Supply Chain Performance Measurement Framework For State-Owned Entities in South Africa

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Abstract **- State-Owned Entities in South Africa remain the major contributor toward socio-economic objectives, the bottom line, quality, value creation and cost savings. Although the National Treasury's Office of the Chief Procurement Officer monitors and evaluates supply chain performance, there is inefficient guidance on executing supply chain performance measurements in state-owned entities. Therefore, this paper aims to suggest a supply chain performance framework suitable for State-Owned Entities in South Africa. The manuscript employs a theoretical literature review on supply chain performance measurement systems and associated metrics. Further study using mixed methods or qualitative research is recommended to understand better the connection between supply chain strategy, SCM regulatory frameworks, SCM practices, and SCM effectiveness. The paper presents a framework that adequately implements supply chain performance measurement in state-owned entities. The study's main limitation was that it was restricted to SOEs registered with the SOEPF; more extraordinary samples from various SOEs would have been ideal. It is recommended that supply chain managers in state-owned entities carefully select supply chain performance measures.**

Keywords: *Supply Chain Management; supply chain performance measures; balanced scorecard; state-owned entities*

1. Introduction

In affluent and developing nations, SCM frameworks have an uncomfortable relationship between public expectations of legislative oversight and effectiveness and quality in the resource management [1]. It became apparent to many SOEs (State-Owned Enterprises) that measuring their performance is necessary to attain an efficient and productive Supply Chain [2]. Shoddy work, incomplete or non-delivery of required goods and services, poor quality goods and services, corrupt practices, incompetence, and political interference and influence still plague SOE procurement [3]. Adopting upgraded SCM techniques in this field could considerably deal with these issues, especially performance.

With the end of apartheid in 1994, public procurement processes in South Africa underwent a significant transformation based on fairness and equity [4]. According to the Public Sector Supply Chain Management Review, the government of South Africa is the biggest consumer of services, products, and construction work [5]. As a basis, its Supply Chain Management policies and legal environment should be clear and straightforward to ensure that the services required and provided are of excellent calibre, reliable, and financially viable [6].

The Constitution authorises state organs (such as departments of government and public enterprises) to develop a preferred procurement strategy that advances those previously disadvantaged by unjust discrimination [7]. For the policy to be enacted, section 217(3) requires legislation to provide a framework and plan for its implementation [8]. Thus, the Preferential Procurement Policy Framework Act 5 of 2000 (PPPFA) and the rules promulgated under it in provide standards for black economic empowerment (BEE) considerations in state bids [9].

International Journal of Supply Chain Management
IJSCM, ISSN: 2050-7399 (Online), 2051-3771 (Print)

Ref [10] further identified that the following are among some of the difficulties encountered in South African SOE procurement:

- Inadequate bidding committees: Failure to pursue competitive quotation and bid processes;
- Improper application of the most recent specified preference points system;
- Unqualified suppliers are used, and even if they do qualify, they are not taxed compliant;
- Incorrect procurement processes in respect of proposal limitations and competitive bidding; and

Little incentive to divert from Supply Chain Management processes.

Some of these shortcomings stem from employees' inability to interpret and apply the Supply Chain Management regulations [4], which exacerbated inadequate policy implementation and operational flaws in the Institutional Supply Chain Management governance [11]. The untrained may well be chastised, but it needs to be highlighted that Supply Chain Management actions are undertaken within a rigorous and decentralised legal framework [2]. The procedure makes it nearly impossible to perceive every one of the protocols and the norms of legislation and policies.

Supply chain performance (SCP) plays a significant role in South African (SA) State-Owned Entities (SOEs) value chain [12], [13] and [14]. However, many performance challenges are facing SOEs. The service delivery challenges require approaches that allow SOEs to attain efficiencies,

And continuous improvement in their SCM [15]. Ref [16] affirms that a well-performing Supply Chain is critical for achieving the strategic objectives and goals of government institutions; as a result, SCP is embedded in the SA Supply Chain Management (SCM) framework [15]. In their works, [17], [18], [19], [20] and [21] recognised SCP measurement as an essential element for the improvement of organisational performance.

SCP measurement will assist SOEs to drive the implementation of government transformational and corporate strategies through a systematic approach to monitoring and evaluating SCM activities [22]. Appropriate SCP measures ensure that SCM Managers allocate resources effectively in critical areas to meet the customers' needs ([20]. Ref [23] asserts that SCP measures drive performance SCM's involvement towards excellence. SCP measures must be designed to provide information about supply chain management's value and achievements to the internal customer groups and external stakeholders [24]. Although a performance measurement system exists in SOEs, there is no evidence that the SCM unit adequately implements such a system. According to [25], SCP measures in SOEs lack SCM insight. Also, the supply chain achievements in SOEs are not sufficiently reported by [16].

SCP in SOEs manifests through adverse audit findings, non-compliance to government policies and regulations, corruption, irregularities, and media report [26]. The negative feedback on SCM has tarnished SCM's credibility over the years, especially in SOEs. Proper SCP measurement will ensure efficiency and effectiveness in SCM and allow for adequate reporting on successes and value created by SCM in SOEs. While there are limited studies on SCP measures in SOEs, this paper extends the study conducted by ([27]. The report recommends that supply chain managers in SOEs carefully select SCP measures aligned to their organisation's strategic goals to improve the service delivery [28]. The paper contributes to the body of knowledge on SCP measurement, particularly SOEs in South Africa. The remaining sections of the document present a background review of supply chain management and performance management systems, a discussion of supply chain performance measures from a SOEs perspective, and a framework for linking supply chain performance with the balanced scorecard.

Many countries' economies rely primarily on state-owned enterprises (SOEs), and they are traditionally regarded as being responsible for enhancing social benefits [29]. In the last quarter-century, China's economy experienced substantial transformation. Many state-owned enterprises (SOEs) have had their profitable functionalities privatised and listed on the stock exchange [30].

To be accountable to the public, State-Owned Enterprises (SOEs) should establish effective governance practices that earn value. [32]. New management practices must be used in marketing, design, engineering, production, finance, accounting, and human resources if the global

economy remains competitive [33]. Implementing the governance framework and effective control processes that empower the governing bodies to carry out their fiduciary responsibilities proficiently and provide strategic vision, governance approval, scrutiny, and accountability was amplified by incorporating King IV SOE's supplement [34].

2. Literature review

2.1 Background

In South Africa, illicit procurement process exploitation is a significant cause of inefficiencies incurred by the public sector, restricting economic growth and compromising service delivery in the state-owned enterprises (SOEs) [35]. SOEs have inadequate risk management systems, exposing them to political influence and perpetuating procurement process transgressions. SCM performance management is supposed to address these constraints because, in most industries, it is pursuing its objectives - examining efficiency in segregation, without inquiring if that effectiveness substantially benefits the corporation in achieving its strategic objectives [36].

Political clout within SOEs is the primary factor linked to compromised risk management systems [37]. Regardless of the change to improve greater transparency and accountability, South African SOEs continue to face significant infringement with procurement standards and procedures [38].

In a study conducted by Ref [39] based on interviews with different participants in the various SOEs in the Gauteng area on the following topics, SOEs who do not use an integrated approach to performance management face a variety of issues that undermine overall performance. This shows that an integrated framework will have a challenge.

Table 1: Performance constraints

CONSTRAINTS	POSSIBLE SOLUTION
There are many intricate reports	What decision-makers ultimately need is a consistent interpretation of events and trustworthy dada that is handled systematically across the enterprise. Transparent, consistent, and timely reporting was considered a privilege
Measures of esoteric performance	The balanced scorecard is an effective and standard method for performance measurement. Regrettably, many organisations create balanced scorecards focused primarily on a few high-efficiency variables that are conceptual and distant from day-to-day procedures.
Plans and budgets that are unrealistic	Every business goes with the flow of budget management, but the outcome rarely bears little relationship to what people truly intend to happen after all the iterations, consolidation, and fudging
Incentive programs that do not drive behaviour	Designing metrics that are directly related to the work people do every day - and tying them to meaningful incentives - is the secret to success

Source: [39]

A complete performance management system is proposed to address the constraints discussed above. Public procurement in a developing economy, such as South Africa, should minimise poverty by stimulating sustainable development [40]. Businesses adopting a sustainable strategic plan commonly employ small senior managers to identify their goals through a meticulous planning [41]. These teams generally start with a thorough analysis of their sector, markets, clientele, products and services, opponents, and internal resources and capabilities. Operational management acquires a comprehensive vision of what success implies and how it will be monitored [42]. Eventually, everyone appreciates their priorities and is liable for accomplishing them.

Once the strategic priorities and plan have been established, it is essential to have the appropriate performance analytical framework to identify if the targets are being achieved on schedule and with the resources assigned to [22]. Incorporating quality management is significant in the public sector

because failure to respond to risks adequately potentially contributes to a crisis in accomplishing long-term targets [11]. Performance evaluation in best-practice firms is typically limited and restricted, with clearly defined objectives.

SOEs concentrate almost exclusively on financial measures. Meanwhile, this approach results in a one-dimensional perspective [43]. Public officials already receive compensation as a reward for the activities they provide to SOEs; there is no need to be reimbursed for executing a role for which they were employed [44]. To minimise these expenditures, the government must participate in skill enhancement and training of public personnel.

The government's ownership of SOEs generates specific challenges in the SOE regulatory system [45]. SOEs report to those in charge of governance (the board of directors), who reports to the Minister of Public Enterprises, who reports to the Cabinet, and who say to Parliament [38].

SOEs transitioned from a rule-based procurement system to an SCM-based procurement system to manage public procurement and address fundamental best practices such as a need for cost efficiency [46]. The introduction of central tender boards limited management sovereignty and, therefore, distorted areas of accountability by eliminating essential powers from the authority of administrative heads [47]. The contrary is achieved through decentralised SOE SCM procurement regimes.

Following this logic, Minister Gordhan announced the creation of the Office of the Chief Procurement Officer in his February 2012 Budget Speech (OCPO). The OCPO was founded on a concept of informational modernism, with information and communication technology implemented alongside cutting-edge procurement practices to secure procedural integrity and efficiency [48]. The OCPO has been developing a new centre-led approach, which includes a central supplier database and e-tender portal allowing foremost suppliers' registration and information dissemination [49]. As transversal contracting signs of progress to establishing framework contracts and e-procurement services, the OCPO sees this as the earliest stepping stone toward a government-to-government electronic commerce platform [50]. Legally, this entails greater authority to centralise procurement process phases.

Therefore, the following sections focus on supply chain management in SOEs, the supply chain performance measurement systems, followed by discussions on selected SCP measures.

2.2 Understanding supply chain management from a SOEs perspective

An efficient SCM assists organisations to obtain goods and services at the right place, quantity, the right price, and good qualities in the correct position [16]. Organisations design SCM strategies to help them achieve value and improve operational efficiency [51]. In the 2016/17 financial year, the SA public sector procurement spent on goods and services was over R938 billion, contributing approximately 29 per cent of SA's gross domestic product (GDP) [52]. Given the high procurement spent, public sector SCM is used as a vehicle to advance the socio-economic imperatives of the country [53].

The National Treasury continues to strengthen the SCM systems at all levels of government, including SOEs, to ensure that every cent spent can be accounted for. Therefore, the SCM in SOEs is based on the National Treasury SCM framework, policies, regulations, and guidelines issued from time to time. However, when it comes to performance measurement, the National Treasury does not impose a particular measurement system on the SOEs; they support the use of reputable performance measurement tools and have considered them in developing the performance information guidelines [16], hence the choice of BSC for this study. The following section provides an overview of SCP measurement systems.

2.3 Supply Chain Performance Measurement Systems

Performance measurement quantifies the strategic objectives into operational plans and, consequently, day-to-day activities [54]. It simplifies what the organisation wants to achieve into a language that every employee would understand. The performance measures are the key focus areas, while the metrics are a detailed list of critical activities to be measured with weights [55]. The SCP measurement systems are tools organisations utilise to track performance against set targets [56].

Various methods are used to measure SCM performance includes amongst others, the Activity-Based Costing (ABC) [57], the Economic Value Analysis (EVA), Logistics scorecard, total quality management (TQM) [58], the supply chain operations reference model (SCOR) ([59]) and the balanced scorecard (BSC). Historically, most performance measurement systems such as the ABC and EVA only focused on cost financial measures such as profits margins, return on investment, cash-to-cash cycle, and customer profitability [60] and [61]. It might explain a lack of attention to strategic alignment in the SOEs [62]. Currently, most SOEs in South Africa use the BSC to measure their Procurement performance [61].

The balanced scorecard was developed in the early 1990s by Robert Kaplan and David Norton of Harvard Business School [63]. According to [64] and [65]), a BSC enables organisations to translate their strategic vision into measurable actions, thereby providing a balanced approach toward performance measurement and evaluation. BSC views the organisation from the following four perspectives,

- ***Customer perspectives:*** *A customer is the most crucial stakeholder in any organisation. The customers' measures focus on providing excellent customer service and ensuring that the customers' needs are sufficiently met and satisfied.*

- ***Financial perspectives:*** *The financial measures indicate whether the organisational strategies and plans contribute to the triple-bottom-line, return on investment, cost reduction and profitability.*

- ***Internal business processes:*** *These measures focus on the organisation's interior areas to achieve efficiency. Providing good quality, reducing cycle time, and improving response time are essential aspects of internal business processes.*

- ***Learning and Growth:*** *Focuses on human capital management, information technology and organisation's policies and procedures. Human capital is an essential asset of organisations. Investment in human capital, training and development is critical for organisational success.*

The application of BSC to SCM is not new; various studies [66] conducted in this area but not in the South African Public sector context. According to [67], BSC can be successfully implemented in SCM. The implementation guidelines are aligned with the Government reporting frameworks and with the SOE's corporate plans, appropriate metrics are selected or designed, and implementation gaps are addressed. [63] asserts that the BSC provides a balanced approach to measuring performance. However, it is unclear whether the SOE's Procurement measures are designed to implement the strategy and its plans. Therefore, the following section provides an overview of crucial SCP measures suitable for the public sector.

2.4 Theories supporting supply chain performance measures and metrics

SCP measures should constantly be benchmarked to align with best practices [68]. There are numerous studies conducted on SCP measures [69], [70] and [71]. According to [70] and [71], many SCP measures that are found today were identified through the Pittiglio Rabin Todd and McGrath (PRTM's) annual surveys conducted in the early 1990s of which the third survey identified even more measures. Ref [71] grouped the SCM measures into four (4) categories, delivery performance, flexibility and responsiveness, logistics costs, and asset management. Ref [71] further assigns the measures into business processes: plan, source, make, deliver, and overall business processes. In developing the framework, Ref [71] recognises the customer, shareholders and internal stakeholders as the crucial players in SCM. In 1999 Benita M. Beamon set a framework for selecting performance measurement systems for the manufacturing supply chains [72]. The framework grouped the SCM performance measures into Resources (R), Output (O) and Flexibility (F) [72. The framework was based on the fundamental principle that the desired output of any organisation will require the use of efficient resources. The framework ensures that the measures are aligned with the organisation's strategic goals [72]. The disadvantage of Beamon's framework is that although it considers the different elements of SCM, it does not package the measures into various echelons of SCM structures.

Ref [73] acknowledge that Gunasekaran et al. developed an SCM framework better to understand the importance of SCM performance measures and metrics. The framework classifies the performance measures into the three echelons of management: strategic, tactical, and operations. Furthermore, Gunasekeran et al. operated because performance is measured differently at the different levels of the organisation. At a strategic group of SCM, the expectation is that the performance measures must be at a high level and be directly aligned with the strategic goals of the organisation [74]. The SCM measures are cascaded down to the tactical and operational levels. Ref [73] mentions the discussion of Gunasekaran et al. that SCM performance measures in planning, source, make and delivery based on the manufacturing environment background. SCM performance measures cannot be developed in a silo but require input from various supply chain participants. The Gunasekaran et al. framework is internally focused and does not integrate the measures concerning the organisation, suppliers and customers[73].

This article also reviewed the framework developed by Cai et al. (2009), which systematically improves SCM performance indicators. According to [73], Cai et al.'s (2009) framework determines the relationship between KPIs, evaluates the costs associated with accomplishing each performance measure, and identifies the gaps in standards. The framework focus on evaluating measures and continuous improvement. The framework is not designed to be able to adjust to change. If one of the measures changes, other measures' impact would not be the same as before. Therefore, applying the same criteria in a changing environment will not yield relevant results. The framework also works properly in an environment where SCM is already fully functional. In evaluating the current challenges and criticisms facing public sector SCM, it is imperative to understand that SCM operates in a dynamic environment and that many factors impact SCM performance internally within an organisation (dependency on internal partners) and externally (dependence on suppliers, customers, legislations, economic risks) [75].

The SCM performance measures were carefully selected, considering the environment in which they will be applied, especially considering that not all SCM measures in literature can be used in SOEs. The selection of SCM measures considered the approach introduced by Gunasekaran. Ref [54] identified a gap in SCM performance measures. SOE SCM scorecards did not include cost savings, quality, on-time delivery, and efficiency measures. Ref [76]) extended SCM performance measures scope to include (1) cost measures, (2) compliance to policies and regulations, (3) risk measures, (4) reporting, (5) time, (6) quality measures, (7) socio-economic measures and (8) inventory management and (9) staff management for the SOEs environment. The identified SCM performance measures consist of financial and non-financial metrics [55]. The table below presents the various positions on supply chain performance measures.

Table 2 Summary of SCP measures

Authors	Position on SCP measures
[19]	The SCM measures were grouped into four (4) categories: delivery performance, flexibility and responsiveness, logistics costs, and asset management.
[64]	categorised supply chain performance measures which are into resources, output and flexibility.
[74]	classifies the supply chain performance measures into the three echelons of management: strategic, tactical, and operations.
[55]	identified a gap that existed in SCM performance measures, which is that criteria such as cost savings, quality, on-time delivery, and efficiency mainly were not included in SOE SCM scorecards
[77]	extended SCM performance measures scope to include (1) cost measures, (2) compliance to policies and regulations, (3) risk measures, (4) reporting, (5) time, (6) quality measures and (7) benchmarking

Source: [76]

Therefore, as indicated in table 2, organisations have no clear and unique supply chain performance measures. In this paper, we expatiate on the already identified SCP measures for SOEs (Setino, 2018) and further incorporated an additional three (3), which are socio-economic measures, inventory management and SCM staff management and provide 44 good metrics that can be applied. The nine dimensions of SCM performance measures considered for this paper are discussed in section 2.4 and aligned to the balanced scorecard framework.

2.5 Discussion on supply chain performance measures and metrics from a SOEs perspective

This section discusses the nine identified measures concerning the South African SOEs.

In general, SOEs are established to accomplish specific objectives, which tend to be associated with providing efficient and appropriate public services to promote economic growth and development. The Department of Public Enterprises in South Africa is the government's shareholder representative, monitoring jurisdiction for state-owned enterprises in vital sectors [14]. Some industries are not directly managed by the Department of Public Enterprises but rather by several other institutions [78]. The vision of the Department of Public Enterprises (DPE) is to drive investment, productivity and transformation in its portfolio of State-Owned Enterprises (SOEs), their customers and suppliers to unlock growth, drive industrialisation, create jobs and enhance skills [79]. The article briefly discusses two SOEs for enhancing SCM's coherence, namely Eskom and Transnet.

Electrical energy is considered a valuable resource of energy that is required to fulfil the demand for current electricity generation services for a country's political and social well-being, reliability, and financial growth [80]. South Africa is widely recognised as Africa's most significant producer and user of electrical energy. Eskom received R31.7 billion from the National Treasury in 2021/22 and R56 billion in 2020/21, subject to conformity with the Special Appropriation Act of 2019. Coal accounts for over 70% of the primary energy generation, and over 90% of electrical energy is generated by coal-fired power plants [81]. Because of economic factors, the electrical energy source has been under increased strain. The rapidly growing load demand poses a risk of stability challenges; Eskom and South Africa are not immune from such risks.

Until 2007, Eskom employed a decentralised procurement system in which procurement options were made at the functional level, culminating in dispersed and expensive procurement, compared to a centralised system in which procurement choices are taken throughout one place [82]. Eskom views supplier development as reaching SD&L objectives, including industrialisation, localisation, employment generation, and skills enhancement [83]. The holistic awareness of the SCM framework provides opportunities for increased electrical energy consumption and availability.

Transnet is a significant South African rail, port, and pipeline business with headquarters in Johannesburg. It became a limited corporation on April 1, 1990, [84], with R61 billion in revenues in 2015. It has been refurbishing rolling inventory (wagons) for many years but has recently undertaken a commercial venture, locomotive fabrication, under which it is accumulating competencies to become competitive. According to the DTI, government purchasing power through public procurement contributed between 15% and 25% of GDP in 2016 [85].

Transnet Engineering's and Bombardier's initiatives to produce locomotives in their factories have encountered difficulties, causing congestion and severe effects for suppliers incurring production and working capital constraints [86]. Transnet's general freight business division published a tender in July 2012 for a significantly larger acquisition of 1064 locomotives: 599 dual-voltage electric locomotives and 465 diesel locomotives [87]. The tenders for these locomotives were supposed to finish in October 2012, but they were prolonged until February 28, 2013, [85]. It is conceivable that this was attributable to the fact that the National Treasury and Transnet were hashing out the provisions of the country's Competitive Supplier Development Programme (CSDP) [84].

In some instances, both SOEs offer capabilities that can benefit the entire value chain but, on the other hand, can be harmful to the fiscus and the public's interests. Scholars who study these discussions can examine this in more detail.

2.5.1 Cost measures

Cost-effectiveness in the SCM context refers to the value for money achieved and, to a significant extent, avoiding unnecessary costs incurred in the supply chain [88]. The cost measures focus on extracting value from the purchasing process for the benefit of the Citizenry by maintaining a balance between the bidding administrative costs, compliance costs, premium and the value of the goods being procured [88], [89] and [16]. Cost measures, therefore, require an SCM practitioner to evaluate the efficiency and effectiveness of SCM spending and further attempt to assess the efficient deployment of financial resources, focusing on reducing costs, cost avoidance, cost containment and savings ([90]. The following exemplary metrics of cost measures can be considered; cost savings achieved against a target, cost avoidance percentage, cost avoidance percentage, cost changes/variation orders percentage, contract variations percentage and inventory actuals versus targets percentage.

2.5.2 Compliance measures

Compliance with Government SCM policies and regulations is crucial for achieving good governance and socio-economic imperatives [84], [91]. Compliance failures sabotage transformation goals and delay the development [92]. SCM implementation in SOEs should be closely monitored to adhere to relevant legislative requirements and internal departmental policies and procedures [77]. The review process allows the manager to gauge compliance early, identify gaps and rectify them on time. It will enable the manager to determine the level of the team's understanding of the processes and the application thereof. The examples of performance metrics to be considered for compliance include the following, single sourcing – how many were done and did they comply with the policies, sole suppliers – is their motivation to prove that the supplier is the only one advertisement of tenders for 21 calendar days, were deviations recorded and reported to the treasury, % on-time implementation of management actions for audit findings,% of contracts awarded through the non-competitive process, % spend on black women-owned entities, % spend on youth-owned entities and % spend on localisation.

2.5.3 Risk management measures

The high dependence of SOEs on SCM exposes their organisations to risks such as potential reputational risks, compliance risks, service delivery failures, service disruptions, financial risks and poor quality [93]). Supply chain risks are inevitable but can be managed if proactively identified and mitigation plans. In executing their duties, SCM managers must always think of what could go wrong in their supply chain and be fully aware of the environment in which they operate and the risk exposure. Due to the magnitude of the impact of the deviations or failures, the SCM managers must identify the potential risks and consequences and develop proper mitigation plans to minimise the risks' occurrence and impact [94]. All identified risks must be captured in the organisation's risk register and monitored accordingly. The risk management measures are associated with ensuring the reduction of the risks. Risk reduction must be positioned as a goal and measured, therefore.

2.5.4 Reporting measures

The office of the Chief Procurement Officer is tasked with monitoring and evaluating the SCM performance in government and its entities. According to [16], the accounting officer of an institution must "establish procedures for quarterly reporting to the executive authority to facilitate effective performance monitoring, evaluation and corrective action. Ref [16] is still developing a framework that will standardise reporting of SCM across the public sector. Depending on the nature of the information, the information will be made public monthly, quarterly and annually. Exemplary metrics for reporting include annual procurement plans, the actual implementation of procurement against the procurement plan- Quarterly, acquisitions concluded through the deviation procurement method, purchases completed through the extension or variations of contracts, the number of tenders advertised, the current stage of the

2.5.5 Quality measures

Generally, goods and services must be of good quality and should be worth every penny spent. Quality is one of the key elements considered in evaluating functionality on bids. [95] prescribe that "the minimum qualifying score must not be defined so low that it may jeopardise the quality of the service required nor so high that it may be restrictive

to the extent that it threatens the fairness of the SCM system. As much as grade is evaluated for tenders, measures must be implemented to assess quality at a transactional level. Quality can be measured against supplier deliveries based on production or operations levels [55]. Quality measures considered in SOEs include the number of rejects in goods received and the number of rejects in production; the metrics are calculated by developing a ratio of failures against the total population [77]. The measurement of defects received from suppliers can be a valuable means of monitoring supplier performance.

2.5.6 Time measures

The time taken in the SCM process directly impacts the service delivery [96]. Many factors contribute to time delays in processing procurements documents [96], such as a poor response from end-users to participate in the tender evaluation process, incorrect specifications requiring a tender to be re-advertised, and the unavailability of members to support the procurement process. According to [97], time can improve quality, reduce costs, and enhance goods and service delivery if managed well. The time measures include actual delivery versus promised time taken to process requisitions, time taken to evaluate and adjudicate tenders and time taken with remedial action [92]. Quantifying the time taken in different activities will assist organisations in unblocking the bottlenecks and measuring performance [96]. The performance metrics that can be considered in SOE's SCM include; actual delivery versus promised (on-time deliveries), actual contract end-date versus contracted date, time taken to process requisitions (reduced Procurement cycle), with expansions based on the SOE.

2.5.7 Socio-economic measures

Government and SOEs at large utilise SCM as a vehicle to achieve the socio-economic imperatives [98]. SOEs must design performance measures aligned with the socio-economic goals to complete the set targets. Examples of performance metrics for socio-economic development include % spent on black women-owned entities, % spent on youth-owned entities, % on localisation, % on black youth entities, % on QSE/EME and % on black youth entities spent on people living with disabilities. These measures must be embedded in the SCM practitioner's performance contracts, and the criteria must be tracked and reported as they drive the SCM strategy.

2.5.8 Inventory Management measures

Inventory management is primarily part of the Logistics Management element of SCM. As a result, inventory management performance impacts the SCM due to the interrelationship and other ordering, pricing, and contracting measures. Inventory should be appropriately safeguarded and secured to ensure fairness and diligence in the conduct and accounting of all scrap business practices adopted and supported by duly documented, approved and accessible policies and procedures. The following metrics can be considered, demand forecast accuracy, inventory days, bin accuracy, materials availability (usually 95%), reduced backorders, ABC analysis applied, monitoring of stock levels, adherence to health and safety standards, controls for goods receiving and issuing of parts and stock counts.

2.5.9 SCM Human Capital Management

The practical implementation of SCM strategies, practices, policies and regulations requires competent, ethical, professional and skilled employees within appropriate structures [16]. The SCM human capital measures are deliberately chosen. It goes beyond the costs to include knowledge, skills, competencies, and attributes inherent to individuals, making it easy to achieve personal, economic, and social success [99]. Given the strategic importance of SCM, management should ensure that teams possess the right skills and that the organisation invests in the continuous development of related skills ([100]. In terms of 16A5.1 of the Treasury Regulations [16], "the accounting officer or accounting authority must ensure that officials implementing the institution's supply chain management system are trained and deployed under the Framework for Minimum Training requirements Deployment issued by the National Treasury". Without a well-trained and motivated workforce, the effectiveness of SCM in government will remain a dream [101]. Practical training and development can be implemented following a well-structured personal development plan. Training is divided into on-the-job and off-the-job training, which can be conducted internally or through an appointed external service provider

[102]. The right metrics to measure human capital management in SCM include % of implementation of the team's development plans (PDPs), the number of internal training conducted versus planned, number of external training implemented versus planned.

Table.3: Summary of SCP measures and metrics

Measures	Examples of the metrics	Author (s)
Cost	• Cost savings achieved against a target • Cost avoidance % • Cost changes/variation orders • Contract variations % • Inventory actuals versus targets % • Inventories obsolesce • The actual price paid versus budget • The actual price paid versus market prices	[103], [16], [16] [101] and [104]
Compliance	• Three quotations process (of all the quotations processed in a particular quarter, how many followed the three quotes/complied) • Single sourcing – how many were done and did they comply with the policies • Sole suppliers –proof in place • Contracts above the value of R10 million (all applicable taxes included) may only be awarded the concurrence of the relevant treasury • Advertisement of tenders for 21 calendar days-evidence • Deviations recorded and reported to treasury • % Of the implementation of management actions for audit findings	[105]), [87], [16] and [106]
Risk management	• Risks with valid mitigations • % Reduction of risks • Supplier risks (financial, technical, price &quality) • Service delivery failures, • Disruption risks	[95], [107], [108] and [96])
Quality	• % of rejects in goods received • % of rejects in production/operations • % of project failures	[96]. [109], [110] and [89]
Time	• Supplier's actual delivery versus promised (on-time-deliveries) • Reduced lead time • Actual contract end-date versus contracted date • Time is taken to process requisitions (reduced Procurement cycle) • Time is taken from tender closing until an award • The time it takes to sign a contract • The time it takes to pay due to invoices due to lack of necessary procurement documents • Time was taken with remedial action	[111]), [112], [92], [96], [110] and [89]
Reporting	• Annual procurement plans. • The actual implementation of procurement against the procurement plan- Quarterly. • Acquisitions are concluded through the deviation procurement method.	[15] and [100

	• Acquisitions are concluded through the extension or variations of contracts. • The number of tenders advertised. • The current stage of the Procurement process; • Progress made with contract negotiations; • Tender awards and values versus advertised tenders • Deviations from the Procurement processes;	
Socio-economic measures	• %spend on black women-owned entities • %spend on youth-owned entities • %spend on localisation • %spend on black youth entities • % spend on QSE/EME • %spend on people living with disabilities	[112], [77] and [113]
Inventory Management	• Demand forecast accuracy, • inventory days, • bin accuracy, • materials availability (usually 95%), • reduced backorders, • ABC analysis applied, • monitoring of stock levels, • adherence to health and safety standards, • controls for goods receiving and issuing of parts and stock counts.	[16] and [114] [115] and [116]
SCM Human Capital Management	• % Implementation of team's development plans (PDPs) • The number of internal training conducted. • Number of external training	[104] and [95]

Source: [76]

SCM performance metrics provided in table 3 are examples and are not exhaustive. SCM Managers must select measures that are appropriate for their organisation. In doing so, [117] warns that organisations must not fall into the trap of choosing many actions lest they lose focus. SCP measures must be a selective few that focus on the organisation's critical success areas [118]. The selected few must indicate how the organisation is performing at any given time.

3. Proposed framework: Linking SCP measures with Balance Scorecard

This article aimed to develop an implementation framework for SCP measurement for SOEs in SA. Currently, most SOEs in South Africa use the Balanced Score Card (BSC) to measure the performance of their SCM [54]. While most SOEs use BSC as a performance measurement tool, there are no guidelines for the SCM Manager on aligning the SCP measures with the BSC measures, therefore creating a gap [54]. Due to SOEs' diversity and complex operations, one set of SCP measures that work in one SOE will not automatically work at another SOE [118]. Appropriate measures that drive the performance and success of the organisation still need to be considered [54]. This then calls for SCM managers to have a thorough understanding of their environments, the strategic objectives of their SOEs, the socio-economic goals, the existing gaps and develop SCP measures that will help their organisation achieve efficiency, effectiveness and ultimately organisational performance [22], [118], [54] and [36]. The framework provides a variety of good metrics suitable for SOEs. The proposed framework is based on the work of [101], [119], [74] and [54]. The following sections provide a stepwise approach to implementing the SCP measurement system.

3.1 Clarify and translate vision and strategy

The alignment of BSC and SCP measures begins with a strategic setting process where the organisation's vision, mission, and strategic objectives are assessed [73]. Ref [54] highlights that although they recognise the credibility of the BSC,

they insist that SOEs must follow the strategy mapping process as outlined in the [119]. The strategy mapping process clarifies the performance measurement process's inputs, outputs, and outcomes. SCP measures should be coherent with the SOE's corporate strategies, goals and objectives and socio-economic imperatives [28] and [17].

3.1.1 Link corporate strategies with SCM strategy

The SOE's corporate strategies and goals must influence the SCM strategy and operational plan [74]. The SCM Manager must demonstrate how SCM will support the organisation to achieve its strategic goals, considering the regulatory, commercial and socio-economic aspects of [120] and [92]. SCM strategies that are not aligned with the SOE's strategic goals will lead to a performance [77]. The SCM strategy must be cascaded into an operational plan that drives the day-to-day activities.

3.1.2 Selection of appropriate measures

The Supply Chain strategies must influence what is to be measured. There are nine (9) examples of SCP measures that have been identified in this article. The list of SCP measures is not exhaustive. SCM managers can develop additional, more suitable measurements for their environment. According to [16], the SCP measures can be identified from sources such as the Medium-Term Strategic Framework (MTSF), strategic plans, policy documents and service delivery implementation plans. The selected measures must be aligned with the strategic objectives of the SOE and should focus on the critical areas of success [56]. The selected SCP measures must be assigned to the relevant management echelons, strategic, tactical and operational, to ensure performance and result [97]. This ensures that every SCM practitioner is answerable for their plans, actions and outcomes National Treasury (2002). Individual SCM practitioners are accountable to the head of SCM and other managers in the SCM [121].

3.1.3 Synchronising supply chain performance metrics with BSC measures

The process that follows should be synchronising the measures with the performance measurement tool, in this case, BSC. The conceptual framework (Figure 1.) illustrates how SCP metrics can be mapped with the different perspectives of BSC measures [19] and [73]

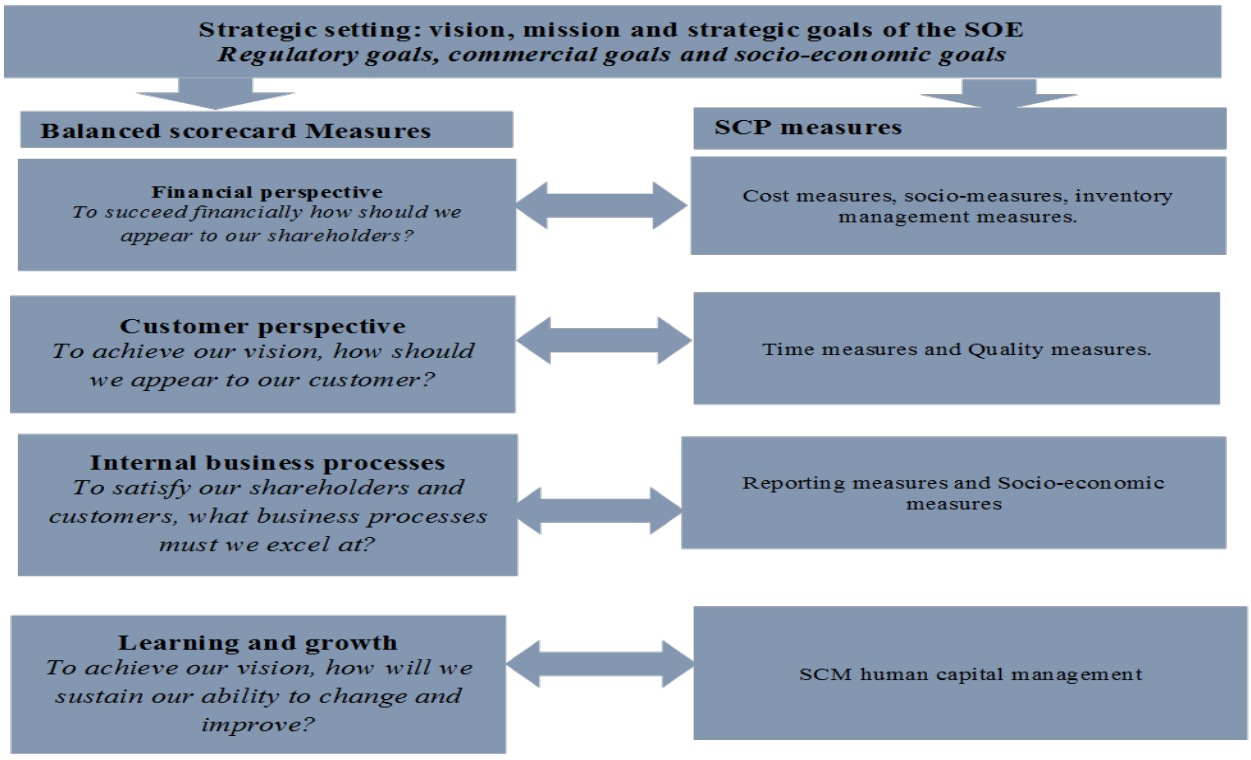

Figure 1: Conceptual framework

3.1.4 Performance evaluation, feedback and continuous learning.

Most organisations conduct performance evaluations quarterly, and organisations do not have to wait for three months to evaluate performance. According to [79], management must determine the SCM managers and practitioners will use the framework to manage SCM performance in SOEs. Well-developed SCP measures will assist management in recognising excellent and bad SCM practices and the results thereof [56].

4. Limitations of this study and further recommendations

The study's main limitation was that it was restricted to SOEs registered with the SOEPF. Senior SCM practitioners working for SOEs who are members of the SOEPF are among the responses. Using a random selection approach, a limited sample of 300 respondents was picked at random from a larger population of 1050 SCM managers. Because the sample size was deemed insufficient, the study could not be applied to a larger population.

It is recommended that further studies use different research methodologies, mixed methods research or qualitative research, which could provide a fuller understanding of the relationship between the supply chain strategy, SCM policies and regulations, SCM practices and SCM performance. The findings of this study showed a need for further research in exploring the relationships between SCM practices (enterprise supplier development, contract management, consequence management, and information technology) with SCM performance in SOEs.

5. Conclusions

This article aimed to conduct a theoretical analysis of the SCP measures and metrics, identify and develop the ones that would be suitable for SOEs, and synchronise the selected measures and metrics with the balanced scorecard. The objectives of this article were achieved as follows; nine SCP measures were identified, more than 40 examples of performance metrics were determined for each step, and finally, a conceptual framework for proper implementation of SCP measurement was developed. The study went further to outline guidelines for implementing the SCP measurement reporting frequency. Performance evaluation is a continuous process and must be incorporated into the manager's day to day activities. Weekly monitoring will enable the managers to identify deviations from commitments at an early stage and rectify them timeously.

system. The SCP measures must be hierarchical and cascaded down to the operational level [74]. Due to their dynamic environments and different mandates, SOEs must select the appropriate SCP measures for their entity [69] and [70]. The list of actions provided in this article is not exhaustive; However, in doing so, they must be careful not to fall into the trap of overmeasuring [67]. The BSC tool was chosen based on its balanced approach to performance measurement. However, this is not to say that the BSC is the only model working in SOEs. SOEs can consider adopting a hybrid model that involves combing the SCOR model and BSC [61]or selecting any other SCP tools if they believe the existing performance measurement framework by the government. The article's intention was not to suggest a standardised approach for all SOEs but recognise the importance of having a catalogue of measures that could serve as a baseline for SCM in the SOE environment.

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