A DECISION-MAKING APPROACH FOR TRAUMA CENTER SITE SELECTION

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Master of Science in Computer Science and Engineering

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APPROVAL

This Project titled **"A Decision-Making Approach for Trauma Center Site Selection**" submitted by AMIT SARKAR to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of Master of Science in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 9nd July 2020.

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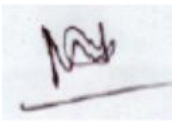

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DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Md. Zahid Hasan, Assistant Professor, Department of CSE,** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree.

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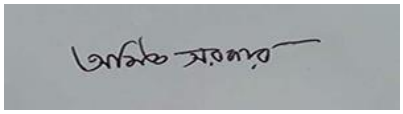

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We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

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ABSTRACT

Normally when one's made a trauma center then once select a suitable place. For selection a place we need to follow many procedures. And need some specialized man power. Such as architect, urban engineer, civil engineer, medical technician etc. For those we need many times, coast and man power. That's all are problem. To solves those problem and saves time & money we make a research project which name is **A Decision-Making Approach for Trauma Center Site Selection** provides a platform which helps to saves time, money, man power and solve those problems. Trauma Center Site Selection is a selection process which is select a suitable place from five or six places, this process calculated by AHP (Analytical Hierarchy Process) algorithm. By using this algorithm also select mobile, car, motorcycle, flat and any types of selection.

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CHAPTER 01

Introduction

1.1 Introduction

Bangladesh is an over populated country. Now is a developing country. We have many industries, vehicles, construction, road etc. In industries and construction many workers are seriously injured, In road increasing accident day by day. For those people need emergency treatment. Only hospital is not enough for those treatment. Also hospital have many process like for accident needed police pass, many types of patient treated by same doctor, doctors quantity is not enough. A "Trauma Center" can solve this problem. It has enough instrument, need small place, doctors are specialized for one type treatment, collecting Police clearance easily etc. So, need trauma center more than hospital. When we make trauma center, we feel some problem [1,2], like which place is better, land is how much important, implementation coast, availability of road, doctor, accessibility to ambulance etc. But we select one place from some place [3]. We need appropriate dissection making tools. The "AHP Method" [4] is help to select a location for Trauma center. This document presents a details story behind the planning "**A decision making approach for trauma center site selection**" by AHP Method. Alongside, it will reveal the requirements, background study, data collection, and calculation process of this. Additionally, the motivation of this research and how it would facilitate users will be illustrated.

1.2 Motivation

- **Reserving Literature:** There are many papers about hospital site selection. This project we can make a documentation of trauma center site selection.
- **Calculating cost:** When we select a place we need many surveys, research, analysis and also need man power. Then cost is very high for place selection.
- **Select appropriate place:** There are some trauma center in Bangladesh but those are not at appropriate place.
- **Specialized Treatment:** In hospital there are any specialized doctor but an emergency patient doesn't get those.
- **Confusion:** A man have confusion to select place.

1.3 Relational of the study

Rationale of the study should be specific to understand. It is also important to explain the research ideally. It is important to relate with the following points:

1.3.1 Contribution to reduce man power

When one selects a place for hospital, industry, university, college, trauma center ones need survey, data collection, fusibility study, calculate coast, targeted people, green speech etc. And for this we need specialized people. But using AHP method not need those people. AHP method select the best place.

1.3.2 Contribution to reduce coast and time

Select a place from many places is very hard, costly and many times needed. But AHP method can do this at a little time.

1.3.3 Contribution to the level of professional development of the researcher

This research has a great level of value in professional development of the researchers. There is so many works on this subject but that work is successful which contributes in professional development of the researcher. It is a great platform to gather more knowledge on AHP Method.

1.4 Research Questions

Questions that was tried to answer through this research are:

- Have any decision-making approach about trauma center site selection?
- Have any place selection process with alternative places?
- In Decision Framework have any process with multiple attribute?

1.5 Expected Output

- Most authentic site or place selection.
- Reduced Coast
- Save time
- Reduced man power

1.6 Project Management and Finance

- **Planning:** This project we want to make a decision-making approach for trauma center site selection.
- **Budgeting:** When we select a place, we need many surveys, research, analysis and also need man power. Then coast is very high for place selection. But budget is almost one time here.
- **Accounting:** There are some one-time coast needed. Those are the data collection coast. Here, we need many information about many places.
- **Financial Reporting:** Here we need not any financial reporting.
- **Internal Control:** Some time needed updating information.

1.7 Report Layout

The report is divided into six chapters. Each chapter deals with the different aspects of "A Decision-Making Approach for Trauma Center Site Selection". Each chapter has various parts explaining in detail.

- **Chapter 1: Introduction**
  This chapter discusses the important theoretical concepts behind our project. Here also discusses motivation, relational of study, research question and expected output.
- **Chapter 2: Background**
  This chapter discusses about related works, research summary, scope of the problem and challenges.
- **Chapter 3: Research Methodology**
  This chapter discusses about research subject & instrumentation, procedure of data collection, statistical analysis implementation requirements.

- **Chapter 4: Experimental Results and Discussion**

  This chapter discusses about experimental results, descriptive analysis.

- **Chapter 5: Impact on Society, Environment and Sustainability**

  This chapter discusses about impact on society and environment, ethical aspects and sustainability plan.

- **Chapter 6: Summary, Conclusion, Recommendation and Implication for Future Research**

  This chapter discusses about summary, conclusions recommendations, further study

CHAPTER 02

Background

2.1 Terminologies

A Decision-Making Approach for Trauma Center Site Selection is a process for select a location from three or more location. There are many researches about selection like hospital, phone, university, super shop, school, police station etc selections. For example, hospital site selection- we select a place basis on some criteria, like demand concern, disaster risk, environmental and administrative concern etc. For choosing smart phone basis on some criteria like, screen, camera, battery, Processor etc shown on table 2.1. And also have some sub criteria.

Table 2.1: Criteria and sub criteria table for choosing a smart phone.

Criteria	Sub criteria
Screen	Size, version, touch, regulation
Camera	Pixel, Zooming, Sensor
Battery	Power, stand by, type

This chapter is having details work present, related work, research summary. Details about Scope of the problem. Our target and challenges that we faced are described here.

2.2 Related Works

Currently there are many selection processes using AHP algorithm [5] like Analytical Hierarchy Process for Hospital Site Selection [6]. Also, using Fuzzy AHP [7].

Many researcher researches about AHP (Analytical Hierarchy Process) algorithm [8]. All calculation process same but Random Index (RI) was different [9]. But we select a default RI that was made by Saaty (1977) [10]. And Further details about AHP in Franek and Zmeskal (2013) [11]. The default RI scale (1-9) made by Saaty by his psychological observation [12]. Satays' scale shown in table 2.2. Now we have 1-15 scale [13] available.

Table 2.2: The default Random Index (RI).

N	1	2	3	4	5	6	7	8	9
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

2.3 Comparative Analysis & Summary

Here we use Analytical Hierarchy Process. We select 5 criteria and every criterion have some sub criteria. All criteria and sub-criteria shown in table 2.3. Then between 2 criteria make pairwise comparison matrix. Pairwise comparison matrix operation also applies at sub-criteria. When compare with each other there have some values shown in table 2.4. Then need some calculation those are Criteria Wight (CW), Weighted Some Value (WSV), Consistency Index (CI) and finally output is Consistency Ratio (CR). CR value is must be CR<0.01. Otherwise this value is inconsistence.

Now primarily select 5 or more location for Trauma Center. And get one place as a result.

Table 2.3: All Criteria and Sub-criteria for Analytical Hierarchy Process.

Criteria	Sub-criteria
Accessibility	Main Road, Public Transport
Availabilities	Doctor Availabilities, Servicing Availabilities, Pharmacy Availabilities, Land Availabilities, Transport Availabilities
Distances	Fire Service Distance, Service Center Distance, Thana Distance, Highway Distance
Infrastructure	Construction Space, Parking Space, (Electricity, gas, water).
Coast	Land Coast, Govt. Tax.

2.4 Scope of the Problem

- Satay make his RI index value physiologically. This value is a big problem.

- Many scientists change this value many times. As though the Satays' value is default up to now.
- In highly populated city if data collection is little bit wrong then calculation has a big change.

2.5 Challenges

- We need to contact with so many people to collect data, also we have to explain them that what actually we want to do in our research, what the importance of our work is.
- Many data are secured by govt.
- All data are not actual or fixed. Those are changed day by day.
- Primary place selection is also a challenge.
- Data synchronization was also taking time to plan.
- Finally, we told that actual data collection is main challenge.

CHAPTER 03

Research Methodology

3.1 Research Subject and Instrumentation

Like all other algorithm Analytical Hierarchy Process (AHP) [6] is nothing but an algorithm. Lots of algorithm is available in computer science, and also AHP plays a prominent role in computer science. This report discusses the theory and implementation of a selection process using AHP. This process is instrumented very carefully with all the process. After completing manual process, we have done our technological process. The work in progress is extending it to handle multiple type of process.

3.2 Data Collection Procedure

Data collection is not very hard here. This is a selection process and not needed any survey, big dataset. We need some information about some location. At 1st we choose some places. Those are Dhanmondi 32, Dhanmondi 27, Kolabagan, Science lab. Panthopoth. Then we create some criteria for information collection and every criterion has some sub-criteria. Those criteria and sub-criteria are shown in fig 3.1. Then we need those five locations all sub-criteria's information.

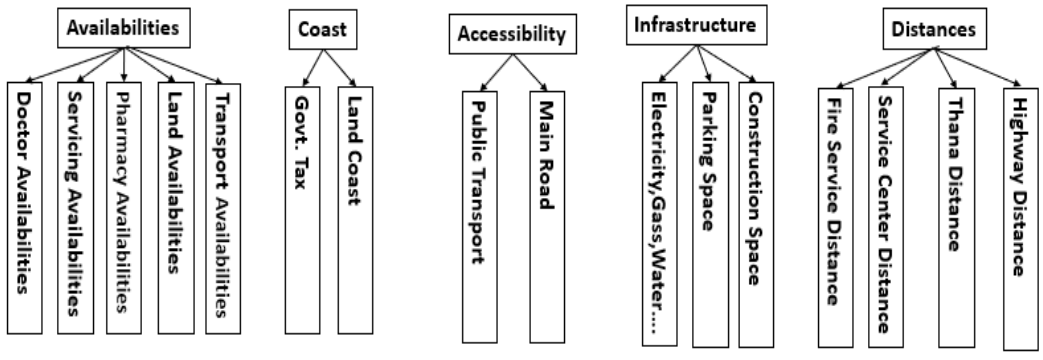

Figure 3.1: Criteria and sub-criteria.

3.2.1 Availabilities

- Transport Availabilities
- Land Availabilities
- Pharmacy Availabilities
- Servicing Availabilities
- Doctor Availabilities

We collect information about those 5 locations. We went those places and collect information like Dhanmondi 32 has 7 routes, rickshaw not allowed. Then we create three levels- high, moderate, low. Shown in table 3.1.

Table 3.1: Sub-criteria of availabilities for all places.

Location	Transport	Land	Pharmacy	Servicing	Doctor
Dhanmondi 32	High (7)	Low (3)	Moderate (5)	Moderate (5)	High (7)
Dhanmondi 27	High (7)	Moderate (5)	Low (3)	Low (3)	High (7)
Kolabagan	High (7)	Moderate (5)	High (7)	Moderate (5)	High (7)
Science Lab.	High (7)	High (7)	Low (3)	Low (3)	High (7)
Panthopoth	Moderate (5)	Low (3)	High (7)	Moderate (5)	High (7)

3.2.2 Coast

- Land Coast
- Govt. Tax

Coast analysis shown in table 3.2. We create three levels high, as usual, low.

Table 3.2: Sub-criteria of coasts for all places.

Location	Land Coast	Govt. Tax
Dhanmondi 32	High (7)	Moderate (5)
Dhanmondi 27	High (7)	Moderate (5)
Kolabagan	High (7)	Moderate (5)
Science Lab.	High (7)	Moderate (5)
Panthopoth	High (7)	Moderate (5)

3.2.3 Accessibilities

- Main Road
- Public Transport

Accessibilities analysis shown in table 3.2.

Table 3.3: Sub-criteria of accessibilities for all places.

Location	Main Road	Public Transport
Dhanmondi 32	High (7)	High (7)
Dhanmondi 27	High (7)	High (7)
Kolabagan	High (7)	High (7)
Science Lab.	High (7)	High (7)
Panthopoth	High (7)	High (7)

3.2.4 Infrastructure

- Construction Space
- Parking Space
- Electricity, Gas, Water…

We collect information about those 5 locations. Then we create three levels- available, moderate, not available. Shown in table 3.4.

Table 3.4: Sub-criteria of infrastructure for all places.

Location	Construction Space	Parking Space	Electricity, Gas, Water…..
Dhanmondi 32	Moderate (5)	High (7)	High (7)
Dhanmondi 27	Moderate (5)	High (7)	High (7)
Kolabagan	Moderate (5)	High (7)	High (7)
Science Lab.	Low (3)	Moderate (5)	High (7)
Panthopoth	Low (3)	Moderate (5)	High (7)

3.2.5 Distances

- Highway Distance
- Thana Distance
- Service Center Distance
- Fire Service Distance

We collect information about those 5 locations. Then we create three levels for distances- X<5=A, 5<X<7.5=B, 7.5<X=C. Shown in table 3.5. And distance collect from google map shown in Fig 3.2.

Table 3.5: Sub-criteria of distances for all places.

Location	Highway	Thana	Service center	Fire service
Dhanmondi 32	4.6 km (6)	1.7 km (3)	0.5 km (6)	1.5 km (5)
Dhanmondi 27	3.9 km (7)	1.5 km (5)	0.7 km (5)	0.8 km (7)
Kolabagan	5.3 km (5)	1.5 km (5)	1 km (4)	2.2 km (4)
Science Lab.	6 km (3)	0.9 km (7)	1.9 km (3)	2.9 km (2)
Panthopoth	5.7 km (4)	1.4 km (4)	0.2 km (7)	2.6 km (3)

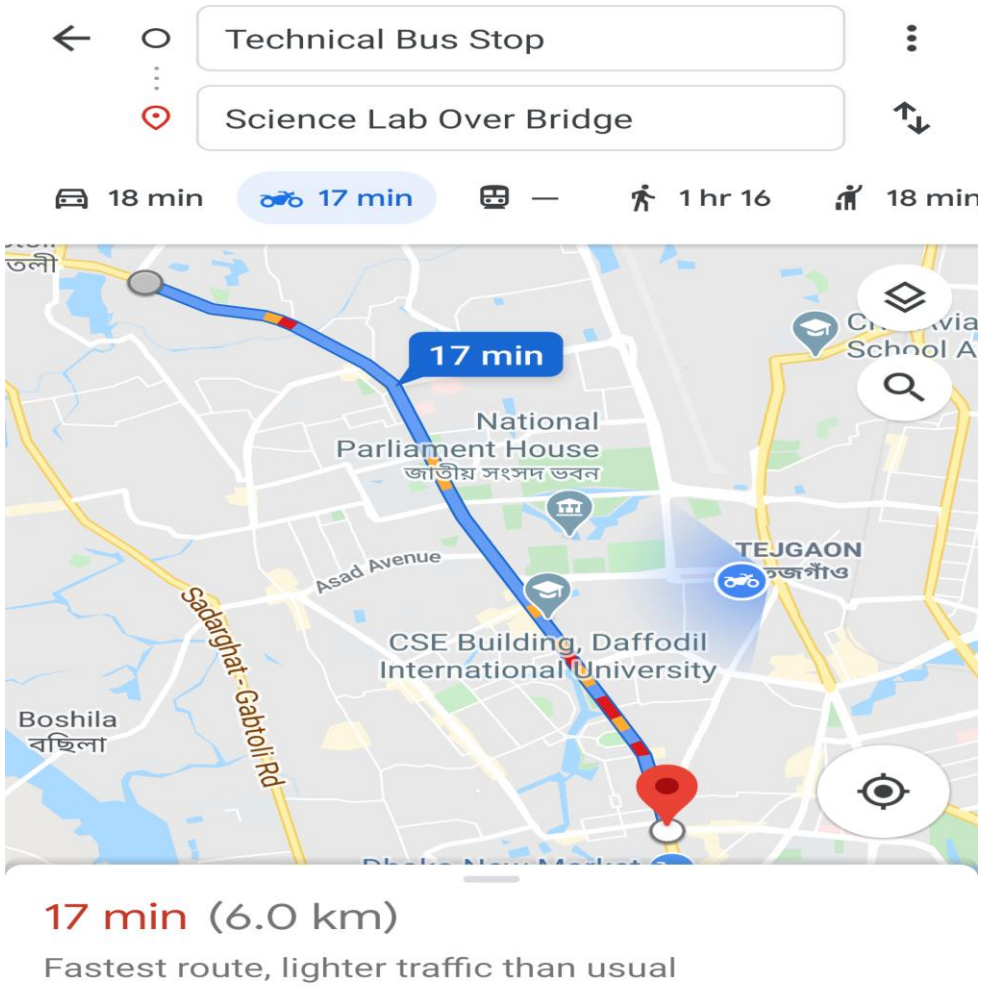

Figure 3.2: Distances collection from google map.

3.3 Statistical Analysis

While collecting information about trauma center, hospital, road accident there are many problems and all problem blames to location. Good location selection is a very big thing. There are a big amount of road accident occurred at high way. Patient whose are injured by road accident and when they go to hospital, they faced many problems such as serial, can't get emergency treatment, time wastage, police investigation etc. Every year many people died by slackened treatment. In the last 21 years there are 84000 road accident occurred. 56000 people died and 63000 people injured. In 1999 DMP Published a Road Safety Report [15]. They made a survey show in Fig 3.3, 3.4, 3.5.

Thana	Fatal	Grievous	Simple	Collision	Total	(%)
Ramna	33	57	34	52	176	19.7
Motijheel	8	33	14	13	68	7.6
Sabujbag	4	9	1	1	15	1.7
Sutrapur	4	7	1	2	14	1.6
Kotwali	4	6	0	1	11	1.2
Demra	55	48	21	15	139	15.6
Lalbag	1	0	0	2	3	0.3
Dhanmandi	5	8	7	2	22	2.5
Tejgaon	47	34	10	29	120	13.5
Mohammadpur	7	8	5	0	20	2.2
Mirpur	11	10	1	2	24	2.7
Gulshan	24	31	6	9	70	7.8
Cantonment	21	21	8	1	51	5.7
Uttara	32	23	4	4	63	7.1
Pallabi	4	2	1	0	7	0.8
Badda	21	7	1	0	29	3.3
Kafrul	8	11	3	4	26	2.9
Khilgaon	3	5	3	1	12	1.3
Hajaribag	0	0	0	0	0	0.0
Kamrangichar	0	1	0	0	1	0.1
Shyampur	12	7	2	0	21	2.4
Total	**304**	**328**	**122**	**138**	**892**	**100.0**

Figure 3.3: Accidents in DMP area by severity and thana.

		Year				
Sl no	Thana	1996	1997	1998	1999	Total
1	Ramna	104	137	203	176	620
2	Motijheel	70	85	71	68	294
3	Sabujbag	41	62	43	15	161
4	Sutrapur	46	49	41	14	150
5	Kotwali	21	11	20	11	63
6	Demra	134	137	186	139	596
7	Lalbag	7	25	16	3	51
8	Dhanmandi	23	31	51	22	127
9	Tejgaon	175	189	191	120	675
10	Mohammadpur	33	34	16	20	103
11	Mirpur	100	114	77	24	315
12	Gulshan	86	80	77	70	313
13	Cantonment	97	98	138	51	384
14	Uttara	49	57	62	63	231
15	Pallabi	15	14	10	7	46
16	Badda	0	0	0	29	29
17	Kafrul	0	0	0	26	26
18	Khilgaon	0	0	0	12	12
19	Hajaribag	0	0	0	0	0
20	Kamrangichar	0	0	0	1	1
21	Shyampur	0	0	0	21	21
	Total	1001	1123	1202	892	4218

Thana serial no. 16-21 started from 1999

Figure 3.4: Accidents by thana DMP 1996-1999.

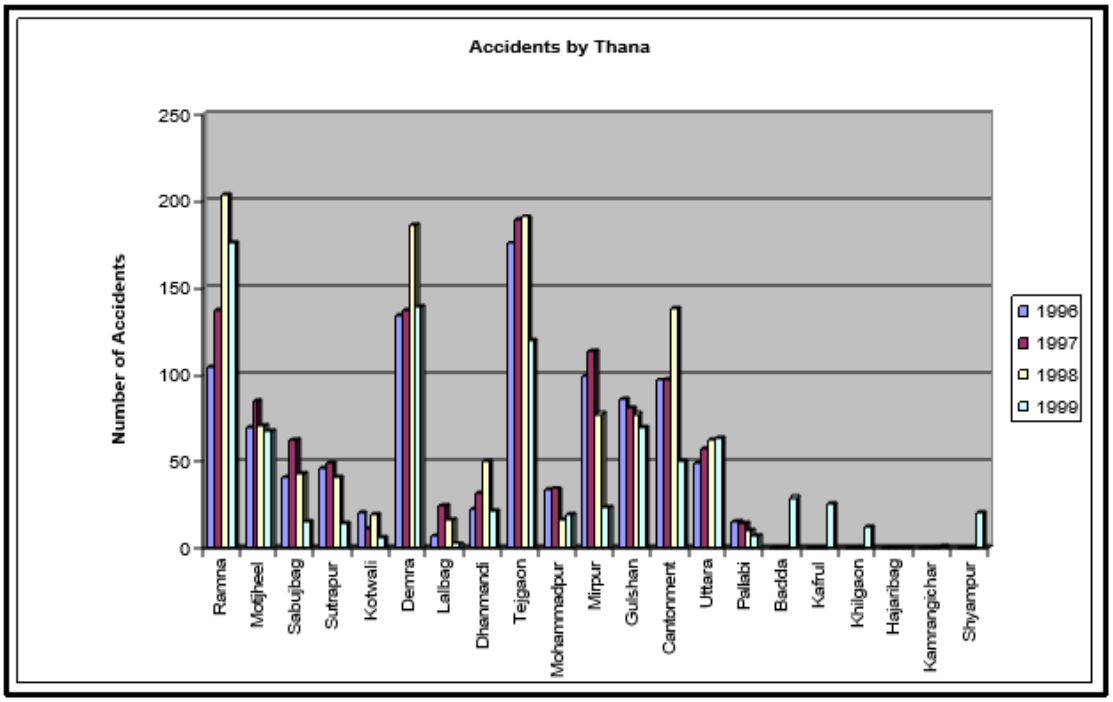

Figure 3.5: Accidents by thana graphical view.

3.4 Proposed Methodology

Analytical Hierarchy Process (AHP) use for selection. This is a famous algorithm by Saaty, 1977. Location to goal diagram shown in Fig 3.6.

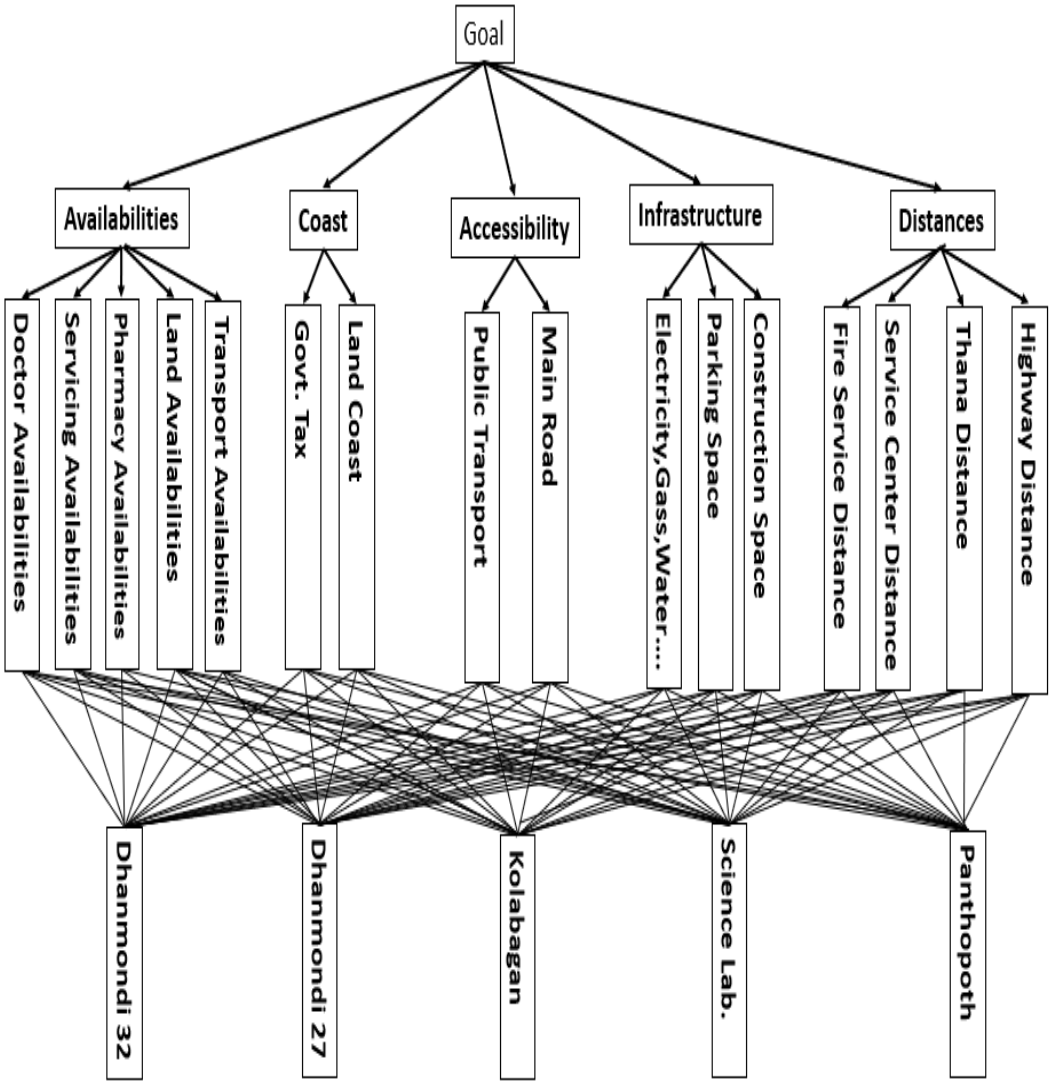

Figure 3.6: Location to Goal whole process.

3.4.1 Pairwise Comparison Matrix

There are some values for measurements –

- Equal Important = 1
- Moderate Important = 3
- Strong Important = 5
- Very strong Important = 7
- Extreme Important = 9
- Intermediate Values = 2,4,6,8
- Value of Inverse Comparison = 1/3, 1/5, 1/7, 1/9

Let, value = X.

Calculation shown in Fig 3.4, 3.5, 3.6, 3.7 step by step.

How importance is Availabilities with respect to Coasts?

- Availabilities is of a strong importance than coasts.
- Coasts- x value
- Availabilities- 5x value
- Here, row element/ Colum element
- Shown in Table 3.6.

Table 3.6: Pairwise comparison between Availabilities and Coast.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances
Availabilities		$\frac{x}{5x} = \frac{1}{5}$			
Cost	$\frac{x}{5x} = \frac{1}{5}$				
Accessibilities					
Infrastructure					
Distances					
Sum					

Availabilities is of an equal importance with Availabilities

- We know, Equal Importance = 1
- Coasts is of an equal importance with Coasts
- Here, all row and Colum result are same where entity is same
- Shown in Table 3.7.

Table 3.7: Pairwise comparison between all equal important things.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances
Availabilities	1	5			
Cost	$\frac{1}{5}$	1			
Accessibilities			1		
Infrastructure				1	
Distances					1
Sum					

Availabilities is of a strong importance than Accessibilities

- Accessibilities – x value
- Availabilities – 4x value
- Accessibilities is of a moderate important than Coast
- Coasts – x value
- Accessibilities – 2x value
- Shown in Table 3.8.

Table 3.8: Pairwise comparison between all equal important things.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances
Availabilities	1	5	$\frac{4x}{x} = 4$		
Cost	$\frac{1}{5}$	1	$\frac{x}{2x} = \frac{1}{2}$		
Accessibilities	$\frac{x}{4x} = \frac{1}{4}$	$\frac{2x}{x} = 2$	1		
Infrastructure				1	
Distances					1
Sum					

Comparisons among Availabilities, Coasts, Accessibilities, Infrastructure, Distance -

- Availabilities is of a very strong importance than Infrastructure
- Coasts is of a moderate importance than Infrastructure
- Accessibilities is of a moderate important than Infrastructure
- Availabilities is of a moderate important than distance
- Distance is of a strong important than coasts
- Distance is of a strong important than Accessibilities
- Distance is of a strong important than Infrastructure
- All are shown in Table 3.9.

Table 3.9: Pairwise comparison among all criteria.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances
Availabilities	1	5	4	7	2
Cost	$\frac{1}{5}$	1	$\frac{1}{2}$	3	$\frac{1}{4}$
Accessibilities	$\frac{1}{4}$	2	1	3	$\frac{1}{4}$
Infrastructure	$\frac{1}{7}$	$\frac{1}{3}$	$\frac{1}{3}$	1	$\frac{1}{5}$
Distances	$\frac{1}{2}$	4	4	5	1
Sum					

3.4.2 Criteria weighted value

Some of all and all comparisons divided by sum-

- Shown in Table 3.10.

Table 3.10: Criteria weighted value calculation.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances
Availabilities	$\frac{1}{2.09}$	$\frac{5}{12.33}$	$\frac{4}{9.83}$	$\frac{7}{19}$	$\frac{2}{3.7}$
Cost	$\frac{0.2}{2.09}$	$\frac{1}{12.33}$	$\frac{0.5}{9.83}$	$\frac{3}{19}$	$\frac{0.25}{3.7}$
Accessibilities	$\frac{0.25}{2.09}$	$\frac{2}{12.33}$	$\frac{1}{9.83}$	$\frac{3}{19}$	$\frac{0.25}{3.7}$
Infrastructure	$\frac{0.14}{2.09}$	$\frac{0.33}{12.33}$	$\frac{0.33}{9.83}$	$\frac{1}{19}$	$\frac{0.2}{3.7}$
Distances	$\frac{0.5}{2.09}$	$\frac{4}{12.33}$	$\frac{2}{9.83}$	$\frac{5}{19}$	$\frac{1}{3.7}$
Sum	2.09	12.33	9.83	19	3.7

Here,

Criteria weight = Average value of all Colum in same row

Criteria weight of Availabilities → $\frac{.48+.41+.407+.37+.54}{5} = .44$

Details shown in Table 3.11.

Figure 3.11: Criteria weighted values.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances	Criteria Weight
Availabilities	0.48	0.41	0.407	0.37	0.54	0.44
Cost	0.096	0.08	0.051	0.16	0.068	0.09
Accessibilities	0.12	0.16	0.1	0.16	0.068	0.12
Infrastructure	0.067	0.03	0.03	0.05	0.05	0.04
Distances	0.24	0.32	0.407	0.26	0.27	0.299

3.4.3 Weighted sum value

Criteria weights are multiplied with all row value in same Colum-

- Shown in Fig 3.10.

Weighted Some Value = Sum of all Colum value in same row

Weighted sum value of Availabilities → .44+.45+.48+.28+.598 =2.25

All weighted sum value shown in Table 3.12.

Table 3.12: Row value multiply with CW.

Criteria weight	0.44	0.09	0.12	0.04	0.299
	Availabilities	Cost	Accessibilities	Infrastructure	Distances
Availabilities	1*0.44	5*0.09	4*0.12	7*0.04	2*0.299
Cost	0.2*0.44	1*0.09	0.5*0.12	3*0.04	0.25*0.299
Accessibilities	0.25*0.44	2*0.09	1*0.12	3*0.04	0.25*0.299
Infrastructure	0.14*0.44	0.33*0.09	0.33*0.12	1*0.04	0.2*0.299
Distances	0.5*0.44	4*0.09	4*0.12	5*0.04	1*0.299

Table 3.14: Weighted sum value.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances	Weighted Sum Value
Availabilities	0.44	0.45	0.48	0.28	0.598	2.25
Cost	0.88	0.09	0.06	0.12	0.075	0.433
Accessibilities	0.11	0.18	0.12	0.12	0.075	0.605
Infrastructure	0.06	0.03	0.04	0.04	0.06	0.23
Distances	0.22	0.36	0.48	0.2	0.299	1.56

3.4.4 Consistency Ratio

Consistency Ratio = $\frac{\mathbf{CI}}{\mathbf{RI}}$

Consistency Index (CI) = $\frac{\lambda max \ - n}{\boldsymbol{n-1}}$

n = number of compared elements

$\lambda max \ = \frac{\mathbf{WSV}}{\mathbf{CW}}$

here,

WSW = Weighted Sum Value

CW = Criteria Weight

Shown in Fig 3.12-

$\lambda max \ = \frac{\mathbf{5.11+4.81+5.04+5.75+5.22}}{\mathbf{5}} = \mathbf{5.19}$

Table 3.14: Value of λmax.

	Availabilities	Cost	Accessibilities	Infrastructure	Distances	Weighted Sum Value	Criteria Weight	$\frac{WSV}{CW}$
Availabilities	0.44	0.45	0.48	0.28	0.598	2.25	0.44	5.11
Cost	0.88	0.09	0.06	0.12	0.075	0.433	0.09	4.81
Accessibilities	0.11	0.18	0.12	0.12	0.075	0.605	0.12	5.04
Infrastructure	0.06	0.03	0.04	0.04	0.06	0.23	0.04	5.57
Distances	0.22	0.36	0.48	0.2	0.299	1.56	0.299	5.22

Consistency Index (CI) = $\frac{\lambda max \ - n}{\boldsymbol{n-1}} = \frac{\mathbf{5.19-5}}{\mathbf{5-1}} = 0.0475$

Default Random Index RI Shown in table 3.6.

Table 3.15: Random Index

n	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45

Consistency Ratio = $\frac{\mathbf{0.0475}}{\mathbf{1.12}}$ = 0.042410714

3.5 Implementation Requirement

Select one thing from three or more thing is a problem where we feel indecision. We use some algorithm for select this. There are many selection algorithms like AHP, Fuzzy AHP etc. Here We select Analytical Hierarchy Method (AHP). To accomplish this task, there are some calculation which can be either automatic or manual. Most of the processes is done by using computers and thus done automatically. Pairwise comparison matrix was formed and comparisons were made with the Supper Decision Software Program (Version 3.2) [16]. The geometric mean method and relative weight of the elements of each level were estimated. All comparisons were analyzed to determine the consistency of each item.

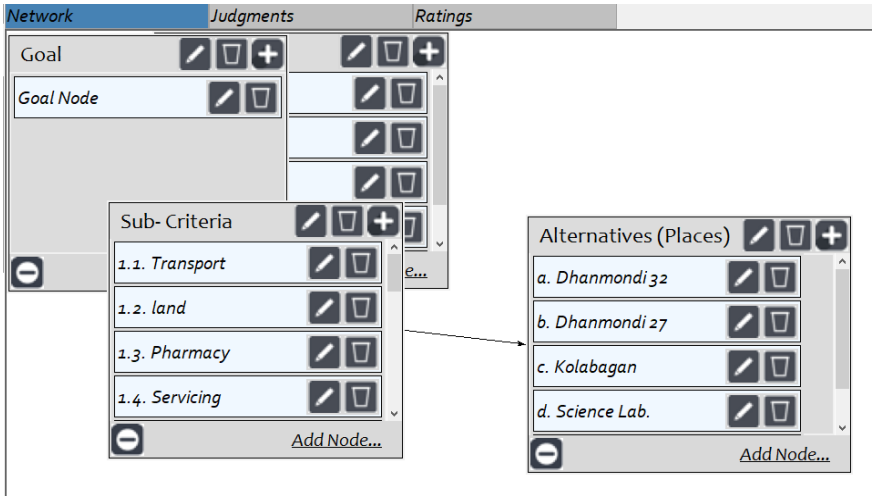

Figure 3.7: Super Decision Software.

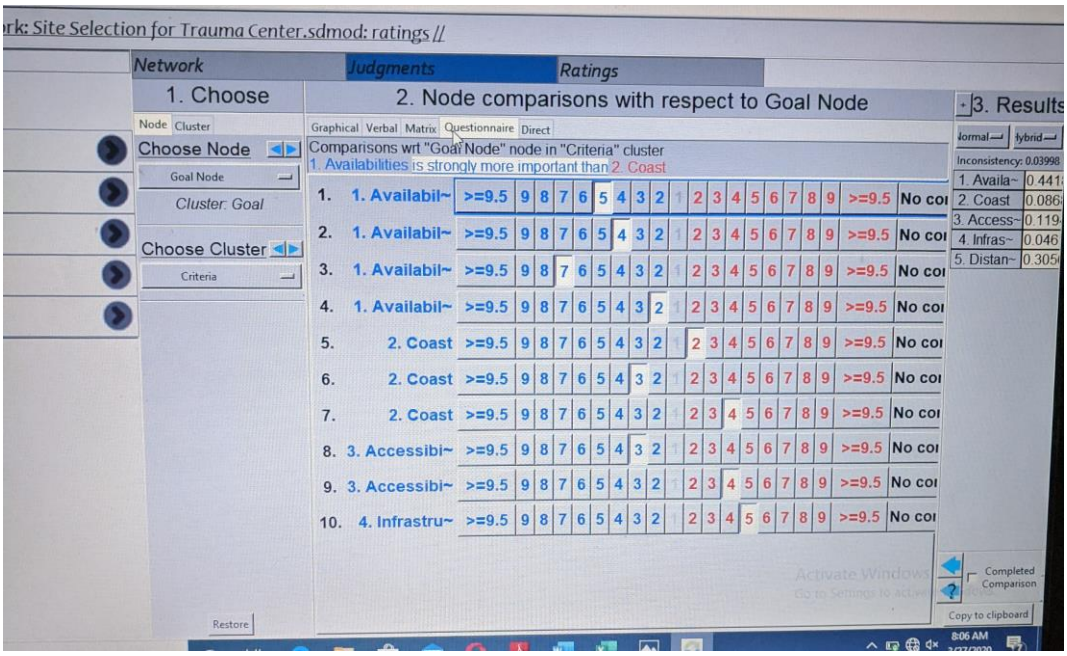

Figure 3.8: Node Comparisons in Super Decision Software.

CHAPTER 04

Experimental Results and Discussion

4.1 Experimental Setup

In this research, we select a place from 5 places. For this process we use Analytical Hierarchy Process (AHP). Use AHP we can create any type of selection. Here, we select a place for Trauma Center. The values are consistence or inconsistence we know from this algorithm's calculation result.

4.2 Experimental Results & Analysis

If the consistency ratio is less than 0.10 (X<0.10) [18]. Then we called the algorithm is consistent. If the ratio was greater than 0.10 then we should realize that our experimental data are not right.

Here, Consistency Ratio = 0.042410714

That is less than 0.10

0.042410714 < 0.10

So, our experiment is right.

4.2.1 Descriptive Analysis

However, there does not exist a standard relevant way to select a place for trauma center. When one's selected a thing, they need a big process, a big amount of money, many people, many times. Such as for a trauma center site selection need many theses and for those need many times. Architect, arbane engineer, civil engineer, contractor and for this needed many people. Then this is very costly and a big process. Now we make a selection process using AHP, that is savings time, money and man power. So that we can select a place by an excel worksheet easily that is shown in Fig 4.1.

Pairwise comparisons

ONLY ENTER in the yellow fields

Item Descriptions can be text

Item Number	1	2	3	4	5	6	7	8	9	10
Item Description	DMS	DEI	DMC	PV	DR	DGW	DEP			
DMS	1.00	2.00	3.00	5.00	3.00	5.00	3.00			
DEI	0.50	1.00	5.00	3.00	3.00	5.00	3.00			
DMC	0.33	0.20	1.00	2.00	4.00	3.00	2.00			
PV	0.20	0.33	0.50	1.00	2.00	5.00	2.00			
DR	0.33	0.33	0.25	0.50	1.00	5.00	1.00			
DGW	0.20	0.20	0.33	0.20	0.20	1.00	0.33			
DEP	0.33	0.33	0.50	0.50	1.00	3.00	1.00			
								1.00		
									1.00	
										1.00
Sum	2.89	4.39	10.58	12.20	14.20	27.00	12.33			

STANDARDIZED MATRIX

	DMS	DEI	DMC	PV	DR	DGW	DEP				Weight
DMS	0.35	0.46	0.28	0.41	0.21	0.19	0.24				30.5%
DEI	0.17	0.23	0.47	0.25	0.21	0.19	0.24				25.1%
DMC	0.11	0.05	0.09	0.16	0.28	0.11	0.16				13.9%
PV	0.07	0.08	0.05	0.08	0.14	0.19	0.16				10.9%
DR	0.11	0.08	0.02	0.04	0.07	0.19	0.08				8.4%
DGW	0.07	0.05	0.03	0.02	0.01	0.04	0.03				3.4%
DEP	0.11	0.08	0.05	0.04	0.07	0.11	0.08				7.7%

Figure 4.1: Selection process using excel worksheet.

4.4 Discussion

With the spread of computers in all parts of the world including developing countries need a proper planning. That's why it has a great importance of AHP. As like as Trauma Center Site Selection using AHP is important for us. The result of the preprocessed data is used to make the purpose easy. To implement this technology, it is important to make all the data be changed according to the requirement of the algorithm. After scanning the images, the experiment is on its way to process all the data.

CHAPTER 05

Impact on Society, Environment and Sustainability

5.1 Impact on Society

From this research, we get a proper technology for selection process using AHP. With the spread of computers in all parts of the world including developing countries need a proper planning. That's why it has a great importance of AHP. As like as Trauma Center Site Selection using AHP is important for us. To implement this technology, it is important to make all the data be changed according to the requirement of the algorithm.

Caring for trauma patients requires clinicians to address acute problems, to think on their feet and to operate and/or perform more proficiently. The opening of the trauma center will raise the clinical excellence across the continuum of our institution in surgery, radiology, nursing, emergency care, and more. It will help to create an even more robust and efficient delivery system. The impact will be positive for trainees and all involved in the delivery of clinical care.

5.2 Impact on Environment

Here, we select some places then collect some data of those places with following some criteria. One of the important criteria is infrastructure and there have some sub-criteria those are about environment. And almost all criteria and sub-criteria is related with environment.

Trauma centers and trauma systems represent valuable resources for the community Understanding the need for funding mechanisms requires an understanding of the nature and the makeup of both trauma centers and trauma systems. Too often, the public perception of the trauma system centers around either emergency medicine services (EMS) or the emergency department. While both these entities are critical components of the trauma system, they do not comprise the entire system. The Resource Document for the Optimal Care of the Injured Patient defines trauma systems and trauma care

from prior to injury to full recovery. The system should use population or volume criteria to designate trauma centers, and the triage criteria in place should direct patients to the trauma centers.

5.3 Ethical Aspects

Bangladesh is overpopulated and developed day by day. We need hospital more but place not enough. And in hospital there are many processes for treatment. For those processes many problems creates. But in this process, we save time, money, places etc.

5.4 Sustainability Plan

Our country is an over populated country and also a developing country. Not only our country but also every over populated and developing country need a well-planned urbanization. Trauma center is most important things in Bangladesh and also Trauma center site selection is most important. So, we should work continuously to make our well-planned city and it is the great recommendation. Here we use AHP algorithm. By using this its make very stabled. We need little bit update some days later and continuing this process.

CHAPTER 06

Summary, Conclusion, Recommendation & Implication for Future Research

6.1 Summary of The Study

From this research, we get a proper technology for selection process using AHP. All the process is made to make the accuracy rate of Trauma Center Site Selection. We have tried our best to emphasize on a way or method of Analytical hierarchy process in the simplest possible manner. There is a huge area to research on AHP and Saaty's RI Index.

6.2 Conclusion

In this process we make a selection process using excel work sheet that is like a software or a calculator. The approach that we discussed above in this research to process. We make Trauma Center Site Selection using AHP algorithm.

6.3 Implication for Further Study

The default Random Index (RI) in AHP which is generated by Saaty psychologically. Then many researchers generate RI index many times. Which index should we use?

In future any one study about this algorithm then one's should research about those topics such as

- why researcher changed RI index?
- why saaty's index is default?
- Is Random Index consistent or inconsistent?

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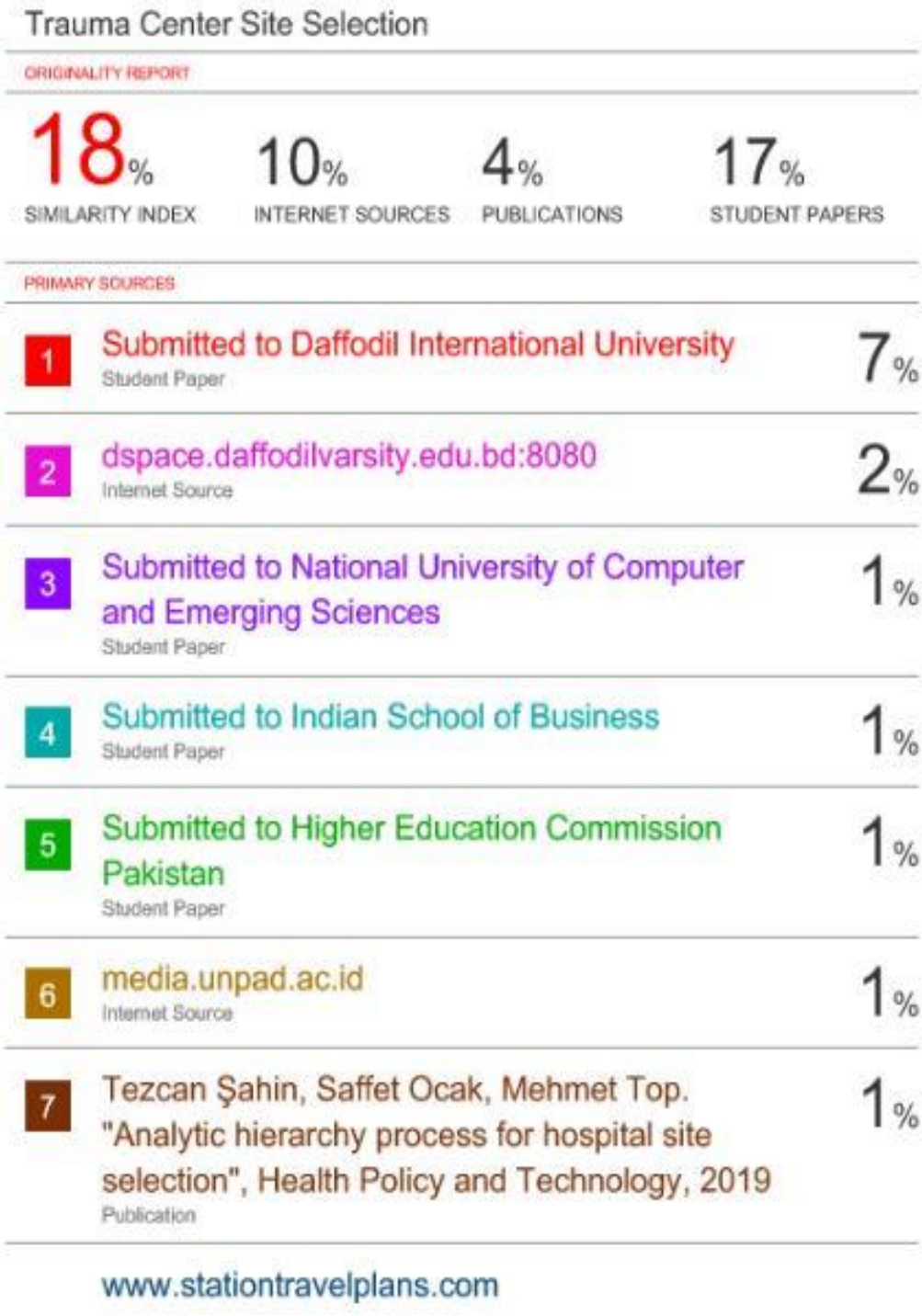

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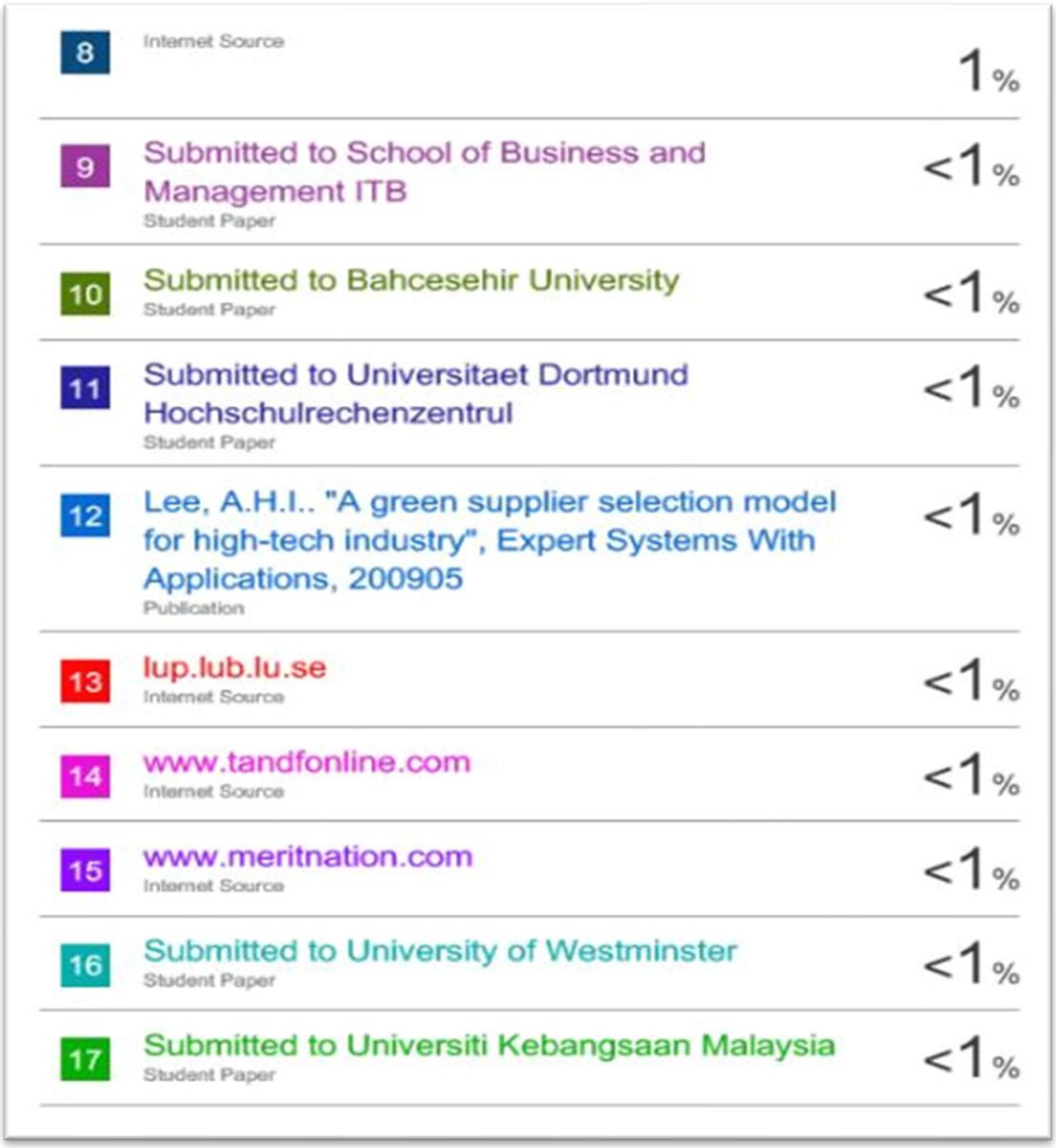
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