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Faculty of Management / project management

The Role of Quality, Planning, and Cost Management on Project Management an Empirical Study of The Riyadh Metro Projects in Riyadh City, Kingdom of Saudi Arabia

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Final Project - 2

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The 29st Jun- 2024

Acknowledgement

First and foremost, praises and thanks to the God the mighty for his showers of blessing throughout my research work to complete the research successfully I would like to express my deep and sincere gratitude to my research supervisor doctor for giving me the opportunity to do research and providing valuable guidance throughout this resource here, dynamic version, sincerity and motivation have deeply inspired me. She has taught me the methodology to carry out the research, and to present the research work as clearly as possible it was a great privilege and honor to work and study under her guidance, I am extremely grateful for what she has offered me. I would also like to express my sincere gratitude to my friends and parents, who stood by me and encouraged me to work on this project. I am overwhelmed in humbleness and gratefulness to acknowledge my debt to all those who have helped me to put these ideas, well above the level of simplicity and into something concrete. I would like to express my special thanks of gratitude to my teacher as well as the founder of this university who gave the golden opportunity to do this wonderful project on the topic of The Role of Quality, Planning, and Cost Management on Project Management an Empirical Study of The Riyadh Metro Projects in Riyadh City, Kingdom of Saudi Arabia, which also helped me in doing a lot of research and I came to know about so many new things. I am thankful to them. Any attempt at any level can't be satisfactorily completed without the support and guidance of my family and friends. I would like to thank my family who helped me a lot in gathering different information, collecting data and guiding me from time to time in making this project, despite of their busy schedules, they gave me different ideas in making this project unique.

Dedication

This research project is dedicated to my wife, whose unwavering love and support have been the driving force behind my academic pursuits. Her encouragement and belief in me have been a constant source of inspiration, and I am forever grateful for her guidance and wisdom. I look forward to attending the graduation ceremony with you.

I would also like to dedicate this work to my supervisor, whose expertise and guidance have been instrumental in shaping my research skills and knowledge. Her mentorship has been an invaluable asset to my academic and professional growth.

Finally, I would like to dedicate this research to all those who have been affected by the subject matter of this study. It is my hope that this work will contribute to the advancement of knowledge and understanding in this field, and ultimately lead to positive change and progress.

Thank you all for your unwavering support and encouragement throughout this research project.

Abstract

We carried out this study to look into the impact of traffic management initiatives on Riyadh Metro projects. Transportation is a problem that necessitates continuous movement, which leads to conflicts, friction, and crashes. The responsible authorities need to control the situation regarding road conditions, car quality, driving behavior, and pressures on the surrounding demographic and geographic areas as the number rises. Nowadays, Riyadh stands among the most car-clogged cities in the Arab and worldwide worlds. There is little doubt that traffic congestion has worsened as a result of the high standard of life, which has led to each family owning many cars. It is undeniable that several sectors play a part in paving roads, building bridges, transporting vehicles, and delivering these services, but the crucial distinction was When the Riyadh metro system is implemented as a sustainable transportation option that would provide inexpensive, convenient, and dependable urban mobility, the study's significance resides in bringing to light a crucial issue. We spoke with residents of Riyadh firsthand to learn how they deal with the everyday traffic. We distributed a survey to various parent groups on What's App and to many work groups; many of them messaged us in addition to responding to the survey. A group sample of parents and workers in Riyadh City received the survey; all our informants were kept anonymous. Among our inquiries were:

What are the causes of traffic in Riyadh? Who is responsible for this traffic?

What are the solutions in your opinion? Why is he responsible for the traffic in Riyadh?

Our intention in interacting with various citizen types was to extract possibly divergent viewpoints rather than obtain a representative sample of the Whats App groupings. We can determine the number of persons who viewed our survey in light of the previously described problems. Through exchanged messages, we obtained 8 responses to our questions from over 300 people. The replies we got showed a wide range of viewpoints regarding the target demographic. Even though we are able to measure the audience's perspective on the matter, the responses we got offer insightful information about some fundamental distinctions in audience conception. Subsequent research studies could investigate the frequency of these responses and their correlation with population figures, demography, or socioeconomic standing.

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One strand of research has focused on the barriers and bridges to certain modes of transport. Derek Halden Consultancy (2003) examine car users' barriers to switching to the metro, BRT, walking or bicycling, and identify bridges that enable this switch. Blainey, Hickford, and Preston (2012) show that even when rail travel is the most cost-effective transport mode for a particular journey, many travelers still choose other modes. Thus, non-financial barriers to choosing rail transport exist. Blainey, Hickford, and Preston (2012) identify 37 distinct barriers divided into three broad groups,

Figure 1. Thirty-seven distinct barriers to modal shifts to rail.



Source: Blainey, Hickford, and Preston (2012).

as Figure 1 shows. These groups represent hard barriers (e.g., travel time, reliability and cost), soft barriers (e.g., comfort, information and security) and complementary barriers (e.g., weather and

lifestyle). However, the concepts of ‘hard’ and ‘soft’ factors or measures are not yet clearly defined.

A consensus has formed that the former are more related to indicators and interventions on the supply side of the transport system. In contrast, the latter are more related to the demand side, which includes psychological and behavioral strategies (Queiroz, Celeste, and Moura 2020). Blainey, Hickford, and

Preston (2012) also identify four types of bridges. These are enhancing alternative modes, making car travel less attractive, ensuring efficient management and administration, and providing information on available modes.

Other studies have found that individuals’ socioeconomic characteristics strongly affect their mode choices (Limtanakool, Dijst, and Schwanen 2006; Munshi 2016). For instance, income, car ownership, gender, age, household composition and lifestyle are robust and relevant predictors of mode

Figure 1. Thirty-seven distinct barriers to modal shifts to rail.

Source: Blainey, Hickford, and Preston (2012).

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Table 1. Independent variables in the utility function and sample description.

Descriptive statistics of choice attributes	Sample: Car to metro		Sample: Taxi to metro	
Total observations	1,332		432	
Choice attributes	Car mean (sd)	Metro mean (sd)	Taxi mean (sd)	Metro mean (sd)
Walk time to access the transit mode	4.05 (3.22)	6.43 (3.96)	2.94 (1.18)	11.27 (3.10)
Wait time for the transit mode	0 (0)	4.43 (2.20)	2.98 (1.22)	4.33 (2.06)
Travel time for the transit mode	33.50 (18.29)	28.39 (18.94)	24.63 (9.23)	16.63 (9.96)
Cost of the transit mode	12.65 (12.62)	4.83 (1.59)	30.00 (10.86)	5.00 (1.63)
Descriptive statistics of respondents				
Total number of respondents	148		48	
Sociodemographics	Frequency	Percentage	Frequency	Percentage
Age: Younger than 30 years	75	50.7	23	47.9
Age: 30 to 45 years	59	39.9	19	39.6
Age: 45 years or older	14	9.5	6	12.5
Nationality: Non-Saudi	63	42.6	0	0.0
Nationality: Saudi	85	57.4	48	100.0
Education level: Low	27	18.2	14	29.2
Education level: Intermediate	50	33.8	19	39.6
Education level: High	71	48.0	15	31.3
Employment status: Employed	109	73.6	24	50.0
Employment status: Student	27	18.2	18	37.5
Employment status: Retired	2	1.4	3	6.3
Employment status: Looking for work	10	6.8	3	6.3
Marital status: No	74	50.0	19	39.6
Marital status: Yes	74	50.0	29	60.4
Family type: Single person	23	15.5	9	18.8
Family type: Nuclear family	112	75.7	38	79.2
Family type: Extended family	9	6.1	1	2.1
Family type: Other types	4	2.7	0	0.0

More than one household car: No	59	39.9	24	50.0
More than one household car: Yes	89	60.1	24	50.0
Travel purpose: Work	61	41.2	3	6.3
Travel purpose: Shopping	28	18.9	8	16.7
Travel purpose: Personal business	8	5.4	12	25.0
Travel purpose: Social and recreation	32	21.6	6	12.5
Travel purpose: Medical	2	1.4	6	12.5
Travel purpose: School	6	4.1	6	12.5
Travel purpose: Others	11	7.4	7	14.6

Source: Authors.

Table 1 summarizes the basic statistics for our sample data based on the travel mode. We consider age, nationality, educational level, employment status, marital status, family type, car ownership and trip purpose. The majority of respondents use cars for work trips, whereas taxis are used most frequently for personal business trips. Almost 50% of car users are well educated (i.e., hold a bachelor's degree, master's degree or Ph.D.). The highest proportion of taxi users have an intermediate level of education. Most respondents were employed, followed by students. Approximately 57% of car users are Saudi citizens, whereas non-Saudis are found less taxi users.

Over 40% of trips are work trips by car, whereas the majority of taxi trips are personal business trips, followed by shopping and recreation trips. The majority of the respondents were from nuclear families.

Table 1 also provides the mean and standard deviation of travel cost, travel time, wait time and walk time for a one-way trip. Taxis are the most expensive, whereas car trips have the longest travel times. The survey asked respondents to compare the metro's travel time, cost, walk time and wait time to their current modes. For modeling purposes, however, we use data reflecting the values for each mode rather than in comparison with the current mode.

Finally, a limitation of the data is the small sample size. However, the data are the only available official data from the Riyadh planning authority. As they are official survey data, they are assumed to be reliable. We apply a sufficient modeling approach to achieve robust results using a small sample size.

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1. Chapter 1: Introduction

1.1. Research Background

In this research, I address the topic of The Riyadh Metro projects and although it is a topic that has been extensively researched before by many researchers, I add to them recent growth patterns and future forecasts indicate that Riyadh will have very high population growth rates, which will lead to an increase in the demand for travel on its roadway network and transportation system which is what I focused on due to the connection of this issue with life style in Riyadh city. The study relied on a survey and analytical approach to the factors of quality, planning and cost of transportation and roads and their related factors. The Riyadh metro system is being implemented as a sustainable transport option that will offer reliable, affordable, and comfortable urban mobility. It is important to understand the factors influencing the likelihood that people will use the new metro system. Thus, this study's key objective is to investigate *To investigate the influence of Riyadh Metro projects on managing Riyadh traffic.* We wanted to know what's behind Riyadh's traffic that will influence the choice to use Riyadh's proposed metro system. Giving the Travel times, travel costs, walk times and transfer requirements significantly affect people's mode choices. Travel cost has a greater influence on car users, whereas travel time has a stronger impact on taxi users. Socioeconomic characteristics, such as age, nationality, education level and car ownership also significantly impact the choice to use the metro. The Kingdom of Saudi Arabia has expended considerable efforts to create an energy- efficient urban transport system Such a system can help the Kingdom achieve two important goals. First, the economic sustainability of the energy sector is a top priority for Saudi Arabia as it is one of the world's largest exporters of oil. According to the Saudi Arabian Monetary Agency, approximately 33.42% of the Kingdom's gross domestic product in 2019 was generated by the oil sector (Mahmood, Alkhateeb, and Furqan 2020). Second, achieving the country's net-zero by 2050 target is also a key priority. For instance, the National Renewable Energy Program (NREP) is a strategic initiative of Vision 2030. The program aims to increase the Kingdom's share of renewable energy production, achieve a balance in the mix of local energy sources and fulfill its obligations toward reducing carbon dioxide emissions. Both goals require the country to use all possible strategies to mitigate climate change and achieve energy efficiency. Transportation is a major energy-demanding sector and a major contributor to carbon

emissions (Khalili et al. 2019), and is thus gaining importance in the Kingdom's energy policies. Urban transport in Saudi Arabia is predominantly automobile oriented. A shift from automobiles to public transport can reduce energy demand and carbon emissions and thus improve the country's energy efficiency. However, the urgent need to reduce carbon emissions to mitigate adverse climate impacts requires a drastic shift toward more sustainable modes of transport. According to Kenworthy (2020), public transport can be 55 times more energy efficient than automobile travel. Thus, the Kingdom has proposed a metro system for Riyadh that is currently under development. However, the energy efficiency gains from this system will depend on people's willingness to switch from more traditional car use to metro use. Thus, this study investigates the factors that influence people's willingness to ride the proposed metro. The number of metro systems is increasing globally, societies are becoming more urbanized, and metro systems are critical for mobility. The International Association of Public Transport (2018) notes that at the end of 2017, 178 cities in 56 countries had metros. Moreover, 75 new metros have been constructed since 2000, mainly in Asian countries. Metros transport an average of 168 million passengers per day worldwide (International Association of Public Transport 2018). The growing body of research on metros covers topics ranging from feasibility to operations enhancement and passenger satisfaction. Understanding the necessity of metro systems is helping to accelerate the construction of metro infrastructure. Nonetheless, the modal shift from private cars to metros or bus rapid transit (BRT) is a relatively new research topic. Some recent examples include studies on the proportions of passenger car and motorcycle users shifting to BRT and rail (Kwan, Sutan, and Hashim 2018; Satiennam et al. 2016). Other recent studies analyze the health benefits of BRT (Bartels et al. 2016) and commuters' willingness to shift to the metro (Fraszczyk, Weerawat, and Kirawanich 2019). Anwar and Yang (2017) consider the effects of transport policy on the modal shift from cars to public buses. Krishna, Thomas, and Salini (2020) measure the reduction in fuel consumption and emissions resulting from this modal shift. Mostafi (2022) explores the importance of information and communication technology (ICT)-based mobility services in Cairo. The study examines parameters associated with the frequency of ridesourcing use as well as with the modal shift from different mobility modes, such as from public transport to ridesourcing. Finally, Shaheen and Cohen (2020) investigate mobility on demand and mobility as a service. This study explores people's intentions to shift from their current modes of transport to the metro. Specifically, it considers the proposed new metro system in Riyadh, which includes six lines

covering a 176-kilometer network as well as 85 underground, elevated or at-grade section stations (Royal Commission for Riyadh City 2022). The Riyadh metro is intended to achieve the city's sustainable transport goals. Thus, the factors that influence intention to ride the metro should be explored so that the government can formulate effective transport strategies. This study attempts to provide recommendations for metro stakeholders. The recommendations it provides can help gauge respondents' willingness to shift to the metro and identify the preferred conditions that should be accommodated in planning policies. We also deliver empirical guidelines for understanding customers' perspectives and the mechanisms of shifting from other modes of transport to the metro. These guidelines can eventually be used to meet customer expectations after the new metro system is operational. We aim to understand the underlying factors influencing private transport users' intentions to shift from their current modes of travel to the metro once it becomes available. Using this information, we can better predict the direction of the resulting energy efficiency gains in the urban transport sector.

1.2. Research Problem

Transportation is an issue that requires constant movement and thus results in friction, collisions, and disputes as well. As the number increases, the competent authority must regulate the situation in terms of the ease of the road, the quality of vehicles, the driving of drivers, and the factors pressing on the geographical and demographic environment.

1.2.1. Theoretical Gaps

Despite the significant research on Transportation, there may be a lack of understanding of the underlying mechanisms of the Transportation system. For example, although much research has been done on the reason behind it, the exact mechanisms that lead to traffic jam are not yet fully understood.

1.2.2. Practical Gaps

The access and utilisation of Transportation ways through, organizing and spreading awareness that can help individuals to gain and apply knowledge to manage their time effectively. This gap occurs from the different needs and financial literacy between populations and makes us wonder what is really behind the causes for Riyadh traffic?

1.3. Research significant

The city of Riyadh has become one of the Arab and international cities most crowded with cars. Due to the high standard of living, which has made each family have more than one car, traffic congestion has therefore increased very clearly. The role of multiple sectors in providing transportation services, vehicular traffic, paving roads, and constructing bridges is not denied, but the vital difference was With the Riyadh metro system when its being implemented as a sustainable transport option that will offer reliable, affordable, and comfortable urban mobility the importance of the study lies in unveiling a vital and extremely important matter.

1.3.1. At the theoretical level

be a lack of understanding of the underlying mechanisms of the Transportation system. For example, although much research has been done on the reason behind it, the exact mechanisms that lead to traffic jam are not yet fully understood because of the high standard of living, which has made each family have more than one car, traffic congestion has therefore increased very clearly.

1.3.2. At the practical level

We understand The role of multiple sectors in providing transportation services, vehicular traffic, paving roads, and constructing bridges is not denied, The access and utilisation of Transportation ways through we don't understand what is really behind the causes for Riyadh traffic?

1.4. Research questions

- What is the causes for Riyadh traffic?
- How does the traffic effect the lifestyle in Riyadh city?
- What are the solutions?
- Who is responsible and why?
- What is the impact of The Riyadh Metro projects?
- What are the benefits and drawbacks of The Riyadh Metro projects?

1.5. *Research objectives*

- *To investigate the influence of Riyadh Metro projects on managing Riyadh traffic.*
- *To provide answers on why the problem existed.*
- *To provide solutions*

1.6. Research hypotheses

What is the effect of growth of population in Riyadh city on Riyadh traffic jam?

1.7. Research model

The capital, Riyadh, is experiencing a difficult state of traffic congestion. This problem threatens human health in this expanding city that is about to increase in population by a million in the coming years due to many considerations, including economic and political ones. What is certain is that traffic congestion threatens its quality of life programs and entertainment and tourism activities for residents and visitors. Some of us have begun to cancel our social connections due to the struggle of reaching the destination within the city. The strange thing is that in recent years, Riyadh has witnessed the construction of main streets in northern Riyadh that are parallel to King Fahd Road. They are supposed to reduce traffic congestion on it, but unfortunately they have become traffic congestion points that put pressure on even the side streets in the capital, Riyadh. This problem requires solutions, even if they are partial and temporary, until permanent solutions to this issue are reached. At the forefront of these solutions is the operation of the public transportation system in the capital, including the almost completed tunnel networks and the network of transport buses that roam the capital empty in long experiments that have become a burden on traffic instead of be part of the solution, but we are hopeful and optimistic that the tunnel and bus network will soon be launched in the capital because they are one of the radical solutions to this stifling traffic crisis.

1.1. Scope of The Study

1.2. The Project Structure

2.Chapter 2: Literature Review

2.1. Introduction

Certain unreasonable urban transportation policies and practices can cause traffic jams, demand a lot of time and energy, reduce the effectiveness of commuting, and increase weariness, tension, and anxiety. Additionally, heavy carbon dioxide emissions from motor vehicles and a packed and congested transportation planning environment may have a negative impact on commuter comfort.

2.2. The independent variable

2.2.1 Time index (in minutes)

People's daily time budgets are greatly reduced by commuting, which means they have less time for other, more enjoyable pursuits. The last time someone traveled, the longer they were away from home, must commit to other activities, which raises stress levels, deteriorates mental health, and has a negative effect on job satisfaction.

On the other hand, reduced travel times can promote more time spent sleeping and exercising, both of which are beneficial to one's physical and mental well-being.

2.2.2. The index of inefficiency

Inefficient transportation not only costs cities money, but it also pollutes the environment.

Enhancing public transportation, providing better service, and promoting non-motorized mobility can all help to increase or print transportation efficiency.

2.3. The dependent variable

2.3.1. Traffic index

Traffic jams lengthen travel times, make arrival times unpredictable, and lengthen car lines. It has also been discovered that traffic intersections are detrimental to society.

2.3.2 Time Exposure Index

Traffic commute times are thought to be a significant factor in an individual's quality of life, and more productive commutes will benefit travelers overall. Thus, in order to make commute time efficient, pleasant, and of high quality, urban design must take into account a plethora of amenities like sidewalks, bike lanes, and safe and comfortable bikes. Convenient public transit can also be a relief to those who make frequent, active excursions. To put it another way, meaningful travel makes time spent traveling more valuable, which could lead to people feeling as though their journey is passing more quickly without actually cutting into their travel time.

2.3.3 Index of CO2 Emissions

Even in medium-sized cities, there is an increase in pollution due to traffic-related greenhouse gas emissions, such as CO₂. As a result, numerous research are examining vehicle emissions in an attempt to find ways to reduce pollution.

2.4. The relationship between the independent and the dependent variables

Traffic, Time Exposure and CO₂ Emissions are **dependent variable** and they are a result of the independent variable. Were inefficiency and Time (in minutes) being the dependent variable are the outcome of interest for the study, and the independent variables are the factors that may influence the outcome. For example, if we want to explore whether high traffic rate impact car incidence, traffic rate is the independent variable while car incidence is the dependent variable.

2.5. Conclusion

traffic is caused by the lack of organization and following basic rules of driving in the daily life. further research discovered that traffic is associated to lack of understanding of the city or environment with population increased, traffic increased. The direction of the relationship between population and traffic seems to be that population number (possibly based upon myths about traffic). Taken as a whole, it appears that exposing an increases of population would increases the problem there for it should be managed delicately. Future research should replicate these findings in more natural settings with different populations.

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Appendix – Survey responses

Kind regards,

This questionnaire aims to better understand the behavior of traffic of Riyadh city in kingdom of Saudi Arabia.

We will use the information collected through this survey to improve and better meet the needs of our customers.

The target audience are citizens of Riyadh city.

The questionnaire takes 10 minutes to complete and will be distributed online and by email.

Our questions included:

What are the causes of traffic in Riyadh?

Who is responsible for this traffic?

What are the solutions in your opinion?

Why is he responsible for the traffic in Riyadh?

Our goal in approaching different types of citizens was not to get a representative sample of the WhatsApp groups but to elicit potentially diverse perspectives. Given the issues mentioned above, we are able to assess how many people saw our survey. We received 8 responses from over 300 members users through shared messages who replied to our queries. The responses we

received revealed many different perspectives on audience. While we can quantify audience perspective to the issue the responses we received provide valuable insight into some core differences in conceptualizing audience. Future empirical work might examine the prevalence of these answers and their relationship to citizens counts, demographics, or social status. As we now demonstrate the answers of our survey

What are the causes of traffic in Riyadh?

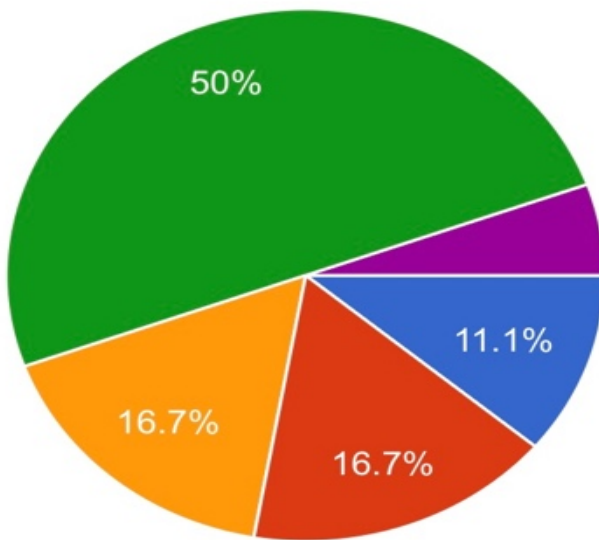
Compatibility of working hours and overlapping of business sectors' working hours with educational institutions. Closing some streets and relying on narrow main streets and lack of paths. The presence of jobs, major companies, ministries, agencies, and entertainment and cultural events in the city of Riyadh is greater. Infrastructure. Population density and large number of cars. Many green buses, labor buses, and trucks. The large presence of foreigners, permitting visit visas, and preventing them from returning. Lack of awareness of the basics of driving and following the correct and specified route, or the legal speed of the road

What are the solutions in your opinion?

A flyover bridge like Kuwait City is being built to ease congestion. Establishing supporting roads for the main road (for example, Kharia's Road is the only road that connects the east to the west. There is no other option, so most of the time the road is crowded) and all roads are in this way. Do not move some companies outside of Riyadh or neighboring areas to revive them, move industrial cities outside of Riyadh, prevent workers. Buses avoid being present on public roads during times of congestion. There is an alternative or supporting route that relieves congestion. Returning to the "primitive" method, which is mass transportation, and instilling this culture through subsidized and free activities and performances so that the citizen can use this means. Organizing working hours for employees - students - universities and colleges. Operating trains and expanding an advanced transportation network throughout Riyadh and linking nearby cities and governorates to a high-speed train network. Establishing fast lines for buses and trucks, changing the working hours of companies, for example, in the middle of Riyadh, and his work center there works at such and such time, and the one in the north of Riyadh has such and such

time, or organizing the number. Stopping visit visas, correcting residency conditions, activating flexible working hours in some sectors, allocating some days to educational institutions (remotely), and activating flexible working hours in business sectors + eliminating old cars for disrupting traffic + imposing a fine on workers and owners of trucks whose speed is less than 100. Educating the people to follow the designated lane and the legal speed of the road.

Who is responsible for the traffic?



- ① Traffic management due to its weak ability to control congestion.
- ② The culture of the population of the city of Riyadh is such that every person owns a car.
- ③ Inactivation of public transportation.
- ④ Weak planning in terms of placing all ministries and departments in one road or one area.
- ⑤ Failure to activate government electronic services to remove bottlenecks in ministries.

Why is the reason you chose in the previous question responsible for the traffic in Riyadh?

As you can see from the pie chart the option number (4) got chosen the most by 50% who agreed that Weak planning in terms of placing all ministries and departments in one road or one area because suddenly, there were projects in Riyadh and the population density increased, and the

streets could not accommodate the number of cars in them. hundreds of millions have been spent on bridges, tunnels, and roads, and we see that this is a form of renaissance and modernity, such that we find the first countries in the world that do not have this large amount of asphalt, which turned the city of Riyadh into a black city consisting of cars, sidewalks, and palm trees in an ugly view, and we fought mass transportation. A country considered a continent in which there is only “SAPTCO” for mass transportation around cities!! No trains, no metro. In contrast, in the poorest countries in the world, such as Abyssinia, we find that the metro has been operating there for decades! But what I want to add is that when we think about operating the metro in the future, we must not price its ticket at a high price, as everything is more expensive than everything around us. This, and God and His Prophet know best. when planning is the most important thing to solve the problem, they do not have a major and permanent role in finding traffic solutions until after the problem occurs! This sector must be allocated to be profitable and capable of finding solutions while participating with international bodies - randomness and ministerial confusion between tourism and entertainment, attracting visas to the good and the bad, a terrible spread of violators in most neighborhoods of Riyadh, poor study and planning among them, lack of agreement with the Ministries of Interior and Foreign Affairs - failure to develop future plans for planning. Polarization and studying the challenges in transportation - in Arabic. The ministries must meet, study the situation, and come up with a sound and plan that benefits society and benefits the economy.

Traffic, Time Exposure and CO2 Emissions are **dependent variable**, and they are a result of the independent variable. Were inefficiency and Time (in minutes) being the dependent variable are the outcome of interest for the study, and the independent variables are the factors that may influence the outcome. For example, if we want to explore whether high traffic rate impact car incidence, traffic rate is the independent variable while car incidence is the dependent variable.

1.1. Conclusion

traffic is caused by the lack of organization and following basic rules of driving in the daily life. further research discovered that traffic is associated to lack of understanding of the city or environment with population increased, traffic increased. The direction of the relationship between population and traffic seems to be that population number (possibly based upon myths

about traffic). Taken as a whole, it appears that exposing an increases of population would increases the problem there for it should be managed delicately. Future research should replicate these findings in more natural settings with different populations.