

The residents' take on using bicycles in the urban environment: The case of the city of Alexandroupolis, Greece

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Abstract: - This paper has recorded the views of the residents of the city of Alexandroupolis, by means of a questionnaire, concerning bicycle use as a means for their transportation. The study determined the suitability level of the city for cycling, particularly the existence of the necessary infrastructure and the appropriate education and behavior of cyclists and drivers of other vehicles. According to this research, 82.8% of residents view bicycle use positively and consider that the city of Alexandroupolis is absolutely (18.5%) and very (27%) appropriate for using the bicycle as a means of transportation. However, only a small percentage of residents use the bicycle as their means of transportation (15.3% use it rarely and 29.8% never use it), although they suggest that bicycles are a very cheap or cheap (20% and 39.3% respectively) means of transport. While Alexandroupolis is a flat and sea-side city, and thus is suited for cycling, its infrastructure is borderline fair (49.5% mediocre, 26% good and 16.8% poor) for cyclists, whose behavior is positively impacted (68.5%) by whether their fellow residents cycle. However, 22% of residents state that the use of a motor vehicle is always necessary, irrespective of the distance to be covered. Residents claim that drivers of other vehicles respect cyclists on the road rarely to sometimes (28.3% and 29.8% respectively), making the use of bicycles marginally safe for minors (37.8%). According to the residents of Alexandroupolis, young cyclists adhere to the highway code sometimes and rarely (33.5% and 29.5% respectively), while the same is also true of adult cyclists (43.3% of those asked believe that adult cyclists adhere to the code sometimes, while 23.3% believe that this is rare).

Key-Words: - Residents' view, bicycle use, transport in the urban environment, city of Alexandroupolis, loglinear analysis

1 Introduction

Healthy cities remain at the center of the debate for more sustainable urban futures [1]. But in many cities around the world, the constant rise in daily traffic has rendered necessary the research for sustainable means of everyday transport [2-4].

Given that 30% of car transport in Europe covers distances of less than three kilometers [5], efforts have been made to promote not only public transport, but also cycling, in an attempt to decrease traffic jams during rush hours and pollution [6], while preserving biodiversity [7,8]. Thus, any policies aiming to reduce car use and especially promote walking and cycling may first

make sure that adequate transportation networks are developed [9] (Milakis et al. 2017).

Of course, cycling is not recommended for all cities, and in fact there are certain factors which have an adverse effect on its broader use, such as steep street gradient, climatic conditions, etc. [10,11].

Many research projects have been published, especially in America [11-14], fewer in Europe [15,16], but also in Australia [17], concerning cycling inside cities and the benefits enjoyed by cyclists and by the rest of the residents alike [18]. There are, however, numerous papers which also refer to the dangers from accidents due to cycling [16,17,19-21].

The first bicycle networks in Greek cities came very late when compared to other European countries [22]. Previous studies in Greece investigated residents' intentions to cycle in three major cities [23-25]; only two studies dealt with residents in smaller cities, of which one had an actual cycle lane network and one did not [26-29].

This paper aims to record the views of the residents of Alexandroupolis concerning cycling and its use within the city, the existence or absence of the necessary infrastructure and the educational level of cyclists as well as the behavior of the rest of the drivers towards them.

2 Materials and Methods

2.1 Research area

The Region of Eastern Macedonia and Thrace occupies the northeast part of Greece. It borders with Turkey and Bulgaria and is washed by the Aegean and Thracian Sea. The research area of this paper was the city of Alexandroupolis. The municipality of Alexandroupolis occupied in 1217.0 km² and includes a long bicycle net (5.15km) with increasing tendencies (fig. 1).



Fig. 1. Map of Alexandroupolis with the existing cycling net and the intended construction of woonerf streets.

2.1 Methodology

The survey was conducted with the assistance of personal interviews in the city of Alexandroupolis. Random sampling was the methodology employed and was preferred due to its simplicity, and due to the minimum requirements on population knowledge compared to the other methodologies. The estimation of the proportion (p) among the population and the standard error (s_p), are provided by the formulas of simple random sampling [30-31].

The size of the sample was estimated with the assistance of a pilot sampling the size of 50 persons. The size of the sample was estimated for every variable and according to the formula of simple random sampling. More specifically, the sample size was determined to 400 individuals for each city. The data collection was carried out during the first semester of 2017. For the data Analysis the statistical package SPSS and descriptive statistics were used.

For the three groups of variables: a) "is Alexandroupolis appropriate for cycling", "if your fellow residents were to use the bicycle, would this also lead you towards that choice" and "using the bicycle to move around town" b) "is Alexandroupolis appropriate for cycling", "do drivers respect cyclists" and "how do you judge the infrastructure for bicycle use" and c) "your opinion on bicycle riding", "is Alexandroupolis appropriate for cycling" and "the distance requiring the use of a car or motorcycle", a frequency analysis was conducted per more than two criteria.

Prior to the initiation of the loglinear analysis (in particular of the hierarchical) it is intentional to examine the size of the expected frequencies in the crossing table [32]. Large number of the expected frequencies (higher than 20%) with rate lower than 5 – but not lower than 1, run the risk of leading to the power loss of the applied analysis [33]. This examination is carried out with control of double-sided crossing tables through the SPSS program [34].

The classes of variables were grouped in order to satisfy the above mentioned conditions. Our data are classified in accordance with 3 criteria and express frequencies. The assumption H_0 is: $H_0 : 3$ criteria are fully independent from each other

It is unlikely for this assumption to be accepted, but the analysis will allow the pre-cise level of various interrelations and will be included in a model that expresses the data interrelations [35].

Loglinear analysis forms a special case of multiple regression analysis according to which one or more variables relate to others, in the framework of a multidimensional crossing table. During this analysis, all homographs are considered independent and any recess of the crossing table dependent [32]. Finally, in order to interpret the impacts on the model of optimum adjustment, we present the data in the form of one or two – dimensional tables [36]. This paper presents only the results.

3 Results and discussion

3.1 The view of the residents on the use of the bicycle in the city of Alexandroupolis

The view of residents on the question of using the bicycle in Alexandroupolis is positive (82.8%), with smaller percentages of residents having a neutral (13.8%) and negative (3.5%) outlook (Fig 2). Thus, 13.3% of Alexandroupolis residents declare that they always use the bicycle, 20.5% that they use it often, 18% use it sometimes, 15.3% rarely use it and 29.8% never use it, while 3.3% of the residents did not answer (Fig 3). The city of Preveza presents a better picture: 28.2% of its residents declare that they always use the bicycle, 26% that they use it often, 17.2% that they use it sometimes, 11.2% that they rarely use it and 17.2% that they never do [29], while the city with the worst percentages is Orestiada, where 56.3% of residents declare that they never use the bicycle, 22% that they use it rarely, while just 16.8% of residents bike frequently and only 5% move always on their bicycle [28]. In Greece, regular cyclists (those who bike 1 or 2 times a week) are 7.5%, while occasional cyclists are only 1.8%. These percentages are much smaller when compared to other European countries, such as Holland (65.8% regular cyclists and 7.2% occasional ones) and Denmark (50.1% and 8% respectively) [5].

In general, cyclists prefer to ride in cities with streets with a low gradient, and along routes with pleasant aesthetics and green landscapes, without pollution and important automobile traffic [10]. The city of Alexandroupolis combines such routes, and in fact next to the sea. Therefore, 18.5% of its residents regard their city as absolutely appropriate for bicycle use, while 27% deems it as very appropriate, 29.5% quite appropriate, 20.3% as marginally appropriate and 4.8% not suitable at all (Fig 4). Moreover, the lack of knowledge on how to ride a bicycle is not considered an obstacle, as 88.8% of residents declare that they know how to ride a bike, 6.5% that they do not know and 4.8% of residents did not answer that question.

It appears that residents are influenced by the behavior of the entire social whole. Thus, 68.5% answered yes to the question whether using the bike by their fellow residents would also urge them to make that choice, 25.3% answered no to that question, while 6.3% gave no answer (Fig 5).

Before applying loglinear analysis on all three cases, we look at the cross-check table and we observe that there is no anticipated frequency less than 5, therefore there is not an issue with smaller anticipated frequencies. We also note that there is

an imbalance between the observed and the anticipated frequencies. Therefore, the hypothesis of complete independence between the 3 criteria does not stand.

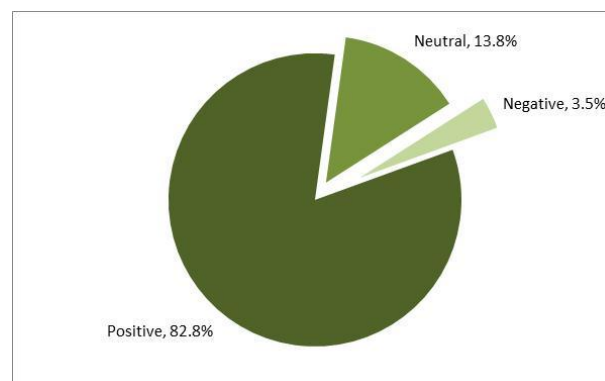


Fig. 2. View of the residents on using the bicycle in the city of Alexandroupolis.

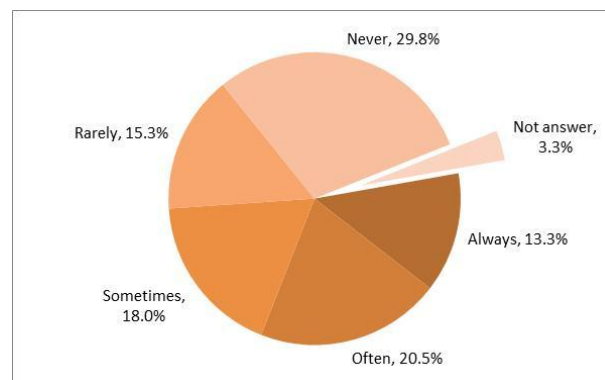


Fig. 3. Bicycle use by residents

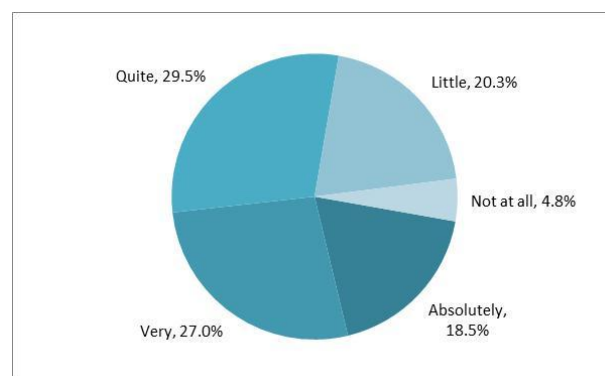


Fig. 4. Appropriateness of Alexandroupolis for cycling

Through the application of Hierarchical Log-linear analysis, after the removal of the third class degree of correlation, it was established that the most appropriate model was the one which included the impact and the interaction of the variables divided by two. We have interaction per 3 criteria, because the X^2 for Pearson's test is 4.534

with probability (p)=0.104 and because the X^2 likelihood ratio is 4.420 with probability (p)=0.110. Influences are:

- Residents declaring that they are influenced by whether their fellow residents ride bicycles, declare that they use the bicycle by copying the others for their transport, ranging from always to sometimes. Contrarily, those who do not copy their fellow residents declare that they cycle rarely or never.
- Residents declaring that they are influenced by whether their fellow residents ride the bike, by copying them, declare that the city of Alexandroupolis is from absolutely to very appropriate for cycling. Contrarily, those who do not imitate their fellow residents declare that their city is from quite to not at all appropriate for cycling.

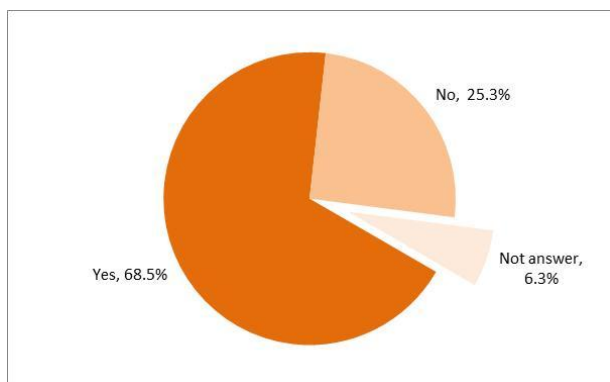


Fig. 5. Imitating others in using the bicycle

3.2 Cycling infrastructure in the city of Alexandroupolis

Residents declare that the city infrastructure for cycling is borderline adequate. 49.5% among them characterized them as fair, 26% good, 16.8% poor, 4.5% very good and 2.8% very poor (Fig 6). 0.5% of residents did not answer the question. Also, 28.3% of the residents declared that motorists respect cyclists sometimes, and 29.8% rarely (Fig 7). 16.8% declared that they respect them often, 10.8% that they never respect them while 4% answered that motorists always respect cyclists. 0.5% of residents did not answer the question.

Through the application of Hierarchical Log-linear analysis it was established that the interaction of per 3 criteria was eliminated, because the X^2 for Pearson’s test is 1.511 with probability (p)=0.219 and because the X^2 likelihood ratio is 1.527 with probability (p)= 0.217. We noted the following interactions:

- Residents evaluating cycling infrastructure from very good to mediocre declare that the city of Alexandroupolis is absolutely appropriate to very appropriate for cycling, while, respectively, those who consider that this infrastructure is poor to very poor declare that the city is quite inappropriate to not appropriate at all for cycling.
- Residents evaluating cycling infrastructure ranges from very good to mediocre declare that motorists respect cyclists from always to sometimes, while residents who regard the infrastructure as poor to very poor declare that motorists respect cyclists rarely to ‘never’.
- Residents who declare that motorists respect cyclists always to sometimes, see the city of Alexandroupolis is absolutely appropriate to very appropriate for cycling. Contrarily, those who declare that motorists respect cyclists rarely to never, deem their city to be ‘quite’ to ‘not appropriate at all’ for cycling.

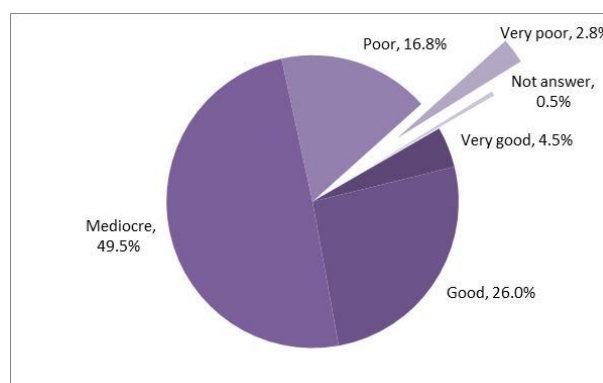


Fig. 6. Evaluation of bicycle infrastructure

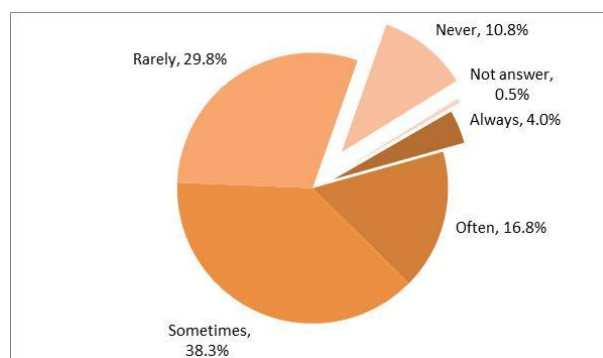


Fig. 7. Cyclists respected by motorists.

Lack of infrastructure is translated into a lack of safety for cyclists, with children being particularly vulnerable. In fact, numerous studies mention that the low percentage in cycling is largely related to safety [37-39]. According to a recent study, lack of cycling infrastructures is considered by Greeks as

one of the main inhibitors of bicycle use especially among women and older age groups [40].

It is therefore not a surprise to find that 37.8% the residents of Alexandroupolis consider the bicycle as a means of transportation within the city, and particularly for minors as not very safe. 26.5% believe it is quite safe, 25% believe it is not safe at all, 8.5% consider it to be very safe and 1% considers it to be absolutely safe. 1.3% of residents did not answer this question. In fact, residents believe that young cyclists adhere to safety rules while cycling sometimes (33.5%), rarely (29.5%) and never (20%). Smaller percentages replied with often (14%) and always (2%), while 1% did not reply.

43.3% of residents declared that adult cyclists adhere by the Code of Road Transport sometimes, 23.3% declared that they often do, and 20.3% that they rarely do. 7.8% declared never and 5% always, while 0.5% of residents did not reply. According to Vlasto [41] any cyclist, be it experienced or inexperienced, has a tendency to cycle freely, and not to adhere to the rules of the Code. This freedom is accepted by a large section of the residents. So, in answering whether new cyclists should undergo obligatory training and pass exams, 56.5% answered yes, 38.8% answered no and 4.8% of residents did not reply. On the same question, the residents of Orestiada answered no at 51.5% and yes at 48.5% [28], while in Preveza, 59.2% of residents answered yes and 40.8% answered no [29].

3.3 Using the bicycle in the city of Alexandroupolis

The use or non-use of the bicycle is also related to the behavior of residents themselves and of the social whole regarding their transportation. Thus, to the question 'what is the distance over which it is necessary to use the car or motorcycle' 32.5% of residents accept that they must use a vehicle for distances up to 1 kilometer and 53.9% for distances up to 3 kilometers (Table 1).

Through the application of Hierarchical Log-linear analysis it was established that the interaction of per 3 criteria was eliminated, because the X^2 for Pearson's test is 1.804 with probability (p)=0.406 and because the X^2 likelihood ratio is 1.805 with probability (p)=0.406. We noted the following interactions:

- Residents who evaluate using the bicycle in a positive light declare that the city of Alexandroupolis is absolutely appropriate to very appropriate for cycling, while,

respectively, those who evaluate cycling in a neutral or negative light declare that the city is fairly appropriate to entirely inappropriate for cycling.

- Residents who evaluate bicycle use positively consider that it is necessary to use a car or motorcycle for distances over 1.5 kilometers, while respectively, those who evaluate cycling in a neutral or negative light declare that the use of motorized vehicles is necessary also for smaller distances.

Table 1. Distance over which it is necessary to use the car or motorcycle.

Distance	Percent	Cumulative percent
Always	22.0%	22.5%
100 meters	1.0%	23.5%
300 meters	0.5%	24.0%
500 meters	2.3%	26.3%
1 Km	6.0%	32.5%
1.5 Km	3.3%	35.8%
2 Km	8.3%	44.2%
3 Km	14.8%	53.9%
4 Km	12.0%	71.6%
5 Km	27.8%	100.0%
No answer	2.3%	

As to the economizing aspect of cycling, 59,3% of residents consider that the bicycle is a very cheap or a cheap means of transportation (20% and 39.3% respectively), 6.5% consider that it is very expensive or expensive (0.5% and 6% respectively) and 34.3% declare it as of average cost.

Table 2. Percentage of expenditure on the part of the state which would prompt someone to purchase a bicycle.

Expenditure percentage	Percent	Cumulative percent
0 - 20 %	8.3%	8.8%
21 - 40 %	27.3%	38.1%
41 - 60 %	34.0%	75.5%
61 - 80 %	16.8%	92.5%
81 - 100 %	7.0%	100.0%
Δεν απάντησε	6.8%	

38.3% declare that the cost is an obstacle in purchasing a bike, 55.3% declare that it is not an obstacle and 6.5% did not answer the question.

However, 85.5% of residents accept the state financing for bicycles, 9.3% do not accept such an action and 5.3% of residents did not answer. Table 2 shows the expenditure percentage on the part of the state which would prompt someone to purchase a bicycle.

3.4 Residents' socio-demographic profile

The residents' demographic profile is presented in Table 3. Its main feature is the prevalence of young people, who are most interested in using the bicycle. Percentages are evenly divided between

men and women, as well as between married and single people. Participants have medium or higher level of education.

Regarding their income, 38.5% declare to be satisfied, 24% only slightly satisfied, 21.5% not satisfied at all, 6.5% very satisfied, 4.8% absolutely satisfied and 4.8% did not answer. Regarding their quality of life, 49.5% declared to be satisfied, 25% only slightly satisfied, 15.8% very satisfied, 4.8% absolutely satisfied, 1.8% not satisfied at all and 3.3% did not answer the question.

Table 3. The socio-demographic profile of the residents.

1. Gender	Male 46.8%	Female 53.3%			
2. Age	18-30 45.8%	31-40 20.8%	41-50 16.5%	>50 14.5%	No answer 2.8%
3. Marital Status	Unmarried 50.3%	married 43.3%	divorced or widowed 6.5%		
4. No. of children	no children 56.3%	one child 13.8%	two children 21.5%	three children 3.8%	more than three children 4.8%
5. Educational level				did not answer the question 2.8%	
	Primary School 2.8%	Lower Secondary School 7.5%	Technical School 7.5%	Upper Secondary School 52.5%	Technological education 5.3%
6. Profession	private employees 16.5%	public servants 21.0%	self-employed 6.5%	Students 25.6%	University 21.8%
	Unemployed 14.0%	housewives 5.8%	farmers or stock-breeders 2.8%	pensioners 4.8%	did not answer the question 4.3%

4 Conclusion

A large percentage of the residents of Alexandroupolis city do not use the bicycle for their everyday transport, although it is a cheap means of transport and they state that they know how to ride a bicycle. However, they declare to be positively disposed to cycling and consider that it is absolutely appropriate to quite appropriate for their city.

In order to justify this differentiation, we must understand the social acceptance linked to using the bicycle and how it affects the residents' stance. A large percentage among them declare that their behavior is positively impacted if their fellow residents ride the bike. Also, residents declare that they are influenced by whether their fellow residents ride the bike by copying them, stating that they use the bicycle from always to sometimes for their transport, and they also note that the city of Alexandroupolis is absolutely appropriate to very appropriate for cycling.

Moreover, we must differentiate the fixed stance of residents who insist on the use of the car or motorcycle for very small distances. Even those who do not wish to use the bicycle must accept that walking contributes to the prosperity of residents. The participants in the survey who evaluate the use of the bicycle in a positive light and declare that the city of Alexandroupolis is absolutely appropriate to very appropriate for cycling, also consider that the use of the car or motorcycle is imperative for distances exceeding 1.5 kilometer.

Regarding the behavior of motorists towards cyclists, the majority of residents declared that they believe the latter are respected rarely and sometimes. In fact, residents that declared that motorists respect cyclists always to sometimes, are the ones who declare that the city of Alexandroupolis is absolutely appropriate to very appropriate for cycling. The city is coastal and flat, suitable for cycling, but residents consider that cycling infrastructure is borderline acceptable. Infrastructure is linked to cyclist safety. In fact,

residents considering that cycling infrastructure is very good to mediocre are the ones declaring that motorists respect cyclists always to sometimes.

The bicycle is the primary means of transportation for the young. The majority considers that as such, the bicycle is a little safe or not safe at all for a minor and that sometimes to rarely do minor cyclists adhere to safety rules. In fact, they believe the same to hold true for adult cyclists as well.

Regardless of the level of cycling infrastructure, appropriate education and training for cyclists and other drivers alike leads to wiser behavior [41]. However, a large percentage of residents do not agree with obligatory training and exams for new cyclists.

Finally, a relatively significant percentage declares that cost is not an obstacle to purchasing a bicycle. However, the majority also sees positively a state funding program for acquiring bicycles. In fact, 60% or even less would be considered a good incentive.

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