

Private car use and home-work travel: Case study of RTC ‘Sonatrach Bejaia’ employees

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Abstract: This study explores the relationship between urban mobility and modal choice for daily commutes, focusing on the role of the car in home-to-work travel within the city of Bejaia. This study investigates the prevalence of private car use among employees of RTC 'Sonatrach Bejaia' and the factors influencing their commuting choices. A field survey conducted from March 15 to April 15, 2024, gathered data from 69 employees, revealing a strong reliance on individual cars due to inadequate public transport services, safety concerns, and the convenience offered by personal vehicles. The results indicated that 58% of respondents preferred driving their cars for daily commutes, with a notable 74% acknowledging the lack of public transport in the port area. Statistical analyses, including Chi-square and Cramer's V tests, confirmed significant relationships between modal choice, the quality of public transport, and individual car performance. These findings highlight the urgent need for improved public transport infrastructure to address the growing mobility demand and reduce traffic congestion in Bejaia. The study underscores the importance of considering employee commuting patterns in urban planning to foster sustainable mobility solutions.

Keywords: Motorization; Public transport; City of Bejaia; Sonatrach Bejaia- RTC- Commuting.

JEL codes : R 41, R49, O18

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I- Introduction:

The issue of urban mobility is currently a significant social, economic, and environmental challenge in the functioning of cities. With the increase in individual motorization, the inconveniences caused, such as road insecurity, noise and air pollution, and time loss due to traffic congestion, become more burdensome (Bencherif, 2015), (Idrès, 2020) (Bounouni et al., 2020). The prioritization of the automobile in urban planning policies (Merzoug, 2017) and the neglect of other modes of transport (Kenworthy & Laube, 1999) have resulted in the exclusion of non-motorized individuals (Dupuy & Gallez, 2018).

Interactions between travel purposes and modes of transport are at the core of urban mobility. Commuting to work represents a significant portion of travel within urban areas and covers

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long distances (Orfeuil, 2006). Cities worldwide are structured around work-related travel, raising numerous challenges for residents and public and private stakeholders.

In this perspective, the superiority of individual vehicles over public transit in urban mobility in general as well as work commutes particularly is a result of their performance (Héran, 2001), the car systems (Dupuy, 1999), and territory planning approaches (Newman & Kenworthy, 2006).

Our study, set within this context, aims to provide some answers to the following question: Why is individual car usage so prevalent for work commutes in Bejaia?

To answer this question, we focused on the employees of RTC-Sonatrach Bejaia and based our research on the following hypotheses.

- The employees' modal choice is influenced by the poor quality of public transport services in the port area, where RTC-Sonatrach Bejaia is located.
- The importance of individual motorization can be attributed to the flexibility and availability offered by personal cars.

This study aims to demonstrate the following points:

- Inequality in the deployment of public transport services within the city of Bejaia;
- The qualitative and quantitative inadequacy of public transport provision in the face of growing demand for mobility in the city;
- The individual motorization of the workers of the RTC is a response to the insufficiency of the alternative for their displacements in particular those of home-work;
- The performance of the private car makes the modal split in this vital area of the city of Bejaia difficult.

Similar to most medium-sized towns in emerging economies, Bejaia has a significant daily influx of travel connected to work because it is home to many government offices, a university, an airport, a port, and industrial zones. Due to its limited capacity, low service quality, and informal nature, public transit is under pressure to meet the increased demand for mobility brought about by this circumstance (Merzoug & Louani, 2020). As a result, there's a discernible rise in the accessibility of vehicles in cities, particularly for workers' travels in Bejaia.

The chosen methodology is based on a microeconomic approach, relying on qualitative analysis using data collected from a survey of RTC-Sonatrach Bejaia employees. The study is structured in two parts. The first part presents the characteristics of the city of Bejaia, particularly the port area, along with the urban mobility issues. The second part presents the main data from the survey and includes an analysis and discussion of the results.

II- Background of the study:

1-The city of Bejaia, Between growing mobility demand and limited public transport supply:

Bejaia is the capital of the wilaya, located in the northeast of Algeria, 250 km from Algiers, with an area of 120 km². Its importance lies in the centralization of administrative, economic, and social services, which are essential not only for the city's residents but for the entire population of the wilaya. The city is also a tourist destination due to its concentration of historical sites and natural landscapes.

1-1 The city of Bejaia: Between attractiveness and increasing mobility

Bejaia is the gravitational center of the wilaya, attracting tens of thousands of people for various reasons, leading to significant pressure on the road network, public transport, and urban mobility in general. In addition to its status as the wilaya's capital, Bejaia is an attractive hub due to the concentration of a range of administrative infrastructures (the wilaya headquarters, the directorates of various sectors, economic and service departments, the university), economic infrastructures (a port, an airport, a bus station, an industrial zone), and service facilities (administrative blocks, university residences, and various tertiary activities) (Bouchama, 2017). Moreover, Bejaia is expanding increasingly due to demographic growth and the availability of land around the city (Bounouni & Baouni, 2019). This expansion increases travel distances, negatively impacting the efficiency of public transport and favoring the use of individual cars. Furthermore, the urban collective transport supply is characterized by limited capacity per operator, an aging fleet, and artisanal and traditional transport that does not meet current transport demand requirements (Merzoug, 2017).

1-2 Urban transport in Bejaia: Obsolescence and poor coverage of the urban area:

The number of public transport seats provided by private and public operators (ETUSB) in Bejaia increased from 8,032 in 1988 to 16,149 in 2022, representing a 100% growth according to the Bejaia wilaya transport department. However, when examining the ratio of seats per 100 inhabitants, it is evident that the transport supply in Bejaia is limited, with the ratio only reaching 8 seats per 100 inhabitants between 2018 and 2022. Considering the tens of thousands of daily visitors, this ratio falls well below 8.

The primary reason for this situation lies in the limited number of seats offered by public transport, with an average capacity of 35 seats per bus for private operators and 100 seats for the public operator. From a quality perspective, the bus fleet is outdated, with an average age of 15 years, and 92% of the buses are over ten years old. Only five buses owned by private operators are less than five years old. Notably, private operators provide 80% of the seats, with the remaining 20% offered by ETUSB. As for the public operator, a company founded in 2010, 88% of its fleet is between 10 and 15 years old, with only 5 buses under five years old.

This situation can be attributed to private operators' inability to renew their buses for various reasons, such as fixed ticket prices since 2017, declining revenues insufficient to cover operating costs due to rising bus prices, and the recent freeze on imports. The current situation

exerts pressure on the public transport supply in a city already facing issues of poor service quality. Moreover, the poor allocation of public transport within the city of Bejaia can be a significant factor contributing to individual motorization, particularly for employees in the port area. The majority of the public transport service is concentrated on the Wilaya-Cité Tobal-Porte Sarrasine axis, as shown in the following figure, with 8,380 seats available. In contrast, which represents 25 operators, accounts for only 3.68% of the total seats offered, and the port area is completely excluded from the collective transport service. This area is the main employment hub of Bejaia, due to the concentration of companies such as EPB, BMT, Cevital, Naftal, and Sonatrach (RTC). The inadequate coverage of this zone by public transport leads households to turn towards individual motorization, using personal cars and motorcycles, which adds further pressure on the city's road network and accelerates traffic congestion and bottleneck processes in Bejaia.

II- The empirical methodology:

Due to the absence of data necessary for this study, we conducted a field survey using a questionnaire administered to employees of a company located in the port area of Bejaia.

1- Survey presentation

An empirical study was conducted by carrying out a field survey targeting the employees of RTC-Sonatrach in Bejaia. The objective of this survey was to identify the determining factors influencing the respondents' choice of transportation mode. The survey period was from March 15 to April 15, 2024. Once the data were collected, they were processed using SPSS software. Additionally, Chi-square tests and Cramer's V tests were used to examine the relationship between the studied variables. The process of administering the questionnaires involved visiting the headquarters of Sonatrach, located on Port Street in the port area of Bejaia. Considering the total number of employees in this entity and the total number of distributed questionnaires, we managed to obtain 76 responses, of which only 69 were validated, and 4 were not returned.

2- Survey Presentation

The results obtained from the randomly selected sample indicate that 56% of the respondents were male and 44% were female. The majority of the respondents were married, representing 81%, with single individuals making up 17%, and widows accounting for the remaining 2%. Regarding household composition, only 2% of respondents reported living alone, 17% lived with their spouse, 19% with one child, and more than half, or 58%, comprised households of more than four people.

Additionally, 68% of the employees were under the age of 45, as shown in the following graph, and only 6% reported being over 55 years old. This can be explained by the company's policy of investing in young human resources of administering the questionnaires involved visiting the headquarters of Sonatrach, located on Port Street in the port area of Bejaia. Considering the total number of employees in this entity and the total number of distributed

questionnaires, we managed to obtain 76 responses, of which only 69 were validated, and 4 were not returned.

Additionally, the results regarding the distances traveled daily by employees for their round-trip commutes show that 66% of respondents live within 3.5 km, 9% within 5 km, and 25% more than 5 km from their workplace, as illustrated in the graph below.

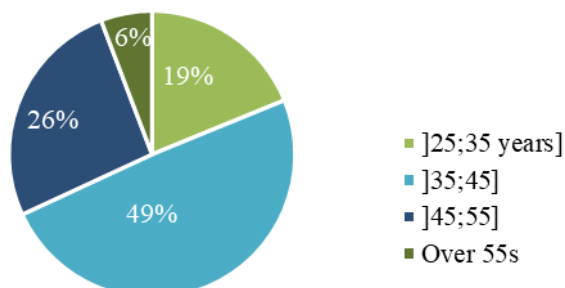


Figure 1: Age of respondents

Source: Authors, Survey March 2024.

In other words, 71% of the respondents live in the city center and surrounding neighborhoods of Bejaia, while 29% live outside the city. These results can be attributed to the company's strategy of recruiting individuals from Bejaia to ensure punctuality, or to employees choosing to reside near their workplace for various reasons such as reducing travel time and distance, transportation issues, and children's schooling.

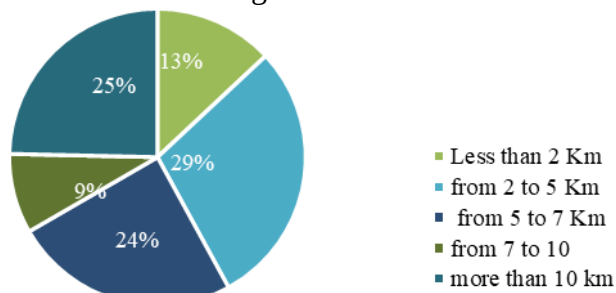


Figure 2: Distances traveled for round-trip commutes

Source: Authors, Survey March 2024.

Finally, regarding the mode of transportation used for commuting to work, individual cars represent more than half, with 58% of the responses. Public transport, walking, and personal or company service vehicles account for 14%, 12%, and 1%, respectively, as illustrated in the graph below. It is evident that non-motorized modes represent only 29% when excluding company-provided transport, which includes buses and cars.

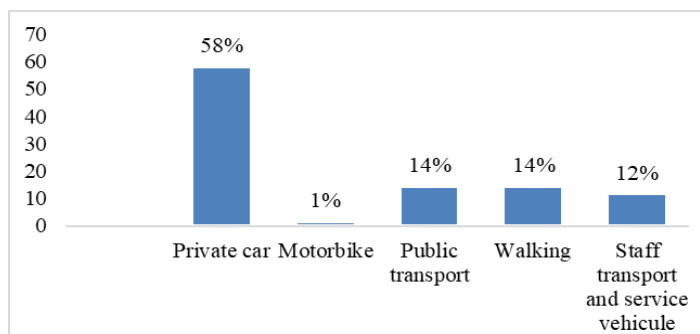


Figure 3: Modes of transportation used for commuting to work

Source: Authors, Survey March 2024.

III- Results and discussion:

1- Modal choice and the safety offered by Individual cars

As previously mentioned, there is an imbalance in the provision of public transport in the city of Bejaia, particularly in the port area. The survey revealed that the majority of respondents, 74%, confirmed the total absence of public transport in the Bejaia port area. The graph below illustrates the respondents' opinions on public transport provision in the port area according to the modes used. Additionally, 80% of employees who commute by public transport corroborated this situation. According to the results, 67% of the respondents expressed dissatisfaction with the operator's serving points near their workplaces, notably the bus station stop, while the remaining 33% described the service quality as average. The flexibility and waiting times at bus stops were tested to evaluate the effectiveness of public transport provision. However, 77% of RTC-Sonatrach employees expressed dissatisfaction with this aspect, along with 75% indicating the lack of amenities (bus shelters).

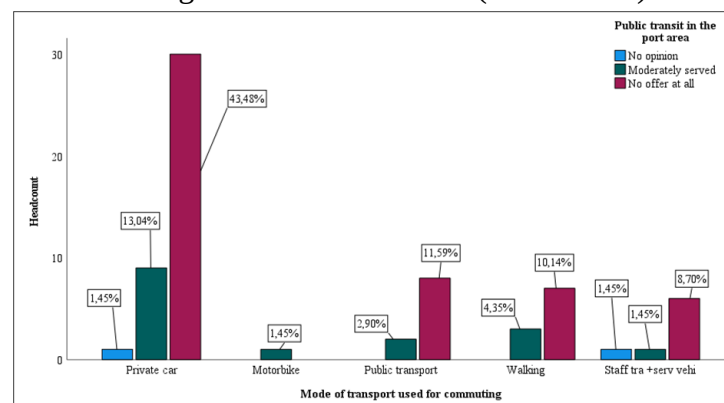


Figure 4: Public transport provision in the port area according to modes used

Source: Authors, Survey March 2024.

The study of the relationship between modal choice and public transport provision, using the Chi-square association test, demonstrated that the calculated Chi-square value is 61.289 and is statistically significant at the 5% level ($\alpha=0.000$). In this case, we reject the null hypothesis (H_0), which posits the absence of a relationship between the choice of individual cars and the

quality of transport provision in the Bejaia port area, and accept the alternative hypothesis (H1), indicating the existence of a relationship between the two variables.

Furthermore, to examine the intensity of this relationship, we used Cramer's V test. The Cramer's V coefficient indicates a value of 0.942, which is statistically significant at the 5% level ($\alpha < 0.001$), confirming a strong relationship between modal choice (individual motorization) and the poor quality of public transport provision in our study area.

Thus, it can be concluded that the poor quality of transport provision, particularly the absence of public transport services, has influenced the choice of automobile mobility among the employees of this company. This confirms both our initial hypothesis and the thesis proposed by Merzoug (2017) on the adaptation of the city of Bejaia to automobile mobility and the artisanal nature of its transport provision.

2- Individual motorization and the performance of individual cars

Individual cars are a preferred means of transportation when public transport provision is of poor quality, as cars offer safety during travel, speed, and significant flexibility compared to other modes of transport. Their availability provides motorists with assurance of travel under any circumstances.

The results, as illustrated in the table below, show that out of 54 surveyed motorists, 84% affirmed that car availability is one of the main reasons for their choice of automobile mobility. The possibility of door-to-door travel was mentioned by 32% of respondents, followed by travel speed and safety offered by individual cars, with 11% and 19% of responses, respectively. (The total exceeds 100% because this question allowed multiples responses, hence the sum of proportions is 145.90%).

Table 1: Reasons for choosing automobile mobility

		Responses		Percentage of observations
		N	Percentage	
reasons for choosing the private car ^a	Safety and auto-mobility	7	13,0%	18,9%
	Speed and automobile mobility	4	7,4%	10,8%
	door-to-door and car mobility	12	22,2%	32,4%
	Availability and car mobility	31	57,4%	83,8%
Total		54	100,0%	145,9%

a. Group of dichotomies tabulated at value 1.

Source: Authors, Survey March 2024.

Although the majority of employees opted for automobile mobility, most expressed their willingness to switch to public transport, with 80% of motorists willing to do so. Only 9 individuals stated their attachment to their vehicles, even if their commute was effectively served by public transport, due to the flexibility, speed, and constant availability of cars.

Additionally, to confirm the relationship and its intensity between automobile mobility and individual car performance, we conducted Chi-square and Cramer's V tests.

2-1- Modal choice and the safety offered by individual cars

Safety is a crucial parameter in daily commuting. We tested the potential existence of a relationship between the choice of individual cars over other modes of transport concerning the safety level of this mode using the Chi-square test.

The results are represented in the table below, with a Chi-square value of 61.26 and a significance level below 5% ($\alpha < 0.001$). Therefore, we can reject the null hypothesis, which posits no relationship between the two variables, and accept the alternative hypothesis, acknowledging that safety is a factor in the modal choice of Sonatrach employees.

Moreover, the intensity of the relationship between the two variables, expressed by Cramer's V coefficient, which is 0.942 and statistically significant at the 5% level ($\alpha < 0.001$), confirms a strong relationship between the choice of individual cars and the safety level offered by this mode of transport among the motorized employees in our sample.

Table 2: Safety and individual motorization

Chi-square tests			
	Value	df	Asymptotic significance (bilateral)
Pearson Chi-square	61.26 ^a	2	,000
Likelihood ratio	78,561	2	,000
Linear by linear association	53,277	1	,000
No. of valid observations	69		
a. 2 cells (33.3%) have a theoretical size of less than 5. The minimum theoretical number of cells is 2.94.			

Source: Authors, Survey March 2024.

2-2- Individual motorization and commercial speed

Commercial speed is a factor in choosing individual cars for daily commutes (Bonnafeous, 2004). To verify the existence of an association between car choice and the commercial speed of this mode, we performed the Chi-square test. The results are illustrated in the table below, with a Chi-square value of 61.223 and a significance level below 0.001 ($\alpha < 0.005$). Therefore, we can reject hypothesis H0, which posits no link between the two variables, and accept hypothesis H1, acknowledging a relationship between car choice and the speed it offers its owners.

Additionally, the intensity of this relationship, using Cramer's V coefficient, demonstrates that Cramer's V, equal to 0.942, is statistically significant at the 5% level ($\alpha < 0.001$), indicating a strong relationship between the two variables.

Table 3; Individual motorization and car speed

Chi-square tests			
	Value	df	Asymptotic significance (bilateral)
Pearson Chi-square	61,223 ^a	2	,000
Likelihood ratio	78,223	2	,000
Linear by linear association	56,121	1	,000
No. of valid observations	69		
a. 2 cells (33.3%) have a theoretical size of less than 5. The minimum theoretical number of cells is 1.68.			

Source: Authors, Survey March 2024.

2-3- Individual motorization and seamless commutes:

Door-to-door travel by individual cars enables mobility with less physical effort and efficiency between origin and destination points (Héran, 2001). Our study results show that over 32% of surveyed motorist employees stated that door-to-door travel is a determining factor in their modal choice. To test the existence of a statistically significant relationship between the two variables, we used the Chi-square association test, and the results are presented in the table below.

Pearson's Chi-square value is 61.339 and is statistically significant because the significance level is below 0.005 ($\alpha < 0.001$). Consequently, we can reject hypothesis H0, which posits the independence of the two variables, and in this case, we accept hypothesis H1 and the existence of a relationship between modal choice and the door-to-door travel offered by individual cars.

Table 4: Individual motorization and door-to-door travel

Chi-square tests			
	Value	df	Asymptotic significance (bilateral)
Pearson Chi-square	61,339 ^a	2	,000
Likelihood ratio	79,197	2	,000
Linear by linear association	49,050	1	,000
No. of valid observations	69		
a. 0 cells (0%) have a theoretical size of less than 5. The minimum theoretical number of cells is 5.04.			

Source: Authors, Survey March 2024.

Additionally, the intensity of the relationship between the two variables, using Cramer's V coefficient, shows that it is 0.943 and statistically significant at the 5% level ($\alpha < 0.001$). Thus, we can confirm a very strong relationship between modal choice, individual motorization, and seamless commutes offered by individual cars.

2-4- Individual motorization and car availability:

The availability of a mode of transport is an essential factor in individuals' modal choices. Individual cars offer their owners undeniable freedom and flexibility due to their availability, allowing travel at any time and under any conditions.

To verify the existence of a link between individual motorization and the quality of "availability" of individual cars in our study, we performed a Chi-square association test between the two variables, and the results are presented in the table below.

Table 5: Individual motorization and car availability

Chi-square tests			
	Value	df	Asymptotic significance (bilateral)
Pearson Chi-square	61,321 ^a	2	,000
Likelihood ratio	79,062	2	,000
Linear by linear association	48,492	1	,000
No. of valid observations	69		
a. 1 cells (16.7%) have a theoretical size of less than 5. The minimum theoretical number of cells is 4.62.			

Source: Authors, Survey March 2024.

The results show that Pearson's Chi-square value is 61.321 and is statistically significant at the 5% level ($\alpha < 0.001$). Consequently, we can reject the null hypothesis (H_0), which posits no link between the two variables, and accept the alternative hypothesis (H_1), acknowledging an association between the individual motorization of surveyed employees and the availability of individual cars. Furthermore, verifying the intensity of this relationship using Cramer's V coefficient is statistically significant at the 5% level ($\alpha < 0.001$) and has a value of 0.943. This leads us to conclude a very strong relationship between modal choice and the availability of individual cars. The conclusions of this study reveal a relationship between the choice of individual cars, individual motorization for urban mobility, and the commute of CRT-Sonatrach employees in Bejaia, and the performance of individual cars. Additionally, the latter allows users to make smoother, uninterrupted door-to-door trips. Furthermore, the flexibility and availability of individual motorization are closely linked to its availability compared to other modes.

Conclusion:

The issue of urban mobility has been studied and analyzed by scientists for several years in developed countries and more recently in developing countries. The objective is to find pathways and solutions to address the dominance of individual car use in urban travel due to the inconveniences caused by this mode of transportation.

One of the solutions to this problem is public transport. However, its success is also linked to other areas such as urban planning and proactive policies to promote this mode of transport by implementing measures to encourage modal shift.

The difference between developed and developing countries lies in the fact that the former face mobility difficulties despite the abundance of public transport and walking infrastructure, a situation referred to as "automobile dependency." In contrast, the latter face "individual motorization" due to the lack of alternatives, leaving individuals with no other option than to choose automobile mobility.

In this research, we attempted to understand and analyze individuals' decisions regarding the use of private cars for commuting by conducting a survey among employees of CRT-Sonatrach in Bejaia.

From the results obtained, we concluded that the poor quality of public transport, its artisanal nature, and the absence of a line serving the port area (the main axis of the port area) have contributed to increasing individual motorization among the employees of this company. In other words, the poor quality and low coverage of public transport in different areas of the city of Bejaia explain the prevalence of individual motorization among port area employees. Additionally, the characteristics of private cars have played an essential role in the motorization of employees in this area of Bejaia, particularly due to their commercial speed, availability, and flexibility offered to motorists.

To mitigate the negative impacts of this mode of travel and enable the city of Bejaia, and the port area in particular, to align with the principles of TOD (Transit Oriented Development) and achieve sustainable mobility, we have identified the following recommendations that will help approach these objectives, particularly in the Bejaia port area:

Improve the public transport provision in the city of Bejaia, particularly along the route from the bus station to the port area.

Enhance adequate infrastructure to encourage employees living within 3.5 km to walk and cycle.

Equip the city of Bejaia with modern modes of transport, such as cable cars on the heights and trams on the plain, to better serve different areas of the city and contribute to reducing artisanal modes (classic buses and minibuses) and individual car use.

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