



Investigate the best method according to the standards of freight Multimodal transportation using AHP Technique

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Abstract:

The cost and quality of multimodal transport and logistics services are increasingly relevant for the participation of developing countries in the globalized economy. It is estimated that a doubling of transport costs leads to a drop in the economic growth rate of more than half a percentage point and that variables related to transport costs account for more than two thirds of the statistical variation in per capita income between countries. For today's requirements, traditional transport services are often insufficient. In this paper, transport routes examined by the powerful tool, AHP in IRAN. Finally, the best way to transport the desired criteria to be considered experts.

Key Words: Multimodal Transportation, AHP method, Paired comparison, Freight

Introduction:

Literature review of AHP: Decision making is an important characteristic of human. Some of these decisions are very important and some are not. We face with Multi-criteria decision problems every day and we should solve them. For example, in buying a house we should attention to: neighborhood culture, closeness to shopping centers, closeness to educational institutes, cost and etc. Because timely and accurate decisions are effective in personal and social life of humans, there is a need for powerful technique that can help people in this context. One of the efficient techniques is Analytical Hierarchy Process- AHP that created by Thomas L.Saaty. In 1980 this technique is based on paired comparison and let the managers to investigate different scenarios.

Advantages of AHP:

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1-Unity: AHP is a simple, unity and flexible model for solving a broad restricts of problems without any structures (logical) that are understandable for people.

2- Complexity: for solving complex problems, AHP uses a system approach with component analysis. It means AHP uses the two dimensions.

3- Hierarchy structuring: AHP make hierarchical systems, so this kind of organization match with human thinking and components are classified in different levels.

4- Measurement: AHP method provides a scale for measuring qualitative criteria and a method for estimating priorities.

5- Process repetition: AHP make people to correct their problem definition and improve their judgment and decision making.

6-Consistency and consensus are other advantages of AHP.

In this article we want to choose the optimum method of transportation with considering the criteria and kind of shipment by using AHP method. We enter several criteria and some option in terms of transportation experts in decision making. Speed, safety, cost, availability, quality, service, warehousing and packaging process units. Now for each of these criteria, we selected options (very low, low, medium, high, very high) and weighting according to the degree of importance. Now using AHP algorithms that examine the criteria of the paired comparison, we will find the most useful and most efficient route and type of transportation. Also, we concentrate on most important routes of transportation and important criteria that affects on it.

Our important routes for transportation are;

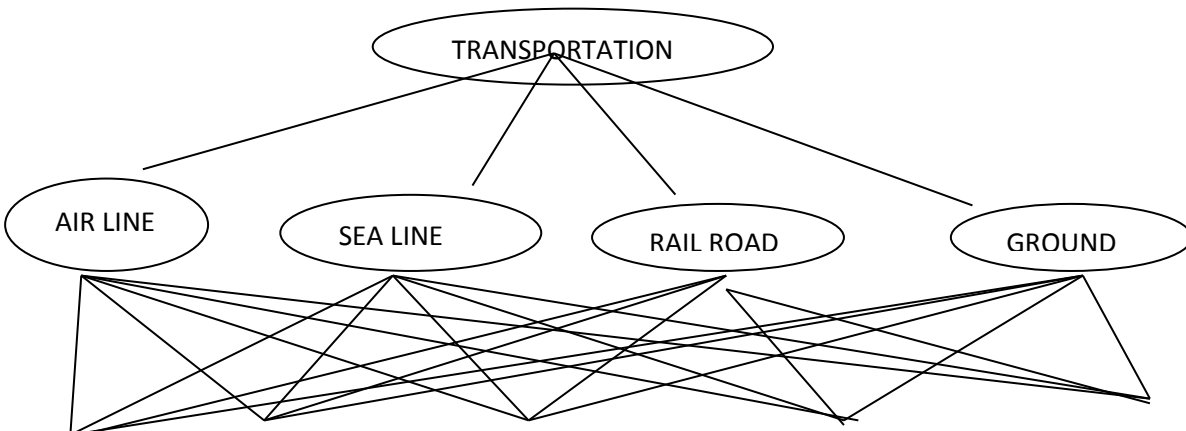
On ground: Bazargan Border, Mehran Border, Kish And Bandar Abbas Port And Afghanistan Border.

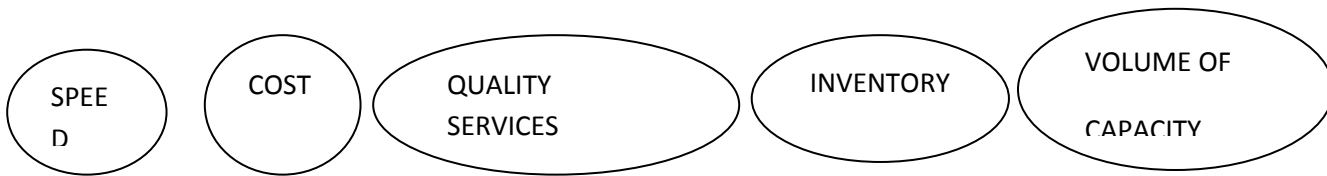
On sea: Chabahar Port, Anzali Port, Boushehr Port, Gheshm Port, Bandar Abbas And Kish Port.

On rail way: Khorasan, Bazargan, Bandar Abbas.

On air: Gheshm Air Port, Anzali Air Port, Chabahar Air Port.

In AHP method we have two phases: 1-making hierarchical structure. 2- Calculate weight.





Dig.1: Hierarchy choosing transportation

Table.1: Numerical value for paired comparison

Numerical value	Oral judgment
9	Extremely preferable
7	Very strongly preferable
5	Strongly preferable
3	Moderately preferable
1	Equally preferable
2,4,6,8	Another preferences

Table.2: Calculating the relative weight of routes with speed

	Air	Sea	Ground	Rail
Air	1	2	7	5
Sea	1/2	1	6	4
Ground	1/7	1/6	1	1/3
Rail	1/5	1/4	3	1
Total	1.84	3.42	17	10.34

Table.3: Calculate total weight of routes with speed

	Air	Sea	Ground	Rail	Average
Air	0.54	0.58	0.41	0.48	0.5
Sea	0.27	0.29	0.35	0.38	0.322
Ground	0.077	0.04	0.059	0.032	0.045
Rail	0.108	0.073	0.176	0.097	0.113
Total	1	1	1	1	1

As can be seen, our priorities for transportation considering speed are: air, sea, rail and the last is ground.

Table.4: Calculating relative weight of routes considering cost:

	Air	Sea	Ground	Rail	Average
Air	0.58	0.64	0.47	0.53	0.55
Sea	0.19	0.21	0.34	0.27	0.25

Ground	0.08	0.042	0.07	0.07	0.065
Rail	0.15	0.1	0.14	0.14	0.132
Total	1	1	1	1	1

As can be seen, our priorities for transportation considering cost are: air, sea, rail, ground.

Table.5: Calculating relative weight of routes considering quality services:

	Air	Sea	Ground	Rail	Average
Air	0.45	0.45	0.4	0.46	0.44
Sea	0.22	0.22	0.2	0.23	0.87
Ground	0.12	0.12	0.1	0.077	0.1
Rail	0.22	0.212	0.3	0.23	0.242
Total	1	1	1	1	1

Sea, Air, Rail, Ground

Table.6: Calculating relative weight of routes considering Inventory problems:

	Air	Sea	Ground	Rail	Average
Air	0.2	0.2	0.17	0.25	0.205
Sea	0.2	0.2	0.17	0.25	0.205
Ground	0.4	0.4	0.33	0.25	0.345
Rail	0.2	0.2	0.33	0.33	0.245
Total	1	1	1	1	1

Ground, Rail, Air and Sea.

Table.7: Calculating relative weight of routes considering The high volume capacity:

	Air	Sea	Ground	Rail	Average
Air	0.123	0.145	0.39	0.073	0.183
Sea	0.5	0.581	0.3	0.67	0.512
Ground	0.013	0.083	0.043	0.038	0.044
Rail	0.37	0.2	0.26	0.22	0.26
Total	1	1	1	1	1

Sea, Rail, Air, Ground

Now we determine Contribution of each criterion in choosing the best route to transportation.

Table.8: Calculating the contribution of each criterion on them selves.

	Speed	Cost	Quality services	Inventory	Capacity	average
Speed	0.158	0.11	0.12	0.21	0.283	0.176
Cost	0.47	0.34	0.35	0.21	0.283	0.33
Quality services	0.158	0.11	0.12	0.14	0.093	0.124
Inventory	0.052	0.11	0.03	0.071	0.057	0.07

Capacity	0.158	0.34	0.35	0.36	0.283	0.298
Total	1	1	1	1	1	1

The most effective factor is the cost for transit and others with sequence are : high volume of capacity , speed, quality services and at last, inventory.

Now we can calculate the weights of routes. So:

Final weight of Air transportation:

$$0.5*0.176 + 0.55*0.33 + 0.44*0.124 + 0.205*0.07 + 0.183*0.298 = 0.3929$$

Final weight of Sea transportation:

$$0.322*0.176 + 0.25*0.33 + 0.87*0.124 + 0.205*0.07 + 0.044*0.298 = 0.2745$$

Final weight of Ground transportation:

$$0.045*0.176 + 0.065*0.33 + 0.1*0.124 + 0.245*0.07 + 0.26*0.298 = 0.1434$$

Final weight of Rail transportation:

$$0.113*0.176 + 0.132*0.33 + 0.242*0.124 + 0.245*0.07 + 0.26*0.298 = 0.1880$$

Now if we want to now in Sea line routes choose which one of the routes, we will have:

Table.9: Choosing the best route for sea line.

	GHESHM	ANZALI	CHABAHAR	KISH	Average
GHESHM	0.27	0.26	0.38	0.23	0.285
ANZALI	0.07	0.06	0.047	0.076	0.063
CHABAHAR	0.13	0.26	0.19	0.23	0.202
KISH	0.53	0.4	0.38	0.46	0.442
Total	1	1	1	1	1

So Kish airport is so important for us and we see even Ghesm and Chabahar are 1/2 degree of importance of Kish air port. At last we have Anzali air port.

Now if we want to now in ground routes choose which one of the routes, we will have:

Table.10: Choosing the best route for ground transportation.

	Bazargan	Afghanistan Border	Mehran	Kish & Bandar Abbas	Average
Bazargan	0.21	0.33	0.27	0.19	0.25
Afghanistan Border	0.042	0.067	0.045	0.095	0.062

Mehran	0.1	0.2	0.136	0.14	0.576
Kish&Bandar Abbas	0.64	0.4	0.54	0.57	0.46
Total	1	1	1	1	1

Now if we want to now in rail routes choose which one of the routes, we will have:

Table.11: Choosing the best route for rail road.

	Kish&Bandar Abbas	Bazargan	Khorasan	Average
Kish&Bandar Abbas	0.74	0.8	0.57	0.7
Bazargan	0.15	0.16	0.357	0.222
Khorasan	0.094	0.032	0.07	0.065
Total	1	1	1	1

Now if we want to now in air line routes choose which one of the routes, we will have:

Table.12: Choosing the best route for air line.

	Bandar Abbas	Gheshm	Chabahar	Boushehr	Anzali	Average
Bandar Abbas	0.1	0.285	0.12	0.143	0.037	0.137
Gheshm	0.5	0.143	0.2	0.143	0.226	0.242
Chabahar	0.5	0.428	0.598	0.5	0.567	0.518
Boushehr	0.05	0.714	0.086	0.071	0.567	0.297
Anzali	0.3	0.714	0.12	0.143	0.113	0.278
Total	1	1	1	1	1	1

Suggestion:

As you can see in tables, Mehran's border have maximum rate but it's not necessarily to pay our most attention to it. We should look on what goods are in transfer there. For us ,Kish is more strategic than Mehran's border. It can be more efficient if we increase the volume of high capacity there.

Kish and Bandar Abbas with pay attention to moving important cargo from any guild range, is tremendously important rail rout to us. Then Bazargan's border because of it's connection with borders of Azerbaijan and Turkey and it's a way to reach us to Mediterranean sea.

In see line we can see that Chabahar port have maximum rate and actually it have. Because it is the only ocean port of Iran and it have 300Km sea border and it have the most depth for giant berthing ships. We can develop the platform.

At end in air routes we have Kish air port. It's important for because of width of the air port so it placed the Antonov plane in himself(it have 84 meter length and 18meter height and it can transfer 250 T goods) and it is commercial highway for the merchants.

Conclusion:

With Paired comparison we will find that using the ships would be more optimal than use of others with pay attention to access of Iran to free eater resources of world and it can be a tremendous added value to national income and the marine industry. Order of preference is: shipping lines, air line, rail road, and finally ground. We suggest that in MCSL route and Anzali, Nowshahr, Kish and other ports in south like Chabahar with Create a larger platform for berthing and unloading with attention to sea depth is logical and necessary. In the country using of grounded and rail ways activity can be continued.it also has lower cost and higher speed.

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