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B_{V2}TrS Appraiser Model: Enforcing BHARAT Version2 in Tree Soft Modelling for Appraising E-Mobility Hurdles

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Abstract: Electric vehicles (EVs) are being introduced to lessen greenhouse gas (GHG) emissions, air pollution, and reliance on fossil fuels. As a result of the government's aggressive promotion of EVs and rising environmental consciousness, EVs are quickly rising to the top of the low-carbon transportation market. Several viewpoints suggested that shifting to electric vehicles has been seen as a potential way to achieve sustainable mobility. Nevertheless, many studies discussed the obstacles and hurdles that obstruct the embracing of various electric-mobility (E-mobility) as EVs and electric-scooters (E-scooters) as eco-friendly means. Herein, we discussed these hurdles and determined them through surveys for prior studies. Therefore, appraising these hurdles is the objective of our study. Best Holistic Adaptable Ranking of Attributes Technique – version 2 (BHARAT -v2) as a novel Multi-Criteria Decision Making (MCDM) technique is leveraged as an appraiser technique for these hurdles. Tree Soft (TrS) methodology is utilized for modeling these hurdles. Hence, we hybridized and integrated two methodologies for constructing BHARAT v2 Tree Soft (Bv2TrS) as an appraiser model. Subsequently, we discussed the findings of the Bv2TrS appraiser model.

Keywords: Electric Vehicles (EVs); Electric-Mobility (E-mobility); Tree Soft; Multi-Criteria Decision Making (MCDM); Best Holistic Adaptable Ranking of Attributes Technique - version2 (BHARAT-v2).

1. Introduction

A global effort is underway to employ renewable energy sources to cut greenhouse gas emissions ;hence achieving a green environment. There are several motivations why nations embrace the concept of a green environment. Whilst [1] highlighted two well-known important environmental issues that are facing the world now are climate change and global warming. Also, the scholars demonstrated that the transport sector is considered the main contributor to these issues. This has been confirmed by [2] where more than 20% of the world's CO_2 emissions come from the transportation sector. [3] stated that fossil fuels like petroleum and diesel, whose burning produces carbon dioxide and other greenhouse gases, are largely used in transportation. As well [4] indicated that India's swift industrialization and commercialization will increase the country's need for transportation, which would increase the demand for vehicles. One growing concern among these forecasts of affluence in the future is global warming. Thereby [5] fossil fuel-powered vehicles are starting to be banned by several territories. An impending shift in the transportation system [6] toward a low-carbon, ecologically sustainable regime is necessary to combat the danger posed by greenhouse gas (GHG) emissions, air pollution, and reliance on finite fossil fuels.

Given a variety of technologies, approaches, and innovations in [7] to help decarbonization, the market for electric vehicles (EVs) is expanding quickly. Moreover, EVs were introduced by Kumar et

al. [8] as one of the best ways to address the current climate crisis. This alteration provides safe, emission-free transportation, improves health, lowers energy prices and consumption, preserves land, and creates jobs [9]. According to [10] As environmentally beneficial and sustainable substitutes for traditional internal combustion engine (ICE)-based automobiles, EVs have drawn a lot of interest.

Even while EVs are better for the environment, there are still significant barriers to their widespread adoption. prior perspectives as [11] categorized the obstacles and hurdles to market penetration from the viewpoints of investors, manufacturers, and governmental organizations. Others as [12] highlighted three categories have been identified as the elements influencing consumers' inclinations to embrace electric vehicles: A user's psychological factors include driving experience, attitudes, emotions, perceived behavioral control, societal influence, and symbolic value. (i) Situational factors include technical specifications, price, environmental factors, and subsidy policy. (ii) Individual variables include gender, age, occupation, income, and education. (iii) Household variables include vehicle ownership, accessibility to plug-in vehicles at home, and household size.

Accordingly, various scholars as [13] Prior research have attempted to determine the hurdles to EV adoption from the viewpoints of experts or users. A pilot study of the clients and expert opinion have been utilized to direct the research to narrow down the identified hurdles. Thereby [14] emphasized the existence of interrelatedness between the examined EV hurdles using factor analysis and recommended, simplifying the problem, concentrating on the reduced set of barriers according to the degree of linkage between those.

Herein, we are analyzing electric mobility in other words e-mobility's hurdles in the form of categories and sub-categories. Hence, we are structuring this problem into a hierarchical shape by using a novel methodology of tree soft sets (TSSs) introduced by Smarandache [15]. Also, this methodology has proven its efficiency and implemented in other studies and applications as evaluating Cloud Services [16] also, in bioinformatics problems [17]. Nevertheless, analyzing mobility's hurdles is based on experts who are related to this field. The appraising process is conducted through leveraging the ability of Multi-Criteria Decision Making (MCDM) techniques which are able to treat conflicting criteria[18–22]. Accordingly, this study contributed to harnessing a novel technique of MDM is Best Holistic Adaptable Ranking of Attributes Technique (BHARAT). this technique is proposed by Rao [23] which harnessed BHARAT version-1 for the first time in selecting optimal electronic commerce (E-commerce) websites in [24].

Generally speaking, the study's objectives are illustrated in a set of points:

1. Conducting surveys related to our scope based on prior studies.
2. Highlighting the importance of e-mobility and EVs toward bolstering the green environment as a result of the previous point. Also, e-mobility's hurdles impede the embracing and implementation of e-mobility and EVs.
3. Determining the hurdles of e-mobility and classifying it into a set of levels through leveraging TSSs.
4. Appraising the determined hierarchical hurdles through BHARAT -v2 of MCDM techniques based on a soft scale used by an expert for appraising. Resulting in, constructing a BHARAT-v2 tree soft model ($B_{v\text{-}2}$TrS) to appraise e-mobility's hurdles.
5. The most and least influential hurdle is the result of the $B_{v\text{-}2}$TrS model.

2. Survey of the Scientific Studies and Methodologies

The intent of conducting this section is to survey and examine the related studies that serve and cover the study's objectives which are stated in previous points.

2.1 Obstacles to Embracing Electric Mobility

For analyzing the e-mobility's hurdles, the crucial step is determining contraindications that retard the implementation of e-mobility for achieving a green environment. The result of conducted surveys of [4, 25] is aggregated in Figure 1.

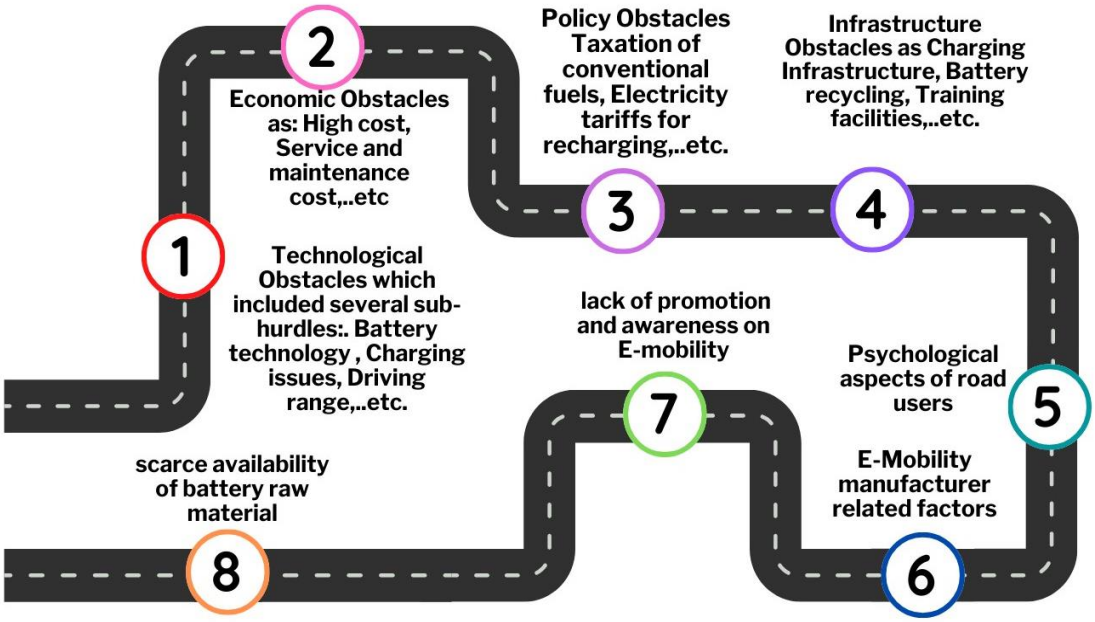

Figure 1. Electric-mobility hurdles.

2.2 *Methodologies for Evaluation E-Mobility*

Herein, we highlight the utilized methodologies that volunteered for appraising e-mobility with various purposes.

The appraising process for e-mobility is conducted by constructing pair-wise matrices based on the Analytical Hierarchical Process (AHP) in [26]. the best and worst criterion that contributes to appraising e-mobility is determined through [27] by employing the best-worst method (BWM). Others rank a set of alternatives of e-mobility and select the optimal one amongst the determined alternatives with support of the Technique for Order of Preference by Similarity to the Ideal Solution (TOPSIS) [28]. Another ranker of MCDM is exploited for ranking alternatives which is represented in VIsekriterijumska optimizacija KOmpromisno Resenje (VIKOR) [29] with support from objective MCDM method of entropy for obtaining criteria's weights. Ecer et al. [30] Used weight-multiplied comparable and weight-similar sequences for performance analysis, the COmbined COmpromise Solution (CoCoSo) technique generates a ranking list. MCDM techniques and the Delphi study are used in [31] to identify and assess the drivers for addressing LIB recycling and explore its key drivers.

2.3 *Core Concepts: New Methodologies in Decision-Making*

This sub-section intends to illustrate the utilized key conceptions in this study and their role in the appraising process.

2.3.1 **Tree Soft Methodology: Structuring Appraising Problem into Hierarchical Form**

We are using a novel expansion of the soft set involved in TSSs in this investigation, which was first introduced by Smarandache and emphasized in [15]. After that scholars of [16] embraced this new expansion and described it as:

Let $\aleph$ be a universe of discourse that includes τ a non-empty as a subset of $\aleph$, thus the powerset of τ expressed as p (τ).

Assume that our tree soft set encompasses a set of levels, each one has a multitude of nodes:

Level 1: consists of a multitude of nodes where each node represents the main criteria or hurdles, then expressed as Hu = {Hu_1, Hu_2,..Hu_n} for integer n ≥ 1.

Level 2: includes several sub-nodes of {Hu_1, Hu_2, ..Hu_n} and stated as { $Hu_{1\text{-}1}$, …$Hu_{1\text{-}n}$ } branched of Hu_1, { $Hu_{2\text{-}1}$, …$Hu_{2\text{-}n}$ } branched of Hu_2, finally { $Hu_{n\text{-}m}$, …$Hu_{n\text{-}m}$ } branched of Hu_n.

We call the leaves of the graph-tree, all terminal nodes (nodes that have no descendants).

Then, Tree Soft Set: F: P (Tree (Hu)) → p (τ).

Tree (Hu) is the set of all nodes and leaves (from level 1 to level n) of the graph tree, and P (Tree(δ)) is the powerset of the Tree (Ind). All node sets of TSSs of level n as Tree (Hu) = {Hu_{nm} | nm= 1, 2, ...}.

2.3.2 **Novel BHARAT: Analyzing Hurdles and Sub-hurdles in Constructed Tree Soft**

Generally, BHARAT is considered a novel MCDM technique proposed by Rao [23]. Moreover, it is illustrated and applied in [24]. Herein, we applied BHARAT -v2 in our appraising problem through pair-wise matrices for hurdles and sub-hurdles in tree soft as follows:

1. For generating nodes' weights in level 1:
   1.1 Constructing pairwise matrices for main hurdles based on a number of decision-makers (DMs) who contribute to ranking hurdles. MS utilized soft scales in [32] for ranking main hurdles with each other.
   1.2 Aggregate the constructed matrices into a single decision matrix. Then, computational operations are conducted to obtain the main hurdles' weights based on Eqs. (1) and (2).

$$\wp = \sum_{i=1}^{i} \frac{1}{x_j} \quad (1)$$

$$w_i = \frac{1/\wp}{\sum_{i=1}^{m} 1/\wp} \quad (2)$$

   where x_j indicates to rank of the criterion
2. For generating sub-node weights in level 2:
   2.1 Constructing pairwise matrices for each sub-hurdle by soft scale used by DMs.
   2.2 Aggregate the constructed matrices into a single decision matrix for each sub-hurdle. After that, local weights are generated based on Eqs (1) and (2), and global weights are obtained by multiplying the main hurdles' weights by local sub-hurdles' weights.
3. Ranking main hurdles and sub-hurdles based on weight values.
   - Rank 1: largest main and sub-hurdle weight.
   - least rank: smallest main and sub-hurdle weight.

3. Description of BHARAT-v2 Tree Soft Model: Bv2TrS

The methodologies in the previous two sub-sections are leveraged in appraising the problem of this study. The following steps illustrate procedures for implementing these novel methodologies in solving our problem of appraising.

3.1 Gathering Information and Prioritizes

- Determining the influenced hurdles and sub-hurdles.
- Forming a panel of experts or DMs who related to our appraising problem. These DMs are contributing to appraising and ranking main and sub-hurdles.
- Soft scale in [32] we utilized a 7-point scale for non-beneficial attributes, where hurdles and sub-hurdles were considered non-beneficial attributes.

3.2 Modeling Influenced Hurdles and Sub-Hurdles into Tree Soft Structure

- Forming the influenced main and sub hurdles into a multitude of levels.
- At level 1: Main hurdles resident in tree soft as nodes in this level.
- At level 2: Sub-hurdles resident in tree soft as nodes which inherent from nodes in level 1.

3.3 Implementing BHARAT v2 in Tree Soft to Obtain Main and Sub-Hurdles' Weights

BHARAT v2 works in nodes of TreeSoft to solve the problem of appraising.

3.3.1 **N of Pairwise Matrices are Constructed Based on N of DMs**

- Forming the influenced main and sub hurdles into a multitude of levels.
- At level 1: for each node or main hurdle, N of pairwise matrices is constructed.
- For each node, Eq. (3) is implemented for generating an aggregated matrix.
- Average or Aggregated of DMs'rating $= \frac{DM_{1+}\ DM_{2+\cdots\ldots\ldots+DM_n}}{n}$ (3)
  Where n is the number of DMs.
- In the aggregated matrix for each node, the average for each hurdle per column is calculated. Hence vector of values is generated.
- The generated vector is utilized to produce a new matrix. Calculating the average for each hurdle per raw $(\mathcal{g})$ and calculating the sum of the average column $(\hbar)$.
- Weights of main hurdles are computing as in Eq. (4).
  $w_{i=} \frac{\mathcal{g}}{\hbar}$ (4)
- At level 2: for each Sub-node or sub-hurdle, N of pairwise matrices is constructed.
- The aggregated matrix for each sub-hurdle is computing. The average for each sub-hurdle per column is calculated. Hence vector of values is generated.
- Eq. (4) is utilized for obtaining local weight for each sub-hurdle $(\mho_i)$.
- Finally, the global weight for each sub-hurdle $\Re_i$ based on Eq. (5).
  $\Re_{i=} w_i * \mho_i$ (5)
- Ranking sub-hurdles based on values of $\Re_i$.

4. An Empirical Case Study: Validating B_{v2}TrS

The purpose of this section is to verify the authenticity of our constructed B_{v2}TrS. Thus, we applied this B_{v2}TrS model in a case study. Accordingly, the previous procedures of B_{v2}TrS are implemented in this case study as the following.

4.1 We are communicating with a group of DMs to form a DMs panel. Thereby, three DMs are contributing to appraising e-mobility's hurdles

4.2 The appraising is conducted for three main hurdles and ten sub-hurdles as mentioned in Figure 2

4.3 Tree soft illustrates three main hurdles and ten sub-hurdles in a hierarchical structure.

4.4 BHARAT-v2 is leveraging in constructed tree soft to appraise the main hurdles of e-mobility and obtaining weights for hurdles

4.4.1 4BHARAT-v2 starts with level one to obtain weights for three nodes by appraising these nodes according to three DMs (see Appendix A, Table A1).

4.4.2 An aggregated matrix is generated by calculating the mean of three pair-wise matrices through applying Eq. (3) as listed in Table 1.

4.4.3 Vector for mean for main hurdles (H_n) through calculating the average for each main hurdle per column. Hence, {1.65666667, 1.342211, 0.59256667} are mean for H_1, H_2, H_3.

4.4.4 This vector is utilized in Table 2 to obtain hurdles weights.

4.4.5 Through applying Eq. (4), the hurdles' weights.

Table 1. Aggregated matrix

Aggregated	H_1	H_2	H_3
H_1	0.5	0.666633	0.7222
H_2	2.73	0.5	0.5555
H_3	1.74	2.86	0.5

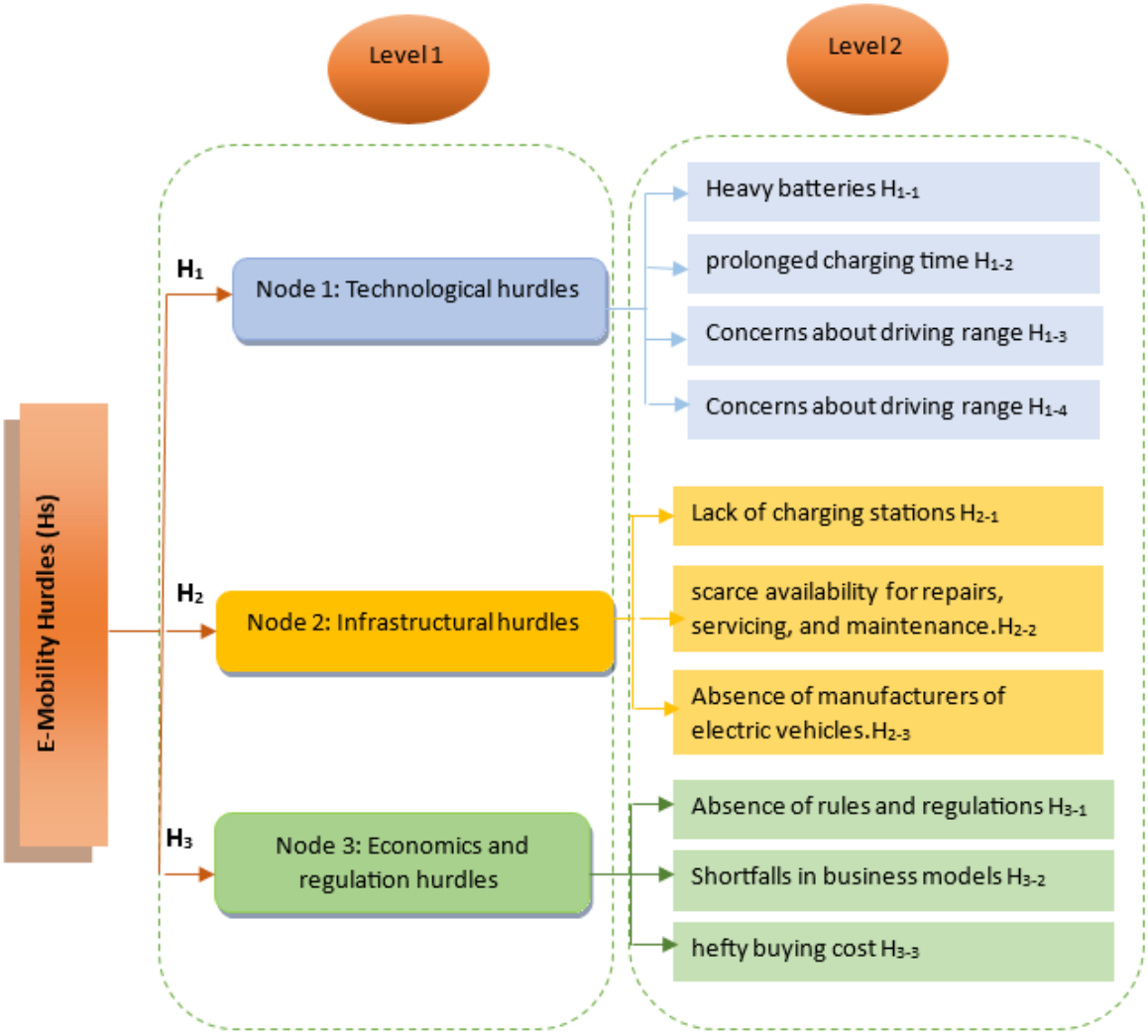

Figure 2. Tree soft model for main and sub-hurdles for e-mobility.

4.5 BHARAT-v2 is leveraging in level 2 of Tree Soft to appraise sub-hurdles of Technology and obtain weights for it

4.5.1 For each sub-hurdle, three DMs are generating pair-wise matrices (see Appendix A, in Tables A2).

4.5.2 The Aggregated matrix for each sub-hurdle is generated as listed in Table 3.

4.5.3 Vector for mean for sub-hurdles ($H_{1\text{-}n}$) through calculating the average for each sub-hurdle per column. Hence, {2.900333, 1.493688889, 0.555533} are mean for $H_{1\text{-}1}$, $H_{1\text{-}2}$, $H_{1\text{-}3}$.

4.5.4 Eq. (4) is utilized for obtaining local weights for sub-hurdles of Technology as in Table 4 and global weight is computed through using Eq. (5) and listed in Table 4.

4.6 BHARAT-v2 is leveraging in level 2 of Tree soft to appraise sub-hurdles of Infrastructure and obtain weights for it

4.6.1 For each sub-hurdle, three DMs are generating pair-wise matrices (see Appendix A, in Tables A3).

4.6.2 The Aggregated matrix for each sub-hurdle is generated as listed in Table 5.

4.6.3 Vector for mean for sub-hurdles ($H_{2\text{-}n}$) through calculating the average for each sub-hurdle per column. Hence, {2.203333, 0.972211111, 0.555533} are mean for $H_{2\text{-}1}$, $H_{2\text{-}2}$, $H_{2\text{-}3}$.

4.6.4 Eq. (4) is utilized for obtaining local weights for sub-hurdles of Technology as in Table 6 and global weight is computed through using Eq. (5) and listed in Table 6.

4.7 BHARAT-v2 is leveraging in level 2 of Tree Soft to appraise sub-hurdles of Economics and regulation and obtain weights for it

4.7.1 For each sub-hurdle, three DMs are generating pair-wise matrices (see Appendix A, in Tables A4).

4.7.2 The aggregated matrix for each sub-hurdle is generated as listed in Table 7.

4.7.3 Vector for mean for sub-hurdles ($H_{3\text{-}n}$) through calculating the average for each sub-hurdle per column. Hence, {0.78, 0.798877778, 0.648022} are mean for $H_{3\text{-}1}$, $H_{3\text{-}2}$, $H_{2\text{-}3}$.

4.7.4 Eq. (4) is utilized for obtaining local weights for sub-hurdles of Technology as in Table 6 and global weight is computed through using Eq. (5) and listed in Table 8.

4.8 Ranking sub-hurdles based on global weight values in Tables 4, 6, 8

Table 2. The main hurdles weigh in level 1.

	H_1	**H_2**	**H_3**	**Average**	**weights**
H_1	1.65666667/1.65666667	1.34/1.65666667	0.59256667/1.65666667	0.721	0.721/3.461=0.208321
H_2	1.65666667/1.34	1.34/1.34	0.59256667/1.34	0.89	0.89/3.461=0.257151
H_3	1.65666667/59256667	1.34/.59256667	59256667/59256667	1.85	1.85/3.461=0.534528
Total Sum				3.461	1

Table 3. Aggregated matrix for sub-hurdles of technology.

Aggregated	$H_{1\text{-}1}$	$H_{1\text{-}2}$	$H_{1\text{-}3}$
$H_{1\text{-}1}$	0.5	0.611066667	0.7222
$H_{1\text{-}2}$	2.851	0.5	0.4444
$H_{1\text{-}3}$	5.35	3.37	0.5

Table 4. Global weights of sub-hurdles of technology in level 2.

	$H_{1\text{-}1}$	**$H_{1\text{-}2}$**	**$H_{1\text{-}3}$**	**Average**	**Local weight**	**Global weight**
$H_{1\text{-}1}$	2.900333/2.900333	1.493688889/2.900333	0.555533/2.900333	0.57	0.57/4.63=0.12311	0.025646
$H_{1\text{-}2}$	2.900333/1.493688889	1.493688889/1.493688889	0.555533/1.493688889	1.11	1.11/4.63=0.239741	0.049943
$H_{1\text{-}3}$	2.900333/0.555533	1.493688889/0.555533	0.555533/0.555533	2.95	2.95/4.63=0.637149	0.132732
Total Sum				4.63	1	0.208321

Table 5. Aggregated matrix for sub-hurdles of infrastructure.

Aggregated	$H_{2\text{-}1}$	$H_{2\text{-}2}$	$H_{2\text{-}3}$
$H_{2\text{-}1}$	0.5	0.666633333	0.4444
$H_{2\text{-}2}$	1.81	0.5	0.7222
$H_{2\text{-}3}$	4.3	1.75	0.5

Table 6. Global weights of sub-hurdles of infrastructure in level 2.

	$H_{2\text{-}1}$	**$H_{2\text{-}2}$**	**$H_{2\text{-}3}$**	**Average**	**Local weight**	**Global weight**
$H_{2\text{-}1}$	2.203333/2.203333	0.9722111/2.203333	0.555533/2.203333	0.57	0.57/4.07=0.14004914	0.036014
$H_{2\text{-}2}$	2.203333/.97	0.9722111/0.9722111	0.555533/.0.9722111	1.28	1.28/4.07=0.314496314	0.080873
$H_{2\text{-}3}$	2.203333/.56	0.9722111/.0.555533	0.555533/0.555533	2.22	2.22/4.07=0.545454545	0.140264
Total Sum				4.07	1	0.257151

Table 7. Aggregated matrix for sub-hurdles of economics and regulation.

Aggregated	H 3-1	H 3-2	H 3-3
H 3-1	0.5	0.666633333	0.610867
H 3-2	1.84	0.5	0.8332
H 3-3	4.2.84	1.23	0.5

Table 8. Global weights of sub-hurdles of economics and regulations in level 2.

	H3-1	**H3-2**	**H3-3**	**Average**	**Local weight**	**Global weight**
H3-1	0.78/0.78	.799/.78	0.65/.78	0.953	0.953/3.033=0.314210353	0.167954104
H3-2	.78/.799	.799/.799	.65/.799	0.94	0.94/3.033=0.309924167	0.165663019
H3-3	.78/.65	.799/.65	.65//.65	1.14	1.14/3.033=0.37586548	0.20091047
Total Sum				3.033	1	0.534527593

5. Discussion

To validate the authenticity of the $B_{v2}TrS$ model, we applied it to a case study. Also, determining technological, infrastructure, and economics and regulations as the main hurdles for e-mobility. Accordingly, its sub-hurdles are determined.

In this study tree soft is utilized for modeling these influenced hurdles into a multitude of nodes in various levels as shown in Figure 2. After that BHARAT-v2 was implemented in tree soft modeling to obtain weights for each node contained in each level. Subsequently, the influenced hurdles of e-mobility are ranked according to global weights for each sub-hurdle. Figure 3 represents the ranking of each sub-hurdle for every main hurdle. For instance, $H_{1\text{-}3}$ is the most influential hurdle in technology, otherwise $H_{1\text{-}1}$ is the least. Also, $H_{2\text{-}3}$ is the most influenced hurdle in infrastructure, otherwise $H_{2\text{-}1}$ is the least. Finally, $H_{3\text{-}3}$ is the most influenced hurdle in infrastructure, otherwise $H_{3\text{-}2}$ is the least influenced.

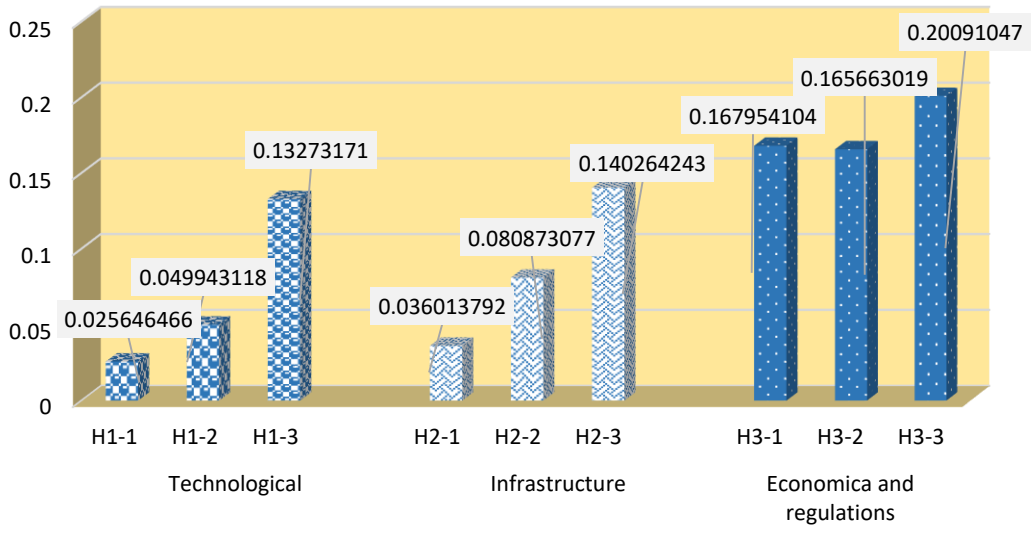

Figure 3. Ranking of sub-hurdles of e-mobility based on global weights.

6. Conclusions

E-mobility as EVs and e-scooters is an effective inducement to adopt the notion of a green environment. Consequently, the market for EVs is quickly expanding thanks to a variety of decarbonization-supporting technologies, methods, and inventions. This is due to a multitude of factors. For instance, Per the International Energy Agency's (IEA) transportation CO_2 emission report for 2022, automobiles and vans accounted for 48% of the total CO_2 emissions. All over the globe economies are moving toward the adoption of alternate fuel technologies because of the rising worldwide concern about climate change brought on by greenhouse gas emissions from vehicles and the depletion of natural resources. Hence, Electric vehicles (EVs) are positioned as a clean, green alternative technology that may make it possible to preserve natural resources and move to a low-carbon transportation system with efficiency. Although the importance of embracing EVs in our daily lives, it suffers from a set of hurdles.

Herein, the objective of this study is to analyze these hurdles and prioritize them. Therefore, to achieve this objective, we are modeling the determined hurdles through tree soft methodology. For appraising these hurdles which are modeled in tree soft, BHARAT -v2 is applied as a novel MCDM technique to appraise the influence of hurdles on e-mobility. Hence, we constructed $B_{v2}TrS$ as an appraiser model for ranking these hurdles.

The findings of this model and according to Figure 3 indicated that $H_{1\text{-}3}$ is the highest-influenced hurdle in technology with a global weight is 0.13, otherwise, $H_{1\text{-}1}$ is the least with a global weight is 0.025. In the same vein, $H_{2\text{-}3}$ is the most influenced hurdle in infrastructure with a global weight is 0.14 and $H_{2\text{-}1}$ is the least with a global weight is 0.036. Finally, $H_{3\text{-}3}$ is the most influenced hurdle in infrastructure where its global weight is 0.20, Unlike $H_{3\text{-}2}$ is the least influenced.

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Author Contributions
All authors contributed equally to this research.

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.

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

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Appendix A

Table A1. Pair-wise prioritize matrices for main hurdles in level 1.

DM_1	**H_1**	**H_2**	**H_3**	**DM_2**	**H_1**	**H_2**	**H_3**	**DM_3**	**H_1**	**H_2**	**H_3**
H_1	0.5	0.8333	0.3333	H_1	0.5	0.1666	1	H_1	0.5	1	0.8333
H_2	1/0.8333	0.5	0.6666	H_2	1/0.1666	0.5	0.8333	H_2	1	0.5	0.1666
H_3	1/0.3333	1/0.6666	0.5	H_3	1.0000	1/0.8333	0.5	H_3	1/0.8333	1/0.1666	0.5

Table A2. Pair-wise prioritize matrices for sub-hurdles of technological in level 2.

DM_1	**H_{1-1}**	**H_{1-2}**	**H_{1-3}**	**DM_2**	**H_{1-1}**	**H_{1-2}**	**H_{1-3}**	**DM_3**	**H_{1-1}**	**H_{1-2}**	**H_{1-3}**
H_{1-1}	0.5	0.1666	0.8333	H_{1-1}	0.5	1	0.3333	H_{1-1}	0.5	0.6666	1
H_{1-2}	1/0.1666	0.5	0.3333	H_{1-2}	1	0.5	0.1666	H_{1-2}	1/0.6666	0.5	0.8333
H_{1-3}	1/0.8333	1/0.3333	0.5	H_{1-3}	1/0.3333	1/0.1666	0.5	H_{1-3}	1	1/0.8333	0.5

Table A3. Pair-wise prioritize matrices for sub-hurdles of infrastructural in level 2.

DM_1	**H_{2-1}**	**H_{2-2}**	**H_{2-3}**	**DM_2**	**H_{2-1}**	**H_{2-2}**	**H_{2-3}**	**DM_3**	**H_{2-1}**	**H_{2-2}**	**H_{2-3}**
H_{2-1}	0.5	0.3333	0.1666	H_{2-1}	0.5	0.8333	0.1666	H_{2-1}	0.5	0.8333	1
H_{2-2}	1/0.3333	0.5	0.8333	H_{2-2}	1/0.8333	0.5	1	H_{2-2}	1/0.8333	0.5	0.3333
H_{2-3}	1/0.1666	1/0.8333	0.5	H_{2-3}	1/0.1666	1	0.5	H_{2-3}	1	1/0.3333	0.5

Table A4. Pair-wise prioritize matrices for sub-hurdles of economics and regulation in level 2.

DM_1	H_{3-1}	H_{3-2}	H_{3-3}	DM_2	H_{3-1}	H_{3-2}	H_{3-3}	DM_3	H_{3-1}	H_{3-2}	H_{3-3}
H_{3-1}	0.5	0.3333	0.1666	H_{3-1}	0.5	0.8333	0.1666	H_{3-1}	0.5	0.8333	1
H_{3-2}	1/0.3333	0.5	0.8333	H_{3-2}	1/0.8333	0.5	1	H_{3-2}	1/0.8333	0.5	0.3333
H_{3-3}	1/0.1666	1/0.8333	0.5	H_{3-3}	1/0.1666	1	0.5	H_{3-3}	1	1/0.3333	0.5

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