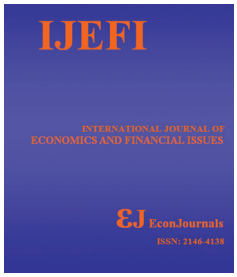

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Macroeconomic Impact of National Fresh Produce Market's Infrastructural Investment under the Local Political Environment: A case study of the Joburg Fresh Produce Market

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ABSTRACT

This study examines the macroeconomic impact of potential investments in the infrastructure of the National Fresh Produce Markets (NFPMs), with Joburg Market (JM) as a case study due to its aging infrastructure. The study utilized the Social Accounting Matrix (SAM) broad transactional database for 2025. The Conningarth Economists (2021) Gauteng Macroeconomic Impact Model (GA-MEIM) was employed to estimate the macroeconomic impacts. The results showed increases in Gross Domestic Product (GDP), capital formation, government revenue, and household income during the construction and operational phases, in millions of Rands. The Balance of Payments (BoP) impact results revealed a negative BoP across all construction scenarios, but a positive BoP during infrastructure operation. The results further showed increased job opportunities during the infrastructure's operation compared with construction. Regarding greenhouse gas (GHG) emissions, the results show that increased investment leads to higher construction-related carbon emissions than during infrastructure operations. The study recommends that the local government of Gauteng prioritize asset-based strategies and invest in market and support infrastructure to improve operational efficiency, as these measures are expected to drive economic growth. The government should also consider a technological shift in energy and incorporate renewables in its infrastructure plans to reduce carbon emissions.

Keywords: National Fresh Produce Markets, Macroeconomic Impacts, Investments, Political Environment
JEL Classification: E16, F62, H11, H54

1. INTRODUCTION

South Africa has approximately 17 major National Fresh Produce Markets (NFPMs) that trade in fruits and vegetables (Department of Agriculture, Land Reform and Rural Development [DALRRD], 2022). The JM is the largest market in South Africa and in Africa in terms of volume and revenue (Malungane and Wegerif, 2025; South African Union of Food Markets [SAUFM], 2024). Most of these markets are owned by municipalities; hence, operations occur under the uncertain cloud of local political governance (Human Science Research Council [HSRC], 1991). The markets serve as the largest public infrastructure facilities and are key marketing distribution channels for different types of farmers (Malungane and Wegerif, 2025). Their contribution ensures food security for the country (Tempia et al., 2023). The number of NFPMs decreased due to challenges associated with aging infrastructure and a municipal governance environment that does not recognize them as part of its core business mandate (Department of Agriculture, Land Reform and Rural Development, 2020). The markets are also affected by the changing world economy that uses direct contracting for procuring the produce, through its own supply chains (Malungane and Wegerif, 2025), and thereby bypassing the NFPMs. Collectively, the markets trade more than 3 million metric tons of fresh produce per annum (Department of Agriculture, Land Reform and Rural Development, 2022). Trading in fruit and

vegetable commodities is a significant business in the NFPMs, generating billions of Rands per annum.

The NFPMs generated R18.7 billion in revenue during the 2021 financial year, rising to R20.2 billion in 2022, representing an increase of R1.5 billion (Department of Agriculture, Land Reform and Rural Development, 2022). An increase in revenue, based on total volume supplied and marketed, significantly contributes to the positive spatial performance of the markets and to the South African economy's Gross Domestic Product (GDP), which was estimated at 2.4% annually in 2020 (National Treasury, 2021). In addition, the markets play a critical role in creating employment, as South Africa faces the triple challenges of unemployment, poverty, and inequality. According to Statistics South Africa (Stats SA) (2025), unemployment figures increased to 33.2% in the second quarter of 2025. Moreover, South Africa is experiencing population growth, with a population of 16 million in 1960 and approximately 62.02 million in 2022 (Statistics South Africa, 2022). Most of the indicated population needs access to affordable, nutritious, and safe fruits and vegetables, but when infrastructure is lacking, these needs may go unmet, affecting not only suppliers but also all stakeholders in the fresh produce industry.

Marketing infrastructure and support infrastructure, such as transportation, road, rail, and communication, are important assets that determine market access, overall market functioning, and spatial market integration (Goletti et al., 1995). As a result, suppliers of fresh produce may be reluctant to deliver to areas with inadequate infrastructure, as they may incur post-harvest losses. Infrastructure can be graded as "A" or regarded as world-class by international standards (South African Institution of Civil Engineering [SAICE], 2022). When this occurs, there is a high probability of increased economic activities, and markets will perform better. The best internationally built infrastructure will facilitate the flow of commodities across different market locations and reduce the transfer and transaction costs for role players, compared to infrastructure at risk of failure, which will not be able to cope with increased user demand, be on the verge of collapse, and be unfit for purpose (South African Institution of Civil Engineering, 2022). As a result, markets will not perform optimally, and stakeholders may be negatively impacted by the state of the infrastructure.

In terms of jurisdiction, the fresh produce markets fall within the local sphere of government and are therefore owned by local municipalities (Human Science Research Council, 1991). The markets are part of the municipal institutions established to promote social and economic development (Republic of South Africa [RSA], 1996). Section 156 of the Constitution sets out the powers and functions of municipalities. Section 160 (1) of the Constitution states that the Council has all the powers to make decisions concerning all functions and performance of the municipality's institutions, including, amongst others, passing of by-laws, approval of budgets, imposition of rates and taxes, and the raising of loans and other duties that it finds essential for the Municipal functionality. The local municipalities are therefore involved in the markets as administrators, owners, and designers of market by-laws and procedures, and as providers of fresh-produce infrastructure for the trading of fruits and vegetables (National Agricultural Marketing Council [NAMC], 2007).

Consequently, various governance models are used in fresh produce markets to manage them, including municipal-owned, corporatized, public-partnership, and private market models (Department of Agriculture, Land Reform and Rural Development, 2020). The government's business can be corporatized to allow more focus on the strategic functions of organizations, providing the ability to pursue service innovation, and making public service more like a private business venture (Verbeeten and Spekle, 2015). Markets such as JM have been corporatized to increase the autonomy of the public institution (Laegreid, 2013). However, it does not exonerate the market from operating outside its political governance jurisdiction under the Municipal Systems Act No. 32 of 2000 (Republic of South Africa, 2000). As a result, the market remains tied to the municipal system of operations, which somewhat hinders its growth and infrastructure development, as the municipal government still approves its plans and budgets. The markets significantly contribute to the revenue of local municipalities, which is not reinvested in NFPM infrastructure development through the 5% facilities charge (Department of Agriculture, Land Reform and Rural Development, 2020). NFPMs require a robust market infrastructure that meets international standards to ensure competitiveness in the fruits and vegetables supply chain.

1.1. Problem Statement

Fresh produce markets are important agricultural marketing outlets worldwide in the distribution of fresh fruits and vegetables (Canggat et al., 2025). Most of the South African NFPMs are on the verge of collapse due to their aging and decaying infrastructure facilities (Malungane and Wegerif, 2025), which have been constructed over the past five decades. According to the Construction Industry Development Board (CIDB) (2021), infrastructure has a useful life of 30-50 years. The outdated marketing infrastructure poses a serious challenge to industry stakeholders, such as producers who supply markets with agricultural commodities daily, by increasing the likelihood of post-harvest losses. The Competition Commission of South Africa (CCSA) (2025) further highlights other challenges NFPMs such as cleanliness, hygiene, and food safety, as well as issues with cold and ripening rooms. The issues highlighted, and the changing structures of the fresh produce marketing industry around the world, have led to direct contracts with retailers and supermarkets and the bypassing of the wholesale markets (Cadilhon et al., 2003; Epperson, 2009), hence the corresponding decrease in volume for fresh produce markets.

1.2. Purpose of the Study

The purpose of this study is to estimate the macroeconomic impacts of investing in market infrastructure, considering issues related to aging infrastructure. The objectives of the study are to (1) Display the macroeconomic impacts of constructing and operating the new infrastructure, (2) Highlight the sectoral contribution to GDP and employment, and (3) Indicate the impact of greenhouse gas emissions (GHG) from both construction and operational activities.

2. LITERATURE REVIEW

The NFPMs utilize various marketing and economic support infrastructure to trade fruits and vegetables. NFPMs account for 40-50% of growers' sales (Competition Commission of South Africa, 2025). Consequently, the agricultural marketing infrastructure affects commodity movements and prices and plays a crucial role in spatial market integration and overall market performance. According to Balineau et al. (2021), market infrastructure encompasses buildings, facilities, and equipment used to transport, consolidate, store, and trade foodstuffs. Marketing infrastructure can further include packhouses and facilities such as information and communication technology (ICT) systems. On the other hand, infrastructure is sometimes considered an asset because it generates economic and financial benefits for companies, governments, and households (International Financial Reporting Standards [IFRS], 2016). All assets and/or marketing infrastructure have an economic lifespan after which a major replacement is needed for the assets to remain productive. Infrastructure can be on the verge of collapse and unfit for purpose if it has reached the end of its economic useful life (South African Institution of Civil Engineering, 2022). The NFPM's infrastructure includes buildings. Trading halls, loading and offloading bays, storage facilities, cold rooms, ripening rooms, inspection service infrastructure, and ICT infrastructure.

Market trading buildings are important infrastructure facilities employed for trade. However, such infrastructure requires maintaining the annual maintenance norm of between 5% and 8% of total income generated (Botha, 2021) and major replacement or upgrading every 30-50 years (CIDB, 2021). Unfortunately, that appears not to have been the case, with most of the municipality's facilities falling behind and spending only 3.4% annually on infrastructure maintenance (Botha, 2021). According to Bivens (2014), maintenance projects are significantly less capital-intensive than the construction of new buildings. Although this form of investment seems affordable based on cost comparisons, challenges in budget allocations from local political authorities meant that NFPMs ended up repairing infrastructure erratically rather than conducting a thorough review to meet international standards. Moreover, municipalities, as the owners of most NFPMs, do not demonstrate a willingness to reinvest the 5% fee they charge for the facilities (Department of Agriculture, Land Reform and Rural Development, 2020). The funds have instead appeared to be used to improve service delivery, an area where the municipality has competence, rather than the operation and management of the NFPMs.

Storage and cold facilities are another infrastructure component that can guarantee a surplus of commodities for sale in markets, thereby ensuring national food security (Balineau et al., 2021). Storage and cold facilities can further mitigate price volatility, thereby strengthening spatial market integration and enhancing overall market performance. Turley and Uzsoki (2018) argue that cold storage infrastructure gives producers bargaining power and the option to decide when to trade their commodities in the markets. Cold storage facilities can extend commodity shelf life, maintain quality and freshness, leading to greater local sales, enhanced export competitiveness, and higher producers' incomes (Turley and Uzsoki, 2018). More importantly, enhanced cold storage facilities lead to less price volatility and less food insecurity (Balineau et al., 2021). Therefore, cold storage can support the economic development and growth of farming and non-farming sectors.

Most NFPMs trade in bananas and therefore require banana marketing infrastructure. According to Rodrigue (2013), bananas are the world's most consumed fruit, and they require ripening infrastructure before they can be purchased and consumed. Ripening is an important aspect of banana's commodity value addition and an excellent postharvest handling system (Mebratie et al., 2016). Accordingly, green bananas may take about 3-4 days to ripen in the marketing facilities' rooms after being treated with ethylene, making the commodity available for trade (Rodrigue, 2013). All NFPMs are supposed to have an inspection service infrastructure that ensures the commodities purchased by customers are tested and free from pesticides and other chemicals used during production and processing. According to Department of Agriculture, Land Reform and Rural Development (2021), the national government has established a legislative and regulatory framework to ensure food safety and quality assurance. The Department of Agriculture, Land Reform and Rural Development (2021) states that the JM is the only Municipal entity in South Africa with a food laboratory infrastructure for testing fruit and vegetable pesticide residue. Other markets rely on the food safety and quality assurance standards set out in the Agricultural Products Standards Act 119 of 1990, as amended, as well as on physical food inspection services conducted in the markets.

ICT infrastructure is another vital aspect that transmits sales volume and price signals. According to South African Institution of Civil Engineering (2022), businesses, markets, and households rely on ICT infrastructure to achieve their objectives. The ICT infrastructure, therefore, plays a vital role in enabling the NFPM's business operations. Without an ICT infrastructure, agricultural trade will be based on asymmetric price information. Therefore, communication technologies are not haphazard investments in the market space but are often introduced based on anticipated economic benefits (Hjort and Poulsen, 2019).

In addition to the marketing infrastructure, there are economic support infrastructures, such as the transport sector, which serves as an input for every commodity produced and marketed (Zolfaghari et al., 2020), and energy, which is required for the full operation of markets. Access to reliable electricity is crucial, as it enables the production and marketing of produce and creates employment opportunities (Lipscomb et al., 2013). All the marketing infrastructure facilities stated and discussed do not appear to support full market operations and require upgrades to meet food safety, quality, and international standards. However, all the infrastructure, facilities, and equipment mentioned require huge investments (Lipscomb et al., 2013).

3. RESEARCH METHODOLOGY

These sections describe the research methodology, including the sampling method, study area, data used, and research method.

3.1. Sampling Method

The Joburg Market (JM) was purposefully selected as a case study because it is South Africa's largest market for the trading of fruits and vegetables. According to South African Union of Food Markets (2024), the JM traded 1.36 million tons of fruits and vegetables and generated R11.3 billion in revenue. The JM is 2 times the Tshwane Market (TM), which traded approximately 0.62 million tons of fruits and vegetables and generated R4.6 million (South African Union of Food Markets, 2024). The JM is therefore an important marketing distribution channel that serves many farmers and helps ensure the nation's food security.

3.2. Study Area

The study was conducted in Johannesburg City, commonly known as Joburg, which is the largest metropolitan city in South Africa and a principal economic hub. Its strategic role within both the national and Sub-Saharan African economy is reinforced by its advanced infrastructure, concentration of corporate headquarters, and position as a gateway for regional and international trade. The JM is in the city's deep area of the Gauteng province, which was highlighted in many reports (CCSA, 2025; Agriculture South Africa (Agri SA) and Institute of Market Agents of South Africa (IMASA), 2022) as having infrastructural issues that impact the nation's food security and needing a revamp. This provided a valuable research area for estimating the macroeconomic impact of infrastructure revamping on the entire economy of Gauteng and for improving markets and livelihoods in a rapidly developing metropolitan environment.

3.3. Data Employed

To compute the macroeconomic impact of infrastructure investment in the JM and developing scenarios, the 2025 Social Accounting Matrix (SAM) economic database for the Gauteng province was used, which is a secondary data series. The SAM database extends input-output tables and records all the country's economic transactions in a square matrix for a particular year (Dadhich, 2018). The SAM database for the Gauteng province was used because it differs from those of the other provinces in structure, scale, and the level of integration of economic activities. For example, it is well known that Gauteng is the economic hub of South Africa and is dominated by finance and business services, manufacturing, trade, and logistics, while other provinces, such as Limpopo, depend on mining, and the Free State has agriculture, while the Western Cape and KwaZulu-Natal have more tourism activities. The SAM database is updated annually to reflect new input and output structures (Conningarth Economists, 2021). The SAM structure and transactional data it captures allow for the proper macroeconomic policies planning, designs of programs, and operation of the economy over time (Trinh and Toan, 2020).

3.4. Methods Employed

Investment in infrastructure is crucial for enhancing economic growth, increasing employment opportunities, and reducing inequality in South Africa (Msimango et al., 2023). This study uses the Conningarth Economists (2021) Gauteng Macroeconomic Impact Model for Gauteng (GA-MEIM) to estimate the macroeconomic impact of potential infrastructure investments in the JM across different scenarios. The GA-MEIM incorporates general equilibrium computation, the SAM database, and multipliers and/or Leontief (1986) multiplier effects. The SAM multipliers connect all industries, institutions, and households, showing how a change in one industry's investment output ripples through the entire economic system. The multipliers help measure the macroeconomic impact of an output on GDP, capital formation, employment, household income, and other economic indicators based on every R1 million invested in the economy (Quantec, 2022).

Considering these connections, direct, indirect, and induced impacts of an investment in infrastructure development can be determined. Additionally, the impact of investment can further be observed through fiscal benefits to the government and the Balance of Payments (BoP). Lastly, the GA-MEIM helps assess the environmental impact of construction and operational facilities by measuring carbon emissions. Other Macro-economic models, such as the Quantec model, could not be used in this research because they do not incorporate the environmental impact indicators. In the simplest form, the GA-MEIM with the SAM multipliers and/or Leontief (1986) multiplier effects, as indicated by the Conningarth Economists (2021), can be written as follows:

$$\Delta X = (I-A)^{-1}.\Delta F \quad (1)$$

where:

ΔX = Change in output/production/supply
I = Identity/unity matrix
A = Input-output coefficient matrix
$(I-A)^{-1}$ = Multiplier matrix (Leontief inverse)
ΔF = Change in final demand.

Equation 1 is used for the economic impact performance analysis and comprises output, final demand, and intermediate inputs (Rakhmanto et al., 2025).

3.5. Description of Variables Used in the GA-MEIM

Table 1 describes the economic and social impact variables employed by the GA-MEIM. The economic and social impact variables included in the GA-MEIM are as follows: Gross Domestic Product (GDP), employment, capital formation, household income, fiscal impact, and Balance of Payments (BoP). The GA-MEIM further includes environmental variables such as greenhouse gases (GHGs), including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (NO_2).

3.6. The GA-MEIM Used Inputs and Scenarios

Table 2 presents JM's GA-MEIM two capital investment scenarios (funding portion) that led to the model's kick-start. Scenario one is based on partial infrastructure upgrades with a capital investment of R250 million. Scenario two represents the JM's full-scale infrastructure development, with a capital investment of R550 million. The two investment scenarios consider the construction and operation of the markets and are based on the markets' total revenue and size.

The scenarios enable comparisons of macroeconomic impact results, helping policymakers, investors, and interested parties in the fresh produce industry make informed decisions.

Table 1: Economic, social, and environmental indicators used in GA-MEIM

Economic impact indicators	Unit of measurement
Gross domestic product (GDP)	GDP is measured in millions of South African Rands
Capital Formation	Measured in millions of South African Rands, invested in the economy
Employment opportunities	Measured by the number of people employed in construction and operations
Household income	Measure through the monthly income in Rands
Fiscal or government revenue	Measured in billions of South African Rands
Balance of payments (BoP)	Measured in billions of South African Rands
Greenhouse gases (GHG)	Measured in metric tons per year

Source: Author's compilations based on the GA-MEIM, 2025

Table 2: GA-MEIM's two investment model input scenarios for the Joburg Market

Project information	Scenario 1 Value and/ Percentage	Scenario 2 Value and/ Percentage
Trade sector's standard industrial classification (SIC) number	52	52
Funding portion (R million)	250	550
Investment in new assets (%) by JM	100	100
Investment in new assets (R million)	250	550
Operational years (numbers)	20	20
Project base year	2025	2025
Project construction period (years)	3	3

Source: Author computation based on Conningarth Economists, GA-MEIM, 2025

4. RESULTS OF THE STUDY

4.1. Macroeconomic Impacts of JM's Investment during the Construction Phase

The macroeconomic impacts resulting from the construction of JM infrastructure indicate that the Gauteng economy will have a total GDP of R114 million under scenario one and R251 million under scenario two, using 2025 as the base year, as indicated in Table 3. The investment is expected to result in positive capital formation, estimated at R267 million under scenario one and R587 million under scenario two. Consequently, a total of 381 jobs under scenario one and 838 under scenario two will be created during construction, benefiting mostly skilled workers. The households' income is estimated at R79 million in scenario one and R175 million under scenario two for the entire Gauteng economy, benefiting mostly the high-income group. The government will collect R30 million in fiscal revenue under scenario one and R65 million under scenario two. The Balance of Payments (BoP) was found to have a negative balance of R32 million and R70 million, observing both scenarios. The negative BoPs arise from net imports of materials and associated equipment during the project's construction phase.

4.2. Direct, Indirect and Induced Construction Impacts – Scenario Two

Table 4 shows direct, indirect, and induced construction impacts of investment at the JM under scenario two as an example. The

Table 3: Macroeconomic construction impact scenarios at 2025 prices for Gauteng

Economic and social impact indicators	Scenario 1's R250 million total macroeconomic construction impact	Scenario 2's R550 million total macroeconomic construction impact
GDP (R million)	114	251
Capital formation (R million)	267	587
Employment (Numbers)	381	838
Skilled workers	143	315
Semi-skilled workers	137	302
Unskilled workers	100	221
Household income (R million)	79	175
Low-income	11	25
Medium income	8	18
High-income	60	132
Fiscal impact (R million)	30	65
National government	22	48
Provincial government	9	17
Balance of payments (BoP) (R million)	−32	-70

Source: Author's computation based on Conningarth Economists, GA-MEIM, 2025

results show that the total contribution to GDP will come from the direct impact of R158 million and the induced impact of R50 million. More capital formation will emanate from the induced impact of R293 million and from the induced investment impact of R156 million. Most employment will come from indirect impacts, with 356 people employed, followed by direct impact jobs for 325 workers.

4.3. Macroeconomic Impacts of JM's Investment during the Operational Phase

The macroeconomic impacts resulting from the operation of JM infrastructure indicate that the Gauteng economy will have a total GDP of R584 million under scenario one and R1,284 million under scenario two, using 2025 as the base year, as indicated in Table 5. The investment is expected to result in positive capital formation of R877 million under scenario one and R1,929 million under scenario two. Consequently, a total of 2,324 jobs under scenario one and 5,113 under scenario two will be created during operation, benefiting mostly unskilled workers in both scenarios. The households' income is estimated at R433 million in scenario one and R953 million in scenario two for the entire Gauteng economy, benefiting mostly the high-income group. The government will collect R186 million in fiscal revenue under scenario one and R409 million under scenario two. The Balance of Payments (BoP) is estimated to be positive at R557 million and R1,225 million, respectively.

4.4. Direct, Indirect, and Induced Operational Impacts - Scenario Two

Table 6 shows direct, indirect, and induced operational impacts of investment at the JM under scenario two as an example. Further analysis shows that the total contribution to GDP will come from direct impacts of R832 million and induced impacts of R273 million per annum. More capital formation will result from the induced impact of R851 million and the direct impact

Table 4: Macroeconomic construction impact at 2025 prices for Gauteng -scenario two

Economic and social impact indicators	Direct impacts	Indirect impacts	Induced impacts	Total impact
GDP (R million)	158	43	50	251
Capital formation (R million)	139	293	156	587
Employment (Numbers)	325	356	157	838
Skilled workers	90	161	65	315
Semi-skilled workers	130	117	54	302
Unskilled workers	105	77	39	221

Source: Author's computation based on conningarth economists, GA-MEIM, 2025

Table 5: Macroeconomic operational impact scenarios at 2025 prices for the Gauteng economy

Economic and social impact indicators	Scenario 1's R250 million total macroeconomic operational impact	Scenario 2's R550 million total macroeconomic operational impact
GDP (R million)	584	1,284
Capital formation (R million)	877	1,929
Employment (Numbers)	2,324	5,113
Skilled workers	517	1,137
Semi-skilled workers	787	1,732
Unskilled workers	1,020	2 245
Household income (R million)	433	953
Low-income	63	139
Medium-income	47	103
High-income	323	712
Fiscal impact (R million)	186	409
National government	145	318
Local government	39	86
Balance of payments (BoP) (R million)	557	1,225

Source: Author's computation based on Conningarth Economists GA- MEIM, 2025

of R550 million in investment. Regarding employment, more jobs will be for unskilled workers (1,878 jobs) and semi-skilled workers (1,238 jobs).

4.5. Sectoral Operational Investment Impacts on GDP

Table 7 presents the sectoral operational impact results of the JM infrastructure investment on the Gauteng economy, focusing on the GDP. The results show that the trade and accommodation sector will contribute R410 million under scenario one and R902 million under scenario two. Financial and business services are to contribute R100 million and R219 million under scenario two. The agricultural sector is expected to contribute very little to the Gauteng economy. This is because the sector provides inputs to other sectors of the economy, allowing them to thrive; hence, its productivity is often lower than that of other sectors.

4.6. Sectoral Operational Investment Impacts on Employment

Table 8 presents the sectoral operational macroeconomic impact results of the JM infrastructure on the Gauteng economy, with a focus on employment. The results show that trade and accommodation will create 1,181 jobs under scenario one and 3,983 under scenario two, each representing about 78% of the total. This is followed by financial and business services, with 276 jobs under scenario one and 606 job opportunities under scenario two, each representing about 12% of the total. The agricultural sector will create very few jobs.

4.7. Construction Phase Impacts and GHG Emissions Results - Scenario One

Table 9 presents the construction-phase impact results for a R250 million investment, with a focus on GHG emissions. The results indicate that a total of 6,052 tons of carbon will be emitted into the atmosphere and environment. The total impacts of methane and nitrous oxide will be 394 tons and 108 tons, respectively. Most of the carbon emissions will be from the direct impacts of JM infrastructure development. As a result, the total carbon equivalent (CO_2e) will be 6,553 tons. These computed figures appear high and may significantly contribute to global warming and climate change, thereby increasing risks to the climate and the environment.

Further investments of R550 million in infrastructure construction indicate that 14,418 tons of CO_2e will be emitted into the atmosphere and environment. This implies that carbon emissions increase with higher investment, prompting investors and the government to reconsider material use in the construction of large infrastructure.

4.8. Operations Phase Impacts and GHG Emissions - Scenario One

Table 10 presents the operational-phase impact results for an R250 million investment, with a focus on GHG emissions. The results indicate that a total of 2,861 tons of carbon will be emitted into the atmosphere and environment. Most of the carbon emissions will come from induced impacts of JM's infrastructure development, totaling 2,031 tons. The total CO_2e will be 4,039 tons. These computed GHG figures do not appear to be high and may contribute less to global warming and climate change.

The R550 million investment in scenario two indicates that the infrastructure's operation will emit a total of 8,885 tons of CO_2e into the atmosphere and the environment. This implies that the carbon equivalent increases with higher investment, prompting investors and the government to reconsider a shift to technologies that enable facilities to operate at lower energy costs.

Table 6: Macroeconomic operational impacts at 2025 prices -scenario two

Economic and social impact indicators	Direct impact	Indirect impact	Induced impact	Total impact
GDP (R million)	832	180	273	1,284
Capital formation (R million)	550	528	851	1,929
Employment (Numbers)	3,675	582	857	5,113
Skilled workers	558	226	352	1,137
Semi-skilled workers	1,239	199	294	1,732
Unskilled workers	1,878	156	211	2,245

Source: Author's computation based on Conningarth Economists, GA-MEIM, 2025

Table 7: Aggregated the main sector's operational impact scenarios on GDP

Sectors	Scenario 1: R250 million total operational impact on GDP	Scenario 2: R550 million total operational impact on GDP
Agriculture	1	2
Manufacturing	29	64
Electricity and water	11	25
Construction	2	5
Trade and accommodation	410	902
Transport, storage and communication	27	59
Financial and business services	100	219
Community services	4	8
Total	584	1284

Source: Author's computation based on Conningarth Economists GA-MEIM, 2025

Table 8: Aggregated the main sector's operational impact scenarios on employment

Sectors	Scenario 1: R250 million total operational impact on employment numbers	Scenario 2: R550 million total operational impact on employment numbers
Agriculture	3	6
Manufacturing	82	181
Electricity and water	9	20
Construction	14	30
Trade and accommodation	1,811	3,983
Transport, storage and communication	63	139
Financial and business services	276	606
Community services	67	147
Total	2,324	5,113

Source: Authors' computation based on Conningarth Economists, GA-MEIM, 2025

Table 9: Construction impacts results and GHG emissions in tons - scenario one

Greenhouse gases	Direct impact	Indirect impact	Induced impact	Total impact
Carbon dioxide (CO_2)	4932	749	371	6052
Methane (CH_4)	5	259	129	393
Nitrous oxide (N_2O)	34	4	70	108
Total (CO_2e)	4971	1012	570	6553

Source: Author computation based on Conningarth Economists GA-MEIM, 2025

Table 10: Operational impact and GHG emissions in tons - scenario one

Greenhouse gas	Direct impact	Indirect impact	Induced impact	Total impact
Carbon dioxide (CO_2)	106	724	2031	2861
Methane (CH_4)	0	69	708	777
Nitrous oxide (N_2O)	0	20	381	401
Total (CO_2e)	106	813	3120	4039

Source: Author computation based on Conningarth Economists GA-MEIM, 2025

5. DISCUSSIONS, CONCLUSION, AND RECOMMENDATION

This study estimated the macroeconomic impact of potential infrastructure investments in the National Fresh Produce Market, with JM as the case study. The intention was to determine the macroeconomic impacts of injecting capital into the JM infrastructure across the entire Gauteng economy, given the market's aging infrastructure. The study utilized Conningarth Economists (2021) Gauteng Macroeconomic Impact Model (GA-MEIM), which utilizes multipliers and the Social Accounting Matrix (SAM) database.

The macroeconomic impact results showed increases in Gross Domestic Product (GDP), capital formation, fiscal revenue, and household income during both the construction and operational phases of the infrastructure, in millions of Rands across all developed scenarios. These results suggest that the Gauteng economy will be positively ignited, as the GDP will be 5.1 times higher during the operational phase than during the construction phase, helping not only the national province to grow but also contributing to the growth of the South African economy's GDP. The results of this study align with those of Mosenogi (2016), who found that capital spending in the construction sector had a significant positive impact on South African GDP. Regarding capital formation, the results reveal a value 3.2 times higher during facility operations than during the construction phase. The fiscal impact across all scenarios was found to be 6.2 times greater during operations than during construction, indicating increased tax revenue when the facilities are in use, which is a positive sign for governments' or investors' returns.

The households will earn more income during project operations, which is 5.4 times higher in the project operation phase than during the construction phase across all scenarios. Additionally, the income received by households seems to benefit high-income

earners the most, followed by lower and middle-income earners. The result of this study again aligns with Mosenogi's (2016) findings, which established that households receive more income from the construction sector, with middle-income households receiving more. The Balance of Payments (BoP) impact results revealed a negative BoP across all construction scenarios, but a positive BoP during infrastructure operation. This is because the construction sector relies heavily on imported materials, including machinery, and, to some extent, on the expertise required. The negative BoP in the construction industry is linked to delayed payment systems, which may worsen contractors' liquidity and lead to project delays and higher construction costs.

The results further showed that job opportunities were 6.1 times higher during infrastructure operations than during the construction phase. Detailed analysis of employment revealed that more job opportunities will come from indirect-impact jobs, followed by direct-impact jobs, across all investment scenarios. Regarding GHG emissions, the results show higher carbon emissions during construction, arising from the direct impacts of infrastructure, and lower emissions during infrastructure operations. Increased investment resulted in higher CO2e emissions into the atmosphere and the environment, as seen in scenario two. The result of the study aligns with the Intergovernmental Panel on Climate Change (IPCC) (2022) study, which found that emissions from building operations were small compared with other sectors. The study recommends that the local government of Gauteng prioritize asset-based strategies and long-term financing tools to improve operational efficiency by investing in markets and supporting infrastructure, as these lead to increased GDP during project operations. The government should promote local manufacturing of construction inputs, such as cement, steel, and aggregates, through tax incentives to reduce reliance on imports. The local government should consider incorporating renewables into its infrastructure development plans to reduce carbon emissions.

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