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Land Evaluation Techniques: Assessing the Role of Soil Texture and Other Key Factors in Effective Land Management

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***Abstract**: Importance of Land Evaluation Techniques: Effective resource allocation and informed decision-making are made possible by the use of land evaluation techniques, which offer insightful information on the qualities, possibilities, and constraints of land. These strategies support the identification of the most appropriate land uses, reduce risks and conflicts, and maximize resource utilization by evaluating elements such soil quality, water availability, topography, climate, and socio-economic concerns. Integrated Approach: Land appraisal strategies take an integrated stance by taking into account various stakeholder viewpoints and circumstances. In order to evaluate the suitability, capability, and limitations of land, this calls for integrating qualitative and quantitative methodologies, incorporating data from multiple sources (such as field surveys, remote sensing, and geographic information systems), and employing modelling and simulation tool. Land use planning and decision-making procedures are greatly influenced by land evaluation methodologies. These strategies help policymakers, land managers, and stakeholders make well-informed decisions about land development, conservation, and resource allocation by providing systematic and objective assessments of land appropriateness, capability, and limitations. By assuring sustainable and ethical land management practices, the research done in this area helps to increase the efficacy and efficiency of land use planning techniques. resolving Environmental and Socio-economic Challenges: Techniques for land appraisal have significant research value in resolving environmental and socio-economic issues related to land usage. The process for examining the effectiveness of electronic payment systems in India might include a number of processes and research techniques. Here is a recommended approach. Decide on a clear study objective, such as assessing the effectiveness, uptake, or effects of electronic payment systems in India. Gather pertinent data from a variety of sources, such as government reports, business magazines, academic journals, and financial organizations. Data can contain user demographics, transaction volumes, values, trends, and technological infrastructure. Alternative taken as Soil texture, Soil calcium carbonate, Organic matter, Soil salinity, Soil alkalinity. Evaluation preference taken as Soil texture, Soil calcium carbonate, Organic matter, Soil salinity, Soil alkalinity. soil texture secured rank 1 in land evaluation techniques. soil texture performed well in land evaluation techniques when compared to others.*

***Keywords:** Soil texture, Soil calcium carbonate, Organic matter, Soil salinity, Soil alkalinity*

1. INTRODUCTION

In order to make suggestions on how to improve its utilization, land evaluation entails evaluating the features of a particular piece of land, such as its climate, soil quality, and vegetation cover. The objective of this procedure, as described by Namath et al. (2006) and FAO (2007), is to identify workable options for optimizing land usage. Guidelines from the Food and Agriculture Organization of the United Nations (FAO) from 1976 to 2007 emphasize the significance of land evaluation as a key element of land use planning. It is well known that merging many academic fields, such as economics, social sciences, environmental studies, agriculture, and biology, is the ideal technique for promoting sustainable land management. This all-encompassing strategy makes it easier to develop and conserve property in an informed and balanced manner. In order to make suggestions on how to improve its utilisation, land evaluation entails evaluating the features of a particular piece of land, such as its climate, soil quality, and vegetation cover. The objective of this procedure, as described by Németh et al. (2006) and FAO (2007), is to identify workable options for optimising land usage.[1]. In the context of logical land-use planning, the goal of land performance measurement in land evaluation is to offer forecasts that are helpful to decision-makers. Early techniques for evaluating property contrasted parcels based on their physical attributes while accounting for long-term restrictions on land usage. There was frequently an underlying economic basis for these physical land designations. For instance, the USDA Land Capability Classification (Klingebiel & Montgomery, 1961) divides land into classes from 1 (best) to 8 (worst) depending on the amount of management needed to maintain the intensity of land use that the land can support. According to this rating, more diverse land uses will provide farmers more options to make money, and less stringent management standards would result in reduced production costs[2]. An examination of the land's suitability for particular uses, like arable farming or irrigated agriculture, is done. An area's socioeconomic conditions and/or biophysical parameters may be used in the evaluation (FAO 1976). While socioeconomic factors are altered by social, economic, and political circumstances, biophysical factors are typically more constant (Dent and Young 1981; Triantafilis et al. 2001). For efficient land-use planning and development, physical land suitability assessment is therefore essential (Sys 1985; Van Ranst et al. 1996). Decisions for the best use of land resources are guided by the useful information it gives on the constraints and opportunities related to land use (FAO 1983). For Africa's rural development, effective land resource management has emerged as a crucial issue. This worry results from the growing demand on land resources brought on by population growth. The demand for land has also increased as agricultural production has moved from subsistence to market-oriented practices (Sankoh et al. 2001)[3]. If enough inputs are given, soils may be used for a variety of agricultural endeavors. Inputs can play a significant role in determining how crop growth conditions are shaped, as is seen in greenhouse farming. But each individual soil unit has its own capacities and constraints, and each particular soil usage has its own biophysical specifications. External input or improvement provision entails financial, energy, or environmental expenses. By forecasting a soil unit's inherent ability to support a particular soil use and management over an extended period without degradation, soil protection aims to reduce these socioeconomic and environmental costs. Enhancing the usage, organization, and management of agricultural soil is part of soil protection. Maintaining the biophysical potential of the soil while also diversifying the agricultural soil system are the goals of sustainable soil use and management. This entails taking into account a range of options to boost crop production, such as (i) increasing the agricultural land area, (ii) introducing improved crop varieties, (iii) utilising irrigation techniques, (iv) applying fertilisers and pesticides, and (v) implementing sensible soil tillage practises (Robert et al., 1993). These techniques can be used to increase crop yield while protecting the soil's long-term capacity for sustainable soil use and management [4]. The two primary approaches to land evaluation are parametric and hierarchical. To assign numerical values to land attributes and produce a final numerical expression, parametric systems use mathematical formulas. According to McRae and Burnham (1981), these techniques are deemed to be straightforward, impartial, quantitative, trustworthy, simple to comprehend and apply, and easily adaptable to various objectives. Additive, multiplicative, or complex functions may be used in parametric systems. Examples include the productivity index (Delgado and Lopez, 1998), the square root (Sys et al., 1991), and Storie (1938). On the other hand, hierarchical systems divide land into many groups according to its significance or potential for usage. These systems classify land into tiers of like order, class, subclass, or type. Geographic Information System (GIS) and Multi-Criteria Assessment (MCA) techniques are helpful in land evaluation because they can handle enormous volumes of spatial data and analyse varied natural land systems. By combining these methods with AHP, it is possible to evaluate different soil and land features and give them weights based on how important they are in relation to other factors for optimal land use (Dengiz et al., 2015). Effective methods for dealing with challenging geographic issues related to land evaluation are provided by GIS and MCA[5]. In order to fill the information gap between biophysical land-related information and the comprehensive information requirements of land use planning, the interdisciplinary discipline of land evaluation has arisen. The phrase "land evaluation" refers to a wide range of ideas and analytical techniques, but its main emphasis is typically on interpreting biophysical resource data and figuring out how well-suited, vulnerable, and productive land resources are for various types of use (McRae and Burnham, 1981). By defining various land types, identifying the biophysical requirements of various land uses, and facilitating comparison and evaluation of each land type for various uses, these techniques for land-use classification play a crucial role in the land use planning process (Food and Agriculture Organization (FAO), 1976) [6]. According to Beek (1978), the goal of physical land evaluation is to forecast the performance of particular land use systems while taking into account the impact of the physical characteristics of the land. Surveys are often conducted to acquire information on the soil, water, climate, and other pertinent biophysical resource characteristics. Then an inventory of land resources is made using these data. The identification of homogeneous land units is based on their shared biophysical characteristics. The biophysical qualities chosen for land appraisal are those that are most directly related to the needs of the land uses under consideration. In order to identify a land unit's significance for a particular use, integral land evaluation compares its physical assessment and productivity for many potential uses to societal objectives. These objectives are often described in terms of the demand for goods, services, and facilities as well as economically feasible production levels. It acknowledges that there are limitations on the potential uses of the land for meeting diverse needs due to both the biophysical properties of the land resource and the socioeconomic circumstances. Integral land evaluation, in its simplest form, evaluates the suitability of the land for various land uses by taking into account the interaction between the physical characteristics of the land and the socio-economic context [7] There have been various methods for evaluating land that each have their own unique process. One strategy is qualitative systems, which are grounded in empirical evaluations that depend on knowledge and comprehension of the particular area being evaluated. For instance, Verwood and Ranst used a GIS environment and a qualitative land suitability classification technique to divide large-scale biophysical data from soil surveys into five suitability groups. Similar to this, Ghaffari et al. used GIS to evaluate a site's appropriateness for potato production based on the crop's biological needs as well as the site's qualities and features. Their research included topographical data such as slope and altitude, climatic data, and land quality characteristics that have a long-term impact on crop compatibility. They utilised the Simple Limitation Approach to create a GIS-based land suitability model. These examples show how GIS technology and certain criteria can be used to adopt qualitative approaches to land appraisal and determine if a piece of property is suitable for a variety of uses[8] highlighting that market factors and supply and demand dynamics play a key role in determining the value of land. Traditional tribal agricultural communities do not estimate the value of their land in terms of financial exchanges because the land is communally owned and there is no market for it. In contrast, land is viewed as a productive resource in contemporary free-market economies, and the value of that resource is impacted by things like its inherent production capability and the anticipated future income that it can produce through various uses or socio-economic conditions. A value-added premium may affect the value of land in non-rural locations when there are greater prospects for alternative land uses and development. This premium represents the expected earnings or advantages that may result from adjustments in land use, speculation, or other socioeconomic factors. For instance, the potential for commercial or residential development in a prominent metropolitan area may increase the value of the land there, which might result in large returns on investment [9]. Due to the high demand and financial benefits of prawn culture, coastal regions have changed, and other industries like rice farming and salt production have also been impacted. It is essential to have suitable approaches for site selection in prawn farming in order to address these difficulties and ensure sustainable aquaculture development. Such techniques ought to take into account socioeconomic, environmental, and resource considerations. The abuse of natural resources, environmental deterioration, and social disputes that cause poverty can all occur from failing to take these elements into account when choosing a place. By making predictions about a piece of land's performance based on its characteristics, land appraisal is essential in resolving these possible issues. The use of several analytical models, from qualitative to quantitative, functional to mechanistic, or specialized to general, is possible. These models aid in determining a site's appropriateness for aquaculture based on environmental and socioeconomic factors [10] Traditional land evaluation techniques frequently rely on qualitative evaluations and professional opinion. Agronomists and soil surveyors are essential in gathering field data and interpreting it so that planners, engineers, extension agents, and farmers may understand it. These professionals assess the potential and limitations of the land for various purposes using their expertise and experience. However, recent developments have made it possible to evaluate land using more quantitative methods. The results of in-depth investigations of particular soil-related variables, such as fertility, water availability, oxygen levels, workability, and degradation risks (such as erosion and salinization), have been very instructive. The foundation for quantitative models of land use dynamics and yield forecasting has been laid by these works. The value of land is highly correlated with its capacity for agricultural production in rural areas where agriculture predominates. Based on the property's suitability for farming and the potential revenue from agricultural pursuits, the price of the land is established [11]. The advancement of quantitative land evaluation has been greatly aided by the growth of information technology. Thanks to tools like geographic information systems (GIS) and quantitative modelling techniques, researchers can now more effectively analyses the relationships between the interconnections between land resources and land use. With the aid of these technologies, it is possible to combine several data sources, including soil, climate, and land use information, to create quantitative models that simulate and forecast the performance of land use systems. Overall, while qualitative techniques of land evaluation and expert opinion continue to be significant, more rigorous and quantitative approaches to land evaluation are now possible thanks to advances in quantitative modelling and the availability of technology. These developments offer useful techniques for evaluating land resources, examining how land use affects those resources, and making informed decisions regarding land management and planning [12] The process of evaluating land is intricate and comprises numerous steps and factors. By taking into account numerous concerns, methodologies, and stakeholders in an open and methodical way, integrated evaluation approaches seek to fulfil the varied needs of various users. This makes it possible to evaluate trade-offs and make decisions that account for various viewpoints. The regional integration of land evaluation is greatly facilitated by geographic information systems (GIS). By efficiently organizing and storing land mapping units and their features, GIS technology offers a spatial framework for analysis and decision-making [13].

2. MATERIALS & METHODS

Alternative parameter: Soil texture, Soil calcium carbonate, Organic matter, Soil salinity, Soil alkalinity
Evaluate parameter: Soil texture, Soil calcium carbonate, Organic matter, Soil salinity, Soil alkalinity
Soil texture: The relative amounts of sand, silt, and clay particles in the soil are referred to as its texture. It specifies the soil's physical makeup and is essential in determining the soil's characteristics and suitability for various purposes. Important elements like water-holding capacity, drainage, nutrient retention, and root penetration are influenced by the texture of the soil. While soils with more clay particles tend to have better water-holding capacity but worse drainage, soils with a higher proportion of sand particles often have better drainage but lower water and nutrient retention.
Soil calcium carbonate: The term "soil calcium carbonate" refers to the soil's calcium carbonate minerals, commonly referred to as "lime" or "calcite." It frequently occurs in soils made from limestone or chalk formations and has a big effect on soil characteristics. Calcium carbonate in the soil can change the pH and increase the alkalinity of the soil. This might have an impact on how plants grow because different plants need a different pH for the best nutrient absorption. Furthermore, high quantities of calcium carbonate can change the structure of soil, resulting in the development of compacted or hardened layers that can obstruct root penetration and water infiltration.
Organic matter: The decomposing remains of plants, animals, and microorganisms are referred to as organic matter in soil. It contributes significantly to soil fertility and general soil health and is made up of complex carbon-based molecules. Improved soil structure and porosity caused by organic matter result in enhanced water infiltration and retention. Additionally, it strengthens the soil's capacity to retain vital nutrients, limiting their loss through leaching. Additionally, beneficial soil organisms like earthworms and bacteria use organic matter as food, which helps the breakdown of organic materials and the cycling of nutrients.
Soil salinity: Soil salinity refers to the concentration of salts, primarily sodium, potassium, calcium, and magnesium ions, in the soil. High levels of soil salinity can negatively impact plant growth and productivity. Excessive soil salinity can lead to osmotic stress, where the high salt concentration in the soil hinders the ability of plant roots to take up water. This can result in reduced plant growth, wilting, and ultimately, plant death. Salinity can also affect nutrient availabilit, as high salt levels can interfere with the uptake of essential nutrients by plants. Additionally, increased soil salinity can alter soil structure, leading to soil crusting and reduced water infiltration, exacerbating the negative effects on plant growth.
Soil alkalinity: The term "soil alkalinity" refers to a soil's pH value, which is more than 7. It suggests that the soil is naturally more basic or alkaline. The availability of nutrients and plant growth can both be significantly impacted by high soil alkalinity. Plants' ability to get nutrients can be impacted by alkaline soils. Alkaline environments make some vital elements, like iron, manganese, and phosphorus, less accessible to plants, which can result in nutrient shortages. Due to the fact that many soil microorganisms prefer neutral to slightly acidic environments, alkalinity can also have an impact on soil microbial activity. As a result, soil alkalinity can throw off the equilibrium of soil ecosystems.

TOPSIS Method: In order to solve problems involving Multiple Criteria Decision Making (MCDM), the TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) method is frequently utilised [2, 3]. It is useful for a variety of real-world situations, such as reviewing financial ratios within a certain industry, comparing firm performances, and analyzing financial investments in modern manufacturing systems [4, 5]. However, TOPSIS is not without its drawbacks. Enhancing the weight sensitivity of the R value has been the main goal of earlier research to improve the original TOPSIS approach [6, 7]. The methodology for determining the R value has also advanced, thanks to innovations like the "Miqiezhi" approach [8]. There is a need for a simpler and more efficient technique to understand the fundamental connection between the R value and alternative evaluation due to the complexity of evaluation difficulties. The modified TOPSIS (M-TOPSIS) method is a revolutionary strategy that is presented in this research. In order to assess the quality of alternatives, it entails figuring out how far reference points and alternatives are from one another in the D+ D- plane. By providing a simpler and improved method to handle MCDM problems, the M-TOPSIS method seeks to increase understanding of the assessment process. [1]The current equation for converting objective criteria is unable to guarantee consistency between the language ratings of subjective criteria and the values of the objective criteria. The converted values and the fuzzy numbers defined within the [0,1] range may then have compatibility problems. The translation of A3 using Liang and Wang's direct connection equation, for instance, yields values that lie outside the [0,1] range, resulting in incompatibility when three alternatives (A1, A2, and A3) are evaluated under a benefit criterion with precise values. Their inverse relationship equation raises the same problem. [2]It is incorrect to regard the product of two positive triangular fuzzy numbers as a triangle fuzzy number. However, it's possible that this isn't always the case. To provide proper representation, the membership function of the multiplication of two positive triangular fuzzy numbers needs to be further developed.The approach used by Liang and Wang uses a ranking strategy that includes maximising set and minimising set [9]. However, the presented information does not go into specific detail or usefulness of this rating approach. [3]The Technique for Order of Preference by Similarity to Ideal Solution, or TOPSIS method, is a popular technique in multiple criteria decision making (MCDM). It has been widely used in numerous studies and fields, including those cited in the literature (Abo-Sinna & Amer, 2005; Agrawal, Kohli & Gupta, 1991; Cheng, Chan & Huang, 2003; Deng, Yeh & Willis, 2000; Feng & Wang, 2000, 2001; Hwang & Yoon, 1981; Jee & Kang, 2000; Kim, Park & Yoon, 1997; Lai, Liu[4]Fuzzy MCDM issues are also now covered by the TOPSIS approach. Different strategies have been put forth by researchers to use TOPSIS to address fuzzy MCDM. For instance, Tsaur, Chang, and Yen (2002) use centroid defuzzification to transform a fuzzy MCDM problem into a crisp one before using the TOPSIS approach. Fuzzy integrals are used by Chen and Tzeng (2004) to convert a fuzzy MCDM problem into a nonfuzzy MCDM problem, and grey relation grade is used to specify the relative proximity of each choice. Chu (2002a, 2002b) and Chu and Lin (2003) use the TOPSIS method to turn a fuzzy MCDM problem into a crisp one and solve it. They use interval arithmetics of fuzzy numbers to create membership functions of weighted ratings, which they then defuzzify into crisp values using the mean of method [5].The TOPSIS technique is based on the premise that the preferred alternative should be the closest to the ideal solution that is positive and the furthest away from the perfect solution that is ideal. The ratings of alternatives and the weights of criteria are true values in traditional TOPSIS. This traditional approach has been effectively used in a number of domains, and the literature extensively discusses these uses However, in some circumstances, particularly when taking into account imprecise criteria, it can be difficult to exactly determine the real values of the ratings of alternatives. The ratings are shown as fuzzy values in these circumstances. Although TOPSIS has been extended to address fuzzy decision-making issues, these additions frequently have drawbacks. For instance, ideal solutions are frequently presented as real values rather than fuzzy values, while ideal solutions that might not be possible in the decision matrix are represented as fuzzy values [1, 5, 6, 32, 23, 55]. [6]It is feasible to collect ground-truth findings for comparison in classification problems, which aids in assessing how well various strategies perform. With MCDM, we only have access to ratings or assessments of candidate alternatives, and both the normalisation methodology used and the MCDM method have an impact on these ratings.The optimum choice answer may be missed if the normalisation methodology is not appropriate for the particular decision problem or the selected MCDM method. To guarantee accurate and pertinent results in MCDM, it is crucial to thoroughly consider and choose a suitable normalisation technique.[7]Each object is assigned a synthetic index by the approach, which measures how closely it resembles the positive ideal solution and how far it is from the negative ideal solution. The best values for each attribute are represented by the positive ideal solution, and the worst values are represented by the negative ideal solution. In order to give a thorough evaluation of the objects in terms of the multidimensional economic phenomena under examination, TOPSIS takes into account both the proximity to the positive ideal solution and the distance from the negative ideal solution.This strategy enables decision-makers to evaluate the effectiveness or performance of numerous items or alternatives based on multiple factors at once. It allows for item comparisons and ranking based on relative performance, taking into consideration all pertinent determinants or variables [8].The values that maximise the benefit criterion and minimise the cost criteria are represented by the positive ideal solution, whilst the inverse is represented by the negative ideal solution. The best possible values for each criterion are included in the positive ideal solution, while the lowest possible values are included in the negative ideal solution.In the TOPSIS technique, a decision matrix is built using the scores or ratings given to each alternative for each criterion. Then, this matrix is normalised to take into account variations in scale or measurement units amongst criterion. The distances between each choice and the positive and negative ideal solutions are computed using the normalised decision matrix[9].A multiple attribute decision-making (MADM) problem is seen by TOPSIS as a geometric system made up of points that represent different options in an n-dimensional space.By measuring the distance between an alternative and the positive-ideal solution, which represents the best possible values for each criterion, and the negative-ideal solution, which represents the worst possible values for each criterion, the approach seeks to identify the alternative with the shortest distance to the positive-ideal solution. To identify the most advantageous option, an index termed similarity to the positive-ideal solution and remoteness from the negative-ideal solution are calculated.

3. RESULTS AND DISCUSSION

TABLE 1. Data Set for The Performance of Electronic Payment Systems in India

	Reliability.	Mobility.	Service Continuity.	User Convenience.	Energy Efficiency.
Smart Waste Bins	0.2513	0.7897	0.6510	0.5193	0.8496
Waste Level Sensors	0.6328	0.9775	0.6669	0.4478	0.0206
AI Recycling Robots	0.4937	0.3698	0.3597	0.4222	0.3928
E-Waste Kiosks	0.1074	0.0040	0.9872	0.0237	0.8644

Table 1 shows the data set of land evaluation techniques

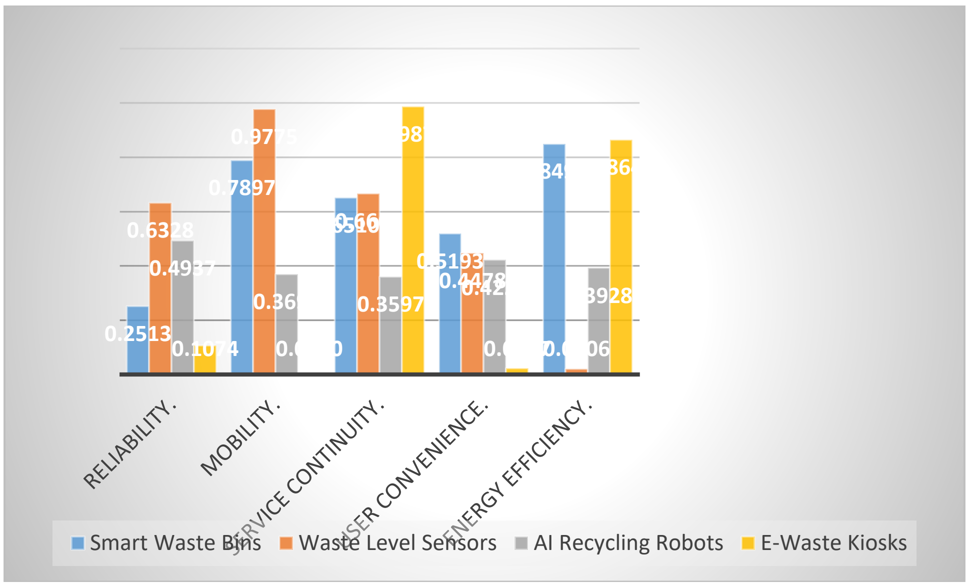

FIGURE 1. Date Set

Figure 1 shows the graph of data set of land evaluation techniques

TABLE 2. Normalized Data

	Reliability.	Mobility.	Service Continuity.	User Convenience.	Energy Efficiency.
Smart Waste Bins	0.296464	0.602843	0.463497	0.644564	0.666719
Waste Level Sensors	0.746327	0.746236	0.474838	0.555887	0.01618
AI Recycling Robots	0.582288	0.282318	0.256114	0.524082	0.30829
E-Waste Kiosks	0.126673	0.003035	0.702926	0.029427	0.678366

Table 2 shows the normalized data of land evaluation techniques

TABLE 3. Weight

	Reliability.	Mobility.	Service Continuity.	User Convenience.	Energy Efficiency.
Smart Waste Bins	0.2	0.2	0.2	0.2	0.2
Waste Level Sensors	0.2	0.2	0.2	0.2	0.2
AI Recycling Robots	0.2	0.2	0.2	0.2	0.2
E-Waste Kiosks	0.2	0.2	0.2	0.2	0.2

Table 3 shows the table of weights of land evaluation techniques

TABLE 4. Weighted Normalized decision matrix

	Reliability.	Mobility.	Service Continuity.	User Convenience.	Energy Efficiency.
Smart Waste Bins	0.059293	0.120569	0.092699	0.128913	0.133344
Waste Level Sensors	0.149265	0.149247	0.094968	0.111177	0.003236
AI Recycling Robots	0.116458	0.056464	0.051223	0.104816	0.061658
E-Waste Kiosks	0.025335	0.000607	0.140585	0.005885	0.135673

Table 4 shows the weighted normalized decision matrix of land evolution techniques

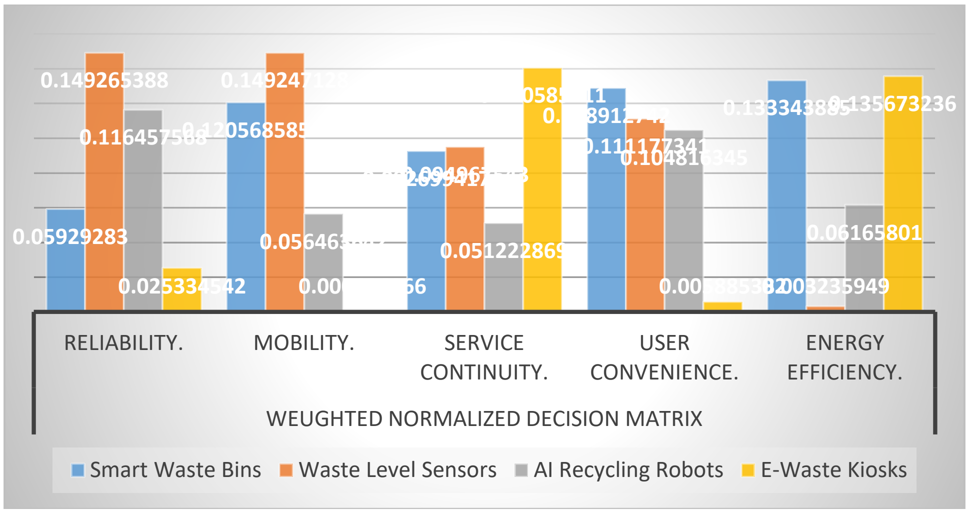

FIGURE 4. Weighted Normalized decision matrix

Figure 4 shows the graph of normalized decision matrix of land evaluation techniques

TABLE 5. Positive Matrix

	Reliability.	Mobility.	Service Continuity.	User Convenience.	Energy Efficiency.
Smart Waste Bins	0.149265	0.149247	0.140585	0.128913	0.135673
Waste Level Sensors	0.149265	0.149247	0.140585	0.128913	0.135673
AI Recycling Robots	0.149265	0.149247	0.140585	0.128913	0.135673
E-Waste Kiosks	0.149265	0.149247	0.140585	0.128913	0.135673

Table 5 shows the land evaluation techniques of positive matrix

TABLE 6. Negative Matrix

	Reliability.	Mobility.	Service Continuity.	User Convenience.	Energy Efficiency.
Smart Waste Bins	0.025335	0.000607	0.051223	0.005885	0.003236
Waste Level Sensors	0.025335	0.000607	0.051223	0.005885	0.003236
AI Recycling Robots	0.025335	0.000607	0.051223	0.005885	0.003236
E-Waste Kiosks	0.025335	0.000607	0.051223	0.005885	0.003236

Table 6 shows the land evaluation techniques of negative matrix

TABLE 7. SI Plus, Si Negative, and Ci

	SI Plus	Si Negative	Ci
Smart Waste Bins	0.105906	0.222099	0.677122
Waste Level Sensors	0.141192	0.224617	0.614028
AI Recycling Robots	0.154044	0.15692	0.504624
E-Waste Kiosks	0.229322	0.159766	0.410617

TABLE 8. Rank

Smart Waste Bins	1
Waste Level Sensors	2
AI Recycling Robots	3
E-Waste Kiosks	4

Table 8 shows the ranks of land evaluation techniques

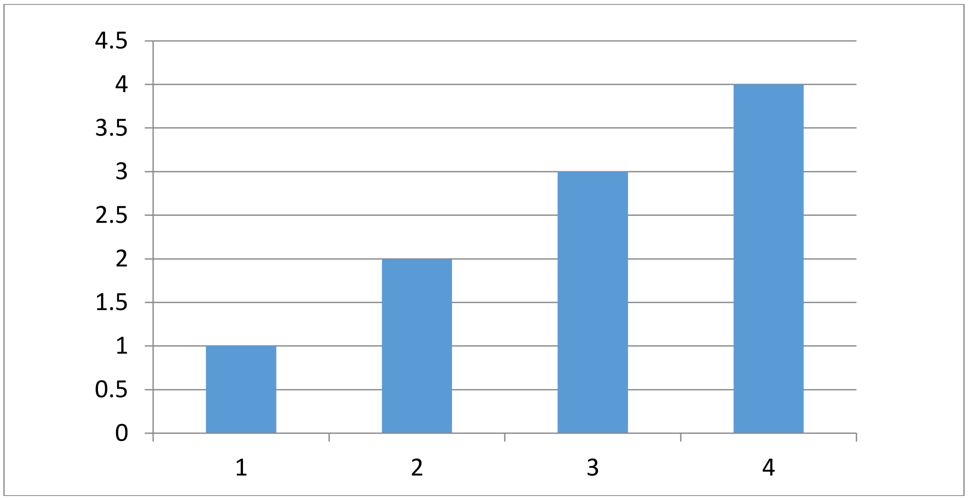

FIGURE 8. Rank

Figure 8 represent the rank of land evaluation techniques

4. CONCLUSION

In conclusion, methods for evaluating land are essential for determining its suitability, capacity, and constraints for a variety of uses. These methods integrate data from several sources, including field surveys, remote sensing, GIS, economic analysis, and expert knowledge. They combine qualitative and quantitative methodologies. Land evaluation approaches offer important insights for land-use planning, sustainable management, and decision-making processes by taking into account biophysical, socioeconomic, and environmental issues. A thorough understanding of land features and their suitability for certain applications is possible through the use of qualitative evaluation methodologies, professional judgement, and field observations. The optimization of land use alternatives is made possible by quantitative modelling and simulation approaches, which allow the prediction of land performance and outcomes under various scenarios. The visualization, overlay, and integration of diverse data layers are made easier by the integration of GIS and spatial analysis, allowing for the construction of suitability maps and assisting spatial decision-making. In order to rank and choose the best land use possibilities, multi-criteria decision analysis offers a structured method for taking into account various criteria and stakeholder preferences. By evaluating the financial viability and profitability of various land uses, economic analysis approaches supplement land appraisal and aid in the formulation of well-informed economic decisions. Techniques for evaluating land are essential for environmental preservation, socioeconomic development, and sustainable land use. These methods aid in maximizing land use, reducing environmental effects, and encouraging good land stewardship by offering a systematic and thorough examination of land resources.

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