BIG DATA IN SMART TRANSPORTATION PLANNING: TOWARDS AN APPLICABLE SMART SOCIO-ECONOMIC TRANSPORTATION PLATFORM IN HISTORICAL MEGA CITIES

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ABSTRACT

This paper aims to develop the feasibility of transportation big data in order to drive changes that impacts directly both government and citizens' goals and objectives. The relevance is to face and develop transportation challenges in the down-town of historical mega-cities. A smart transportation platform is proposed that can manage huge amounts of big transportation data planning (BTDP) and give guidance to the urban authorities to make their municipalities smarter and digital, and to propose smart transportation building (STB) as part of smart digital city while preserving its historical identity. This paper proposed a developed framework for smart socio-economic indicator through transportation platform for city data harvesting. The results were able to classify major challenges facing users which revolving the socio-economic indicator; according to a surveying questionnaire on the historical down-town of Alexandria City in Egypt as an important historical mega-city; in order to set applicable solutions via using the Smart socio-economic transportation platform (S2TP).

Keywords: big transportation data planning (BTDP), historical mega-cities, smart transportation building (STB), socio-economic indicator, smart socio-economic transportation platform (S2TP).

1 INTRODUCTION

Big data in transportation is one of the most fashionable concepts nowadays, governments try to exploit the huge new amount of available information [1]. One of the most important problems facing transportation planning in mega-cities is the huge amount of non-upgraded data in order to make it more digital and smarter; while preserving its historical identity. Therefore, heading towards using smart transportation platforms and real-time applications will face these challenges while classifying historical identity.

Subsequently this paper determine down town of Alexandria City in Egypt as a case study in order to specific the maturation of socio-economic composite indicator as a basic return on both social and economic bearings, and goes along the government development plan to improve communication between transport systems and developing economy to correspond objectives of the strategic plan for Alexandria year 2032 [2].

2 BIG TRANSPORTATION DATA FRAMEWORK AND METHODS

Through civil registrations the previous decades saw a similar data avalanche as we are witnessing today, partly through bureaucratic and commercial records, through surveys and mapping, and data has subsequently come to underlie city planning and decisions [3].

2.1 Purpose of big data framework

People should evaluate the purposes for which their data is used and weigh the benefits that supplying their data may provide. When the rewards are immediate and personal (social services, commercial gain), most people are willing to provide their information with the entity that requests it [4].

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Benefits of big data sharing with a broader, societal purpose are less readily acknowledged as a worthwhile trade-off. Concern that their data will be used for purposes other than those for which they were acquired is a complicating element for citizens and consumers assessing the purpose of big data acquisition [5]. Determine what kinds of privacy concerns people as citizens, workers, shoppers, or travellers in smart cities may have as a result of the usage of smart transportation open, huge and linked data. On the basis of existing research on privacy perceptions, it is asserted that these concerns are underpinned by people's perceptions of particular data as personal or impersonal as shown in Fig. 1; their concerns differ depending on the purpose for which data is collected service or surveillance, four areas of concern emerge that range from hardly (impersonal data, service purpose) to extremely high (personal data, surveillance purpose) as shown in Fig. 1.

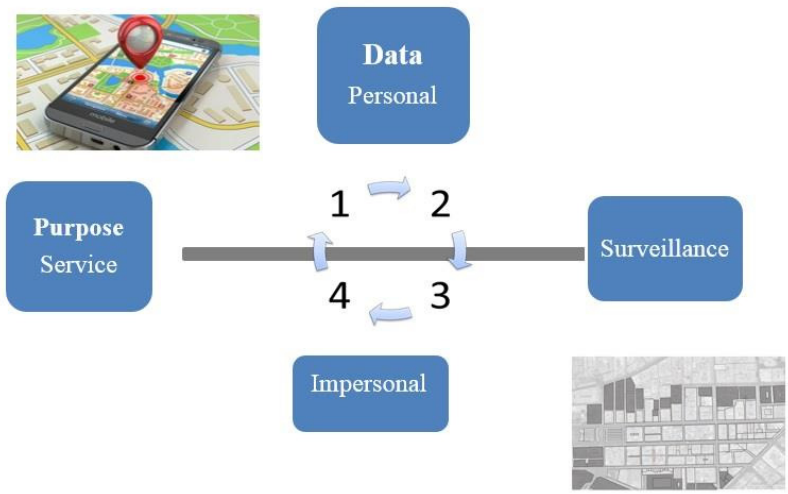

Figure 1: Contrasting challenges for data city transport.

The framework was then used to investigate how specific technology (such as smart parking) and data utilisation (predictive, policing, social interaction) could result in varying levels of privacy concerns. This led to the general idea that smart technology selection and the application of certain combinations of big data and analytic tools are critical variables in understanding people's concerns about smart transportation [6].

2.2 Implementation of big transportation data surveying methods:

Big transportation data has been harvested in this research using three methods:

1. Site visiting real live shots in order to identify historical places challenges
2. Satellite real-time maps as shown on google maps
3. Surveying questionnaire in order to collect data from users (drivers, passengers and pedestrians); which includes visits information, walkability, location identification and usability of smart transportation platforms.

The road real-time maps are placed globally, generating traffic data such as the number of cars and average traffic; it also could be implemented to locate historical places, shortcuts

roads, service and car parking availability. The three sources transfer data through the internet to the smart transportation building (STB), which is a component of the smart city building to gather incoming city data over the network and devices via using smart transportation n applicable platform [7].

3 SOCIO-ECONOMIC COMPOSITE INDICATOR IN SMART TRANSPORTATION PLANNING AND IMPACTS

Following the introduction of big transportation data framework and its recommended implementation; thus, it is necessary to determine composite indicator for big data in transportation; which needs to be collected, upgraded and managed in mega cities characterized as historical cities.

Worldwide 55% of the global population growth in mega cities. Thus, the current urban population of 4 billion people is expected to grow to 6 billion by 2050 [8].

Urban planning adopt various forms and characterizations, and urban growth patterns change between regions, as a result of socio-economic, cultural and historical variances. Therefore the speed of transportation presents challenges which need to be settled and solved according to a smart socio-economic indicator as a main composite impacted indicator, essentially in the down town of mega-cities.

3.1 Socio-economic data collecting of mega-cities

Data about socio-economic has been collected from a number of cities around the world [9]. The data utilised is assumed to be comparable across its impact on historical down-town of mega cities allowing for a global development of the transportation performance indicator. The performance composite indicator for this study is the weekly visits for users to the down town district; facilitating the purpose of the visits, whether it is for business, trade, visiting historical places, or for entertainment, shopping and walking.

3.2 Developing socio-economic mainstream data parameters

A smart city links human capital, social capital, and infrastructures to handle public concerns, develop transportation, and improve citizens' quality of life.

Indeed, when considering the success criteria for a smart transportation deployment, it is clear that citizens have precedence over the other enablers, as in the economic strategy scheme, people, process, and technology must engaged, informed, and connected citizens [10]. All components are deployed in a comprehensive and consistent manner, towards a smart citizen including passengers, drivers and pedestrians

Socio-economic parameters including solving and improving citizens' quality of transportation usability, in parallel big infrastructure data management including vehicles to vehicles (V2V) in order to interact with each other and vehicular networks (VN).

3.3 Transportation digitalization for global world economy

The transportation industry is one of the most heavily influenced sectors of the economy by digitization. The application of technologies that have been successfully tested in big data and intellectualization processes to the transportation sector [11].

As a result, smart transportation systems (STS) are the industry's key technological development trend. The digitalization of the transportation business necessitates a shift in the production's core technical and economic basis. There are important aspects of the transportation sector's digitalization effort at the moment; thus transportation infrastructure

and supply chains are becoming more digital, including management procedures and automation on a large scale [12].

3.4 Socio-economic impacts

Big data analysis, multi-criteria evaluations, and data envelopment analysis (DEA) are the most prevalent assessment approaches for socio-economic assessments. These methods are used to evaluate the socio-economic consequences of intelligent transportation systems [13]. Economic, social, transportation, and environmental integration, which would ensure a decent existence for at least several generations of citizens [14].

Information, knowledge, widespread use of massive transportation data planning, and information and communication technology all play important socioeconomic roles.

The city is an economic and social laboratory in which the citizen image of the city is generated at each step of its historical evolution [15].

4 TRANSPORTATION IN ALEXANDRIA'S HISTORICAL DOWN TOWN CHALLENGES SURVEYING AND IDENTIFICATION

Alexandria is one of the most important mega cities in the world with a distinct historical and cultural identity. Likewise, it is known as the cosmopolitan city [16], and according to the increase of population explosion in several areas, especially the downtown district, and the number of people visits, especially on rush hours times, and the multiplicity of users and visitors, whether for work, trade, services or entertainment; such as shopping and walking.

As per the researcher's evaluation during previous surveying questionnaire, transportation has become afflicted by a number of challenges. According to the strategic urban plan of Alexandria City 2032; the strategic pyramid defines developments tenors and alternatives, which settle that one of the most effective tenor is to define the identity transportation in Alexandria as a smart city with a brilliant history.

4.1 Transportation challenges in down-town of Alexandria City

Historical down-town in Alexandria City in Egypt includes several important landmarks, land uses and significant characteristics are handled together at same boundaries. Therefore, demanding networked management process are necessity.

Challenges in down-town of Alexandria could be summed up into five major determinants as shown in Fig. 2: disconnected users, walkability and pedestrianism lanes or platforms, public and private disconnected vehicles, big traffic non-managed data including historical places and unavailability of car-through services. Subsequently, after identifying challenges; proposals could be provided.

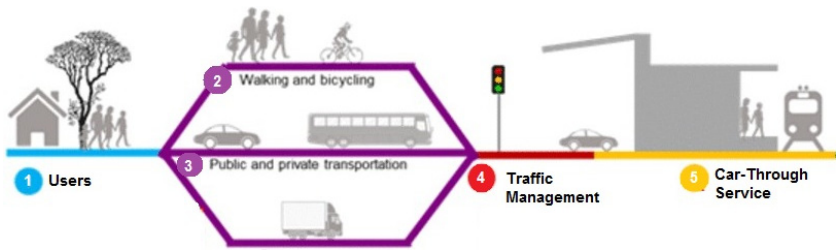

Figure 2: Info-graph shows transportation challenges in down-town of Alexandria City. *(Source: [17], edited by researchers, 2022.)*

4.2 Surveying and identification using satellite maps integrated by real live shots

4.2.1 Historical identity locating and definition

Not all of historical buildings and streets in the down-town of Alexandria City are visible or identifiable on satellite maps as shown in Fig. 3; therefore, big data of historical identity must be updated on the smart transportation real-time platforms.

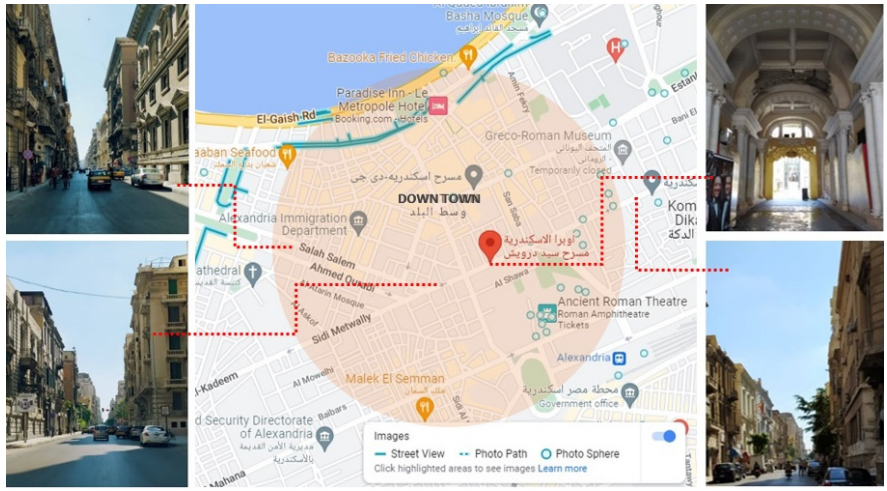

Figure 3: Historical identity in down-town using real live photos. *(Source: Google maps, and photos by researchers, 2022.)*

4.2.2 Car parking spaces availability

There are numerous of parking spaces that are non-organised and inadequate as they are not upgraded nor connected to a smart network as shown in Fig. 4; thus, many problems occur that cause congestion and traffic jams. On the other hand, using networked vehicles upgraded on real-time smart platform reduces stated problems.

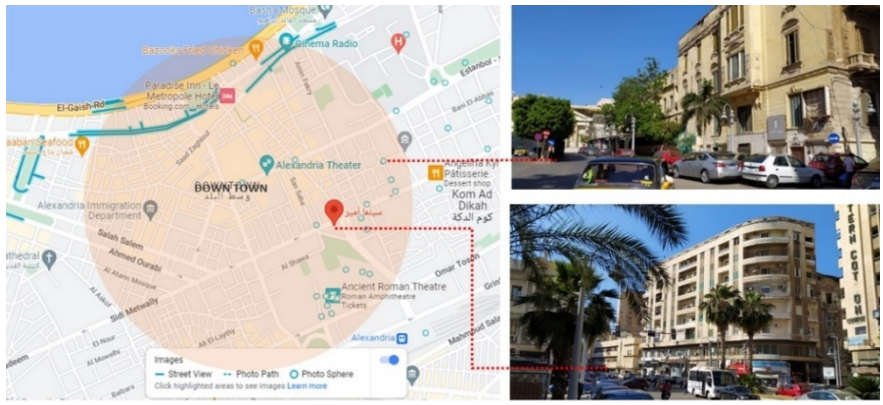

Figure 4: Down-town car parking spaces. *(Source: Google maps, photos by researchers, 2022.)*

4.2.3 Side-roads accessibility suitable for shortcuts

Most of users are accustomed mainly to the use of the main streets and roads; As a result, traffic is completely disrupted during rush hours. Despite the availability of secondary shortcuts that can be used as another alternative to reduce traffic density and solve many road disruption crises as shown in Fig. 5, these shortcuts are not described or updated on smart transportation platforms.

Figure 5: Side-roads in down-town of Alexandria City, Egypt.

4.2.4 Car-through services applicable lanes

Alexandria's downtown district is one of the city's most important commercial centres, among many services such as shops, national service centres, and banks; as a result, users need to perform many services while driving cars to save time and avoid looking for car parking places for long periods of time. Most of service centres and banks are located on the city's major roadways as shown in Fig. 6, allowing the development of a car-through services lanes to reduce wasted time and overcrowding; assuming of necessity, all these lanes and services consistently have to be upgraded on smart transportation platforms.

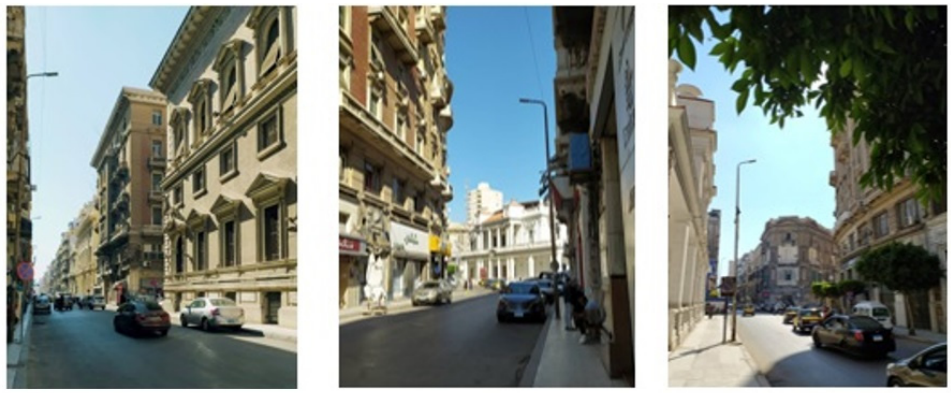

Figure 6: Roads for car-through service lanes proposals.

4.2.5 Walkability and platforms

Creating developed crosswalk pathways is one of the most important elements in the downtown district of Alexandria City in order to illustrate and identify the historical identity. Thus, to increase the number of visitors and tourists to the historical down town of mega-cities, to get acquainted with it, whether for shopping or entertainment. Even satellite maps lack this important determinant socio-economic indicator. Hence the importance of upgrading smart transportation real-time platforms and providing them with crosswalk pathways for pedestrians as proposed by researchers on satellite map in Fig. 7.

Figure 7: Crosswalk pathways proposed by researchers in down-town of Alexandria, Egypt. *(Source: Google maps, photos by researchers, 2022.)*

5 SOCIO-ECONOMIC INDICATOR SURVEYING ANALYSIS IN DOWN-TOWN OF ALEXANDRIA CITY, EGYPT

Due to applying a surveying questionnaire on 50 citizens through 20 questions by the researcher in the historical downtown district in Alexandria City; citizens selected by different categories in terms of age, gender and classification between passengers and drivers of private vehicles. The researcher was able to settle main problems to ask users about.

5.1 Identifying citizens' categories and their problem statements results

The common problems which citizens face by transportation system as shown in Fig. 8, car parking availability, feasibility of drive-through car service, The usability of short-cuts during rush hours, their Satisfaction of available smart real-time transportation platforms, percentage of their personal usage of real-time transportation platforms, level of satisfaction about walkability and public spaces, identifying historical architecture in buildings and side roads, reasons and numbers of visits to the down-town district, and finally most important proposals of down-town development which fit your needs.

5.2 Citizens' considerations of transportation in down-town development

After applying the surveying questionnaire and rearranging results data into charts to classify them the researcher can come to a conclusion about citizen's observation of the historical

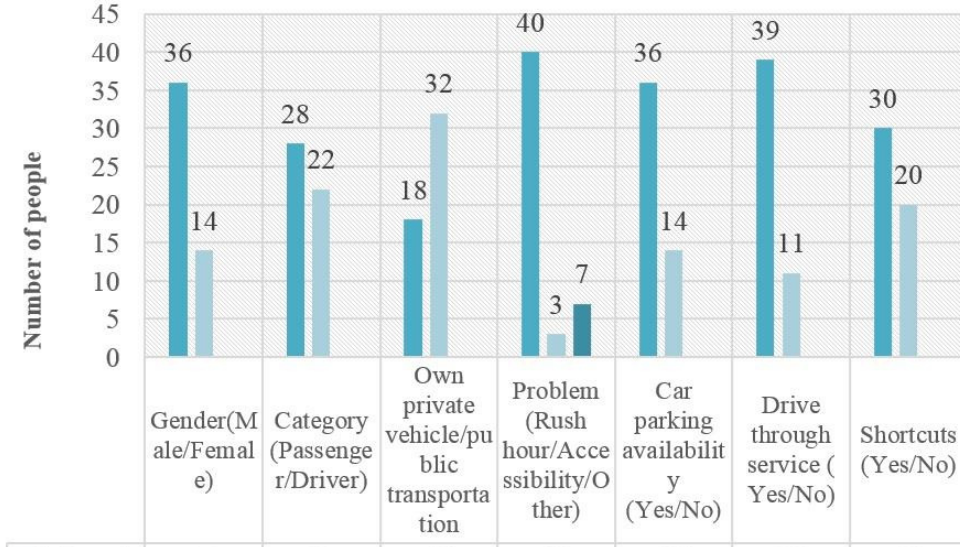

Figure 8: Diagram chart shows classification of citizens and their problems statement about transportation in down-town.

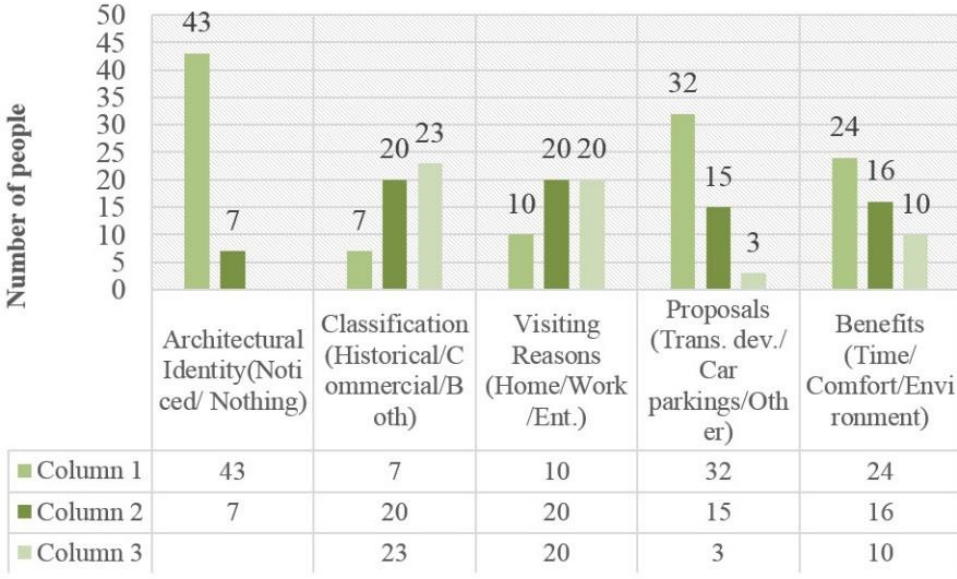

Figure 9: Diagram chart classify citizens' visits, identification and considerations of down-town.

identity of architecture in the down-town of Alexandria City, reasons of citizens' orientations to the down-town; and number of visits per week. The most important valuable benefits of developing transportation in the district of down-town which meet the needs of citizens have also been classified, all results data processed into diagram charts as shown in Fig. 9.

5.3 Citizens' percentage of satisfaction about smart transportation platforms

The researcher can observe citizens' satisfaction about the role of current smart transportation platforms to solve out their need in order to face complicated challenges in transportations in down-town of Alexandria City; through collecting data and processing into diagram chart shown as shown in Fig. 10. Although, results could clarify challenges of:

- Usability of current transportation real-time applications and platforms.
- Satisfaction of walkability and bikes service feasibility
- Historical buildings identification.
- Non-vehicles period proposal acceptance.

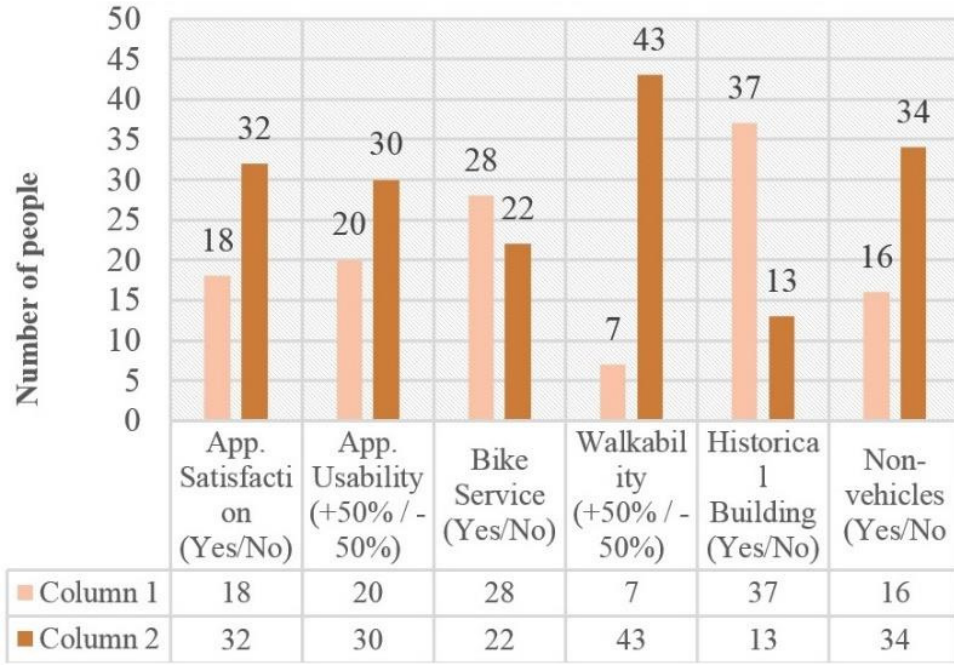

Figure 10: Diagram chart illustrate citizens' percentage of satisfaction about usability of current smart transportation platforms.

5.4 Major challenges in transportation according to consolidated surveying results data

Based on previous diagram charts of surveying results; the researcher consolidates a combined data results into a diagram chart as shown in Fig. 11, and conclusion pie-chart shows percentage of five major transportation challenges in down-town of Alexandria City in Egypt as shown in Fig. 12.

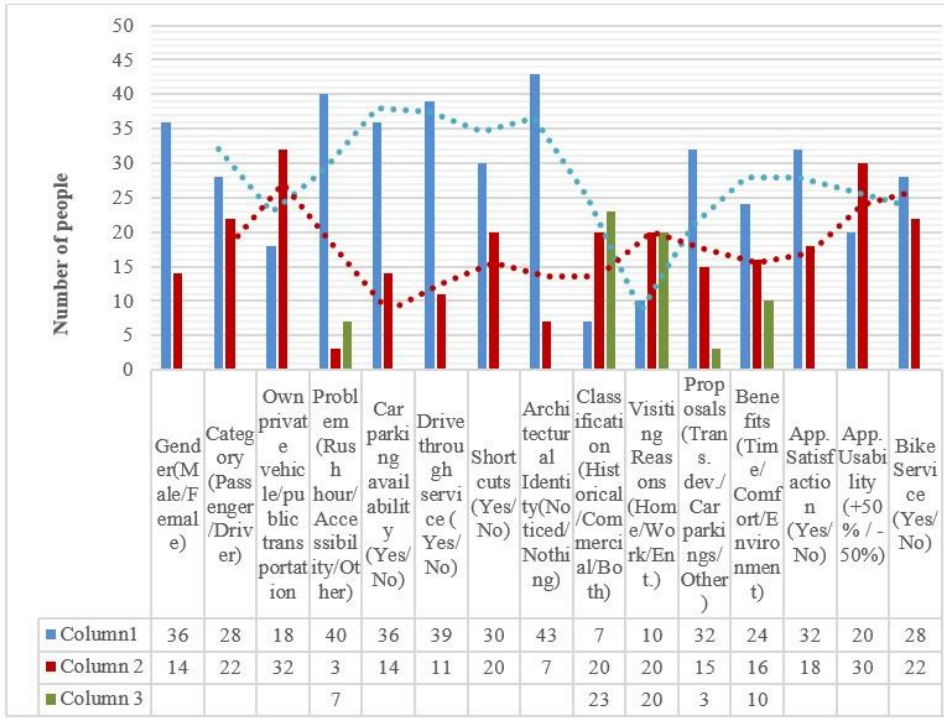

Figure 11: Consolidated diagram chart of surveying questionnaire in down-town of Alexandria City.

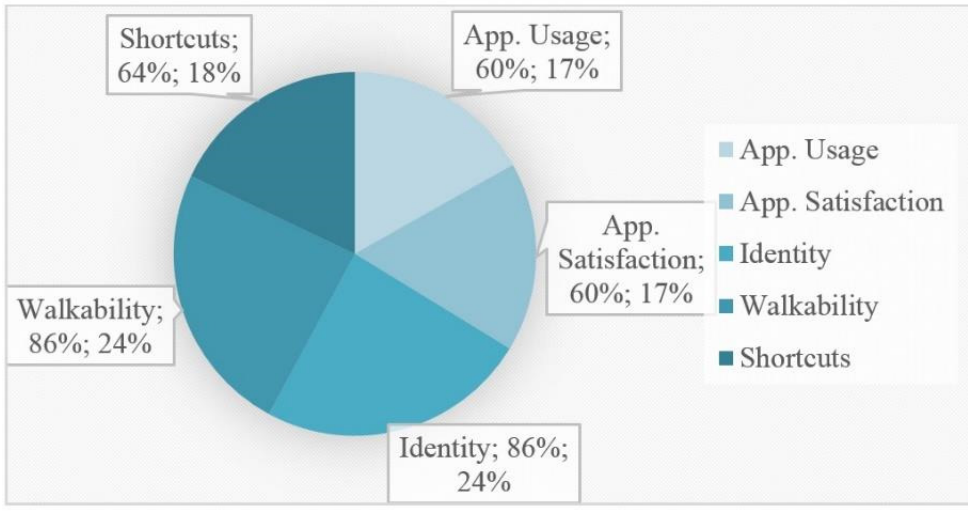

Figure 12: Pie-chart diagram shows percentages of five major transportation challenges in down-town of Alexandria City.

According to the survey combined results chart, the researcher was able to classify five major challenges facing citizens about transportation in 2022, which revolving the socio-economic indicator:

1. Architectural historical buildings identity.
2. Citizens' comfort of walkability and platforms.
3. Shortcuts advantages and accessibility.
4. Smart real-time transportation applications usage.
5. Satisfaction of smart transportation platforms

Following the completion of both analysis and surveying; the results revealed that taking into consideration the socio-economic indicator upgrading is sufficient to accomplish the following outcomes: Transportation: data transportation planning management with networked vehicles. Services: Fully automated services including information, banks and car-through lanes in order to be more engaged and saving time. Integration: A smart city's common information space, integrating data from mega cities infrastructure, big data management systems. Government: Decision-making support system, analysis, incident management, electronic delivery of public and municipal services, open data publication and historical identification. Citizens and users: improving information services, as well as information distributors in historical down-town in mega-cities.

6 CONCLUSIONS:

This paper presents a survey of three methods of big data harvesting from Socio-economic composite indicator in historical mega-cities locating down-town of Alexandria City in Egypt as a case study, and how those surveying results are proposed to be used in an applicable smart transportation platform. The aim of Smart Socio-economic Transportation Platform (S2TP) is to contribute to enhance the transportation planning process through improving big data collecting and management methods for users. (S2TP)'s aim is to upgrade survey data harvesting with network and users' needs inferred from the use of real-time transportation platforms.

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