

Land Transportation Infrastructure and Economic Growth: An Assessment of the SADC Regional Infrastructure Development Master Plan

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Abstract. This Southern African Development Community (SADC), as a regional economic integration organization in Africa, has 16 member countries with rich natural resources and tourism resources, attracting the attention of global investors. Although the region's transport infrastructure is among the leading in Africa, it still lags far behind global standards. This study provides a comprehensive assessment of the current state of transport infrastructure in SADC, with a particular focus on road transport facilities within the region. Based on SADC's official "SADC Regional Infrastructure Development Master Plan Transport Sector Plan, 2012", this paper evaluates the current situation of its road transport infrastructure and conducts an in-depth analysis of the future road development plan in the plan. This research aims to reveal the challenges faced by SADC at the infrastructure level, and provide a comprehensive and in-depth perspective for policy makers, investors and other relevant stakeholders. At the same time, this study can provide some new ideas for future research and provide new solutions to the problems of transportation infrastructure in the SADC region.

Keywords: SADC, Land Transport, Infrastructure, Regional Integration, Economy

1. Introduction

1.1. Background

All The Southern African Development Community (SADC) is a multinational regional economic community. Its member countries include 16 countries in southern and central Africa, with a total area of more than 9.88 million square kilometers. This vast land has abundant natural resources in Africa: including minerals, agricultural products and fishery resources; and rich tourism resources [1]. As a pioneer of regional economic integration in Africa, SADC is one of Africa's trade hubs, and its huge potential for economic development has attracted the attention of investors. Although the transportation infrastructure in the SADC region, especially around South Africa, is already in a leading position in Africa, there is still a big gap compared with the international ones [2].

Transportation infrastructure is a cornerstone of economic development and crucial for promoting mutual regional economic growth. [3]. Enhanced inland transportation infrastructure is vital for sustainable economic growth among SADC countries.

1.2. Literature Review

Regional economic integration in Africa has been fruitful over the past few decades, giving birth to ECOWAS in West Africa, EAC in East Africa, and SADC in Southern Africa. Studies have shown that regional economic integration plays an important role in promoting national economic development [4]. Khandelwal and Padamja believe that regional integration can be used as a means for African countries to promote trade and achieve economies of scale, thus contributing to the industrialization and modernization process of African countries [1]. Infrastructure, particularly enhanced transportation, is crucial to regional economic integration development. [3].

SADC's transportation infrastructure is the leader in Africa, but there is still a big gap compared with the international level [2]. According to the official document: Southern African Development Community (SADC). "Regional infrastructure development master plan—transport sector plan. "In

the overall assessment of road and railway facilities in the SADC area, the infrastructure conditions in some countries and regions are still not optimistic.

Improving the state of regional infrastructure and increasing investment in infrastructure is an important direction in the future. Research conducted by Anathi, Hlotywa, and E. A. Ndaguba has shown that Road Transport Infrastructure Investment (ROTI) plays a significant role in strengthening the economic chain and accelerating the growth and development of the country [5]. Therefore, the government needs to provide policy support according to the necessity of economic development and reasonable judgment of the future situation [6]. However, Mafusire's research also pointed out that the internal trade among member countries of SADC regional economies is still not optimistic [7]. Research by Ranganathan, Rupa, and V. Foster further reveals that landlocked countries and small countries in SADC need to improve transportation infrastructure to seek economic development, but high infrastructure maintenance costs may instead change landlocked countries and small countries [8]. The serious economic burden of small countries, so the introduction of external economic assistance is necessary.

1.3. Objection

Overall, sound road infrastructure is a necessary condition for SADC's economic development. However, funding issues, aging and imperfect infrastructure and other issues have challenged the goal of improving road infrastructure, and also put forward higher requirements for the future development of transportation infrastructure in the SADC region. Based on SADC's official transport status and development guidance document: SADC Regional Infrastructure Development Master Plan Transport Sector Plan, 2012, this article makes an overall assessment of the transport infrastructure data provided in it - the current status of roads, and makes an overall assessment of the status of the roads made in the document. Further analysis and evaluation of the future road development plan.

2. Current status of SADC land Transportation Infrastructure

2.1. Road Infrastructure Conditions

Table 1. Regional Trunk Road Network [10]

Header	Reference Roads (km)	Intermediate Roads (km)	Branch, Link and Connecting Roads (km)	Total (km)	Total Percentage
Angola	4600	300	3600	8500	14%
Botswana	1700	1200	100	3000	5%
Democratic Republic of Congo	3900	300	8900	13200	21%
Lesotho	200		900	1100	2%
Madagascar	1300				
Malawi	4000	400	200	1900	3%
Mauritius					
Mozambique		1400	300	5700	9%
Namibia	2700	1200	800	4700	8%
Seychelles					
South Africa	4200	2100	2400	8700	14%
Swaziland	200		200	400	1%
Tanzania	3300	1900	1900	7100	11%
Zambia	1400	1700	1400	4500	7%
Zimbabwe	1600	1000	1100	3700	6%
Total	29300	11600	21700	62600	100%

Source: SADC Regional Infrastructure Development Master Plan Transport Sector Plan, 2012, p.9-10

Table 2. Summary Statistics of Road Infrastructure in SADC Member Countries

Data Panel	Total	Intermediate Roads	Branch, Link and Connecting Roads (km)		Reference Roads
Average	5208	1150		1816	2425
Median	4600	1200		1000	2200
Maximum	13200	2100		8900	4600
	DRC	South Africa		DRC	Angola
Minimum	400	300		100	200
	Swaziland	Mozambique		Botswana	Lesotho

According to the official data document provided by SADC, the road data of SADC member countries are as follows [9]. Calculate the average, median, maximum and minimum values based on Table 1 and summarize them in Table 2. As can be seen from Table 2, among SADC member states, DRC has the longest roads with the longest total mileage, followed by Angola, South Africa and Tanzania, whose total road mileage accounts for more than 10%, while the roads of the remaining member states None of the total mileage accounted for more than 10%. Namibia, Botswana, and Zambia are all SADC member countries with large land areas, but the total road mileage accounted for no more than 10%, and the road network is not dense. Compared with the total length and top ranking of the Democratic Republic of the Congo and South Africa There is still a big gap.

Joseph and Juliet pointed out in their research that the transportation infrastructure in the SADC region leads Africa, but there is still a significant gap with the world's mainstream level [2]. It can also be concluded from Fig. 1 that while the overall regional infrastructure development in the SADC region is lagging behind, the development between economies is extremely unbalanced.

Data from the World Bank's publicly available databases also provide strong evidence of uneven regional transport infrastructure development. This study collects and organizes infrastructure data from major SADC economies from 2010 to 2022, and summarizes them in Table 3.

The first is the aggregation of data on the quality of land transport infrastructure. In Table 3, this study converted the World Bank's official 5-point scale into a 100-point scale in order to more clearly and straightly show the inequality in infrastructure development of regional economies.

Table 3. SADC Main Country Logistics Performance [9]

Logistics performance index: Overall (1=low to 5=high)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average	Median	Final Score (Full Score 100)
South Africa	3.46	3.67	3.43	3.78	3.38						3.70	3.57	3.57			71.30
DRC	2.68	2.21	1.88	2.38	2.43						2.50	2.35	2.40			48.06
Zambia	2.28		2.46	2.43	2.53							2.43	2.45			48.92
Zimbabwe		2.55	2.34	2.08	2.12						2.50	2.32	2.34			46.79
Tanzania	2.60	2.65	2.33	2.99								2.64	2.63			52.50
Botswana	2.32	2.84	2.49	3.05							3.10	2.76	2.84			56.80
Mozambique	2.29		2.23	2.68								2.40	2.29			45.80
Namibia	2.02	2.65	2.66	2.74							2.90	2.59	2.66			53.16
Angola	2.25	2.28	2.54	2.24	2.05						2.10	2.24	2.25			44.91
Malawi		2.81	2.81		2.59							2.74	2.81			56.20

As can be seen from Table 3, South Africa has the best transport infrastructure among all SADC countries, with a score of 70 points [9]. The overall score for other countries is around 40 to 55. This reflects the poor overall transport infrastructure of all SADC countries except South Africa, which has the best transport infrastructure. The road condition diagram shown in the SADC official document also illustrates this point.



Fig. 1 SADC Regional Trunk Way Net Work [10]

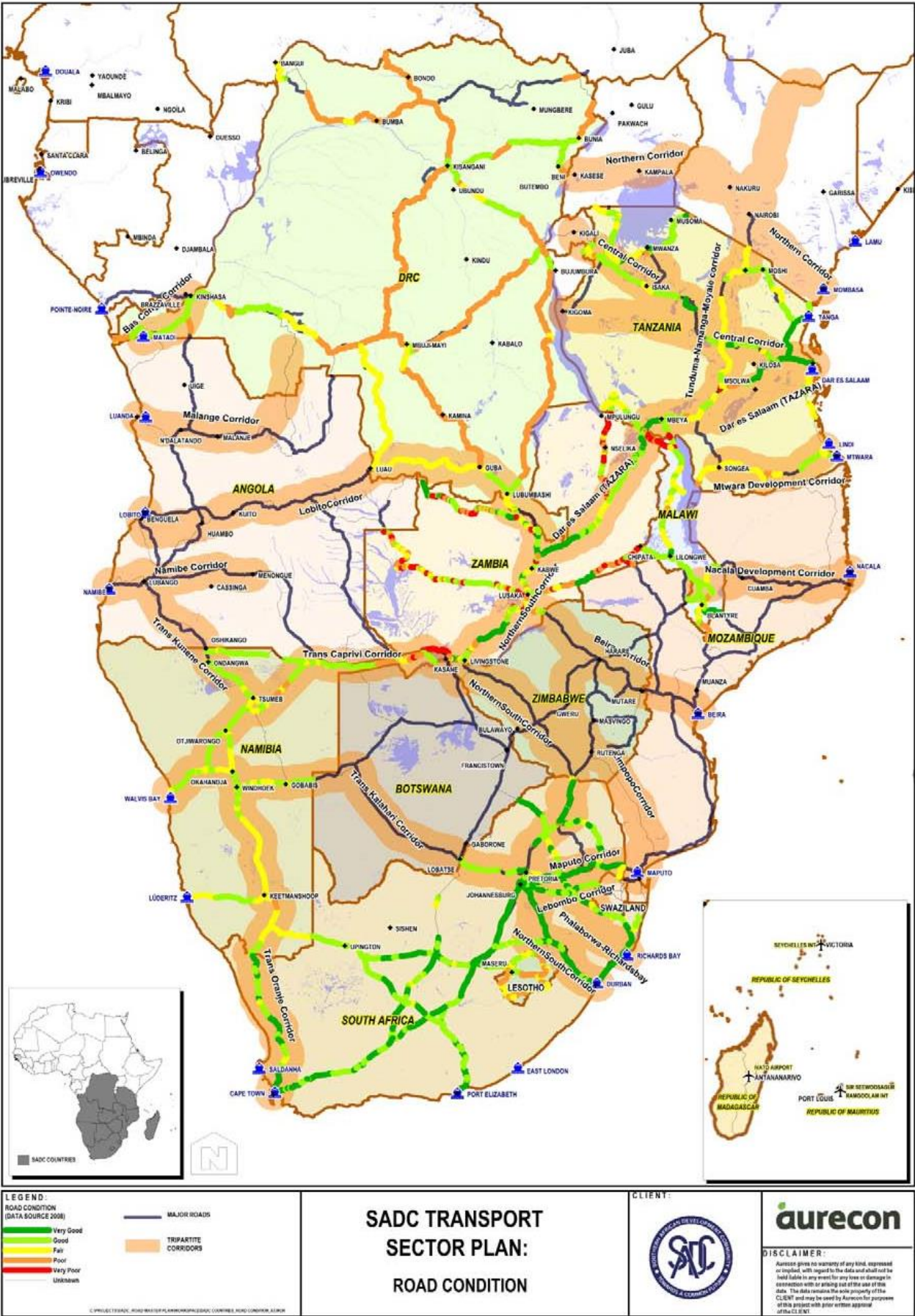


Fig. 2 SADC Road Condition [10]

Fig. 2 differentiates the condition of roads via color-coding, where green signifies optimal road conditions, whereas yellow and orange indicate suboptimal conditions. As demonstrated in Fig. 2, South Africa is predominantly marked in green, suggesting that it boasts the finest road conditions within the SADC region. Conversely, certain landlocked countries, such as the Democratic Republic of the Congo and Zambia, are primarily marked in yellow or orange, highlighting their comparatively subpar road conditions. Therefore, it can be inferred from Fig. 2 that South Africa surpasses other nations in the SADC region in terms of road quality, while the Democratic Republic of the Congo and Zambia appear to struggle with inferior road conditions [10].

To sum up, apart from South Africa, the development of infrastructure in other countries in the SADC region is generally backward, which further reflects the inequality in infrastructure development in the SADC region. SADC countries still need further improvement in terms of overall road mileage development and road conditions.

2.2. Status of Railway Infrastructure

Table 4. SADC Main Country Railway Length [9]

Railway Lines-Route km	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total	Percentage
South Africa						20953	20953	20953	20953	20953	20953	20953	20953	20953	57.47%
DRC	3641	3641	3641	3641	3641	3641	3641	3641	3641	3641	3641	3641	3641	3641	9.99%
Zambia								1248	1248	1248				1248	3.42%
Zimbabwe	2583								3120	3120	3120			3120	8.56%
Tanzania	2600	2707						2701						2700	7.41%
Botswana						886	886	886	886	886	886	886		886	2.43%
Mozambique	3116	3116												3116	8.55%
Namibia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Angola	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
Malawi	797													797	2.19%

According to World Bank data between 2017 and 2022, the total railway mileage of SADC's major economies is summarized in Table 4.

Table 4 shows that the total railway mileage of major SADC countries has remained unchanged in the last five years. Moreover, the total mileage of SADC railways occupied by railways in various countries shows a very large imbalance. South Africa alone accounts for more than 50% of SADC's national railway mileage. None of the remaining major economies accounted for more than 10% of the total mileage of railways.

The overall condition of the railways is not in a very good condition either. According to Fig. 3, the existing railways in two countries except South Africa and Angola are in good condition [10]. The network continuity of mainline railways in other countries is not consistent, and their overall conditions still need continuous improvement.

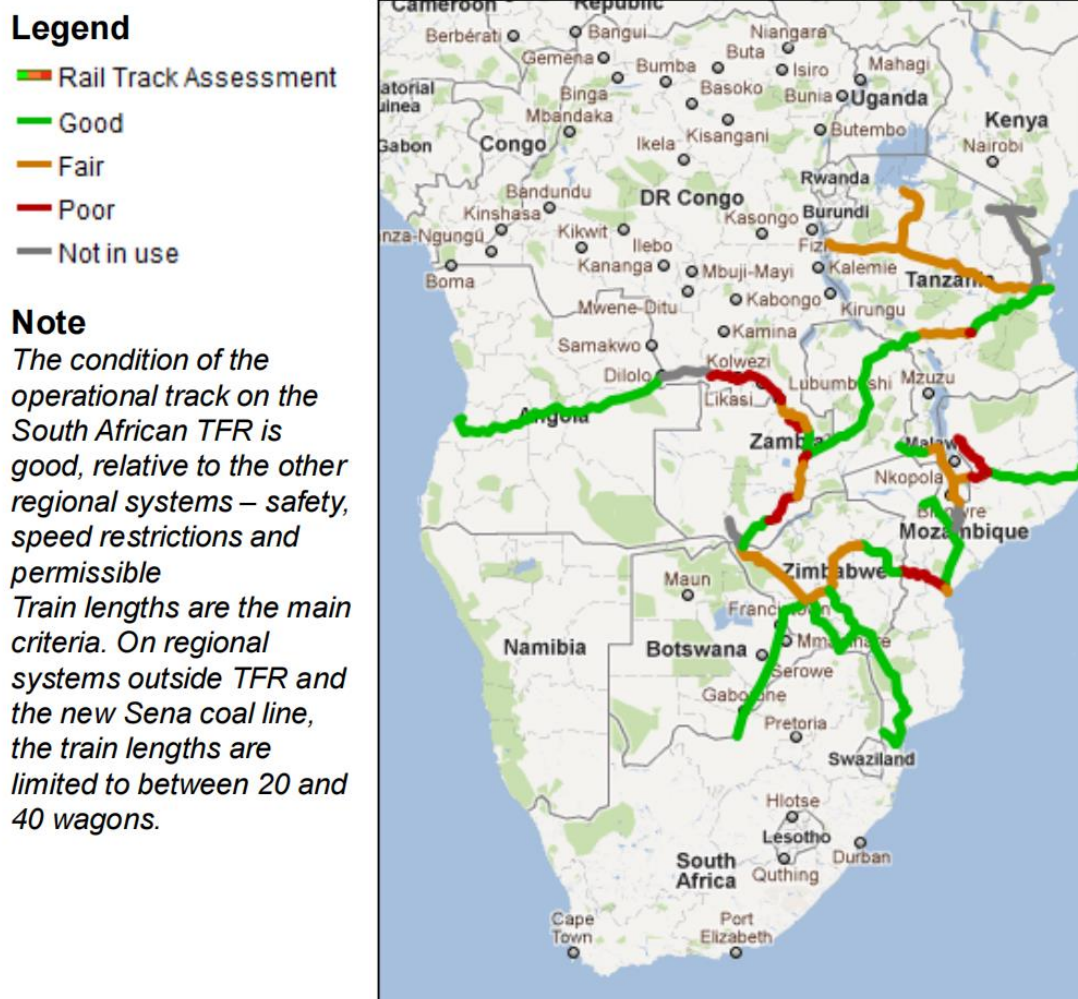


Fig. 3 SADC Railway Condition [10]

To sum up, the development of railways in the SADC region, like its roads, has South Africa significantly ahead of all other countries. All SADC countries except South Africa need further improvement and improvement in terms of railway mileage and railway condition. The total railway mileage is short, the railway trunk lines are poorly connected, and the development of regional railway infrastructure is unbalanced. These are the current situation of SADC's railway infrastructure.

3. Assessment For SADC's Official Transport Infrastructure Development Plan

3.1. Assessment for Road Development Master Plan

The long-term plan for road development in the official development plan of SADC infrastructure is: Road Integration. The document pointed out that to accomplish this goal, it is necessary to further improve the Road Corridors in various places in order to strengthen the connection between SADC regional roads. At the same time, it is necessary to improve the legal framework of the SADC region, improve and draft bilateral or multilateral agreements, and further reduce trade costs among member states.

Road infrastructure investment in the SADC area is mainly led by the government, and the market generally lacks confidence in the road investment in this area. At the same time, roads in some countries lack effective management, operation and maintenance, and lack sufficient funds to maintain the above activities, which will lead to further deterioration of road conditions and further reduce investor confidence [10].

According to the public data of the World Bank, except for South Africa whose GDP can reach over 100 billion US dollars, the GDP of other countries in the SADC region is maintained at around

10 billion US dollars, and some countries even have a GDP of only a few billion US dollars. The financial situation of most countries is not good, the industrial structure is single, and most of the citizens remain low-income groups. Low national income and financial distress are the status quo in most SADC countries.

It can be seen that the fiscal situation is the main factor limiting the upgrading of road infrastructure in SADC countries. In addition, the uncoordinated regional development, the asynchronous development level and development plan between countries are also the main factors that limit the upgrading of infrastructure in this region.

Therefore, when perfecting the goal of regional road integration, each country should fully consider its own financial situation and not blindly build new roads to prevent a huge burden on the national finance. Most SADC countries should aim to maintain and optimize existing roads (especially trunk roads). All in all, a conservative policy may be more suitable for most SADC countries.

However, if SADC countries want to fundamentally improve the condition of road infrastructure, they need to vigorously develop their own economy, develop domestic advantageous industries, promote domestic industrial upgrading, and increase national income. In this way, the government will be able to have the motivation to improve the country's road conditions, and let the high-quality road system feedback economic growth.

3.2. Assessment for SADC Railway Development Master Plan

In the official document, the development plan for the railway system is: relying on SADC and SARA (Southern African Railways Association) to develop the railway system in the SADC region, improve railway-related policies, and strengthen railway management and supervision.

The rail system in the SADC region faces many challenges.

The first is the maintenance and management of railways. At present, the railways in most SADC countries lack effective management and maintenance, and the railway system is seriously aging, which further brings about the decline of railway performance. The speed of freight railways in some countries is slow and the timeliness is extremely poor. The railway system is also regularly subject to vandalism: railroad ties are often stolen, and in times of political unrest in some countries, destructing railways are often the first target of armed forces [10].

Second, the income from railroad operations cannot cover its expenses. The rail system cannot be sustainable. The poor financial situation of the railway directly affects the government's confidence in railway investment and planning. Some profitable railways are built for the purpose of serving joint venture projects, which are highly targeted.

To base SADC's railway planning on the regional organizations SADC and SARA, research show that many SADC countries participate in multiple economic or trade agreements, resulting in Conflicting and sometimes overlapping terms [4]. This shows that the countries in SADC need railway development plans suitable for their own national conditions, while development plans based on regional economies may have a significant drop in implementation efficiency.

Second, as with their road systems, countries in the SADC region may need to be cautious about investing in new railways in the absence of foreign investment. Alotaibi, Saleh pointed out in his research that the investment in railways does not yield immediate benefits but gradually after 2-3 years [11]. Conservative policies are suitable for the development direction of railways in most SADC countries except South Africa.

Last but not least, SADC countries need to give priority to optimization and upgrading of mainline railways that are connected to ports. Examples include the mainline railway to Wavis Bay in Namibia and the mainline railway to the port of Dar es Salaam in Tanzania. These railways connected to ports have great economic advantages, and are important routes for transporting raw materials for international trade and transporting domestic and foreign trade commodities. Other countries also try to consider adding or optimizing the railway system connected to the seaport when planning their own railways.

4. Conclusion

The status quo of land transport infrastructure in SADC countries is as follows; although it is in a leading position in Africa, its development level still lags behind the world as a whole, and the level of infrastructure development between regions shows a great imbalance. The road infrastructure system in the SADC area currently has some problems: including the continuous deterioration of road conditions and poor inter-regional road connectivity. The rail system also faces similar problems as the road system, but compared to the road, the rail system is more vulnerable to man-made damage and faces unprofitable problems. In response to these problems, this study suggests that the authorities, if there is no assistance from foreign capital, maintain a conservative strategy for new road and railway projects, so as to avoid a large financial burden. Secondly, the government should focus on maintaining and optimizing the existing transportation infrastructure to further improve the efficiency and quality of current transportation.

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