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Decision Matrix

In order to select an electric vehicle, we choose price, brand name, range, performance, styling, and cargo space as criteria. We then chose four alternatives representative of the range of current options: the Tesla Model X, the Nissan Leaf, the Chevrolet Bolt, and the Kia Soul EV. We then assigned preliminary weights to each of the alternatives:

selection criteria	weight
Purchase price	3
brand name	2
range	4
performance	3
styling	2
cargo space	4

We then assigned weights to each by pair-wise comparison:

criteria weightings

	price	brand name	range	performance	styling	cargo space
price	1	3	0.2	0.333333333	3	3
brand name	0.333333333	1	0.333333333	0.333333333	1	5
range	5	3	1	1	5	3
performance	3	3	1	1	3	0.333333333
styling	0.333333333	1	0.2	0.333333333	1	0.2
cargo space	3	5	3	3	5	1

1 = same importance, 3 = moderately more important, 5 = strongly more important, 7 = extremely n

We then took a geometric mean and divided by a total to get a normalized weight for each of the criteria:

	geometric mean	weight
	1.1247461131	0.11
	0.7137091228	0.07
	2.9541769391	0.29
	1.5518455739	0.15
	0.3385037595	0.03
	3.6801096141	0.36
sum(means)	10.3630911225	1

We then calculated ratings and normalized, using min/attribute for low better attributes and attribute/max for high better attributes, and the 1, 3, 5, 7, 9 rating as in the pairwise matrix for the qualitative attributes, dividing each attribute by the total:

price($)		Rating = min/price	normalized rating
Tesla Model X	79500	0.3859119497	0.1232643315
Nissan Leaf	30680	1	0.319410507
Chevrolet Bolt	37450	0.8192256342	0.2616692751
Kia Soul EV	33145	0.9256298084	0.2956558864
sum		3.1307673923	1

brand name		Weight = rating/total
Tesla Model X	5	0.4166666667
Nissan Leaf	3	0.25
Chevrolet Bolt	3	0.25
Kia Soul EV	1	0.0833333333
sum	12	1

range (miles/charge)		Weight = range/max	normalized rating
Tesla Model X	237	0.9957983193	0.3526785714
Nissan Leaf	107	0.4495798319	0.1592261905
Chevrolet Bolt	238	1	0.3541666667
Kia Soul EV	90	0.3781512605	0.1339285714
sum		2.8235294118	1

Performance (0-60 s)		Weight = min/performance	normalized rating
Tesla Model X	6	1	0.3011197753
Nissan Leaf	6.3	0.9523809524	0.2867807384
Chevrolet Bolt	8	0.75	0.2258398315
Kia Soul EV	9.7	0.618556701	0.1862596548
sum		3.3209376534	1

styling		Weight = rating/total
Tesla Model X	5	0.4166666667
Nissan Leaf	3	0.25
Chevrolet Bolt	3	0.25
Kia Soul EV	1	0.0833333333
sum	12	1

cargo space (ft^3)		Weight = cargo space/total
Tesla Model X	88.1	0.5976933514
Nissan Leaf	23.6	0.1601085482
Chevrolet Bolt	16.9	0.1146540027
Kia Soul EV	18.8	0.1275440977
sum	147.4	

We then computed scores for each of the alternatives, using the previously calculated normalized ratings:

alternatives	Price (0.11)	Brand Name ((Range (0.29)	Performance (Styling (0.03)	Cargo Space (0
Tesla Model X	0.12	0.42	0.35	0.30	0.42	0.60
Nissan Leaf	0.32	0.25	0.16	0.29	0.25	0.16
Chevrolet Bolt	0.26	0.25	0.35	0.23	0.25	0.11
Kia Soul EV	0.30	0.08	0.13	0.19	0.08	0.13

Finally, we multiplied each score by the weight assigned to each attribute, giving a score for each alternative. We then ranked each by this weighted score:

alternatives	score	ranking
Tesla Model X	0.41	1
Nissan Leaf	0.21	3
Chevrolet Bolt	0.23	2
Kia Soul EV	0.15	4
sum	1	

The Model X scored almost twice as much than the next alternative according to our selection criteria, although when the Kia Soul is judged by the cargo space of its two seat configuration this process ranks it slightly above the Leaf.