TWINNING CONTRACT

JO/13/ENP/ST/23

Strengthening the capabilities of the Department of Statistics in Jordan

MISSION REPORT

on

Activity: 2.7 Follow-up on work done and recommendation for future work

Mission carried out by
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22-26 March 2015

Version: Final

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List of Abbreviations

APS	Agricultural Prices Survey
CFS	Capital Formation Survey (in agriculture)
CLS	Child Labour Survey
CPS	Crops Production Survey
DoS	Department of Statistics of Jordan
HIES	Household Income and Expenditure Survey
NSI	National Statistical Institution
SA	Seasonal Adjustment
SBR	Statistical Business Register
ToR	Terms of Reference
QNA	Quarterly National Account

Executive Summary

This was the last mission of the project within Component 2 (Sampling Techniques). This report covers the outstanding issues covered during this mission as well as a description of results generated during the entire component. The main conclusions and recommendations can be summarised in three points:

- Creation of statistical business register will be a huge step for economic surveys. It will allow deriving of much more precise population frames and application of more advanced weighting procedures.
- Centralisation of survey methodology in one unit will allow introducing more efficient and targeted training for DoS employees involved in survey methodology. A centralised survey methodology unit will also help to preserve the knowledge even in case of staff rotation.
- The project allowed us to highlight areas where more training is necessary. Generally all the techniques introduced during the component have been well received by the DoS staff, but a lot of practice is needed before the techniques can be used in the proper way on a daily basis. This is especially true for the software R.

1. General comments

This mission report was prepared within the Twinning Project "Strengthening the capabilities of the Department of Statistics in Jordan". It was the final mission to be completed within Component 2 (Sampling Techniques) of the project. The component has seen a total of eight missions, including a study visit to Latvia.

The purposes of this mission were:

- To discuss any outstanding issues with relation to the topics in the component
- To discuss the status regarding the component at the beginning of the project
- To discuss the status of the project results
- To prepare recommendations regarding the sustainability of the achievements
- To prepare recommendations for the future work
- To identify needs for further support

The expected outputs of this mission were:

- Recommendations prepared for outstanding issues with relation to the topics in the component
- Description of the status regarding the component at the beginning of the project
- Description of the project results
- Recommendations prepared on the sustainability of the achievements
- Recommendations prepared on the future work
- Description of needs for further support

The consultants would like to express their thanks to all officials and individuals met for the kind support and valuable information which they received during the stay in Jordan and which highly facilitated the work of the consultants.

This views and observations stated in this report are those of the consultants and do not necessarily correspond to the views of EU, DoS, Statistics Denmark or Central Statistical Bureau of Latvia.

2. Assessment and results

This section is divided between specific outstanding issues (Section 2.1) and a more general description of the component (Section 2.2) broken down by five items: Status at beginning of project, project results, sustainability of the achievements, recommendations for the future, and identification of needs for additional support.

2.1 Outstanding issues (specific)

A substantial amount of time was spent on discussing and working on outstanding issues regarding the three surveys in the agricultural directorate that were also the topic of Activity 2.6:

- Redesign of the Capital Formation Survey (CFS)
- Estimation in the Crops Production Survey (CPS) and the Agricultural Prices Survey (APS).

The calculation of sample size for the future Child Labour Survey (CLS) was also discussed.

2.1.1 Capital Formation Survey

The aim of the CFS is to measure the change in capital in agriculture over a year. The optimal sampling design to measure a change over time is a sampling design with a rotating panel where part of sample units are overlapping between two consecutive time periods. The length of the panel defines the overlap between two samples. For example, panel for two years (sampled units are kept in a panel for two years) guarantees 50% theoretical overlap between two years; panel for four years (sampled units are kept in a panel for four years) guarantees 75% theoretical overlap between two years. The choice of the panel length is a trade-off between response burden (length of the panel) and the precision of the change estimates (the overlap between two years sample).

Another benefit of rotating panel scheme is that information about the holding's capital has to be asked only about one time period, for example, current capital during the interview or at the specified date (the end of a financial year). There is no need to ask what is the current capital and the capital one year ago. This is because the same holdings (the overlapping part) will be interviewed at the beginning of the year and one year latter – allowing deriving the change in capital over a year. This approach has a potential to reduce measurement errors – because holders have to answer only about the current capital (there is no need to "remember" the capital figures one year ago).

Two stage sampling with localities (or villages) as the first stage units and holdings (or farms) as the second stage sampling units is a traditional sampling design used in Jordan for agriculture surveys. The sampling design choice is a reasonable choice because a statistical farm register is not available at the DoS. The frame of localities is constructed from the last agriculture census. The frame of holdings within each locality is updated in each sampled locality. This is an optimal sampling design based on the information available at the DoS.

Two stage sampling design is recommended also for the CFS. The frame of localities can be constructed using the census data. Standard output (SO)[1] computed for each locality could be the optimal auxiliary variable used for sample optimisation (and weighting after survey data collection). SO is an economic indicator describing the economic activity of the farm expressed in euro (or any other currency). The merit of SO is that it includes crops and livestock production of the farm. SO for each farm is calculated by assigning a coefficient (expressed in currency)[2] for each agricultural product, multiplying the amount of each product by the corresponding coefficient and summing achieved values of all products. SO for a locality can be computed by summing the SO over all holdings in a locality. The SO of a locality will represent an agricultural activity of the locality. The agricultural activity (expressed by SO) possibly is correlated with the amount of investments made in a locality. So standard output computed from the census data could be a very good auxiliary variable used for sampling and weighting purposes.

Stratified systematic sampling with probabilities proportional to the unit size could be a possible sampling design for the first stage sampling. The SO of localities can be used as the size measure. In this way localities with higher SO will receive higher sampling probabilities. The sorting of the localities can be done by geographical location (for example by the governorate, district and sub-district). There are systematic sampling schemes allowing implementation of the rotating panel sampling design (see Annex 6).

The frame of holdings will be updated in each sampled locality. Holdings can be sampled with simple random sampling or stratified simple random sampling in each sampled locality.

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[1] http://ec.europa.eu/eurostat/statistics-explained/index.php/Glossary:Standard_output_%28SO%29

[2] The coefficients used for SO calculation are country based. The best option would be to derive the Jordan specific coefficients. The SO coefficients of similar country could be used as well.

The benefits of the described sampling design:

- This is a probabilistic sampling design allowing to derive design weights, point estimates of the total capital and the change in capital, and precision measures for the estimates;
- Rotating panel scheme allows to have sample overlap between two consecutive years. The estimates of change in capital over a year will be more precise if compared to independent sampling in each year;
- The information about the capital is asked only about the current period (there is no need to ask for the capital figures one year ago). The measurement errors potentially can be reduced in such way.

2.1.2 Crops Production Survey

Regarding the CPS a substantial amount of time was devoted to getting the right data files. It is a prerequisite, that the sample data (what was collected in the field) can be related to the sample frame (the list from where the sample was selected). This took some effort, but was eventually accomplished. After this it was possible to verify the inclusion probabilities and thus the weights. The first stage design weights (for localities) where recalculated according to the sampling design used (stratified simple random sampling of localities). The final weights for holdings were corrected according the response (which was very high).

Further, the calculation of point estimates and coefficient of variation were done. The point estimates were different from those previously calculated because the weights were recalculated (see Table 1).

	Winter			Summer		
	Population size	**Total estimate**	**CV (%)**	**Population size**	**Total estimate**	**CV (%)**
Field crops	71 199	763 353	10.6	71 199	20 519	41.0
Fruit trees	71 199	571 508	16.1	71 199	574 968	16.1
Vegetables	71 199	217 590	60.7	71 199	318 748	53.9

Table 1: The point estimates and CV estimates for the CPS

There was a discussion about specific holdings which should always be sampled in CPS. The following idea was presented: Divide each cluster (locality) into two strata: One *take all*-stratum (certainty stratum) containing e.g. the 10 largest holdings, and a *take some*-stratum containing the rest of the holdings. The design weights will be 1 for the units in the *take all*-stratum, and N_h/n_h for the selected units in the *take some*-stratum (N_h is the number of units in the *take some*-stratum, and n_h is the number of units selected from the *take some*-stratum). In this way the sample of holdings will be a representative sample even if all of the largest units have been selected. However, there will (correctly) be two different design weights within the same locality. This is the purpose of this design.

2.1.3 Agriculture Price Survey

The target population for the APS is divided in Jordan valley and uplands. Different sampling designs are used in each of these sub-populations. Stratified simple random sampling is used to observe Jordan valley. It was found, that the collected data in uplands was not from a probability sample. Like most other agricultural surveys, it is a multi-stage design. The first stage units are localities (villages). The localities are stratified by governorates. Four localities with the highest production are selected for the sample, thus the sampling probability for those four localities is 1 and the sampling probability for other localities in the same governorate is 0. In the second stage 30 holdings are sampled from each selected locality.

Having the most productive localities sampled has some merits, but it cannot be considered a representative sample for the entire governorate (and Kingdom). Usage of non-probability sampling for uplands does not allow for measuring the precision of the estimates. The recommendation is to draw a probability sample for uplands which would allow deriving sampling weights and measure the precision of the estimates. Currently precision can be estimated only for the Jordan valley but not for the whole Kingdom.

2.1.4 Child Labour Survey

The last CLS was organised in 2007. The next CLS is planned to be organised after the next Population Census (2015 or 2016). Child labour is a rare phenomenon in the population – this is the main difficulty for planning a sample for this survey.

The target population of the CLS is children in age group 5–17 years old in Jordan. The domains of interest are well defined (governorates split by different population subgroups). The advice was to plan each of these domains as separate stratum and calculate a sample size for each domain independently. This approach will allow controlling the sample size in each domain – and potentially it will allow to achieve reasonable precision for each domain.

The calculation of expected precision was discussed. We assume these parameters to be known in each stratum:

- N_h – the population size (the number of children in age group 5–17) in stratum h. The population size will be available from the next population census data.
- p_h – the proportion of children in labour in stratum h. The proportions partly can be estimated from the previous CLS data. The estimates have to be adjusted using general knowledge about the child labour in Jordan.
- n_h – the sample size (the number of children in age group 5–17) in stratum h. This is a planned sample size.

We assume Y_h to be the population parameter of interest representing the number of children (age group 5–17) in labour. It is computed as $Y_h = \sum_{U_h} y_{hi}$, where U_h is the set of population units in stratum h and y_{hi} is a binary variable assigning the value 1 for children in labour and 0 for children outside labour. The expected value of Y_h can be computed as $\hat{Y}_h = N_h p_h$.

It is possible to derive the expected variance for the estimate of Y_h under the assumption of simple random sampling of children in each stratum:

$$V(\hat{Y}_h) = N_h^2 \frac{1-\frac{n_h}{N_h}}{n_h} S_h^2 \approx N_h^2 \frac{1-\frac{n_h}{N_h}}{n_h} p_h(1-p_h).$$

It is possible to derive the expected values for the standard error, coefficient of variation and confidence interval (with 95% confidence level):

$$SE(\hat{Y}_h) = \sqrt{V(\hat{Y}_h)},$$

$$CV(\hat{Y}_h) = \frac{SE(\hat{Y}_h)}{\hat{Y}_h},$$

$$CI(\hat{Y}_h) = \left(\hat{Y}_h - 1.96 \cdot SE(\hat{Y}_h);\ \hat{Y}_h + 1.96 \cdot SE(\hat{Y}_h)\right).$$

The values of expected coefficient of variation and confidence interval can be used to evaluate the expected precision. The idea is to find the value for n_h so the expected precision is acceptable. The

necessary number of households to be sampled in each stratum can be computed as $m_h = \frac{n_h}{a_h}$, where a_h is the average number of children (age group 5–17) per household in stratum h.

The Excel sheet with the formulas was generated and provided. These calculations can be used only to get a rough idea about the necessary sample size. The calculated sample size has to be critically evaluated because:

- Sampling design in each stratum will be random sampling of households (clusters of children);
- The values of p_h could be imprecise;
- Non-sampling errors will decrease the precision.

2.2 General description of results generated by the component

The component has seen a total of eight activities including the current mission and a study visit:

- Activity 2.1: Assessment of current use of sampling methodologies
- Activity 2.2: Design of surveys
- Activity 2.3: Study visit to Latvia
- Activity 2.4: Training in seasonal adjustment
- Activity 2.5: Weighting, imputation, non-response and sampling errors
- Activity 2.6: Test run of the new sampling techniques
- Activity 2.7: Follow-up on work done and recommendation for future work (current mission)
- Activity 2.8: Imputation and imputation using R

Date and name of the experts for the individual missions are shown in Annex 4. Conclusions and recommendations by activity (generally found in Section 3 in the individual mission reports) are shown in Annex 5. This section will try to summarise the most important

2.2.1 Status at the beginning of the project

The status at the beginning of the project was assessed during mission 2.1. The recommendations are shown in Annex 5, but in short form they may be stated as follows:

- The sampling designs applied are reasonable taking into account the available frames.
- Weighting and estimation might be improved by introducing calibration.
- Imputation techniques are not widely used.
- Calculation of sampling errors has to be introduced as a standard procedure.
- Currently no seasonal adjustment is performed.

Based on these findings a training plan with eight points was drafted:

- Training on statistical software R
- Training on imputation (mainly for household surveys)
- General training on compiling economic statistics
- Theoretical and practical training on weight calibration.
- Theoretical and practical training on sampling error estimation.
- General training on register assisted statistics.
- Introductory training on seasonal adjustment.
- Assistance to the Agriculture Directorate on implementing new survey design, especially moving from census to sample survey for the Cultivated Area Survey in Jordan Valley (Aghwar).

It is reasonable to evaluate component 2 of the twining project based on the extent to which these objectives have been reached.

2.2.2 Status of project results

The project has delivered a number of specific results, especially training and workshops within methodological core processes including sampling design, imputation, weighting and calculation of standard errors, and seasonal adjustment. The training using the computer facilities at DoS have generally been very successful. However, adjusting the daily working routines has of course proved somewhat harder.

Imputation

At the Economics directorate no imputation techniques are used in the internal trade statistics. Staff have tried to replace non-response by donor values (same type judged by different characteristics), but it has not worked very well. For very large or unique enterprises, a general strategy of "last value carried forward" is applied. This is an acceptable practise.

At the Agriculture directorate response rates are normally very high, so there is not much use for imputation. Adjustment of raising factors is done instead.

Imputation is used for the Household Income and Expenditure survey (HIES). The sampling design has four rounds, i.e. one household will participate four times in a survey. In the case of missing observations expenditure will be imputed by another round (preferably from the same month or season). The aim is to make imputation for expenditure codes as well (food, non-food, etc.). The current procedure is not always sufficient because many households are not responding. Reweighting is also done to deal with unit non-response – it is not really clear in which situations which method is used.

Sampling design

At the Economics directorate, it is normal practice to include all large enterprises in the sample. This is a preferable approach. Generally estimates at the Kingdom and region level are of sufficient precision, while the estimates at the governorate level are not. There is demand for estimates at the governorate level, so if the total sample size cannot be increased, then the design must be changed. One possibility is to look at sample allocation. A smaller sampling fraction must be accepted for the Amman area if other regions (or governorates) must also be covered by the sample.

Two stage sampling design is usually used for agriculture surveys. The lack of statistical farm register is the main reason for such approach. The first stage sampling frame is built using the data from the last agriculture census. The sampling units are localities or villages at the first stage. Sampling frame of holdings or farms is updated by field work in each sampled locality. The second stage sample is drawn from the updated frame of holdings in each sampled locality. This is very sensible choice of sampling design under current conditions.

However we have observed situation when non-probabilistic sampling has been used (the case of Agriculture Price Survey in Jordan uplands). This is not a recommended approach. This approach allows deriving estimates of population parameters but the precision of estimates cannot be evaluated. The general recommendation is to plan the methods for weighting and precision estimation together with sampling design. For each sample there should be a plan for weighting and precision estimation available in advance. This is a preferred solution to plan sampling, weighting and precision estimation as a whole process together.

For the household surveys no changes regarding sampling design is to be made until the census is done. This is because the census will provide a new frame for household surveys. The framed is used

by forming a master sample. Some advice or guidance regarding the formation of a new master sample will be welcome.

Calculation of weights

Calibration using a known population size (in breakdown by some population domains) is done for social surveys. The calibration is done using Excel. This naturally limits the number of auxiliary variables that can be utilized in calibration because it is not feasible to do a calibration with many calibration equations in Excel (the formulas used are rather complicated and not suitable for calculation "by hand"). There is a wish to use more variables for the calibration, but this would without doubt demand the use of better suited software.

For the Economics directorate there are no outstanding issues, and the experts feel confident regarding the weighting methods used here.

Weighting is done for agriculture surveys with some exceptions. Weighting is not used for Agriculture Price Survey (where non-probabilistic sampling is used for uplands). The recommendation is to use probabilistic sampling and introduce weighting for the Agriculture Price Survey.

There was a case of Crops Production Survey where weighting did not corresponded to the sampling design used. The weights were recalculated and new estimates were delivered. They were different from the previous estimates computed using the original weights. It is very important to document each survey process. The lack of documentation for sampling process could be a reason for the situation when survey weights do not match the sampling design used.

Calculation of standard error (or CV)

Within the transportation survey it was found, that some types of transportation had to high CV because of large variation within strata. The staff will try to either increase the sample size or divide the strata into more homogeneous types. This is a good example of how the results of one wave of a sample survey can feed information into the next wave.

CVs are estimated for household surveys. Currently the calibration effect is not taken into account in the CV estimation. The current estimates of CV could be over-estimated in cases when study variable is correlated with the calibration variables. The recommendation is to take the calibration effect into account when the estimation of CVs is done.

Estimation of CVs is not used for agriculture surveys. CVs for the Crops Production Survey where derived during the project. The SPSS code for CV estimation in Crops Production Survey was delivered.

Seasonal adjustment

The software for seasonal adjustment JDemetra+ was introduced during activity 2.4, and the potential of the program was immediately recognised. The program should be directly applicable to the quarterly GDP, where the norm is to compare a quarter to the same quarter last year. However, no one has asked DoS to do seasonal adjustment of these figures, and thus it has not been introduced.

A couple of difficulties have influenced this. For example, when a full calendar year is published, the quarterly figures are benchmarked to match this. But this could also be done for the seasonal figures, i.e. sum of seasonally adjusted quarterly figures can be made to match the sum of the raw figures within a calendar year. In this way the seasonal adjustment redistributes volume within a year, it does not add or remove anything. However, according to the Eurostat guidelines for SA this is not recommended. On the other hand, the seasonally adjusted figures could be benchmarked to the calendar adjusted series. This is a more acceptable practice.

Another difficulty is the revisions, which will almost always occur when performing SA. The users are not thought to be willing to accept any revisions. This shows that there is a huge task in telling the public how the figures should be interpreted, because revisions are not inherently bad but actually shows that we have gained more knowledge.

2.2.3 Sustainability of the achievements

During the component a lot of cases have been discussed and problematic areas have been highlighted. This could serve as a base for prioritization and formation of work plans. If no work plan is set up, then the achievements are in risk of being lost. The training needs expressed by the staff are recorded, but this is not necessarily to be done with experts brought in from the outside. It could very well be done by setting up study groups or through self-study.

2.2.4 Recommendations for the future

Sufficient resources should be allocated to establish a Methodology Unit where a more targeted capacity building regarding both statistical theory and programming skills can take place. As stated before knowledge of both is needed. This is a decision to be taken by the top management.

Centralisation of survey methodology (sampling, weighting, precision estimation, imputation, possibly time series analyses) in one unit will help to accumulate and raise the knowledge about survey methodology. It will help to preserve the knowledge also under rotation of the stuff (which of course is unavoidable).

Imputation

Item non-response and unit non-response must be distinguished. Generally item non-response (for non-critical items) can be handled by means of imputation. Unit non-response should be handled by means of weighting, perhaps except for the largest unit, where imputation might be acceptable.

Sampling design

Some advice regarding the CFS is given in this report. For the APS there is a distinction between the Jordan valley and uplands. Generally the design for the valley is fine (a stratified sample is already used), for the uplands some work on designing a new sample is still needed.

For the economic surveys the currently used sampling design are appropriate.

For the household design the current design are appropriate. A big challenge is the creation of a new master sample following the census. For the HIES we got the impression that panel attrition plays a big role (very few households participate four times), so it should be considered to redesign HIES by discarding the panel component of HIES (observing household only once).

Calculation of weights

The household surveys could benefit from usage of more auxiliary variables in calibration, but this would require different software.

The agricultural surveys should pay extra attention to correspondence between the sampling design and the weights. A useful check is to sum the design weights which should correspond to the population size.

For the economic surveys the currently used weighting procedures are appropriate.

Calculation of standard error (or CV)

Transfer of the knowledge from the transportation survey to other surveys within the Economic directorate regarding calculation of CV could readily take place.

Estimation of CVs should be introduced for agriculture surveys.

Calibration effect should be taken into account when doing CV estimation for social surveys.

Seasonal adjustment

Can SA be applied to all surveys? The decision is not linked to the survey but to the resulting time series – this is a small but important distinction. If the (quarterly or monthly) time series displays seasonal behaviour, then it is suitable for seasonal adjustment. JDemetra+ has initial tests for seasonality.

The issue of calendar was brought up again. Again we refer to the manuscript[3] prepared by N.A. Kocak of the Turkish Statistical Institute, who has made a good description of the solution to this applied in Turkey (which by all means must have similar calendar).

A release version of JDemetra+ was announced by Eurostat and the European Central Bank in February 2015. The version 2.0.0 can be downloaded from https://github.com/jdemetra/jdemetra-app/releases/tag/v2.0.0. Even more information is available from the CROS website: http://www.cros-portal.eu/content/jdemetra-seasonal-adjustment-software.

2.2.5 Identification of needs for additional support

It is deemed that further support would be very beneficial in many areas. One area deserving special attention is the need to start building a *Statistical Business Register* (SBR). In many surveys the main obstacle is the lack of a suitable sampling frame. Conducting a census every 5 years is not sufficient. It seems as an administrative business register already exists within other governmental bodies. However, setting up an agreement about sharing data, and subsequently transforming an administrative into a statistical register is a huge task. For example, the administrative register has over-coverage because businesses which are no longer active are not immediately removed from the register. To illustrate the administrative register consists of about 250,000 units, while the last census estimates around 156,000 units. Including tax information could help to distinguish active / non-active units.

The R software was introduced, but the staff at DoS needs more training, introduction through a single mission is not enough. The staff members need to be able to make the programs by themselves. Depending on executing scripts prepared by someone else is not a sustainable solution. The experts totally agree with this. However, the best way to learn how to use R (or any other software) is by using it. The sooner staff will start using just a little time to experiment with R, the sooner they will be proficient users of the software.

Imputation

The use of imputation techniques for item non-response (partial non-response) should be introduced.

[3] http://www.cros-portal.eu/sites/default/files/A%20Note%20on%20Using%20Calendar%20Module%20in%20Demetra.pdf

Sampling design

More solid descriptions of the applied sampling designs should be used. Multistage sampling (as used know) is probably the best option given the lack of statistical registers.

Calculation of weights

For the agricultural statistics more training is needed on sampling concepts. Solid knowledge on basic concepts must be ensured such that the calculation of weight reflects the actual sampling design.

Calculation of standard error (or CV)

For social surveys current estimation of CVs does not take into account calibration (made by Excel). Normally calibration reduces the variance, so the current estimates of CVs are perhaps too high. Training in the theory and application of calibration is needed.

In the Economic directorate calculation of CV is implemented for the transportation survey only. Training is needed before the calculations can be implemented in other areas.

Seasonal adjustment

Staff working on QNA thinks they are able to install the new version of the software and retrieve the manuals, but they also need training using the software with their own data series.

3. Conclusions and recommendations

The recommendations and the agreed upon training plan from activity 2.1 are to a large extent still valid. Some training has been conducted and some transfer of knowledge regarding statistical methodology has taken place, but more could be done in all the mentioned areas.

It was emphasized by the consultants, that statistical methodology consists of both statistical understanding and programming proficiency.

Regarding the draft training plan mentioned in Section 2.2.1, we conclude that all areas have been covered. The topics can be grouped together as follows:

- General training on compiling economic statistics;
- Theoretical and practical training on weight calibration;
- Theoretical and practical training on sampling error estimation.

These areas have been the main focus of this component. Calculation of weights (directly from the design or model-assisted using calibration) and calculation of standard errors should be seen as connected operations. Also, when planning the survey one should already plan how to do these calculations. If no solution can be found, then a simpler design should be considered.

- Training on statistical software R;
- Training on imputation;
- Introductory training on seasonal adjustment.

Training has been conducted in these three specific areas. A lot of practice and perhaps even additional training is needed in all areas.

- General training on register assisted statistics.

This topic was covered during the study visit to Latvia.

- Assistance to the Agriculture Directorate on implementing new survey design.

This has also been accomplished.

Annex 1. Terms of Reference

Terms of Reference

EU Twinning Project JO/13/ENP/ST/23

22-26 March 2015

Component 2: Sampling techniques

Activity 2.7: Follow-up on work done and recommendation for future work

0. Mandatory results and benchmarks for the component

- Improve the capacity of DoS staff to understand and apply modern sampling techniques (Apr 2015)
- Assessment report on current situation (Jan 2013)
- Provide inputs to the design of surveys (Aug 2014)
- Conduct a training course in seasonal adjustment (Oct 2014)
- Give recommendations on how to deal with weights, imputation, non-response and sampling errors (Apr 2015)

1. Purpose of the activity

- To discuss any outstanding issues with relation to the topics in the component
- To discuss the status regarding the component at the beginning of the project
- To discuss the status of the project results
- To prepare recommendations regarding the sustainability of the achievements
- To prepare recommendations for the future work
- To identify needs for further support

2. Expected output of the activity

- Recommendations prepared for outstanding issues with relation to the topics in the component
- Description of the status regarding the component at the beginning of the project
- Description of the project results
- Recommendations prepared on the sustainability of the achievements
- Recommendations prepared on the future work
- Description of needs for further support

3. Participants

DoS

Mrs Ghaida Khasawneh, Head of Sampling Division *(Component Leader*)
Staff from the Directorate of statistics studies
Staff from the Directorate of Economic surveys
Staff from the Directorate of Agricultural statistics

MS experts
Mr. Peter Stoltze, Deputy Head of Research and Methods Division, Statistics Denmark
Mr. Martins Liberts, Deputy Head of Mathematical Support Division, Central Statistical Bureau of Latvia

Annex 2. Programme for the mission

Time		Place	Event	Purpose / detail
Sunday, morning	08.30 – 10.00	DoS	Meeting with RTA	To discuss the programme of the week
Sunday, morning	10.00 – 12.00	DoS	Meeting with BC Component Leader and BC Experts	Discussions of the week's programme Discussions of any outstanding issues regarding the topics in the component and especially Activity 2.6.
	12.00 – 01.00		Break / Preparations / Report writing	Break / Preparations / Report writing
Sunday, afternoon	01.00 – 03.30	DoS	Meeting with BC Component Leader and BC Experts	Discussions regarding the status of the topics in the component at the beginning of the project
	03.30 – 04.00		Preparations / Report writing	Preparations / Report writing
Monday, morning	08.30 – 09.00	DoS	Preparations / Report writing	Preparations / Report writing
	09.00 – 12.00		Meeting with BC Component Leader and BC Experts	Discussions of the status of the project results
	12.00 – 01.00		Break / Preparations / Report writing	Break / Preparations / Report writing
Monday, afternoon	01.00 – 03.30	DoS	Meeting with BC Component Leader and BC Experts	Continued.
	03.30 – 04.00		Preparations / Report writing	Preparations / Report writing
Tuesday, morning	08.30 – 09.00	DoS	Preparations / Report writing	Preparations / Report writing
	09.00 – 12.00		Meeting with BC Component Leader and BC Experts	Discussions on how the achievements can be sustained
	12.00 – 01.00		Break / Preparations / Report writing	Break / Preparations / Report writing
Tuesday, afternoon	01.00 – 03.30	DoS	Meeting with BC Component Leader and BC Experts	Continued.
	03.30 – 04.00		Preparations / Report writing	Preparations / Report writing

Wednesday, morning	08.30 – 09.00	DoS	Preparations / Report writing	Preparations / Report writing
	09.00 – 12.00		Meeting with BC Component Leader and BC Experts	Discussions about future work
	12.00 – 01.00		Break / Preparations / Report writing	Break / Preparations / Report writing
Wednesday, afternoon	01.00 – 03.30	DoS	Meeting with BC Component Leader and BC Experts	Discussions of needs for further support
	03.30 – 04.00		Preparations / Report writing	Preparations / Report writing
Thursday, morning	08.30 – 09.00	DoS	Preparations / Report writing	Preparations / Report writing
	09.00 – 12.00		Meeting with BC Component Leader and BC Experts	Final clarifications with BC Experts, preparation of report and presentation for BC Project Leader
	12.00 – 01.00		Debriefing with BC Project Leader	Conclusions and decisions and their consequences

Annex 3. Persons met

DoS:

Mr AbedWadood Matouk, project leader

Methodologies and Statistical Techniques Directorate:

Ms Ghaida Khasawneh, Head of Sampling Division *(Component Leader*)
Ms Wafaa Amer
Mr Abdullah Mostafa

Agricultural Directorate:

Mr Bassam Zain, Head of Crops Production Division
Mr Mohammad Aljawarneh
Mr Abd Alnaser Obidat
Mr Saed Shawawreh

Directorate of Household Surveys:

Ms Sana AlMomani

Economic Directorate:

Mr Khaled AlZeitawi
Mr Thamer Barakat
Mr Mohammad Fathi

Directorate of National Accounts:

Mr Moawiah Zghool
Mr Walid Battah

RTA Team:

Mr Thomas Olsen, resident twinning adviser (RTA)
Ms Christine Salman, RTA assistant
Mr Mohammad Junaidi, Interpreter

Annex 4. List of activities within component 2

Activity 2.1: Assessment of current use of sampling methodologies
Peter Stoltze, Statistics Denmark and Mārtiņš Liberts, Central Statistical Bureau of Latvia
8th to 12th December 2013

Activity 2.2: Design of surveys
Mārtiņš Liberts, Central Statistical Bureau of Latvia and Kai Lorentz, DeStatis
16–20 February 2014

Activity 2.3: Study visit to Member State
Study visit carried out by the following staff of DoS: Ghaida Abdullah Mohamed Khasawneh Mohamed Ahmad Salameh Thnyyan, Nimer Hashem Nimer Gharbia, Mohammad Yahya, Ahmad Al-jawarneh, Abdel-naser Sado Ahmad Jariri, and Wafa Mohammad Ibrahim Amer.
28-31 October 2014

Activity 2.4: Training in seasonal adjustment
Roberto Iannaccone, ISTAT and Nigel Stuttard, NI-CO
18-22 May 2014

Activity 2.5: Weighting, imputation, non-response and sampling errors
Peter Stoltze, Statistics Denmark and Kai Lorentz, Destatis
15–19 June 2014

Activity 2.6: Test run of the new sampling techniques
Nigel Stuttard, NI-CO and Mārtiņš Liberts, Central Statistical Bureau of Latvia
18-22 January 2015

Activity 2.7: Follow-up on work done and recommendation for future work
Peter Stoltze, Statistics Denmark and Mārtiņš Liberts, Central Statistical Bureau of Latvia
22-26 March 2015

Activity 2.8: Imputation and imputation using R
Ugo Guarnera, ISTAT and Kai Lorentz, Destatis
7–11 December 2014

Annex 5. Conclusions and recommendations by activity

No.	Conclusions and recommendations (normally Section 3 of the mission report)
2.1	The sampling techniques currently being applied for sample surveys are reasonable when taking into account the available sampling frames and survey modes used. The weighting and estimation can be improved by introducing weight calibration as a common weighting procedure. The standard software for weight calibration has to be considered and introduced in the statistical production process. The modernisation of weighting procedures will allow usage of more auxiliary information for weighting. However, if no efforts are made towards more advanced sampling frames (i.e. with more auxiliary information) this might be of little value. The imputation techniques are not widely used as response rates are quite high for most of the surveys. The knowledge about imputation can be improved to increase the capability of DoS to deal with future situations when response rates might decrease. The calculation of sampling errors has to be introduced as a standard procedure for most of the sample surveys. The standard software for sample error calculation has to be considered. The application of seasonal adjustment was not detected during the mission. The knowledge about seasonal adjustment has to be improved.
2.2	The general recommendation for DoS: • General capacity building regarding the theoretical and practical knowledge in survey methodology for the DoS; • More extensive usage of survey and census data in survey planning process (especially in calculation of required sample size and optimal sample allocation); • Usage of auxiliary information for weighting (for example GREG estimation); • It is recommended to carry out the estimation of standard errors regularly for all the subject matter areas. It is recommended to continue the work on capacity building of DoS staff members on survey sampling in one of the next missions on activity 2.5 or following activities. The recommended topics for the following activities are: • Teaching of theory on sampling (especially on weighting, imputation, non-response treatment and sampling error estimation) to a broader group of statisticians from DoS; • Introducing with the practical concepts of modern methods and tools on weighting (GREG estimation); • Introducing with concepts and methods for imputation; • Giving recommendations on specific practical topics proposed by DoS related to sampling methodology; • Providing a training course with R software in linkage with previous mentioned topics. The component leader expressed following recommendation for the activity 2.5: • To cover unit and item imputation as one of the topics; • To provide more practical knowledge. The expected proportion for theoretical and

	practical course material is 1:3; • Introduction with R software. • To proceed DoS work in the Sampling techniques using R and SPSS software. • Enhance the DoS staff capability in using such software in sampling techniques.
2.4	There is no tradition of producing seasonally adjusted data either within Jordan or in the region as a whole. This means that the producers and users of statistics will need to go on a learning curve before they are in a position to produce and use information in this form. One way forward is for the department to start to produce seasonally adjusted versions of some of the more important short-term indicators, first for internal use and then for external use as experimental statistics. It should be noted that it is good practice to publish both seasonally adjusted and non-seasonally adjusted versions of time series to meet different users' needs. Short bullets points: • DoS start to produce seasonal adjusted series, initially for internal use and then for external use on an experimental basis. • Develop a centre of expertise for seasonal adjustment. • Develop a calendar of regression variables for Jordan.
2.5	The usage of the R-software as an additional tool within the IT environment of DoS has been general accepted. But, the usage of this software is only beneficiary for specialized staff members. This group of staff members has to get more acquainted with the usage of this software. Given the rich sources of information about R on the internet self-study is a good possibility. However, language might be a barrier, since most of this information is in English. It was emphasized by the consultants, that statistical methodology consists of both statistical understanding and programming proficiency. R is a powerful tool, but one what should be very cautious about the statistical meaning of the operations performed. It was emphasized by the Jordanian counterparts that gaining knowledge on imputation is of great interest at DoS, in the areas of economic surveys and also household surveys.
2.6	Very specific recommendations regarding four specific statistical areas: • Capital Formation Survey • Crops Production Survey • Agricultural Prices Survey • Economic Survey on Transport The following actions were proposed: • In the short term, estimates of capital formation in agriculture to be based on combining data of the latest five years using the current methodology. • Steps are taken to improve the documentation and version control for agriculture statistics. • DoS develop a rolling panel survey designed to collect capital formation in agriculture. • Recalculation of sampling weights for the Crops Production Survey. • Calculation of sampling errors for the Crops Production Survey using the code delivered with the correct weights. • Calculation of sampling weights for the Agricultural Prices Survey. • Preparing a complete survey data set for Agricultural Prices Survey in Jordan Valley.

	Calculation of sampling errors for the Agricultural Prices Survey in Jordan Valley using the code delivered. • Calculation of sampling errors for Economic Survey on Transport (for several quarters) using the code delivered. • Evaluation of the precision of Economic Survey on Transport using the sampling error estimates from several quarters.
2.7	See Section 3 of this report.
2.8	The usage of the R-software as an additional tool within the IT environment of DoS has been generally accepted. But, the usage of this software is only beneficial for specialized staff members. This group of staff members has to get more acquainted with the usage of this software. It is recommended to apply this software more often, especially in the context of sampling plan development, drawing of a sample, point estimation and variance estimation (CV calculation) as well as imputation. Concerning imputation, the following very general recommendations are given: • DoS staff members have to analyse carefully, whether blanks in the data actually represent the value "0" or are really missing. If the value "0" is meant by the blank, "0" should be at the corresponding places instead of a blank. • One should distinguish the cases of unit non-response (whole unit did not provide answers) from the cases of item non-response (only the values of some variables are missing). The first case should in general be treated with re-weighting, the second with imputation. • Reasons of non-response have to be analysed carefully. If a unit for example does not exist anymore (e.g. a company which stopped their economic activity), nothing has to be imputed. In this case, imputation would lead to an over-estimation of the considered variables. • For economic surveys, imputation cells according to size class and/or economic activity should be considered. Concerning the planned survey on capital formation within the agricultural sector, it is recommended to develop a sampling plan in a future mission, if time and resources are available.

Annex 6. Sampling scheme for rotating panel surveys

The aim is to design a survey with rotating panel, where part of the sampled units are kept in a sample for the next period, but other part is rotated-out (replaced with new sampled units). The sampling design described has to be used in each stratum independently. The following notation will be used:

- N is the size of population (units in a frame, for example the number of localities in a frame);
- x_i is the size measure of a unit (for example, standard output of locality);
- P is the lengths of a panel (for example, number of years a sampled unit is kept in a panel). The length of a panel defines the overlap between two consecutive periods;
- n is the sample size for one replicate, giving $m = nP$ to be the total sample size for one period.

The idea is to draw P (for example, four) systematic samples for each period. We will call these samples as replicates. The samples will be drawn dependently to reduce the overlapping in one period. The standard procedure of drawing systematic sample will be used. The units in frame are ordered by some variable and numbered ($i = 1,2, \cdots, N$). The cumulative sum of the size variable x_i is computed for each unit in a frame

$$X_i = \sum_{k \le i} x_k.$$

A sample step is computed as

$$D = \frac{\sum_{i=1}^{N} x_i}{n}.$$

A random number α from uniform distribution in interval $[0, 1]$ is drawn and the sequence of n numbers is computed:

$$\alpha D, (1 + \alpha)D, (2 + \alpha)D, \cdots, (n - 1 + \alpha)D.$$

The first sampled unit is the unit with the highest X_i value under the condition $X_i < \alpha D$. The second sampled unit is the unit with the highest X_i value under the condition $X_i < (1 + \alpha)D$ and so on till the last sampled unit is the unit with the highest X_i value under the condition $X_i < (n - 1 + \alpha)D$. We can see that sampled units are defined by the number α (so called starting point).

For each replicate different starting point will be chosen

$$\alpha_p = (\xi + (p - 1)\Delta) \; mod \; 1,$$

where $\Delta = \frac{1+\delta}{P}$ and δ is a parameter controlling the rotation of the panel. There is not any rotation of units ot of the sample if $\delta = 0$ – the same units are kept in a sample forever. The value of delta usually is chosen from an interval $\left(0; \frac{1}{P}\right)$. For example δ could be chosen equal to 0.1 in case the length of a panel is four.

The starting points for the following periods are computed as

$$\alpha_{pt} = (\xi + (t + p - 1)\Delta) \; mod \; 1,$$

where t is a the number of year and α_{pt} refers to the sample starting point for replicate p at the year t. The example of starting points in case of four years panel are given in Table 2. We can observe how the starting points are shifting from one replicate to another and finally replaced with a new starting point.

Year (t)	$p = 1$	$p = 2$	$p = 3$	$p = 4$
2015	0.034	0.309	0.584	0.859
2016	0.309	0.584	0.859	0.134
2017	0.584	0.859	0.134	0.409
2018	0.859	0.134	0.409	0.684
2019	0.134	0.409	0.684	0.959
2020	0.409	0.684	0.959	0.234

Table 2: The example of starting point in case of four year panel