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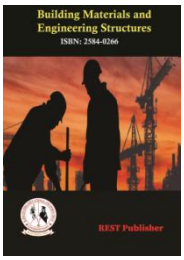

Evaluation of a WSM system for a smart system in agricultural systems

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Abstract. *On the earth, there will likely be over 9 billion people, and food demand will rise by 50%. In addition, a 10% decrease in agricultural productivity may result from climate change. Because arable land is stable, multi-layered farms are a feasible approach to produce additional food from small regions. Utilizing intelligent technologies to boost production in these farms that mimic factories makes sense. Smart farming (SF) is the application of information and communication technology on equipment; it includes sensors and equipment used in agricultural production systems. Internet of things and cloud computing are recent innovations. This, together with the use of robots and artificial intelligence in agriculture, ought to spur growth. Wheat, barley, fruits, vegetables, and fodder are the most widely consumed agricultural goods. Agriculture's socioeconomic viability is weather-dependent. By choosing the right crops, a farmer can increase productivity and do it at a lower cost. based on the cost and natural resources available A multi-criteria decision-making model (MCDM) can be used to sort crop options, promote sustainable agriculture practises, and identify the optimal crop for the situation. When evaluating the quantity of food produced in a season, a vertical farm's indoor hectare can provide the same yield as 30 hectares of land using 70% less water and no pesticides. One of the key factors impacting the evolution of SF among the numerous systems available was demonstrated to be cohesion. Additional limitations include the education, skills, and ability of farmers to understand and operate SF instruments. Businesses were able to research and address these problems because to these limits, and science can help. India's use of basic for sustainable farming methods The model's development is the main focus of the study. Using MCDM methods, the best crop was identified, followed by soybean, apple, rice, corn, and cucumber. Fruits also become a crop with a high yield. Such a method is applicable to other places and can be expanded to include different crops for sustainable agricultural operations. The Ministry of Environment and Agriculture in India expects help from the study to build an acceptable agricultural policy. Soybean is in 1st rank and Rice is last rank.*
Keywords: *agriculture, crops, WSM method.*

1. INTRODUCTION

Today's agricultural practices involve greenhouses and mechanization through precision farming techniques, which also maintain and improve the natural resources already at our disposal. One innovative example of water conservation is sprinkler and drip irrigation. The yield per unit of land must be increased to cope with the increasing population rise. Sustainable agricultural production techniques have grown in importance as a way to balance supply and demand and control volatility. It is urgently necessary to raise the general population's level of life and safeguard the planet's natural resources. Social, economic, and natural resource considerations all play a role in sustainable agriculture methods. These elements are intimately tied to the self-assurance and personal fulfillment of farmers. Crop yield and a farmer's financial situation, including the crop's market value. Due to high temperatures and low rainfall, the desert zone's ecological situation is difficult. Agriculture-related goods both provide national development and food security. The Food and Agriculture Organization (FAO) considers carbon sequestration, crop yield value, water quality, and natural soil nutrients to be crucial elements of agricultural production. Rural households make about 70% of India's economy. An vital role is played by agriculture. Sales are halted in the event of flooding or intense rains that prevent animals from grazing. It requires a lot of labor-intensive and time-consuming work, such as manually watering the plants. These operations must be completed successfully and accurately. They are the bare minimum and quite basic. Furthermore, inefficient resource use reduces crop quality, decreases output, and disturbs the ecological balance. For farmers, mechanization in agriculture makes life easier.

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Automated devices with sensors give farmers options so they may monitor and do agricultural tasks. include computer and database technology a number of automated system-based techniques have been put out in the literature. However, for field control, a less expensive and straightforward option is what farmers urgently need. The challenges raised above are recommended to be resolved by an autonomous system composed of a master controller and the necessary sensors. To manage agricultural-related tasks, this system keeps an eye on the field. Designed to be useful to farmers. Sensors have a significant function to play in the autonomous operation of the computer. Harnessing the advantages of the global agricultural sector The Indian government has created a number of IoT policies. Indians' main goals are to control pest-related issues by alerting farmers and monitoring soil conditions like as density and condition. Due to IoT's ability to change the digital landscape The IoT policy in India in 2015 focuses on communication and written by the Ministry of Information Technology. Smart agriculture has emerged as a result of the widespread adoption of big data, smart technologies, and the Internet of Things in the agricultural sector. [1], [2] Modern technology, including smart phones, IT platforms, cloud services, big data, the internet of things, and 3S, which combines technology with the knowledge and expertise of specialists, is the foundation of smart agriculture. [3], [4]. A more efficient farming process and, ultimately, a more sustainable food supply chain, can be achieved through precision agriculture, smart water management, agricultural monitoring, monitoring agricultural practices, and improving the quality and safety of agricultural products [5]. A fair evaluation of the available alternatives should be used to assist a company's decision to use smart farming technology. Evaluation and selection of agricultural solutions Because big data and smart technology are so widely used in agriculture, the concept of "smart agriculture" has developed. [1], [2] Smartphone's, IT platforms, cloud services, big data, the Internet of Things, 3S technologies, expert knowledge and competence, etc. are the foundation of smart agriculture. [3], [4], etc. Smart agriculture integrates contemporary technologies. Some of the ways smart agriculture contributes to an all-around better and more efficient agriculture and, ultimately, a more sustainable food supply chain, include precision agriculture, smart water management, agricultural monitoring, monitoring agricultural practises, and the quality and safety of agricultural produce[5]. Many nations have laws or administrative rules that assist the development of the agricultural industry and help to foster agriculture's long-term growth. Encourage agribusinesses that already have smart farming solutions in order to generate a new model of smart agricultural development. Traditional farm management software's restrictions Farmers are having trouble utilizing agricultural smart solutions due to the technical shortcomings of agricultural organizations. [6] Agribusinesses find it challenging to make an informed choice given the large range of smart farming solutions available on the market today that differ greatly in terms of technical quality, advantages, and management techniques. To further complicate matters, money and a sizable number of resources—both in the form of human capital—will be needed to successfully deploy a smart farming system. [7] The monitoring of the soil, plants, and environment (including temperature and humidity), transportation, supply chain management, infrastructure management, control system management, animal monitoring, and pest control are just a few of the many duties required for agricultural production. MCDM methods [24]–[27] coupled with fuzzy theories [21]–[23] a practical instrument that is reliable for producing outcomes across several decision domains. Especially when dealing with complex issues, the decision-making process Specific requirements must be followed. Multi-criteria decision-making in science has a specific function, claim Zavatskas et al. [29]. Decision Makers (DM) can help people accomplish their objectives. used to pick the best option from a list of choices. Whenever we tackle a real-world issue, decision-making procedures It is a tough issue in our opinion. Occasionally complex, interwoven, or The selection problem becomes increasingly difficult as a result of conflicting objectives [1, 2]. The main contribution of this study can be summed up as follows: Determine the various possibilities for fuzzy design graphs. Think about those options. When making a choice, weigh the several options that have been evaluated.

2. CROPS

We set out to integrate ICT with smart farming practices in order to examine the most recent innovations. In the interim, we quickly reviewed the published works of top authorities on this topic. See precision agriculture, digital earth, information agriculture, virtual agriculture, and more for a description of the relationships between digital agriculture. A unique tactic is suggested. It was mentioned that digital agriculture needed to be promoted. Smart farming with wireless sensor networks using smart phones It is possible to collect sensor data and manage irrigation for vegetable crops. Environmental data gathering and irrigation system control are both possible with a Smartphone. Utilizing cloud computing for early tomato borer detection Intelligent farming is proposed. This problem is fixed using IoT and cloud computing. For multipurpose vehicle route control and data gathering, real-time GPS tracking monitoring is advised utilising a Zig-Bee multi-hop mesh network. Section dedicated to route planning for multifunctional vehicles It contains everything. Based on the ZigBee wireless network and the Global Positioning System, vehicle tracking systems use computers to communicate (GPS). utilising environmental sensors and technology for tracking cattle For Agriculture Case Study focuses on an experimental smart farm. A website is offered. An agricultural region has tested a system that represents awareness, and the results have been studied. The use of a connected cube enables massive data sharing and long-term analysis. From the literature review mentioned

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above, keeping an eye on environmental conditions outside, We have discovered a novel method for performing agricultural labour using a smart sensing system that interacts with a smart irrigation system. The problems this method was causing farmers have been fixed. Their main problems are a lack of energy, a lack of physical labour, a lack of automation, a lack of agricultural expertise, and a lack of macromineral supplies (N, P, and K). Forget about applying the amount. Our system operates by detecting and adjusting to its surroundings. take place in cash crops Various illnesses that affect the quality of plant production One of the most important human endeavours in India is agriculture, despite the country's significant size reduction. The process of discovering and categorising diseases and their varieties is thought to be a crucial endeavour. As a result, it's important to take mitigation measures for any diseases that are discovered in the plants. The economic success of Indian farmers and the country as a whole is accelerated as a result of the significant improvement in plant health. The agricultural sector is expected to suffer the most from a few plant diseases. Plant life is diminished, and the capacity of the unaided eye to identify and classify different diseases is significantly diminished. Farmers who lose their crops to specific diseases end their lives because they can no longer afford to pay their obligations. According to the majority of research, distinctive features include shape, size, and colour. recognising ambiguity-causing similarities in visual characteristics Adapted methodology detects numerous foliar diseases. Based on user input, these features are utilised to assess the expert system. fighting foliar diseases In order to determine if a disease is present or not, the first step is to take into account the features required. It is essential to use computers in agriculture since they are used to produce leaf symptoms in a variety of dormant crops. We began building a smart farming model to address all of the aforementioned problems that afflict the agricultural business while overcoming a power constraint after evaluating the difficulties farmers face when doing related tasks. Solar panels are included with the system. through an automated wheeled crane system The issue of physical work is resolved, but there is a lack of expertise to address the issue of green manure, including compost, soil moisture, and soil macromineral concentrations (N, P, and K). We built a database server and assessed the crops. Depends on the environmental parameters of the soil and cultivated during a specific season of the most productive crops Farmers can obtain all the information. This was put into practise, and we also tasted the crop to determine how much compost and green manure it needed to grow. Green manure and compost were added to the soil as the crop required. We have implemented our suggested strategy, which consists of all necessary components, on the ground. In our experience, the model has been effective. The strategy worked and achieved its objective.

3. WSM Method

WSM is one of the most well-known MCDM methods in decision theory, and it is one of the easiest ways to evaluate options based on specific criteria. Each piece of information is one dimensional. Or WSM is only effective when in a unit. WSM is not a standalone MCDM method that can be applied to multidimensional issues. All quantities have various units when a quantity is multidimensional. There are various ways to tackle a one-dimensional problem besides employing WSM. However, they were initially designed to address multidimensional issues; a unique methodology creates the WSM technique. Only numerical data are compatible with the weighted scoring system. Consequently, before determining the final score, each substitution each evaluation criteria should be used as a benchmark. Aside from user satisfaction and optimization requirements, no additional criteria for component selection will be directly evaluated. As a result, all options that are pertinent to each assessment criterion take into account the user needs of the software components are assessed first. If all units are the same in one-dimensional scenarios, WSM can be used with ease. The complexity of this strategy becomes clear when used to solve multidimensional MCTM problems. To get around this issue, the Weighted Product Method was created. The key difference between it and WSM is that the model uses multiplication rather than addition. Both one-dimensional and multidimensional MCDM problems can be solved with WPM. This is a benefit of the strategy since relative values can be used in place of actual values. It has examined the issue of improving the performance of the new system by analysing the decision-making issues arising from the evaluation and selection of market segments in accordance with preset criteria. The weighted sum model (WSM) method is one of the decision support system methods that can be used to simplify this. The application of the weighted sum sampling method is a fairly straightforward process that only requires a few steps to produce results for section evaluation and exam results. Implement a decision-support system. The WSM method is an application created to help in market segmentation evaluation and selection when deciding who should receive a special allocation fund.

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TABLE 1. Manure Content Details of Different Crops Data Set

	Vater Content (g)	Nitrogen (lb/ac)	Phosphorous (mg)	Potassium (mg)
Soybean	8.54	193	704	1797
Apple	85.15	150	11	107
Rice	11.25	120	115	115
Corn	75	112	80	270
Cucumber	95	130	24	147

Table 1 indicates the information set for the Soybean, Apple, Rice, Corn, and Cucumber of the Water Content (g), Nitrogen (lb/ac), Phosphorous (mg), and Potassium (mg). Best values are negative factors in lowest value for data set and positive factors in highest value for data set. Worst values are positive factors in lowest value for data set and negative factors in highest value for data set.

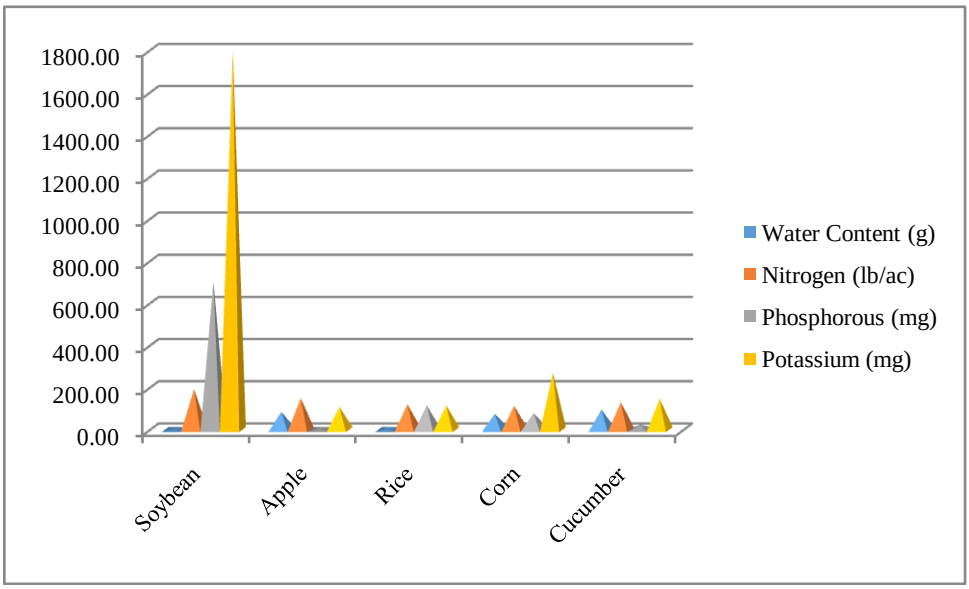

FIGURE 1. data set in graph

Figure 1 suggests the statistics set for the Soybean, Apple, Rice, Corn, and Cucumber of the Water Content (g), Nitrogen (lb/ac), Phosphorous (mg), and Potassium (mg). Soybean is highest value for data set. Rice is lowest value for data set.

TABLE 2 normalized in data set

	Normalized			
Soybean	0.0899	1.0000	1.0000	1.0000
Apple	0.8963	0.7772	0.0156	0.0595
Rice	0.1184	0.6218	0.1634	0.0640
Corn	0.7895	0.5803	0.1136	0.1503
Cucumber	1.0000	0.6736	0.0341	0.0818

Table 3 gives the normalized data of the data set. Given this data is easily calculated.

TABLE 3 gives weight matrix

	Weight			
Soybean	0.25	0.25	0.25	0.25
Apple	0.25	0.25	0.25	0.25
Rice	0.25	0.25	0.25	0.25
Corn	0.25	0.25	0.25	0.25
Cucumber	0.25	0.25	0.25	0.25

Table 3 gives weight matrix all values is taken for same values.

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TABLE 4 Weighted normalized result matrix

	Weighted normalized decision matrix			
Soybean	0.0225	0.2500	0.2500	0.2500
Apple	0.2241	0.1943	0.0039	0.0149
Rice	0.0296	0.1554	0.0408	0.0160
Corn	0.1974	0.1451	0.0284	0.0376
Cucumber	0.2500	0.1684	0.0085	0.0205

Table 4 gives the weighted normalized decision matrix of the weight. Given this data is easily calculated.

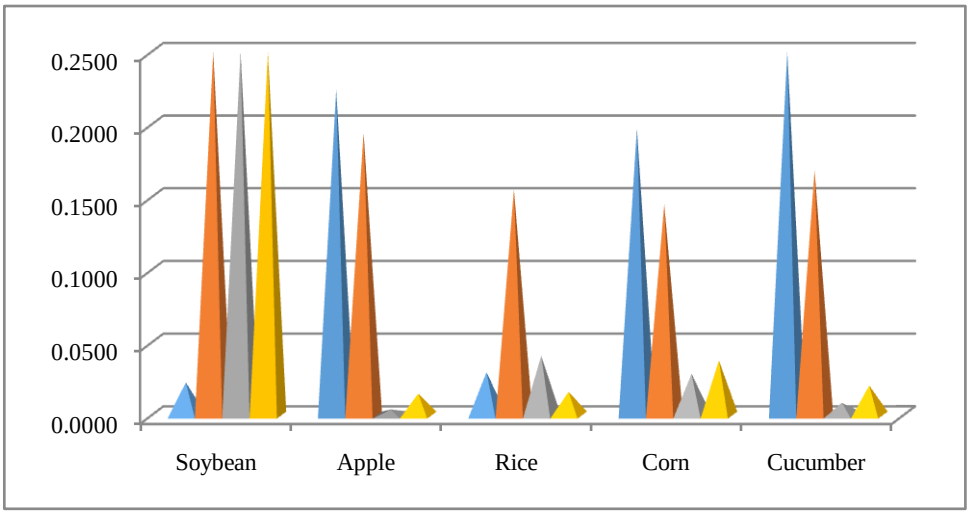

FIGURE 2. Weighted normalized result matrix

TABLE 5 Preference Score for data set

	Preference Score
Soybean	0.7725
Apple	0.4372
Rice	0.2419
Corn	0.4084
Cucumber	0.4474

Table 5 gives the Preference Score. Swiggy is highest values for preference values shown in figure 3.

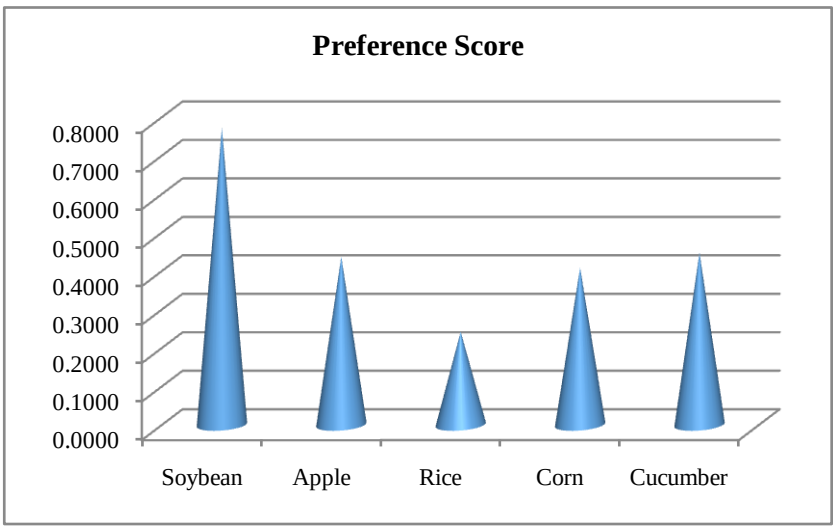

FIGURE 3. Preference values graph.

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TABLE 6 Ranking

	Rank
Soybean	**1**
Apple	**3**
Rice	**5**
Corn	**4**
Cucumber	**2**

Table 8 shows that the Soybean is in 1st rank and Rice are last rank. Figure 4 shown in ranking.

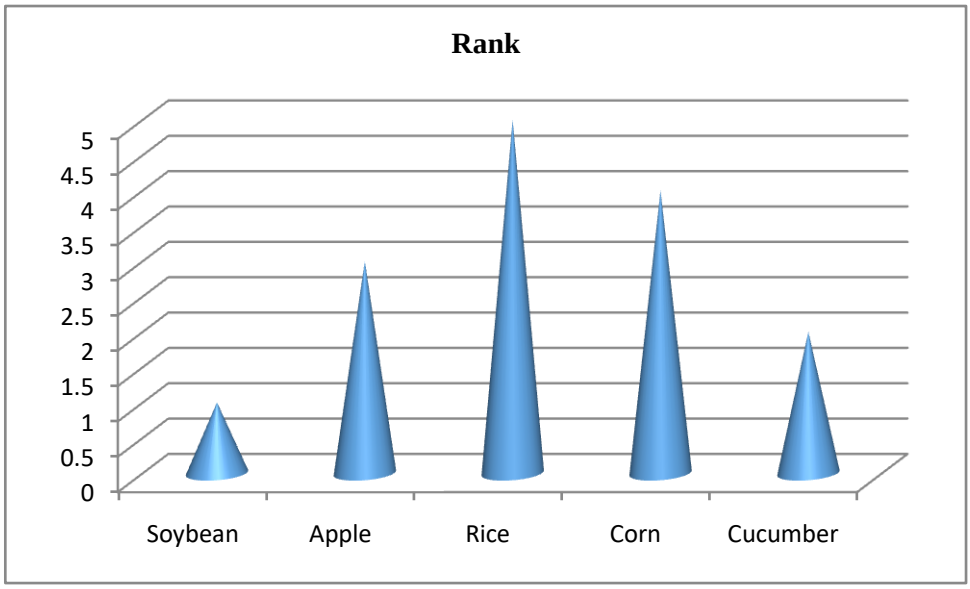

FIGURE 4. Ranking

4. CONCLUSION

In India, 70% of the population relies on agriculture for a living. The majority, or 18% of the GDP, is. The primary reason for this poor performance is a lack of farm labor mechanization. Our highly developed sensing system provides accurate results, and our highly developed watering system adjusts to the requirements of the crops. Successfully sprays the required nutrients. Based on the findings of the soil moisture test, the irrigation system was supplied with an adequate amount of water. Alter the production process, change agricultural practises, and dramatically liberate agricultural power. User friendliness is crucial while developing a smart agriculture system. The WSM approach is incredibly adaptable and is one of the methods utilized in multiple criteria decision making. By computing the distance between ideal and anti-ideal solutions, the approach determines the best choice out of a variety of feasible choices. It is generally criticized for ignoring uncertainty.

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