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Procedia Engineering 77 (2014) 2 – 10

Procedia Engineering

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Fourth International Symposium on Infrastructure Engineering in Developing Countries, IEDC 2013

Development of a Regional Transport Policy Support System for Rural Planning Agencies in Developing World

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Abstract

Socioeconomic imbalances and rural poverty are the main rationales of urbanization in developing countries. These problems are the resultant of transport inaccessibility in scattered destitute sub regions. There could be many reasons responsible for inaccessibility, however; this study focuses the issues of rural planning agencies from data absence and its proper management. The aim of this research is to develop a regional transport policy support system. The master plan's data were utilized to develop this tool for rural planning agencies. The research's end product can be helpful in the timely execution of transport policies for the inaccessible rural population of the developing world.

Peer-review under responsibility of the Accounting Research Institute, Universiti Teknologi MARA.

Keywords: socioeconomic imbalances; poverty; urbanization; transport inaccessibility; regional transport support system; master plan; rural infrastructure

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Selection and peer-review under responsibility of the Department of Urban and Infrastructure Engineering, NED University of Engineering and Technology
doi:10.1016/j.proeng.2014.07.003

1. Introduction

The fields of transportation, engineering, planning and information technology are obligatory for the salvation of both urban and rural settlements. Transportation planning is a key constituent of regional planning that provides basic accessibility and brings physical and socioeconomic development in rural sub regions of the developing world [1]. The implementation of regional transportation policies helps reducing urbanization process from the developing world by strengthening the basic infrastructure of destitute sub regions. Infrastructure planning [2] is a focal point for many of the developing countries. The planned physical and socioeconomic infrastructure is mandatory for the prosperity and planned growth of developing countries. The physical infrastructure mostly includes dwelling units and transportation corridors [3]. Infrastructure and transportation planning have improved accessibility of local people and supported sub regional economic development (see Fig. 1).

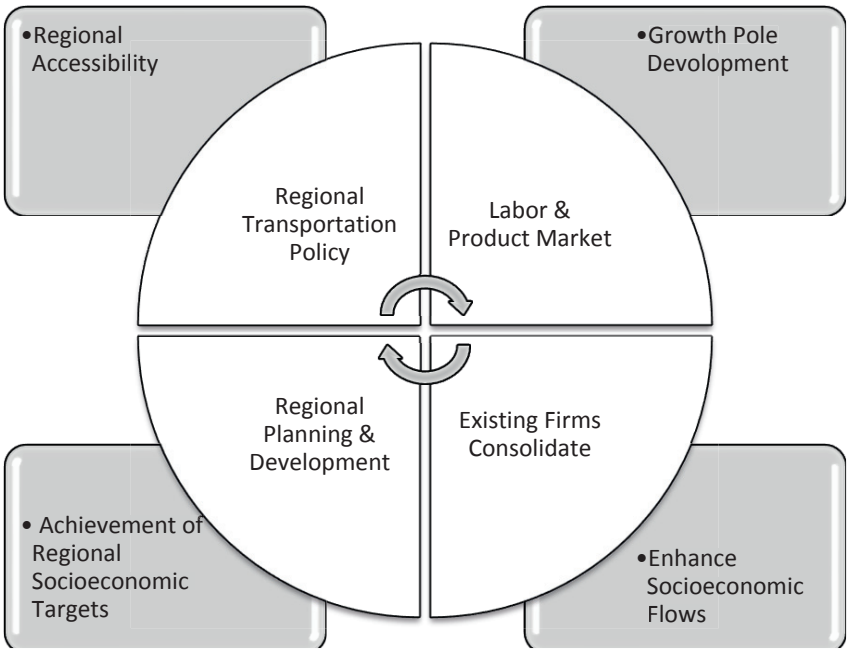

Fig. 1. Transport and regional economic development

These are the sole economic problems, which bring physical, socioeconomic and environmental problems altogether. Urbanization [4] in developing countries is at its peak because of shaky economic conditions and sub-regional instability. In Pakistan, this is projected that urbanization would be enhanced to 140% by the year 2030 [5]. People used to migrate from rural sub regions to urban centers in search of a better life including retrieval of basic amenities and services. The urbanization is a result of many imperative issues such as poverty, backwardness, unemployment, decrepit infrastructure, rural inaccessibility and unavailability of transport development proposals in deprived sub regions of the developing world [6-11]. Transport inaccessibility or less accessibility in developing countries is regarded as a root cause behind the backwardness of rural people [12, 13], which force them to migrate towards urban centers. The rural accessibility [14] is not a goal by itself, but it is considered as a demand within rural context. Therefore, rural accessibility would be taken as a detailed point while framing a regional transport policy, if this would focus life improvement of common people by promoting access to employment [15], goods and services [16]. The rural inaccessibility often creates a state of social exclusion for the rural inhabitants. This state hindered the local population to take part in their daily activities [17]. The social exclusion puts a negative impact on the sub regional economy and considered as a root cause behind rural poverty

[18]. In this way, the population of destitute sub regions would become susceptible to physical and socioeconomic evils and wedged into a vicious deprivation circle. Because of these problems, the rural sub regions would be transformed into depressed sub regions. The depressed sub regions have many negative characteristics (e.g. an outgoing population, declining resources, dormant economic features and a shabby physical infrastructure).

In Pakistan, about two-third of the total population lives in rural areas and the rest remains in urban settlements, having the population in millions. Most of the urban centers have congested because of urbanization and have lost their planned structure [19], such as a metropolitan city of Karachi [20]. The decayed transport infrastructure in general and the backlog of services in particular could be the main reasons of congestion in cities that are the subsequent of urbanization. Pakistan's transport sector condition is still vague because of the absence of suitable literature. Some studies are important as these provide some credulous information about the hidden secrets of Pakistan's transport sector (e.g. according to the study conducted by the *National Transport Research Center* (NTRC) [21], the total length of the roads in a country is about 252,000 kms (see Table 1)).

Table 1. Pakistan's road length (kms) [21]

Road Category	Earthen	Single	Total	Paved	Overall
National Highway	-	-	-	8479	8479
Motorways	-	-	-	367	367
Provincial Highways/Roads	8114	18254	26368	74470	100838
District Roads	34806	38857	73663	31570	105233
Municipal Roads	753	1873	2626	32119	34745
Cantonment Roads	-	127	127	1872	1999
TOTAL	43673	59111	102784	148877	251661

About one-third of the total rural population not connected with paved roads [22]. From every five rural communities just one has access to all weather roads and three rural communities from every ten have no transportation services availability. Overall (20%) of rural villages are not connected with all-weather roads comprising about (15%) of a total rural population, i.e. 15 million rural inhabitants. The one of the major reasons of rural transportation and infrastructure related problems is unavailability of policy resolutions. The concerned rural authorities have not been able to trigger the policy solutions over the years. It was felt that due to lack of appropriate resources, professionals and data management systems, these authorities have failed to formulate policy proposals for the planned development of rearward sub regions [23]. Therefore, the aim of this research is to develop a *Regional Transportation Policy Support System* (RTPSS) for the planning agencies and development authorities. The RTPSS can be helpful in storing and analyzing the data that could be beneficial in the development process of regional transportation policies. The timely implementation of plans and policies can curtail the pressing problems of rural regional inaccessibility, poverty, urbanization and can further strengthen the development process in rural sub regions of developing countries.

2. Material and methods

There are various data collection methods available for the development of regional transportation plans and policies [24]. The unvarying data needed for the development of RTPSS, therefore; a document of "Hyderabad Master Plan 2001-2015" referredto develop RTPSS. The Master Plan is a comprehensive plan and made for the longer period [25]. After the metropolitan city of Karachi, Hyderabad is the second biggest city of Sindh province, Pakistan [26]. The city of Hyderabad is a sub-regional headquarter and a commercial hub that attracts the rural population of Sindh for many reasons like health, education and employment. The high proportion of migrants has resided in the Hyderabad city already and urbanization process is continuing with its full magnitude.

The progresses in information and communication technologies have played a radical role in the fields of engineering and planning. In America, a punch card machine was executed for conducting the population census that was created by Hermann Hollerith [27]. The important data were managed with the help of computers in the decade of '50s that were later on followed by various models. During the '60s, the data management systems were comprehensively implemented by planning authorities for their everyday functions [28]. The data and its handling tools are vital for the formulation of policy plans for the pastoral development authorities [29]. The development

authorities devise various policy plans like development plans, land use plans, action plans and sub-regional plans [30]. Many of the resources are needed in the preparation process of these plans including enormous data and itsanalysis. Therefore, a dire need was felt to develop an automated system that could take care of these data issues including storage, availability, analysis and simple recovery. In this way, the rural region's problems, including sub regional inaccessibility could be solved efficiently. Furthermore, with the successful implementation of RTPSS, it is expected that the urbanization process could be curtailed and planned growth could be injected in pastoral sub regions of the developing countries.

The RTPSS utilizes powerful and user-friendly language Visual Basics-6.0 (VB) [31] and TeraData Database [32]. VB worked at the front end while TeraData installed at the back end, and these two are interlinked through Open Database Connectivity (ODBC). The Graphic User Interface (GUI) is designed with the help of VB that can easily be operated by users in rural environments. The two-tier architecture is utilized in a system (see Fig. 2). In this architecture, clients can directly interact with TeraData server. The server also responds quickly to the client's queries and displays desired data within seconds.

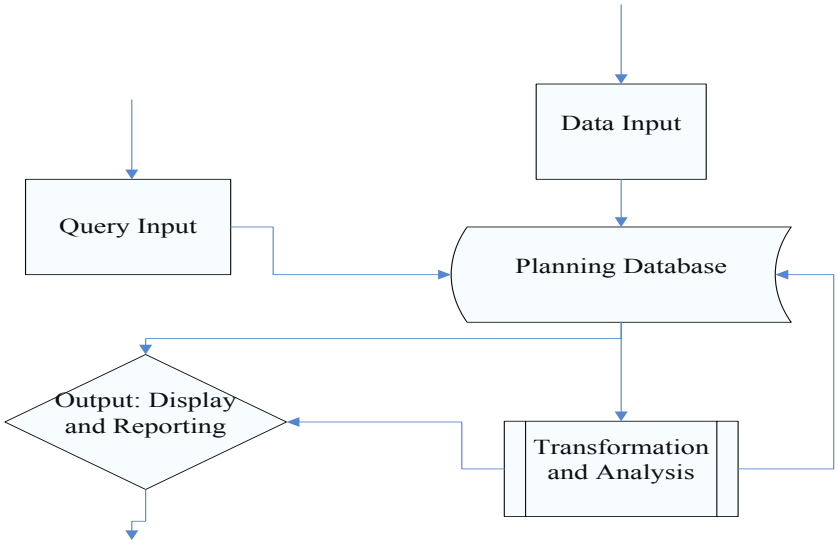

Fig. 2.RTPSS architecture

Fig. 2 reveals that data can be stored simply in the system. The automated system answers the queries and shows the data on client machines.

3. Results and discussion

The RTPSS was prepared for the rural development authorities of deprived sub regions, to store crucial data that can be easily retrieved when needed. The system was designed and developed as simple as possible that is suitable for less skilled rural employees. Initially, four types of user interfaces have been planned for the system to obey dissimilar functions (e.g. to show, append, erase and add new records) in the system. The run-time snapshot of these basic interfaces can be seen in Fig. 3 that shows data about demographic characteristics, land uses and Hyderabad Development Authority's total jurisdiction area.

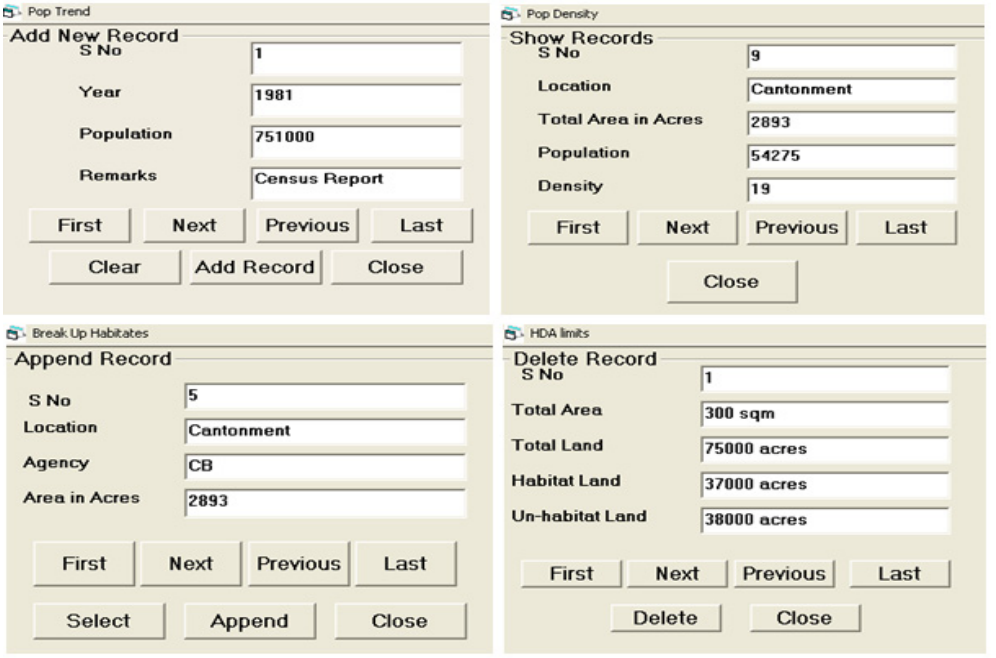

Fig. 3. Basic system interface

The detailed demographic trends of the city are shown in Fig. 4, which elaborates information about the population of Hyderabad from the years 1998 to 2018. The system in this figure has answered the user's query (e.g. "Select S no, year and population from HDA.pop_trnd"). The system responds at once to the query and the required information is prompted that is easy to interpret for policy formulation.

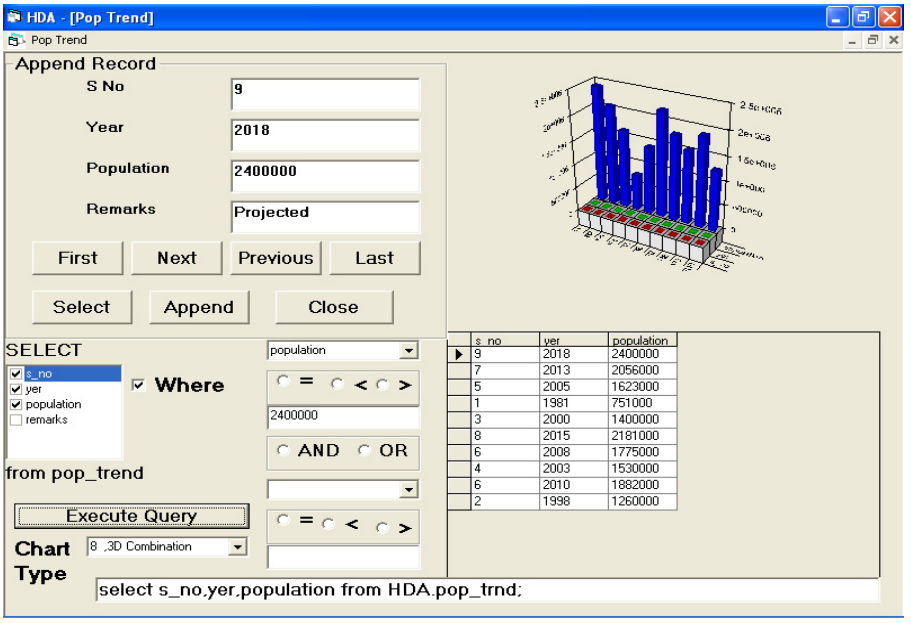

Fig. 4. Population trends

Fig. 5demonstrates population density results of the different zones existed in the Hyderabad city together with the total area and population characteristics.The client has asked about location wise demographic data that are the area, total population and density. The system answered said query and displayed information as required.

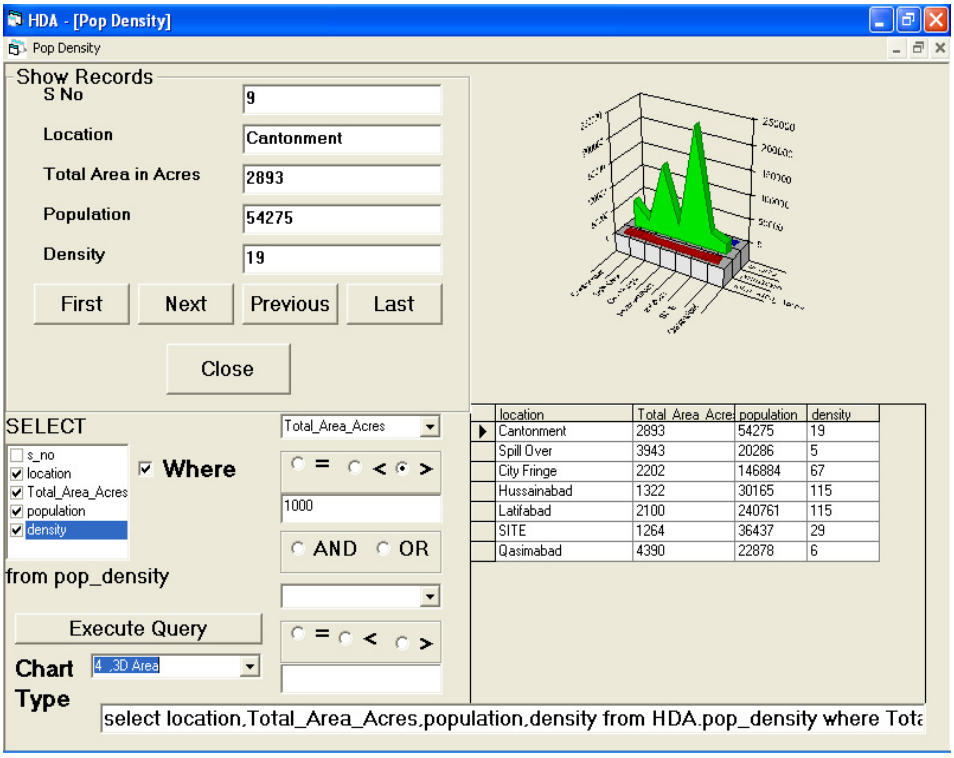

Fig. 5. Population density

Fig. 6 draws the information about different land use characteristics of the city with its total area.By viewing this figure, it is clear that (HDA 7) zone has the highest area in acres that spread over about 16,369 acres and (SITE) has the low area of about 1,264 acres.

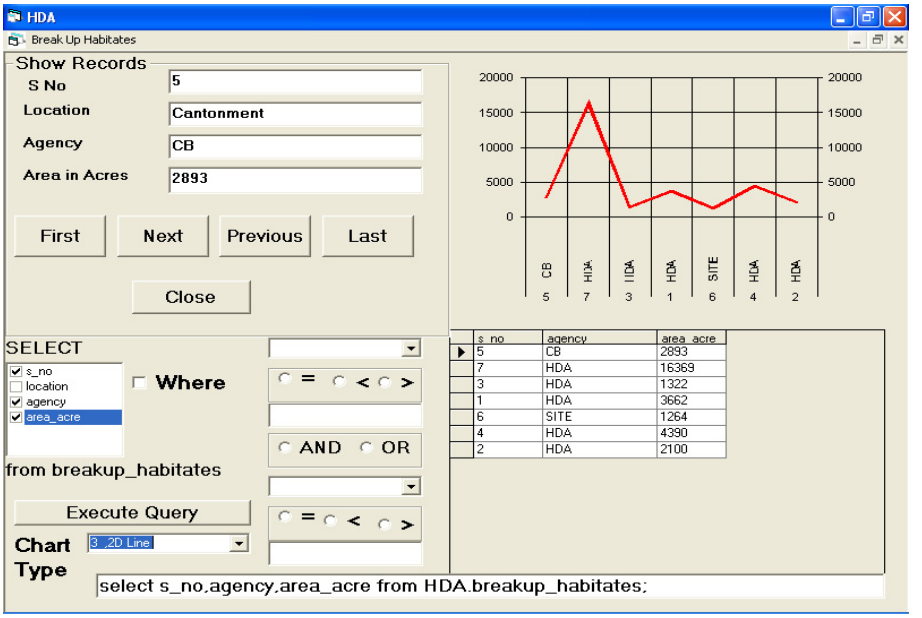

Fig. 6. Land uses

Fig. 7illustrates information about the total land area come under the control of the *Hyderabad Master Plan*. The total land includes habitat and un-habitat land. The habitat land in the master plan was 37,000 while, un-habitant land was 38,000 acres. The total area came under the authority of the master plan of Hyderabad was 300 km^2.

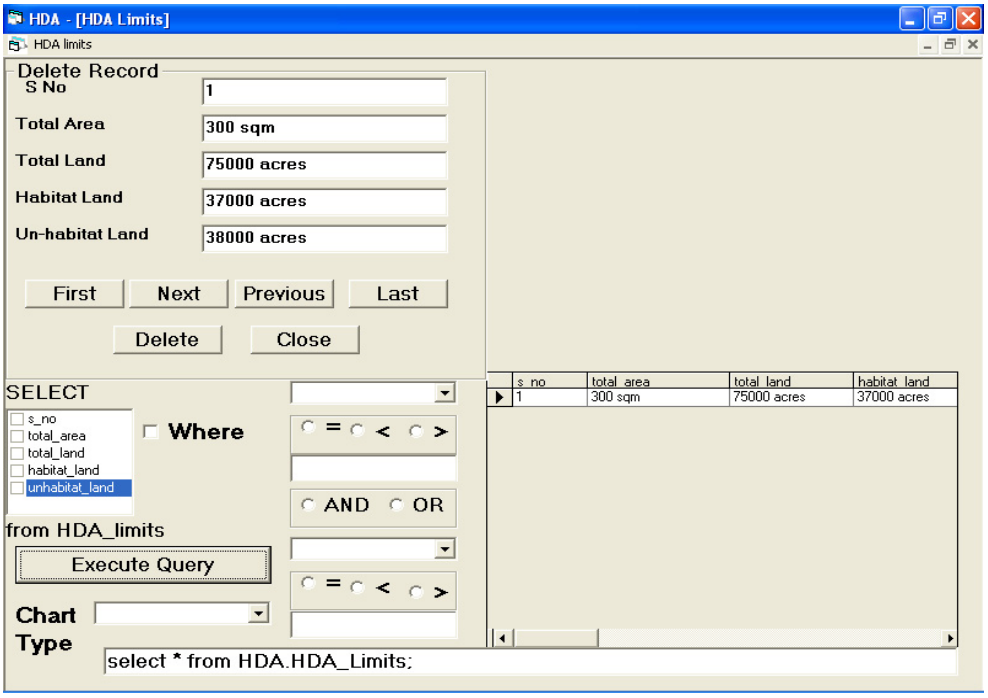

Fig. 7.Total area

This is palpable from the results that RTPSS can store anenormous amount of data and display the results simultaneously. RTPSS can be implemented in rural planning agencies, as these can maneuver this system for the planned growth and infrastructure development of rustic sub regions. With the help of RTPSS, transport and related policy proposals can be launched with the easy process of data that were dreamt before. Therefore, this would not be wrong to state that RTPSS can give breakthroughs for the planned development of pastoral sub regions.

4. Conclusion

The results corroborated the goal of this study. Transport and related plans could be developed timely with the help of RTPSS,which could prove to be a supportive tool for rural development authorities.The RTPSS can assist planning authorities in resolving data relatedissues, which can speed up the implementation and development processes of transport policies. In this way, it is concluded that rural infrastructure can be consolidated and urbanization process can be truncated from the destitute sub regions of developing countries.

Acknowledgements

The authors are truly indebted to the Department of Civil Engineering, UniversityTechnology PETRONAS Malaysia, for its support and provision of encouraging research environment. As a corresponding author, I am very much grateful to my research supervisor Dr. Madzlan Napiah for his assistance and guidance and co-authors in completion of this research article.

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