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Rank and Analysis Several Solutions of Healthcare Waste to Achieve Cost Effectiveness and Sustainability Using Neutrosophic MCDM Model

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Abstract: Managing healthcare waste (HCWTT) from healthcare facilities is difficult. It's high up on the list of health concerns. This growth in HCWTT has been especially visible in recent years, as the quantity of medical services available has increased. Because of the potential danger, this garbage poses to people and the planet, it must be properly disposed of. Because of ineffective waste management practices, inadequate financial resources, and a lack of adequate facilities, HCWT administration is especially crucial in developing nations. Reducing HCWT via appropriate treatment is important for the area's financial and environmental health. In order to solve single-valued neutrosophic (SVN) group decision-making issues with missing weight details, this research creates a unique multi-criterion decision-making (MCDM) approach. First, it's important to remember that various decision-makers (DMs) have varying levels of expertise. To get over the problem that the standards cannot compensate for each other, an improved version of ELECTRE is studied. The ELECTRE method is used under neutrosophic environment to rank solutions of HCWT.

Keywords: Sustainability, Healthcare Waste Management, MCDM, Neutrosophic Set.

1. Introduction

The leadership of healthcare waste (HCWT) is an important aspect of public health since it entails concern for the environment. Medical and laboratory facilities often produce hazardous waste, or HCWT. The disposal of medical waste has evolved into a difficult and intricate issue. Healthcare facilities produce HCWTs, which have the potential to harm humans and their surroundings. Managing HCWT waste may be done in a number of ways. To properly handle this waste and lessen its impact on human health and the contamination of the surroundings, the right procedure and proper equipment for HCWT handling must be chosen[1], [2].

The gathering of waste from hospitals, choosing the delivery mode and routes to purifying facilities, the determination of treatment technological advances, and the choice of a disposal area are only few of the many steps that make up HCWT administration. Difficulties in HCWT administration include reducing waste and increasing recycling rates, limiting the release of harmful gases from incinerators, and developing new methods of burning. Since there are several HCWT solutions available, converting HCWT to municipal waste is only one option for handling the same. To this end, a variety of mathematical tools and techniques were used to determine the best approach to HCWT administration[3], [4].

Various multicriteria methods for the HCWT problem of management may be found in previously completed research, such as the fuzzy approach and a fuzzy set, interval fuzzy logic, and intuitionistic hesitant fuzzy sets[5], [6].

Smarandache first introduced the concept of a neutrosophic set (NS) with three possible memberships (truth, indeterminacy, and falsehood). When representing information that is ambiguous, partial, or inconsistent, NSs are preferred over FSs and IFSs because of their versatility and usefulness[7]–[9]. This paper ranks and analysis of HCWT solution by applying ELECTRE method under neutrosophic environment. ELECTRE is a multi-criteria decision-making approach from the family of outranking methods; it involves building an over-classification connection that takes into account the decision-makers created choices in light of the assessed criteria and the choices that are presented[10], [11].

2. Healthcare Waste Risks

When we talk about healthcare waste, we're referring to everything that is thrown away when providing medical treatment in a hospital, clinic, or private home. There are many different ways to categorize HCWT, however, the most common methods separate it into risky and nonhazardous components that account for 75–90% and 10–25%, respectively. The non-hazardous portion of healthcare waste (HCWT), referred to as general HCWT, is composed mostly of paper, plastic, glass, and food scraps and jars and is comparable to municipal solid trash[12], [13].

Risky waste, in contrast to non-hazardous trash, may pose a variety of chemical and physical dangers to the natural world and human health. Type, origin, and potential hazards during collection, transportation, storage, and disposal all contribute to the different groups into which hazardous household waste (HCWT) falls. Sharps, infectious trash, dated chemicals, medications, anatomical/pathological waste, and radioactive material are all part of this category of garbage. In particular, the expense of getting rid of hazardous trash is multiplied by 10 compared to that of regular garbage. Therefore, accurately determining the kinds and amounts of HCWT generated when measuring HCWT production rates is very important in appropriate and safe HCWT administration[14]–[16].

3. Healthcare Waste Sustainability

As among the most rapidly expanding industries worldwide, the healthcare business is also one of the most wasteful since it offers so many products and services to prevent and cure illness. Healthcare waste (HCWT) has the potential to significantly impact local ecology and public wellness. In addition, the worldwide supply of HCWT increases at a rate of 2% to 3% each year in line with the rise of the overall population index and the expansion of healthcare infrastructure. China has the fastest-growing HCWT market, with a projected volume of 2.496 million tons in 2023. As an important ecological problem, HCWTs need careful oversight and the implementation of appropriate treatment procedures prior to disposal[17]–[19].

HCWT administration is crucial for ensuring safeguards for the environment and economical sustainability since it provides the means to correctly classify, collect, transport, process, and discard of HCWT. However, there are several obstacles in the way of effective implementation of HCWT management strategies, including inadequate funding from hospital management, inexperienced personnel dealing with infectious materials, and antiquated technology and procedures for disposing of HCWT. For example, just 58% of institutions examined from 24 countries throughout the globe had sufficient mechanisms for coping with the secure removal of HCWT, based to an evaluation published by the globe Health Organization.

The past ten years have seen an explosion in study of HCWT in all its forms. HCWT administration difficulties throughout the COVID-19 pandemic have all received considerable attention in previous research. Waste reduction and the implementation of programs to prepare for recycling, composting, and restoration according to the circular economy (CE) model should be explored in the healthcare business to conserve both ecological and monetary assets without compromising the industry's top objective of providing high-quality care to patients.

Despite the fact that HCWT is a severe concern to human and environmental health owing to its infectious and dangerous properties, there is a paucity of information in the literature about how a CE model may be used to deal with HCWT. However, the COVID-19 pandemic's breakout has added another layer of complexity to the already difficult task of disposing of HCWT in an ecologically sound manner, given the prevalence of highly transmissible waste generated by both patients and healthcare personnel. In addition, more study is necessary because of the haze that surrounds a comprehensive structure of HCWT research topics and developments towards a CE transformation and ecological sustainability[20], [21].

3.1 Plastic Waste

How much plastics have improved our lives or how much they may complicate them in the future may be the most divisive topic of conversation as we enter the 21st century. Because of its cheap cost, adaptability, and resilience, plastic is one of the most important materials used in the packaging industry. Although mass manufacture of plastics began roughly 60 years ago, it has recently increased so much that 8.3 billion metric tons have been produced, the majority of which are in disposable goods that end up as rubbish. Plastic is just a long-chain polymer molecule, chemically synthesized from the repeating structural components of a single monomer. Polyethene is the molecular term for the plastic used to make things such as grocery bags, foil, and various types of toys. Up to 20,000 separate ethane molecules are linked to make each polyethylene chain under extreme conditions of heat and pressure. The enormous number of chains of polymers in such plastic makes it challenging to break down in the environment. The vast majority of polymers used in consumer goods today have their origins in fossil fuels.

It's no surprise that polymer substances have had a significant effect on our way of life, and it's not easy to dispose of plastics in an environmentally responsible manner. Most typical plastic items employ polymers that are not biodegradable and have a degradation time in moist soil of more than a century. Only 16% of plastic trash gets recycled into new plastics, despite the fact that more than 380 million tons of polymers are generated annually across the globe. To aid with the recycling procedure and various forms of recycling, the Society of the Plastics Industry (SPI) has allocated a recycling code (ranging from 1 to 7). It is crucial to create a system for managing plastic trash that has a good effect on the environment via recycling, reusing, and appropriate disposal[18], [19].

3.2 Medical Waste

However, biodegradable artificial polymers are extensively used in the healthcare and bio-sector due to their important qualities to manage the function of efficacy and rate of biodegradability. Drug administration systems, implants for surgery, spectacles, sutures, tissue manipulation, and many more medical device applications make extensive use of artificial biodegradable polymers. There are two primary sources of medical waste: hospitals and other institutional settings (such as pathology labs) and individuals (who throw away their own personal supplies of medicine).

Cytotoxic waste (waste containing materials with cytotoxic effects) make up 15% of all medical wastes, as reported by the World Health Most of these waste products are damaging to the ecosystem and the medical field because they include poisonous components and hazardous compounds. Infectious diseases may spread to both medical patients and healthcare workers if medical waste is not disposed of properly. In addition, the improper disposal of healthcare wastes is harming landfills, water, and the surrounding environment, all of which pose potential indirect health concerns. It's crucial to sort medical wastes by category before properly disposing of them, taking all necessary precautions along the way.

Various kinds of healthcare waste are often stored in containers with corresponding tiers and color codes. IV bottles, IV sets, infection dressing, aprons, and gloves are all placed in red plastic bags or containers before being autoclaved or microwaved. Solid hazardous or pathogenic items, including cotton buds, dressing substances, and anatomic or bodily tissues, should be placed in yellow boxes or plastic bags before being incinerated, plasma paralyzed or deep buried in a landfill. Ampoules, syringes, glass, scalp veins, needles, and blades that have been contaminated are thrown away in either a blue container or a white (or transparent) container, depending on the kind of contamination. The contents of the blue box are usually sterilized in a sterilizer, microwave, or hydrolase before being recycled. A sealed lead bucket marked "radioactive" is used for disposing of radioactive materials. Wrappers, food ingredients, and papers are thrown out in a black container or bag[20], [21].

3.3 Electronic Waste

E-waste, or electronic garbage, is an increasing problem in addition to the more common non-biodegradable plastic. Humanity's propensity to generate e-waste is expanding as a result of the widespread use of digital technologies, which are transforming everything from our daily routines to our sports and our health care. There has been a 21% increase in e-waste output over the last five years, and most of it is not routinely collected or reused, as reported by the United Nations Global E-waste Report 2020. The analysis estimates that in 2019, Asia produced 24.9 Mt of e-waste, the Americas produced 13.1 Mt, and Europe produced 12 Mt; Africa and Oceania produced 2.9 Mt and 0.7 Mt, respectively. Unfortunately, much of the electronic garbage produced in the developed world ends up in the landfills of nations in Africa, Asia, and Latin America. The poisonous chemicals and dangerous elements included in electronic trash, such as mercury, are harmful to human health and the environment. The World Health Organization reports that millions of individuals, mainly children and women, have their health put at risk due to the informal processing of discarded electronic trash. It is not good for children and women to gather metals and precious items from electronics dumps, which is what most underdeveloped nations do. This is a major problem[22].

4. Healthcare Waste and COVID-19

The recent spread of the pandemic COVID-19 has caused widespread alarm. Social isolation, lockdowns, border closures, protective clothing, aprons, and face shields are only some of the preventative measures that have been used in every nation throughout the world. The number of infected individuals and mortality rates continues to rise every day despite the efforts of international and local governments in most nations. By October 15, 2021, it is expected that 240 million people will have been affected and 4.90 million will have lost their lives due to the disease. Personal protective equipment (PPE) including masks, gloves, and face shields are used to prevent the spread of disease, but their usage results in an alarming amount of hospital and medical waste. Low-income nations are particularly vulnerable to the dangers posed by medical waste. Infections spread by improperly discarded medical supplies kill at least 5.2 million people per year, including 4 million children. The amount of medical waste produced as a result of this epidemic has been documented in a number of studies[23], [24].

Medical waste in China amounts to around 469 tons per day, as reported by Peng et al. A total of 12,740 tons of medical waste were produced in only 60 days after the first incidence was discovered in Indonesia. Due to their potential as a communication channel, great care must be taken while disposing of infectious wastes. Many nations' environments and populations are at risk because of the waste generated by this epidemic. Used protective equipment (PPE) plastic contamination has received widespread attention and will continue to add to the accumulation of microplastic Many poor and rising nations lack adequate regulations for the disposal of such materials, which might lead to the eventual spread of this virus.

This virus may live on pavement for up to 9 days, as shown by Kampf et al., which raises worry in many nations due to the potential for general waste contamination in the absence of waste disposal programs. In addition, there is a higher risk of transmission since recycling employees in numerous nations gather items without wearing sufficient PPE and then reuse these substances. Inadequate disposal of this garbage will increase the risk of disease transmission both during and after the pandemic. As a result, managing biomedical waste is crucial, particularly in emerging and low-income nations, to stop the spread of this epidemic[25], [26].

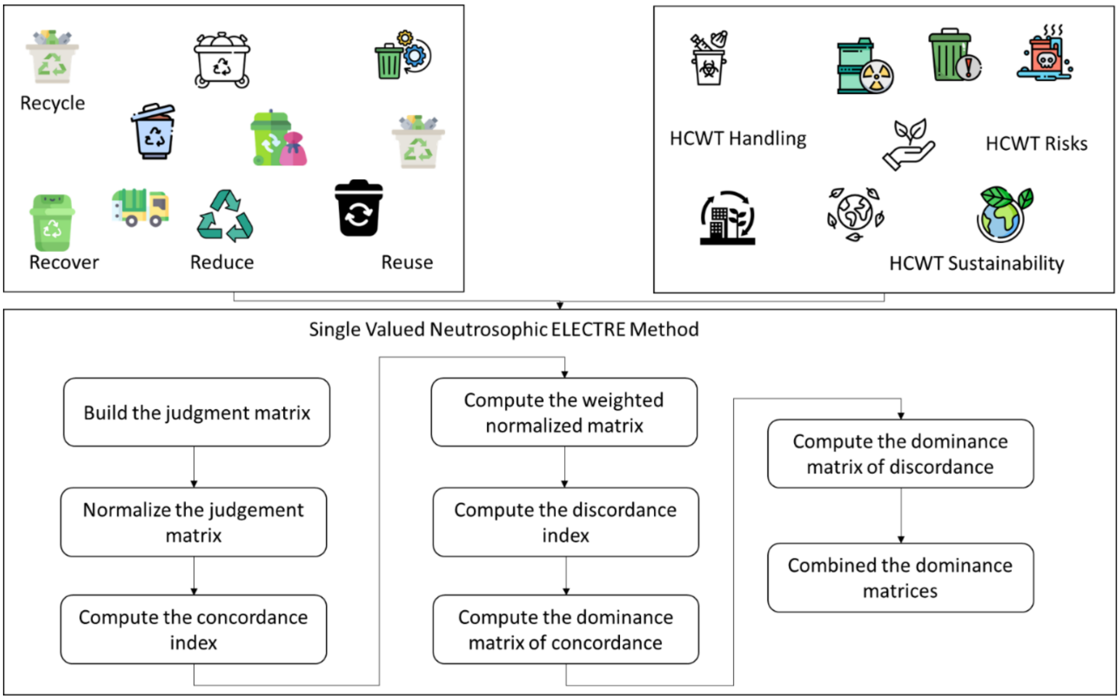

Figure 1. The combined between HCWT criteria and proposed method.

5. MCDM Methodology

The Roy-proposed ELECTRE technique is the most widely used multi-criteria analysis approach within the group of outranking techniques. Contradictory choice factors and their relative relevance may be used to build ordering connections among options, allowing for the definition of harmony and disagreement indices. As a result, the approach aids in identifying the group of solutions that are most preferable, even if they are not ideal. Similarly, to other European School MCDM approaches, the ELECTRE approach does not offer a ranking of options but rather groups them together based on outranking indices. The best alternatives from the perspective of all the criteria analyzed simultaneously are those in the kernel set, which is the set that examines other options not over-classified by any other. The number of viable options may be narrowed down in this manner. One way to categorize the other sets is by the options that are being passed up. As a result, the user's preferences may be taken into account by increasing the size of the pool of viable options by establishing the maximum amount of outranking connections[27]–[29]. Figure 1 shows the framework of the proposed method. The HCWT suitability, handling and risks are entered as an input of criteria to the proposed method, also the recycle, reuse, recover and reduce are criteria of HCWT. Also, the figure show the steps of the proposed method.

5.1) Build the judgment matrix.

5.2) Normalize the judgement matrix

$$T_{ij} = \frac{x_{ij}}{\sqrt{\sum_i x_{ij}^2}} \quad (1)$$

5.3) Compute the concordance index.

The next step of the procedure involves contrasting each set of options using a different set of criteria.

$$d_{mm} = \sum_{j|\,T_{ij}>T_{nj}} w_j + 0.5 \sum_{j|\,T_{ij}=T_{nj}} w_j \quad (2)$$

5.4) Compute the weighted normalized matrix.

$$WT_{ij} = T_{ij} * w_j \quad (3)$$

5.5) Compute the discordance index

$$S_{mn} = \frac{\max_{j|\, T_{mj}<T_{nj}} |WT_{mj} - WT_{nj}|}{\max_j |WT_{mj} - WT_{nj}|} \quad (4)$$

5.6) Compute the dominance matrix of concordance

$$O_{mn} = \begin{cases} 1, if\ d_{mn} > c \\ 0, if\ d_{mn} \leq c \end{cases} \quad (5)$$

5.7) Compute the dominance matrix of discordance

$$P_{mn} = \begin{cases} 1, if\ S_{mn} < d \\ 0, if\ S_{mn} \geq c \end{cases} \quad (6)$$

5.8) Combined the dominance matrices

$$L_{mn} = o_{mn}.P_{mn} \quad (7)$$

6. Results

The efficient leadership of HCWT is a critical and challenging issue for all hospitals and clinics. Multi-criteria decision-making is necessary to address this issue. The single valued neutrosophic numbers are used in the context of HCWT leadership in this research. This section provides the application of the proposed neutrosophic method under single valued neutrosophic set. This study gathered 15 criteria as a feature of HCWT as shown in Figure 2 and 10 solutions.

Table 1. Initial matrix by single valued neutrosophic numbers

	HCW_1	HCW_2	HCW_3	HCW_4	HCW_5	HCW_6	HCW_7	HCW_8	HCW_9	HCW_{10}	HCW_{11}	HCW_{12}	HCW_{13}	HCW_{14}	HCW_{15}
HCA_1	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.8, 0.2, 0.15>	<0.2, 0.8, 0.7>	<0.9, 0.1, 0.05>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.3, 0.7, 0.6>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.9, 0.1, 0.05>
HCA_2	<0.9, 0.1, 0.05>	<0.5, 0.5, 0.45>	<0.9, 0.1, 0.05>	<0.65, 0.35, 0.3>	<0.8, 0.2, 0.15>	<0.9, 0.1, 0.05>	<0.65, 0.35, 0.3>	<0.9, 0.1, 0.05>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.3, 0.7, 0.6>	<0.9, 0.1, 0.05>	<0.65, 0.35, 0.3>	<0.2, 0.8, 0.7>
HCA_3	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.8, 0.2, 0.15>	<0.5, 0.5, 0.45>	<0.8, 0.2, 0.15>	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>	<0.65, 0.35, 0.3>	<0.8, 0.2, 0.15>	<0.8, 0.2, 0.15>	<0.5, 0.5, 0.45>	<0.8, 0.2, 0.15>	<0.3, 0.7, 0.6>	<0.3, 0.7, 0.6>
HCA_4	<0.8, 0.2, 0.15>	<0.3, 0.7, 0.6>	<0.9, 0.1, 0.05>	<0.5, 0.5, 0.45>	<0.9, 0.1, 0.05>	<0.5, 0.5, 0.45>	<0.65, 0.35, 0.3>	<0.9, 0.1, 0.05>	<0.5, 0.5, 0.45>	<0.9, 0.1, 0.05>	<0.5, 0.5, 0.45>	<0.9, 0.1, 0.05>	<0.65, 0.35, 0.3>	<0.65, 0.35, 0.3>	<0.2, 0.8, 0.7>

HCA_5	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.5, 0.5, 0.45>	<0.2, 0.8, 0.7>	<0.5, 0.5, 0.45>	<0.3, 0.7, 0.6>	<0.5, 0.5, 0.45>	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>	<0.8, 0.2, 0.15>	<0.5, 0.5, 0.45>	<0.3, 0.7, 0.6>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>
HCA_6	<0.9, 0.1, 0.05>	<0.5, 0.5, 0.45>	<0.3, 0.7, 0.6>	<0.3, 0.7, 0.6>	<0.65, 0.35, 0.3>	<0.65, 0.35, 0.3>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>	<0.65, 0.35, 0.3>	<0.65, 0.35, 0.3>	<0.2, 0.8, 0.7>	<0.5, 0.5, 0.45>	<0.65, 0.35, 0.3>	<0.8, 0.2, 0.15>	<0.2, 0.8, 0.7>
HCA_7	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.65, 0.35, 0.3>	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>	<0.8, 0.2, 0.15>	<0.5, 0.5, 0.45>	<0.3, 0.7, 0.6>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>
HCA_8	<0.8, 0.2, 0.15>	<0.9, 0.1, 0.05>	<0.65, 0.35, 0.3>	<0.65, 0.35, 0.3>	<0.8, 0.2, 0.15>	<0.5, 0.5, 0.45>	<0.8, 0.2, 0.15>	<0.5, 0.5, 0.45>	<0.8, 0.2, 0.15>	<0.8, 0.2, 0.15>	<0.2, 0.8, 0.7>	<0.65, 0.35, 0.3>	<0.3, 0.7, 0.6>	<0.3, 0.7, 0.6>	<0.3, 0.7, 0.6>
HCA_9	<0.8, 0.2, 0.15>	<0.3, 0.7, 0.6>	<0.8, 0.2, 0.15>	<0.2, 0.8, 0.7>	<0.5, 0.5, 0.45>	<0.2, 0.8, 0.7>	<0.8, 0.2, 0.15>	<0.2, 0.8, 0.7>	<0.8, 0.2, 0.15>	<0.8, 0.2, 0.15>	<0.3, 0.7, 0.6>	<0.8, 0.2, 0.15>	<0.8, 0.2, 0.15>	<0.2, 0.8, 0.7>	<0.8, 0.2, 0.15>
HCA_{10}	<0.2, 0.8, 0.7>	<0.3, 0.7, 0.6>	<0.9, 0.1, 0.05>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.9, 0.1, 0.05>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.9, 0.1, 0.05>	<0.3, 0.7, 0.6>	<0.2, 0.8, 0.7>	<0.9, 0.1, 0.05>	<0.2, 0.8, 0.7>	<0.9, 0.1, 0.05>	<0.2, 0.8, 0.7>

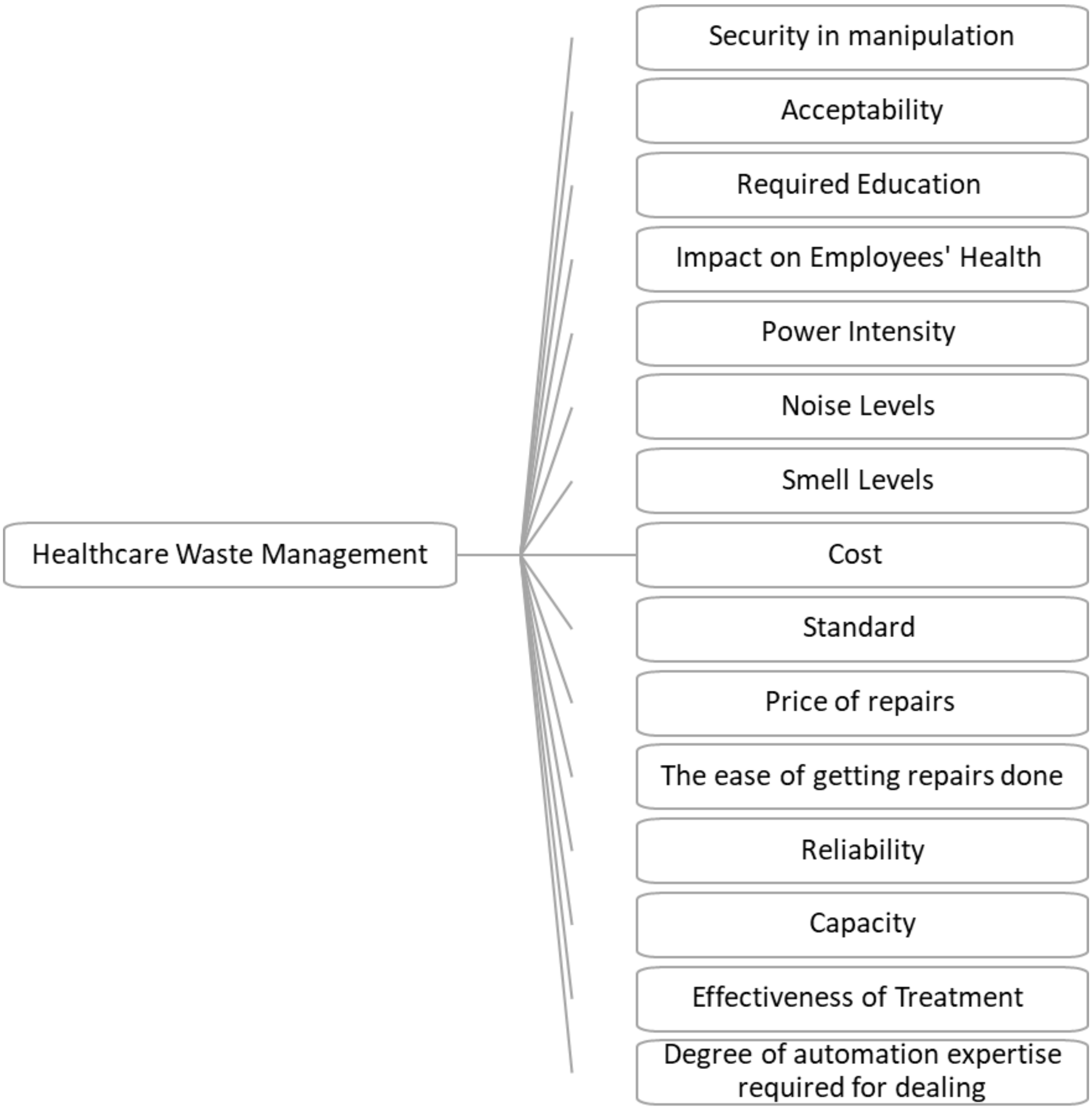

Figure 2. The healthcare waste criteria.

Then apply the steps of the proposed method using single valued neutrosophic numbers as shown in Table 1. Then let experts to evaluate the criteria and alternatives. Then apply the proposed method. Then normalize the dataset to ensure all data in the same range as shown in Table 2 using Eq. (1). Then compute the weights of criteria, and multiply it by the normalization decision matrix as shown in Table 3 using Eq. (3).

Table 2. Normalization decision matrix

	HCW1	HCW2	HCW3	HCW4	HCW5	HCW6	HCW7	HCW8	HCW9	HCW10	HCW11	HCW12	HCW13	HCW14	HCW15
HCA$_1$	0.042813	0.118694	0.048309	0.058824	0.05291	0.048611	0.123116	0.055777	0.125285	0.05848	0.052239	0.055096	0.061162	0.044872	0.235043

HCA$_2$	0.168196	0.091988	0.13285	0.168067	0.12963	0.190972	0.100503	0.219124	0.091116	0.05848	0.052239	0.055096	0.168196	0.128205	0.059829
HCA$_3$	0.042813	0.118694	0.118357	0.130252	0.12963	0.048611	0.100503	0.079681	0.091116	0.143275	0.182836	0.085399	0.149847	0.064103	0.08547
HCA$_4$	0.149847	0.059347	0.13285	0.130252	0.145503	0.107639	0.100503	0.219124	0.070615	0.160819	0.115672	0.151515	0.122324	0.128205	0.059829
HCA$_5$	0.042813	0.118694	0.074879	0.058824	0.082011	0.069444	0.077889	0.055777	0.091116	0.05848	0.182836	0.085399	0.061162	0.128205	0.08547
HCA$_6$	0.168196	0.091988	0.048309	0.084034	0.10582	0.138889	0.100503	0.079681	0.091116	0.116959	0.052239	0.085399	0.122324	0.157051	0.059829
HCA$_7$	0.042813	0.118694	0.096618	0.058824	0.10582	0.048611	0.100503	0.055777	0.091116	0.05848	0.182836	0.085399	0.061162	0.064103	0.059829
HCA$_8$	0.149847	0.163205	0.096618	0.168067	0.12963	0.107639	0.123116	0.123506	0.111617	0.143275	0.052239	0.110193	0.061162	0.064103	0.08547
HCA$_9$	0.149847	0.059347	0.118357	0.058824	0.082011	0.048611	0.123116	0.055777	0.111617	0.143275	0.074627	0.134986	0.149847	0.044872	0.209402
HCA$_{10}$	0.042813	0.059347	0.13285	0.084034	0.037037	0.190972	0.050251	0.055777	0.125285	0.05848	0.052239	0.151515	0.042813	0.176282	0.059829

Table 3. weighted normalization decision matrix

	HCW$_1$	HCW$_2$	HCW$_3$	HCW$_4$	HCW$_5$	HCW$_6$	HCW$_7$	HCW$_8$	HCW$_9$	HCW$_{10}$	HCW$_{11}$	HCW$_{12}$	HCW$_{13}$	HCW$_{14}$	HCW$_{15}$
HCA$_1$	0.763936	1.583661	0.576983	1.024913	0.664066	0.867386	1.413443	0.928153	1.37442	0.973126	1.004749	1.149265	0.730492	0.898042	3.911217
HCA$_2$	3.001179	1.227337	1.586703	2.928324	1.626962	3.407589	1.153831	3.646314	0.999578	0.973126	1.004749	1.149265	2.008854	2.565835	0.995582
HCA$_3$	0.763936	1.583661	1.413608	2.269451	1.626962	0.867386	1.153831	1.325932	0.999578	2.384158	3.516621	1.78136	1.789706	1.282918	1.422261
HCA$_4$	2.673778	0.79183	1.586703	2.269451	1.826182	1.920641	1.153831	3.646314	0.774673	2.676096	2.224801	3.160478	1.460985	2.565835	0.995582
HCA$_5$	0.763936	1.583661	0.894324	1.024913	1.029302	1.239123	0.894219	0.928153	0.999578	0.973126	3.516621	1.78136	0.730492	2.565835	1.422261
HCA$_6$	3.001179	1.227337	0.576983	1.464162	1.328132	2.478246	1.153831	1.325932	0.999578	1.946251	1.004749	1.78136	1.460985	3.143148	0.995582
HCA$_7$	0.763936	1.583661	1.153966	1.024913	1.328132	0.867386	1.153831	0.928153	0.999578	0.973126	3.516621	1.78136	0.730492	1.282918	0.995582
HCA$_8$	2.673778	2.177534	1.153966	2.928324	1.626962	1.920641	1.413443	2.055195	1.224483	2.384158	1.004749	2.298529	0.730492	1.282918	1.422261

HCA_9	2.673778	0.79183	1.413608	1.024913	1.029302	0.867386	1.413443	0.928153	1.224483	2.384158	1.435356	2.815699	1.789706	0.898042	3.484539
HCA_{10}	0.763936	0.79183	1.586703	1.464162	0.464846	3.407589	0.576916	0.928153	1.37442	0.973126	1.004749	3.160478	0.511345	3.528023	0.995582

Then compute the concordance index using Eq. (2). Then compute the discordance index using Eq. (4). Then compute the dominance matrix of concordance using Eq. (5). Then compute the dominance matrix of discordance using Eq. (6). Then compute the dominance matrices using Eq. (7) to obtain the final score as shown in Figure 3.

The second solution is the best followed by third, fourth, and tenth solutions. The seventh solution is the worst and least importance.

Figure 3. Values of combined the dominance matrices.

7. Conclusion

An essential part of the healthcare infrastructure is the problem of how to best manage healthcare workers. Hazardous healthcare waste (HCWT) is produced by healthcare facilities and may be harmful to humans and ecosystems. The risks associated with HCWT, however, must be mitigated to the greatest degree feasible by appropriate treatment. This research addresses the issue of acquiring a new HCWT sterilization plant to convert the same into utility trash, one of several potential approaches to dealing with HCWT. Choosing a new building is an example of a typical decision-making issue that may be solved using MCDM techniques. This paper applied the ELECTRE method under single valued neutrosophic set. The single valued neutrosophic set is used to overcome the uncertain data. Then the ELECTRE method is applied into single valued neutrosophic numbers. This study used 15 criteria and 10 solutions to give best solution in HCWT. The main results show the second solution is the best followed by third, fourth, and tenth solutions. The seventh solution is the worst and least importance.

Data availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare that there is no conflict of interest in the research.

Ethical approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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