CSIR Smart Mobility
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Leading logistics performance: Indicators for systemic change

Position Paper: Logistics Indicators

Executive summary

Indicators of logstics performance can serve as valuable markers of the status of the logistics system and trends in key performance parameters. They can significantly guide decision-making towards improving system performance. However, indicators must adopt a systemic view, ideally comprise both prospective and retrospective indicators, and must be trusted by stakeholders.

In the South African logistics system, notable performance indicators include the national cost of logistics, the World Bank's Logistics Performance Index (LPI) and Global Container Port Performance Index (CPPI), and selected industry-driven indices such as Ctrack's Transport and Freight Index (TFI). These indices are published by different stakeholders for different purposes and evidence of their adoption in decision-making processes is not readily available.

This position paper recommends developing a coherent and comprehensive set of South African logistics performance indicators to guide decision-making and improve performance. It includes a brief summary of the logistics system and current performance metrics, an overview of indicator types and their application, and a review of some published logistics indicators. Based on this overview, it is recommended to develop a comprehensive set of context-specific indicators in collaboration with key stakeholders. This approach aims to guide decision-making and build trust among local and international stakeholders regarding the nature and extent of change being implemented in the logistics system.

Introduction

Logistics is a key enabler (or disabler) of economic growth. The national logistics system must provide the infrastructure and services within which the products of economic activity is transported. The demand for logistics services is directly derived from economic activity. Consequently, the performance of the logistics system is both an enabler of growth and an indication of economic health. When the system fails, the economy is at risk of failing, and vice versa. This close relationship emphasises the need to understand systemic performance well, respond timeously to changes, and to have access to information that enables proactive decision-making.

In this multi-actor logistics system, where different stakeholders have varying interests and objectives, information is not innocent. For example, stakeholders responsible for the system's performance and those who benefit from economic activity by using the logistics system may

want to emphasise different perspectives when considering information. In contrast, information aimed at informing decisions for improved systemic performance should reflect the system's reality as accurately and unbiasedly as possible. This points to a need for independent and validated information to use as baseline for the development of indicators of performance.

Further, a singular perspective on the performance of this complex system is insufficient and counterproductive in supporting decisions. For example, a singular view on reducing the cost of logistics may lead to a compromise in quality. Similarly, optimising border post performance alone could overload downstream nodes such as ports, yielding limited positive impact on overall system performance. As such, a balanced, multilevel set of indicators is essential.

Finally, in a system embedded in global trade, indicators can influence trade partners' intent to continue or discontinue their engagements with a country. To enable balanced decision-making, prospective indicators are sought that provide perspectives on change and growth, in addition to retrospective indicators that report on past or recent performance.

This position paper reflects on the nature of indicators that are currently used to report on logistics performance in South Africa, presents a view on holistic indicators and recommends developing a comprehensive indicator framework that can fulfil multiple functions to collectively inform decision-making for systemic improvement.

South African logistics: The status of performance measurement

The performance of the South African logistics system is under pressure, as reported by users of the system. Operational issues such as bottlenecks at ports and border posts (e.g., National Coal Suppliers, 2023 and Goddard, 2023), as well as low profit margins and a complex regulatory environment leading to the closure of road transport companies (e.g., Mzobe, 2022 and Venter, 2024) are prevalent. Key indicators, such as the CPPI, show a declining trend in port performance (the World Bank, 2024). Operational performance statistics, reporting on weekly and daily performance at key points in the system, reflect congestion and delays that inhibit trade (e.g., BUSA, n.d.).

The narrative outlined above paints a picture of a system that is unable to meet demand, suggesting ongoing decline. However, it lacks several important perspectives, such as views on future capacity constraints, the influence of investments and their prospective impact on capacity, the current and future economic impact of these constraints, and prioritisation relative to predefined objectives.

Systemic objectives are broadly available for specific actors in the system. For example, the draft Freight Logistics Roadmap (Department of Transport, 2024) outlines the following key performance indicators for Transnet:

- Reduce the cost of logistics as a percentage of transportable gross domestic product (GDP);
- Implement and accelerate the shift from road to rail;
- Leverage the private sector in the provision of both infrastructure and operations where required;
- Integrate South Africa with the region and the rest of the world; and
- Optimise sustainable economic, social and environmental outcomes of all activities undertaken by the state-owned company.

There is an opportunity to translate these objectives into systemic indicators, to be monitored with a view on reporting on how well the system responds relative to actions aimed at achieving these and similar objectives set by other key role players.

The following table provides an indication of the nature of information (indicators) that is reported in the South African logistics landscape, including their possible use and implications for decision support:

Table 1: Some indicators used to report on South African logistics performance

	Indicator/ index	Unit of analysis	Reported as	Possible use	Potential for decision support
Natiional perspective	LPI	National logistics system	Index and rank	Benchmark against trade partners	Impacts trade partners' business choices
	Cost of logistics	National logistics system	Cost as percentage of GDP	Benchmarking	Identify trends Identify cost drivers
	Reserve Bank's Composite Supply Chain Pressure Index	National supply chain	Changes in volumes, cost, delivery periods and inventories relative to demand, raw materials shortages	Detect trends in supply chain pressures	Reacted to expected inflationary pressures as a result of supply chain pressures
National and sector-	TFI	Transport subsectors (rail, road, air, sea, pipelines and warehousing)	Index based on activity (volumes or real terms) per sub-sector	Detect trends (sector growth or decline)	Outlook for the sector
Entity / node perspective	CPPI	Individual ports	Rank	Benchmark against trade partners	Impacts trade partners' use of port facilities
	Operational indicators (e,g., Busa report)	Truck/ container movement	Weekly and monthly operational performance parameters at key points (ports, borders and others)	Shows operational bottlenecks	Firm-level operational decisons

Information on logistics performance in South Africa is sparse and limited to a few indicators that, while interesting, notable, and noted, do not provide an integrated view on current and expected future systemic performance. These indicators are produced by various role players with differing objectives and interests, and do not necessarily complement each other. Further, as shown in the table above, these indicators report on the current status of specific perspectives on the system. While understanding the status quo and benchmarking against peers are important for target setting, indicators should ideally guide action that leads to improved performance. As such, a comprehensive framework or set of indicators is required to facilitate decision-making for improved systemic performance.

A national framework of indicators can provide a means of comprehensively reporting on the performance of the logistics system, encompassing levels from the strategic to the operational, and with consideration of different functions such as describing system performance (current and past), identifying trends, providing insights into expected future performance, and measuring progress towards overall systemic goals. Both retrospective and prospective views should be considered. Indicators should be accepted and trusted by stakeholders and should

guide towards systemic performance, in addition to reporting on status for benchmarking purposes.

Indicators for systemic change

An indicator is "a sign of the presence or absence of a concept being studied" (Babbie, 2012:129). The Organisation for Economic Co-operation and Development (OECD) defines an indicator as (Von Schirnding, 2002:20):

> *A parameter, or a value derived from parameters, which points to/provides information about/describes the state of a phenomenon/environment/area with a significance extending beyond that directly associated with a parameter value*

The latin term *Indicare* serves as origin, which means to announce, point or indicate (Van Schirnding, 2002).

Of importance in the OECD definition is that the significance of an indicator extends beyond the parameter value. For example, the number of new companies emerging in the logistics sector could signify industry growth. This contrasts with a *metric*, which represents the measurement of something (e.g., the cost of logistics as a percentage of GDP or the number of ships waiting to dock at a specific port in a given week, which may or may not be an *indicator* of worsening port management capability).

A number of indicators can be combined (usually in weighted form) to create an *index*. This composite value summarises several indicators into a single number, used to observe changes in a phenomenon of interest and to provide a basis for comparison (Foltin, 2028). For example, the LPI (The World Bank, n.d.) summarises a country's logistics performance into a single number, based on six underlying aspects: customs and border management, trade and transport infrastructure, cost of international shipments, service quality and performance, tracking and tracing and timeliness. The CPPI (the World Bank, 2024) serves as another example.

The simplistic yet powerful concepts of indicators and indexes can be used in a number of ways:

Report on the current status

- To express the *current state or condition* – e.g., the cost of logistics as a percentage of the GDP can be an indicator of the current efficiency of the logistics sector.
- For *benchmarking* – e.g., the CPPI can provide a means of benchmarking the recent state of port performance against that of trade partners and competitors.

Report on changes over time

- To indicate *a trend over time* – e.g., if the cost of logistics is increasing or decreasing over time, it can indicate improvement or worsening cost drivers in the system.

Understand challenges

- To aid in *diagnosing challenges* in the system – e.g., an increase in port dwell time may be indicative of insufficient handling capacity at the port under consideration.

Report on progress of interventions

- To report on how well a country is progressing towards a predefined goal as a result of a project or intervention – e.g., ongoing congestion at a border post, despite operational improvements, may indicate that improvements are not sufficient to reach a predetermined goal for truck processing time.

Predict future performance

- To *predict* future performance of the system – e.g., a measure of investment in logistics infrastructure could be an indicator of future improved performance due to increased capacity.

- To *report* on a country's ability to meet a predetermined goal – e.g., a slow transition of freight from road to rail may indicate that a viable status in support of economic growth will not be reached in the near future.

In the above uses, we are considering indicators over different time frames. These include, for example, *retrospective* or *lag* indicators that reflect on *past* performance, which measure performance against end-state objectives or desired outcomes (Gartner, n.d.). Similarly, *concurrent* or *co-incident* indicators (Kenton, 2022) report on the current (or most recent) state of the system. Most indicators reported in the South African logistics system, as well as international benchmarking indicators (e.g., the various performance indicators by the World Bank), seem to be retrospective or concurrent indicators, whether reporting on status or reflecting on trends.

To make informed comment on the overall status of the logistics system and to support decisions for improved performance, a comprehensive view of past, current and expected future performance is required. This requires the inclusion of forward-looking *prospective* or *lead indicators,* which are predictive of desired outcomes (Gartner, n.d.). For example, investment in logistics infrastructure as a percentage of sector spend could be indicative of improved future capacity and hence performance.

Ultimately, information about the logistics system, and indicators of its performance, should **inform proactive decision-making**. Indicators play a key role in this regard as they "provide a synthesised view of existing conditions and trends which can be used in decision-making" and play a role in improved communication between public and decision-makers (Van Shirnding, 2002). Indicators integrate information about the logistics (or any other) system in a manner that adds value for decision-making, as follows (Briggs et al, 1996):

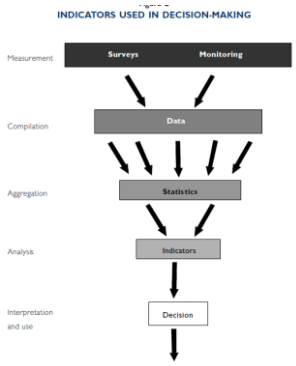

Figure 1: Indicators for decision-making

Indicators can be linked to different levels of decision-making, such as strategic, tactical and operational (Gunasekaranet al. 2004). This differentiation is useful since it links indicators to decisions that need to be made in the long, medium, and short term, and assists in determining what should be included in a comprehensive set of indicators.

When considering the systemic nature of the logistics system, the ideal is to have indicators that reflect and guide decisions towards systemic change. One approach is to consider the system in its current state, define a desired future state and the interventions that will facilitate the desired change, and then track indicators of progress towards a future state. The *vector theory of change* (Doyle, 2021) considers systemic change in this manner, focusing on steps towards the desired change. In these systems evolution approaches, systemic behaviour is observed and changes in the appropriate direction are identified. In the logistics system, examples of systemic behaviours towards a better state could include increasing self-regulation by freight owners and transporters or shifting freight from road to rail. When observing such changes, their drivers can be understood and incentivised.

There is an opportunity to develop a balanced framework of indicators that reflect performance from a retrospective, concurrent and prospective vantage point, and at different levels of decision-making. Indicators should report on the current state for benchmarking, while also reporting on progress against objectives and the effect of current or planned interventions.

Towards indicators for sustained logistics performance

To migrate from singular, disconnected views of the logistics system towards an integrative, localised view, it is proposed that a framework of indicators be developed. This framework should describe elements or behaviours of the system in a manner that informs decision-making. The system can be conceptualised and interpreted from various perspectives for indicator development.

The representation in Figure 1 suggests a concept by which the logistics system can be differentiated to define indicators at different levels, with a view on working towards a comprehensive framework. Different classes of indicators are suggested at each level:

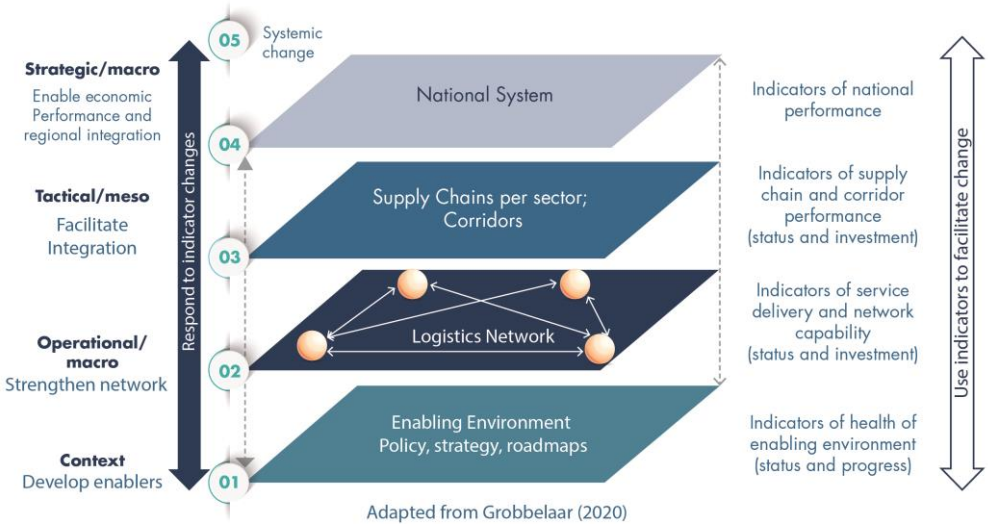

Figure 2: Conceptual framework: indicators for systemic change

Activities on the left-hand side of the diagram proposes actions that should be informed by the various indicators.

Some examples of indicators that can be developed at each level are as follows:

Strategic

- Cost of logistics;
- Cost drivers; and
- Impact of logistics on economic growth.

Tactical

- Speed, cost, reliability of sector-specific supply chains;
- Corridor congestion, fluidity;
- Investment in intermodal facilities;

- Corridor improvement programmes in progress;
- Skills development programmes in progress; and
- Company births and deaths.

Operational

- Status of infrastructure;
- Infrastructure investment;
- Bottlenecks;
- Service delivery; and
- Incidents.

Enabling environment

- Percentage of policies considered constraining;
- Incomplete policies; and
- Inclusivity of policy development.

Based on the discussion in the previous section, some approaches to indicator development can be identified:

- Define indicators that measure change in the system, based on a Theory of Change approach (i.e., measure inputs to improve performance, as well as the outputs, outcomes and impacts resulting from improvement initiatives);
- Define indicators that describe the status and performance of different elements of the system (e.g., infrastructure, services, corridors, supply chains per sector);
- Define indicators at different levels of abstraction and decision horisons (i.e., macro, meso, micro/strategic, tactical and operational); and
- Define lead indicators to enhance perspectives that only consider concomitant or lag indicators

Further examples of different indicators, based on the approaches outlined above, are summarised in Appendix 1.

Given the current status of information and indicators available to inform improvements in national logistics performance and the vulnerabilities associated with relying solely on international indicators, it is recommended that a process be followed to develop a framework of indicators relevant to the local environment. This framework should be informed by validated data, trusted by a broad base of stakeholders and inform decision-making in addition to reporting on status. To this end, it is proposed that a multistakeholder process be followed to develop a set of indicators for national performance, as follows:

- Develop a theoretical framework that describes the logistics system in a cohenrent and integrative manner;
- Develop indicators within this framework that are linked to issues of national concern;
- Validate the framework with a broader base of stakeholders;
- Compare and align indicators with international indicators;

- Verify and refine internationally used indicators for local conditions and negotiate their application with stakeholders, where appropriate; and
- Define a process for periodic calculation and communication of key indicators.

Conclusion

The South African logistics system is constraining economic performance and growth, and limited validated information is available to support decision-making towards change. Specifically, an integrated framework within which status can be assessed and decisions can be supported is not available. Instead, singular measures of performance are reported on, and the system is vulnerable to non-localised indicators that affect investor confidence. While such indicators are interesting to consider, their ability to support positive change in the system is unclear.

It is recommended that a process be followed whereby a framework of indicators suited to local complexities is developed and validated with key stakeholders and that a processs for the periodic calculation thereof, based on validated information, is implemented.

Appendix A

Indicators based on different perspectives

Perspective	Describe and illustrate	For example
Indicators of systemic progress Theoretical basis: Theory of Change as monitoring and evaluation approach	Inputs made to improve the system	Investments in skills, infrastructure and others
	Outputs achieved from activities to improve the system	Changes in skills base, transport capacity, nature of transport network and others Reduced inefficiencies (delays, congestion and others) Improved performance (port freight handling performance) Small, Medium, Micro Enterprise (SMME) birth/death rate
	Outcomes based on activities to improve the system	Changes in freight volumes handled, changes in speed of delivery and others
	Impacts	Reduced cost of logistics as % of GDP, improved ranking in LPI and others
Indicators that relate to different levels of abstraction Theoretical basis: decision theory	Macro/strategic	Cost of logistics as percentage of GDP, differentiated into cost drivers
	Meso/tactical	Reach of the logistics network
	Micro/operational	Containers handled per port
Indicators that relate to different time frames Theoretical basis: decision theory/systems theory	Lead indicators	Investment in: • Skills • Infrastructure • New services • Freight-friendly policies • Innovation
	Lag and co-incidental indicators	Status of: • Skills • Infrastructure • Service delivery • Nodal performance (ports and border posts) • Link performance (road, rail and pipeline) Capacity (infrastructure) Cost of logistics LPI

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