AN EXAMPLE STUDY OF TOURISM LOGISTICS FOR TOURISTIC PLACES IN TURKEY

Bahadır GÜLSÜN[1], Onur YILMAZ[2], Büşra ASLAN[3]

[1]*Assistant Professor, Industrial Engineering, Yildiz Technical University, İstanbul, Turkey*
E-Mail: bahadir@yildiz.edu.tr

, [2]*Research Assistant, Industrial Engineering, Yildiz Technical University, İstanbul, Turkey*
E-Mail: onyilmaz@yildiz.edu.tr

[3]*Industrial Engineering, Yildiz Technical University, İstanbul, Turkey*
E-Mail: ie.busraslan@gmail.com

ABSTRACT

The tourism sector is one of the most significant economic sectors in the Turkish economy and one of the sectors which has undergone the greatest evolution in recent years. It is important to point out the substantial transformation that has occurred in tourists' preferences and behavior, abandoning pre-organized tourist packages offered by tourism intermediaries in favor of other more personalized options. This study represents an innovation for the tourism sector. The study is optimum route planning in the lowest costs to use with travelling salesman problem algorithms for the most famous touristic places in Turkey. It aims to increase customer satisfaction which is critical for tour companies in a competitive market while minimizing costs. It procures flexible service logistics solutions in the lowest costs for all different types of travelers in tour agencies.

The optimization model was formed regarding the distance and travelers' requests for visiting touristic places, the most visited central places of Turkey and they are subject to possible changes with the diversity of travelers considering different services and types of vehicles. In this study preferred dates of tour and the limits of budget were included to the model to find a logistics solution for tour agencies.

Keywords—computer-aided travelling salesman problem, personalized tourism routes, tourism logistics

INTRODUCTION

Tourism sector has been developing rapidly due to the advance in logistic capabilities and reduces fees. As the number of travelers expands, so does the span of requests by the travelers. Many companies increase the flexibility of their services to respond these varying requests. The objective of this study is to determine the optimum route plan which will give travelers the chance to visit a designated number of touristic places at minimum costs. For this purpose, it takes into account the constraints of the traveler budget and free time. It provides the travelers with opportunity of choosing some specific places among all touristic places, which is basically determining the tour route. Thus, it gives the opportunity to choose the optimal tour option which they want to attend. This is an innovation for tourism sector, because it includes mutualistic approach for both parties by the freedom of choice to travelers while minimizing costs for tour companies.

In section 2, a brief literature review is given for the better understanding of the problem and the method. Our proposed method is demonstrated with three scenarios in section 3. Finally, in section 4 we present our conclusions and view about future research in this area.

LITERATURE REVIEW

According to Landré and Peeters (2011), there's a deep gap between tourism and transport research communities. This results in a relatively small number of comprehensive studies in literature about tourism logistics, for many studies tend to be prepared by the viewpoint of either a tourism researcher or a transport researcher.

Dukic and Sesar (2008) utilized a computer-aided travelling salesman model to plan day trips for tourists. They took the time spent for transportation and the time spent for sightseeing into consideration. The goal of the model is to minimize the total time.

Rodríguez et. al. (2012) considered various activities that tourists may prefer to combine and develop a tool to design personalized routes. Mathematical modeling is employed to obtain the routes and interactive multi-criteria decision making technique is employed to select the activities for each tourist. This study considers the case where private cars are used and public transportation is not.

Ngamsirijit (2013) used capacity flexibility model to design most flexible and efficient routes for small buses among various locations. For this purpose, first, the maximum capacity of transporting passengers (MAXCAP) was assessed. Then, three routing options were considered to obtain the flexibility.

Brandinu and Trautmann (2014) dealt with scheduling of tour buses that takes tourists to various film sites. They employed mixed-integer linear programming and minimize the total waiting time before they minimize the total travel time of all buses. Unlike our study, their study didn't include designing a route depending on tourist's needs.

Additionally, orienteering problem differs from our case as its vertices have scores and its path is necessarily limited in length. A broad survey on orienteering problem is presented by Vansteenwegen, Souffriau and Van Oudheusden (2011).

METHODOLOGY

Travelling salesman problem algorithms were employed to achieve the objective of the study. Seven scenarios were created to reflect the variety of problems that the method can solve. Some assumptions have been made through various scenarios. Three of these seven scenarios are given as examples.

1.1. SCENARIO 1: ONE SPECIAL REGION

The distances among the most touristic points in the Aegean region are given in Table 1. Optimal tour routes are determined by the travelling salesman problem algorithms for 10 touristic places in the Aegean region for travelers who want to see 2,3,...,10 of them and their corresponding distances are specified (see Table 2). Also, the estimated time of travel for each distance was calculated with the assumption of traveling at an average speed of 60 kilometers per hour. The results are also given in Table 2.

Table 1

Distances between touristic points in the Aegean region

		1	2	3	4	5	6	7	8	9	10
	AEGEAN	**Akyaka**	**Bodrum**	**Çeşme**	**Gökova**	**Kuşadası**	**Marmaris**	**Pamukkale**	**Söke**	**Şirince**	**Urla**
1	**Akyaka**	**0**	**136**	**315**	**5**	**184**	**33**	**173**	**173**	**192**	**278**
2	**Bodrum**	**136**	**0**	**320**	**137**	**153**	**166**	**250**	**133**	**182**	**283**
3	**Çeşme**	**315**	**320**	**0**	**316**	**178**	**344**	**316**	**188**	**164**	**64**
4	**Gökova**	**5**	**137**	**316**	**0**	**184**	**30**	**174**	**174**	**193**	**279**
5	**Kuşadası**	**184**	**153**	**178**	**184**	**0**	**213**	**185**	**21**	**29**	**142**
6	**Marmaris**	**33**	**166**	**344**	**30**	**213**	**0**	**203**	**203**	**221**	**307**
7	**Pamukkale**	**173**	**250**	**316**	**174**	**185**	**203**	**0**	**173**	**192**	**278**
8	**Söke**	**173**	**133**	**188**	**174**	**21**	**203**	**173**	**0**	**50**	**151**
9	**Şirince**	**192**	**182**	**164**	**193**	**29**	**221**	**192**	**50**	**0**	**127**
10	**Urla**	**278**	**283**	**64**	**279**	**142**	**307**	**278**	**151**	**127**	**0**

Table 2

Details about the optimal routes

ROUTE	NUMBER OF POINTS	DISTANCE (KM)	TIME (Hour)
1,4,1	2	10	0.17
1,4,6,1	3	68	1.13
5,8,10,9,5	4	328	5.47
1,4,9,5,8,1	5	421	7.02
1,4,6,9,5,8,1	6	479	7.98
1,4,6,9,5,8,2,1	7	575	9.58
1,6,4,2,8,5,9,7,1	8	748	12.47
1,4,6,10,3,9,5,8,2,1	9	889	14.82
1,6,4,7,10,3,9,5,8,2,1	10	1062	17.70

1.2. SCENARIO 2: ONE SPECIAL POINT

In this scenario, only seven points were included in the tour plan from the 10 touristic points in the Aegean region. One point of the 7 points is absolutely wanted to be visited. We selected that point to be Pamukkale. In this case, the optimal tour route will be longer and more costly than the case with seven points in scenario 1. The tour route will ultimately be 1,8,5,9,7,4,1 and the total distance will be 594 km according to the traveling salesman problem algorithm. This is the optimal solution for this scenario.

1.3. SCENARIO 3: MORE THAN ONE ZONES

This time the tour plan covers a total of 10 touristic points in three different regions, namely Marmara, Aegean and Mediterranean regions. The distances between the points that can be visited in these regions are given in Table 3. Consider a case that travelers want to see at least two points from each region. According to these constraints, a solution consisting of points 1,3,4,6,9,8,1 will be the route to be taken and the total distance will be 1069 km. The route is also shown on the map of Turkey (see Figure 1). The number of points and the regions that they belong to are given in Table 4.

CONCLUSION

The approach based on the traveling salesman problem algorithm was offered to increase customer satisfaction and profit, decrease costs while planning the tour in the tourism sector. For this purpose, an approach was made with industrial engineering perspective. It aims to visit more places with shorter distance and thus increase the customer satisfaction. This problem can be solved by using different approaches, modeling and meta-heuristic approaches. A different perspective was brought in the tourism sector which is sub-branch of the service sector.

Table 3

Distances between the touristic points in the three regions

		1	2	3	4	5	6	7	8	9	10
	Marmara-Aegean-Mediterranean	**Sapanca**	**Ayvalık**	**İznik**	**Kuşadası**	**Bodrum**	**Marmaris**	**Alanya**	**Kaş**	**Kemer**	**Manavgat**
1	**Sapanca**	**0**	**438**	**84**	**572**	**714**	**672**	**844**	**717**	**615**	**628**
2	**Ayvalık**	**438**	**0**	**364**	**244**	**381**	**410**	**702**	**581**	**639**	**676**
3	**İznik**	**84**	**364**	**0**	**502**	**641**	**668**	**646**	**681**	**574**	**589**
4	**Kuşadası**	**572**	**244**	**502**	**0**	**153**	**213**	**537**	**385**	**445**	**480**
5	**Bodrum**	**714**	**381**	**641**	**153**	**0**	**166**	**556**	**337**	**462**	**498**
6	**Marmaris**	**672**	**410**	**668**	**213**	**166**	**0**	**452**	**230**	**360**	**395**
7	**Alanya**	**844**	**702**	**646**	**537**	**556**	**452**	**0**	**322**	**179**	**59**
8	**Kaş**	**717**	**581**	**681**	**385**	**337**	**230**	**322**	**0**	**144**	**266**
9	**Kemer**	**615**	**639**	**574**	**445**	**462**	**360**	**179**	**144**	**0**	**122**
10	**Manavgat**	**628**	**676**	**589**	**480**	**498**	**395**	**59**	**266**	**122**	**0**

Figure 1 The optimal route for scenario 3

Table 4

Points on the optimal route and the regions that they belong

Marmara		Aegean		Mediterranean	
1	3	4	6	9	8

REFERENCES

G. Dukic and M. Sesar (2008), "Using a Computer-Aided Travelling Salesman Model in Tourism Management Decision Making", *An Enterprise Odyssey. International Conference Proceedings*, Pp. 827-837.

M. Landré and P. Peeters (2011), "Editorial: Transport and Tourism: a Weak Symbiosis. An Introduction to the Special Issue", *European Journal of Transport and Infrastructure Research*, Vol. 11, No. 3, Pp. 276-280.

P. Vansteenwegen, W. Souffriau and D. Van Oudheusden (2011), "The Orienteering Problem: A Survey", *European Journal of Operational Research*, Vol. 209, Pp. 1-10.

B. Rodríguez, J. Molina, F. Pérez and R. Caballero (2012), "Interactive Design of Personalised Tourism Routes", *Tourism Management*, Vol. 33, Pp. 926-940.

Ngamsirijit (2013), "Using Capacity Flexibility Model for Responsive Tourism Logistics: The Case of Pattaya City", *2013 IEEE International Conference on Service Operations and Logistics, and Informatics (SOLI)*, Pp.404-407.

G. Brandinu and N. Trautmann (2014), "A Mixed-Integer Linear Programming Approach to the Optimization of Event-Bus Schedules: A Scheduling Application in the Tourism Sector", *Journal of Scheduling*, Vol. 17, Pp. 621-629.