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An Overview of the Algiers Subway Management Before and During the Covid-19 Pandemic to Avert Potential Financial Losses

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Abstract

The purpose of this paper is to assess the Algiers subway passengers' demand and to show its importance as mass transport means. Also, to carry out a forecast evaluation on the subway operation proposed by the Algiers Metro Company (EMA) for the year 2022, under the Covid-19 pandemic, to limit future financial losses and to respond optimally to passengers’ demand. The methodology used in this research paper is based on the real Algiers subway passengers' demand between 2018 and 2021. In the first step, the consequence of the Covid-19 pandemic has been analyzed. Then, an evaluation of the Algiers subway operation before and during the pandemic has been done. As a result, the study demonstrated that the current operation is inefficient, which will lead to future financial losses. To avoid this last issue, the paper proposes some suggestions to adapt the subway capacity with the real users’ demand.

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Keywords: Algiers; subway management; Covid-19 pandemic; financial losses; passengers’ demand.

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1. Introduction

In a world where the demand for mobility continues to grow, it has become essential to manage public transport means efficiently. As a widely used mode of public transport, the subway can alleviate congestion and respond to the high mobility demand by reducing the use of personal vehicles, thanks to its high passenger-carrying capacity (Amponsah and Adams, 2016; Xu et al., 2020).

In addition to the several challenges that the operators of the public transport should face in normal conditions, they have to make more effort to offer an efficient public transport operation in order to ensure a high level of safety during the Covid-19 pandemic (Betkier, 2020; Tirachini and Oded, 2020). The first case of the Covid-19 pandemic was detected in China between the beginning of October to mid-November 2019. After that, it has dispersed all over the world (Shaik et al., 2021).

In this critical situation, several countries all over the world decided to implement a standstill in their public transport systems and they opted for the confinement of the population at the start of this pandemic (Liu et al., 2021; Abdullah et al., 2021). As a step to reduce the number of infections and to control the whole health crisis, Algeria is one of these countries that opted for this measure when Covid-19 appeared in March 2020.

To confront the outbreak and spread of the Corona pandemic, the Algiers Metro Company (EMA) has decided to implement immediately a standstill of its various services, including the subway operation since March 22, 2020. A decision that was social in its dimension aimed at preserving the citizens' safety, was in turn, the reason of large financial losses estimated at 13 billion dinars at the end of 2020, including the total losses of the different (EMA) services: subway, tramway, cable cars, and gondolas services (Rouha, 2020).

However, after a strict standstill, the Algerian authorities have taken gradual mitigation of the containment measures leading to the resumption of some services, where the first was the tramway on 22nd of June, which was characterized by a low passengers’ demand compared to the pre-pandemic period (Senoussaoui, 2020; APS, 2020). This means of transport continued to incur losses during its activity in the post-pandemic period too.

Thus, the main question that arises is about the losses recorded in the subway service in the light of its operation disruption throughout 18 months, from March 2020 and until the 7th of October 2021, the date of its resumption. Also, about the proposed operation in the period of its resumption. The importance of this study lies on the contribution in analyzing a current critical problem of transport safety. In addition, it aims at evaluating the proposed Algiers subway operation, especially for this year, to suggest solutions for an efficient operation during the pandemic of the Covid-19. This can improve the efficiency of the Algiers subway management in case if it is not optimal, to avoid future financial losses.

The first section of this paper shows the challenge of public transport to ensure a high level of service under the Covid-19 pandemic. The second section presents the case study and the methodology used to attain the objective of this study. Finally, the last section illustrates several results and recommendations to propose an optimal, feasible, and least expensive operation to improve the passengers’ safety during the Covid-19 pandemic. This is for limiting the financial losses due to the inefficiency of Algiers subway management.

2. The challenge of the public transport under the Covid-19 for a high level of service

An efficient public transport should respond optimally to the several key performance indicators that attract passengers to use it (Figure 1). This permits to ease the population mobility in the city (Kozakova, 2015; Ha et al., 2019). During Covid-19 pandemic, the safety and the comfort of passengers are the most important factors that attract passengers to use public transport.

However, to ensure a high public transport performance, it is necessary to respect the other key performance indicators, especially the public transport reliability (regularity, travel time, speed, stopping time). In addition, it is necessary to ensure an efficient public transport in terms of the accessibility and the ticket price. This last should not be augmented because of the economic crisis. An efficient management of public transport helps people to travel in good conditions.
3. Case study: Algiers subway

3.1. The Algiers subway networks

The length of the first line of the Algiers subway was inaugurated on November 01, 2011, it stretches from the Grande Poste to Hai El Badr along 9.5 linear km and includes 10 stations. The first extension was inaugurated on July 4, 2015, from Hai El Badr to El Harrach Center over 4 km includes 4 stations. Then, the second extension was inaugurated on April 09, 2018, from the Grande Poste to the Place des martyrs, it extends over a length of 1.7 km and includes 2 stations. The third extension was also inaugurated on April 09, 2018, with a length of 3.6 km, from Hai el Badr to Ain Naadja. Noting that the intermediate stations of this extended line were inaugurated on November 13, 2018, it includes 3 stations. The future extensions of the Algiers subway will be from the El Huarache to the airport and from Ain Naadja to Barraki Bouder et al. (2017); Baouni (2015).
3.2. Characteristics and capacity of the Algiers subway

The Algiers subway network is equipped with 14 train sets with a length of 108 meters, each train can carry up to 1290 travelers, including 210 seats. The maximal speed of the subway is 72 km/h. The Algiers subway is equipped with advanced intelligent systems. It also allows the displacement of 40,000 passengers/hour/direction under normal conditions (before the pandemic of Covid-19). This value is calculated based on the subways time intervals of 3 minutes in peak hours, and 5 minutes in the other hours per day Baouni et al. (2013); Bouder et al. (2017).

Then, we evaluate the operation applied in the year 2022, in order to assess the subway management efficiency, by using the equations.1. and 2. This will avoid incurring financial losses caused by the subway standstill implementation by March 22, 2020, but later on, the losses increased significantly throughout the following months of 2020 and 2021 as well. The financial losses are varied from month to month with an estimation of about 200 million, 212 million, 188 million, and 193 million. Furthermore, the lowest losses were about 157 million (DA) in November, December 2020, and January, February, and April 2021 estimated respectively at about 200 million, 212 million, and 188 million (DA) as the largest losses, which is recorded in October 2020, in addition to the following months of August 2020 and 2021. So, the high losses from September to July indicate the significant dependence of the Algerian citizens on this means of transport during their periods of activity.

Table 1. Timetable of Algiers subway operation under Covid-19. (Source: Algiers Metro Company- EMA).

| Time / all days       | Interval between subways |
|----------------------|--------------------------|
| From 6 am to 9 pm    | 4 minutes                |

4. Methodology

The methodology used in this study is based on the passengers’ attendance between 2018 and 2021. The data of passengers’ demand in this interval of time have been recorded from the Algiers Metro Company (EMA). First, we present approximately the financial losses of the operating company due to the subway standstill caused by the Covid-19 pandemic, using as a reference, the data of passengers’ attendance for the year 2019. The calculation of values in this analysis is based on the Algiers subway ticket’s price which is estimated at 50 DA in the equation.1.

\[ F_L = (P_r - P_c) \times 50 \]  

- \( F_L \) is the financial losses (DA),
- \( P_r \) is the passengers’ number of the reference year,
- \( P_c \) is the passengers’ number of the pandemic Covid-19 year.

Noting that the revenue of each year is calculated in the equation.2.

\[ R = (P_r) \times 50 \]  

- \( R \) is the revenue (DA).

Second, we assess passengers’ demand between 2018 and 2021 to evaluate the offered and needed capacity using the equations.3. and 4.

\[ C_o = (S_c \times S_n \times N_h \times D_m) \]  

- \( C_o \) is the offered capacity for the year 2022,
- \( S_c \) is the Algiers subway capacity,
- \( S_n \) is the number of subways used per hour,
- \( N_h \) is the number of hours used in the Algiers subway operation per day,
- \( D_m \) is the days’ number of the month.

\[ C_n = (P_M \times D_m) \times 2 \]  

- \( C_n \) is the needed capacity for the year 2022,
The equation.4. is multiplied per 2 to ensure the double transport capacity applied by the company for passengers’ safety inside the subway.

\[ I_c = \frac{P_{n+1}}{P_n} \]  

(5)

- \( I_c \) is the coefficient of increase,
- \( P_n \) is the passengers’ number of \( n \) year. Where \( n \) is the defined year,
- \( P_{n+1} \) is the passengers’ number of \( n+1 \) year. Where \( n+1 \) is the next year of the defined year.

\[ P_f = (P_r \times I_c) \]  

(6)

- \( P_f \) is the forecast of passengers’ demand for the year 2022.

Noting that the highest \( I_c \) has been chosen to calculate the \( P_f \) for all months to ensure a high level of safety and service quality.

5. Results & Discussion

The standstill decision that has been taken by the Algiers Metro Company (EMA) because of the Covid-19 pandemic, caused large financial losses estimated at 13 billion dinars at the end of 2020, including not only the subway’s losses but the total losses of the different company services: the subway, the tramway, the cable cars and the gondola services; while the standstill of the subway service has lasted from March 2020 to October 7th, 2021, unlike the tramway that has been back in service since June 17th, 2020. This long period of the subway’s standstill has led to significant losses resulting from the decline in the passengers' demand and consequently in the revenues of the tickets (figure 3 and figure 4), where the total losses from March 2020 to September 2021 compared to 2019, were estimated at 3.4 billion dinars. These losses are estimated at more than 1.7 billion dinars during 2020, excluding a profit estimated at 16 million dinars recorded during the first two months of 2020 preceding the emergence of the first cases of Covid-19 in Algeria. Figure 4 shows clearly the monthly decrease in the subway passengers' transportation revenues in each year: 2018, 2020, and 2021 compared to the year 2019, which represents the reference year of the study. The analysis of the losses evolution shown in figure 4 indicates that the Algiers Metro Company (EMA) incurred low losses in March 2020, the month in which the first suspect of Covid-19 has been announced in Algeria, leading to the aforementioned standstill. The losses in this month can be considered insignificant because of the standstill implementation by March 22, 2020, but later on, the losses increased significantly throughout the following months of 2020 and 2021 as well. The financial losses are varied from month to month with an estimation of about 219 million (DA) as the largest losses, which is recorded in October 2020, in addition to the following months November, December 2020, and January, February, and April 2021 estimated respectively at about 200 million, 212 million, 200 million, 188 million, and 193 million. Furthermore, the lowest losses were about 157 million (DA) in August 2020 and 2021. So, the high losses from September to July indicate the significant dependence of the Algerian passengers on this means of transport during their periods of activity.
Through this work, an evaluation of the Algiers subway demand was carried out before and during Covid-19, to improve its operation and reduce the financial losses linked to its management in the future. The results proved that there were significant financial losses incurred by the company due to Covid-19, especially, in light of the high passengers' demand before its standstill. In addition, the capacity of transport offered by the company during the resumption under Covid-19 conditions exceeded the real demand by 4 and 5 times, which will harm the track and rolling stock. This will generate further financial expenses in the future caused by this bad operation. This fact proves that there will not be a balance between transport supply and passengers demand in 2022. Hence, to resolve the problem between supply and demand imbalance, a forecast demand has been calculated using the highest coefficient of demand increase which is 1.5. This allowed us to find the necessary highest capacity that can respond to the future passengers' demand. Thus, to preserve this means of transport and avoid more financial losses. We recommend ensuring a better use of the subway to guarantee a better mobility. This cannot be done without

In light of such significant losses and the high need for mobility in the city, the Algiers Metro Company (EMA) decided to resume the subway operation on October 07, 2021, that is coinciding with the social return. The Algiers Metro Company (EMA) endeavored to achieve its sustainable goal, both social and economic, so it supported the resumption by a set of important measures, such as increasing the passengers’ capacity while respecting the distancing measures, by increasing the number of subways.

The results of this research prove that the users’ demand for the Algiers subway increased in 2019 and the first two months of 2020 before the emergence of the covid-19 in Algeria and the subway standstill decision on March 22, 2020. When the Algiers subway operation is resumed, the managers of the operating company decided to increase the transportation capacity by using 4 minutes as a time interval between subways, this equal to 15 train sets per hour per direction, to provide more safety, and to reduce the risk of contamination. Also, this offer will ensure a double transport capacity for 160,000 passengers per day, from 6:00 a.m. to 9:00 p.m. Figures 5 and 6 indicate that the offered capacity for the year 2022 exceeds by more than 4 and 5 times the demand recorded just before the subway standstill i.e. between the year 2019 and March 2020.

Noting that the coefficient of passengers' increase demand between 2018 and 2019 is 1.15. This fact proves that there will not be a balance between transport supply and passengers' demand in 2022. Therefore, to be able to provide a solution to this imbalance between supply and demand, a forecast demand has been calculated on the basis of the highest increases coefficient which is 1.5, which make it possible to find the maximum necessary capacity that can meet the future demand optimally.
6. Conclusion

Through this work, an evaluation of the Algiers subway demand was carried out before and during Covid-19, to improve its operation and reduce the financial losses linked to its management in the future.

The results proved that there were significant financial losses incurred by the company due to Covid-19, especially, in light of the high passengers’ demand before its standstill. In addition, the capacity of transport offered by the company during the resumption under Covid-19 conditions exceeded the real demand by 4 and 5 times, which will harm the track and rolling stock. This will generate further financial expenses in the future caused by this bad operation. This fact proves that there will not be a balance between transport supply and passengers demand in 2022. Hence, to resolve the problem between supply and demand imbalance, a forecast demand has been calculated using the highest coefficient of demand increase which is 1.5. This allowed us to find the necessary highest capacity that can respond to the future passengers’ demand. Thus, to preserve this means of transport and avoid more financial losses. We recommend ensuring a better use of the subway to guarantee a better mobility. This cannot be done without
a balance between transport supply and passengers' demand, while respecting the filling rate in the wagons and safety measures related to Covid-19 to limit the contamination rate.

Our contribution could be considered as a start for future papers that would treat the public transportation management in the period of Covid-19 pandemic, to satisfy the real travelers demand efficiently, increase the safety of users and avoid the financial losses caused by the inefficient public transport operation.

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