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Insurance Management Information System for the new Community Health Fund structure

Newsletter 3 Analytic and reporting component (AR-IMIS)

Health Promotion and System Strengthening Project
Dodoma, Tanzania
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Abbreviations

CHF Community Health Fund

IMIS Insurance Management Information System

TZS Tanzanian Shilling

1 Introduction

The purpose of this newsletter is to provide information to users on using of the Analytic and Reporting component of the Insurance Management Information System (AR-IMIS). This component provides managerial data for management of health insurance schemes supported by IMIS, allows easy and speedy analysis of these data with the objective to reveal causes of different phenomena encountered in supported health insurance schemes. Provided data allow also monitoring of developments within supported health insurance schemes and identification of potential errors in operational data.

2 Concept of AR-IMIS

The concept of AR-IMIS is based on populating of the Data Warehouse with aggregate data from the operational database of IMIS. This populating is done automatically and regularly (usually once a week) from the operational database by Extract, Transformation and Loading process (ETL). Within this process data from the operational database are aggregated and stored in the Data Warehouse in conformance with multidimensional data model (see Figure 1). This model is suitable for analysis of data. Questions like “What is the number of newly covered insureds by an insurance product at during a calendar period and who were of an age, a gender, lived in a location and were cared for by a enrolment officer? Data in the multidimensional Data Warehouse are presented by a suitable front-end tool. Currently AR-IMIS uses MS Excel¹ as the front-end presentation tool. An Excel file is remotely connected to the Data

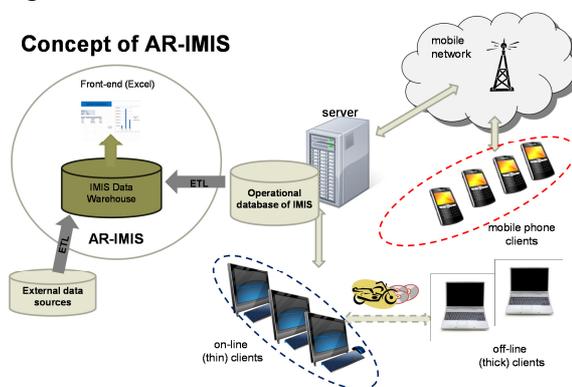


Figure 1

Warehouse and data are stored in the Excel file in the form of so called pivot tables. The multidimensional model is based on the notion of facts and dimensions. The facts (indicators) are what we are interested in. For example, a fact may number of insured persons, number of active policies, number of submitted claims etc. Facts can be looked at from different angles-for example from the point of view of age and gender of insured persons, from the point of view of time period etc. These angles (points of view) are captured by the notion of dimensions that are used for qualification of facts (see Figure 2).

¹ DHIS2 may be used also as another option in future.

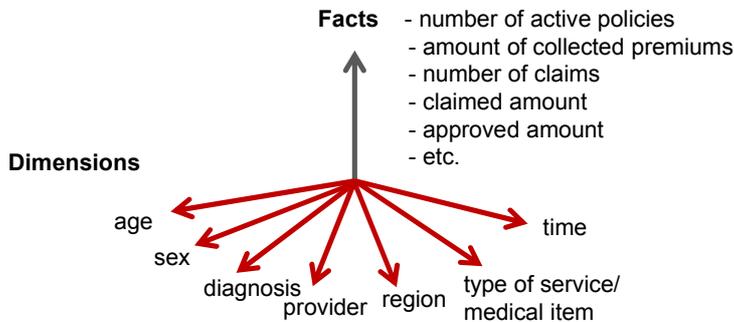


Figure 2

A dimension is composed from points that represent specific values in the dimension for which we want to look at facts—for example *November 2015* may be one point in the Time dimension. Points of a dimension may be organized in hierarchies.

Higher levels of hierarchies represent more aggregate views. Going to the lower

levels by so called *drill down* operation we can analyze facts in more detail—for example we may drill down from calendar years to quarters of corresponding calendar years and further to months. We can go in an opposite direction and looked at facts from more aggregate points of view (*drill up*). For example from looking at the amount of collected premiums in calendar months we can look at the same indicator according to quarters of a year or according to calendar years

Facts with related meaning and the identical set of qualifying dimension are represented in the multidimensional model of the Data Warehouse as so called cubes. We can do other operations on cubes as for example *slicing* when we select one or several points in one dimension and look at the rest of cube or dicing when we select on or several points in two or more dimensions. All such operation allow analysis of data in the Data Warehouse in an easy and comprehensive way.



3 Dimensions

Dimensions represent our point of view on facts. Each dimension has several values (points). The points are used for qualification of our view on the facts. AR-IMIS provides values of facts corresponding to specified points across one or more dimensions. The points may be organized in hierarchies. Lower levels of a hierarchy allow looking at a fact according to more specific points. For example, the most important *Time* dimension has at the lowest level calendar months. The calendar months are grouped into quarters and quarters into calendar years. So, we can get a value of a fact corresponding to a specific month. Going one level up in the dimension *Time*, we can get a value of the fact corresponding to a specific quarter and going even up we can get a value of the fact corresponding to a specific calendar year. If we don't specify any point in a dimension, it means we are interested in a value of a fact for all points together in the given dimension.

AR-IMIS defines several dimensions. Their meaning is dependent on the context of a fact for which they are used. For example, for the fact *Number of submitted claims* the *Time* dimension means in AR-IMIS a period in which claimed health care was provided. It could have also other interpretations, for example, it may be a period in which claims were submitted. Exact interpretation of each dimension is indicated with description of each fact provided below.

The points of a dimension are either fixed, e. g. the points *Sex* are *Male/Female/Undefined* for the dimension, or are obtained from registers in the operational part of IMIS. For example, the points for the dimension *Services* are obtained from the current status of the register of services in IMIS.

The following table shows dimensions used across AR-IMIS. For each dimension its name, names of attributes used for referencing of their points, source for their points, and their meaning.



Name	Names of hierarchy/attributes	Source of data	Points
Time	Time Hierarchy Other fields: Month Name Quarter Name Year Time	generated by IMIS	Hierarchy: Years->Quarters->Months
Age	Age Range	generated by IMIS	below1,1-4,5-9..., 80+,Unkown
Gender	Gender Name	generated by IMIS	Male, Female, Unknown
Regions	Region Hierarchy Other fields: District Ward Village	register of locations	Hierarchy: Districts->Wards->Villages
Products	Product Hierarchy Other fields: District Product Name Product Code	register of insurance products	Hierarchy: Districts->Products
Payers	Payer Name	register of payers	Families, Payers (the list of)
Officers	Officer Hierarchy Other fields: District Last Name Other Names Officer Code	register of enrolment officers	Hierarchy: Districts->Officers
Services	Service Hierarchy Other fields: Service Code Service Name Service Category	register of services	Hierarchy: (Curative, Preventive)->Services
Items	Item Hierarchy Other fields: Item Code Item Name	register of medical items	Hierarchy: (Drugs, Prostheses)->Items

	Item Category		
Diseases	Disease Hierarchy Other fields: Disease Name Disease Code Disease Category	list of diseases	
Providers	Provider Hierarchy Other fields: Provider Name Disease Code Provider Category	register of health facilities	Hierarchy: Districts->(Dispensary, Health Centre, Hospital) ->Health facility
Care category	Category Care	generated by IMIS	Emergency, Other, Referral, Unknown
Care type	Care Type	generated by IMIS	In-patient, Out-patient, Unknown
Questions	Question	generated by IMIS	Care Rendered, Drug Prescribed, Drug Received, Payment Aske, Unknown

Table 1

4 Facts

Facts provided by AR-IMIS can be structured into the areas according to the **Error! Reference source not found.** Within each area several facts packed into one or several

Enrolment & Policies	Claims
Revenue	Utilization of health care
Feedbacks	Expenditures for health care

Figure 3

for association with given point (period) in the *Time* dimension.

cubes are provided. Facts are packed into the same cube if they have an associated meaning and are provided with the same set of dimension. The following articles lists available cubes according to the areas, for each cube indicates available facts with description of their meaning and underlying set of qualifying dimensions. If meaning of a dimension is not straightforward, its description is provided. It relates especially to the *Time* dimension where it is important which datum related with a fact is taken as governing

4.1 Facts on enrolment and policies

This group of facts relates to acquisition of insures and development of coverage by health insurance schemes. Facts available are listed in Table 2.

Cube	Fact	Meaning	Dimension	Comment
Population	Population	Number of inhabitants	Gender	
			Region	
			Time	Currently all data are from the census 2012. No age structure of population is available now.
Number of households	Number of households	Number of households according to a census	Region	
			Time	Currently all data are from the census 2012
Current and new insurees	Current insurees	Insurees covered by at least one policy active at the end of a time period	Age	Age at the end of a time period
			Gender	
			Officers	An enrolment officer responsible for corresponding policy
	New acquired insurees	Insurees newly insured during a time period	Region	Place of living of a family
			Products	An insurance product covering an insuree
			Time	
All types of policies	Current policies	Number of active policies at the end of a time period	Age	Age of the head of a family at the end of a time period
	Expired policies	Number of policies that expired during a time period	Gender	Gender of the head of a family
	Renewed policies	Number of policies that were renewed	Officers	An enrolment officer responsible for



		during a time period		corresponding policy
	Sold policies	Number of policies that were sold during a time period	Region	Place of living of a family
			Products	An insurance product of a policy
			Time	
Share of insured population	Share of insured population	=Current insures / Population at the end of a time period	Gender	
			Region	Place of living of a family
			Products	An insurance product covering an insuree
			Time	
Share of insured households	Share of insured households	=Current policies /Number of households at the end of a time period	Region	Place of living of a family
			Products	An insurance product covering a family
			Time	

Table 2

4.2 Facts on collected revenue

This group of facts relates to revenue of health insurance schemes. Facts available are listed in Table 3.

Cube	Fact	Meaning	Dimension	Comment
Collected premiums	Premium collected	Premiums collected in given time period	Officers	Collection of premiums from policies of an enrolment officer
			Payers	Collection of premiums from an institutional payer or



				from families itself
			Products	Collection of premiums within an insurance product
			Time	
Allocated premiums	Premium allocation	Amount of collected premiums allocated proportionally for using in a time period	Products	Allocation of premiums within an insurance product
			Time	

Table 3

4.3 Facts on claims

This group of facts relates to claims forwarded by health care providers to administrators of health insurance schemes. Facts available are listed in Table 4.

Cube	Fact	Meaning	Dimension	Comment
Claim details	Amount claimed	Total amount in nominal prices that was submitted by health care providers for health care provided in given period	Providers	Providers that entered and or submitted claims
	Amount rejected	Total amount that was on totally rejected claims	Time	Time period of provision of health care that was invoiced in claims
	Entered claims	Number of claims entered		



	Submitted claims	Number of claims submitted		
	Rejected claims	Number of claims totally rejected		
	Average amount claimed	=Amount claimed/ Submitted claims		
	Average amount rejected	=Amount rejected/ Rejected claims		
Claim details products	Amount approved	Amount approved after medical review in nominal prices	Providers	Providers that submitted claims
	Amount valuated	Amount actually to be paid to health facilities taking into account indexes of relative pricing	Products	Products by which health care claimed was covered
	Processed claims	Number of claims sent for valuation	Time	Time period of provision of health care that was invoiced in claims
	Valuated claims	Number of claims actually valuated		
	Average amount approved	=Amount approved /Processed claims		
	Average amount valuated	=Amount valuated/ Valuated claims		

Table 4



4.4 Facts on utilization of health care

This group of facts relates to utilization of health care by insureds according to submitted and not rejected claims. Facts available are listed in Table 5.

Cube	Fact	Meaning	Dimension	Comment
Admissions and visits and hospital days	Number of hospital admissions	Number of hospital admissions	Age	Age at the time of provision health care
			Gender	
			Disease	.
	Number of hospital days		Care category	
	Average length of stay	= Number of hospital days/ Number of hospital admissions	Products	In case two or more insurance products covered a hospital admission/visit, it is accounted to each of them
	Number of out-patient visits		Providers	Providers which claimed health care
			Time	Hospital admissions are associated with time periods according to dates of discharge. Time period of provision of health care
Utilization of services	Services utilized	Number of utilized services according to submitted claims. If a service was provided during one visit/hospital stay, the service is counted according to the number of its provision	Age	Age at the time of provision health care
			Gender	
			Disease	.
			Care category	
			Care type	
			Products	
			Providers	Providers which claimed health care
			Services	



			Time	Hospital admissions are associated with time periods according to dates of discharge. Time period of provision of health care
Utilization of medical items	Items utilized	Number of utilized medical items according to submitted claims If a medical item was provided during one visit/hospital stay, the medical item is counted according to the number of its provision	Age	Age at the time of provision health care
			Gender	
			Disease	.
			Care category	
			Care type	
			Products	
			Providers	Providers which claimed health care
			Items	
			Time	Hospital admissions are associated with time periods according to dates of discharge. Time period of provision of health care
Average utilization of services per insuree	Average utilization of services per insuree	= Services utilized / Number of inhabitants	Age	Age at the time of provision health care
			Gender	
			Disease	
			Products	
			Services	
			Time	Hospital admissions are associated with time periods according to dates of discharge. Time period of provision of health care
Average utilization of medical items	Average utilization of medical items	= Items utilized / Number of inhabitants	Age	
			Gender	



per insuree	per insuree		Disease	
			Products	
			Services	
			Time	

Table 5

4.5 Facts on expenditures for health care

This group of facts relates to expenditures for health care actually paid to health care providers. Facts available are listed in Table 6 .

Cube	Fact	Meaning	Dimension	Comment
Expenditures for services	Service expenditures	Expenditures for services actually remunerated to health facilities	Age	Age at the time of provision health care
			Gender	
			Disease	.
			Care category	
			Care type	
			Products	
			Providers	Providers which claimed health care
			Services	
Expenditures for medical items	Item expenditures	Expenditures for medical items actually remunerated to	Age	Age at the time of provision health care
			Gender	



		health facilities	Disease	.
			Care category	
			Care type	
			Products	
			Providers	Providers which claimed health care
			Items	
			Time	Hospital admissions are associated with time periods according to dates of discharge. Time period of provision of health care
Average expenditures for services per insuree	Average expenditures of services per insuree	= Service expenditures/ Number of inhabitants	Age	Age at the time of provision health care
			Gender	
			Disease	.
			Products	
			Services	
			Time	Hospital admissions are associated with time periods according to dates of discharge. Time period of provision of health care
Average expenditures for medical items per insuree	Average expenditures for medical items per insuree	= Item expenditures/ Number of inhabitants	Age	Age at the time of provision health care
			Gender	
			Disease	.
			Products	
			Items	
			Time	Hospital admissions are associated with time periods according to dates of



				discharge. Time period of provision of health care
Average expenditures for health care per insuree	Average expenditures per insuree	= Average expenditures of services per insuree + Average expenditures for medical items per insuree	Age	Age at the time of provision health care
			Gender	
			Disease	
			Products	
			Time	Hospital admissions are associated with time periods according to dates of discharge. Time period of provision of health care

Table 6

4.6 Facts on feedbacks

This group of facts relates to evaluation of request for feedbacks on provided health care that are issued by medical officers during processing of claims. Facts available are listed in Table 7.

Cube	Fact	Meaning	Dimension	Comment
Feedback details	Feedbacks sent	Number of requests for feedbacks sent in a time period	Products	Insurance products that covered claims initiating requests for feedbacks
	Feedbacks responded	Number of feedbacks received in a time period	Providers	Providers that submitted claims initiating requests for feedbacks
	Overall assessment	Sum of all assessment overall assessment marks in responded feedbacks	Time	

	Feedback return share	= Feedbacks responded/ Feedbacks sent in a time period ²		
	Average overall assessment	= Overall assessment/ Feedbacks responded		
Feedback answers	Answers Yes	Count of all Yes answers	Products	Insurance products that covered claims initiating requests for feedbacks
	Average assessment according to specific questions	= Answers Yes/ Feedbacks responded in responded feedbacks	Providers	Providers that submitted claims initiating requests for feedbacks
			Questions	
			Time	

Table 7

5 How to access data from the Data Warehouse

Data from the Data Warehouse can be accessed by means of an Excel file. As access to the Data Warehouse is protected, a user has to get from an administrator of AR-MIS URL of the Data Warehouse for remote access, a userid and a password. A userid may allow access to all data in the Data Warehouse or only to a subset of data corresponding to a specific district or to selected districts.

The procedure of accessing of data is as follows (see **Figure 4**):

1. Open an Excel file
2. Click on the menu item **Data**
3. Click on the sub-menu **From Other Sources**
4. Click on the sub-menu **From Analysis Services**
5. A dialog box appears for specification of logon data:
 - a. Enter URL of the Data Warehouse into the field **Server Name**
 - b. Select the option **Use the following user name and password**
 - c. Enter your userid into the field **User Name**

² The indicator is only indicative as feedbacks sent may be responded in another period



- d. Enter your password into the field **Password**
- e. Click on **Finish**
6. A box appears (**Select Database and Tables**) with the list of available cubes. Select one and click on **Finish**
7. A box appears (**Save Data Connection File and Finish**). Check the box **Save passport in file** and click on **Finish**.
8. A box appears (**Import Data**). Select whether cube should be accessed by a pivot table and/or chart and specify a placement of the pivot table. Click on **OK**.
9. An area for the pivot table appears in the sheet with the **Pivot Table Field** area on the right (see Figure 5). Click on facts to be displayed and click or drag dimensions to appropriate sectors of the pivot table in the **Pivot Table Field** area.

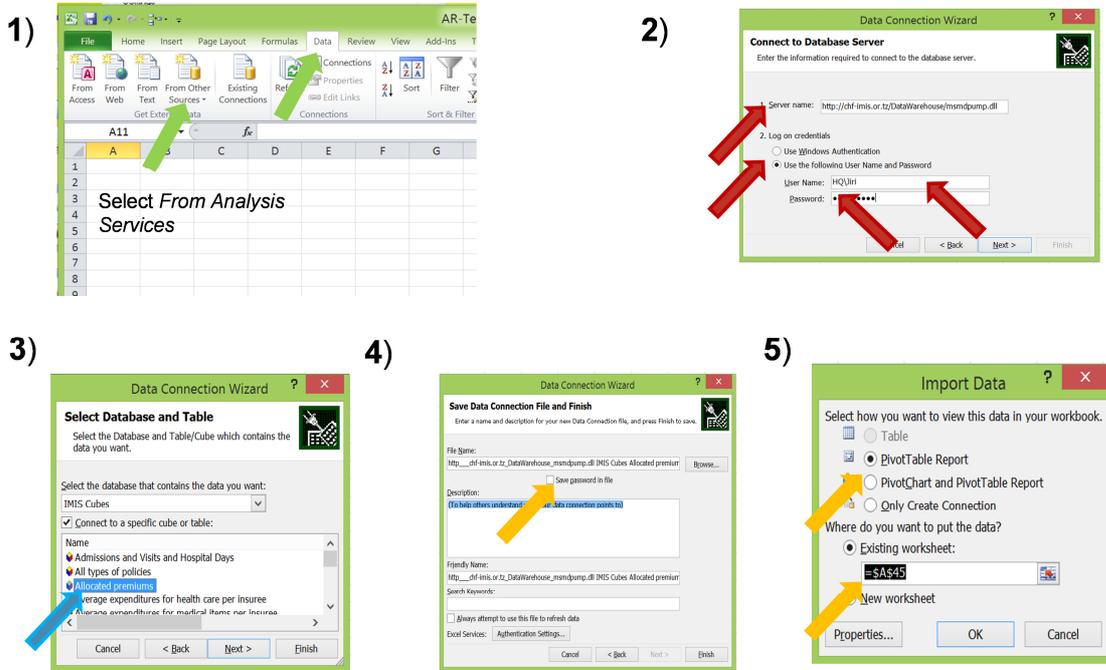


Figure 4

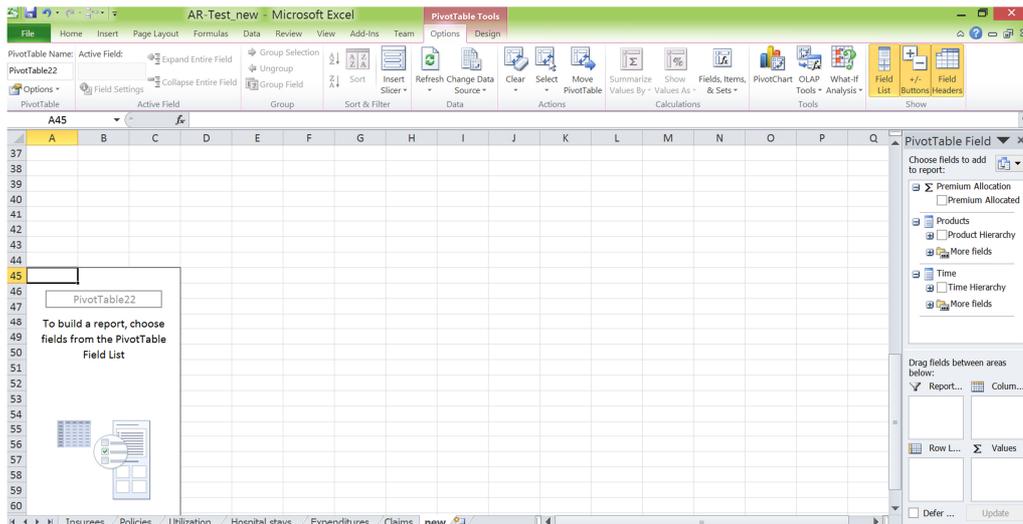


Figure 5

6 Tips for elaboration of front-end Excel files

Accessing data from the Data Warehouse needs a front-end tool. Currently standard Excel from Microsoft is used in this role. On one hand it lends to AR-IMIS enormous flexibility in present of data using rich Excel functionality. On the other hand it requires some effort to elaborate a good looking presentation. Here are some tips that can help to users willing to prepare their own tailor made presentation of IMIS data.

6.1 Structure of front-end Excel files

The first thing a user has to decide whether data from AR-IMIS belonging to different areas will be presented in several Excel files, in one Excel file with several sheets or just by one Excel file with one sheet. Using of intuitive names for the Excel files and/or their sheets helps a lot with user's orientation.

Data of a cube can be placed in the form of a pivot table anywhere in a sheet. However, attention should be paid to neighbouring pivot tables in case drill in operations are applied for dimension displayed in row headings (in this case the pivot table expands down as a consequence of a drill in operation) or in column headings (in this case the pivot table expands to the as a consequence of a drill in operation). An adding of a dimension to the filter area of a pivot table results in an expansion of a pivot table up. If an expansion hits on the boundary of a neighbouring pivot table or on the upper edge of a sheet, corresponding operation is prohibited. Therefore, placement of several pivot tables in a sheet has to be carefully planned with respect to envisioned operations with the pivot tables-see

6.2 Content of pivot tables

Generally, a pivot table represents one cube in the Data Warehouse. Several pivot tables can represent the same cube in a front-end Excel file. Additional pivot tables can re-use the connection string created by Excel during connecting to the cube for the first time- see Figure 6. A pivot table can contain all facts and dimensions from its source cube in the Data Warehouse or just a subset of them. Selection is done by clicking on a fact or dragging of an attribute of a dimension in

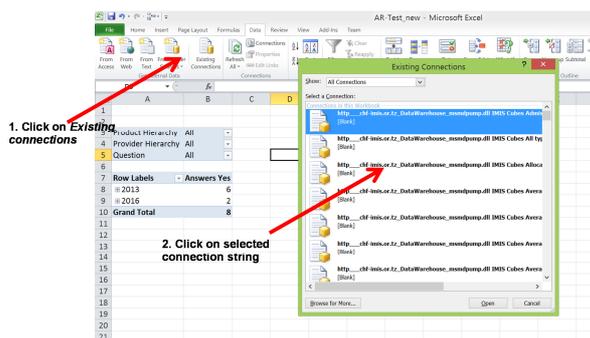


Figure 6

the field list associated with the pivot table – see Figure 7. It is possible to include one fact in a pivot table several times. The justification for it may be a need to display the fact in several different forms, e.g. in absolute numbers, as a percentage of a whole-see below.

The order in which attributes of dimensions are dragged into the areas for row and column labels in the field list is rather important. It determines parent-child relationship among dimensions in the pivot table. This relationship is relevant for drill down operations and also for calculations on facts – see below.

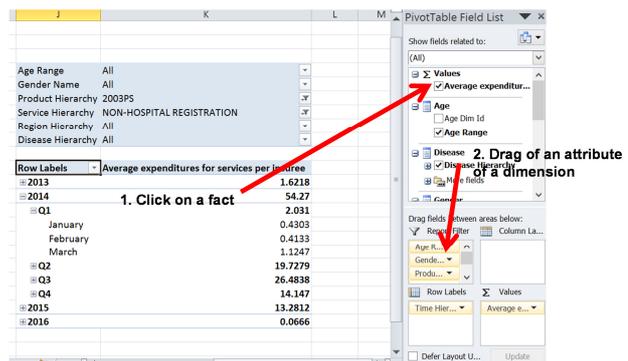


Figure 7

6.3 Style of pivot tables

Pivot tables make take different appearance and may be presented under different options. Especially the following features are relevant:

- Whether rows and/or column totals should be generated automatically. Automatic generation of totals is not too much recommended from two reasons:

- It doesn't make sense for some so called non-additive facts as it is for example the number of active policies at the end of a period. Generating of totals for such facts may be misleading.
- Collapsing of a pivot table to the highest levels of dimensions provides the totals as well for facts that are additive in nature

Generating of totals can be blocked/ unblocked by the procedure shown in Figure 8 .

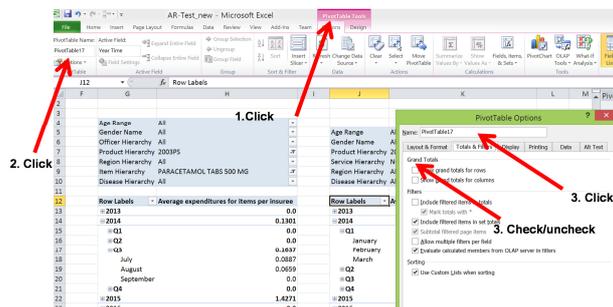


Figure 8

- Whether points of dimensions should be shown although they have no value in a cube. Blocking/unblocking display of non-value points of dimension can be accomplished by the procedure shown in Figure 9.

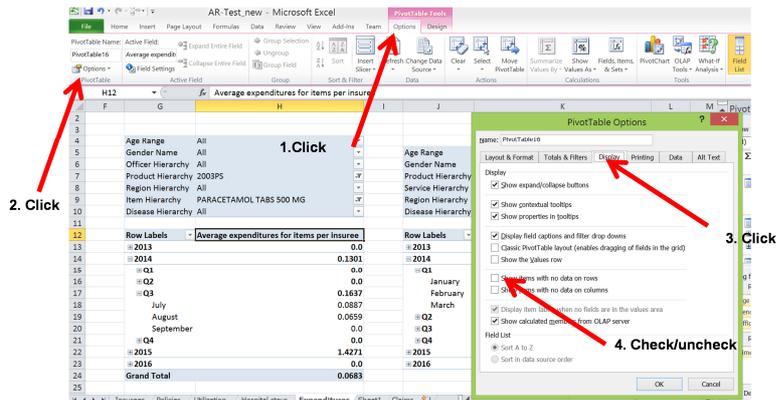


Figure 9

- What layout use for a pivot table? There is plenty of predefined layouts and colour scheme for pivot tables in Excel. Just follow the procedure in Figure 10

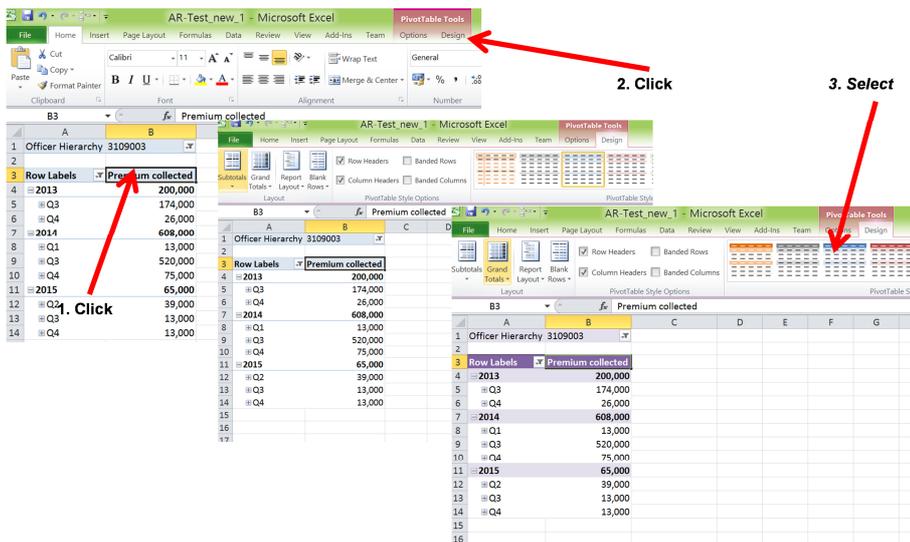


Figure 10

There is a lot of other features that can be used for shaping of pivot tables in the *Design* sub-menu of the *PivotTable Tools* menu. It is up to user's preferences which ones to use.

6.4 Presenting facts as charts

Facts in cubes can be presented in front-end Excel files as pivot tables, charts or in both forms. If both a pivot table and a corresponding chart are presented, they are synchronized

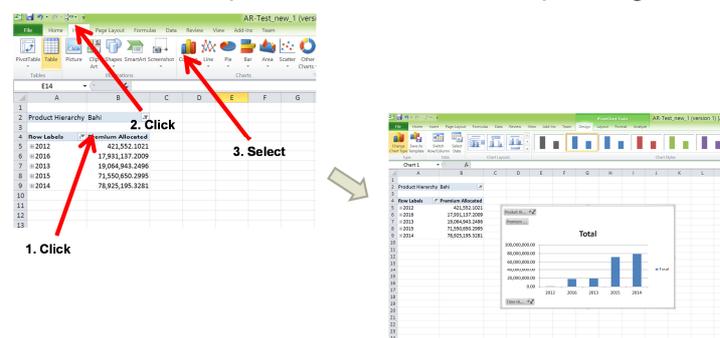


Figure 11

in the sense that both display values of facts belonging to the same set of points of dimensions. In this case, it is not needed to display filters and row/column labels with the chart but it is enough to rely on selection of dimension points in the pivot table. The chart will change accordingly.

If a user decides to present a cube as a chart after the corresponding pivot table is created then the procedure in Figure 11 can be used for construction of a chart later on. A chart shows all facts displayed in the associated pivot table. It can happen that facts in one pivot table are not comparable in their magnitudes or measurement units (absolute values versus percentages) resulting in not too much explanatory charts.

There is a lot of other features that can be used for shaping of pivot charts in the *Design/Layout/Format* sub-menus of the *PivotChart Tools* menu. It is up to user's preferences which ones to use.

6.5 Data formats for presentation of facts

A fact can be presented in a pivot table in different data formats. They can be easily changed by the procedure in Figure 12.

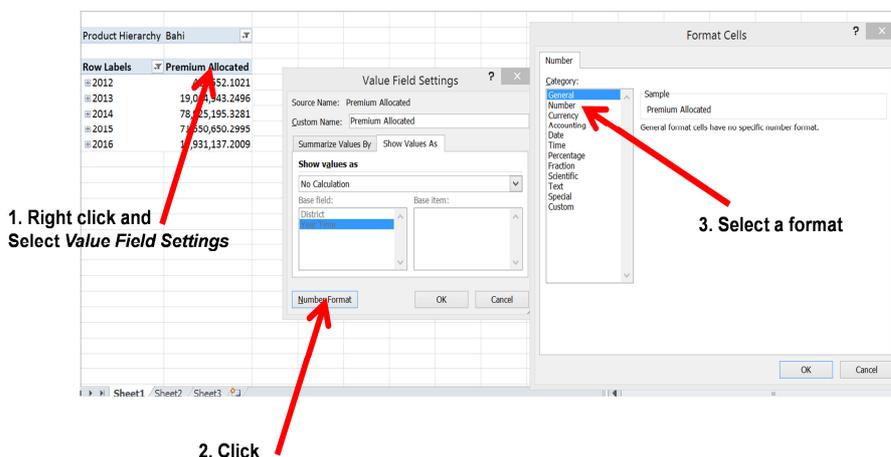


Figure 12

6.6 Calculations on facts

Strength of Excel lies in rich choice of different calculations. However, with respect to pivot tables that are fed from the Data Warehouse there are some limitations. It is not possible to create another fact by means of a formula based on other facts in the same cube or even in different cubes. If it is necessary, such calculation has to be done at the level of the multidimensional Data Warehouse by developers. It doesn't mean that some calculation based on actual values in cells of pivot tables cannot be done. However, such calculations

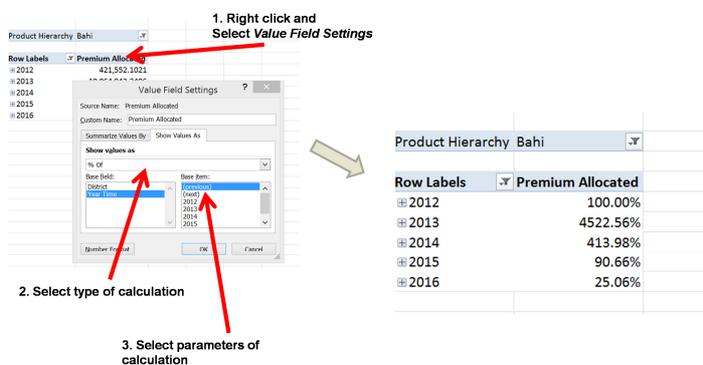


Figure 13

are external to a pivot table and once another set of dimension points are used in the pivot table, such external calculation loses its meaning.

Only calculations relating to the same fact are possible at user level in order to be done for a pivot table and not losing its meaning whenever a setup of dimension points in the pivot table changes. The procedure is shown in Figure 13

There is a choice of calculations/transformations of a single fact, for example:

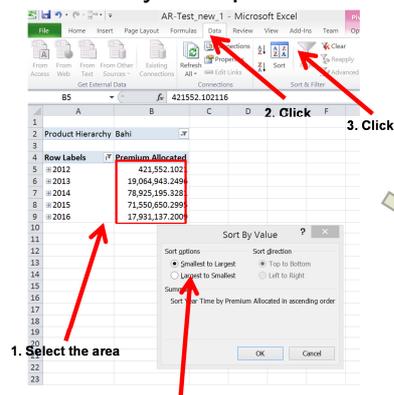
- **% Of** - Displays values as a percentage of the value of the **Base item** in the **Base field**.
- **% of Grand Total** - Displays values as a percentage of the grand total of all of the values or data points in the report.
- **% of Parent Column/Row Total** - Calculates values as follows:

$$(\text{value for the item}) / (\text{value for the parent item on columns/rows})$$
- **% Difference From** - Displays values as the percentage difference from the value of the **Base item** in the **Base field**.
- **% Running Total in** - Calculates the value for successive items in the **Base field** that are displayed as a running total as a percentage
- **Rank Largest to Smallest** - Displays the rank of selected values in a specific field, listing the largest item in the field as 1, and each smaller value will have a higher rank value.

Calculations referring to parent column/row are sensitive to the order, in which column/row labels (dimensions) are used in a pivot table.

6.7 Sorting of facts

A user may wish presentation of facts in some order, for example look at years in the order of



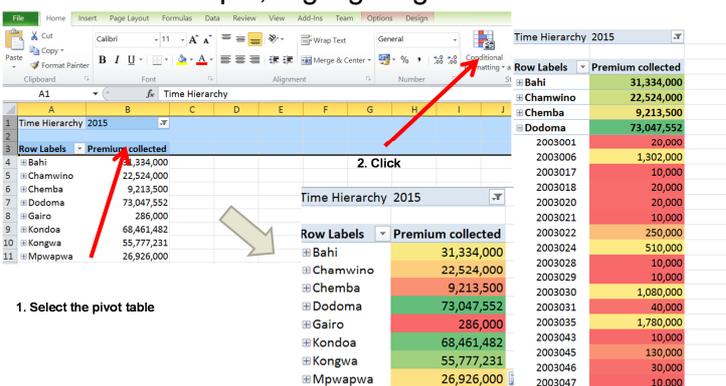
the amount of collected contributions. This can be done according to the procedure depicted in Figure 14. The sorting procedure can be applied according to Figure 14. **Sorting is applied also in lower levels.**

Product Hierarchy	Bahi
Row Labels	Premium Allocated
2012	421,552.1021
2016	17,931,137.2009
2013	19,064,943.2496
2015	71,550,650.2995

Figure 14

6.8 Conditional formatting of pivot tables

It may be needed to change appearance of fact cells in a pivot table according to values of facts. For example, highlighting of enrolment officers with extra high performance in given



period may be desirable. Conditional formatting of pivot tables is a right choice in such circumstances. Just select the area with a fact in the pivot table, click on **Conditional Formatting** menu item and get plenty of options how to highlight cells with specific meaning (see Figure 15)

Figure 15

7 Moving of a front-end Excel file to another computer

Elaboration of a front-end Excel file to AR-IMIS that meets specific requirements of its user may require some effort. It would be a pity if such effort had to be repeated each time the same or another user needs the same front-end on another computer. As the access to AR-IMIS is protected by logon data (userid and password) it is not enough just to move the Excel file.

If the user on another computer has the same logon data for access to AR-IMIS then the process of moving of an Excel front-end file requires two steps:

1. Moving of the Excel front-end file itself
2. Moving of the folder (automatically generated by MS office) */Documents/My Data Sources* with all connection files belonging to all cubes from AR-IMIS accessed from the Excel front-end file. Connection files have the following names for AR-IMIS:

http__chf-imis.or.tz_DataWarehouse_msmdpump.dll IMIS Cubes <name of the cube>

If the user on the destination computer has to use different logon data then the third step is needed:

3. Substituting of logon data in the connection strings in each connection file, as follows in the box below:

```
<odc:ConnectionString>Provider=MSOLAP.4;Password=xxxxxxx;Persist Security Info=True;User ID=yyyyyy;Data Source=http://chf-imis.or.tz/DataWarehouse/msmdpump.dll;Initial Catalog=IMIS Cubes</odc:ConnectionString>
```