

Evaluation of Transportation Economies: A case study of Transportation sector of Sudan (1960-2013)
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المستخلص

بدأت هذه الدراسة بإبراز مفهوم قطاع النقل واقتصادياته، إذ أن ذلك يدعم منحى الدراسة لواقع قطاع النقل في السودان للفترة من 1960 الى 2013م في المسائل المتعلقة بالتحليل ووضع السياسات، حيث يعتبر قطاع النقل من القطاعات الحيوية والمهمة لعملية التنمية، إذ يربط مراكز الإنتاج بتجمعات الاستهلاك وموانئ التصدير ويساعد على تنمية المناطق التي تمر بها طرق ووسائل النقل. وقد ركزت مشكلة الدراسة على دور النقل في الاقتصاد السوداني من خلال الوقوف على مساهمته في الناتج الإجمالي، وتحريك قطاع الصادر، ونقل الركاب وموقف بنيته التحتية وذلك للفترة من 1960 والتي شهدت بداية التخطيط الفعلي الشامل (الخطة العشرية) وحتى العام 2013 والذي كان نهاية للخطة الخماسية الأولى للإستراتيجية الربع قرنيه (2008-2032). وقد كانت الأهداف العامة للدراسة التعريف بمفهوم النقل ونظرياته وجوانب العرض والطلب والتكاليف وأهمية دوره في المؤشرات الاقتصادية الكلية. ثم الوقوف على دور قطاع النقل في تحريك الاقتصاد خلال فترة الدراسة. وقد اتبعت الدراسة المنهج الإحصائي الوصفي والتحليلي في دراسة البيانات التي تم جمعها من الجهات ذات الصلة خلال فترة الدراسة. بعد تحليل المعلومات بواسطة الجداول وإجراء المقارنات، فقد أثبتت الدراسة أن مساهمة قطاع النقل في الناتج المحلي الإجمالي خلال فترة الدراسة كانت متذبذبة ولكن الاتجاه العام كان منخفضاً، وقد ظلت مساهمة السكة حديد في الناتج تسجل تدنيا مستمرا منذ الستينات والسبعينات،

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الثمانينات، التسعينات وحتى 2013م. وفي المقابل ارتفعت مساهمة النقل البري على حساب النقل بالسكة حديد. في حين وصلت مساهمة النقل المائي والجوي خلال الفترة بعد عام 2000م لأدنى مستوى. وأوضحت الدراسة أن مساهمة قطاع السكة حديد في نقل الشحنات المعدة للمصادر عبر الخطوط البحرية (خلال فترة الدراسة) تمثل نسبة (53%)، ويستحوذ النقل البري على 47% وهذا لتنامي دور النقل البري منذ فترة التسعينات، ويلاحظ أن النقل عبر الخطوط البحرية كانت نسبته الأعلى باعتبار أن حوالي ثلثي الشحنات التي ترد للمصادر عبر السكة حديد أو النقل البري تذهب عبر الخطوط البحرية، وفي المقابل فإن أساهم الخطوط الجوية في المصادر إسهام ضعيف للغاية. كما أوضحت الدراسة أن خطوط الطرق المعبدة ازدادت ولكن لم يكن فيها توازن في التوزيع الجغرافي لاسيما مناطق غرب البلاد، وركزت على مناطق دون أخرى وفي المقابل ظلت خريطة السكك الحديدية كما رسمها المستعمر، وقد شهدت خلال الحقبة الأخيرة تناقصا كبيرا في طول الخطوط العاملة، وكان ذلك خصما على البنية التحتية الداعمة للمصادر في شرق البلاد، الأمر الذي اضعف من مساهمة السكة حديد في المصادر. في الختام أوصت الدراسة بعدة توصيات لتطوير قطاع النقل في السودان شملت جانب السياسات، معالجة الازدحام في العاصمة إضافة لمعالجة مشاكل أنماط النقل المختلفة.

Abstract

The study puts on its priority the basic concepts, and t the economic side of transportation sector as this will support analysis and policy design , however, the study explored the condition of transportation sector in Sudan during the period (1960-2013), As far as it links production units, with consumption centers, & the ports of exports. In addition, the transport lines like the paved roads revive all the areas located nearby. The problem of the study concentrated on the role of transport sector on Sudanese economy; however, its share in GDP, as well as exports enhancement, passengers' transport and infrastructure studied. The study covered the period from (1960) which witness the beginning of real comprehensive planning (ten years planning 1960/1961-1970/1971), up to 2013 the end of the of first five years plan in the 25th years strategy ended in 1932(centurial strategy). The general objectives of the study are to inform about the concept of transport and its theories, beside the demand and supply sides, and to highlight its contribution upon the some macroeconomic indicators, and its performance in the Sudanese economy during the period of the study. The study adopted the descriptive statistical analysis method in studying data collected during the study period, from the related institutions. Tabular, charts, and comparison analysis used in the analysis of data. Accordingly, the study proved that the share of transport sector in the GDP had been fluctuated, but the general trend showed deterioration. The railway contribution in GDP reflects acontinuous decrease since 1960 up to 2013. On the other side, the land transport share stroke high, on the account of the railway, while the share of the Water and Air transportation, reached the minimum level after the year 2000.

The study explained that the percentage share of railway in mobilization of cargoes allocated for export by the Sudanese Sea lines about 53% since 1960 up to 2013. while the percentage share of land transport reached 47% during the last two decades. This reflects the increasing contribution of land transport since nineties.

In addition, the study explained that two third of the export shipments transported through sea, but the Air share in export is marginal. The study confirmed that the net of the paved roads extended in different states, during the period of the study, but not equally distributed specially in the western part of the country. On the other hand, the map of railway lines not change since the period of the colonial rule, but in the last decades, some lines in the eastern region are out of service, which weakened the role of railway in export through the red sea reduced.

The study approved the increasing role of land transport in transporting items or passengers, accordingly the role of other means of transportation reduced, therefore the economic role of transportation sector negatively affected.

Finally, the study raised some recommendations to promote transportation sector in Sudan, included policies, traffic jam in the capital, and the problems related to each means of transportation sector.

(A) Paper Plan

Preface:-

Transportation has become an important issue of the hour in both developed and developing countries, since transportation-industry directly affect the national economy in the general sense and on its performance in itself on the special scale, beside its effect on the type and style of people's life. This explains why voices has been raised claiming the promotion of transportation sector in both quality and quantity.

. There is no a single chance for a country to attain development in agricultural, industrial, commercial or tourism ,,,,sector without having successful transportation means, well planned to suit every sector and operated on high quality, & monitored on budget bases. All this, of course, necessitates the study of numerous spheres that

include demand on transportation analysis, beside the role of supply of transportation, its pricing, expense and marketing ...etc Man's need for transportation has been real since the dawn of history as far as, transportation directly linked to the permanent global shifting of man in quest for necessities of life.

. As time passed, there has been emergence of complications, which caused problems of transportation in rural areas, incarnated in difficulty, of transportation of inputs and raw materials. In urban areas jammed streets, traffic congestions, noise and environmental pollution, this situation necessitated the appearance of systems and means to facilitate life affairs, either socially, economically and politically. The transportation systems looked upon as the most important factors for civilian settlement in most of the world's cities in both developed and developing countries.

The problem of the study

Transport plays an important role in today's economies and societies, and it has a larger impact on growth and employment. So in considering Sudanese transport sector(Sudanese railways corporation, Land transport, Sudanese Airway, River Transport Corporation & Sudanese shipping lines), during the period (1960-2013). The main question raised to what extent transport sector participate in economic process. . However in this context other questions raised, by how much transportation accounts for gross domestic product (GDP)?, what are the percentage shares, of the means of transportation in conveyance of individuals and items (raw materials and finished products)? In addition, to what extent transport sector support export sector? Finally, what are the problems that hinder the, ecc 378 participation of transportation sector?

Study Hypothesis

1-As a result of the weak transport infrastructure, (routes & dragging power) the general trend of the transport sector contribution in GDP is not significant during the period of the study.

2- As a result of the weak transport infrastructure, (routes & dragging power) the general trend of the main means contribution in conveyance items and individuals is decreasing during the period of the study.

3-The weak & unbalance distribution of transport infrastructure, (routes & dragging power) lead to the decreasing role of transport sector in supporting export sector.

Objectives of the Study

This paper tried to achieve the following objectives:-

1-To explain, the basic concepts of transportation definitions, medium, and means.

2- To explain, the economic side, of the transportation sector and its main theories.

3- To access the real participation of Sudanese transport sector in GDP, during the period of the study.

4- To access the real participation of Sudanese transport sector in conveyance items & passengers during the period of the study.

5- To investigate the contribution of Sudanese transport sector in supporting exports.

Importance of the study

The importance of the study is related to the crucial role of the transportation sector in the process of production, from the beginning stage, (stage of raw material), to the final stage (stage of distribution). In addition transportation sector has not been considered too much by analysis and studies, so this paper tried to fill the gap in this field.

Methodology:-

The study is going to adopt the descriptive statistical and analytical method, through studying Sudanese transport sector economic role during the period (1960 - 2013.) Then the paper will discuss the results and raise the recommendation.

The span of the study:-

The study is going to cover the period from (1960-2013) to evaluate economic role of Sudanese transportation sector.

(B) Economic side of transportation sector

1-The concept of transportation:

Transportation is the process of moving objects from a place to another, and is the commercial operation of transporting goods, resources and labor force to the areas where they are more beneficial.

As Hans Adler the expert on transportation affairs for the international Bank, says, "transportation expresses the service or

the action of communicating production centers to the densely populated areas”¹ thus assuring the role of transportation in the civilized development, expansion of the market and facilitating the flow of goods and people to remotest areas. The English economist Jim Thompson defines transportation as:” An intermediary service at its utmost and a mean to attain a target without being a target in itself and the subjected target is expressed in the locations either for people or goods”

Economists’ state that production forms is not complete, unless when products are within reach of consumers. This, geographical measures, confronted by a very important fact and it is that: transportation activities or mobilization of goods, people or opinion is considered as a type of production that is takes transportation more comprehensive.

Transportation is a facilitator process, which includes necessary means and tools, which are vital for the mobilization of passengers and goods.

According to the total logistic concept, transportation means the moving of materials and equipment from importers to the project area then delivering the materials from the project location to the clients, in this point the importance of transportation as one of supply determinants. The concept of Transportation is related to the logistics side , as it is the process of transporting, activities, planning and organizing it in an ideal way to suit the convenient timing, in handling goods, resources, information and carrying people from the point of the origin to the point of arrival, employing different transportation modes (air, sea ,land or by rail).

¹Introduction to multimodal transportation planning – principles and practices- Victoria transport institute – pp 18. USA- 2011.

. In this prospect, logistics of transportation require special precautions at the loading of objects; packing, arrival & time-management in order to deliver items in the required time, and then come the co-ordination between related entities to all these stages of transportation especially when it is a multi-type nature of transportation. Therefore, it is just a process of, goods, resources, information people and energy, mobilization from the source points to the consumers or to the arrival point.

. The process of transportation in urban areas is more complicated compared with the rural areas. Cities recently considered as areas of production, consumption (dense nature of demand) as well as distribution sites so multi-modes of transportation are needed. The mobilization of people may be of the most priority, especially ³⁷⁶, through linking people with the utilities, beside the process of mobilizing commodities, and goods from resource points to the markets.

The main function of transportation is clear when it provides a connection between the house, work site and school or university beside social relations between people, or for recreation and sightseeing...etc but it proved that the biggest portion of journeys within cities are related to work. This feverish movement of people requires means and systems of transportation such as roads, buses ...etc. a variation of public transportation to facilitate this mobilization and accomplish it at its utmost perfection. Elasticity, from this point transportation considered a special industry with a special nature that affects the control of demand and supply of commodities and their cost.

This diagram shows the contribution of transportation in covering all purposes.

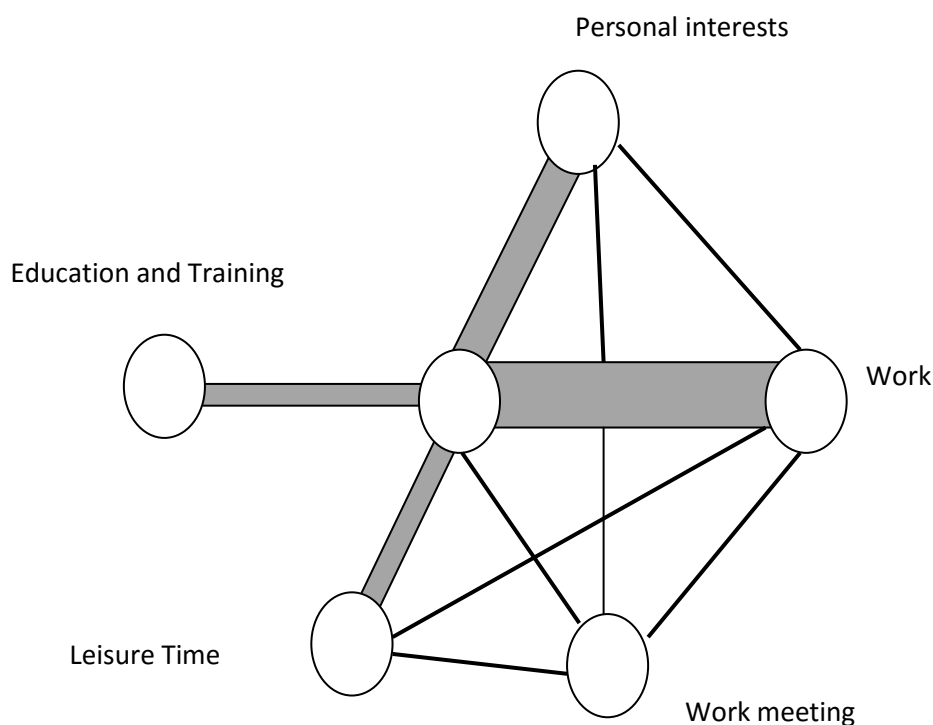


Diagram (1) Distribution of N- journeys according to different purposes

The question of transportation has been subject to variable theories mostly focusing on the starting destinations; those theories seek to attain their target through the following conditions:

- Safety: it means the safety of souls of subjects when an individual is to get to his destination unharmed. Besides

mobilization must be a factor of recreation in addition to safety.

- Interval: Transportation must consider that the convenient interval of arrival is the shortest one to link between the starting destination and terminal destination.
- Economy: transportation processes must consider low financial cost without dumping the other conditions.

Many theories tried to design the best way to use transportation to meet the economic and development needs of the societies. The behaviorist theory has focused upon the effect of transportation experiences on opinion and orientations of individuals on which bases; they decide to favor One specific means of transportation over the other. Interaction Theory focused on the factors and patterns of interaction that enable mobilization in accordance distance with the distance, amount of inhabitants and the transportation process. The Integration Theory based on the relation that triggers mobilization as an integrative one for instance, the integration between production and consumption areas. where the mathematical theory focused on the costs of transportation of inputs and output On other hand transportation theory considered the development side within the context of allocation of industrial and agricultural sites.

2- Why transportation sector need , studying, planning and analysis ?

1. Transportation resembles an indispensable portion of vertical expenditure.
2. It incarnates a great percentage of production cost.
3. It represents the greatest size of economic sectors in so many countries.

4. It considered as supportive and basic sector to other economical sectors.
5. Actively contribute to the piling of resources.
6. Contribute to the process of employment.
7. The sector of transportation with its numerous types, occupies vast areas of land allocated for roads, parking places ...etc, which increase variable costs and demand in general. The utilization of land by transportation sector for roads, airports, seaports, land ports and bridges has stirred a lot of grudge in cities and rural areas not only in the third world countries but also in most of the developed countries. The problem of transportation pricing, besides parking fees has occupied the thought of most countries.
8. The amount of gas and fuel required for transportation sector has become pro 374 specially in countries that do not produce oil beside the widespread of pollution problem resulting from gas and oil consumption, which aggravates with the increase of air, river, sea and land voyages.
. All these has motivated the world countries to sign Q2 protocol to help retrieving climate conditions by decreasing fumes and consumed gases.
9. Transportation sector has a special impact on the environment, which results in social costs that considered as vital in the study of transportation economics, since other sectors do not affect people who do not produce or consume the products of those sectors. An instance of the social costs of transportation sector are traffic accidents, problem of noise especially aero plane's roar while air fleets are increasing and the expansion in air ports is surging. Studies indicate the increase of people's awareness of the increase of social costs of transportation

with education and environmental knowledge especially on the housing sector.

10. The varied transportation means depend upon one another generally. This situation is behind the traffic jam that hinders work and wastes time.
11. Economists who are concerned about the study of transportation sector are keen about the logical analysis and marginal cost when it comes to decide to travel in accordance with time and money factor or both, people don't seem complacent in taking decisions because they may not be able to estimate the cost accurately.
12. The transportation demand is derivative demand, because it is not on transportation itself but on its services. (Example people move to go recreating or to work) that is why transportation economics related to other systems such as land use.
13. Change of location, and change of demand on transportation:- City centers are not more as important as in the previous time, because of the availability of information and communication beside the spread of transportation and traffic, anyway service business corporations are no more limited to central locations of cities for the sake of either clients or employees. Therefore, we can say the industry of locations has changed and so has the demand on them.
14. The importance of travel surveys:- Governments and private corporations perform vast surveys to highlight the affairs connected to transportation but for transportation operators local surveys might be more helpful. The local authorities, for instance, may need

to know the number of people who pass through a specific location.

15-Changes in types of Shopping:

Many stores toil to learn about people's movement to decide about their locations. On these bases, shopping centers erected all over the world. The funding of these shopping centers enabled the flow of both consumers and workers and the traffic 373 ds and consequently types of demand and shopping changes.

16- Lack of similarity, in the demand on transportation.

In varied cases, transportation service price varies not only from one type to another but also in the same type range and the same distance or journey, this can be referred to different factors such as the model.

3-The concerns of Transportation economics:-

It concerns with the quantitative determination effects of varied substitute policies and forecasting, & the possible effects of future changes on the demand of transportation.

The vitality of transportation planning has aroused along with the necessary measures due to decision-making policies and the trend to determine and analyze revenues to organize transportation projects.

The features of growth in transportation sector are huge and numerous, hence transportation is considered the most prominent industry which witness a great progress. Means of transportation has a great contribution and concrete effect on the economic development through the services it provides either by securing mobilization for individuals, from their residential sites and their work quarters or by securing availability of goods from production areas to consumption or storage areas.

On these bases, it is not exaggerating to say, "Transportation is the cornerstone of development and civilization for any country in the world". It observed the increased traffic rush and the surge in cars' ownership in both developing and industrial countries, and what has led to the increase in the trend to possess cars. It is simply the local trend towards globalization, abolition of barriers and increase of competition, Led to more demands on vehicles.

Immigration from rural areas to urban areas has lately become a common characteristic among most of the world countries, beside the family sector trend to allocate a valuable portion of its income for transportation.

The emergence of new cities in addition to the vast concern about regional development policies has the ultimate effect on the increase of new transportation services'. The increase of transportation services' intensity and its intricate feature has led to the appearance of concepts and legislations to control transportation in world countries. At the same time, they paved the way to logistics and multi-media transportations ...etc.

Not to neglect the impact of free economic policies, in the third world countries, and the opening of transportation market before competition and application of profitability, costs, and revenues principles on transportation projects.

3-1-The contribution of transportation in the economic share indicated below²

(A) Market size, productivity & industrial integration

1. Expansion of the market: Transportation system contributes to the market expansion by providing

² Omer Saliman –basics of international transportation –university publishing & distribution center- Hal wan university – pp 27-Egypt 2007

- mobilization to individuals and goods to where they can be more benefiting by combating piling of goods at one place,
2. Increase of productivity: A good transportation system facilitates mobilization of resources and elements of production then it becomes possible to utilize human and material resources in a way that increase productivity when goods and labor can transport to places where they needed.
 3. Helps industries to reside where they are convenient from the economical prospect: Where factories and commercial and agricultural projects are not restricted to a specific area but they are able to reside where raw material or water resources are available which positively affect production cost of commodities and services. In short, the availability of transportation for commercial and industrial projects helps localization of these projects in the suitable sites.

(B)Economics role of transportation on trade

An important part of the international trade process for exporters of any size is ensuring that the goods that are shipped reach their destination intact and in timely fashion. Appropriate packaging and proper documentation is essential in meeting these goals. The exporter's options for transporting goods are dictated in large measure by their final destination. Exporters who are faced with the choice of air or water modes of transport need to be cognizant of the advantages and disadvantages of those two options. While shipping by water is generally less expensive than transporting by air, the difference in cost is narrowed somewhat by ancillary costs associated with sea transport, such as the cost of transporting goods to the dock. (area for trucks to deliver cargo). Merchandise shipped over water also takes longer to reach its ultimate destination, and since some export transactions do not require the importer to pay until they are in possession of the goods,

exporters in immediate need of cash infusions will need to weigh this factor carefully.

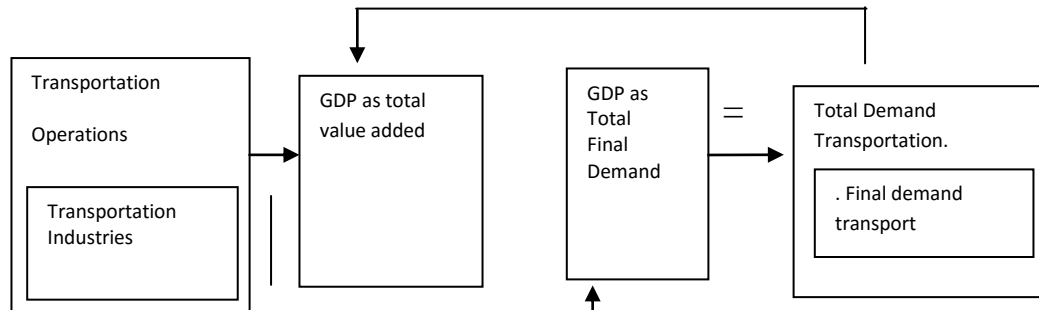
(C) Transportation and GDP

Gross domestic product (GDP) is widely accepted as the most comprehensive measure of

The size of an economy. Transportation, as a component of the economy, naturally is

Often measured against GDP. Transportation GDP counts all parts of GDP that have originated in transportation Operations.

Transportation in Relation to GDP

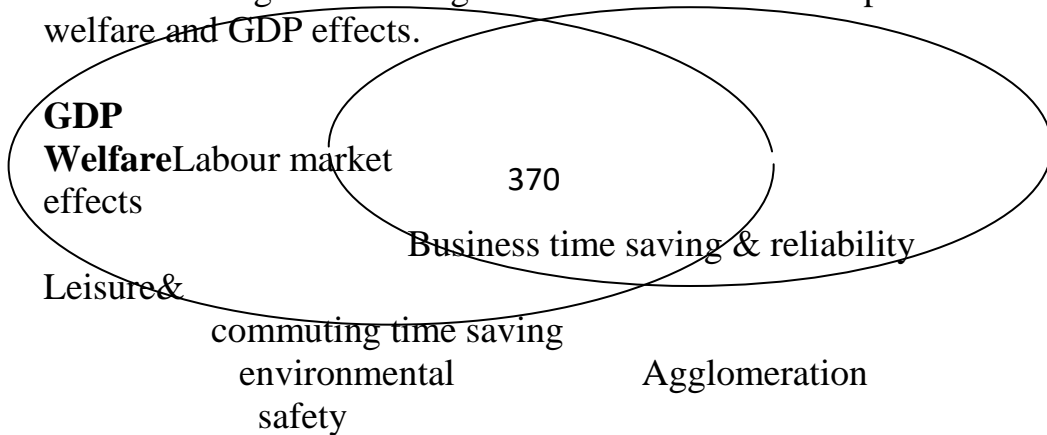


Source: the author

the size of transportation operations is not necessarily equal to that of transportation demand. Because transportation operations produce, transportation services while transportation demand includes goods like vehicles and gasoline. Similarly, transportation industries are different from transportation final demand. Second, all transportation operations contribute value added to GDP but only those in transportation industries supply to the GDP basket. This is so because transportation operations in non-transportation industries satisfy the industries' internal transportation needs. Third, all transportation demand induces

GDP creation but only transportation final demand uses goods and services out of the GDP basket.

The following Venn diagram illustrates the overlap between welfare and GDP effects.



source : The Author

If less time spend on travelling welfare gain will be higher including environmental safety and through time saving &reliability agglomeration ,increasing labors income, which contribute to increase GDP.

(C) Economic Impact of Transport Infrastructure

The transportation routes increase the level of economic activity in the counties that they pass directly through. The historical construction of infrastructure such as railroads coincided with periods of rapid economic growth in different countries. Today, it is indis0putable

That richer countries have dramatically better transportation infrastructure than

Poorer ones. But one should consider the causality of the infrastructure of each mode separately and this vary from country to other. Also the distributional effects of infrastructure should be taken into consideration.

3-2-The importance of transportation for the support of society's economic development:-

. Transportation is the most important sector in each of the developed and developing countries. Transportation planning inside cities looked upon as multi-phased question and as a part and parcel of urban planning for its close connection with architectural composite and land use, which make an important factor for journeys. The promotion of transportation sector in our recent time is one of the standards or indicators that show the degree of architectural progressiveness and development.

The progressiveness of countries measured, by the degree of transportation systems progress, according to the integrative relation between it and all the other sectors. Transportation rises to the top of the list of those sectors supporting the economic structure and becomes the pivotal post for national economy.

. Isn't expected to accomplish a balanced growth among the varied economical sectors 369 country in the world without securing the need of these sectors to transportation, which is unattainable until a good planning of transportation that is closely coordinating with the planning of the other economical sectors is prepared. Besides transportation contributes in economical development through the link of areas of production to areas of consumption and through providing traffic of individuals, raw material and goods from and to areas of investment in addition it facilitates exploitation of natural resources, which exist in remote areas. Transportation support the tourism sector is obvious too, where there is a greater share of tourism in countries where

developed transportation sectors exist with modern network of roads. Therefore, we can say tourism industry has boomed according to the rate of promotion of transportation.

The prominent role of transportation in development in any country can be sum up as follows:

- Selection of residence of industrial areas that provide the most benefit for the national economy such as lowering of production cost transportation cost and distribution cost.
- Discovery and utilization of natural resources, in the most suitable circumstances.
- Expansion, of utilized agricultural areas.
- Growth and bloom of cites and urban areas.
- Attain the balance in processes of supply and demand on commodities in the varied local and foreign markets.
- Attain economic integration and socio- cultural unification.

Transportation of passengers and goods is one of the prominent tasks of transportation in every country for the great role it plays in decreasing final product cost where transportation cost is the most effective factor. The economic studies which, has been performed, proved "transportation cost represent approximately 20% of the final cost of every product"³ and from this point the importance of the study of transportation economies, rise, which target the lowering of transportation cost and consequently lowering final product cost.

Bedside, transportation provide plenty of employment opportunities that is for the basic role human element represent, it is inevitable providing human talents in sufficient amounts to

³ Dr. Ahmed Abdelsalm Elam – Science of transportation Economics. pp 21- Dar Alwaffa for printing and publishing- Alexandria - Arabian Republic of Egypt

meet the current development requirements in transportation sectors either in quantity or quality. Which mean availability of work chance for the varied specializations needed by transportation sectors?

Transportation sectors has recently developed and greatly affect the economic development by treating the distance and remoteness factors which help expanding the market utilization of natural and human resources, increase of production, traffic of commodities and labor to where they are more beneficial and residence of projects in better economically feasible locations.

According to what has been mentioned previously, we can state that transportation stands behind every socioeconomic development that occurs in a society. However, this development is not true unless accurate scientific planning systems are applied on the bases of factual reality considering the balance between the development of transportation systems on one part and the social economic circumstances on the other. Transportation availability help nourishing the markets and connecting areas of the productivity and consequent expansion of local markets, so it brings a vital condition for economic development.

Transportation help the revival of development for the dependability of most countries. in the international trade, Transportation increases national income, beside employment and service opportunities, it is considered as one of productivity inputs where it facilitates mobilization of people between centre's of production and consumption.

In addition transportation has an effect on production functions for its obvious impact on the elements of production through decreasing of storage amount, it also affect production elements

control especially the labor element that is by moving it to areas where it can be more productive.

Transportation has its effects on individuals welfare through making commodities available and increasing the social steadfast and abilities promotion.

. In order to accomplish the developmental role of transportation it is inevitable to obtain the suitable means of transportation. the selection of suitable means, depend especially upon topographical and inhabitant's characteristics. Statistics of the areas beside consideration of the increase of economic activities in quality and quantity, in fact this last factor has raised the concern about transportation policies that transportation facilitates economic growth on both the regional and international arena, improvement of cities' environment economic growth, rural development and facilitates connection to educational and hygienic corporations ...etc.

Transportation has become. performing all these functions, of more safety, cleanliness ε 367 for all users and the ample society with its vastness. For extra analysis, we can sum-up the importance of transportation activities in the following points:-

Transportation provides vital basic services for all the society, which contribute to the progress and development of the society through obtaining numerous services such as:

1. Help in creating competition that is by moving commodities from production areas in different areas to varied areas of consumption, which increase the available substitutes for the consumer and this entire mean the creation of suitable factors of competition.

This is beside the fact that the more transportation activities increase the least prices become which provide reasonable transportation cost and stability of prices.

2. Accomplishment of mass economics in production:

This point is related to the previously mentioned one where the spread out and increase of market areas lead to increase the shares of corporations which by its turn give the chance for mass production which ends to lower cost and consequent decrease of prices of these products to manage a degree of welfare for the society.

3. Decrease of production cost: Decrease of production cost leads to lower prices as reasonable result of three factors:

- First factor: Revives competition that leads to lower and stabilize prices levels.
- The second factor: Springs from obtaining the chance to mass production and corporation attaining this mass productivity, which decreases cost and prices.
- Third factor: it results from the fact that transportation cost is part of the total cost so whenever it is possible to decrease this factor of cost the quantitative cost of products decreases which by turn lowers prices.

4. Availability of commodities produced abroad:-

Firstly:-Transportation increase the chance for commodities not locally produced which increase chances of choice degree of rational interest of individuals

Secondly:- The importance of transportation for corporations: - It starts by the imminent selection of the corporations' location passing through decision related to importing production requirements, ending with the distribution processes in markets as follows:

1. Transportation cost considered a vital factor to decision making toward the location of the corporation and importing of production requirements.

2. Cost of transportation activity also relates to energy and scheduling.
3. Decision of products pricing linked, with cost accounts (example: transport), which affect product's prices.
4. Finally, the decision about products sales points' location is usually made based on availability of transportation.

The vitality of transportation in general, refers to its task of adding timely and place benefits to the value of the commodity, where the speed to move products from a point to another is counted on the quality of this function (Transportation). It is also true to say that no economical function will come into being without the availability of transportation.

Being the means of mobilization, transportation acquired its importance in ancient times when it developed through the passage of time from travel by animals, then carts driven by animals to ships, trains and automobiles reaching modern traffic means such as airplanes, rockets and sub-marines.

The increase in inhabitants adds to the importance of transportation beside the increase in residence area, which has necessitated an increase in transportation to make it possible to connect people with varied activities and services. Researches have proved that improvement in transportation has optimistic outcomes that include utilization of time, and time control through :-

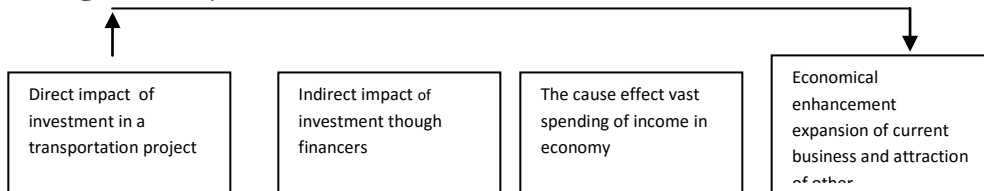
- The construction of new roads, and orbits in the crowded areas.
- Shifting from private traffic, decrease traffic jam and consequently decrease exhaust of time.
- Decrease of time cost through:
 - Decrease of fuel, maintenance and waiting cost.

- Decrease of ownership expenses such as insurance and licensing.

All these requirements promotes purchasing level of consumers, expands business and shopping. Investment in transportation has varied economic effects such as:

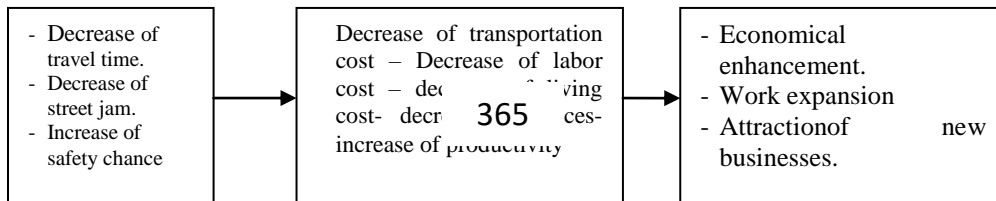
(1) Maximizes economic enhancement:

Diagram (A)



Source: The author - Transportation economics – Aneelain university press-2013

Diagram (B)



Source: The author –Transportation economics – Aneelain university press-2013

According to study performed by the American public transportation association in the year 1984 about the impact of investment in transportation on labor and business (Investment in public transportation clearly supports the creation of employment and the increase of business income on both the local and national arenas and leads to economic benefits).

(2) Investment in transportation affects economy in the following directions:-

1. New investment chances (such as spending on land ownership, architectural foundations or whatever to do with these activities such as traffic navies and the like ...etc.)
2. Modernization cost such as spending on the validity and rehabilitation for all the system composite due expiry date.
3. Investment of expansion to increase service expansion such as the economical benefits resulting from investment in transportation traffic organizing which include the environment, energy and expenditure.

The impact of investment on transportation is varied from an area to another in accordance with the variation in the economical structure among areas (The most benefited areas are those which own vehicles and factories much more than those who tend to import them) The variation of impact according to areas indicates:

1. Degree of economic dependability among areas and how areas benefit by transportation service and investment, which mean: How does transportation investment in an area affect the other areas?
2. The impact of the area of investment has national indications: The change in Transportation and travel means has its economic impact through the period elapsed in traffic lines, which affect fuel cost, and this by turn has its values on economy and improvement of transportation on the social and personal approach.

The above diagram shows the decrease of costs of products of competitive quality in the long term.

The following example explains the effect of transportation in the decrease of production cost and increase of income:-

Both areas (1) and (2) produces (A) and (B) products and production cost comes as follows:-

Production program chart before the foundation of the road:

Area (1)	Production cost	Area (2)	Production cost
Product(A)	40 \$ for a board	Product (A)	60\$ per unit
Product (B)	60 \$ per unit	Product (B)	40 \$ unit
Total	100 \$	Total	100 \$

Source: Dr. Abdelrahim Ahmed Ibrahim- Transportation Economics in Sudan – pp-41 Dar Azza for publishing 2004.

If transportation cost of one unit is equal (5) dollars, and each area has a unit from (A) and (B) which ,worth 85\$ compared to the 100 \$ stated on the chart ,before the foundation of the road ,consequently each area has 15 \$ to go to the saving account which enable them to purchase additional requirements which help promoting living standard.

See the following chart:

A chart indicates the consumption in the two areas (1) and (2):

Area (1)	Values \$	Area (2)	Values \$
A unit from (A)	40\$	A unit from (A)	40 +5 = 45 \$
A unit from (B)	40 +5 = 45\$	A unit from (B)	40 +5 = 40\$
Total consumption cost	85\$	Total consumption cost	40 +5 = 85\$

Source: Dr. Abdelrahim Ahmed Ibrahim- Transportation Economics in Sudan – pp 42Dar Azza for publishing, 2004.

4- Transportation cost

4-1-Types and groups of costs

Transport costs can be stated in the following groups as follows:-

1) Transportation employers' cost (owner of the means):-

It includes -**fixed costs** such as: - (Vehicle's license + vehicle's registration fees + total and compulsory insurance + warehousing and loading and unloading ...etc. -**Variable costs** in this group include- (Workers and operator's right + fuel, lubricants, maintenance, spare parts and journey time value). Also **cost of general services** related to transportation: (Expenses of roads structure +bridges+stations+air ports +railway lines.... . etc). Accordingly on the analysis side, the (average fixed and variable, and marginal costs are considered.

2) Social cost: -

A cost of this group includes-

(Air pollution by gas and fumes emitted by vehicles +noise resulting from the roar of vehicles)

Social cost composite is viewed through:

1/**Cost of stations:** it includes handling and all the process related to the preparation of the cargo for the journey through out the regular loading of cargo on the vehicle.

2/**Regular routes cost:** it is the cost of travel of the cargo from the origin to the terminal destination (vehicle operation cost from the source point to terminal 363 ng of the vehicle valid for operation+ expenses related to roads' structure and maintenance..... etc)

3/**storage cost:** cargoes during travel are idle working capital while they draw additional expenses these expenses differ on the

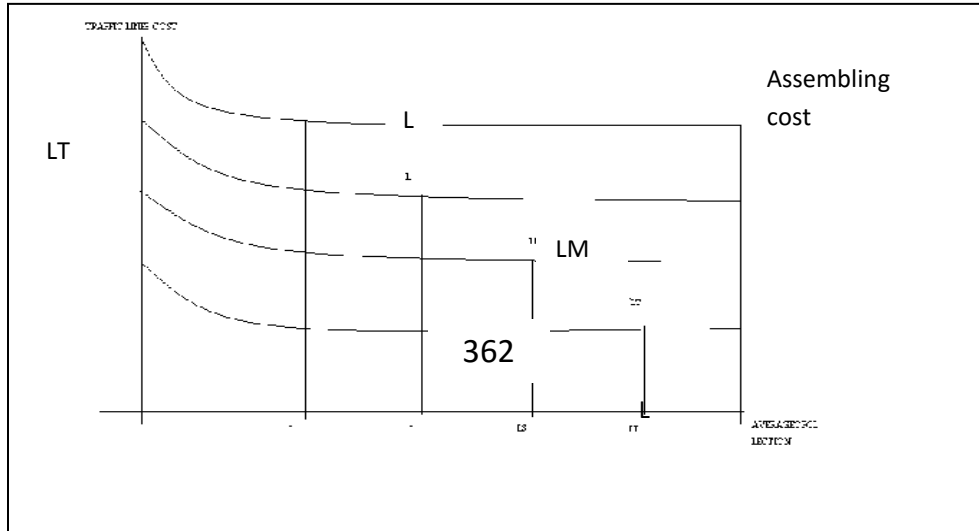
bases of the transportation type and nature of transported items beside the sizable damage expected to take place, this make the variety in cost. The studies performed by the American public transportation office proved that" railway stations are more expensive compared with the cost"⁴. On the other hand,direct travel lines in railway service are cheaper than trucks especially in case of long journeys. For storage, cost trucks enjoy the advantage of assigning cost compared with railways and since storage is a form of the working capital, so keeping it adds to the expense.

4-2-The type of cost that affects the supply of transportation services:-

1/traffic lines operation costs:- Travel contractor can lower regular lines' cost and then delivery cost. in transient travel ,cost is counted on the bases of paid travel of load, this mean the increase of collected average loads increase the total loads which travel fare is already paid, this by turn lowers the cost of regular traffic lines at the increase of collection processes until it reach the ideal average paid loads

⁴ -Introduction to multimodal transportation planning – Ibid-USA- pp 31- 2011.

-A diagram explains costs and upheaval collection of cargoes:-



Traffic lines cost consequently lowers until it get to the ideal level at (L T)

For the final consumer's cost, the higher the collection rate as with lines cost average loads, the lower the number of deliveries to the consumer. The repetition of deliveries over long in time lead to raise the storage cost which affect consumer price, in addition to the increase of time cost resulting from the increase of collection along with the average load increase. By this, the ideal commodities' final delivery, at the collection rate that is in harmony with loading, becomes at (L s) in the above diagram.

2-Costs related to the type of commodities:-

Cost differs on the bases of cargoes type, vegetables, for instance, easily rot, therefore its cost differs from that of coal travel for this reason decisions related to transportation should consider the nature of the commodity of object.

3- Long and short term cost:

The time factor affect cost, in the long-term cost changes, and all costs become variable.

In the field of transportation cost accounts of transportation means, long-term marginal costs are costs of the suitable transporter and long term marginal costs identify the qualities of the varied transporters in performing a specific assignment of a cargo travel.

Therefore, transportation services supply is determined on the bases of long-term marginal costs, and not on the book value cost. Whenthere is difficulty in calculating costs, away from value books for the variation in t 361 rvicees along with the costs related to each, so these **costs can taken individually on the bases of the travel medium.**

1-Watertravel: -itis difficult to set a generalized view about water travel cost since there are numerous water travel types and there are differences between water and land travel or travel among coasts as well. Terminal destination cost differs according to the location of the watercourse related to the resource point. if the resource point is land, there comes cost of travel to the destination(station costs) besides costs of handling and storage ,and this is not the end because cost of destination travel depend upon the type of the commodity. Some stations are equipped to handle just a specific type of commodity and others equipped with automatic lifts to deal with different types , so costs differs according to :-

1/the sizes being handled.

2/the amount of automatic apparatus used in the handling process.

Generally, the more automatic handling is used the lower becomes costs of stations (labor, fines, delay) all this refers to the speed of loading, handling and reloading processes. For direct travel lines' cost (taw ally), it differs on the bases of speed,

characteristics of employed navy and water passage (distance, width, depth and the dragging power....).

2- Sea travel costs:- sea travel is important and it is complementary to railway and other land travel, it contributes in transportation of exports and imports of varied commodities. Numerous factors affect costs of international sea travel such as:-

A/ The distance: -

Recently, an intention to increase commercial cargo travel cost on the bases of increased distance between source and terminal points, has prevailed.

B/ The insurance factor:- the cost per-unit weight tends to rise in exports of countries where high additional value tax is applicable because of the insurance composite in its travel cost.

C/products with exceptional qualities:-some products need validity protection measures such as cooling (cooled commodities have doubled cost compared to others for the same distance)⁵.

D/lack of equilibrium on the two sides of navigation line: -

The difference in orientations of international trade and variation in the size of travel between exports and imports, this leads to the return of some cargo ships while they are empty in regular navigation routes, which raise travel average cost and one side of the trade process, (export or import) becomes of more cost and less profit.

E/The principle of revenues against the size of travel vessel:-

The transport of a container (20 feet) of size on board a ship of 200 container of capacity 360 is expensive, than transport it

⁵Dr. Sad Alden Ashmawie– Organization and management of transportation- pp 39 -Einshams library – 44Alqusr Elaine – Cairo 1975.

on board a ship of 100 container of capacity for the same distance.

F/Technology:-

The use of containers in sea travel led to the decrease of handling costs, and the increase in transient travel.

G/**Monopoly:-** leads to the increase of the sea travel cost, like the commercial policies of some countries such as the detainment of some goods, along with some restrictions in seaports.

3-railways travel costs:-

The costs related to railways transport varies according to the type of equipment in use and the traveled cargo, any way, costs can lowered ,when it is possible to transfer enormous cargoes (economically sized cargoes). In addition, the specification of cargo trains facilitates processes of loading and travel beside operational cost, consequently, labor cost lowers. The outstanding example for this measure in Sudan is the specified trailers for Sega Flour Company.

4-Travel cost through pipelines:

It is of remarkably low cost with the size of pipes and increase of traveled liquids (crude petrol and its products has bountiful weight and occupies vast area this makes it relatively expensive to travel by land and railway lines)⁶.

4-3-The impact of transportation costs on decisions:

(A) Travel route:-The availability of travel is beneficial to reach the resources of raw material on one hand ,and the final consumer on the other ,where travel costs are supposed to be in linear relation with the distance :-

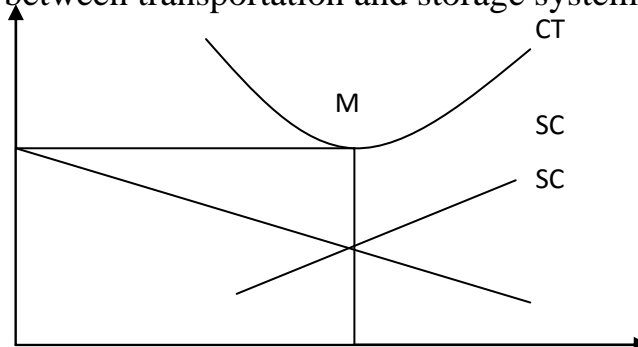
⁶Dr. Osman Ibrahim Essayed- Sudan Economy (Applied study)-pp -31- Sudan Open University publishes- 2006.

Example (2): If the composite of a raw material to produce a final product (x), located in point (A) , and the final product will be market at point (B). Given the transportation cost between (A) and (B) ,is 50 pounds per-ton. Assuming the existence of a middling point between (A) and (B) ,named (C) ,in addition the transportation cost from(A) to (C) is 30 pounds ,and another 30 pounds from (C) to (B)per-ton. given the fact that, there will be no loss of weight in the process of transporting, from (A) to (C) and from (C) to (B) which denotes equal production cost to the journey from (A) to (B). Point (C) will not be chosen for the increase cost $(A \rightarrow c + c \rightarrow B) = 60$ pounds per ton while the direct journey from (A) to (B) cost just 50 pound 359 n. But (C) can be preferred over (B) if (A) location point is impractical for technical reasons.

(A) ___ 30 pounds ___ (C) ___ 30 p ___(B) (A)___ 50 p ___B
 Companies usually tend to choose locations away from each other to avoid redoubling transportation cost + production cost in addition, markets are geographically spread out so each company get specialized in a specific marketing area.

(B)The Targeted Market:

Transportation costs affect the selection of targeted marketing area where it directly affects sales and geographical distribution prices, whichconsequently affect total sales. The transportation technology, information systems, and the infrastructures of transportation, all create a relation between transportation cost and ware houses operation cost. A diagram denotes to the mutual relationship between transportation and storage system



Ware houses operation cost tends to the relative rise relatively to the increase in warehouses number. (Curve Sc). Transportation cost tends to decrease relatively to the increase in warehouses number as denoted by the falling curve (TC) despite the equal quantity of goods. This exchanged relation between transportation cost and storage cost (TC and Sc) oblige the company to decide any better available choice and the ideal number of ware houses is determined through the measurement of the impact of both substitute choices on total operation cost where the ideal situations are attained:-

- 1) Equilibrium of storage cost 358 ansportation cost (crossing of TC with SC).
- 2) Total cost must be at its lowest limit (M).
- 3) Operation cost must be the ideal as expressed by the line linking between the lowers total cost point (M) and the vertical pivot before a consumer can take a decision to purchase a commodity he should investigate about its real cost and it's utility. Before buying a vehicle, for instance he should have a deep opinion about its cost, maintenance cost, insurance cost and its fuel cost. Also true, when one decides to travel and decision of planning, those decisions and varied benefits and cost must be analyzed for varied transportation types.

Consider below table:-

Transportation groups- classification chart (A)

The cost	The description
Vehicle ownership	Fixed cost of vehicle ownership
Vehicle operation	Variable cost (fuel – lubricant – très...etc
Exchanged support	Financial support to

	public traffic service
Journey time	The agreed time value
Collision of internal effect	Collision cost assumed by passengers
Collision of external effect	Cost of collision assumed by others
Waiting	Parking service or road side
Crowdies	Fees on crowdies imposed on street users
Land value	Money value paid for street usage
Air pollution	Cost of rising fumes and pollutions
Noise	Cost of noisy sounds
Water pollution	Cost of water –polluting leakage
Vehicles waste resource – (The researcher)	Cost of vehicles waste

Source:Dr Ayoub Taha SidAhmed –transportation Economics – Alneelain university-pp87 -2013

5-Social costs

A cost of this group includes:- (Air pollution by gas and fumes emitted by vehicles +noise resulting from the roar of vehicles). Also for more analysis consider the below table Classification chart of some patterns of transportation cost as (internal or external – (fixed or variable)

(The owner assumes Internal) (The others assume External)
Table (B)

Cost	Internal/external	Variable/Fixed
1. Vehicle ownership	Internal	Fixed
2. Vehicle operation	Internal	Variable
3. Offered support	Internal	Fixed
4. journey time (period)	Internal	Variable
5. Internal collision	Internal	Variable
6. External collision	External	Variable
7. Waiting	Internal	Fixed
8. Overcrowd	External	Variable
9. Street land value	External	Fixed
10. Air pollution	External	Variable
11. Noise	External	Variable
12. Water pollution	External	Variable
13. Transportation – means waste	External	Variable

Source: Dr Ayoub Taha SidAhmed –transportation Economics – Alneelain university-pp86 -2013

Consequently, when detailed studies about transportation cost are prepared the following, identified:

- 1) Average cost of the vehicle and base of the type of previous cost at the distance gone by the vehicle.
- 2) Costs can be divided according to the types of vehicles on land roads, which make economic analysis for transportation planning applicable in varied approaches:-
 1. Analysis of transportation policies &state the strategic objectives, withthe consideration to indirect impact at theend.
 2. Reasonable pricing of transportation services, which expresses the total cost.
 3. Impacts of Investment transportationpolicies.
 4. The analysis rendered by demand control by focusing on all the impacts at the evaluation of strategies that
 5. reduce vehicle journeys ,and that encourage other types of transportation.

4-4 -Transportation pricing decisions:-

(The transportation pricing decisions include different theories fro example **Cost of load capacity theory**, This theory focuses, upon identifying fixed costs, and the cost distributed among the total load , in order to reach the per unit cost of each transported unit.

The ability of load, to pay theory:-

This theory expresses the care for that pays more, which also mean little care given to those who pay less. In transportation industry cost system must be related to pricing system , because transportation tariffs varies according to the conditions of operation cost for each journey, loading energy of transportation means to and fro and whether operation is of seasonal or annual type. examples of pricing policy include unified tariff ,according to phases ,groups ,organized journeys ,or organized journeys.

5- Demand on Transportation:-

5-1-Features of the demand on transportation:-

1. Demand on transportation is looked upon as derivative (transportation not demanded for itself but for its services) contrary to the demand on other commodities and services. Also demand on products is responsible for the increase in demand on transportation facilities)
2. Demand on transportation fluctuates throughout the times of the same day, as much as when it increase at certain intervals such as weekends and other public occasions (Eids)
3. Demand on transportation is known to be seasonal, increases at certain seasons of vacation or harvest of crops in agricultural areas.
4. Besides, time factor has a greater effect on demand, where it increases for recreation against less work journey at other times.
5. As demand on transportation is limited to certain times and places, it can't be delayed or postponed.
6. Transportation in some area is featured by a non – balance and this feature is referred to passengers destinations or direction of commodities market place or services and range of distribution of populated production and consumption areas.
7. Location of terminal and starting point of destination has ample effect upon the size and pattern of demand on transportation.

5-2- Classification of demand on transportation services:

1. The demand on a specific means of transportation is defined according to the chosen medium of transportation, which enables us for instance, to say demand on land

transportation services, or sea or air transportation then the type of medium is specified.

2. Consigner demand: stands for the person who perform the loading operation or who make available the transportation service.
3. The group demand on transportation service means the total demand of individuals in the specific area.
4. The aggregate demand on transportation service means the total collective demand in the specific country.
5. The determined demand of a specific product on transportation service: That is when a specific area, imports a product from another area.

5-3- Demand determinants on transportation services:-

1-price of transport service:-

The monetary paid cost in fees and effort of transportation is the most sensitive composite for demanders and users of transportation. The limited Fluctuations in price level, always, have a specific impact on the demand on travel and transportation services, but not in an absolute way. As the demand on cargo-services is inelastic. Because, there are no substitutes close to cargo-service, besides, the feeble (weak) impact of cargo-service tariff on the final sales prices of cargoes.

There is a strong probability that changes in demand occur among the varied transportation means as a result to the change in tariff structure imposed by one of them in a way that exceed the tolerance of its demand.

The vision to raise transportation service prices at peak times has become valuable, but in fact, it is not commonly, that effective factor on roads price policies, in some cities fees, are collected against crowd. Transportation economists prescribed those fees to be, imposed on the bases of social marginal cost of

crowd and pollution, according to the principle of scarce resource utilization (vacant areas of streets). Price plays a role in enforcing market efficiency under the umbrella of an ideal pricing strategy. Pricing policies vary in accordance with the aims and objectives of policies in transportation.

. Private institutions, which perform transportation service, have a sole objective of raising profits, which depend upon the rate of competition.

However, in monopoly market, the monopoly importer enjoys the choice of prices and the amount of service he put in supply. In the state of expansion witnessed by transportation market, the objective of the importer becomes rising of sales revenues, not profits.

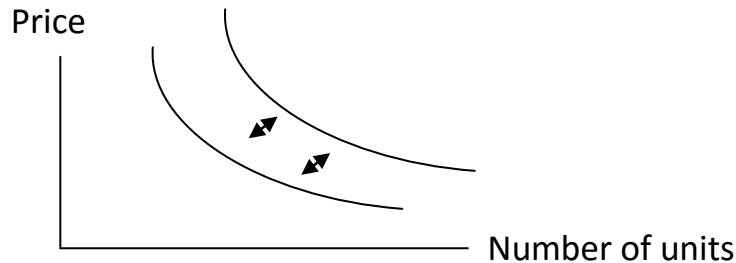
2-The impact of income on transportation services:

Families, always, allocate a portion of their budget for transportation, so demand on transportation increase in accordance with the increase of income but this relation differs on the bases of short and long period.

3-The impact of tastes on the demand on transportations:

Variation in tastes affect demand function on transportation but not all tastes are matching with the process of decision taking, where other factors interfere, such as, increase in wealth and free time to rotate tastes toward private transportation sector, which provides flexibility and the feeling of freedom.

The demand function on transportation is a complex function in a number of elements. To study each element on its own we must secure the other element from change. This approach cause the demand curve to move up or down ward as displayed in the diagram below:



4-The competition of means of transportation, demographic and socio economic changes has direct effect on the demand of transportation services.

5-3-Factors that affect transportation price sensitivity:

The factors below denote the rate of change in prices and its impact on transportation behavior:

- 1) Purchase prices of vehicles, registration and license fees:
Affect the type of vehicles purchased.
- 2) Prices of fuel affect the 354 vehicles used.
- 3) Fees on roads change the direction of some journeys.
- 4) Pricing of crowd (Time exhausted at crowd times) affect time of journeys and their amount.

5-4-transportation demand studies models

These models are based on equations that foretell the quantities and types of voyages demanded by people in a specific time, and state beside the impact of transportation system on the delivery of these voyages. the study of all these help to foretell about demand which has been mentioned before in most urban areas, four steps based patterns are used to foretell the size of traffic, crowd, pollution and the like.

The first step : The study of journey's starting point to tell for the number of journeys those can be performed in accordance with factors such as: the Number of residents, availability of work

chances, demographic factors, the state of transportation system (capacity of streets, types of traffic service, prices and the like)

The second step: -The Distribution of journeys among areas on the bases of distance.

The third step: The share of each type of transportation, it means allocation of journeys among the types of transportation (walking, transportation by bicycles, cars...etc)

The forth step Allocation of journeys in accordance with available passage points.

Despite the importance of all these models, but they are limited to certain problems and consequently give, limited solutions and they may not be sensitive to other factors such as public transportation and land use, pricing and so on. So such models seem extravagant in estimating the benefit of roads expansion, belittling benefits of walking on foot, bicycles or public transportation services...etc. Accordingly other models showed up in which the variability of transportation types is regarded beside their integrity, so it becomes more effective in evaluating types of transportation, their impact and factors that affect them.

1-Economic models: Depends upon the determination of demand and supply of each area and fulfillment of demand without neglecting supply. one of the most common applied is the liner programming.

2-Timeseries method: - which used to study data collected for longer periods

3-Demand size estimation method:- which used when studying passenger transportation, for instance, so many variables show up such as population rate of growth, personal income rate of increase, size of employment and size of investment in

transportation sector all these elements are to be put in consideration.

5-5- The other models to study demand on transportation:

- 1) Analysis of the size transported items per kilometer in accordance with the type of transportation.
- 2) Analysis of the contribution of each transportation means in the traffic of passengers and inventory.

Demand on transportation service at peak hours, in most cities, at the beginning of the day and end, which lead to traffic jam that delay passengers from getting to their destinations. There are numerous ways to treat these problems.

- 1) Imposing higher ticket fees at peak hours.
- 2) Priority is for the far away, destinations passengers.
- 3) Design a system to control traffic at peak hours...etc

5-6- Demand on passengers' Transportation service and elasticity of demand on transportation service:

In general, demand on transportation for business not expected to be elastic compared to demand on social voyages this refers to the non-existence of substitutes that mean the decrease in price does not result in a remarkable increase in demand. Nevertheless, the contrary is true for passengers, when a decrease in tickets prices results in an increase in number of passengers and range of voyages for users of buses. However, the impact on those, who are not regular users of buses, takes a time. In the long run the impact of decrease of prices may include the area of residence or work, because elasticity effects clearly on the long run not in the short. To analysis perspective demand on transportation, time series are used for specific data such travelers' movement and transportation means as well as numeric and geometric growth in transportation sector.

5-6-1 price elasticity of demand on transportation service:

Most studies denote a very low elasticity of demand on transportation in cities, which means a low sensitivity of demand on transportation for the reason of fluctuations in prices. To study demand in more accuracy, we have to consider four groups of factors:-

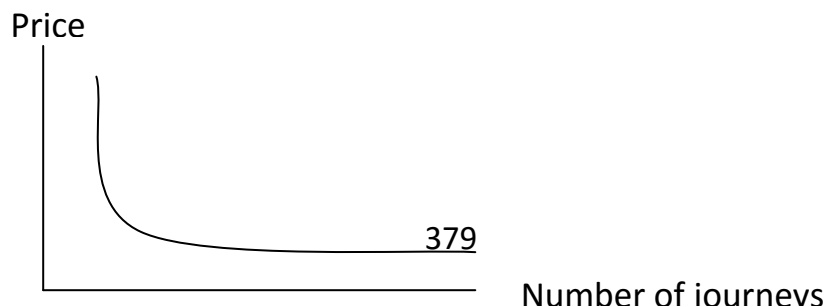
The first group: (The purpose of travel): To be in more précis we have to define between aims of travel, elasticity is bigger and demand greater in sensitivity toward fluctuations of prices when the aim of travel is business.

The second group: (Type of payment): Users of the vast types of transportations and the users of different services of the same types of transportation pay in cash or in credit cards, studies find out sensitivity of demand is bigger in case of cash payment and smaller in case of credit card payment.

The third group: (Period of Time): Increase in cost of daily travel to work in small cities result in a feeble effect, but in the long run it may lead to a change in the period of residence or work itself which greatly affect demand on transportation.

The fourth group: (range of travel)

The Studies proved that, elasticity of demand increase in relation with the distance range of the journey. However, this conditionally weight amount to change price. The purpose of journey decided the amount of demand on it, important journeys demanded regardless to their prices, and unimportant journeys demanded when price and time are reasonable and luxury is available. The diagram below explains demand curve on transportation (The range of price impact on numbers of journeys.



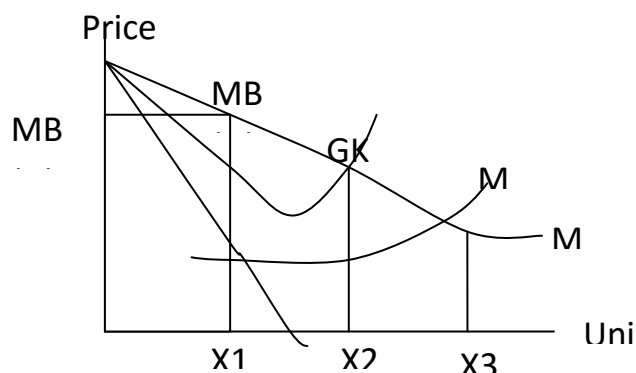
We notice that the curve has a long tail, this mean when prices (Monetary, period of journey, hard ship, risk cost) are less, seekers of service increase. Price elasticity of demand is affected by, the type of marketing, when it is retail market, or vice verse. To high light elasticity of demand on transportation, the chart below denotes the common price of the journey by car, bus or train, the price include (The ticket + the time cost-price estimated) that is because number of travels are affected by total cost.

Price demand elasticity and transportation type

general price level			Demand Response/ price
(Train)	(Bus)	Car	
0. 057	0. 09	0. 3-	Demand on cars
0. 13	0. 64-	0. 17	Demand on bus
0. 50-	0. 20	0. 056	Demand on trains

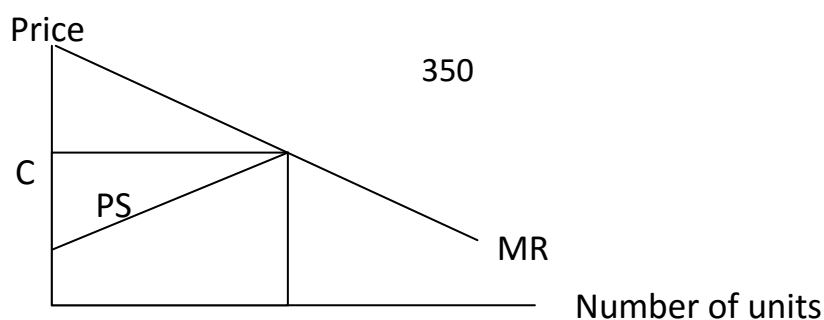
Source:Dr Ayoub Taha SidAhmed –transportation Economics – Alneelain university-pp- 114 -2013

It is noticed in the above chart, that price elasticity is denoted in the upper right column of the chart to the lower left side(leaning distance)and it has a minus signs, this means, when the price elasticity of car (0. 3-) this 351 ncrease of general price by %10, the demand on this type or transportation decreases by %3. But for cross elasticity, it is denoted outside, the previously mentioned column, and it takes positive signs this mean that all the choices in the chart are considered substitutes to each other.



The cross elasticity of the bus fare, by the demand of travel by a car, as denoted, equals (0.09). This mean, when the general price of travel by bus increase by %10, the demand on car travel increase by %9 and by this, transportation market become prevailed by natural monopoly, it is a type of monopoly decided by the type of transportation that is featured with a intensive capital which hinders the access of commercial institutions. We have to study the following diagram, to acknowledge the attitude of public companies in the market, we find that, marginal costs lie under average costs (line Mk lies under line Gk). Consequently, the highest profit is reached, solely at (X1) whenever marginal revenues equal marginal cost, however, this level is not favored by public companies because it raises prices and lowers production and social well fare. Therefore it is better, to promote production to (X 3) at the point when marginal revenues equals marginal costs, this mean the marginal revenue becomes under total revenue and the public companies lose. Which is inconvenient for commercial companies to remain in the market, beside the public companies which find government support to serve the society services

One of the additional solutions is to give permission to public companies to apply (price discrimination) policy ,. This policy mean the beneficiaries of transportation service (passengers), final varied prices for the same types of transportation, in trains, for instance, they find the first class, second class... so on i. e. each class has its own tariff and this enables the monopolist of the service to find opportunity to increase his profits.



In the upper curve the price customer can afford is (c) and the triangle (PS) represents the producer surplus that accomplishes welfare. However, we must identify customers who would not pay which necessitate classify them by social status and age etc, where adults pay more than youngsters' age. Businesspersons pay more than students do.

5-6-2-Elasticity of demand and its relation with type of journey and passengers:

1. Business journeys are less respond to change in price than individual journeys.
2. Daily, back and forth journeys for work are less elastic to price change than shopping and recreation journeys.

3. Passengers of high incomes are of less impact and sensitivity to price than those of low income.
4. Journey inside city at peak hours have less price elasticity because crowd lines does not encourage journeys of less outcome.

5-6-3-Elasticity of demand and it's relation with other types of travel means and infra structure

Price increase and highly responding to:-

1. Promotion of quality and types of transportation means.
2. Range of Availability of substitute means of transportation.
3. Price of high ways fees are more respondent and sensitive when other roads' service fees are found.

It is possible to use varied standards to measure elasticity such as (period and type of journey/operation cost a tariff/type of available transportation service ...so on)

5-6-4-Range and level of pricing and it is relation to elasticity:

Demand on transportation is, typically, more elastic for the availability of substitutes and choices. Demand on travel by car on a specific road at peak hours is more elastic than the total transportation of individuals.

5-6-5- Services and their impact upon demand of transportation service:-

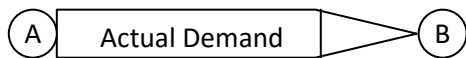
A- Education services: The of Demand of Education is variable, the financial support³⁴⁹ cation the less becomes fees, besides the decisions taken by governments concerning the age group admitted to education on the bases of population census, which by turn affect the age group admitted to university. Such polices, collectively, affect prospective demand on education type that necessitate travel.

B- Health care services: - Demand on health care lead to the increase of traffic. In addition, increases of patients who do not possess vehicles leads to specific complications, especially new hospitals are not always in city centers. Besides problematic situations arise when hospitals impose parking fees or when local, authorities increase transportation fees.

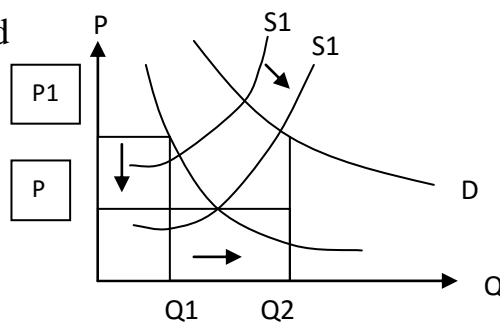
C- Services of Modern Technology:

The appearance of some modern techniques, such as mobile phones, has become an option instead of making decisions by travelling personally; in addition, people started tending to stay at home for longer hours after the appearance of recreational and amusement devices such as computer games, internet and T. V. All these lowered demand on travel to areas of recreation like cinema, parks ...etc.

The Latent demand on transportation expresses the amount of movement between two locations (A) and (B) neglecting the cost in this framework, the perceived demand on transportation expresses the actual movement in the frame of cost from the starting point (A) to the terminal point (B)



Latent Demand



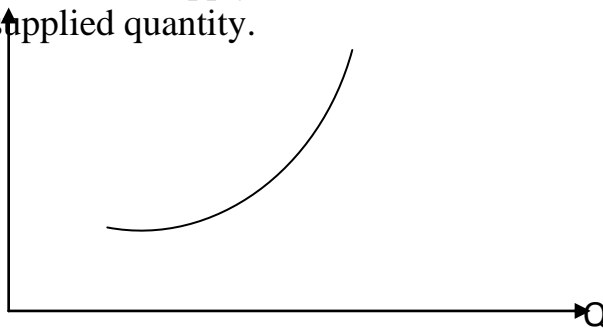
When supply increase to S_2 , price decrease to p_2 and Q increase to Q_2 . when roads expanded, traffic jam decrease and time consumed also, beside the decrease of public spending on each journey.

Studies denoted that, demand elasticity on traffic related to expansion in road is between zero and one. This indicates that 1% increase in roads leads to increase in demand on traffic between (0-1%), but in long run be more than 1%.

6- Supply of transportation service:

Supply is the desire and ability of service providers to make it available, in this sense, the quantity of supplied service is related to price rates and input cost in addition to the technology used.

In addition, assuming the stable nature of factors of impact on transportation service-supply, the increase in service price lead to increase in supplied quantity.



The institutions that serve in the field of transportation, provides varied products that look homogenous, as productive units of kilometers of passengers, but they are heterogeneous in terms of exchange process, as a unit of transportation supply is bigger than the unit of demand, and the production function of transportation and its cost related to the units is varied. In addition, transportation market takes varied types such as:-

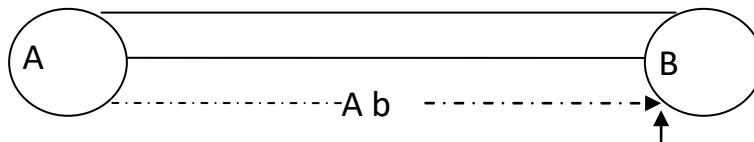
(A) Market of perfect completion: - in this market price determined by market forces. Moreover, the institutions working follows the price of the market (price taker) and since this types of price are subject to change, so transportation institutions will have full knowledge about the forces prevailing in the market.

(B) Market of commercial unities:-In this type price determined by the working institutions.

(C) Monopoly market: There are no substitutes for the services rendered by the monopolists, so they determine the price (price makers). This type of market appears in railway traffic where we find price discrimination (varied tariff for different classes in the same means of traffic)

D) Oligopoly Market: Where there are limited numbers of operators who determine the same price under the leadership of the biggest company among them.

In the diagram below, supply of transportation, service between the locations (A) and (B) is (a b) (include, indirectly, the ability of a certain type of transportation to support traffic movement. It also includes ³⁴⁷ port of traffic resulting from transferring from one type to another.



6-1-Factors determine supply of transport services

1) Factors those determine supply on the land medium (Roads)

- a) Capacity and the width of roads.
- b) Density of the vehicles.
- c) Speed.
- d) Content and repetition of service.

2) Factors determining Railway traffic service:

- a) Number of lines and trailer power.
- b) Capacity of stations.
- c) Capacity of lines.
- d) Density and speed of trains.

3) Factors, which determine supply of Air Traffic:-

- a) Capacity of landing areas.
- b) Capacity of airports.
- c) Capacity of planes.
- d) Speed and rote of service repetition.

4) Factor which determine supply of sea traffic service:-

- a) Capacity of seaports.
- b) Capacity of ships.
- c) Capacity of lines.
- d) Speed and service repetition rate.

5) Factors that determine supply of communication service:

Speed and transformation ability (cables – antennas- satellites,.... etc), of data. This measured by the size of data (Bit/second). transportation, as sector that supply and give a medium service, is expected to satisfy a number of expectations, individual and collective of nature, which draw a total portrait of the role of transportation sector and its impact on development Agenda.

Presentation of transportation service (supply of transportation service) by some government is considered as embarrassing in most countries for the following reasons:

- a) The outstanding contradiction, when governments try to play the roles of planner, organizer and operator of transportation at the same time.
- b) Contradiction and '...ity when this government provides transportatio³⁴⁶ es in a commercial frame –

work at the same time they pretend to give it in a social framework.

- c) Restrictions of administrative procedures, which hinder the free development of this sector.
- d) Competition of state demand function over resources to satisfy the needs of education, health etc negatively affects the allocation of resources for transportation sector.

A controversy is going on, to whom should, supply and presentation of infrastructure of transportation, belong, to public sector or private sector.

Some believe that the public sector is more tolerant to risks of refunding than the private sector. Besides, the public sector is more interested in environmental and planning prospects, which are required by the transportation sector. In addition, retrieval of cost will not be direct from the users especially In the case of roads.

7-Transportation sector in Sudan

It is one of the important sector for national economy, it helps production sectors to perform their roles in a good way, and consumer and service sectors to perform their role, in obtaining their needs from other sectors in a continuous way, springing from this point, transportation sector in Sudan found concern in programs and plans of development in Sudan.

7-1 Features of Transportation sector in Sudan:-

- A) Sudanese Transport sector characterized by unbalance motion of traffic. in some parts of Sudan goods&passengers traffic, for instance, prevails over traffic, in some areas, through specific routes compared to other routes.

- B) Fluctuation of demand on inventory transportation from season to the other, since Sudan is amply agricultural, in times after harvest demand increase on transportation and decrease during autumn.
- C) Demand on transportation is characterized by fluctuating during the same day, this is clear in the capital city, when it increases in the morning (passenger travel) and in the afternoon and decrease in other times of the day.
- D) Nature of exports and imports formulates the form of transportation service supply; trucks specialized for cattle transport, for instance, or tankers for petroleum products.
- E) Transportation traffic, not proportionally distributed among regions, these negatively affect investment cost, and pricing of transportation.
- F) The impact of length of routes and climate and natural hindrances, affect transportation service in most cases and areas.
- G) Land transportation means resembled in (cars, buses + trucks) is dominant in passengers and inventory transportation
- H) that the relative importance of each type of transportation differs for the considerations related to each type.

7-2-Evaluation of the performance of Sudanese transportation sector during (1960-2013)

(A) descriptive statistics tables

Table (1) Geographical distribution of the Length of paved roads (in kilometer)

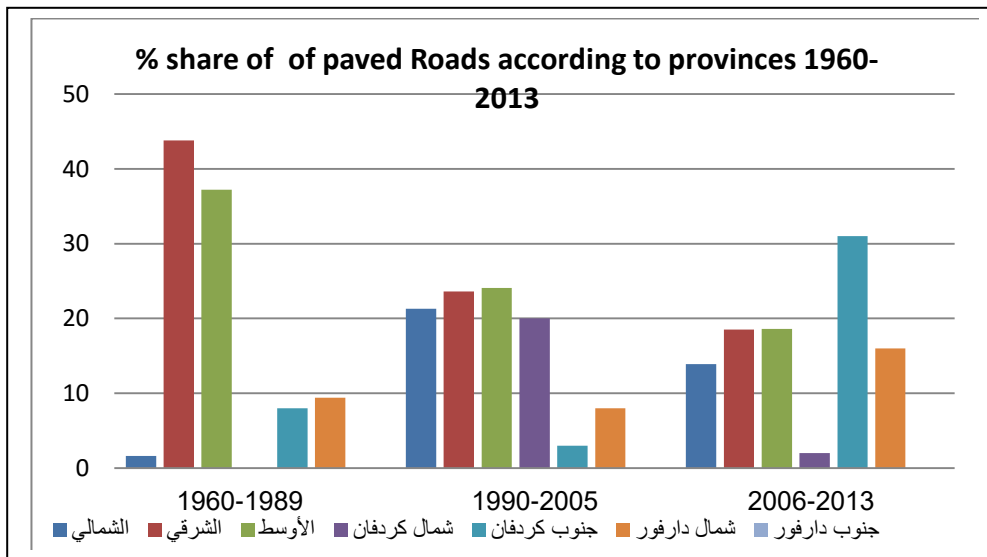
%	-2006 2013	%	-1990 2005	%	-1960 1989	region
%9 .13	448	.21 %3	807	%6 .1	36	Northern
%5 .18	580	.23	884	.43	1005	Eastern

		%6		%8		
%6.18	600	.24	914	.37	851	Middle
		%1		%2		
%2	72	%20	759		-	Northern Kordofan
%31	1000	%3	116	%8	186	SouthKordofan
%16	528	%8	307	%4.9	215	Northern Darfour
-	-	-	-		-	South Darfour
%100	3228	%100	3787	%100	2293	Total

Source : Roads and bridges corporation reports

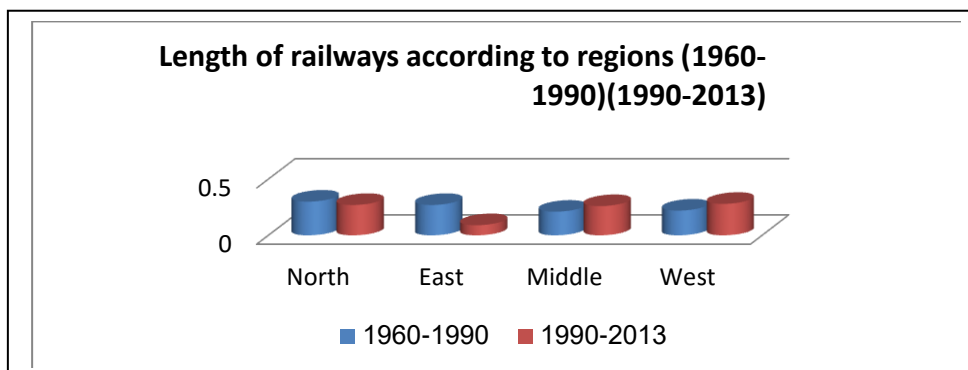
- 1- The eastern & the central regions has the longest lines of paved roads , and this reflect export oriented policies that aim to link production areas located in the central region ,with the ports of export along the red sea.
- 2- Also we notice that the share of the other regions from paved roads lines is marginal, especially the western states, accordingly infrastructure necessary for development affected negatively.

Tale (2) Length of railway lines according to regions(60-2013)



%	After 1990(km)	%	Before 1990(km)	Periods// regions
%37	1145	%30	1145	Northern
%9	286	%27	1081	Eastern
%26	801	%21	801	Middle
%28	861	%22	861	Western
%100	3093	%100	3888	Total

Source: Railway Corporation



The railway map remain as its since the colonial rule. In addition , we notice that the railways lines working in the eastern region reduced by 74% , this reflects weak railways infrastructure that support export sector.

Table (3) Percentage participation of modes of transportation in conveyance passengers & consignment (1960-2013)

T. modes	TOTAL passengers	Total tons	%participat ion in Tran.	% participati
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المجلة العلمية لجامعة الإمام المهدي العدد (8) - ديسمبر 2016م

	transported(000)	transported (000)	Passengers	on in Tran. Tons
Railways(1960-2013)	82370	102251	0.38	46.0
Land(1995-2013)	32130	95405	0.15	43.0
River (RTC)	5512	4462	03.0	02.0
Sea (SSLs)	72585	17176	3.04	08.0
Air(SA)	21618	422	10.0	01.0
Total	214215	219716	1	1

Source:-statistical annual review-Bureau of statistic

The average contribution of Land transport in transportation of inputs and outputs during the period (95-2013) reached 43% out of the total, and this ratio is nearer to the average contribution of railways during the period (1960-2013) that equal 47%. The other modes of transport share is marginal. but the role of Sudanese Sea lines is in transporting passengers abroad is significant relative to the Sudanese Air ways lines.

Table(4)The average numbers of the Dragging power of the main means of transport (1960-2013)

Period--- Means	sixties	seventies	€ 343 ies	net ies	200 0-	2013
Railways(different types of trains)	719	612	450	358	184	30
Airways (different types of	8	3	3	11	-	1(owned)+2(rented)+7(out of work)

airplanes)						
Sea lines (vessels)	4	8	10	6	4	2

Source: - collected from different sources.

The table above reflects the high deterioration of dragging power of the means of transport sector in Sudan during the period of the study.

The weak infrastructure in Sudan transportation sector negatively affected the socioeconomic spillovers like :-

(1)the accessibility in terms of economic and social quantities that can be reached.

(2)the creation and reallocation of employment.

(3)the productivity and gains of industries.

(4) social inclusion

(5)external effects on environment

(6)Accordingly the welfare gain will be lower and at the end GDP negatively affected.]+858

(B) Macroeconomic indicators tables

Table (5) Percentage share of transportation sector in GDP (1960-2013)

السنة	% مساهمة النقل في الناتج الاجمالي الحقيقي
1960	8.6%
1961	5.6%
1962	3.6%
1963	4.6%
1964	4.6%
1965	4.6%
1966	4.6%
1967	6.5%

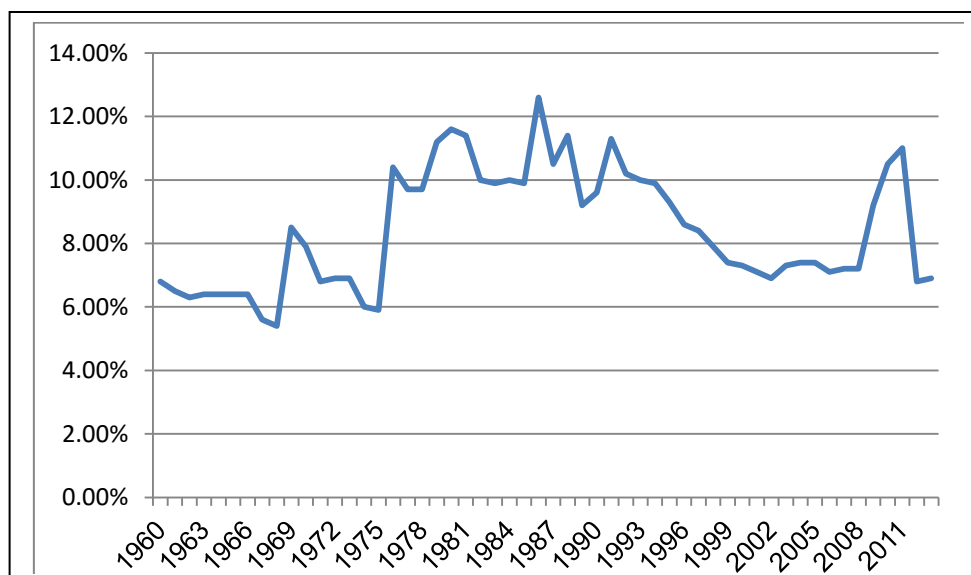
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%4 .5	1968
%5 .8	1969
%9 .7	1969
%8 .6	1970
%9 .6	1972
%9 .6	1973
%6	1974
%9 .5	1975
%4 .10	1976
%7 .9	1977
%7 .9	1978
%2 .11	1979
%6 .11	1980
%4 .11	1981
%10	1982
%9 .9	1983
%10	1984
%9 .9	1985
%6 .12	1986
%5 .10	1987
%4 .11	1988
%2 .9	1989
%6 .9	1990
%3 .11	1991
%2 .10	1992
%10	1993
%9 .9	1994
%3 .9	1995
%6 .8	1996
%4 .8	1997

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%9.7	1998
%4.7	1999
%3.7	2000
%1.7	2001
%9.6	2002
%3.7	2003
%4.7	2004
%4.7	2005
%1.7	2006
%2.7	2007
%2.7	2008
%2.9	2009
%5.10	2010
%11	2011
%8.6	2012
%9.6	2013

Source: Economic structure report –ministry of finance



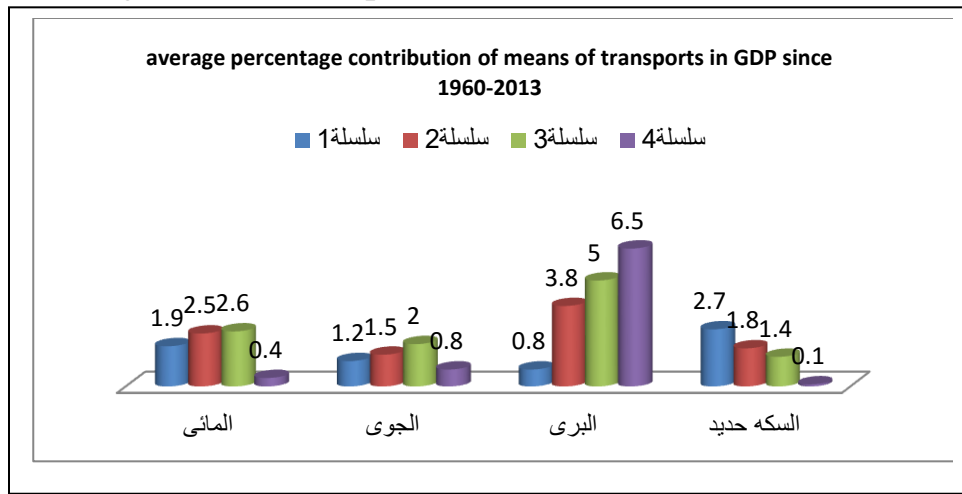
1-We notice that the percentage contribution of transport sector since 1960 until 2013, is fluctuated, but the general trend is declining.

Table (6) Percentage share of modes of transport in GDP (60-71/72-89/90-200/2000-2013)

Years	60-	72-89	90-2000	2000-
Railway	2.7	1.8	1.4	0.1
Land	0.8	3.8	5	6.5
Air	1.2	1.5	2	0.8
Water	1.9	2.5	2.6	0.40
Average	.1	40.2	75.2	95.1

Source: collected by the researcher

Percentage share of transport sector in GDP (1960-2013)



We notice that the percentage share of transport sector in GDP increased during sixties and seventies. During eighties and nineties, the level of increase had been with decreasing rate. After 2000 up to 2013, the percentage share deteriorated. Although share of land transport increased by 5.7% since 1960

up to 2013, But this reduction and deterioration can be justified by the following reasons:-

1-the share of the railway decreased from 1960 up 2013 by 2. 6%.
2-the Air and water transport share in GDP decreased since the 2000 by 1. 2% and 2. 2% respectively.

3-From all the above analysis the decline contribution of (T. S) IN GDP reflects weak share of value added resulted from (transportation operations side)

Table (7) Percentage share in the external sector of some types of transport sector (1960-2013)

Modes of transport	Exports(000) 340	% out of ea export	% out of the total export(sea+Air)
Railways	2717	53%	0. 34
Land		47%	
Sea	5170	100%	0. 64
Air	154	-	0. 02
Total	8041	-	1

Source: Economic structure report –Ministry of finance.

Railways share in transport of the export-oriented consignment through the red sea during the period of the study represent 53% (1960-2013), while the share of the Land transport is 47% since nineties up to 2013. this analysis reflects the increasing share of Land transport in export oriented items. In addition the share of Air transport is very weak.

But in my view the concentration on one type of means of transportation in not practical to enhance exports as far as trans border transportation issues remain to be better addressed in terms of capacity, efficiency , competition and security

Reference to tables above (1/2/3/4/5/6/7), analysis the results justify the study hypothesis as far we see the negative impact of the weak infrastructure(routes & dragging power) of transport sector contribution in GDP& on its role in conveyance items and individuals & supporting export sector during the period of the study.

7-3-problems facing types of Sudanese transport

1-Railway lines:- It's role in transporting for long distances is clear in a country like Sudan with a reasonable cost, but this role was minimized after, the door to door service of trucks, has been implemented, and in more speed. However, performance of railways deteriorated in the last decades and this attributed to:-

- The high cost compared to transported units.
- Weak production efficiency, in terms the dragging power, and infrastructure.
- Lack of suitable allocation of cost, which affects the process of suitability of pricing and in turn affect profitability.
- Weakness of the production efficiency that resulted from infrastructures and dragging- power.
- Lack of the automatic control over trains.
- Means of communication, between stations are very weak.
- Lack of joint lines in railway lines which hinders the perfect use of trains and trailers this lead to the waste of more hours in the same journey.
- Lack of maintenance and protection for the lines, which make them subject to Sudden impair.

2) **land transportation:-** It is the most important type of transportation, for its elasticity³³⁹ depth into areas of production, with the expansion in prod its importance increased and

pared roads has been founded besides, investment in Trucks does not cost high capitals, this explains the majority of tiny investors in it. Themajorproblems in this type are-

- Cost of fuel, spare parts and licenses.
- Laws related to operators labor laws.
- Law of ordering the relation between trucks owners and clients.
- Infrastructure.
- Traffic jam
- Accidents
- Cost of shipments.

3) **Sea transportation:** Sovereignty and security demands the state to found and operate sea parts seaports corporations owns a number of steamers beside a number of other companies, sea transportation sector has witnessed development after the increases of seaports and progress in the process of handling, ware housing, packing, insurance and seas port works.

Problems face this type of transportation:-

- 1) Seaports fees cost, which is very high.
- 2) Weak transport navy.
- 3) Inefficiency of using capacity
- 4) **River Transportation:**the major problems facing this type of transportation are:-

1-Inefficiency of vessels, which are traditional.

2-Problems related to security of lines and capability.

3-problems related to rivers navigations

5) Air transportation:-the major problems facing this type of transportation are:-

- Weak navy of Sudan Airways lines
- Problems, of punctuality, and quality of service.

- High fixed cost and operational cost.
- Problems of preparations and infra structures.

7-4 Traffic Jam in Khartoum State

To combat traffic jam in capital city, many measures has been taken to organize traffic such as:

1. Transportation by tram to link the three towns (Khartoum – Khartoum North – Omdurman) that was in the past.
2. Promotion of public transportation, by buses, and autobuses, through Khartoum state transportation company.
3. Then transportation transferred to be by medium means (Ting and moderate) to facilitate the flow of traffic.
4. Owing to the incre: 338 population in the capital city, Trucks used to transport passengers after the mid eighties.
5. Under the Slogan “toward a civilized secure capital city” plans have been steered to make circle lines to link the three towns by modern buses in order to minimize cost, effort, and wasted time according to the old intermediate stations.

But unfortunately the traffic jam still increase as far as the increasing rush of people from other states ,accordingly the welfare gain lowered.

7-5-The study recommendation:-

The study recommended the following to promote the transportation sector:

(A) In the area of General policy

- **Review of policies of institutions in the field of transportation and promoting them to be up to date.**
- **Application of regulations related to size and weight.**
- **Strictness in applying regulations of expiring of transportation means.**
- **Reviews of policies related to fuel prices.**

- Review of policies related to spare parts and maintenance.
- Review of policies of transpiration tariff.
- Activation of consultancy role, to secure the safety and modernization, of transportation sector.
- The vitality of attaining the highest rate of traffic safety through the regulations related to drivers, vehicles and roads.
- The importance of promoting transportation means of collective nature especially in areas of high density of population to minimize the impact of crowdies and pollution.
- Endeavour to minimize use of cars, through planning residence close to work areas and planning cities in the form of integrated assemblies with al family needs in touch.
- Use of vehicles of efficiency, those do not pollute the environment. The vitality of providing sufficient transportation service to meet purposes of development and to facilitate arrival of individuals to service centers.
- The vitality of determining of funds resources and financial credits before commencing erecting of transportation projects.
- The importance of connecting transportation roads planning, and types of transportation, with areas of agriculture, industrial production, and Tourism area in the states.
- treatment of reasons behind the continuous flow of inhabitants to the capital city
- Formulation concrete studies depend on the orientation the basis of the above mentioned analysis of transportation economics.

(B) In the area of types of transportation

The study, recommend the following to promote the means of transportation sector in Sudan.

(A) Railway sector:

- 1- promotion of railway lines and construction of double lines**
- 2- Increase the dragging power.**
- 3- Introduce wagons suitable the nature of transported items.**
- 4- Adoption of trains' automatic control.**
- 5- Promotion of stations.**

(B) Land transport:-

- 1- paved roads should be equally distributed between all regions.**
- 2- technical side of roads and bridges construction should give priority.**
- 3- All land means of transport should be suitable to the nature of transported items.**

(C) Sea transport

- 1- promotion of vessels by introduction of new ones, that suitable to all types of transported items.**
- 2- Increase numbers of vessels.**
- 3- open new lines**

(D) Air transportation

- 1- rehabilitaion of planes**
- 2- Introduce new cargo, and passengers' planes.**
- 3- Open new lines and airports.**

(E) River transport:-

- 1- Increase the navigable parts along rivers.**
- 2- Introduce new means suitable with transported items.**

At last, all these recommendations should be within over all planning, management and strategic policies.

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