (Al-Sulaiti [2022](#); Al-Sulaiti [2007](#); Khalid et al., [2004](#); Khalid et al. [2005](#); Sulaiti et al. [2006](#)). Mathematical models have a growing role in measuring sustainability in social and agricultural sciences (Abaalzat et al. [2021](#); Al-Sulaiti et al. [2021](#); Al-Sulaiti et al. [2007](#); Ismail et al. [2009](#); Jaffar [2020](#)).

Mathematical applications start from crop output forecasting to plant breeding and genetics that affects many industries sustainable performance (Al Halbusi et al. [2022](#); Jawad et al. [2023](#); Jiakui et al. [2023](#); Su et al. [2021](#)). This article will examine in detail a few distinctive and in-depth uses of mathematical and statistical tools that are useful in health, social, economic and environmental sectors. (Lebni et al. [2021](#); Mohammadi et al. [2021](#); Shoib et al. [2022](#); Soroush et al. [2021](#); Su et al. [2021](#)). The mathematical tools are also helping in measuring productivity and sustainability of agricultural science (Hafeez et al. [2023](#); Iorember et al. [2022](#); Micah et al. [2023](#); Mubeen et al. [2021](#); Peter et al. [2017](#)). In order to ensure food security, one of agriculture's biggest challenges is to forecast crop yields sustainability, which is essential in this context (Farzadfar et al. [2022](#); Liu et al. [2021](#); Local Burden of Disease [2021](#); Moradi et al. [2021](#); Zafar et al. [2022](#)). To feed the world's expanding population, according to the Food and Agriculture Organization (FAO) of the United Nations, food output must rise by 70% by 2050 (FAO, 2011) and products completion is vital for sustainability (Ge et al. [2022](#); Hussain et al. [2017](#); Schmidt et al. [2022](#); Yu et al. [2022](#); Zhang et al. [2022](#)).

The application of these tools guarantee of assessing food security and long-term economic viability, agricultural scientists must therefore make correct sustainable crop yield predictions (Aqeel et al. [2021](#); Asad et al. [2017](#); Azhar et al. [2018](#); Geng et al. [2022](#); Li et al. [2022](#); Mubeen et al. [2021](#); Zeidabadi et al. [2022](#)). Food security and crop yield prediction is the process of estimating how much food a specific crop will generate using mathematical models (Abbas et al. [2019](#); Aman et al. [2022](#); Paulson et al. [2021](#); Rahmat et al. [2022](#); Toqeer et al. [2021](#); Yao et al. [2022](#)). These simulations adjust for a number of variables, including soil type, weather patterns, pest infestations, and sustainable fertilizer use (Aman et al. [2021](#); Khazaie et al. [2021](#); Mamirkulova et al. [2022](#); Wang et al. [2021](#); Yoosefi Lebni et al. [2021](#)). The biophysical model, which is based on the idea that crop yield is a function of plant growth and development as well as environmental variables, is one of the most frequently used models for crop yield prediction (Aman et al. [2019](#); Aman et al. [2019](#); Fattahi et al. [2020](#); Pouresmaeil et al. [2019](#)). To correctly forecast crop yield, biophysical models use information on the characteristics of the crop, the soil, and the climate (Brisson et al., [2003](#)).

A crucial part of agricultural output, water management and irrigation also use mathematical tools for measuring sustainability (Hussain et al. [2021](#); Hussain et al. [2019](#); Lebni et al. [2020](#); Mamirkulova et al. [2020](#); Moradi et al. [2020](#)). Water management and sustainable use is a key component of agriculture, and the ideal amount varies based on the soil type, weather conditions, and rainfall (Balsalobre-Lorente et al. [2023](#); Jaffar et al. [2021](#); Mansourian et al. [2019](#); Shah et al. [2023](#)). Mathematical models are used to optimize irrigation and water management because irrigation is crucial for assuring crop growth and development. These simulations account for a number of variables, including the demand for water by crops, the moisture content of the earth, and the availability of water. An indicator of crop water demand, the crop water stress index (CWSI) is one example of a mathematical model used to determine crop water stress. (Idso et al., [1981](#)). Another crucial element of agriculture is pest management, and mathematical models are

used to forecast and manage pest populations.

Pests have the potential to seriously harm crops and lower agricultural yields, which can have negative economic effects (Al-Sulaiti et al. [2022](#); Jaffar et al. [2023](#)). To forecast pest outbreaks and create control plans, mathematic models are used. An example of a mathematical model used to forecast pest numbers is the population dynamics model (DeVries et al., [1987](#)). To correctly predict pest populations, this model takes into consideration variables like pest lifecycles, weather patterns, and plant health. Mathematics plays a major part in the fields of genetics and plant breeding, which are two other important areas of agricultural science. To understand genetics and foresee how traits are handed down from one generation to the next, mathematical models are used. The most hopeful plants for breeding and selecting for desired traits can be found using these models .An illustration of a mathematical model used to forecast the likelihood of traits being passed down from one generation to the next is the quantitative genetics model (Falconer et al. [1996](#)).

Table 1: List of various studies conducted on the role of mathematics in agriculture and its allied branches

Sr.	Study conducted	Year	Country	Conclusion of study	Reference
1.	Formation of the digital platform for precision farming with mathematical modeling	2020	China	The research covered the use of remote sensing, GIS, and GPS technologies, as well as the role of mathematical models in precision agriculture. The authors came to the conclusion that mathematical models are crucial in precision agriculture for maximizing crop output and reducing environmental impact.	Medennikov et al., 2020
2.	A review on the use of unmanned aerial vehicles and imaging sensors for monitoring and assessing plant stresses	2019	China	The authors of this study examined the application of imaging sensors and unmanned aerial vehicles in agriculture and recommended using mathematical models to examine and understand the data gathered.	Barbedo (2019)
3.	Toward a new generation of agricultural system data, models, and knowledge products: State of agricultural systems science	2017	USA	In order to address contemporary issues like climate change and food security, this study addressed the need for a new generation of agricultural system data and models. The writers recommended using mathematical simulations to create sustainable agricultural methods.	Jones et al., 2017
4.	Coping with	2015	Netherlands	In this book, risk management in agriculture was covered,	Hardaker et al., 2015

	risk in agriculture			along with the use of mathematical models for risk assessment and administration.	
5.	Yield gap analysis with local to global relevance—a review	2013	Netherlands	The research concentrated on the analysis of yield gaps and the function of mathematical models in locating and bridging yield gaps in crop production. The authors concluded that mathematical models are crucial in determining yield potential and management strategies that can maximize crop output.	Van Ittersum et al., 2013
6.	Yield trends are insufficient to double global crop production by 2050	2013	USA	The study looked at trends in crop yields around the world and concluded that the production of food will need to rise by 70% by 2050 if current trends continue. The writers recommended using mathematical simulations to create sustainable agricultural methods.	Ray et al., 2013
7.	Climate change, plant diseases and food security: an overview	2011	UK	The authors of this research used mathematical models to examine how climate change affects plant diseases and how that affects the safety of the world's food supply. They concluded that developing adaptable measures was essential because climate change would have a significant impact on plant diseases.	Chakraborty et al., 2011
8.	Rainfed agriculture: unlocking the potential. Comprehensive Assessment of Water Management in Agriculture	2010	UK	The research emphasized the use of mathematical models to increase productivity and sustainability in rainfed agriculture. The writers concluded that using mathematical models is essential for creating plans for making the most effective use of rainwater and for lowering the likelihood of crop failure.	Midmore (2010)
9.	Nutrient use	2008	China	In this research, data were	Zhang et al.,

	efficiency of major cereal crops in China and measures for crop improvement			analyzed using mathematical models to examine the effectiveness of nutrient use in the main cereal crops grown in China. The authors came to the conclusion that better crop management practices could increase the efficiency of nutrient use, and they recommended more study to maximize nutrient use.	2008
10.	Prioritizing climate change adaptation needs for food security in 2030	2008	USA	This research evaluated the effects of climate change on world food security using mathematical models and proposed adaptation measures. The authors came to the conclusion that food security required adaptation steps.	Lobell et al., 2008
11.	An overview of the crop model STICS	2003	France	The research introduced STICS, a crop model that makes use of mathematical models to forecast crop yield while accounting for various elements like soil type, weather patterns, pest infestations, and fertilizer use. According to the authors, STICS can correctly forecast crop yield and can aid in the development of agricultural practices that are sustainable.	Brisson et al., 2003
12.	Soil-water thresholds for the responses of leaf expansion and gas exchange: a review	1996	Australia	The research covered the use of water potential models as well as the role of mathematical models in understanding how leaf expansion and gas exchange react to soil moisture. The writers came to the conclusion that mathematical models are crucial for forecasting crop responses to water stress and for creating management strategies that can maximize crop yields in situations where there is a scarcity of water.	Sadras and Milroy (1996)
13.	Source-sink relationships and grain mass	1994	Spain	In this research, source-sink relationships in wheat plants were examined using	Slafer et al., 1994

	at different positions within the spike in wheat			mathematical models, and it was found that the interaction between source and sink strengths was what determined grain mass.	
14.	Irrigation water management: irrigation methods. Food and Agriculture Organization of the United Nations	1988	Italy	The study covered the use of crop coefficients and evapotranspiration models as well as the importance of mathematical models in irrigation water management. The authors came to the conclusion that mathematical models are essential for maximizing irrigation water use efficiency, which results in an increase in crop yield and a decrease in environmental effect.	Brouwer et al., 1988

2 Conclusion

This review covered how mathematical applications assist researchers to conduct research in the fields of Islamic finance, marketing research, tourism and other behavioral disciplines. Scholars of various fields, such as finance, economics, marketing and management sciences use mathematical applications and statistical tools to evaluate the relationships between the chosen variables of the frameworks. Besides, it is yet important that precision agriculture is a farming technique that maximizes crop output by using technology like GPS and remote sensing (Liu et al., [2018](#)). Precision agriculture depends heavily on mathematics, which is used to create and put into practice its methods. To analyses soil and plant data, for instance, mathematical models are used, which can assist farmers in making data-driven choices. Precision farming may increase crop yields, lower input costs, and have a smaller negative effect on the environment (Liu et al., [2018](#)). In conclusion, mathematics is an important tool in agricultural science and has a wide range of important uses. Mathematical models are becoming more and more crucial for ensuring sustainable agricultural practices in a variety of fields, including crop yield prediction, pest control, and plant breeding. Scientists can make data-driven decisions and optimize agricultural production using mathematical models and analysis, which lowers costs and has a smaller negative environmental effect (Liu et al., [2018](#)). The use of mathematics in agricultural science will become even more important in developing sustainable solutions as agriculture confronts increasing challenges, such as climate change and a growing population.

Author Contributions

Osama Aldereai and Khalid Ibrahim Al-Sulaiti contributed to the conceptualization, literature review, identification and synthesis of mathematical applications in Islamic finance, marketing, agriculture, and social sciences, interpretation of the published evidence, organization of the manuscript, and preparation of the article. Both authors contributed to writing—original draft and writing—review and editing. Both authors read and approved the final version of the manuscript and agreed to be accountable for all aspects of the work.

Conflict of Interest

The authors declare that they have no financial, professional, institutional, commercial, or personal conflicts of interest that could have influenced the content, interpretation, or conclusions presented

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Data Availability

No new primary or empirical dataset was generated or analysed in this study. The article is based on published literature and previously reported studies relating to mathematical applications in Islamic finance, marketing, agriculture, and social sciences. All information supporting the discussion is available through the sources cited in the manuscript.

Ethical Approval

Ethical approval was not required because this perspective article relies exclusively on published literature and secondary information and did not involve human participants, animals, biological materials, or personally identifiable data.

Informed Consent

Not applicable. The study did not involve the recruitment of human participants or primary collection of personal information.

Use of Generative AI

The authors declare that no generative artificial intelligence tools were used to conduct the literature synthesis, generate the scholarly content, interpret the evidence, or formulate the conclusions presented in this article.

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