DHIS 2 manual for the Bottleneck Analysis App

Applicable to version 1.1.1-rc.0

BNA App team
February 2020
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February 2020

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1 About this guide

The BNA App implementation is a collective effort and has been developed by the development team and users. While the guide strives to be complete, there may be certain functionalities/topics which have been omitted or which have yet to be documented. This section explains some of the conventions which are used throughout the document.

DHIS2 is a browser-based application. In many cases, screenshots have been included for enhanced clarity. Shortcuts to various functionalities are displayed such as Data element “>” Data element group. The “>” symbol indicates that you should click Data element and then click Data element group in the user interface.

Different styles of text have been used to highlight important parts of the text or particular types of text, such as source code. Each of the conventions used in the document are explained below.

- **Note**
  A note contains additional information which should be considered or a reference to more information which may be helpful.

- **Tip**
  A tip can be a useful piece of advice, such as how to perform a particular task more efficiently.

- **Important**
  Important information should not be ignored, and usually indicates something which is required by the application.

- **Caution**
  Information contained in these sections should be carefully considered, and if not heeded, could result in unexpected results in analysis, performance, or functionality.

- **Warning**
  Information contained in these sections, if not heeded, could result in permanent data loss or affect the overall usability of the system.

Program listings usually contain some type of computer code. They will be displayed with a shaded background and a different font.

Commands will be displayed in bold text, and represent a command which would need to be executed on the operating system or database.

Links to external web sites or cross references will be displayed in blue text, and underlined like this.

1.1 Intended Audience

This guide is intended to be used by users who can have administrative privilege to do system setup, and who have are capable of doing some technical setup of interventions, indicators and sharing of objects related to BNA app.
2 Introduction and Usage

2.1 Bottleneck Analysis Dashboard and Demo server

2.1.1 Introduction to the BNA App

Bottleneck analysis (BNA) is a structured analysis of the determinants of coverage for a wide range of interventions delivered through the health sector, useful to supporting targeted operational planning. It is a systematic, outcome-based approach to equitable health programming and real-time monitoring that strengthens the health system, complementing and building on what exists.

The BNA App is developed and maintained by the HISP Community (UiO, HISP-Tanzania and HISP Uganda) in collaboration with UNICEF. The BNA app is available [here](#) for download. It is currently compatible with DHIS2 2.28 and above.

![Standard layout of the BNA App dashboard](image)

2.1.2 Advantages of the BNA App

The bottleneck analysis and planning approach contribute to existing national and sub-national planning and monitoring cycles by offering a strategic, rapid and systematic approach to analyzing key health systems barriers to reaching intervention coverage targets.

This approach can help save time and increase the efficiency of resources available by identifying where the greatest pockets of unmet needs or poor service outcomes exist and, in those places, identifying key bottlenecks, prioritizing what should be addressed immediately, what should be deferred (prioritization of most effective actions) and ensuring that resources are programmed to tackle priority bottlenecks with evidence-informed solutions.

2.1.3 Rationale for the BNA App

Health managers have competing demands resulting in limited time, resources and training to conduct data analysis. Collecting data from multiple sources and preparing it for analysis themselves can be a barrier to effectively using data for planning. While the growing trend of building dashboards into DHIS2 is encouraging, too often the information displayed in
Dashboards is a collection of related (or sometimes unrelated) indicators rather than a well thought out process (or framework) of how a workflow or intervention actually works. The bottleneck analysis app helps address these issues by automating data gathering and presentation within DHIS2 and displaying it in a manner that facilitates systematic analysis for programming.

Effective and timely use of DHIS2 data by stakeholders at all levels of health system is critical for health service delivery. DHIS2 dashboards have the potential to enhance the use of data for decision making and planning by displaying information for managers in an accessible and actionable manner. This visualization is made possible by using the bottleneck analysis model integrated with the causality and tracking actions/solutions to effect interventions.

2.1.4 About demo server and the BNA App meta-data

The BNA demo server is setup to support both development, testing, training and ensuring quality of features and functions of the demo server. Additionally, the demo server is also setup to host both demo data and metadata across various interventions to give chance to users of the system to explore and learn system features and functions. The current demo server can be accessed on: https://scorecard-dev.dhis2.org/demo/

The server is hosted in the cloud and can be accessed on the internet via a browser from anywhere as long as there is availability of internet.

2.1.4.1 Using DHIS2 demo server

To use the BNA app demo server you will have to login into the server, you can use the login credentials that are displayed on the login page to login and explore the amazing features of the BNA app.

Logging and accessing the BNA demo server

2.1.4.2 Bottleneck & root cause analysis meta-data

The BNA app borrows its meta-data from the general DHIS2 data source and uses this to create a data store for ease of analysis. Bottleneck analysis metadata such as indicators and indicator groups are managed using the DHIS2 Indicator maintenance App.
Complex indicators that require additional calculations are maintained using the function maintenance app. These include but are not limited to indicators on stock data, Human resources.

2.1.4.3 Functional Maintenance App

The BNA App is also integrated with function maintenance App, used to create custom indicators. Custom Indicators are indicators whose definition and calculation cannot easily be created using the Indicator maintenance app in the DHIS2. The app can be easily used by developers to create custom codes to retrieve and use indicators with complex calculations. To use the app, find it [here](#).
2.2 BNA App architecture

The BNA Application is built on architecture that eases the user interactions by having a design concept that promotes the user to follow their intuition complemented with high performance that considers the lowest internet connection scenarios with descriptive notification messages if the user misses a step along the way.

2.2.1 BNA App Design concepts

2.2.1.1 Do more with less steps

Most of the operations in the application can be achieved in three steps or less. The BNA App gives a district user or any user at any level with no administrative privilege the ability to perform operations without a need to switch between modules or drop ongoing activities. Users can bookmark interventions, filter interventions by organization unit or period and more with everything being just a click away.

2.2.1.2 Trust your intuition

The BNA App has been built from the ground app, to make functionalities more accessible, more intuitive and most importantly more capable. The App follows a minimalistic design that minimizes any chances of the user getting lost in the middle of performing their usual operations.

2.2.2 Layout of the BNA App

The BNA App is flexible to adapt to any number of user journeys depending on country's implementations. The primary two users are the Administrator who can manage the interventions, the district users who analyze the bottlenecks.

The administrator can manage interventions with operations such as creating interventions, applying data filters for interventions, making legend definitions and many more administrative operations.

The district users who analyze the bottlenecks can switch through their interventions, bookmark their favorite interventions and perform root cause analysis through the root cause analysis widget.

Other bottleneck App users can be national, and regional/counties users users who can only analyses bottleneck, sub-nation analysis, route causes for each bottleneck and their solutions.

2.2.3 Global DHIS2 Menu

When using the Bottleneck analysis App the Global DHIS2 Menu is accessible on its usual position. The user can use the global menu to access other apps and to log out of the system. Most of the app notifications will pop on the top position where the DHIS2 global menu exists.
2.2.4 Interventions list

The interventions list is found just under the DHIS2 global menu. Users can only see the interventions if they created them or shared to them. Accessing the shared interventions is limited to the access level they are shared.

List of Interventions accessible to logged in user in the BNA App

2.2.5 Interventions Global filters

Right under the interventions list there are controls for the active interventions. The filter control when clicked expands to offer the user an ability to make data selections, period selections, organization unit selections, and legend configurations. However, all users except administrators have access to Period Organization unit filters only. More details on these operations can be found on chapter 4 section 4.
2.2.6 Intervention items

All interventions in the BNA App contains three items, namely:

1. The Bottleneck Analysis Chart
2. The Sublevel Analysis Table
3. The Root Cause Analysis Widget

These intervention items will be empty when an intervention is created. The administrator is expected to configure the intervention items by making selections on the global filters. More details on how to configure interventions can be found on Chapter 4 Section 5. The district user is expected to enter data into the root cause analysis widget as explained in the next chapters.

2.3 Navigating the BNA App

Bottleneck analysis application can be found in the Apps menu. If the application has not yet been installed in your DHIS2 instance or installation has issues, refer to the installation instructions (Chapter 2) of this documentation for further guidance, or contact the DHIS2 administrator for your instance.

2.3.1 Starting an Intervention

Once open, the bottleneck analysis application will bring a list of created interventions, or when no intervention exists, a quick create button will display for the user to create and add a new intervention.

The new intervention dashboard will display blank templates pending data selection and filtering.
NOTE
If bottleneck analysis application is taking too long to load, and you're not slow on network, make sure you have cleared your browser cache. See BNA App Maintenance for additional information on clearing browser cache.

The bottleneck app makes good use of cached files for better offline experience, as a result, when installing higher versions, the bottleneck app may use older version of cached files and thus break down while loading.

2.3.2 Using global filters

2.3.2.1 Data selection

The administrator user can make data selections from the global filters by simply selecting data. Currently the BNA Application supports data selections of Indicators and Functions. Clicking the Data filter control opens a panel with a list of indicators complemented with a list of data dimension groups. When a user selects an indicator or a function from the list of available data items the selected data items will be populated to the active data dimension group.

NOTE
Long indicators can be shortened by entering alternative display name as indicated above. This will ensure you chart readable and easily interpretable.

2.3.2.2 Legend Configurations

The administrative user can set legend for each indicator in every intervention to show low, medium and high bands with their cut-off points. Administrator can set colors for each band for visualization. Currently the BNA App uses three classes of colors to present indicator performance as per defined cut-off points. Red shows low performance, with yellow and green showing medium and good performance respectively. To manage the Legend, administrator must click Legend tab in Global filter, then select the specific indicator to be set the legends.
Managing Legends for Indicators in the BNA App

NOTE
Continuous legends must consist of legend items that end and start with the same value, for example: 0-50 and 50-80. Do not set legend that leaves gaps or overlaps such as 0-50 and 51-80 or 0-50 and 45-80 etc.

NOTE
For any changes made, administrative user must click update button displayed in the working window and save changes for persistence, or just close the message in case of rejecting the changes.
Modifications made on the legend set management will require the administrator to save the changes.

2.3.2.3 Period selection

The BNA App allows you to make period selections for fixed periods, relative periods and extended relative periods.

All period selections types begin with clicking the period button on the global filters menu. Then clicking on the period type select option button which lists all the period types.

2.3.2.3.1 Fixed period selections

To select fixed periods, start by selecting a period type from the period type list. You can then select periods from the list of available periods.
2.3.2.3.2 Relative period selections

To select relative periods start by selecting a period type from the period type list. You can then select periods from the list of available periods.

2.3.2.4 Organization units selection

The BNA App allows the user to make organization unit selections based on groups, levels and user organization units, these are known as selection modes.
Selection of orgunits

2.3.2.4.1 Selection by levels and groups

From the list of Levels on the under the input box that reads “Search Levels or groups”, users can then make their selections by clicking the desired levels to view on the analysis on the BNA App.

Selection of org units by levels

2.3.2.4.2 Selection by user organization unit

To the top of the selection by level there are buttons which are for selecting organization unit relative to the user-assigned organization unit. This gives flexibility for the users to view the data based on their assigned orgunits or suborgunits of their assigned orgunits.
Selection of org units by user orgunit

NOTE
Selections by user organization unit disables selection by organization unit tree. To disable selection by user organization unit simply click the active option (the one which appears with gray background) to inactivate it and enable selection by organization unit tree.

2.3.2.5 Saving Configurations

After the administrator is satisfied with the filters that they have applied for an intervention they have saved these configuration they have made for the interventions. To save the configurations they simply have to click the “Save” button.

NOTE
Editing and saving configurations of a shared intervention will reflect the new configurations to the district end user with whom the intervention has been shared with.

2.4 BNA Analysis and Interpretation

Bottleneck analysis a systematic way to look at the main determinants of effective coverage for selected interventions to identify problem areas to purposely act on them. The Six coverage determinants, from supply to demand side, provide a mechanism to analyze where health

Each intervention in the bottleneck analysis application comes with three intervention items, the bottleneck analysis chart and sublevel analysis table, and root cause analysis widget which are there to assist the district user in analysing the bottlenecks and enter the route causes and solutions for each identified bottleneck.

2.4.1 Bottleneck chart operations

The bottleneck analysis chart is a bar graph of the bottleneck indicators sub-divided in groups of their determinants. The bottleneck analysis chart can be configured through the global filters whereas the national level administrator can make data selections and sort the arrangement of the determinants, determinant group color, organization unit and period filters for other national users who are not administrators, regional, and district users to make changes on organization unit and period filters.

Options for administrative users to configure indicators, organization unit, period, and legends in BNA application

2.4.2 Analyzing bottleneck Charts

1. Start from left to right: supply first, then demand, then quality
2. Identify the lowest bar in the supply side (weakest determinant in the existing system)
3. Identify the biggest drop in the supply side and quality

A bottleneck is a significant gap or drop in coverage determinant between the expected and the observed. Services must be available first before they are used. Therefore, bottlenecks are analyzed starting with supply, followed by demand and finally by quality. The cascade rule means that quality cannot be higher than demand, and demand higher than supply.
To highlight bottlenecks in the charts, simply click on the bar that represents the identified bottleneck. The bar should change to color RED. This color is not saved as part of the values that represent the different performances.

**NOTE**
To deselect the highlighted bars, click once and the colors will be deselected to the default.

Highlighting bottlenecks in the chart indicated by RED bars.

When the graph seems different from what we expect, care should be given to assess common factors e.g. using different denominators for supply, demand and quality.

### 2.4.3 Sublevel Analysis

The sublevel analysis table makes use of the global filters that the bottleneck analysis chart makes use of with an additional operation of legend configurations for each indicator, that has been selected. It presents sublevel analysis of performance each of the indicators in determinant groups for selected intervention.
Visualization of sublevel analysis in bottleneck analysis application

In sublevel analysis table, user can transpose the layout of the table to exchange presentation of indicators and sublevels. To transpose the table, you have to click an icon just before the download icon below the sublevel analysis table.

Sub-Level analysis layout Switch.

Changing Layout of Sub-level analysis table

2.4.4 Additional Indicator dictionary

The BNA app is equipped with an indicator dictionary to provide additional information on the indicators used in the definition and creation of the BNA chart. To access the indicator dictionary, click on the (i) icon in the sub-level analysis table.

Sub-Level Analysis Indicator dictionary
2.4.5 Root Cause analysis

After the district user has looked at the Bottleneck Analysis Chart and the Sublevel Analysis Chart and has identified the major bottlenecks, they are expected to proceed to the Root Cause Analysis Widget. In the root cause analysis widget they can document the Root causes and Solutions of determinants and indicators for the active intervention based on the period and organization unit filters applied.

At first glance the widget will come up empty and the user can create a new empty row by simply clicking the “Add New” button that is available right under the widget. The new empty row comes pre-populated with the row counter, Intervention Name, Period Name and Organization Unit Name.

The user can select determinants and indicators from the dropdown lists and use the free texts to document the root cause and solutions. Once done there is a tick icon on the solution column, the user will click this icon to save the data.

Sub-Level Analysis Indicator dictionary

The indicator dictionary will display the list of indicators used in creating the BNA chart, including numerators and denominators, calculation details, and corresponding data elements. You can also click on the “Export” button to export the indicator dictionary to excel. To switch back to the table view, click on the Table icon.

Sub-Level Analysis table view
Adding root causes and suggested solutions for identified bottlenecks in the bottleneck application

The quality of the causality analysis is a critical determinant of the quality of the resulting plans and the impact on health system performance. It is important to have around the table people with the right knowledge and expertise.

Once a bottleneck is identified, the root causes need to be thoroughly assessed.

It is important to know what to look for when facilitating a root cause analysis.

1. Common causes of bottlenecks in the health system (specific for each determinant)
2. Main environmental factors (Social Norms, Legislation/Policy, Budget/expenditure, Management/Coordination)
3. Possible crisis/hazards (if relevant)

Once identified, proposed solutions/actions need to be documented for follow-up and implementation.

To edit data the user can simply double click a row to make active for editing or right click a row to get a context menu. Currently the context menu has two operations Edit and Delete, whereas, selecting “edit” makes a column active for changes and selecting “delete” removes the data of the particular row from the system.

Editing or deleting root cause in the specified bottleneck of the selected intervention in the bottleneck application

2.5 Visualization operations

2.5.1 Downloading of visualization

To download the Visualization, hover over the chart, in the bottom-left corner, look out for the download icon below;
Click on this Icon to download the chart using the various formats available.

The Formats provided include, PNG, JPG, CSV, Excel & PDF.

2.5.2 Basic/Full screen visualization

The BNA App support Basic and full screen views for all visualizations. To view the chart in full screen, point your cursor in the top-right-corner of the visualization and click on this icon:

The visualization should display in full screen.
3 Installation and Configuration

3.1 Installing the BNA App

The BNA app is completely free and open source and available on the DHIS2 app store.

To install an application in DHIS2, you require the superuser privilege. Ensure your account has the necessary authority to install the application or contact your DHIS2 support team for support in installing the app.

NOTE
Interactive BNA app supports all versions of DHIS2 from 2.28 going upward, it can run in lower versions limited functionalities and with no support for fixing any issues.

There are two ways of installing bottleneck analysis app into your DHIS2 instance.

3.1.1 Installation from within DHIS2

This installation approach is the most direct, but only available on DHIS2 running version 2.28 and above

Step 1: Access app management from the apps selection menu

Step 2: Once Apps management is open: Go to the apps store panel and the list of online applications for installation will show up. Install the “Interactive Bottleneck Analysis” app and the “Bottleneck analysis” app by clicking on install underneath the app name.
3.1.2 Installation from DHIS2 App store website

Access the interactive bottleneck analysis and bottleneck root cause data entry apps from the DHIS2 app store. This approach is recommended for all DHIS2 instances running on version 2.28 and above.

**NOTE**
Ensure that you have good and stable internet connection to download the zip file. During installation, both the Root Cause and Interactive apps have to be downloaded and installed.

Step 1: Downloading a compatible version from the app store
Once on the DHIS2 App store locate the BNA applications and select them to get the list of available versions of the app. Select the latest version of the app and download a zip file of the latest build into your local hard disk.
List of supported version for bottleneck app in DHIS2

NOTE
The zip file name may have a cryptic alphanumeric name such as “727a1631-85e4-4313-be1f-b5f02f7e25e2”. You may want to rename the zip file to easily locate it in the future with naming such as “Bottleneck App v1.0x.beta.zip”, where “x” is version number of your build.

Step 2: Access app management from the apps selection menu

Apps Management on search menu

Open Apps management to see and manage list of installed applications on DHIS2, bottleneck app can be installed by clicking the upload icon.

The DHIS2 upload icon

Once installed the bottleneck analysis application will be enlisted under standard apps
Bottleneck App listed after installation in DHIS2

When done installing, the bottleneck app will be accessible from the search menu. If the bottleneck analysis app does not appear on your menu, it could be a result of the following two issues.

1. Installation Access credentials/Permissions While the bottleneck analysis application may be installed within your DHIS2 instances, you may not have the necessary permissions to view it. In these cases, communicate with your DHIS2 administrator or DHIS2 support team for the application to be assigned to one of your user roles.

2. Installation not successful The bottleneck analysis application will not be visible in your application if it has not been installed successfully.

NOTE
Most common failures related to installation results from misconfiguration of read/write permissions of the installation folder on the server hosting DHIS2 instance. Misconfiguration of permission can also result from denial of ability to delete an installed application.

To resolve this, the administrator needs to access the back-end of DHIS2, to assign proper ownership and read-write permission of the folder for holding installed apps.

NOTE
The location of the folder for installed apps varies depending on the version of DHIS2 Installation.

1. From version 2.27 going back, the folder for installed apps is located in [DHIS2_HOME]/apps
2. From version 2.28 and above, the folder for installed apps is located in [DHIS2_HOME]/files/apps

For more information on how to create and install applications on DHIS2 please visit https://www.dhis2.org/how-to-create-find-install-apps/

3.2 BNA App Maintenance

3.2.1 Interventions and Indicators Configuration

If no Intervention created and assigned to the dashboard, BNA App loads with predefined interventions, with predefined indicators named “indicator 1” for each determinant. Sub-level analysis and root cause analysis will be empty.
Administrative users can create Interventions and assign them to the dashboard for other users to access depending on the sharing access granted to them.

### 3.2.1.1 Creating Intervention

To create new intervention, administrative user can click on the blue plus sign button just below list of interventions on the dashboard. Interventions are the ones holding determinants which holds indicators.

Then have to write the intervention name (e.g., BEmOnC) and click create button to save the intervention.

**Note:** Attempting creating an intervention that is existing, will be denied by the system and presented a message that the intervention is already existing.

### 3.2.1.2 Interventions and Indicators configuration

Administrative users can configure interventions and indicators by clicking the Settings button just below the intervention list on the dashboard to get the setup page.
Administrative needs to share intervention for other users to access, set the period for BNA presentation and analysis, decision to use indicator short names as display names in the BNA chart, and legends for specified cut-off points for indicator performance. Administrative users can change the colour of each determinant group indicator(s).

**Note:** Bar charts of every indicator attached to a particular determinant group will inherit the colour of that determinant group.

To add indicators into a determinant group, just click on the plus sign button to get a list of indicators from indicators or functions to add to the determinant group for BNA chart configuration.

### 3.2.1.3 Adding Indicators and Configuring legend-sets

Administrative users can add or remove indicators to and from determinants groups by interacting through interface. To add an indicator to a determinant group, users can click on the plus sign button to get a list of indicators or functions to select and add.

Administrative users can configure cut-off points for poor, average, and good performance for each indicator. Cut-off points are used in sub-level analysis visualization.
3.2.1.4 Access control and Sharing interventions

Interventions must be shared for other users and user groups to access. Interventions work in the same way as DHIS 2 dashboards. If not shared, only users who created them can access and manage. There are three sharing options that administrative users can share opt to share intervention.

1. **Can View and edit**: With this option, any user shared intervention with this privilege can access and edit it, including changing settings of items in it. This access should only be given to administrative users only.

2. **Can view only**: Administrative users should select this option to share intervention with users who are supposed to access BNA chart and sub-level analysis and enter root causes. For BNA application context, view only is granted to district, regional and national users who are not supposed to make any changes to the settings.

3. **No Access**: If you don't want to share access to anyone.

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3.2.1.5 Setting Organization Unit and Period

Administrative user can set organization unit and period and save changes for BNA charts to load with. If you set a particular district, all users will get the BNA charts loading for a selected district. Although users can filter the chart with their preferred organization unit and period, it may may confuse them. So it is important administrative user to set 'user organization unit' as default period so that every user can have BNA chart for their levels displayed. It is good practice to assign user organization unit so that every user can access BNA chart and sub-level analysis relevant to their levels.
3.2.1.6 Saving Configurations

After the administrator is satisfied with the filters that they have applied for an intervention they have to save these configurations they have made for the interventions. To save the configurations they simply have to click the “Save Changes” button.

**Note:** Editing and saving configurations of a shared intervention will reflect the new configurations to the district end user with whom the intervention has been shared with.

3.2.2 Standard data analytics

Data which is entered into DHIS2 must first be processed with the DHIS2 “analytics” engine. This means that data is not immediately available in the analytics resources (such as the BNA chart, sub-org unit level analysis tables, pivot tables, data visualizer, GIS or report) after it has been entered. If scheduling is active, the analytics process will run automatically at midnight each day. After that, new data which was entered since the last time the analytics process ran, will become visible.

You can trigger the analytics process manually by selecting **Reports->Analytics** from the main menu and pressing the “Start export” button. Note, the process may take a significant amount of time depending on the amount of data in your database.

3.2.3 Functions data analytics

Functions selections are extended analytics calculations supporting a more open-ended logic of computation, such as logical operations, predictors and other complex analytics use cases. To create functions to work with BNA App, download function maintenance application from this link: [https://play.dhis2.org/appstore/app/dXX2Fk6jwCX](https://play.dhis2.org/appstore/app/dXX2Fk6jwCX). Functions makes use of pure good old JavaScript(vanilla JavaScript) logic to do calculations purely on the browser, without the need for a server. This is accomplished by execution of JavaScript codes that expects period and data selections and return standard DHIS2 analytics results.
Functions selections are extended analytics calculations supporting a more open-ended logic of computation, such as logical operations, predictors and other complex analytics use cases.

### 3.2.4 Maintenance of Indicator functions

Functions comprises of three key building blocks:

1. **Input/Selection parameters:** Function expects standard DHIS2 periods and organization units selections.
2. **Computation logic:** This is an open-ended workspace for writing of calculation logic to work on given period and organization unit selections, computation logic is usually classified into rules dimensions, thus allowing one function to support different use cases by defining multiple rules that will control the computation logic. Possibilities are limitless, among major operations done includes:
   1. Fetching data from aggregate and event analytics and modifying results with custom logic, and reformat the results back in standard analytics format.
   2. Fetching data from existing sql Views, performing custom logics and formatting results in standard analytics format.
   3. Fetching data from other DHIS2 API endpoints(such as data-value and events api) and other data sources(including external sources), performing custom logic and formatting results in standard analytics format.
3. **Output/Returned analytics:** This is the end-result output from functions, formatted in standard analytics format, to allow compatibility with standard DHIS2 analytics applications. To support open-ended support for any level of complexity, function maintenance application has been developed, to allow any developer with basic JavaScript knowledge to quickly develop custom calculations either not supported natively by DHIS2 or to allow developers to work-around limitations or miscalculations from standard analytics.

Main requirements for developing functions includes: * Basic web programming knowledge with JavaScript (jQuery is an advantage). * Understanding of DHIS2 Web API and analytics. * A working installation of Functions maintenance application. When a function maintenance application is installed for the first time, it creates five standard functions with generic use cases as example functions to allow reuse of codes to create other functions. The auto created functions will also be listed in the functions selection list.

**CAUTION**
Sharing settings from 2.28 going back is only implemented on the interface, access control is not strictly enforced, it is for simplicity in management of BNA Interventions only through the datastore.

**NOTE**
User groups appearing on the access sharing list should exist in the user groups that were created in the "Users" app.

### 3.2.4.1 Bookmark an Intervention

To bookmark an intervention an administrative user will have to simply head on to the control options found just below the list of interventions next to the share icon there is a bookmark icon. Clicking the icon will bookmark the dashboard that you are currently viewing. The name of the dashboard you are currently viewing is also displayed on this control area.
3.2.4.2 Deleting an Intervention

The BNA App allows deletion of an intervention from the system whenever necessary. Deleting intervention means you delete all indicators, bottleneck charts, sub-level analysis and root cause analysis created under that intervention. This is why before deleting, you will be asked to confirm if you are sure you want to delete it, where you will click “yes” to delete or “no” to cancel. To delete an intervention, the administrative user can: 1. Go to search for intervention just allocated on the right hand side of adding new intervention icon and 2. click the delete icon next to edit button on the the specific intervention. 3. Select an intervention from the list, and click “DELETE” button on the far right side of the App and confirming deletion by clicking 'yes' option.

3.2.5 BNA Widgets setup

3.2.5.1 Accessing Widgets

BNA Widgets are meant to mainly be accessed by users at district levels. Widget is a separate application that is installed in DHIS2 instance to work with BNA Application. In case you don't find it in your DHIS2 instance, go to App Management in the DHIS2 global menu to install it.
3.2.5.2 Setting up Widgets

At first glance, when the administrator has installed the BNA Application into a clean instance the root cause analysis data entry component of the intervention will display a message prompting the user to head over to the DHIS2 Appstore and download the “Root Cause Analysis Data Entry Widget”. Detailed information on how to install an application from the DHIS2 app store can be found in chapter 2.

If BNA application is taking too long to load, and you’re not on a slow network, make sure you have cleared your browser cache.

BNA Application makes good use of cached files for better offline experience, as a result, when installing higher version, BNA Application may use older version of cached files and thus break down while loading.

3.2.6 Clearing application cache

Approaches to clear application cache and browser interface, vary from browser to browser; for example for Mozilla Firefox the keyboard shortcut is “CTRL+SHIFT+DELETE” while for Google chrome the keyboard shortcut is “CTRL+SHIFT+J”.

Accessing interface for clearing browser cache can be done via the following approaches: • Google chrome: Go to the menu icon on the top right corner, and click it to open, go to more tools menu, and choose “Clear browsing data”. Once interface is open, Make sure, “Clear the following items from” is set to “The beginning of time”.

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BNA widget in DHIS2 App store
• Mozilla Firefox: Go to the menu icon on the top right corner, and click it to open, go to ->Library, and go to History, and choose “Clear recent history”. Once interface is open, Make sure “Time range to clear” is set to “Everything”, and “Details” option is expanded to show all details options. Once on the clear browsing data or recent history, tick “Cache”, “Cookies”, “Hosted app data” or “Offline Website data”. To clear all cached files, cookies and locally stored data by bottleneck.

Menu icons in Google chrome and firefox

NOTE
These will also clear all cache information and cookies from other websites you visited in your browser.

Clear browsing data

Clear the following items from the beginning of time

☐ Browsing history
  4,167 items (and more on synced devices)

☐ Download history
  151 items

☐ Cached images and files
  334 MB

☐ Cookies and other site data
  This will sign you out of most websites.

☐ Passwords
  434 passwords (synced)

CANCEL  CLEAR BROWSING DATA

Google chrome interface for clearing browser cache
3 Installation and Configuration

3.2.7 BNA App Error Messages

The BNA Application has error messages for the expected errors that could occur. For example, attempting to access metadata that no longer exists in the system.
4 User Implementation

4.1 Guide to BNA App Implementation

This guide will provide a detailed overview of the different facets of the BNA App implementation.

4.1.1 BNA App implementation guiding principles

The BNA App implementation is part of a comprehensive approach to analyse key health barriers, identify and prioritize the most significant health system bottlenecks, determine their causes and develop realistic actions to address priority constraints at the sub-national level. To achieve this, Ministries of Health and other bottleneck analysis users should consider taking up the following guiding principles to successfully implement the application.

1. Ensure that before implementation (within the Ministry of Health) inclusive discussions with all stakeholders are undertaken to streamline the process, i.e. MoH (Program & data managers, ICT, M&E teams), stakeholders (Implementing and development partners)
2. For the case of MoH, ensure that there exists a functional DHIS2 instance at the national level with required datasets that provide data for at least the 6 determinants of coverage (Commodities, Human Resource, Geographical Access, Initial Utilization, Continuous Utilization and Effective Coverage)
3. Work with MoH teams (M&E, Program and Data Managers) to develop the BNA list of indicators. Important to ensure that indicators can easily be generated from the DHIS2 or other nationally available sources.

For sources such census, and survey reports, plan to create a dataset with the DHIS2 system to facilitate import.

For systems that are not integrated within the DHIS2 system, data can be exported in spreadsheets and subsequently imported for purposes of generating the bottleneck analysis charts.

Lookout for denominator issues and indicators that require complex calculations. You could opt to use proxies or any other relevant indicator that provide data for the bottleneck analysis.

1. Once the BNA indicator list has been completed, work with the MoH technical teams to map indicators to the DHIS2 system data elements / Indicators.
2. Ensure that the DHIS2 instance has been upgraded to at least dhis2 2.28 and above. The BNA app works well in DHIS2 instances starting with v2.28 - v2.33.
3. Obtain the BNA app installer from Dhis2 app store by either downloading directly from the site and installing the app in the DHIS2 system or installing from with the DHIS2 app management module (follow the installation manual to complete the setup)
4. Use the BNA configuration guide to complete setup for the BNA charts, sub-level and root-cause analysis. Part of the configuration includes sharing the BNA charts with national and district users, setting permissions and protocols for access.
5. To ensure the quality of data generated by the BNA charts, both technical, program and data managers need to validate the data outputs by comparing with other DHIS2 tools in the system such as pivot tables, data visualizers and dataset reports.
6. Plan and conduct BNA app trainings at both national (ToT) and the district levels.

4.2 Planning and organising

Stakeholders: It is important to identify the stakeholders who will participate in the implementation of BNA App and associated activities. Key stakeholders may include but not limited to the Ministry of Health, district staff, UNICEF staff, development and implementing partners.
**BNA Core Team (BCT):** 3-5 people will need to be identified and given the roles and responsibilities of administering the bottleneck analysis app. The core team (ICT and data analysis proficient) support setup and configuration will participate in testing and training activities, organizing and supporting end-user in various groups.

**Technical Steering Committee:** A committee composed of MoH and UNICEF will be needed to coordinate the BNA implementation across various health programs (Malaria, nutrition, reproductive health etc). The committee will lead integration of DHIS2 with other legacy systems (Human resources Systems, LAB systems and Logistics) and make decisions regarding the overall architecture and functioning of the BNA app.

**Identifying users:** Users of the BNA app should be cross-cutting from program managers at the national level to district and facility users at lower levels of implementation. To organize BNA implementation, it is important to group the users for easy management and assigning system privileges. Some examples of user groups include National users, District Users, Facility Users.

### 4.3 Adopting the use of the BNA App

#### 4.3.1 Scope of the App

1. Based on the decisions the system should support (system scope); customization and adaptation of the BNA app will be needed. Each action will need special competence, and should be led by the core team.
2. Assessment of the intended users and beneficiaries is important, as well as their information, and hardware and network needs.
3. An understanding of the larger architecture of the national HIS is important; consideration for what other systems are in place, and how they should interact with BNA app? Also consider what needs there will be for interoperability between electronic systems.
4. If there are needs that are not currently supported by DHIS2, an assessment of additional software development is necessary. For example population data, HR data and denominator calculations not supported with the main DHIS2 core. These can be addressed locally by developing a custom web app or feed into the overall core platform development roadmap process organized by UiO.

#### 4.3.2 Setup and configuration

1. Functionality of bottleneck analysis requires to carefully review meta-data before setup and configuration. The review should be led and spearheaded by the core team.
2. Ensure that all required meta-data (data elements, organisation units, datasets and indicators) are properly configured in the host system.
3. Additional requirements such as data elements for calculating denominators should be carefully analysed and setup in the host system. In cases where data is to be imported from other legacy systems, an integration process need to be in place.
4. Users and their appropriate roles need to be defined first in the DHIS2 and then in the BNA app for proper management.

#### 4.4 Capacity building

#### 4.4.1 National Core Team (NCT)

The National core team will need all the necessary skills (M&E, Data and ICT teams) to support BNA app implementation and bottleneck analysis in general. Both BNA app end-user and technical skills will be required in this case.

1. **User skills:** Ability to generate, analysis and interpret BNA charts, enter root causes for identified gaps, etc
2. **Technical Skills:** know how to setup BNA indicators on charts, configure user access and sharing

### 4.4.2 Training strategies and preparations

1. **National Core Team engagement:** The national core team should be prepared to offer continuous training to both national and district level users in accordance with BNA implementation guidelines.

   The core team should routinely review, identify and share the feedback on BNA app use cases with the development teams at HISP and UiO.

2. **Customization of training materials:** Training material and reference guides to reflect local information needs and local system content should be adopted. The core team should play a key role in ensuring training materials are up-to-date and conform to the country standards.

3. **Development of implementation materials:** Materials for the BNA implementation should be reviewed and developed by the national core team. These may include the Implementation guide, end-user and administrators guide. Were necessary, step-by-step guides should also be developed to enhance the training sessions.

4. **User acceptance testing:** This training is aimed at field testing the features and functions of the BNA app. The training can be organised into two categories of users, administrators and end-users. The purpose is to gauge the ability of users to interact with the app and use it for bna analysis.

5. **Training of Trainers:** Part of the processes to build capacity for support and implementation of BNA is putting in place a national core team. The ToT is aimed at training and building the capacity of a national core team to support BNA configuration and use at both national and lower levels. A team of 5-10 professional staff should be identified, trained and equipped to support the implementation.

### 4.4.3 End User training

Important tasks to note for the end user training are the roles and responsibilities of various users who will interact with the BNA App. These will depend on two factors, what the person will be doing, and where the user is located.

1. **Identify required training:** The most common tasks required for BNA app training will include, Data analysis processing, preparing reports and other information products. The development team should endeavour to work with stakeholders (MoH and Unicef) to plan trainings that have an impact on the users. App maintenance - managing users, changes on indicators and data elements.

2. **Workshops and onsite training:** 1-2 workshops should be organised and conducted in an effort to support BNA app implementation. a) Workshop for indicator identification and mapping, b) Training and capacity building workshop during implementation. Additionally, for lower levels such as facilities, on-site training sessions should be conducted to facilitate hands-on exercises. The on-site training sessions should be decentralized and preferably conducted by the District Health Management Team (DHMT) in conjunction with the MoH.

3. **Focused groups training:** Focused group trainings on use of BNA app should be adopted to allow maximum benefit for the participants. Sub-national level meetings such District Committee, District Health Management meetings should serve as avenues to discuss bottlenecks and mitigation approaches.

4. **Mentorship and support supervision:** Six-monthly onsite support supervision and training on the use of BNA app should be planned and conducted. This will help identify gaps in the BNA app implementation process and generate actions.
4.5 Setting-up a new BNA App

The BNA App utilizes available metadata and data in the DHIS2 instance. It is important to ensure that metadata are properly configured prior to installing the app. The development team has put together pre-configured metadata for sample indicators found here. You can download these and use them as an example to setup a local BNA app use case.

Best Practices for starting up a new BNA app implementation

The following section describes a list of tips for getting off to a good start when setting up and implementing the bottleneck analysis app.

1. Identify a real life use case to use in the BNA process.
2. Discuss and identify priority indicators to use in the BNA process.
3. Quickly populate a demo instance, include examples of BNA charts, tables and dashboard. Use real data, ideally nationwide, but not necessarily facility-level data.
4. Put the demo database online. Server hosting with an external provider can be a solution to speed up the process, even if temporary. This makes a great collaborative platform and dissemination tool to get buy-in from stakeholders.
5. The next phase is a more elaborate BNA implementation process. Parts of the demo can be reused if viable.
6. Make sure to have a local team with different skills and background: public health, data administrator, IT and project management.
7. The core national team should drive the implementation process but be supported and guided by experienced stakeholders.

4.5.1 Installing the BNA App

BNA App can be installed into DHIS 2 system in two ways like other DHIS 2 applications.

1. If the application has been uploaded into the play store, users can browse from DHIS 2 App store to download it. Installation from App store is simply clicking the application and it will be installed. Users can refresh the page to see BNA App in the DHIS 2 menu.
2. If the application has not been uploaded into DHIS 2 App store, users can get the zipped file and upload into the App manager. App Management access needs to be accessed with users who have permission to access and manage Apps. after opening App Management, a user is required to click an upward arrow to get options to select file for uploading.

Best practices for configuration
1. Functionality of bottleneck analysis requires to carefully review meta-data before setup and configuration. The review should be led and spearheaded by the core team. 2. Stakeholders are advised to select tracer intervention that will best represent/identify barriers to health care service delivery. 3. Ensure that all required meta-data (data elements, organisation units, datasets and indicators) are properly configured in the host system. 4. Additional requirements such as data elements for calculating denominators should be carefully analysed and setup in the host system. In cases where data is to be imported from other legacy systems, an integration process need to be in place. 5. Users and their
appropriate roles need to be defined first in the DHIS2 and then in the BNA app for proper management.

4.5.2 BNA Access and Navigation

Once installed, BNA App can be initiated by searching it from DHIS 2 menu and click it to open. At the first time if no intervention has been configured, BNA App will load with predefined interventions, with predefined indicators named “indicator 1” for each determinant. Sub-level analysis and root cause analysis will be empty. Predefined interventions are replaced with user defined interventions with configured indicators for each determinant group of every intervention.

4.6 Data and Metadata

The bottleneck analysis app, works well within existing DHIS2 instance. The app is well supported in DHIS 2 version 2.28 onwards. The app utilizes existing data and metadata in the DHIS2 system to generate BNA charts. BNA app is meant to utilize data reported in DHIS 2 system directly or from external systems after being integrated or imported into DHIS 2. Data from external systems needs to be stored in placeholders created in DHIS 2 for definition of indicators.

4.6.1 Datasets and Data elements

Data elements are the most critical part of the DHIS 2. For the bottleneck analysis app to work, it needs indicators generated from data elements within DHIS 2. Data elements are critical for collection, aggregation and analysis of Health data. The DHIS 2 support team needs to ensure that most of the data for BNA app can be generated from the DHIS 2 system.

Some of the data required for the generating BNA charts may be from other sources that are not pushing data in the DHIS2 for example Human Resource for Health data, population data, data from survey report; in such cases, it is important for the support team to create data elements / datasets to act as place holders for data from external sources. Once the datasets have been created, then data can be adequately imported into the DHIS2 system for generating indicators that aid the creation of BNA charts. Data elements and data sets are created in DHIS 2 maintenance App, and can be used for BNA charts and other analysis tools such as pivot tables etc. You can learn more on data element in and Data set in DHIS 2 Documentation.

4.6.2 Indicator mapping and configuration

Indicator mapping and definition are critical for the BNA process to be successful. Once stakeholders have collaboratively identified interventions and indicators, best practice is to put indicators for each intervention in the document for reference purposes. For each indicator, it is important to identify the numerator and denominator together with their sources. Mapping document will guide the configuration and support team during mapping to know the sources, data element place holders for storing data from external systems and other calculations methods to use. The mapping document should have details of indicators to be collected; numerators, denominators, methods of collection and calculation to provide adequate information to the development team.

4.6.3 Intervention creation

BNA App allows administrative user to create interventions. If no interventions created, users will only see the default interventions with “indicator 1" labels but no data. To create new intervention, user needs to click on the blue plus sign button just below list of interventions on the dashboard. Interventions are the ones holding determinants which holds indicators.
Create Intervention

Then have to write the intervention name and click create button to save the intervention.

Note: Administrative users are the ones to create interventions and share to other users to manage and view.

4.6.4 Interventions and Indicators configuration

Interventions, determinants, and indicators must be properly configured for correct visualization of BNA charts and sub-level analysis. To configure interventions and indicators, administrative user can click the Settings button just below the intervention list on the dashboard to get the setup page.

Use Settings to add indicators

Clicking the Setting button will present a configuration window for administrative user to set choose who to share intervention with, set the period for BNA presentation and analysis, decision to use indicator short names as display names in the BNA chart, and legends for specified cut-off points for indicator performance. In BNA, administrative user can change the colour of each determinant group indicator(s). Bar chart of every indicator attached to a particular determinant group will inherit the colour of that determinant group. To add indicators into determinant group, just click on the plus sign button to get list of indicators from indicators or functions to add to the determinant group for BNA chart configuration.
4.6.5 Data entry and storage

The BNA app accepts entry of data for the root cause analysis component. The main fields captured include the possible root cause and solutions for the gaps in implementation of an intervention.

**Data entry in Root-cause analysis**

The entry of root causes and solutions should follow a comprehensive process of causality analysis usually done during the District Health Management Team meetings. The “ADD” button on the root cause analysis component will facilitate entry and allow you to add as many causes and solutions as possible.

**Note:** These records will also be useful during the planning cycle where district teams will formulate action plans and a monitoring framework for them.

Configuration data for indicators and data from root causes analysis are stored in the DHIS2 “Data store”. The data store is resident on the server hosting the DHIS2 instance and can be modified using the DHIS2 data store management app. Data contained in indicators are saved in DHIS 2 database.

**Note:** i. When the BNA App is uninstalled from the DHIS2, the data stored remains, unless if the data stored is removed.

1. Access to the BNA datastore is limited to system administrators only
4.6.6 Data analysis and presentation

Data analysis and presentation on the BNA app is based on the Tanahashi Model for health systems strengthening and strategic planning. The model emphasises 6 determinants of coverage (Availability of Commodities, Availability of Human Resources, Access to health facilities, Initial utilization of health services, Continuous utilization and Effective Coverage.)

Data visualization is interactive with dynamic relative periods and organisation units. BNA charts will also be automatically generated once DHIS2 data has been updated.

Identifying bottlenecks

Note: The golden rule for analyzing BNA charts is “The demand side cannot be higher than the lowest bar in the supply side” where the denominator is the same. Additional guidance here

Data on the BNA chart is further displayed in a sub-national level tables to show performance of facilities using a scorecard colors (Red, Amber & Green).

Sub-level analysis tables

Data entered in the BNA app using the root cause analysis feature can be analyzed based on the organisation unit, and period of analysis.

Note: all the data presentation charts, tables and reports can be downloaded to either Excel, PDF or Word.
4.6.7 Rollout and Implementation strategies

1. The rollout team should give thought to scale-up of the bottleneck app, following a successful user acceptance testing phase. The rollout should consider sustainability efforts including support within the MoH structure.
2. The core team should play a key role here and each member should have clear responsibilities for the roll-out covering: user support, user training, liaison with health programs, etc.
3. Broader support structures need to be established to provide support, supervision, and communication with global/regional network of expert users and developers.
4. Information use must be a focus area from the start and be a component both in the initial system design and the first round of user training.
5. District Health Team (DHT) review meetings and or equivalent should be supported with appropriate BNA information packages and training.
6. Training will typically be the largest investment over time, and necessitates structures for continuous opportunities. Plan for a long term training approach catering for a continuous process of enabling new users and existing users on new system functionalities.

4.7 End User training

Important tasks to note for the end user training are the roles and responsibilities of various users who will interact with the BNA App. These will depend on two factors, what the person will be doing, and where the user is located.

4.7.1 Identify required training

The most common tasks required for BNA training will include, Data analysis processing, preparing reports and other information products. The development team should endeavour to work with stakeholders (MoH and Unicef) to plan trainings that have an impact on the users.

App maintenance - managing users, changes on indicators and data elements.

4.7.2 Develop training strategies

4.7.2.1 User acceptance testing

This training is aimed at field testing the features and functions of the BNA app. The training can be organised into two categories of users, administrators and end-users. The purpose is to gauge the ability of users to interact with the app and use it for bna analysis.

4.7.2.2 Training of Trainers

Part of the processes to build capacity for support and implementation of BNA is putting in place a national core team. The ToT is aimed at training and building the capacity of a national core team to support BNA configuration and use at both national and lower levels.

A team of 5-10 professional staff should be identified, trained and equipped to support the implementation.

4.7.2.3 Workshops and onsite training

1-2 workshops should be conducted in an effort to support bna implementation. a) Workshop for indicator identification and mapping, b) Training and capacity building workshop during implementation.
Additionally, for lower levels such as facilities, on-site training sessions should be conducted to facilitate hands-on exercises. The on-site training sessions should be decentralized and preferably conducted by the District Health Management Team (DHMT) in conjunction with the MoH.

### 4.7.2.4 Mentorship and support supervision

Six-monthly onsite support supervision and training should be planned and conducted. This will help identify gaps in the bna implementation process and generate actions.

### 4.7.3 Materials and outcomes

Materials for the bna implementation should be reviewed and developed by the national core team. These may include the Implementation guide, end-user and administrators guide. Where necessary, step-by-step guides should also be developed to enhance the training sessions.

### 4.8 Integration Concepts for the BNA App.

Detailed information on DHIS2 Interoperability and Integration can be found [here](#).

### 4.9 BNA App Support and Scale-up

An important element in the scale and support for BNA implementation is support, both technical and end-user. BNA was developed as part of the DHIS2 platform and as such benefits from the vast community support both in-country and globally.

#### 4.9.1 DHIS2 Home and JIRA

The DHIS2 home can be found [Here](#), with rich documentation on use of the platform. Support for DHIS is reinforced by the a community platform ([JIRA](#)) where users commit tickets to seek for support on an identified issue.

Note: JIRA is open to everyone.

1. Go to: [https://jira.dhis2.org](https://jira.dhis2.org).
2. Create an account with your name and email address.

#### 4.9.1.1 Reporting and an Issues

Uncertain whether something is a missing feature, a bug or deprecated? We’d really appreciate that you ask on the developer list before reporting a bug directly. Thanks!

1. Click Create in the top menu.
2. Select a Project from the list.
3. Select an Issue Type:
   1. Improvement - if you’d like to tell us about something that could be better such as usability or design suggestions.
   2. New feature - if you want to suggest a feature.
   3. Task - if you’ve been asked to work on a DHIS2 task.
   4. Bug - if you’ve found something that needs fixing.
   5. Epic - if you’d like to submit an idea for a new DHIS2 area such as an app. Epic is used for issues more complex than new features.
4. Click Create.
5. Tip
To create several issues in one go, select Create another.

6. Fill out the issue form. Please give us plenty of context! Include server logs, JavaScript console logs, the DHIS2 version and the web browser you’re using.

**4.9.1.2 Feedback and Communication**

To share information, clarify requirements, or discuss details about an issue, do this using issue comments.

1. Select the issue you want to comment.
2. In the Issue Detail view click Comment and enter your text.
3. To email others about your comment, simply enter **@User’s Name** in the comment field. An email will be sent to the users’ email addresses that are registered with their JIRA accounts.
4. Click Add.

**4.9.2 Use the community of practice**

Make use of the DHIS2 Community of practice to share experiences, post and request for support on a topic of your interest.

1. Ensure to create an account for yourself follow the guidelines below;
2. Read the community guidelines
3. Claim your existing account or create a new account
4. Add a profile picture and introduce yourself to the community
5. Read all the category descriptions to learn where posts go

**4.10 Opportunities and Challenges**

**4.10.1 Opportunities**

1. Planning and organising the BNA implementation will ensure by-in from Ministry of Health for usability and sustainability of the bottleneck application.
2. Development and implementation of BNA will trigger national interest, leading to greater use of DHIS2 at district and national levels.
3. Bottleneck and causal analysis are useful for evidence based planning and can be used as a tools for resource mobilization.
4. Aligning health program interventions to the already existing national planning cycles and systems during the planning process. This will
   1. Foster Government buy in
   2. Build local ownership
   3. Lower costs of implementation.

**4.10.2 Challenges**

1. Scheduling BNA activities within the national calendar will sometimes become challenging causing delays in reaching consensus.
2. Infrastructure requirements such as internet in some districts may delay the implementation.
4.11 Scale-up and sustainability

Beginning with a pilot is often good as it provides guidance on areas that need most attention. Piloting provides cost estimates that can be used for scaleup projections. Below some factors to consider for scaling up implementation of the bottleneck analysis;

1. Availability of technical support: The BNA App is currently supported by UiO/HISP nodes in east Africa. This support is critical to build local capacity for customization, maintenance, and quality assurance.
2. Community engagements should be aligned to already existing community structures to ensure sustainability.
3. Political and technical district leadership is necessary to influence real change in the communities.