PSA TRANSFORMING THE SUPPLY CHAIN

# Strengthening Health Supply Chain Performance through Robust Costing methods and Cost-calculating Tools

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# Summary

The public sector is still in the nascent stage of linking Supply Chain impacts to its primary goal of effective and efficient health care delivery. Associating a cost to this Supply Chain is even more nascent, as international and bilateral donors, limited in their funds, now request their beneficiaries to show 'value for money' for their projects (USAID, GFATM) or 'pay for performance' (World Bank). Not surprisingly, the availability of calculating tools for costing the Public Health Supply Chain is limited, and rigorous testing and review almost non-existent.

This study reviews Supply Chain costing, some costing methods, and existing calculating tools in both the private and public sectors. It also describes some pilot studies and specific applications of costing Supply Chain in Nigeria, Rwanda, Zambia, and Zimbabwe. Reviews are made of referenced costing tools (including possible applications, advantages, disadvantages/ drawbacks, and limitations).

The purpose of this study is to help make a case for the refining or re-design of cost methods and calculating tools, in particular the USAID|DELIVER Supply Chain Costing Tool (SCCT), in order to account for their various potentials and incorporate the contexts of low to medium-income countries' Public Health Supply Chain's specifics.

There are limitations to the review, the most evident being the paucity of available costing tools, a limited application of the ones available, and an even more limited number of examples of successful usage.

Nevertheless, elements for a model cost calculating tool are presented, to call attention to key areas: primarily the interweaving of clear and precise Supply Chain objectives along with those of performance measurement, recurrent monitoring and evaluation features, and consequent optimisation. It will be essential to include parallel Supply Chains and other stakeholders and to make a simulation. Such calculating tools would empower public health and Supply Chain managers to make appropriate decisions.

Proposals are made for the immediate way forward to stimulate Public Health Supply Chain costing, while highlighting some immediate and anticipated concerns by governments, Supply Chain experts, and international donors in the Supply Chain, as well as outstanding issues for subnational and national considerations.

# Abbreviations

| | |
|---|---|
| ABC | Activity Based Costing |
| ACAME | Association of Central African Purchases of Essential Medicines |
| ACT | Artemisinin-based combination therapy |
| BCE | Baseline Cost Evaluation |
| BMGF | Bill and Melinda Gates Foundation |
| CLMS | Contraceptive Logistics Management System |
| DPP | Direct Product Profitability |
| DTTU | Delivery Team Topping Up |
| ECR | Efficient Consumer Response |
| EPIC | EPI Costing and Financing of Routine Immunization and New Vaccine Introduction |
| ERP | Enterprise Resource Planning |
| GAAP | Generally Agreed Accounting Principles |
| GFATM | The Global Fund to fight AIDS, TB, and Malaria |
| IFRS | International Financial Reporting Standards |
| KPIs | Key Performance Indicators |
| LMICs | Low and middle-income countries |
| MPDD | Medical Procurement and Distribution Division |
| MSH | Management Sciences for Health |
| PSA | Pamela Steele Associates |
| PHSC | Public Health Supply Chains |
| RDT | Rapid diagnostic tests |
| SCT | Supply Chain Transformation |
| SCCT | Supply Chain Costing Tool |
| SIAPS | Systems for Improved Access to Pharmaceuticals and Services |
| TCO | Total Cost of Ownership |
| TOC | Theory of Change |
| USAID | United States Agency for International Development |
| WHO | World Health Organisation |

# 1. Introduction

The Supply Chain is recognised as a critical link between raw material suppliers, manufacturing industries, and service companies, to the production and delivery of products and services, in order to meet customer requirements (Bartolacci, 2004). In public health, the Supply Chain encompasses all functions, activities, arrangements, and resources to forecast, acquire, store, and move the most adequate medicine or health commodity to the last, but most important level - that of the patient, client, or institution that needs it.

Supply Chain Transformation (SCT) is recognised as an important way to improve health outcomes in low and middle-income countries (LMICs). By optimising the processes by which health commodities are brought to last mile consumers, governments and their development partners can optimise their expenditure and ultimately save lives. For this reason, LMICs are incorporating SCT projects into their strategic plans for health, while various aid organisations are stepping forward to fund them.

This emphasis on SCT has given rise to a number of analytical and practical activities, one of which is known as baseline cost evaluation (BCE). As a relatively new practice in the Public Health Supply Chains (PHSC), BCEs provide point-in-time estimates of the total Supply Chain cost of bringing a given quantity of healthcare commodities from the manufacturer to consumers in the community. They also identify major cost drivers and provide breakdowns of the total cost, including by level of the healthcare system and activity type. Ultimately, this information is intended to help decision-makers determine how to improve the Supply Chain (McCord et.al., 2013).

## 1.1. Background

The backdrop for this study is the involvement of Pamela Steele Associates (PSA) in providing technical support to a Bill and Melinda Gates Foundation (BMGF) project, the state-led revitalisation of the Supply Chain in Kaduna State, Nigeria, along with other development partners. Among the outlined deliverables for the pre-project design was the establishment of a Supply Chain costing baseline that can be referenced and fed back into Supply Chain budgeting and performance improvement activities.

The costing of the Supply Chain was a critical response to the evidence that resource mobilisation, budgeting, and resource allocation for Supply Chain activities are mostly based on guesstimates - an overarching national, public sector-wide occurrence. Attempts to cost the Supply Chain in the past had largely focused on limited operations by specific projects or by individual development partners.

The state-wide costing of Supply Chain functions and activities by the Kaduna State Ministry of Health (Kaduna State, Nigeria) was undertaken between May and July 2016, using the USAID|DELIVER Supply Chain Costing Tool (SCCT) with definite outcomes. The details of the baseline cost are captured in the report referenced (Stephen et.al., 2016).

## 1.2. Rationale and objectives of the Supply Chain Cost-calculating Tool review

The Kaduna cost baseline study was not without challenges - both administrative and technical. Lessons learned across the entire exercise would be general or contextual, but technical issues with a cost calculating tool were likely to be recurrent. Calculating tools must be adaptable to country specific requirements, such as instances of parallel Supply Chains, duplicate functions within the same Supply Chain, inadequate funding, and other related issues. Consequently, despite the successful use of SCCT for the Kaduna project, it became necessary to explore in more detail the potential of other costing methods and calculating tools, in order to build a background for the review, re-design and if feasible, the construction of a new calculating tool based on more than one costing method. This study aims to review

and explore the potential and limitations of different costing methods and calculating tools, with the aim to update, re-design, and/or construct new model calculating tool(s) for the costing of PHSC.

## 1.3 Scope of the review

This review is not intended to be a detailed analysis of all costing methods and calculating tools available, but a landscaping reflection across the private and public sectors that dovetails into a guided attempt to overcome the limitations of the SCCT employed for the Kaduna State costing study.

## 1.4. Methodology

The methodology included the following components:

1. Review of literature search, along with the main concepts and themes
2. Review of the Kaduna State costing study report to underpin the technical limitations posed during use: Supply Chain Costing Tool Analyses
3. Review of country experiences to identify advantages and drawbacks to the calculating tool used for costing studies: applications, advantages, and limitations.
4. Stacking of features for the synthesis of an ideal calculating tool for costing the public health sector Supply Chain - from literature, analyses of country experiences, and emerging Issues (contextual and technical)
5. Observations from semi-structured interviews with industry experts with direct experience of BCE, conducted in August and September 2018.

The scope of concepts on global issues of Supply Chain costing is much larger than that of actual practice in public health.

## 2. Supply Chain improvements through costing

Over time Supply Chain has assumed importance as one of the key factors of competitiveness and organisational effectiveness. The pressures of global competition and the need for flexibility and responsiveness to those changes has increasingly forced organisations to embark on activities to improve their Supply Chain, with growing realisation that their competitive advantages reside more in the network of relationships than in a single corporate entity (Abdel-Basset et al. 2019). Therefore, many organisations are currently concentrating their efforts on improving the efficiency and effectiveness of the flow of materials, products, and services throughout the entire Supply Chain and not just the production process.

In public health, the availability of medicine and health commodities to patients and facilities is vital to the optimisation of health outcomes. The processes of acquiring, storing, and moving them from the manufacturing plants to the last points of distribution /prescription (such as health centres, clinics, and hospitals) or to the patient directly, add significant costs to the care provided. A study showed that getting essential public health commodities to patients typically adds between 12-25% to their acquisition price (USAID, 2012). These costs are in addition to already high procurement costs of medicines, which account for a quarter - to more than half of health spending in many countries (WHO, 2004, 2011).

Even though adequate financing is indisputably critical for a well-functioning Supply Chain, it is only when the costs of the Supply Chain activities are known, analysed and acted upon that they can deliver optimal value (USAID, 2013). When LMIC governments commit to improving the operation of their Public Health Supply Chain, they will need to understand that this is only possible when there is detailed and reliable cost information (Bitton et.al., 2019). It is therefore important that countries measure their Supply Chain costs.

The availability of costing tools guides the costing exercise and enables Supply Chain managers to make adequate decisions. Afterwards, costing should assume increasing prominence as a key to strengthening and sustaining the Public Health Supply Chain (Shieshia et.al., 2014).

### 2.1 Costing health Supply Chains

Costing, derived from accounting data, is one of the key factors ensuring the financial awareness of a specific activity and making it possible to deduce its efficiency. Managers of for-profit/private Supply Chain consider Supply Chain to offer ample opportunity for significant cost savings, and therefore it should be embraced as a viable source of competitive advantage (Ellram, 2002). As cost optimisation is a major goal in the for-profit/private sector to ensure adequate financial margin and competitive pricing, companies are making increasing efforts to reduce costs by focusing attention on Supply Chain (Surowiec, 2013). The combined drivers of globalisation and increasing demand for high quality, low priced products and services have steered business strategies away from manufacturing and production to Supply Chain for cost containment. Subsequently, there is now a need for more sophisticated costing tools and methods to be developed.

### 2.2. Private sector versus public sector Supply Chain costing

Initially, companies in the private sector defined “costs” as those within their business, but it became apparent that the real competition is in the Supply Chain, since all the cumulative costs will eventually be added up to give the final price of the finished product (Christopher and Gattorna, 2005). For the private sector therefore, to maintain profitability, cost reduction should encompass the wider Supply Chain, rather than internal operations only (Truong et.al., 2017). Indeed, the cost of goods and services is now increasingly viewed through the perspective of the Supply Chain.

In the meantime, financial authorities have developed international accounting standards (such as the Generally Agreed Accounting Principles - GAAP, and the International Financial Reporting Standards - IFRS) with established methods for costing activities. Less sophisticated methods such as arbitrary/standard cost allocation were abandoned in favour of Activity Based Costing (ABC) in the 70's and 80's. This was followed by the introduction of lean accounting and application of Theory of Constrains (TOC), which brought hybrid views and diversely sophisticated models (Zhu, et.al., 2018).

With the sophistication of accounting, costing methods, and data warehousing software, the increased recognition of the "science" of Supply Chain (and its education in universities), and the growing global competition, costing of the entire Supply Chain has inevitably driven the desire to optimise specific Supply Chain activities (Goldbach, 2002). It has now been recognised that cost optimisation can only be realised by managing the costs along the entire Supply Chain. This is especially true for the extremely competitive industries of electronics (such as Dell, HP, etc.) and automotive equipment (such as Delphi.)

In the public sector, including the Ministry of Health, accounting does not have monthly deadlines for reporting to stringent financial authorities. The financial and cost culture does not prevail as much as in the for-profit/private sector. Often, PHSC personnel have little training in finance and costing, accounting is performed by a remote and bureaucratic department and crisis management and being reactive is more the daily norm than being pro-active. This is likely true for LMICs, as well as high income countries.

In the past decade, accounting has prevailed more in public health. In LMICs, the poor state of PHSC has led to increased awareness around the desperate lack of funding and evidence-based decisions (Ekeigwe, 2019). This created the need for accounting and costing of all Supply Chain activities in order to provide a clear vision. Furthermore, with shrinking funding and numerous examples of wasted investments, international and bilateral donors started to request that beneficiaries provide evidence of 'value for money'.

## 2.3 Landscaping: Supply Chain cost calculation methods and tools

It is difficult to find formal cost calculating tools in the private sector because cost controllers usually extract data from accounting software (SAP, ORACLE, SAGE and other Enterprise Resource Planning - ERP) into an MS Excel spreadsheet on a monthly basis to analyse, tweak and track their Key Performance Indicators (KPIs) of Supply Chain costs.

The impetus for financial accountability has recently reached public health for the reasons stated earlier. The combination of operational and financial dimensions is needed for competitive advantage and operational stability and aids decision making when looking to make improvements to Supply Chain. In public health, most of the costing tools are health program/disease-specific, only focusing on quantification/procurement, or include programmatic financial information (McCord 2013). Often, they include product purchase price, costs for customs, wastage, warehousing, and transportation/distribution, however, they fail to add costs for procurement and other related activities (quantification and specification, tendering and contracting,) such as quality assurance and quality control, reversed logistics, etc. In short, they do not provide a comprehensive landscape of all Supply Chain activities and often use a financial amount instead of detailed accounting data.

The 'common approach for the costing and financing analyses of routine immunization and new vaccine introduction costs' (EPIC) was developed through discussions with country teams for Benin, Ghana, Honduras, Moldova, Uganda and Zambia, and with members of a Technical Steering Committee; and partners of the GAVI Alliance Immunization Financing & Sustainability Task Team (Brenzel, 2014) (Annex 1). Similarly, another concept note outlined

a costing model for estimating the in-country Supply Chain costs globally in order to meet the Millennium Development Goals by 2015 (Sarley et.al., 2009) (Annex 2).

Consequently, the tools to assess and estimate the costs of Supply Chain activities within the public health system remained few. The tools that do exist have mostly emanated vertically through specific health intervention programs with deliberate and particular interest (Tien et.al., 2013). Even more rare, are tools to assess and analyse individual costs across parallel Supply Chains and partners working within the public health sectors in LMIC. These tools have mostly emerged from vertical involved actors and are usually the outcome of deliberate interventions in areas of particular interest (Annex 3).

Traditionally, cost accountants had arbitrarily added a broad percentage to distribute indirect costs against direct costs, however, as the percentages of indirect or overhead costs change and indirect costs deviate from being equal for all products, this percentage becomes inaccurate. As a result, new methods were developed to support Supply Chain costing (Annex 4).

- Direct Product Profitability (DPP) represented the first significant effort to determine the costs of moving products through an entire Supply Chain. The grocery trade initiated DPP as a pricing technique during the 1960s and 1970s (LaLonde et.al.,1996).
- Activity Based Costing (ABC) is a method for assigning the direct and indirect costs of an organisation to the activities consuming the organisation's resources and then subsequently tracing the costs of performing these activities to the products, customers, or distribution channels consuming the activities. Variations include simplified ABC method, time-based ABC, and process-based costing.
- Total Cost of Ownership (TCO) represents a more recent attempt to cost a specific portion of the Supply Chain. 'Total cost of ownership is a structured approach for determining the total costs associated with the acquisition and subsequent use of a given item or service from a given supplier.' (Federico et.al., 2015).
- Efficient Consumer Response (ECR) provides the most comprehensive technique currently available for costing a Supply Chain. ECR focuses on shortening time and eliminating costs in the core value-adding processes of the grocery chain.

## 2.4 Country experiences in costing of Public Health Supply Chain Management

- In Zimbabwe, a costing exercise conducted by the USAID|DELIVER project in 2009 revealed the full costs necessary to run a fully resourced traditional distribution system. When the costs were compared to that of an ongoing vendor managed inventory system, the Delivery Team Topping Up (DTTU), it was found that the DTTU had generated impressive results, with the availability of commodities for reproductive health and HIV reaching as high as 95% and the model could be made to run at a lower cost than the traditional distribution systems. This study contributed to the decision to not only maintain the DTTU for reproductive health, but to extend a similar system for tuberculosis and malaria (Sarley et.al., 2010).

- In Zambia, a costing study that was conducted in 2009 showed that between 8-16% of the values of antiretroviral drugs was used to deliver them to the sampled facilities (Baruwa et.al., 2013). These results found immediate application in the determination of resource requirements for commodity distribution within state budgets, and in informed discussions on obligatory cost recovery (Annex 5).

- A costing process in Nigeria (conducted in 2010) revealed that the funds generated from cost recovery of contraceptives were not enough to cover transportation of the commodities, especially at the local government and service delivery levels. This had resulted in a colossal annual operating deficit for the Contraceptive Logistics

Management System (CLMS) and a large deficit for local governments and service delivery points.

- Kaduna State (Nigeria) baseline costing in 2016 and Niger State baseline costing in 2018 led by PSA (Stephen et.al., 2016).
- A costing study in Rwanda (2012) had the objective of improving the financial sustainability of three tiers of the Supply Chain (a central level, a second tier at 30 district pharmacies; and a further tier of more than 500 service delivery points with primary, secondary, and tertiary facilities and more than 30,000 community health workers (USAID, 2013). The results of the Rwanda costing study helped to explain key financing issues and informed critical decisions, among which were the need to authorise a 14% management fee payable to the Medical Procurement and Distribution Division (MPDD) to cover procurement, storage and distribution, or 8% for storage and distribution only. The study also highlighted the inadequacy of funding for the district hospital pharmacies, and the need to review the financial sustainability. The revelation that as much as 31% of central level operating expenses related to expired products, hence a critical need for improved warehousing and financial management.
- A subnational (state-wide, public health sector-wide) costing study was conducted in Kaduna State, Nigeria, between May and July 2016 (Annex 5). The objective was to assess the baseline costs and performance level of the Kaduna State essential medicines and other health commodities supply management system (Stephen et.al., 2016). There were difficulties in determining the actual cost of value contributions by donors and also the baseline costs provide no information on the level of operational efficiency of the Supply Chain. Further analysis is made of the Kaduna State Supply Chain costing study in this report, for detailed synthesis of a calculating tool adequate for the specifics of Public Health Supply Chain costing.
- In Burkina Faso, the cost calculating tool of Expertise France was piloted in 2015 (Mission User Manual, 2015). The tool was the manual for users during the piloting phase at Association of Central African Purchases of Essential Medicines (ACAME) in Burkina Faso. It describes the principles of the tool and how to use it (Annex 5).
- In Ghana, a baseline cost calculation was completed in 2009 and led by Family Planning Logistics Management and John Snow Incorporated (Huff-Rousselle et.al., 2002). In Guatemala, a similar exercise was conducted in 2012, as part of the USAID Deliver Project (Agudelo et al., 2014).
- A Benin and Kenya baseline costing for artemisinin-based combination therapy (ACT) and rapid diagnostic tests (RDTs) was performed in 2013, led by Systems for Improved Access to Pharmaceuticals and Services (SIAPS) and Management Sciences for Health (MSH) (Shretta et al., 2014). In Tanzania, the cost baseline exercise conducted in 2013, as part of the USAID Deliver Project, was one of the first efforts in the country (Mwencha et al., 2017). Likewise, a similar exercise was conducted in Peru in 2015 as part of the USAID Deliver Project (Sánchez et al., 2015).

# 3. Synthesising features for an "Ideal" Cost Calculating Tool

In view of the limitations of the Supply Chain costing methods and calculating tools that are currently used, it is necessary to compile a set of ideal characteristics, features, and capabilities to meet the expectations for costing the Supply Chain efficiently, especially in LMICs.

## 3.1 Outlining the costing methodology for the tool guidance

LaLonde et.al., (1996) present a six-step outline for developing cost-based performance measures for the Supply Chain activities. This information should be included in the cost calculating document. They are:

- *Analysing Supply Chain activities*: Identification of the key activities within the Supply Chain. The analysis identifies the major activities performed within each step by each stakeholder of the Supply Chain.

- *Breaking activities down into sub-activities/cost drivers*: The major tasks identified in the previous step must be broken down into the specific sub-activities performed by each component of the Supply Chain (Green, 2007). The sub-activities in this phase should include all of those affected by Supply Chain performance.

- *Identifying the resources required to perform a sub-activity*: Performance of the sub-activities will result in the utilisation of resources across different levels of the Supply Chain. Resources include the labour, facilities, utilities, material, etc. required to perform a sub-activity. The accounts or resources must be split to capture important differences in the way they are actually utilised by sub-activities. The proportion of a resource utilised in performing a sub-activity determines the amount of the resource cost traced to a specific sub-activity. Accounting provides the source of the data (Murphy and Schlaerth, 2010).

- *Costing the sub-activities:* The sub-activity cost represents the total cost of performing a specific unit of work. A sub-activity's cost is the sum of the resource costs traced to the sub-activity: the cost of the labour, material, administration, supervision, facilities, or other resources consumed in performing the sub-activity. The sub-activity cost includes both the direct and the indirect resources consumed by the activity. As a result, activity costs provide a more complete picture of how resources are consumed within an organisation and the costs of providing specific logistics services within the Supply Chain. Activity costs can answer questions such as: what work is performed in the Supply Chain, what activities consume the most resources, where management should focus to eliminate Supply Chain costs, and how the costs to perform an activity compare with the value received by the customer.

- *Tracing activity costs to Supply Chain outputs*: Supply Chain costing uses the activity costs to determine the total costs of serving specific products, customers, or distribution channels. The approach uses the activity cost and volume to calculate a cost per activity output. Consumption of the outputs determines the proportion of the activity cost traced to different products, customers, or distribution channels. The assignment of activity provides a complete picture of how different products, customers or distribution channels affect activity and resource costs across the entire Supply Chain (Babad and Balachandran, 1993). Tracing costs to outputs provides several important insights, including profitability by customer, product, or Supply Chain; the value-added versus the cost incurred by the final customer; non-value-added activities which can be targeted for elimination; the potential for more cost effective trade-offs within the Supply Chain, and opportunities for restructuring or "functional shiftability" to

align activities with the firms that can most effectively perform them within the Supply Chain (Pisa and McCurdy, 2019).

- *Analysis and simulation*: Supply Chain costing provides guidance for analysing the cost drivers for specific activities and how variations in product flow or customer demand will affect costs throughout the Supply Chain. The information obtained from Supply Chain costing can support a contribution analysis by product, customer, or distribution channel (Soonhong et.al., 2019). Analyses can be performed to determine the causal effect between the customer demand for specific logistics services and activity costs spanning the entire Supply Chain. The analysis will also enable organisations to evaluate how different channel structures drive costs and contribute to overall profitability. The organisations could use the analysis to determine the most cost-competitive channel to serve their customers. Carriers and third parties could use the analysis to demonstrate how their services add value or reduce overall Supply Chain costs.

## 3.2 Synthesis features for an ideal Cost Calculating Tool

In synthesising an ideal cost calculating tool and a methodology of use, a list of characteristics are summarised below.

| | |
|---|---|
| Objective-based | The tool should focus/highlight the main objective of costing. |
| Synchronise with existing accounting system | The tool should link as seamlessly as possible with the accounting system, so that efforts are reduced. |
| Comprehensiveness | The tool should be as comprehensive as possible to enable the broadest view of the Supply Chain. |
| Discriminating power | The tool should be able to discriminate between the various levels. |
| Reliability | The tool should be consistent with measuring the intended issues. |
| Validity | The tool should be accurate with what it is intended to measure. |
| Objectivity | The tool should be free from bias of interpreting its scope and responses. |
| Practicability | The tool should be easy to use - that is using it is within reasonable means and does not require much expertise. |

## 3.3 Synthesis with considerations of applicability

A review of the issues discussed in this report highlight these key areas of consideration:

- *The methodology for use should help clarify the Supply Chain objectives of the costing exercise*: An ideal tool is best used with clear and precise objectives. If this arrangement is not given its critical place, chaos in operations, and more so in measurement might occur. The signals of impending chaos in a Supply Chain include:
    - A lack of documented or generally understood Supply Chain strategy;
    - The concept of ‘Supply Chain’ as being restricted to one or two functions and/or departments instead of the entire organisation;
    - Internal and external dissatisfaction with services and costs;
    - Supply Chain projects being managed in ‘silos,’ (function as individual discrete departments).

- *Inclusive with performance measurement*: It is important that the tool provides KPIs - both cost-related and not. The results of these measurements will be regularly reviewed and used to set realistic targets for improvement and follow up. Since KPIs should be measured in order to reveal the level of operational adequacy, they should be recognised as meaningful and relevant, tracked and understood across functional departments, used to focus on and drive performance improvement, and indisputably help to improve Supply Chain performance.

- *Costing methods*: Ideally, the tool should offer several costing methods which can be effectively applied to Public Health Supply Chain and provide diverse angles on the cost of the Supply Chain activities, so that they could be improved.

- *Comprehensiveness and inclusion of all stakeholders in the country Supply Chain:* Depending upon the objectives, strategies, operations and performance management indicators, the mapping of all stakeholders in the country Supply Chain and their activities and involvement on the Supply Chain is often necessary for a comprehensive costing exercise. The cost calculation tool should be able to align with this need for national Supply Chain strategic planning.

- *Updating capability with newer information*: The tool should be capable of updating parts of information over time, as Supply Chain functions and improvements are modified, without repeating the entire process of data collection, validation, input, and analysis.

- *Support simulation of envisioned changes:* The tool should be flexible enough in its features to enable simulation of potential changes in the Supply Chain activities and their costs.

- *Support for decision making:* The tool should eventually help Supply Chain managers to make decisions in the design and improvement of the Supply Chain activities according to costs.

## 3.4 Synthesis in context to country experiences

The below list outlines the issues that emerged when using the Supply Chain Costing Tool.

- *Ease of data entry*: This included unclear instructions on how to import data or populate cells, unclear instructions on data limits (maximum data permissible for facilities and medicines/commodities,) no error alerts or bridge system with accounting systems, and no trouble shooting instructions.

- *Comprehensiveness of the data description:* Input data descriptions were not comprehensive enough to accommodate and allocate costs - including administrative costs, operating costs, incidental costs, interactions between the primary organisation and the specific Supply Chain operators and all others in the Supply Chain functions and activities.

- *Coding options*: In case of stakeholders preferring to keep anonymous details of their operations, there should also be ways to code them to enable shielding from wider public consumption, which is not currently possible.

- *Unclear interpretation of output:* The data generated should be unambiguous and simple. Output interpretation was difficult for non-Supply Chain professionals with decision making powers.

- *Unclear output on impacts*: With medicines and health commodities, it was not possible to highlight particular products that are outliers in the Supply Chain - that is, those that contribute unique low or high costs. There was no functionality to help gauge their contribution to the overall Supply Chain costs.

- *Limited impact of lessons learned*: Lessons from past studies, whether pilot or actual should be collected in the cost computing tools and manuals for use, so that positive outcomes are institutionalised and the risks of recurrence of contextual disadvantages are minimised.

# 4. Key pillars for high quality Baseline Cost Evaluation

Through the semi-structured interviews of key industry experts, this study has identified seven key pillars that are required to support high quality BCE. When properly established, they help to ensure an efficient process, accurate results and recommendations, satisfied clients, and greater benefits for health system users.

## 4.1 Pillar 1: Client buy-in and ownership over the process

The first pillar is client buy-in and ownership over the process. Often this extends to multiple parties. While the direct client is technically the aid organisation in a donor funded program, the underlying client is the government and the relevant public sector entities that benefit from the work. Whatever the arrangement may be, clients should be fully enrolled in the Supply Chain transformation project and therefore understand the work and act as decision-makers at all critical junctures. The buy-in of underlying government clients is particularly important for two reasons: firstly, it is a basic principle of ethics that decisions should be made, and systems should be designed by the people they affect. Thus, local government clients must take the lead in the baseline costing exercise because they represent the people most affected by them.

While the first reason is ethical, the second is pragmatic: government clients know their Supply Chains best. PHSC in LMICs are complex, they involve multiple actors, a long list of frequently changing commodities and processes, and they cut across various geographical, administrative, and institutional boundaries. In addition, it is often difficult to achieve a clear view of the Supply Chain because information management systems are limited or, in certain parts of the chain, completely absent. In light of this, the best explanations and understanding about the Supply Chain, as well as the broader context in which it operates, come from those who work within it and manage it. For ethical and pragmatic reasons, the client buy-in process is essential.

However, this raises the question: how can client buy-in be achieved? In PSA's experience, clients are generally enthusiastic about the exercise, having initiated the Supply Chain transformation process themselves. They want to know how the Supply Chain can be improved and they recognise that establishing baseline facts is an important part of this process. Nevertheless, it is always possible to build from this favourable starting point. There is enormous value to be gained by taking a 'personal approach' that emphasises relationship building. This means continual dialogue with clients and going beyond emails to more personal forms of communication, including visits and meetings.

'Experience-sharing' is also effective - showing the impact of BCE in other jurisdictions, or perhaps in different parts of the same country, can deepen the sense that the project is important. At the end of the day, clients are political representatives, and they are therefore most concerned with the impact on people.

## 4.2 Pillar 2: A clear understanding of why the Supply Chain is being costed

According to a review of the Peru BCE in 2015, it is important 'to reach absolute certainty on the terms of reference, in particular what you are measuring and for what purpose' (Sánchez et al., 2015). This applies to all parties within the partnership and to every level of personnel working within them. On the client side, it is not only senior ministry staff who need to appreciate the bigger picture, but also the teams of data collectors going into the field. For consulting companies, understanding must similarly extend from project directors all the way through their teams of consultants and data validators. When this occurs, evaluations are more likely to be driven by smart decision-making and individual enthusiasm for excellence, which in turn translates into better health system improvements and greater benefits for the public.

The reasons for costing the Supply Chain in a particular case will depend on the client's needs and priorities. For some governments, the baseline costing is used to inform their choice of

different Supply Chain designs, while for others it helps determine whether to outsource particular Supply Chain functions to the private sector. Other times the government's priority may be to monitor funding, anticipate funding gaps, or to improve transparency and of course, running in parallel with these reasons are the motivations of donors, which generally relate to Supply Chain transformation funding requirements and the need to quantify the impact of their investments over time. Indeed, donors are naturally concerned with how much they need to spend on the Supply Chain and what benefits they will see in return.

Given the diversity of these motivations, it is important to be led by clients and to resist assuming that all costing exercises are the same. To the contrary, every costing exercise is different, and it is important to identify the underlying purpose from the outset. That being said, a few high-level observations probably apply to every BCE. The first observation is that evaluations are inherently related to Supply Chain financing. By definition, these reveal how much is being spent on the Supply Chain to process a certain quantity of commodities. This information is essential because it allows clients to create realistic budgets for spending on health commodities, and to confidently approach external donors with a clear and credible explanation of how much finance they require to realise their healthcare goals. This point was emphasised by all the respondents interviewed for this report and noted in many of the technical reports.

This is closely related to the second observation, which is that BCE are rarely used by decision makers on their own and are much more often just one piece of a larger puzzle. In other words, the insights gained from the BCE are combined with insights gained from other data collection exercises. Using these insights together, decision makers can identify the crucial challenges and opportunities for Supply Chain transformation and in turn where to focus their resources.

The third observation is that, although every BCE must be guided by its particular purpose and context, it is helpful to remain open to tangential insights that emerge in the process. For example, it may be revealed that extremely long lead times cause users of the public healthcare system to source commodities through private Supply Chains instead. Similarly, 'hard truths' about the Supply Chain may emerge, such as corruption and fraud. From the perspective of healthcare systems strengthening, these are important insights, and they cannot be set aside simply because they do not fall squarely within the brief. Instead, they must be elevated with the degree of sensitivity appropriate to the circumstances.

## 4.3 Pillar 3: A comprehensive and realistic view of the Supply Chain

The idea of this pillar is that the entire Supply Chain cost can be estimated by creating a comprehensive model and by collecting and inserting data from a representative sample. By extrapolating from the sample costs, one can estimate the entire Supply Chain costs, but of course, none of this is as simple as it sounds so it is important to break it down.

Creating a 'model' means setting out how the Supply Chain operates in practice and, most importantly, where the various costs are incurred. This may occur on paper or through sophisticated computer programmes. It may be informed by desk reviews or qualitative interviews with key Supply Chain stakeholders. But in all cases, the intention is to create a model which neatly reflects reality, because the BCE is ultimately concerned with a system existing in the real world.

Models are comprehensive when they include every single cost-incurring activity within the Supply Chain. In the micro-costing or bottom-up approach to BCEs currently prevailing in the sector, constituent costs (meaning the costs of performing specific functions at specific levels of the health system) are identified first and then added together to arrive at an estimated total cost (McCord et.al., 2013). Given that total cost is the ultimate target, it is essential to identify all the pieces making up that total. This can be likened to weighing a basket of goods at the market. In order to identify the total weight of the basket, one must ensure that all the various

goods are physically placed on the scales. If things are left out, the number showing on the scales will not be realistic.

To achieve a comprehensive model, one must identify all the levels of the health system, all the facilities, all the activities taking place, and all the flows of commodities and finance. In addition, it can be helpful to identify the relationships between these components, including the direction of product and finance flows and which actors are involved to make these things happen. Fortunately, there are a number of costing frameworks that can guide this process. The most notable is the USAID Guide, which instructs users to create a model based on the levels of the Supply Chain and the core Supply Chain functions (which can be broken down further into sub-functions). According to the USAID Guide, there are up to four tiers of the health system, and the core Supply Chain functions are procurement, storage, transport, and management.

While this framework is undeniably helpful, it is vital to remember that it is meant to *guide* the design of the Supply Chain model rather than provide a ready-made model for every context. Again, the purpose of the model is to reflect the reality of the Supply Chain. If the components and divisions offered by the USAID Guide reflect that reality, then they should be employed, but if the reality is different, then modifications must be made.

Changes may be required for several reasons, for example, the USAID Guide assumes that health commodities move from one level of the healthcare system to the next, thus forming a linear system. However, some Supply Chains, or pieces of the Supply Chain, actually look more like the wheel of a bicycle. There is a central hub in the middle, with spokes connecting it to various nodes at the periphery, as well as linkages between neighbouring nodes. In a system like this, transport occurs between the hub and periphery, but it also occurs around the *edge* of the periphery as well. This complexity does not easily fit within conventional models and it is therefore important to adapt the model to reflect reality.

Complexity similarly arises through informality, which can be either positive or negative. Positive informality includes people performing Supply Chain functions as unpaid favours, such as using their personal vehicles to pick up supplies and transport them to local facilities while going about their own business. Negative informality generally means corruption, for example skimming off resources or taking work vehicles for unauthorised personal use. Both forms of informality are difficult to factor into conventional costing frameworks, but because they represent genuine costs for the system, it is important to find a way to do so.

Another reason for complexity in many LMICs is the existence of parallel Supply Chains. Failures in Public Health Supply Chains often lead facility managers, such as pharmacists, to fulfil their commodity needs through alternative channels. Most of the time this means procuring products through private sector Supply Chains and selling them on at higher margins. Technically this should not affect the BCE, as clients are only interested in the costs of *their* Public Health Supply Chains, however, in practice it is extremely difficult to disentangle public Supply Chain costs from parallel Supply Chain costs and to identify which are properly attributable to the public sector alone. This is another difficultly which must be worked into the model, one way or another.

## 4.4 Pillar 4: A representative sample of facilities

Once a comprehensive model is in place, the next step is to establish a representative sample of facilities from which to collect data. The representative aspect here refers to the statistical principle that the sample must 'look like' the entire Supply Chain, just on a smaller scale. Thus, care should be taken to include a sufficient number of facilities of every type and to ensure they are representative of variation in natural geographies and population densities. Certainly, there are other factors to consider as well, for example, one must incorporate practical concerns such as the availability of data at different facilities and the financial cost of travelling there. In addition, one must ensure a certain level of political sensitivity during the selection process as clients cannot be seen to be biased towards certain states or districts.

This has been difficult to achieve in practice, as demonstrated by the fact that representativeness was highlighted as an area of concern in almost all the BCEs reviewed for this paper. In the Zambia BCE, for example, the technical report states that 'the analysis does not represent a large enough sample to generalise the results' and that the sample was drawn from a region that is materially different from much of the rest of the country (Baruwa et.al., 2010).

## 4.5 Pillar 5: Careful selection and training of data collectors

Like most Supply Chain transformation exercises, BCE rely on people. Indeed, the bottom-up approach to costing requires travel into the field to collect data, and just like other people-centred exercises, the quality of end results turns primarily on the suitability and preparation of the people involved.

With respect to suitability, the important considerations to balance are experience, access, and reliability. At the very least, team leaders must have experience in the Supply Chain sector and an understanding of sampling methodologies. This helps ensure data collection aligns with the realities of the Supply Chain and the principles of representative sampling.

In an ideal world, all team members would have this kind of experience as well. In the real world, though, experience tends to give way to the need to ensure access within the group. Access refers to the ability of team members to speak to, and obtain honest answers from, people holding information about the Supply Chain - who has access depends on the people holding that information. It is noted that societal and professional culture is a powerful force in many LMICs and as a result people have better and worse access to different levels of the Supply Chain depending on their background. For example, lower level staffers find it difficult to obtain information from central medical stores, but they are well placed to elicit honest responses from their 'peers' at primary healthcare facilities. Conversely, senior health system staffers have strong access to other personnel working at their level, but they often lack trust at community health facilities. Thus, data collection teams must be diverse in terms of their access, reflecting the various contexts from which data is to be collected.

The qualification to this is that "peer-review" data collection introduces potential for biased and unreliable results. This might give rise to collusion of data collectors and interviewees on occasion to make the results 'seem good' in one way or another. To mitigate this and to restore reliability, it is essential to establish appropriate oversight mechanisms, which normally include supervision by senior team members. Team selection should therefore aim to achieve a balance between experience, access, and reliability. However even if this mix is achieved, it remains important to induct the group into the overall purpose of the BCE and to train them for the specific activities they will conduct.

Turning to preparation, then, the USAID Guide makes recommendations about what data collectors should be trained on. These include familiarising data collectors with the purpose and objectives of the BCE, orienting them to their roles and responsibilities, providing an overview of software tools being used, helping them understand what information they will be responsible for collecting - how to record and collect the information, and who they will be interviewing, and discussing how to manage problems and questions that arise in the field. Ideally, preparation will also include mock sampling exercises, either with each other or through field visits to health facilities.

While these areas appear to be covered in practice, there remains a lot of room for improvement. Most importantly, training periods are too short for sufficient learning to occur. In the Peru and Guatemala evaluations, the need for more training time was highlighted as a key lesson learned. Similarly, training during the Kaduna evaluation took place across just two days, while in the Niger BCE it was compressed into one. In both cases it was felt this was too short, and indeed the nature of questions posed by data collectors during the Niger BCE seems to support this. In the author's view, frequent questions about how to measure storage

space, which documents to take information from, and whether information about staff salary was relevant shows a general lack of preparation. While this is not a criticism of the data collectors, or the people responsible for their training, it appears a higher level of understanding is required before the active phase of BCE begins.

The duration of training should therefore be extended to allow data collectors, most of whom have no prior experience in conducting BCE, to come up to speed more fully. In addition, steps must be taken to ensure participants are physically present for the entire training period and that they are tested on their knowledge and skills before being released into the field.

## 4.6 Pillar 6: Critical attention to detail during data collection and validation

Once training is complete, the BCE transitions from theory and planning into reality, as data collectors travel into the field to collect information. During this phase, critical attention to detail ensures the information collected is accurate and reliable. Moreover, BCE is often just the start of a much longer SCT process. If it emerges that the information collected and presented during the BCE is inaccurate, the client may lose trust in the technical consultant, which obviously undermines the rest of the SCT project. The final reason to prioritise accuracy stems from the sampling methodology of BCEs. To repeat what was explained earlier, the cost of the entire Supply Chain is estimated by identifying the cost for a sample of the Supply Chain and multiplying that by the appropriate factor. If there are errors in the sample cost, they will be multiplied many times in the total Supply Chain cost provided to the client.

Accurate data collection is therefore essential to high quality BCEs. To achieve this in practice, it is helpful to know where and how data inaccuracies creep into one's study, as well as how to address them. It is also helpful to know that assumptions will inevitably need to be made and that this can occur on a logical and principled basis.

- Turning to the first of these points, a simple source of inaccuracy is the recording of zero values within MS Excel spreadsheets. To avoid this confusion, it is better to adopt a universal practice that is understood by all BCE personnel, most likely being that zero means zero, while a blank space means the value is unknown.
- A more significant source of inaccuracy is the allocation of costs to different Supply Chain functions. Without doubt, costs must be allocated into different categories because clients are not only concerned with total Supply Chain costs, but also with cost drivers and disaggregated costs by function and facility type. In practice allocation can be difficult, especially in relation to labour costs.

To begin with, most people who perform Supply Chain functions are not purely Supply Chain workers. While they formally occupy just one position in the healthcare system, such as pharmacist or nurse, they probably perform a range of activities, only some of which concern the Supply Chain. For example, a nurse may be paid to offer care within her facility (a non-Supply Chain activity) but find herself travelling to central facility to collect medicines (a Supply Chain activity). This means it is not possible to carve off 'labour' as its own Supply Chain function to which the working hours of all 'Supply Chain workers' could be allocated. Instead, one must identify the activities of workers actually related to the Supply Chain, as well as the proportion of their time spent on each one.

This raises the next difficulty: workers themselves provide an unreliable view of how much time they spend on their tasks. For example, procurement directors often say they spend all their time (being 40 hours per week) on procurement, but this is simply not true. In fact, procurement directors spend most of their time on procurement but also a proportion on management meetings and miscellaneous other tasks, and this also does not take into account time out sick or on leave. Clearly, this time should not be included in the procurement budget for the BCE.

Moreover, even when workers avoid this mistake, they are easily let down by their memory. When there are no invoices or other objective sources of information available, data collectors depend on what the workers at healthcare facilities can recall, which is often unreliable. Workers often give responses that are exaggerated or understated. They sometimes try to make their facilities look good or actively hide information about 'unofficial' Supply Chain activities and for obvious reasons, they are reluctant to engage in pointed conversations about salaries. For these reasons, data collectors must be highly aware when speaking to workers and prepared to sensitively push back in order to get an accurate sense of labour costs.

In these situations, the concept of data triangulation can be adopted. They should begin by asking themselves whether the information they are given makes sense. Is it realistic that petrol expenditure is this low, given what is known about the cost of fuel and the amount of goods passing through the facility? If the answer is no, the reliability of the information should be tested by drawing on all the other information available, focusing wherever possible on objective information. To take a different example, if the total cost of procurement at the central medical store is known and yet the procurement cost at a particular community facility is said to exceed that cost, then the information being provided is probably incorrect.

Ideally this kind of data validation will occur because it is sometimes difficult for office-based data analytics teams to make sense of what exactly data collectors have done, or been told, based on what is recorded in spreadsheets. It is also because those in the field are the only ones with an opportunity to ask more probing questions and gather more primary information. Once they have left the facility, it is impractical and costly to go back.

Nevertheless, data collectors should draw on their colleagues to help them validate their findings. This includes parallel data collection teams and senior staff back at their headquarters. For example, during the Kaduna and Niger BCEs, the data collection teams set up a WhatsApp group to communicate with their supervisors about problems arising in the field. Not only is this helpful to raise the problem, it also helps to grow the collective wisdom of the group. Working together, data collection teams improve their ability to filter out unreliable information and ensure that only accurate information is included in the BCE.

The preceding points stress the importance of checking findings and removing unreliable information, but it is important to remember that BCEs often reveal shocking truths and that not all surprising results are unreliable, for example, exorbitant procurement prices that were 30 times higher than expected were found to be correct when checked. In situations such as this one, it is important that the information is not discarded simply because it seems too high to be true. To the contrary, provided these findings are validated, they are a big reason for conducting BCEs in the first place and they must be included in the study.

Coming to the second point about data accuracy, it is important to know in advance that assumptions will inevitably need to be made during the BCE and that this can occur on a principled basis. Assumptions are generally necessary due to missing data or other practical problems emerging during the data collection process. Whatever the case, assumptions are best made after careful reflection about the problem and the possible strategies to address it. The Ghana BCE offers a good example of this (Huff-Rousselle et.al., 2002). It was noted that when surveyors returned after an initial round of data collection, other experts joined them in a series of working meetings and reviewed the data. The surveyors discussed the data, differences in data from different sites, and differences in data collected by different surveyors. Site visits were also made to validate the data. During a series of meetings, the surveyors discussed the data sources, and the relationship between operations and costs at every level of the system, and their approach to data collection. These meetings were used as a participatory learning approach (PLA) to the study of costs.

Other good examples are found in the Tanzania and Guatemala BCEs, where teams not only reflected carefully on the assumptions that were made, but also conducted a sensitivity analysis to determine the degree of uncertainty that was introduced. In each of these cases,

the Monte Carlo method was used, but it can be assumed that other approaches are available as well (Mwencha et al., 2017; Agudelo et al., 2014). The Monte Carlo Method is a statistical risk analysis technique used to identify the range of uncertainty in quantitative findings. It involves building models of possible results by substituting a range of values for any factor that is inherently uncertain.

## 4.7 Pillar 7: Reports that tell the client what they need to hear in a form they will easily understand

The final pillar for high quality BCEs is reporting that tells the client what they need to hear in a form they will easily understand. BCEs generate an enormous amount of information and reports should only include what matters to the client. To determine what this is, the client's original reasons for conducting the BCE must be understood and they must anticipate the decision-making process going forwards. With respect to the form of delivery, consultants should write as simply as possible. If it is not possible for someone with no involvement in the BCE to understand the report, then changes need to be made.

# 5. Conclusions

The public sector is still in the nascent stage of linking the importance of the Supply Chain and its costs with its primary goal of comprehensive and sustainable health care delivery, even with limited and even dwindling resources, and evident national and international pressures. Even in schemes such as the Drug Revolving Fund, or National Health Insurance, the consequences of cost efficiency in performing the critical roles of delivering medicines and health commodities is yet to be adequately recognised

Furthermore, the cost calculating tools available for costing in Public Health Supply Chain are yet to be rigorously tested through actual, conclusive use by an all-inclusive health system, to interrogate their usability, comprehensiveness, and value to the decisions in improving Supply Chain and health outcomes.

This review has traced the development of Supply Chain costing, and methods available for costing, singly or in combination. The trajectory to the Public Health Supply Chain does not seem to be deliberate but the objectives are inherently congruent across both private and public sectors: the visibility of cost, their optimisation, and the improvement of performance of all Supply Chain stakeholders to deliver on the objectives of providing more for less costs, and to showcase the indisputable contribution of Supply Chain cost efficiency to health program success. There are yet issues to explore in greater depth:

- Can a cost calculating tool be used for an entire country Supply Chain and applied to all contexts?
- Can a cost calculating tool be successfully used recurrently and efficiently to aid decisions for improving Supply Chain?
- Can a cost calculating tool be useful in providing different visions of the Supply Chain costs with different costing methods?
- Should a national strategic plan of Supply Chain always be developed with a costing of the country Supply Chain?
- What tools and methods are needed to accompany a professionalisation of Public Health Supply Chain, support adequate decision making, and ensure good outcome?

The interactions between subnational level use and the overall national picture are of practical concern in the next phase of renewed advocacy for increased Supply Chain costing. The needs for the public health sector Supply Chain costing are that the tool be easily and clearly understood, down to the fundamentals of its design and limits of expected outputs. The manuals for data collection, data input, coding, entry, and analysis should recognise the limitations of the health stakeholders, particularly in LMICs where cost reduction and system optimisation is so critical. Alerts at all stages of use, to signal impending glitches, along with comprehensive instructions for troubleshooting will be imperative to all costing studies.

Accessibility and usability of the tool are also influencing factors in its success. Countries need upfront information on whether the tool is available online, and if so, whether the online versions are in fact usable without recourse to the authors and or designers. Other details should also be clearly described, such as availability of troubleshooting support for things like capacity building, data entry/validation and data analysis, especially where the users are at subnational level, and fees, if applicable.

These, and other issues highlighted should be deliberated upon as activities for updating, re-design, construction, and dynamic use of Supply Chain management costing tools commence in earnest. New potentials and possibilities exist - some are presented in this review report

and their exploitation could have a snowball effect on the entire health care delivery system and national development, heading towards the attainment of the Sustainable Development Goals.

# 6. Recommendations

- Health Supply Chains should not be costed for the sake of it, every BCE should take place for rational reasons aligned with the broader purpose of the SCT project.

- Exhaustive and comprehensive work should be engaged for Generally Agreed Health Costing Principles including recommended costing methods and several cost calculating tools starting from existing tools and using best practices from the private sector and private health sector (hospitals and pharmaceutical distributors).

- In the process of developing countries' national strategic plans for Public Health Supply Chain, that is becoming mandatory before Health System Strengthening investments by the GFATM and other donors, costing the country Supply Chain should become a baseline.

- It would be ideal to get a broad consensus within international and bilateral donors investing in Health System Strengthening and especially in Supply Chain (GFATM, World Bank, Regional Development Banks, UNICEF, UNFPA, USAID, DFID, and country cooperation, etc.)

- The quality of BCEs depends on the extent and quality of planning, the training of participants, and the accuracy and reliability of information collected in the field. What comes out of the BCE is only as good as what goes in. All of this depends on the critical thinking of BCE practitioners and their focus and commitment; it is people who determine the quality of BCEs.

- It must be acknowledged that an ideal cost calculating tool does not exist, but an effective tool should:

    - Be relatively simple – they should not require the involvement of financial experts;
    - Find their input in accounting data;
    - Apply several costing methods to provide different angles on Supply Chain costs
    - Be able to capture the comprehensive country picture and the various external stakeholders;
    - Offer Supply Chain Key Performance Indicators (both linked to costs and not)
    - Be developed as a support for decision making and therefore be recurrent on a yearly basis;
    - Make it possible to simulate potential changes in the country Supply Chain design.

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# Annex 1: Common approach for the costing and financing analyses of routine immunization and new vaccine introduction costs (EPIC)

The purpose of this document is to synthesise and summarise the methods to be used for the EPI Costing and Financing of Routine Immunization and New Vaccine Introduction (EPIC) studies. This common approach was developed through discussions with country teams for Benin, Ghana, Honduras, Moldova, Uganda, and Zambia, and with members of a Technical Steering Committee; and partners of the GAVI Alliance Immunization Financing & Sustainability Task Team. The main questions to be addressed in the EPIC studies are the following:

*Costing of Routine Immunisation:*

- What is the total and unit economic cost of the routine immunisation program at various levels of the health system?
- What is the cost structure by line item and activity?
- What is the total and unit delivery costs?
- What is the cost of new vaccine introduction by major line item?
- What are the factors that drive variation in facility total and unit costs? What are factors related to productivity of health facilities?
- How do costs compare with estimates in the cMYP and with other economic indicators?

*Cost of New Vaccine Introduction*

- What is the total incremental cost of new vaccine introduction, and how are these costs divided between initial start-up and ongoing costs?
- What is the incremental delivery cost of the new vaccine?
- How do the costs of vaccine introduction compare with budgets for introduction?

*Financing of Routine Immunisation*

- What is the total envelope of funding available for RI in the country?
- What are the main sources of financing and for new vaccine introduction?
- What are the intended uses of these funding sources for the RI program?

| **Advantages** |
|---|
| A comprehensive tool for all areas of data collection, and analysis for immunisation and new vaccine costs. |
| Rigorous Quantitative Analysis described in a step wise manner, including the derivation of formulae used. |
| There is provision for qualitative analysis of planning, budgeting and financing. |
| The tool includes a template for the final report. |
| **Disadvantages** |
| Limited application of the costing tool to only a section of public health immunisation, it is not applicable sector wide. |
| The quality of data may be affected at various stages of the study, including at data collection and/or data entry:<br>• Data collection: when interviewers collect the wrong information or make errors in recording information; or information is missing at a particular level of the health system.<br>• Data entry: persons responsible for data entry could miscode data from survey instruments |

# Annex 2: Estimating the global in-country Supply Chain costs of meeting the MDGs by 2015

This concept note outlines a costing model for estimating the in-country Supply Chain costs globally to meet the Millennium Development Goals by 2015. The possible applications included citing available information and identifying data gaps, providing an approach for estimating the variable costs for in-country distribution costs based on a series of assumptions, and proposing a tool to validate those assumptions and develop an approach for estimating capital costs required for the MDGs.

| **Advantages** |
|---|
| The model addresses a major gap in health financing (in-country distribution costs.) These costs are frequently neglected or underestimated |
| It describes how Supply Chain costs will evolve over time as more health commodities move through the health system chain to meet MDG requirements |
| **Disadvantages** |
| Application of cost estimates assumes that these are already present in those countries. As this is not the case, countries are grouped together according to common characteristics (such as geography and economic development) and proxy estimates used to determine the typical cost parameters that apply to them. |
| Health commodities have different characteristics and associated distribution needs and costs. Such specific needs include product bulk, the need for cold or cool chain distribution, security for high value items, and measures to address counterfeit and poor-quality products. Therefore, there may be a necessity to estimate costs for different SC segments that may be associated with different health programs and MDG targets. |

# Annex 3: Supply Chain Costing Tool

The Supply Chain Costing Tool supports the implementation of Public Health Supply Chain costing exercises. The possible applications include: determining the total Supply Chain costs, providing insight into the cost drivers of the Supply Chains (operational factors that most directly affect total costs), and providing critical information to assist government, development partners, technical assistance providers, Supply Chain managers, policy makers, procurement managers and other interested stakeholders with a range of Supply Chain decisions.

| **Advantages** |
|---|
| The tool collects and categorises Supply Chain costs for each tier of the health system and acts across four main Supply Chain functions - procurement, storage, transportation and management. |
| Rigorous Quantitative Analysis described in a step wise manner. It describes the derivation of formulae used. |
| The tool also supports calculation and presentation of Supply Chain costs in discretely outlined metrics. |
| The outcome of the Supply Chain Costing Tool are expected to be useful for advocacy and planning for funding, for better designing, planning and management of systems, to inform decision making on Supply Chain policies and financing, and to provide a clearer understanding of the sources of funding for the Supply Chain. |
| **Disadvantages** |
| The costing exercise captures the Supply Chain system as it is currently functioning. This translates to the fact that estimated cost figures stay the same, whether the system is operating at full capacity or is experiencing stock outs. |
| The Supply Chain tool does not measure Supply Chain performance or optimise Supply Chains. |
| There is a limit of 50 different facilities and 200 different commodities that can be included as part of the costing analysis. (There is however a caveat of combining or creating ‘bundles’ of commodities at the calibration stage. |
| The tool is sensitive to user errors such as misnaming files or entering incorrect figures - the limitations in the level of MS Excel knowledge required to operate this tool may pose a recurrent hurdle. |

# Annex 4: Various methods of Supply Chain costing

Annex 4.1 Direct Product Profitability (DPP)

Annex 4.2 Activity based costing (ABC)

Annex 4.3: Total Cost of Ownership (TCO)

Annex 4.4: Efficient Consumer Response (ECR)

## Annex 4.1 Direct Product Profitability (DPP)

This more accurately depicts product profitability by subtracting from gross margin those costs directly attributable to the product. DPP would include the cost of activities such as handling, freight, discounts, allowances, storage, and direct labour. DPP improved profitability measurements by considering those costs directly affected by a product decision. The approach would provide a better understanding of the profit implications of various merchandising and product-handling decisions

*Limitations:*

- The major problem with DPP stems from its focus on direct costs. DPP excludes overhead and non-volume-based costs. DPP excludes 'fixed' overhead costs such as supervision, facilities, management, detention, demurrage, purchasing, and inventory carrying costs --it fails to recognise overhead and administrative expenses and therefore cannot be used for total company costing purposes. Further, a major factor contributing to the limited use of DPP stemmed from the requirement to maintain an extensive database of physical characteristics and to continually update the database.

## Annex 4.2 Activity based costing (ABC)

ABC is a technique for assigning the direct and indirect costs of an organisation to the activities consuming the organisation's resources and then subsequently tracing the costs of performing these activities to the products, customers, or distribution channels consuming the activities. ABC can help organisations to obtain more accurate information of how specific products, customers, or Supply Chains affect costs and contribute to overall profitability. ABC is seen as a potential tool for evaluating Supply Chain performance. It uses multiple drivers to assign costs. ABC overcomes the limitations of DPP by assigning indirect as well as direct costs. Firms using ABC can obtain more accurate information of how specific products, customers, or Supply Chains affect costs and contribute to overall profitability (Mahal and Hossain, 2015).

A classic success story of ABC implementation was when it was introduced in Bangladesh in 1994. Three leading companies (in their own sector) in Bangladesh namely Novertis, Glaxo SK (BD) Ltd. and Nestlé Bangladesh Ltd. implemented this method. Nestlé covers nearly every field of nutrition; infant formula, milk products, chocolate and confectionery, instant coffee, ice-cream, culinary products, frozen readymade meals, mineral water etc. it is also a major producer of pet food. Nestlé is present around the globe, on all continents, with around 230,000 people working in more in 84 countries with 466 factories and with sales representatives in at least another 70 countries. Nestlé Bangladesh Ltd. introduced ABC in 1997. They used ABC costing as a supplement to the company's usual costing and management methods.

*Advantages*

- ABC increased operational performance by allocating overhead costs based on the actual consumption of the resources by each activity.
- ABC recognises the interdependencies of cost drivers to activities.
- It enables management to see where the most important costs occur as well as what provides them.
- Decisions about improving pricing, marketing, product design, and product mix can be made more efficiently by implementing an ABC system.
- ABC system is the suitable method for correct and accurate information.
- Redeploying a resource from a non-value-added activity to a value-added activity.
- By identifying the weak product lines and accurate costs, ABC helps to increase organisational efficiency and profitability.
- Completely eliminating a non-value-adding activity ABC can take out costs.
- There is functionality to identify and correct an error that was not budgeted, but would have caused an expense had it not been corrected.
- Using the system can provide growth by removing a bottleneck that was causing capacity constraints.
- It helps industrial marketers in three ways; provides cost estimates to use in pricing, guides industrial marketers when adapting negotiation tactics in order to yield significant cost reductions, and indicates areas for change in operations to permit cost reductions that will allow the company to provide better customer price satisfaction.

*Limitations*

- ABC system is more costly to maintain than a traditional costing system.
- The implementation process of ABC system is very complex for managers to understand and it produces numerous data and activity measures and requires a data collecting and checking process, amongst other things.
- Decision-making process becomes lengthy due to the complexity of the implementation and data.
- There is often resistance from management as they are accustomed to using traditional costing systems to run their operations.

- ABC data can easily be misinterpreted, as there are large amounts of irrelevant data.
- In practice, as managers insist on allocating all costs to cost objects, it results in overstated cost, understated margin results and mistakes in pricing.
- If no one in the organisation looks at the new ABC cost and profitability information, the project team becomes disappointed.
- Consultants are not familiar with the company's operations and problems and have failed to support management in some cases.
- Resistance arises because staff feel threatened by the suggestion that their work could be improved.

When ABC is used in the public administration sector, the reported studies do not provide evidence about the success of methodology beyond justification of budgeting practice and existing service management and strategies. Usage in the US Marine Corps started in 1999. Its use by the UK Police has been mandated since the 2003-04 UK tax year as part of England and Wales' National Policing Plan, specifically the Policing Performance Assessment Framework.

## Annex 4.3 Total Cost of Ownership (TCO)

TCO recognises that the purchase price represents only a portion of the total cost of acquiring an item. Vendor performance also affects the costs of ordering, expediting, receiving, and inspecting. Instead of obscuring these costs by burying them in overhead or general expenses, TCO attempts to identify the total acquisition price by including the costs of purchasing, holding, poor quality, and delivery failure. When coupled with activity-based costing, TCO can provide an even more accurate depiction of the activities and resources consumed in dealing with specific vendors

*Limitations*

- Although TCO does provide more accurate information on how the performance of one firm in the Supply Chain affects the costs of another, it does not provide the total Supply Chain cost. The costs captured in a TCO analysis only include the costs of one member of the Supply Chain. TCO does not capture the upstream firm's costs, so TCO may miss opportunities for making inter-firm cost trade-offs. One of the firms may perform some activities more efficiently than the other such as transportation, packaging, warehousing, or inventory management.
- TCO does not demonstrate how the buyer's behaviour may affect the suppliers' costs.
- The lack of an integrated costing approach may prevent the Supply Chain from achieving a cost-competitive position.

## Annex 4.4 Efficient Consumer Response (ECR)

ECR provides the most comprehensive technique currently available for costing a Supply Chain. ECR focuses on shortening time and eliminating costs in the core value-adding processes of the grocery chain. ECR is not a costing model, but attempts to link the individual components of the Supply Chain into a unified, replenishment loop. Cost savings will occur in the form of lower administrative costs from the automation of ordering activities, labour savings by cross-docking instead of putting away and selecting inventory, and more efficient utilisation of manufacturing or store space. ECR's Efficient Replenishment strategy includes two phases for reducing Supply Chain costs:

- Phase I, Best Practices Efficient Replenishment: This automates many of the linkages occurring within the Supply Chain. Cost savings result from the elimination of manual handling of orders and invoices, paperwork errors, and inventory.
- Phase II, Efficient Replenishment: This builds on Phase I automation by attempting to integrate the distributor and supplier replenishment cycles into one. Integration of the replenishment cycles can generate additional costs savings through more accurate sales forecasts, dynamic allocation, and cross-docking.

*Limitations*

- The methodology employed by ECR for costing and evaluating Supply Chain performance suffers from many of the same problems encountered with ABC. The costing has primarily an internal focus; firms have visibility of only their internal costs, but not how their performance or reengineering affects costs elsewhere in the Supply Chain or the total process costs within the Supply Chain. Firms may therefore continue to independently pursue efforts to optimise individual costs, while inadvertently increasing overall Supply Chain costs.
- The reluctance to share cost information may also prove a significant barrier for determining Supply Chain costs. The sharing of cost information may give away a hard-earned competitive advantage or provide negotiating leverage to their Supply Chain partners. However, ECR must possess visibility over the costs across the entire Supply Chain to effectively re-engineer key processes, determine landed marketplace cost, measure performance, or allocate the benefits and burdens between individual firms.

# Annex 5: Country experiences in costing of Public Health Supply Chain Management

Annex 5.1: The Supply Chain costing tool in Zambia

Annex 5.2: The Supply Chain costing tool in Kaduna, Nigeria

Annex 5.3: Expertise France Cost calculating Tool piloted in Burkina Faso

## Annex 5.1: The Supply Chain Costing Tool (SCCT) in Zambia

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| Background | In January 2009, the USAID \| DELIVER PROJECT, Task Order 1, assessed the cost of the antiretroviral (ARV) Supply Chain in Zambia. The survey's overall objective was to cost the logistics systems that distributes the commodities for Zambia's antiretroviral therapy (ART) program using the Supply Chain Costing Tool developed by the USAID \| DELIVER PROJECT. This report presents the findings of the costing exercise, as well as the implications from the results for Zambia's ART program; it also illustrates what the Supply Chain Costing Tool does and how its output can be used. |
| Method | SCCT uses a restricted version of the Activity Based Costing method. |
| Objectives | 1. An assessment and comparison of the Supply Chain costs of the different agencies operating the ARV Supply Chain in Zambia, including the Medical Stores Limited (MSL), which supplies the District Health Offices (DHO) and hospitals directly; the Elizabeth Glaser Pediatric Aids Foundation (EGPAF)/Centre for Infectious Disease Research in Zambia (CIDRZ)/Ngansa facility; which takes the place of the Lusaka Main DHO, and the Churches Health Association of Zambia (CHAZ) Supply Chain.<br>2. An assessment and comparison of the Supply Chain costs, by function (procurement, warehousing, and transportation) at different tiers and facilities (urban/rural, high/low volume) in the Supply Chain. |
| Limitation | The document lists a number of limitations, such as non-representative sample size, the samples' characteristics, these were more of limitations of the country and study context rather than of the SCCT itself. |

## Annex 5.2 The Supply Chain Costing Tool (SCCT) in Kaduna State, Nigeria

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|---|---|
| Background | In 2016, the Kaduna State Ministry of Health and Human Services (SMOH&HS), committed to costing of its public health commodities Supply Chain. The objective consisted in assessing the baseline costs and performance management of the Kaduna State Supply Chain. The exercise was supported by the Bill and Melinda Gates Foundation (BMGF), and her technical partner Pamela Steele Associates (PSA). The study involved survey of 25 facilities samples, which cut across all levels of the state's health Supply Chain: in the three senatorial zones, across three levels of public healthcare delivery (primary, secondary, and tertiary) covering both rural and urban settings. |
| Method | SCCT uses a limited version of Activity Based Costing method. |
| Objectives | 1. Provide a reference document for Supply Chain budgeting by government.<br>2. Provide a reference for partners/donor agencies and other stakeholders.<br>3. Provision of an evidence-based implementation planning tool for Health Supply Chain.<br>4. Serving as a strong advocacy tool for improved funding for Supply Chain functions by the state government.<br>5. The cost baseline will help the government to design a more feasible pricing policy.<br>6. The cost baseline will provide support for future Supply Chain performance assessments.<br>7. It will act as a basis to support data-driven decision-making. |
| Limitation | 1. The tool was very sensitive to errors by the user and lacked error alerts.<br>2. The costing tool captured the Supply Chain as it is currently functioning, meaning estimated cost figures were for a system functioning well or not. It fails to measure Supply Chain performance.<br>3. By design, the survey methodology isolated the SDSS/FMCH Supply Chain system for this costing exercise and may not reflect parallel Supply Chains.<br>4. The tool requires advance spreadsheet manipulation skills. |

## Annex 5.3 Expertise France cost-calculating tool piloted in Burkina Faso

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| Background | This document is the manual for users during the piloting phase at ACAME, in Burkina Faso. It describes the principles of the tool and how to use it in 13 pages. |
| Method | The cost calculation tool uses a comprehensive version of Activity Based Costing method with three levels of cost allocation (one for direct costs and two for indirect costs). |
| Limitation | 1. The tool is only available in French.<br>2. The tool is design for a selling/buying model, often found in African contexts of National Procurement and Central Warehousing Agencies.<br>3. The tool is procurement/central warehousing focused and therefore has a specific angle that is weak on costs related to specification, quantification, quality assurance and quality control, local storing, and reverse logistics.<br>5. The tool does not apply well to contexts with other Procurement and Central Warehousing Agencies funded by or executed by international and bilateral donors.<br>6. The tool works for one year only and does not allow forecasting and simulation.<br>7. The tool needs very detailed accounting information about warehousing space utilisation, cost for pallet volume, transportation costs per kg/km, etc. which makes it super precise but cumbersome.<br>8. The tool does not include Supply Chain Key Performance Indicators (KPIs).<br>9. Except the ABC method, the tool does not provide alternative costing methods.<br>10. In case the organisation being costed follows public accounting standards, accounting adjustment need to be made.<br>11. User-friendliness can be improved. |