

# MODULE 12

## Understanding how to input data into the RAP worksheets (advanced session)

**Duration:** 4 hours

**Prerequisites:** All modules, particularly modules 10, 11

### Key questions:

1. What is the structure of the ILO RAP model?
2. What are the main sources of historical data and projections?
3. Dealing with POP
  - How to project the population?
  - How to calculate the survival population?
  - How to calculate the number of newborns?
  - How to take into account migration?
4. Dealing with EAP and LPR/AR
  - What are the parameters of the labour market?
  - How to project labour market data?
  - How to project the unemployment rate?
5. Dealing with ECO
  - How to project GDP, GDP at constant price (volume effect), and the GDP deflator (price effect)?
6. Hands-on exercises

### Objectives:

The objective of this module is to learn on how to obtain input data (population data, labour market data, macroeconomic data, and general government operations data) and fill in the POP, EAP, ECO, and GGO worksheets of the ILO RAP model. These worksheets are identified by their blue colour coding. They include historical data and projected data. To obtain historical data, several sources may be available. Projections may be available as well in the country. However, when projections are not reliable, the users of the ILO RAP model may need to calculate some of the projections by themselves based on the historical data and a few assumptions. To undertake projection calculations, the basic formulas and linkages between different economic variables need to be well understood. The module also includes hands-on exercises to better understand the concepts and how to fill out the input RAP worksheets.

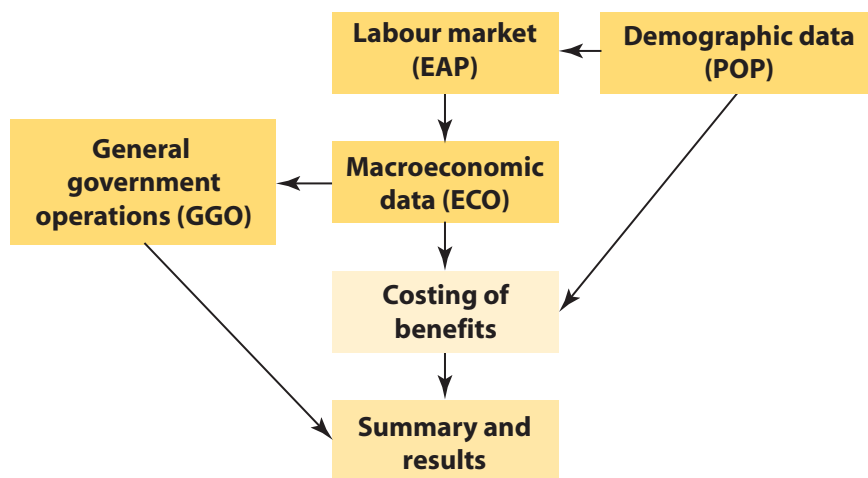


## Overview:

### What is the structure of the RAP model?

The ILO RAP model is an Excel tool that comprises three steps. In the first step, the user inputs data; the second step calculates the cost of several social protection benefits; and the third step calculates the cost of combined benefit packages and presents the results of the RAP model. Additionally, a preliminary analysis of the affordability of the proposed recommendations is conducted.

Figure 17. The ILO RAP model



On the first type of worksheets (blue sheets) participants input data.

Statistical data about the population of the country, its labour market, economic situation and forecasts, and government operations needs to be collected by the participant and entered into the RAP model. Five worksheets need to be completed:

1. Demographic framework (POP worksheet) – Population data per single age and sex are input together with population projections.
2. Labour participation rates (LPR worksheet) or activity rates (AR worksheet) – Male and female labour force participation rates are entered per age group together with projections.
3. Economically active population (EAP worksheet) – The worksheet contains the result of data from the POP worksheet multiplied with data from the LPR/AR worksheet.
4. Macroeconomic framework (ECO worksheet) – Various economic indicators are recorded and projected, including the inflation rate, average monthly wage, minimum wage, poverty line, poverty rate, GDP growth rate, GDP at constant price, GDP at current price, GDP deflator, labour productivity, unemployment rate, and so on. These indicators will be used to calculate and project the cost of social protection provisions and to express these cost estimates as a percentage of GDP.
5. General government operations (GGO worksheet) – The worksheet provides information on the government's revenues (tax and non-tax) and expenditures. This information will be used to express the cost estimates of proposed policy options as a percentage of the government's expenditures.

Historical data and projections are required to calculate the cost of the social protection benefit packages and to project this cost over several years.

### What are the main sources of historical data and projections?

While designing a benefit package, it is important to list the data required for calculating the cost of the benefit package and to identify the organization(s) able to provide historical data and projections. There are many possible sources for historical data according to the type of data.

For instance in Thailand:

- The population census and other surveys are available at the National Statistical Office (NSO).
- The Ministry of Interior is another source of information on population based on the national registration database of all citizens.
- The National Economic and Social Development Board prepares population projections based on the census. NESDB also collects information from different sectors of the economy and updates the System of National Accounts (SNA).
- The Ministry of Commerce sets the official price index.
- The Bank of Thailand publishes economic and financial indicators.
- The Ministry of Finance (MoF) tracks the revenues and expenditures of the Government. The MoF also prepares short-term econometric projections.
- Research institutes, such as TDRI, prepare short-term and long-term economic projections. HISRO has a short-term and long-term health care financial projection.
- National social protection institutes such as the Social Security Office (SSO) and the National Health Security Office (NHSO) also have short-term and long-term projections for their respective schemes.
- Socio-economic surveys provide information on the number of beneficiaries from selected programmes and information on poverty status, access to basic services, among other information.

For long-term projections, a sophisticated analysis is required. High, medium, and low scenarios are projected to reduce the chances of error.

In most countries, trying to find reliable data is a challenge. The data available may not fit the data needed and participants may need to make some assumptions or calculate projections by themselves. For instance, when population projections are not reliable, participants may need to use official historical population data and project population numbers using the cohort-component method, mortality rates from selected life tables, fertility rates, and net migration rates.

Several sources of information may provide different data; therefore, participants need to cross-check and clean the data until they are confident enough to use the data in the model.

To obtain reliable data and validate assumptions and projections, it may be useful to partner with institutions such as the Institute of Statistics in Indonesia or research institutes such as HISRO in Thailand. These institutes can provide comprehensive and coherent datasets and/or validate assumptions and projections. Working with macroeconomists (such as from TDRI in Thailand) can be an advantage for long-term macroeconomic projections.

## Dealing with POP

The POP worksheet includes per single age and sex:

- population numbers (historical data);
- population projections.

As mentioned above, population numbers can usually be obtained from the national census.

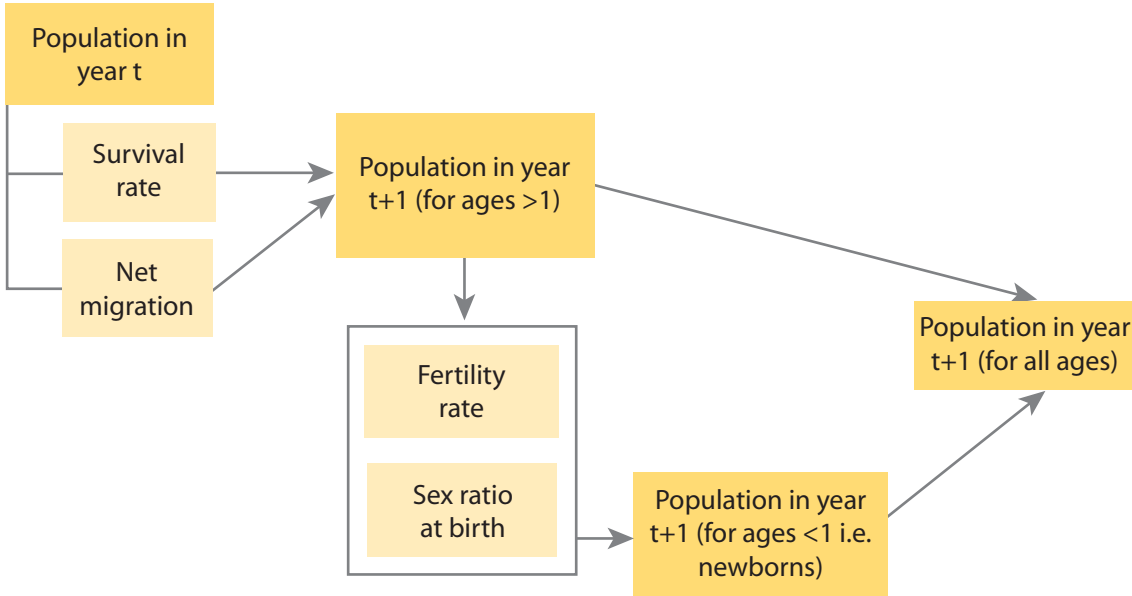
Population projections aim at forecasting the size of the population in the future. Participants can use the official population projections from their respective countries. In case these projections are not reliable, participants may need to calculate the population projections by themselves. There are many methods to calculate the projections. One of these methods is the *cohort-component method*.

Individuals are split into cohorts per single age. A new cohort is created with all the newborns in year  $t$ . The number of newborns is estimated from the number of women in reproductive age and fertility rates. The cohort then evolves from year  $t$  to year  $t+1$ . In  $t+1$  the individuals of the cohort are all of 1 year of age. Each year some individuals of the cohort die or migrate, leading to fluctuations in the total population of the cohort. After some decades, when all the individuals of the cohort have died, the cohort disappears.

To project population numbers, one needs to assess:

- the number of newborns (linked to fertility);
- the number deaths (linked to mortality);
- net migrations from one year to the next.

Figure 18. Forecasting demographic data by cohort



Source: Modified from W. Scholz, M. Cichon, and K. Hagemeyer: *Social budgeting*, Figure 8.4 (Geneva, ILO, 2000).

## How to calculate the number of deaths and the survival population?

The survival population is the population which survives from one year (t) to the next (t+1).

To calculate the survival population in year t+1, one calculates the number of deaths in year t. The number of deaths in year t equals to the population in year t multiplied by the mortality rate in year t for that single age. The survival population in year t+1 equals to the population in year t *minus* the number of deaths in year t.

In the example:

Population (age = 0, male) in 2010 = 356,209

Mortality rate (age = 0, male) in 2010 = 0.0084

Number of deaths (age = 0, male) in 2010 = 356,209 \* 0.0084 = 2,992

Number of survivals (age = 1, male) in 2011 = 356,209 – 2,992 = 353,217

Table 6. Calculating deaths and survivals

Age	Mortality for males	Male population in 2010	Male deaths in 2010	Male survivals in 2011
0	0.0084	356 209	2 992	
1	0.0007	373 622	262	<b>353 217</b>
2	0.0007	403 800	283	373 360
3	0.0007	449 310	315	403 517
4	0.0007	414 605	290	448 995
5				414 315

Mortality rates can be obtained from life tables. There are several different types of life tables. The most appropriate ones are the life tables of your country. The UN life tables or the Coale-Demeny life tables (previously used in Thailand) can be used in the absence of country-specific life tables.

## How to calculate the number of newborns?

Fertility rates for different female age groups are considered while projecting the number of births every year. During the child-bearing age (from 15 to 49 years of age), women of each single age (15 years, 16 years, ..., 49 years) have an age-specific fertility rate. The number of women per single age (or age group) is multiplied by the age-specific fertility rate and the number of newborns is obtained for women of this specific age.

The total number of newborns in the year is obtained by adding the number of newborns for women of each single age (or age group).

In the example:

Female population (age group = 15 to 19) in 2010 = 2,552,600

The fertility rate for this age group = 0.0098

The number of newborns for women of 15 to 19 years of age = 0.0098 \* 2,552,600 = 25,015.

Table 7. Calculating number of newborns for women of a specific age group

Age group	Fertility rate	Female population	Newborns
15-19	0.0098	2 552 600	<b>25 015</b>
20-24	0.0691	2 557 443	
25-29	0.1243	2 617 716	
30-34	0.0796	2 671 012	
35-39	0.0308	2 824 040	
40-44	0.0074	2 830 251	
45-49	0.0008	2 733 680	

The same operation is repeated for all age groups.

The total number of newborns is then obtained by summing up all newborns for women of specific age groups.

In the example:

$$\text{Total number of newborns} = 25,015 + 176,719 + 325,382 + \dots = 849,840$$

Table 8. Calculating total number of newborns

Age group	Fertility rate	Female population	Newborns
15-19	0.0098	2 552 600	25 015
20-24	0.0691	2 557 443	176 719
25-29	0.1243	2 617 716	325 382
30-34	0.0796	2 671 012	212 613
35-39	0.0308	2 824 040	86 980
40-44	0.0074	2 830 251	20 944
45-49	0.0008	2 733 680	2 187
<b>Total</b>			<b>849 840</b>

Among the newborns, some are male and some are female. The sex ratio at birth is used to calculate the number of newborns who are male and the number who are female.

The sex ratio is the number of males to females. The sex ratio for Thailand at birth is 1.06, meaning that the number of male newborns = 1.06 \* number of female newborns.

$$\text{Number of newborns} = \text{Number of male newborns} + \text{Number of female newborns}$$

$$\text{Number of newborns} = \text{Number of male newborns} \times (1+1/1.06)$$

$$\text{Number of male newborns} = \text{Number of newborns} / (1+1/1.06)$$

In the example:

$$\text{Male newborns} = 25,015 / (1+1/1.06) = 12,872$$

$$\text{Female newborns} = 25,015 - 12,872 = 12,143$$

Table 9. Number of male and female newborns for women of a specific age group

Age group	Fertility rate	Female pop	Newborns	Newborns (M)	Newborns (F)
15-19	0.0098	2 552 600	25 015	<b>12 872</b>	<b>12 143</b>
20-24	0.0691	2 557 443	176 719		
25-29	0.1243	2 617 716	325 382		
30-34	0.0796	2 671 012	212 613		
35-39	0.0308	2 824 040	86 980		
40-44	0.0074	2 830 251	20 944		
45-49	0.0008	2 733 680	2 187		
<b>Total</b>			<b>849 840</b>		

Similarly we calculate the male and female newborns for women of other age groups and obtain, by summation, the total number of male and female newborns in the year.

Table 10. Total number of male and female newborns

Age group	Fertility rate	Female pop	Newborns	Newborns (M)	Newborns (F)
15-19	0.0098	2 552 600	25 015	12 872	12 143
20-24	0.0691	2 557 443	176 719	90 933	85 786
25-29	0.1243	2 617 716	325 382	167 430	157 952
30-34	0.0796	2 671 012	212 613	109 403	103 210
35-39	0.0308	2 824 040	86 980	44 757	42 223
40-44	0.0074	2 830 251	20 944	10 777	10 167
45-49	0.0008	2 733 680	2 187	1 125	1 062
<b>Total</b>			<b>849 840</b>	<b>437 297</b>	<b>412 543</b>

Note that the total fertility rate is the average number of children a woman gives birth to during her lifetime. It is obtained by adding the age-specific fertility rates during the child-bearing period. In the example the total fertility rate is  $TFR = 1.609$ , which is lower than the replacement rate.

Table 11. Total fertility rate

Age group	Fertility rate
15-19	0.0098
20-24	0.0691
25-29	0.1243
30-34	0.0796
35-39	0.0308
40-44	0.0074
45-49	0.0008
<b>TFR</b>	<b>1.609</b>

## How to take into account migration?

Net migrations also need to be taken into account to calculate the population in the following year.

$$\text{Net migration} = \text{Immigration (inbound migrants)} - \text{Emigration (outbound migrants)}$$

For instance, in Thailand the net migration compared to total population is very low. Therefore, we assume that net migration equals zero.

## Dealing with EAP and LPR/AR

The EAP worksheet includes the following per age group and sex:

- female, male, and total economically active population;
- EAP projections.

EAP data is obtained in the model by multiplying the labour participation rate (LPR) by the population data.

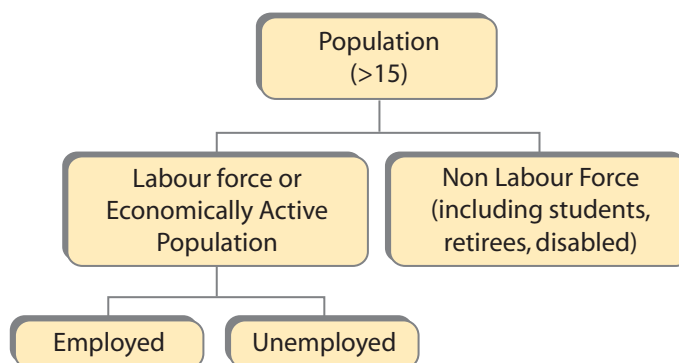
## What are the parameters of the labour market?

It is important to understand the parameters of the labour market in order to be able to collect the data, complete the data input, and cross-check the coherence of the data.

The main parameters of the labour market are:

- labour force or economically active population;
- labour market participation rate or activity rate;
- employed persons;
- unemployed persons;
- unemployment rate.

Figure 19. Calculating labour force data



Source: Modified from W. Scholz, M. Cichon, and K. Hagemeyer: *Social budgeting*, Figure 8.6 (Geneva, ILO, 2000).



The population above legal working age (in Thailand, 15 years old) is separated into two groups:

- labour force (or economically active population) – people who are willing to work;
- non labour force (students, retirees, housewives, people with disabilities) – people who are not willing or not able to work.

The labour force (or EAP) comprises all persons of both sexes above the legal working age who are willing and able to work. It includes all those who are employed (including self-employed) and unemployed.

A person is unemployed if they are willing and able to work, actively looking for a job, and yet still unable to find a job. Therefore, by definition, people who are voluntarily idle are not classified as unemployed because they are not actively searching for a job.

The labour participation rate (LPR) compares the size of the labour force with the number of people that could potentially be part of the labour force.

$$\text{Labour participation rate (LPR)} = (\text{Labour force} / \text{Total population above legal working age}) * 100$$

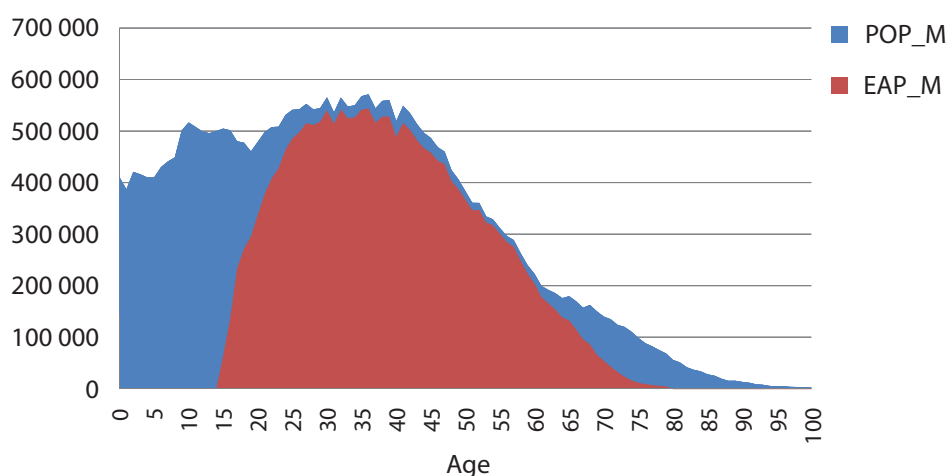
The percentage of the labour force that is unemployed is called the unemployment rate.

$$\text{Unemployment rate} = (\text{Unemployed} / \text{Labour force}) * 100$$

## How to project labour market data?

The labour force is a subset of the total population. The graph below indicates the labour force situation in Thailand in 2007. The situation today may be slightly different due to the free education policy (which took effect in 2001) and the introduction of a minimum old age allowance in 2008. These two policy changes are likely to have contributed to a decline in labour force participation rates among children aged 15 to 18 years and elderly aged 60 years and above.

Figure 20. Population and labour force in Thailand, 2007



Source: Modified from W. Scholz, and J-C. Hennicot: *Health care reform: Financial management – A common health care financing model (II) – User manual* (Geneva, ILO, 2008).

To project labour market data, we need the historical data and the projected distribution of the parameters mentioned above by age group and gender.

For instance, when we projected the LPR in the ILO RAP model for Thailand, we analyzed the LPR over the previous ten years and found that the LPR by age group was nearly constant. Therefore, we assumed that the LPR for all age groups would remain constant, except for the age group from 15 to 19 years of age which was assumed to progressively decline until it reached 27 per cent for males (by 2020) and 15 per cent for females (by 2020), due to the effects of recent Government education policies.

Table 12. Example of male participation rates in Thailand, historical data and projections

Age	Historical data (from 2005 to 2010)						Projections (from 2011 to 2020)									
	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18	'19	'20
0-4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-14	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15-19	36.7	34.1	34.1	34.3	34.2	33.0	32.4	31.8	31.2	30.6	30.0	29.4	28.8	28.2	27.6	27.0
20-24	77.7	76.7	77.3	79.0	79.0	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4	78.4
25-29	94.4	94.2	94.6	94.3	94.6	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1
30-34	96.6	96.3	96.3	96.2	96.0	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5
35-39	96.8	96.7	97.0	96.8	96.7	96.7	96.7	96.7	96.7	96.7	96.7	96.7	96.7	96.7	96.7	96.7
40-44	96.5	96.8	97.2	96.8	96.9	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
45-49	96.1	96.2	96.3	96.4	96.3	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.1	96.1
50-54	93.4	93.3	94.4	94.3	94.3	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1	94.1
55-59	88.9	89.1	89.9	90.0	89.2	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9	88.9
60-64	71.7	71.4	73.8	73.4	73.6	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8
65 +	39.9	38.3	39.5	39.2	39.8	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3

Source: V. Schmitt, T. Sakunphanit, and O. Prasitsiriphol, ILO RAP model for Thailand, 2013.

The ILO's LABORSTA database can be used as a secondary source of information if the national data is not available. The database contains country estimates and projections of the total population, the activity rates, and the economically active population (labour force) by sex and eleven age groups (15–19, 20–24, ... , 60–64, and 65 years and over). The 6<sup>th</sup> edition shows estimates from 1990 to 2010 and projections to 2020.<sup>13</sup> Note that the source for the population figures used in this database is *The 2010 Revision of the World Population Prospects* issued by the United Nations.

As explained below, employment is a measure of labour demand and is linked with two other parameters of the macroeconomic framework, which are productivity and GDP at constant price. The latter measures the “volume” of production in a country.

<sup>13</sup> [http://laborsta.ilo.org/applv8/data/EAPEP/eapep\\_E.html](http://laborsta.ilo.org/applv8/data/EAPEP/eapep_E.html) [accessed 20 Nov. 2013].

## How to project the unemployment rate?

To project the unemployment rate, we used historical data to calculate a trend, which we then applied to future unemployment rates. The historical data for the unemployment rate in the fictitious country of Coresia is as follows:

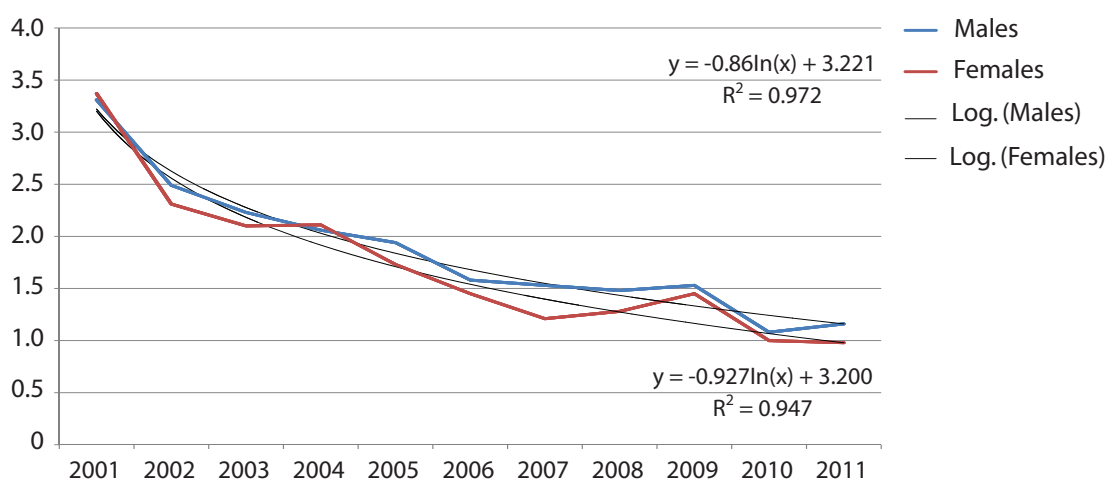
Table 13. Male and female unemployment rate in Coresia, historical data

Historical data (from 2001 to 2011)											
Year	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11
Males	3.31	2.49	2.23	2.06	1.94	1.58	1.53	1.48	1.53	1.08	1.16
Females	3.37	2.31	2.10	2.11	1.73	1.45	1.21	1.28	1.45	1.00	0.98

Source: V. Schmitt and L. De, ILO RAP model for Coresia, 2013.

Step 1: We created a chart from historical data. We added a trend line that yielded the highest r-square (the higher the r-square, the better the trend line).

Figure 21. Chart and trend lines of male and female unemployment rates in Coresia, historical data



Step 2: We then projected male and female unemployment rates from the trend equations.

Table 14. Male and female unemployment rates in Coresia, projections

Projections (from 2012 to 2020)									
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
Males	1.08	1.02	0.95	0.89	0.84	0.79	0.74	0.69	0.65
Females	0.90	0.82	0.75	0.69	0.63	0.57	0.52	0.47	0.42

Step 3: We corrected the projections by stipulating a minimum unemployment rate of 0.95.

Table 15. Male and female unemployment rates in Coresia, corrected projections

Corrected projections (from 2012 to 2020)									
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
Males	1.08	1.02	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Females	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95

Step 4: We calculated the total estimated unemployment as follows:

$$\text{Total unemployment (t)} = \text{Projected male EAP (t)} \times \text{Male unemployment rate (t)} + \text{Projected female EAP (t)} \times \text{Female unemployment rate (t)}$$

Step 5: We calculated the total unemployment rate as follows:

$$\text{Total unemployment rate (t)} = \text{Total unemployment (t)} / \text{Total EAP (t)}$$

Table 16. Total unemployment rate in Coresia, corrected projections

Projection of total unemployment rate (from 2012 to 2020)									
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020
Unemployment rate	1.02	0.99	0.95	0.95	0.95	0.95	0.95	0.95	0.95

## Dealing with ECO: How to project GDP, GDP at constant price (volume effect), and the GDP deflator (price effect)?

The ECO worksheet is mainly based on the projection of economic growth.

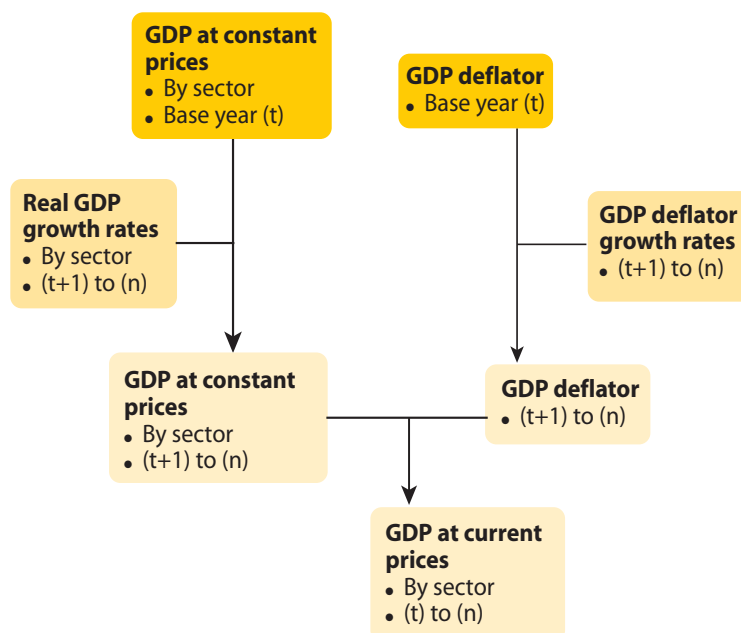
It is recommended to use official government economic projections or economic projections produced by preeminent research institutes. In Thailand, the macroeconomic model developed by TDRI was used. It assumes three scenarios related to high, medium, and low GDP growth.

When official projections are not available, economic growth can be estimated using the simple methodology in the ECO worksheet. In principle, economists try to forecast volumes and prices separately when forecasting the economic situation in the future. This enables one to apply different change patterns to both components.

Projections of GDP at current price will be obtained from projections of GDP at constant price (volume effect) and projections of the GDP deflator (price effect).

$$\text{GDP at current price} = \text{GDP at constant price} * \text{GDP deflator}$$

Figure 22. GDP at current price, GDP at constant price and GDP deflator



Source: T. Sakhunphanit: *Advanced RAP concepts: Macroeconomics*, presentation delivered during the training workshop on “Social Protection: Assessment, Costing and Beyond” organized by ILO DWT-Bangkok and Faculty of Economics, Chulalongkorn University, 15–19 October 2012.

The *GDP at constant price* measures the “volume” of production in a country. It is determined by employment and productivity.

$$GDP\ at\ constant\ price = Productivity * Employment$$

Using this formula, participants can project one of the parameters provided the data for the other two parameters are available in the country.

For example, if forecasts for the unemployment rate and labour productivity are available, projections of GDP at constant price can be obtained using the formula below:

$$Unemployment = Unemployment\ rate * Labour\ force\ (EAP)$$

$$Employment = Labour\ force\ (EAP) - Unemployment$$

$$\Rightarrow GDP\ at\ constant\ price = Productivity * Employment$$

Alternatively, if projections for GDP at constant price and labour productivity are available, participants can project employment and unemployment.

$$Employment = GDP\ at\ constant\ price / Productivity$$

$$Unemployment = EAP - Employment$$

It should be noted that projections by this methodology, which assumes GDP, productivity, and unemployment as dependent variables, could lead to negative values of unemployment in long-term projections. Readjusting assumptions concerning GDP and productivity is a crucial step.

In the RAP model for Coresia, high levels of GDP growth translate into high labour productivity growth (between 4.4 and 5.3 per cent per year) given that employment is near the saturation level. After a sharp increase due to the introduction of the minimum wage from 2011 to 2013, the average wage increase stabilizes at 6 per cent to take into account productivity increases and inflation.

The *GDP deflator* measures the “price” effect. Usually economic growth goes hand in hand with inflation. Inflation is the rate of increase in the average price level of the economy. There are different ways to measure the general price level in the economy, and therefore, inflation. Some of the common measures are the consumer price index (CPI), headline inflation, and the GDP deflator.

- The GDP deflator reflects prices of all goods and services produced within the country. It compares the value of goods and services produced in the current year at current prices with the value of current production at base year prices. The GDP deflator is a broad measure of inflation which is important for understanding the whole economy.
- The CPI reflects the prices of a representative basket of goods and services purchased by the consumers. It compares the price of the same basket of goods and services from one year to the next.
- Headline inflation includes the entire market basket of goods and services consumed in the country, including fuel and food prices, which are volatile. The CPI excludes fuel and food prices.

When projecting the cost of SPF benefits in developing economies the headline inflation is preferred to CPI. This is because fuel and food availability is of greater concern in such countries.

## Hands-on exercises

Hands-on exercises are designed to give participants practical experience in filling in the blue worksheets in the RAP model. The exercises are conducted as a class. An Excel file containing four exercises is distributed to the participants. The present module includes an explanation of the calculations for each exercise. Instructions and comprehensive solutions are provided with the guide (e-box).

### a) Exercise 1:

The first exercise is on mortality. Population and mortality rates are given. Participants have to calculate the number of deaths and total population in the next year.

*Formulas:*

$$\text{Number of deaths} = \text{Population} \times \text{Mortality rate}$$

$$\text{Population in 2012} = \text{Population in 2011} + \text{Newborns in 2011} - \text{Deaths in 2011}$$

*Solution:*

Cohort No. 1 (in yellow in the table below) is composed of all individuals born in 2010:

- The total number of newborns is 200.
- The mortality rate for age = 0 is 0.02.
- The number of deaths in 2010 is 4 (0.02 \* 200).

The total population in 2011 is therefore  $200 - 4 = 196$ .

In 2011, this cohort turns 1 year old:

- The mortality rate for age = 1 is 0.005.
- The number of deaths in 2011 is 0.98 ( $0.005 \times 196$ ).
- The number of survivors is  $196 - 1 = 195$  in 2012.

Cohort No. 2 (in green in the table below) is composed of all individuals born in 2009:

- The population in 2010 is 200.
- The mortality rate is 0.005.
- The number of deaths in 2010 is  $0.005 \times 200 = 1$ .

The population in 2011 is therefore  $200 - 1 = 199$ .

In 2011, this cohort turns 2 years old:

- The mortality rate for age = 2 is 0.005.
- The number of deaths in 2011 is 0.995 or 1 ( $0.005 \times 199$ ).
- The number of survivors is  $199 - 1 = 198$  in 2012.

Table 17. Solution to exercise 1

Age Group	Pop_2010	Mortality Rate	Deaths_2010	Pop_2011	Mortality Rate	Deaths_2011	Pop_2012
0	200	0.02	4	190	0.02	3.80	180
1	200	0.005	1	196	0.005	0.98	186
2	200	0.005	1	199	0.005	1.00	195
3	200	0.005	1	199	0.005	1.00	198
4	200	0.005	1	199	0.005	1.00	198

b) Exercise 2:

The second exercise is on the labour force and unemployment. The number of people in the working age group, the labour force participation rate, and the rate of unemployment (in the labour force) are provided. Participants have to calculate the number of people in the labour force and the number of employed people.

Formulas:

*Labour force* = *Labour force participation rate* × *Number of people in the working age group*

*Number of people in the working age group* = *Number of people of 15 years of age and above*

*Number of employed people* = *Total labour force* – *Number of unemployed people*

*Number of unemployed people* = *Unemployment rate* × *Total labour force*

*Solution:*

In 2010, for instance, the labour force =  $80\% * (700 + 100) = 640$  persons.

- The number of unemployed =  $5\% * 640 = 32$  persons.
- The employed persons =  $640 - 32 = 608$  persons.

*Table 18. Solution to exercise 2*

Age group	2010	2011	2012
0-14	200	240	300
15-59	700	840	1 050
60+	100	120	150
Total	1 000	1 200	1 500
Labour Force Participation Rate	80%	75%	70%
Labour Force	640	720	840
Unemployment rate	5%	5%	5%
Unemployed	32	36	42
Employed person	608	684	798

*c) Exercise 3:*

The third exercise is on calculating the number of newborns from female workers working in the informal sector.

The data provided includes:

- female labour force per age group;
- percentage of those working in the informal sector (among EAP) per age group;
- fertility rates per age group.

*Formulas:*

$$\text{Number of female workers working in the informal sector} = \text{Number of female EAP} \times \text{Percentage of those working in the informal sector}$$

$$\text{Number of newborns} = \text{Fertility rate} \times \text{Number of female workers working in the informal sector}$$

*Solution:*

In 2010 and for the age group 15–19 years of age:

- The number of female workers working in the informal sector =  $58\% * 477 = 277$ .
- The number of newborns =  $0.0098 * 277 = 3$ .

*d) Exercise 4:*

The fourth exercise is on GDP. GDP at constant price, GDP growth, and GDP at current price are given for the year t. Participants have to calculate the GDP deflator for the year t and then project GDP at constant price, the GDP deflator, and GDP at current price in year t+1.



Formulas:

$GDP \text{ at constant price in year } t+1 = GDP \text{ at constant price in year } t \times GDP \text{ growth rate}$

$GDP \text{ deflator} = GDP \text{ at current price} / GDP \text{ at constant price}$

Solution:

In the example, the GDP deflator = 6,000 / 5,000 = 1.2.

- GDP at constant price in t+1 = (1+10%) \* GDP at constant price in t = 110% \* 5,000 = 5,500.
- GDP at current price in t+1 = GDP deflator \* GDP at constant price in t+1 = 1.2 \* 5,500 = 6,600.

In this exercise, for the sake of simplifying assumptions, we assumed that the GDP deflator would remain constant. In reality this is generally not the case.

Table 19. Solution to exercise 4

	t	t+1
GDP at constant price	5 000	5 500
GDP growth	10%	10%
GDP deflator	1.2	1.2
GDP at current price	6 000	6 600



## Takeaway message:

To fill in the POP, EAP, ECO, and GGO worksheets of the ILO RAP model, it is necessary:

- to collect a number of indicators (historical data): population, labour force or economically active population, labour force participation rate, employed persons, unemployed persons and unemployment rate, GDP at constant and current prices, productivity, consumer price index, and so on;
- to collect projections for these various indicators or, when the projections are not reliable or not available, to calculate projections for some of these indicators.

It is important to understand the indicators and their interrelationships with each other in order to be able to collect the data, calculate projections, and cross-check the coherence across data.
















textbook



e-box

## Resources:

	Master module 12 – Understanding how to input data into the RAP worksheets (advanced session)		
	Presentation – Advanced Session on using the RAP		
	Advanced RAP Theory Part 1 – Finding the data (POP and EAP worksheets) Part 2 – Exercises No. 1 to 3 Part 3 – Macroeconomics (ECO worksheet) and Exercise No. 4		  
	Instruction sheet for the hands-on exercises		
	Exercises (Excel sheets with questions and answers)		

e-box available at: <http://www.social-protection.org/gimi/pages/abnd/>