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The Future of the Automotive Manufacturing Industry in Developing Nations: A Case Study of its Sustainability Based on South Africa's Paradigm

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Abstract

Liberalisation of the automotive industry in most developing countries has been difficult, especially in areas where strict controls previously existed. This has put significant pressure on the emerging market, causing the automotive industry to constantly seek better methods such as improving the standard operating procedures to stay competitive, particularly as observed in South Africa. The paper presents research findings on the key elements that influence the automotive industry's competitiveness, using the South African automotive sector as a case study based on its similarity with other developing countries that contribute about the same percentage to their national GDP, with similar automotive industry size. Also presented is the result of the analysis carried out on the industry's competitiveness to determine its sustainability. The findings show the need for urgent actions that will mitigate the decline of the industry's competitiveness.

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Keywords: Competitiveness; Globalisation; Constraints; Developing Nations; the automotive sector

1. Introduction

Nowadays, manufacturing industries are faced with increasing pressure to improve productivity to survive within the global competition. This requires industries to reduce production costs while maintaining product quality and also decision-makers to make the right decision to support and improve the various process in order to be competitive globally. Ronkainen and Czinkota [1] stated that sustainable productivity improvement calls for improvement processes whereby increased productivity, as well as the betterment of the well-being for employees, is taken into consideration.

Due to the complex nature of globalization, there is a lot of competition at the international level for both developing and developed countries. This, in general, requires high level of competitiveness which will include

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rational policies from decision-makers to make the economy of the country competitive and also coping with global risks. In industrialized countries, the key contributor to the national economy, in particular, is the automotive industries. The manufacture of all types of vehicles that are needed or used in different sectors of the government and nation which includes (tourism, transportation, road construction, agriculture etc).

Therefore any improvement or disruption of the automotive industry can deeply affect the economy of the nation either a positive or native way. According to available literature, the global automotive industry produces approximately 70 million units each year, playing a vital role in the world economy and making important contributions to the well-being of societies. This evidently shows the importance of the automotive industries in developed and developing countries and Enhancing the competitiveness in this industries is of crucial importance to the economic. The primary objective of this research was to analyze and identify possible factors that constrain the South African automotive industry competitiveness and also, the strategies that can ensure its sustainability after achieving the goal of global competitiveness.

Globalisation is an essential aspect of an organisation, as it reflects its orientation and established values. The concept demonstrates an organisation's beliefs regarding the transformation into a global market. Every organisation, including nations, has been working tirelessly to meet customers' demand and gain market segment for profits and competitiveness.

The inefficiencies of duplicating product development and production in every nation turn to further pressure to impact resources across the borders for profits. The demand for strategy integration becomes a priority because of the intensifying number of customers working globally, in addition to comparable competitors across main market segments [1].

According to Doole and Lowe [2], the phrase, 'think global, act local' encapsulates the real nature of globalisation by balancing the demand, standardisation, and adaptation to a specific unknown marking situation. The industry's trial to develop into a competent global competitor is curving extensive global presence to a global competitive advantage. The critical factors in accomplishing global competitiveness to a customer's demand are benefits considered superior to local competitors. Czinkota and Ronkainen [3] further outline that internal and external factors will create favourable conditions for the progress of strategies and resource allocation on a global basis, which can be further split into the marketplace and environment price competitive factors.

2. LITERATURE REVIEW

2.1. The automotive industry global competitive forces

Kaplinsky and Morris [4] describe the implications of manufacturing activities as becoming globally secluded due to a shift in the globe of competence of emerging nations, hence insubstantial functions including; Research and Development (R&D), logistics and supply chain, commercial services and designs have been the main centre of focus in industrialised nations while manufacturing and goods transformation from inputs to outputs has been contracted to emerging nations.

Gillespie, et al., [5] in a separate instance, also highlighted that for companies to be flourishing in the globe marketplaces, they need to fully understand the needs of their potential customers and develop strategies on how to meet them to be better competitive compared to other competitors in different nations. The author further highlighted that customer loyalty is also important as it makes it difficult for a new brand to dislodge a popular brand of the product already in existence in a number of marketing segments. Liberalisation of the market in most emerging nations has been embraced, where stringent controls beforehand existed. There are countless reasons for this change in approach in the direction of the contest in developing countries.

The pressures to liberalise marketplaces are external; hence countless nations in the developing world have joined the World Trade Organization (WTO) and demanded the exclusion of barriers to imports or comply alongside with WTO regulations [6]. Because of the acceptance of competition in the local marketing segment, it is eminent for local manufacturing industries to improve their international competitiveness, particularly the South African Automotive. As a result, multinational cooperation (MC) is expected to boost export growth, including technology expertise, global market intelligence, and extensive financial resources [7].

2.2. Global automotive market changes

Memedovic and Humphrey [8] explained that the range of vehicle manufacturing in growing economies experienced faster growth in the 1990s, as these were the boom years after considering economic industrialisation. Alfaro, et al. [9] highlights that the number of vehicles manufactured globally grows exponentially than the human population. Furthermore, Memedovic and Humphrey [8] also emphasised that the impact of globalisation in emerging nations resulted from amendments in the automotive industry value chain, even though adjustments in the trades and investment strategies, including the global strategy of a leading manufacturing organisation, was the main contributing factor. From the aforementioned and analytical point of view, it shows that the strategic key factors that are impacting the automotive industry are:

- Change in investment and businesses policies
- Leading business globalisation strategies
- Value chain adjustment in the automotive manufacturing industry

This evidently shows that any improvement within this key factors, to the South African Automotive industry will greatly improve its global competitiveness. According to a literature, development in the automotive industry in the 1990s came to be recognised as growing markets, whereas countless autonomous automotive industries in Brazil, Mexico, ASEAN span (Malaysia, Thailand, Philippines and Indonesia), India and China restricted imports of vehicles and components [10].

2.3. Importations and Trade Liberalization

Because of trade liberalisation, in 1990 import limits were phased out and import tariffs were reduced. However, the investment guidance or control measures and strategies came under severe threats, ranging from attaining local content requirements and exchange of foreign balance.

Across this era, the main multinational OEMs modified their manufacturing and sales strategies; hence the developing nations gained significance to aid the multinational companies to achieve their plans. Growing marketing segments in developing nations were predestined for an expansive range of vehicle production costs and inexpensive manufacturing locations for the global OEMs [8]. Humphrey and Memedovic [8] analysis and views are supported by Fishwick [11] who articulated that the automotive manufacturing industry in Japan, Western-Europe and North-America, has confronted a mature marketing segment that is stricken with, overcapacity tough price, stagnant demand, and low Profitability as shown on Table 2.1.

Table 2.1: Regional trade investment of light vehicle assembly plant in emerging market's OEMs in the late 1990s, (Japan, European and North America)

Country	Land Rover	Honda	Daimler Chrysler	Toyota	VW Group	General Motors	Ford	Fait	Renault	Nissan
Mexico			XX		X	X	X			
Argentina		X	X		X	X	X	XX		X
Brazil	X		X	X		XX	XX	XX	X	
Malaysia	X	X		X	XX				X	
Thailand	X			X		X	X			X
Indonesia		X		X		X				X
Czech/Slovak		X		X	X			X		
Poland						XX	X		X	
Hungary						X				
India		X	X	X		X	X			
China	X	X	X			X	X			X

Source: Adapted from Humphrey and Memedovic

Notes: X= total number of operational plants in late 1990. XX= two light vehicle assembly plants owned by the company in the same country.

The top ten automotive manufacturing plants that manufacture light vehicles and are owned by the top ten companies and 11 major developing countries are shown in Table 2.1 above. This includes, Brazil and India, which are typical examples of haste to invest in emerging markets. Brazil saw an influx of vehicle manufacturers in post-1994. And by 1997, India saw significant investments achieved by ten (10) OEMs with established manufacturing facilities generating a capacity of 660 000 vehicles per annum, causing a total growth of 4.7% of vehicle sales throughout 1996 to 2002, resulting in overcapacity of global production [8].

Barnes and Kaplinsky [12] concluded that one of the main reasons for rapid changes in the automotive industry is global production overcapacity, and this is evident particularly in the components manufacturing sector of the automotive, having a considerable magnitude due to the changing nature and relationship of OEMs and components manufacturers in the automotive industry.

2.4. The global automotive industry, over-capacity.

Overcapacity means producing products that exceed the customer or market demand. According to Lamprecht [13], the intensity of the competitiveness challenges is likely to disintegrate, and several constraints confront the global automotive industry to advance.

The main consequence of the overcapacity of vehicles is that manufacturers in their pursuit to maintain capacity utilisation, increase productivity outputs and inventories of unsold cars (between 1.5 to 2 months in most markets), and subsequently retain sales incentives, such as discounts, elevated trading in price and free upgrades, to sustain their market segments and shares.

Initially, the setback was limited to the North American marketing segment, which after the 2001 recession, has allegedly seen an increasing "war of attrition" among the manufacturers. The original cause is a continuing inability to adjust output to demand and link the manufacturing design to meet the customers' demands. As Henry Ford created the industry on the premise of production of automotive vehicles as effective and inexpensive as possible, this mass customisation "push-volume" strategy is no longer viable in the current settings of saturated markets.

According to an analysis from ACMA [14] states that a good number of automotive manufacturers have understood the necessity to link manufacturing to customer's demand and have initiated this successfully using "build-to-order" (BTO) tactics. Since 2009, the global automotive industry has endured one of the worst downturns. OEMs globally have restructured, consolidated, and slimmed down, yet they still have too many brands and countless manufacturing plants. Nevertheless, although capacity levels of manufacturing plants are anticipated to be enhanced in subsequent years, they are expected to remain sub-optimal. Even as OEMs are struggling alongside excess capacity, the sluggish commercial development in the Western marketing segments will maintain the demand condition to be rigid.

A combination of excess capacity and rigid demand conditions will consequently intensify the pricing and put a lot of pressure on the OEMs, who have already tried to implement many cost reduction strategies that have an undeviating impact on component suppliers of the automotive sector [15].

This is illustrated in Figure 2.1, how the global production of automotive vehicles exceeds capacity demand and results in severe financial pressure on multinational companies that are the industry's main players. Figure 2.1 further shows that according to global forecast. There was a decline from 20.9 million in 2012 to 15.8 million in 2015, but on the other hand there is a forecasted growth of 6% in the same period from the global assemblers'.

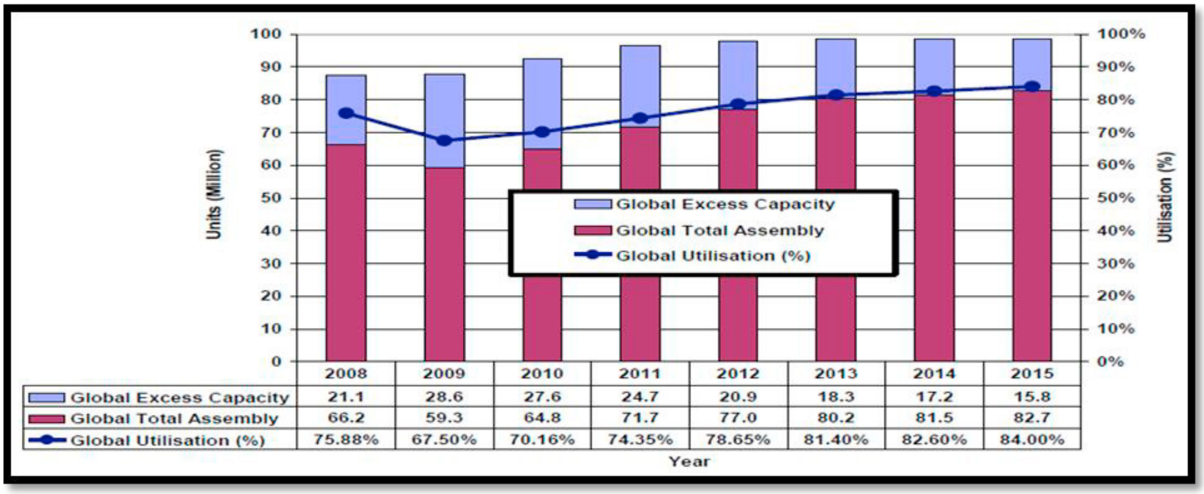


Figure 2.1 Capacity excess of global automotive out-look. Source: Barnes & Hartogh

According to Alfaro et al [9], notwithstanding the overcapacity decline, South African automotive manufacturers could still easily be wipe out by these large multinationals cooperation's with such excess capacity and still be nowhere near to resolving their excess capacity issues.

As a result, if one analyses the domestic sector of the South African domestic automotive industry's manufacturing output of 5, 39, 424 units in the year 2012, it is evident that there are significant challenges in the future, as South Africa's automotive industry could quickly disappear. There will be still sufficient global automotive vehicle production to meet current demand in the global market [16].

2.5. The South African automotive sector

According to research work done by Barners and Kplinsky [17], Ford and General Motors were the first to establish an assembling automotive plant in South Africa between the year (1924 to 1926). Further, according to Julius [18], Duncan [19], the primary reason these industries entered South Africa was due to an anticipation of tariff protection.

Some essential components, including battery, tires and glass, were sourced locally in early 1930, but these local components generally did not change much over the next decade and remained low. Although they were over 94 automotive part manufacturing industries that came into light in early 1958, less than 20% was value-added in the automobile manufacture, and this picture did not change for over two decades [18], the reason being a considerable number of the locally manufactured components were destined for after-market.

Agreeing to Naude [20], it is only 35 percent of the local content of vehicles produced in South Africa, promoting a situation where automotive assembling plants have to import a vast number of automotive components, as local suppliers lack in the market [21]. Competitiveness is of great importance to any organisation's well-being as it also helps stimulate the economic growth of a nation. Therefore any disruption or constraint to an organisation competitiveness, particularly SAAI, is of great concern, as it is an organisation that contributes heavily to the economic growth of the nation.

2.6. The South African Automotive Supply Chain

The automotive supply chain (SC) constitutes many integrated parties to get a final product to a customer. This analysis clearly shows that this industry can be competitive globally if the proper directions are well-aligned. It requires a world-class management strategy of philosophies such as speed response or Just In Time (JIT), Continuous Improvement (CI) and Total Quality Management (TQM) [20]. Despite all these strategies and practices, the South African (SA) automotive industry faces significant challenges. This includes difficulty in getting the right components delivered at the right time and place, causing Work In Progress (WIP) and customer's delivery delays.

According to Barnes [21], South Africa (SA) automotive industry compares favourably with other countries with similar sectors in developing countries regarding availability to raw materials, Flexibility in production, and the support of government and infrastructure. However, despite these positive aspects, the South African (SA) automotive industry's competitiveness is under severe pressure, as it faces challenges such as poor infrastructures, obsolete technology, and high labour costs. This is further justified by a research work done by (Ambe & Badenhorst-Weiss [22] Moodley, Morris & Barnes [23]), where they narrated about the South African (ACMs), having to compete against cheap imported parts, including counterfeit parts in some cases.

3. Research Methodology

The Ishikawa diagram is an important Industrial Engineering tool that identify problems or constraints in a system or process. From the aforementioned, it pointed out from all directions that the Ishikawa diagram was a suitable tool to be used to identify some of the possible factors that could constrain South African automotive industries competitiveness and sustainability.

After identifying the possible contributing factors that constrain the competitiveness of the South African automotive industry, a well-structured questionnaire was developed, to answer the research question of what are the strategies and policies that can ensure the sustainability of SA automotive industry competitiveness.

The questionnaires were administered to several automotive industries in SA, and the data was later analysed using SPSS Software; the results are illustrated and interpreted below.

3.1. Results

According to the results, as presented on Table 2.2, the total number of vehicles produced in Africa in the year 2012 was 586 396 and out of that, South Africa automotive manufacturing industry produced 539, 424 vehicles which equate to 92% of total vehicles produced in Africa for that year [24]. When one looks at the figures, it might be convincing, but in reality, at the international market level, this is relatively small as it represents less than 1% in the global market share. In addition, a total of 84, 141, 209 new vehicles were produced in 2012 with a 5.3% growth rate. According to statistic from OICA [24], from the year 2010 to 2011, the South African automotive shares increased steadily from 0.61% to 0.67%, but unfortunately declined rapidly with a 0.07% drop in 2012.

Table 2.2. The Global Context performance of South Africa Automotive industry.

Year	2007	2008	2009	2010	2011	2012	%change 2011
Global vehicle production (million)	73,15	70,76	61,71	77,61	79,99	84,141	+ 5,3%
SA vehicle production (million)	0,535	0,563	0,374	0,472	0,533	0,539	+ 1,3%
SA share of global production (%)	0,73%	0,8%	0,61%	0,61%	0,67%	0,6%	- 11,7%

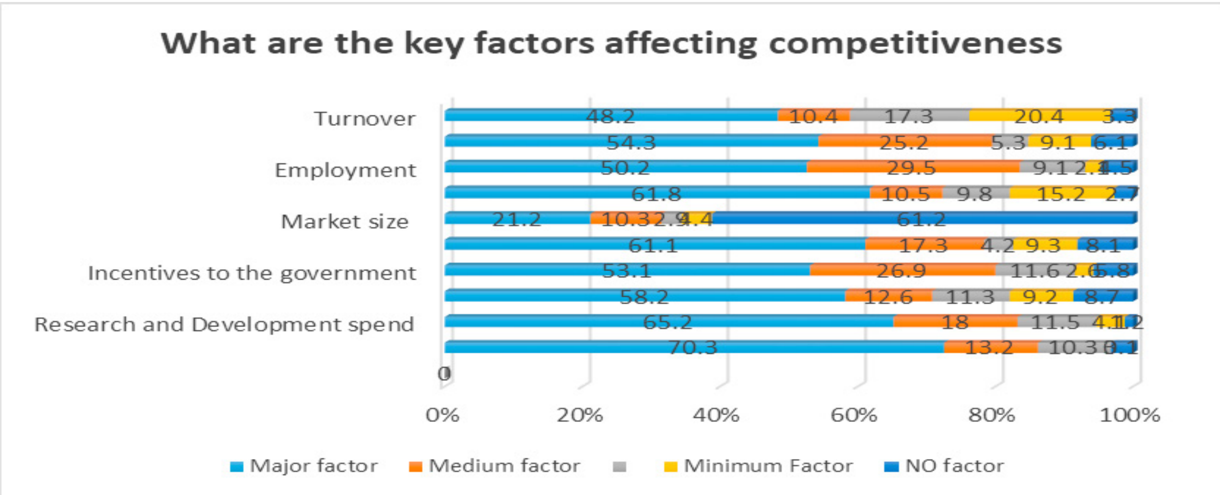
Source: OICA

A global development trend directs the global automotive industry, and satisfying the customers need or demand is of great importance. However, since the introduction of globalisation, the automotive industry has been experiencing enormous challenges induced by mergers and acquisitions, overcapacity, global manufacturing, strategies, outsourcing and insourcing, environmental requirement, innovation and technology. As a result, all of these constraints have a significant impact on emerging nations like South Africa and the survival growth of the South African (SA) automotive industry, particularly (ACMs) global competitiveness, is vital for the development of the nation [24]

3.2. Factors affecting competitiveness in South African Automotive Industry (SAAI)

From the analysis and findings of the well-structured questionnaire and SPSS Software analysis, figure 2 clearly shows that (70.3%) of respondents indicated that profitability and (65.2%) research and development are major factor impacting SAAI global competitiveness. The results further indicate a (61.8%) of technology, (61.1%) Flexibility in the value chain, (58.2%) for Skill and (53.1%) Incentives from the government as other major impacting contributing factors.

Fig. 2: The SA Automotive Industry's Competitiveness factor



Looking at the results on figure 2, there is a clear indication of a significant, positive correlation between Profitability, and research and technology (r=0.489) being factors impacting on competitiveness and productivity. The findings further indicate a significant positive correlation between Technology and Skill (r=0.453) being factors influencing competitiveness.

Table 2.3 illustrates a cross tabulation that indicates the significance between lower Tariffs, Research and development, including Profitability. These were deduced to be significant factors impacting competitiveness. Kruskal-Wallis was further used to explore this relationship which indicated a significant difference between the two variables. The Cross-tabulation between the two variables suggests that Tariffs, Research and developments, and Profitability all significantly impact the industry's competitiveness.

Table 2.3. The Global Context performance of South Africa Automotive industry

Factors	Major factor	Medium factor	Neutral	Minimum Factor	NO factor
Profitability	70.3	13.2	10.3	3 .1	3.1
Research and Development spend	65.2	18	11.5	4.1	1.2
Skills	58.2	12.6	11.3	9.2	8.7
Incentives to the government	53.1	26.9	11.6	2.6	5.8
Flexibility in the value chain	61.1	17.3	4.2	9.3	8.1
Market size	21.2	10.3	2.9	4.4	61.2
Technology	61.8	10.5	9.8	15.2	2.7
Employment	50.2	29.5	9.1	2.1	4.5
Tariffs	54.3	25.2	5.3	9.1	6.1
Turnover	48.2	10.4	17.3	20.4	3.3

3.3. The trade balance of South African automotive industry

Improving export and gaining knowledge of the global automotive industry's trade balance is critical as it helps to underpin any policy attempts of increasing the dependency of importation. Ikome et.al. [25], in a separate instance, said despite the significant increase in export of CBUs, including the automotive components, the automotive industry of South Africa has remained a net user of foreign exchange due to the product importation.

Major components, including gearboxes, engines, and electronic components, are imported. Just a few other components are locally sourced in the domestic market, limiting these industries from wholly relying on imported tools, sophisticated technological plants, global design, and machinery.

3.4. Conclusion

According to the analysis and results, it is evidence that the South African Automotive industry is a pillar of economic growth for the country, and due to the global competitive challenge, the industry's economic performance is on a decline due to severe pressure from the global market. Therefore, any improvement of its competitiveness and sustainability is of great importance.

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References

[1]. Ronkainen, and Czinkota (2007). Trends and Indications in International Business. Journal of International Marketing - J INT MARKETING.

[2]. Doole, I. and Lowe, R. (2004) International Marketing Strategy: Analysis, Development and Implementation. 4th Edition, Cengage Learning, Boston.

[3]. Czinkota, M.R and Ronkainen, IA. (2007) International Marketing. 8th ed. Ohio: SouthWestern, Thomson Learning.
[4]. Kaplinsky, R and Morris, M. (2000) A handbook for value chain research. Durban: Industrial Restructuring Project, School of Development Studies, University of Natal.
[5]. Gillespie, K., Jeannet, J, P. and Hennessey, D.H. (2004) Global marketing, an interactive approach. Boston: Mass. Houghton Mifflin.
[6]. Damoense, M.Y. and Agbola, F.W. (2009). Economic analysis of the impact of policy reforms on the South African Automobile industry. International Journal of Economic Perspectives, 3(4): pp.285-96.
[7]. Oxford Intelligence Business Analysis. (2003) Global investment strategies and location benchmarking: advanced and performance automotive engineering. Oxford. Oxford Intelligence and IBM Business Consulting Services, p 1.
[8]. Humphrey, J and Memedovic, O. (2003) The global automotive industry value chain: what prospects for upgrading by developing countries. United Nations Industrial Development Organisation (UNIDO): Vienna.
[9]. Alfaro, A.L., Bizuneh, G., Moore, R., Ueno, S., and Wang, R. (2012) Microeconomics of Competitiveness. South Africa: Automotive Cluster. Kennedy School of Government: Harvard Business School.
[10]. Fishwick, K. (2005) The role of competitive intelligence in the global automotive supply chain, 200. In: Blenkhorn, D. and Flesher, C.S (eds). Competitive intelligence and global business.
[11]. Barnes, J., and Kaplinsky, R. (2000) Globalisation and the death of the local firm? The automobile components sector in South Africa. Regional studies, 34(9), pp797-812.
[12]. Lamprecht, N. (2006) An analysis of the Motor Industry Development Programme (MIDP) as a promotional tool for the South African automotive industry in the global automotive environment. Unpublished master's dissertation, University of South Africa, Pretoria.
[13]. Automotive Component Manufacturers Association of India (ACMA). (2013) Vision 2020- Indian Auto Component Industry. New Delhi: Automotive Component Manufacturers Association of India.
[14]. Automotive Component Manufacturers Association of India (ACMA). (2012) Automotive component industry in India: Growing Capabilities and Strengths. New Delhi: Automotive Component Manufacturers Association of India.
[15]. The Automotive Industry Export Council (AIEC). (2013)
[16]. Justin Barnes & Raphael Kaplinsky (2000) Globalisation and the Death of the Local Firm? The Automobile Components Sector in South Africa, Regional Studies, 34:9, 797-812.
[17]. Julius, A B (1986) 'The development of the motor car industry in South Africa, with special reference to the first three phases of the local content programme 1 961-1976', DPhil Dissertation, Pacific Western University, California.
[18]. Duncan, D (1 997) We are Motor Men. Caithness, Scotland: Whittles Publishing.
[19]. Naude, Micheline. (2012). Supply chain challenges in the South African automotive sector: Do location, size and age matter?. South African Journal of Economic and Management Sciences. 16. 407-417. 10.4102/sajems.v16i4.411.
[20]. Naude, Micheline Juliana. (2013). Supply chain challenges in the South African automotive sector: Do location, size and age matter?. South African Journal of Economic and Management Sciences , 16(4), 407-417. Retrieved June 30, 2021, from http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2222-34362013000400004&lng=en&tlng=en.
[21]. Ikome J.M., Laseinde O.T. (2020) The Global Constrains of South African Automotive Industry and a Way Forward. In: Markopoulos E., Goonetilleke R., Ho A., Luximon Y. (eds) Advances in Creativity, Innovation, Entrepreneurship and Communication of Design. AHFE 2020. Advances in Intelligent Systems and Computing, vol 1218. Springer, Cham. https://doi.org/10.1007/978-3-030-51626-0_27
[22]. World Motor Vehicle Production. World ranking of manufacturers. Year 2013. OICA correspondent's survey.
[23]. The Automotive Industry Export Council (AIEC) .(2017)
[24]. Demonse , An analysis of the impact of the motor industry development programmer (MIDP) on the development of South Africa motor vehicle industry. Filippini, Massimo, and Lester C. Hunt. (2011) "Energy demand and energy efficiency in the OECD countries: a stochastic demand frontier approach." Energy Journal 32 (2): 59–80.
[25]. Ikome J.M., Laseinde T., Katumba M.G.K. (2021) An Empirical Review and Implication of Globalization to the South African Automotive Industry. In: Trzcielinski S., Mrugalska B., Karwowski W., Rossi E., Di Nicolantonio M. (eds) Advances in Manufacturing, Production Management and Process Control. AHFE 2021. Lecture Notes in Networks and Systems, vol 274. Springer, Cham. https://doi.org/10.1007/978-3-030-80462-6_33.