Statistical Training Framework aligned to the General Statistical Business Process Model

January 2018

Statistical Training Framework

Introduction

The Central Statistics Office of Ireland and the United Nations High Level Group for the Modernisation of Statistics (HLG-MOS) identified the need for the development of a Statistical Training Framework aligned to the Generic Statistical Business Process Model (GSBPM). This Framework will facilitate statistical organisations in measuring and improving the standard of statistical expertise within their organisation in line with the GSBPM and accordingly should improve standards across the entire statistical system.

The Framework is built on 13 high level statistical headings which have been selected as they represent key statistical skills for working in any statistical organisation. This document introduces the rationale for the design of the framework, tracks its relationship to the GSBPM model and details all 13 high level headings. It allows individuals to self-assess their areas of strengths and weakness and targets their training needs more effectively.

Each heading has been broken down into three levels - Basic, Intermediate and Advanced. These terms convey a certain level of learning. They broadly refer to statistical experts: but they could be matched to different roles at different levels within the GSBPM (for example, staff involved in statistical production but without a formal qualification in statistics). As an example, the Advanced descriptors are at a superior level, the sort of skills you would expect from a methodological expert or an individual who has worked in a specific area for several years.

This Framework will work best in conjunction with a Skills Register. A Skills Register is a database containing the skills, knowledge and expertise of the people within your organisation. The combination of the skills levels required for the role, and the current level of skill as identified in the register, will allow for the identification of the person's strengths and gaps. Training can then be more specifically targeted.

Each statistical organisation can draft a list of training interventions in order to improve their skills, knowledge and expertise. It is recommended that these training interventions encompass the 70/20/10 Model. The 70/20/10 Model is a learning and development reference model which captures the three types of learning - experiential, social and formal - and explains their relationship to one another.

Why the GSBPM model?

The GSBPM describes and defines the set of business processes needed to produce official statistics. It provides a standard framework and harmonised terminology to help statistical organisations to modernise their statistical production processes, as well as to share methods and components. The GSBPM can also be used for integrating data and metadata standards, as a template for process documentation, for harmonising statistical computing infrastructures, and to provide a framework for process quality assessment and improvement.

A recent survey[1] reported that 60% of statistical organisations currently use the model. Of the 40% who are not using it, 75% of those have plans to start implementing its use soon. This indicates that over 85% of all statistical organisations are or will use the GSBPM model.

The Statistical Training Framework is based on the GSBPM model. This makes the framework widely applicable as it is based on something which is respected and implemented in the majority of statistical organisations, and which provides a standardised model for statistical business processes in an end to end statistical production cycle.

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[1] Survey data available at https://statswiki.unece.org/display/GSBPM/Uses+of+GSBPM

STATISTICAL TRAINING FRAMEWORK

GSBPM								TOPICS
Specify Needs	Design	Build	Collect	Process	Analyse	Disseminate	Evaluate	
	■	■	■	■	■		■	1. Register Management
■	■	■	■					2. Sample and Estimation
■	■	■					■	3. Survey and Questionnaire Design
■	■			■				4. Imputation and non-response
■	■			■			■	5. Statistical Data Editing
■	■					■		6. Evaluating user statistical needs
	■	■		■	■			7. Index Numbers
■	■			■			■	8. Regression
■	■				■			9. Time Series Analysis and Seasonal Adjustment
■	■				■			10. Statistical Discourse control
■	■				■	■		11. Visualisation and Presentation of Data
■	■			■	■		■	12. Data Matching, Integration and Administrative Data
■	■			■	■			13. National Accounts

What this framework will mean for statistical organisations & their staff:

The Statistical Training Framework is a necessary resource which will form an integral part of strengthening statistical organisations overall statistical capability. While no one person is expected to possess all of the statistical skills listed in the framework to perform a particular job, a statistician should gain a broad range of statistical skills over time.

The Statistical Training Framework will ensure all areas within the statistical process will get the required focus and emphasis on training spend. On occasion it is the more public areas that have the 'spend' on the Specify Needs, Survey Design and the end element disseminate and evaluate.

A structured Statistical Training Framework will:
- Form an Integral part of **strengthening statistical organisations overall capability -** will measure **statistical capability based on the GSBPM in conjunction with the Skills Register and Role Definitions.**
- Align training across all statistical processes with GSBPM

- Identify gaps in statistical levels in organisations but also across the wider statistical organisation
- Assist statistical organisations in Workforce Planning
- Allow statistical organisations identify
    - Where training is taking place
    - Where over training is happening
    - Where undertraining is happening
- Allow statistical organisations to develop clear learning paths for staff through effective delivery of statistical training interventions
- Assist with decision making on the Mobility of Staff
- Provide staff with greater understanding of the range of statistical skills, knowledge and expertise linked to GSBPM
- Maturity Model could be developed to assess where statistical organisations are with regard to training and the GSBPM

A structured Statistical Training Framework will give staff:
- A greater understanding of the range of statistical skills, knowledge and expertise needed to work effectively throughout the end to end statistical production cycle, aligned to the GSBPM;
- A greater understanding of the role of statistical organisations and the policy and legislative environment governing statistical work
- A structured statistical training path for the individuals
- Help with developing career paths and succession planning
- An opportunity to share their knowledge and assist others in developing their statistical skills.

Register Management

Basic

- I know the difference between an administrative register and a statistical register.
- I understand the data sources used to construct the register(s) in subject matter related to my role, and have a basic idea of their quality characteristics, particularly coverage, timeliness and (where multiple sources are used) linkage quality .
- I understand the importance of a register and how it relates to other elements of a system of official statistics.
- I understand the units model underlying the business register, and how the statistical units relate to administrative units.
- I am aware of the need for harmonised classification systems, and know which ones relate to my role.
- I understand the principles of manual and automated coding, to classifications and for other characteristics such as life events (for businesses, people and other types of unit).
- I can use approved register systems to update units and their characteristics, and store the associated metadata.
- I can run a register proving exercise to validate the records on part or all of a register.

Intermediate

- I know how to link multiple sources to generate or update a register, and the strategies for dealing appropriately with unmatched units.
- I understand how samples are selected from the population on a register, including the principles of coordinated sampling, rotational sampling with permanent random numbers, and systematic sampling.
- I understand how sampling information and associated population information (a sampling frame) are created, stored and managed.
- I know how sampling histories and cost information can be used to manage respondent burden.
- I know how register information is backed up and archived, so that it is available long-term for analysis.

Advanced

- I know how to undertake demographic analysis using register information.
- I understand how lags in recording births, deaths and other events affect the register and different strategies for incorporating these in estimation procedures.
- I understand the dangers of sample-based feedback to a register, and options to mitigate these.

Where does Register Management fit into GSBPM model? *(dark blue is central and pale blue is minor)*

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |

Sampling and Estimation

Basic:

- I understand the difference between probability and non-probability sampling, and the advantages and disadvantages of each.
- I am aware of issues of that arise with sampling frames (over coverage, under coverage, duplication etc).
- I understand the difference between sampling and non-sampling errors.
- I understand how weights are used to calculate population totals and means.
- I understand how weights are used to compensate for unequal selection probabilities or for nonresponse.
- For simple random sampling, I can draw the sample and estimate the population mean and total of a given variable, the variance of these estimates and confidence intervals for them.
- From a simple random sample, I can estimate a population proportion for a given variable, and calculate the variance of the estimate, and confidence intervals for it.

Intermediate:

- I understand the following four types of probability sampling: simple random sampling, stratified random sampling, cluster sampling and systematic sampling.
- I am aware of the strengths and weaknesses of each method, and can identify the most appropriate method for a given situation.
- For each type of probability sample, I can draw the sample and estimate the population mean and total of a given variable and confidence intervals for them.
- For each type of probability sample, I can estimate a population proportion of a given variable, and calculate the variance of the estimate, and confidence intervals for it.
- I understand and can implement ratio and regression estimation to improve the precision of sample estimates using auxiliary data, and how to evaluate whether this is worthwhile.
- For each type of probability sample, I can calculate the required sample size for estimating population means and totals, given a particular precision requirement.
- When designing stratified samples, I understand common methods of allocating the samples across the different strata, and the advantages and disadvantages of each method.
- I understand what the design effect of a sample is, and how it affects the effective sample size of the survey, and the precision estimates of population parameters calculated from that sample.
- I know how to calculate the design effect of a cluster sample.
- I understand how post-stratification can be used to adjust a weighted sample for certain variables (e.g. age/sex) to make it conform to a known population distribution.

Advanced:

- I have a good understanding of multistage cluster samples and have experience in implementing them.
- I know how to analyse complex survey data and deal with issues of differential weighting, stratification and clustering.

- I know how to use calibration estimators to extend the accuracy and consistency of estimation with auxiliary data.
- I am familiar with sample coordination methods which maximise or minimise the overlap between several samples drawn successfully in a population that changes with time.
- I am able to extend the design based sampling framework to include the model assisted approach, and understand the advantages and disadvantages of each.
- I understand the issues that arise from informative non-response, and how to design and implement strategies to compensate for it.
- I understand replication methods like balanced repeated replications, jackknife repeated replications and bootstrapping and can use them to estimate variance in complex surveys.
- I know how to design rotating surveys and multi-phase sample surveys.

Where does Sampling and Estimation fit into GSBPM model? *(dark blue is central and pale blue is minor)*

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |

Survey and Questionnaire Design

Basic

- I know how use the Generic Statistical Business process Model (GSBPM) to define stages in a survey, and know how the designs of the different components interrelate.
- I understand the role of questionnaire design in maximising the quality of the data collected in surveys and in administrative systems.
- I understand the need for clear language in questionnaires, with notes to explain concepts and definitions provided with the questions to which they relate.
- I understand the trade-off between questionnaire length and respondent participation.

Intermediate

- I know how to make an assessment of the options for a particular process based on their properties.
- I understand how edit checks within an electronic questionnaire affect respondents and data quality, and how to use them effectively.
- I know the principles of design for on-line questionnaires, and can adapt these to different devices.
- I understand the differences between modes and how they affect respondent behaviour (e.g. through primacy effects).
- I know how to programme an electronic questionnaire in appropriate software, and how to include skip patterns, loops and cross-checks.

Advanced

- I understand how to design a survey taking account of the trade-offs between the elements that make it up to achieve the required outputs with the right trade-off between quality and cost.
- I am able to undertake cognitive interviewing to assess the quality of questionnaires and/or questions, and to analyse the resulting data.
- I am experienced in qualitative analysis techniques.
- I understand and can apply conceptual models for information retrieval processes to improve data collection.
- I am able to develop and implement statistical measurement concepts relative to users' requirements (for example on topics such as wellbeing, sexual identity and environmental protection expenditure where there are no international standards).
- I understand how randomised response, CASI and similar approaches can be used to gather sensitive data.

Where does Survey and Questionnaire design fit into GSBPM model? *(dark blue is central and pale blue is minor)*

Specify needs > Design > Build > Collect > Process > Analyse > Disseminate > Evaluate

Imputation and Non-response

Basic:

- I understand the potential for bias which arises from non-response and the need to compensate for missing data.
- I understand the difference between unit non-response and item non-response.
- I understand the difference between deterministic imputation and stochastic imputation, and in which circumstances each can be used.
- I understand the non-response mechanisms: Missing Completely at Random (MCAR); Missing at Random (MAR) and Missing Not at Random (MNAR), and how each affects the choice of adjustment procedures.
- I understand how non-response can be reduced during the survey design and data collection stages by implementing good practice, monitoring response rates and targeting important units.
- To deal with unit non-response, I understand the approach of calculating survey weights.
- To deal with item non-response, I understand the approach of using an appropriate imputation method.

Intermediate:

- I can define homogenous response classes using modelling or segmentation approaches
- I can implement and evaluate single-imputation methods for item non-response, eg mean and mode imputation within homogenous imputation classes, regression imputation, hot-deck imputation, predictive mean matching.
- I understand and can calculate the components of survey weights: inclusion probabilities (design weights) and non-response adjustments using inverse response rates within homogenous weighting classes.
- I can calculate nonresponse adjustment weights through post-stratification.
- I understand when it might be appropriate to use imputation methods to adjust for unit nonresponse.
- I know how to ensure that imputed values are consistent with edit rules.
- I can assess the potential for bias using appropriate quality indicators (e.g. missingness rates, R-indicators).

Advanced:

- I can calculate nonresponse adjustment weights using calibration estimators.
- I can apply advanced methods for non-response adjustments using response propensity modelling or segmentation algorithms.
- I can account for extra uncertainty due to missing data when analysing survey data, including hierarchical data, through multiple imputation.
- I can calculate variance estimates using analytical expressions, multiple imputation or replication methods to account for the extra uncertainty due to imputation.
- I can design and implement an adaptive design approach to maximise data quality, and understand how processing and analysis need to be adapted to be consistent.

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |

Where does Imputation and Non-response fit into GSBPM model? *(dark blue is central and pale blue is minor)*

Statistical Data Editing

Basic:

- I understand the concept of an edit restriction (edits) and how to define them for both business and social surveys.
- I understand types of errors: validity, consistency, distributional as well as systematic errors and random errors.
- I understand fatal errors (hard edits) versus query errors (soft edits).
- I understand the basic approaches of statistical data editing: interactive editing, selective editing, automatic editing and macro editing.
- I have knowledge of when and where data editing can occur, e.g. at the time of data collection versus post-processing taking into account cost implications.

Intermediate:

- I know how to evaluate the effectiveness of single edits, including their sensitivity and specificity.
- I understand the principles of the Fellegi and Holt (1976, *Journal of the American Statistical Association* **71** 17-35) paradigm.
- I understand approaches that solve the error localization problem.
- I can implement imputation methods to adjust flagged records so that they are consistent with a set of edit rules.
- I can develop and apply a statistical score function to target important units for manual follow-up, and apply automated data editing and imputation to the remaining units.
- I can apply procedures in macro editing for identifying outliers and influential units.
- I understand the risks of over-editing.

Advanced:

- I understand the Fellegi-Holt algorithm (categorical variables)/Fourier-Motzkin elimination (continuous variables) for variable elimination and finding admissible intervals for imputation.
- I understand error localisation as a mathematical optimisation problem.

Where does Statistical Data Editing fit into GSBPM model? *(dark blue is central and light blue is minor)*

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |
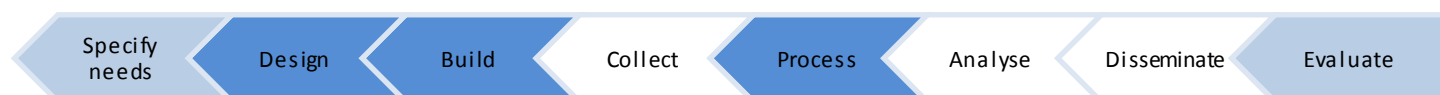
Evaluating User Statistical Needs

Basic:

- I maintain a catalogue of users and uses of outputs, including information on unmet user needs.
- I am able to develop experimental statistical outputs and gather feedback to help them to develop.
- I know how to obtain user information and feedback from a range of different sources, including complaints, web metrics, social media, customer satisfaction surveys, media monitoring.

Intermediate:

- I can undertake a user consultation, including providing evidence, summarising and analysing responses, developing and implementing an action plan.
- I am able to follow up and probe user requirements, and to generate innovative solutions to meet their needs.
- I am able to design and run a user engagement event.
- I maintain regular communication with a range of users using a variety of channels.

Advanced:

- I am able to undertake cost-benefit analysis of a range of outputs and requirements to determine the right balance of outputs to cover a range of user needs with limited resources.
- I am able to develop a long-term work programme to develop my statistical outputs in support of users' needs.

Where does Evaluating User Statistical Needs fit into GSBPM model? *(dark blue is central and light blue is minor)*

Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate

Index Numbers

Basic:

- I am aware of "the index numbers problem", that arises when comparing prices (or quantities) between different time periods, and some practical solutions.
- I understand how index number theory is used in official statistics in the production of some common indices e.g. the Consumer Price Index.
- I understand the concepts of base year, reference year, rebasing and chainlinking for indices.
- I can compare common algebraic methods of index number calculation including Laspeyres and Paasche indices.

Intermediate:

- I know the steps to take to rebase a fixed base series.
- I understand and can apply different techniques that can be used to chain link rebased series.
- I can calculate aggregate indices from elementary ones by applying weights, and know the difference between gross and net weights.
- I understand the challenges in sampling and collecting prices, and how discontinued items may be substituted and incorporated in an index.

Advanced:

- I understand the different approaches to calculating a consumer price index.
- I understand the advantages and disadvantages of the main elementary price index number formulae, i.e. the Dutot, Carli and Jevons indices.
- I understand the challenges in measuring price changes when there are significant quality changes in the goods being priced, and some common approaches to deal with them, including hedonic regression.
- I understand some advanced techniques in index number theory, including superlative indices, the axiomatic versus the economic approach, the utility function and the difference between cost of living and cost of goods indices.
- I can apply these advanced techniques to index number problems in official statistics using appropriate software.
- I understand the challenges and opportunities of web-scraped price data, and which methods can be used to incorporate them in a price index.

Where does Index Numbers fit into GSBPM model? *(dark blue is central and light blue is minor)*

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |
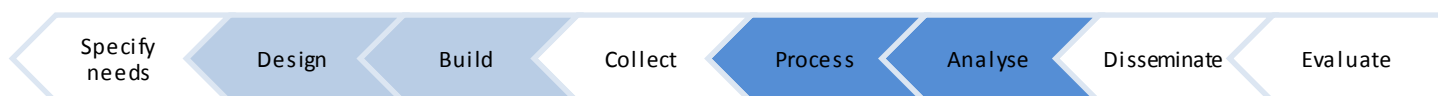
Regression

Basic:

- I am aware of the importance of regression modelling in producing official statistics and understand some examples of how it is applied in the CSO.
- I can undertake exploratory analysis of the relationship between two numerical variables using descriptive and graphical techniques.
- I understand the terminology, concepts and assumptions behind ordinary least squares regression. (In particular, I know that I shouldn't run ordinary least squares regression on time series of data.)
- I can develop a simple linear regression model (including considering transformation, outliers etc.) using statistical software, and interpret the model diagnostics and goodness of fit.
- I am aware of the different regression techniques that are required for different types and/or combinations of variables.

Intermediate:

- I understand variable selection strategies for choosing potential predictors in regression models (forward, backward, stepwise etc.)
- I understand issues that arise with collinearity between predictors in multiple regression and methods to identify and manage it.
- I can develop a multiple linear regression model using statistical software, and interpret the model diagnostics and goodness of fit.
- I understand the terminology, concepts and assumptions behind logistic regression.
- I can develop a logistic regression model using statistical software, and interpret the model diagnostics and goodness of fit.
- I know when to apply these methods to typical data sets arising in official statistics.

Advanced:

- I understand the terminology, concepts and assumptions behind generalised linear models.
- I can develop a generalised linear model using statistical software, and interpret the model diagnostics and goodness of fit.
- I understand the terminology, concepts and assumptions behind multilevel models, and in which cases they are likely to be useful.
- I can develop a multilevel model using statistical software, and interpret the model diagnostics and goodness of fit.
- I know when to apply these different techniques to particular situations that arise in official statistics.
- I am aware of the possibilities of computer based analogues of regression such as machine learning, support vector machines, etc.

Where does Regression fit into GSBPM model? *(dark blue is central and light blue is minor)*

Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate

Time Series and Seasonal Adjustment

Basic:

- I understand the concepts and methods underlying the analysis of univariate time series.
- I am aware of some examples of time series models and their applications in common use in official statistics.
- I am aware of the special problems presented by using time series data in statistical analysis.
- I understand the decomposition of a time series into trend, seasonal and irregular components, and can identify these components in a time series graph.
- I can distinguish between the three types of data: time series, cross-sectional and pooled data.
- I understand concepts such as: stationary, weakly stationary, unit root test, random walk, spurious regression, cointegration, time series models (AR, MA, ARMA, ARIMA), ACF and PACF.
- I can undertake seasonal adjustment (by estimating unobservable components like the trend and seasonal effects, and removing them from a time series) using appropriate software.

Intermediate:

- I can assess the assumption of stationarity for a time series, and transform it accordingly if the assumption does not hold.
- I understand the purpose of smoothing techniques in common use in time series analysis, including moving averages and exponential smoothing methods.
- I understand the theoretical foundations underpinning the ARIMA model approach and can estimate the parameters of the model using e.g. the Box-Jenkins approach.
- I can apply these techniques using appropriate software, and critically assess the output generated.
- I create seasonal adjustment models and conduct diagnostic analysis/quality assurance of the seasonal adjustment models.
- I can produce forecasts by fitting time series models using appropriate software.

Advanced:

- I understand some advanced techniques in time series analysis, including advanced elements of ARIMA model estimation and forecasting, spectral analysis, and the use of the Kalman filter.
- I can apply these advanced techniques to time series in official statistics using appropriate software.
- I can generate and quality assure forecasts of time series data.

Where do Time Series and Seasonal Adjustment fit into GSBPM model? *(dark blue is central and light blue is minor)*

Specify needs	Design	Build	Collect	Process	Analyse	Disseminate	Evaluate

Statistical Disclosure Control

Basic:

- I understand the legal and ethical obligations to protect the confidentiality of respondents.
- I understand the difference between 'safe data' and 'safe access'.
- I know the different types of disclosure, including identification, attribute and group attribute disclosure.
- I understand the different types of data sources arising from surveys, censuses and registers and appropriate methods for protecting their privacy and confidentiality.
- I understand basic concepts of statistical disclosure control methods and their impact on data utility.
- I can evaluate different levels of protection for different types of statistical outputs, including the use of Virtual Microdata Labs and remote access.

Intermediate:

- I can calculate disclosure risk measures for different types of data: microdata and tabular data.
- I can apply statistical disclosure control methods to microdata and tabular data, e.g. Suppression, rounding, perturbation, additive noise.
- I can evaluate the utility of the data following the application of statistical disclosure control methods.
- I am able to evaluate and critique different statistical disclosure control methods depending on the type of statistical output with respect to the amount of protection afforded and the impact on the utility of the protected data.

Advanced:

- I understand the definition of differential privacy and its comparison to statistical disclosure control.
- I can adapt statistical disclosure control methods to new forms of data, e.g. social media, geolocated data, time stamped data and new modes of dissemination, e.g. flexible table builders.
- I understand the properties, uses and risks of synthetic datasets and am able to generate them.

Where does Statistical Disclosure control fit into GSBPM model? *(dark blue is high and light blue is minor)*

Specify needs	Design	Build	Collect	Process	Analyse	Disseminate	Evaluate

Visualisation and Presentation of Data

Basic:

- I can draw out main messages from data, analysis and research. I can communicate information clearly and efficiently via statistical graphs, plots and infographics so that it can be easily understood by different audiences.
- I can perform exploratory data analysis and determine the most appropriate presentation style and tailor it to the audience as required.
- I am familiar with the graphical procedures available in appropriate software.
- I know and use the principles of good table design and data presentation.

Intermediate:

- I am a proficient user of software packages to develop suitable visualisation technologies to summarise my data any convey concepts.
- I have experience of using data visualisation tools such as Tableau, Python etc. to create basic interactive charts.

Advanced:

- I have experience of using data visualisation tools such as Tableau, Python etc. to create sophisticated interactive charts.
- I am able to design web pages to present data in an accessible way, and to critique the presentation on existing pages.

Where does Visualisation and Presentation of Data fit into GSBPM model? *(dark blue is high and light blue is minor)*

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |
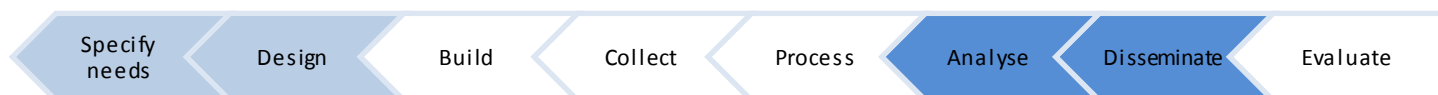
Data Matching, Integration and Administrative Data

Basic:

- I understand sources of data and the difference between data collected by the survey agency for statistical purposes (survey data, census data) and data collected by Government agencies for other purposes such as to record transactions (administrative data).
- I understand the benefits of using administrative data in statistical systems and the challenges it poses.
- I can build and implement a quality framework for providing checks on administrative data according to quality dimensions, eg. accuracy, reliability, timeliness, coverage, coherence, comparability, clarity, linkability, missing data.
- I can articulate privacy issues related to the analysis of administrative data for research purposes.

Intermediate:

- I understand the principles of probabilistic record linkage (Fellegi-Sunter 1969) for the situation where the same data units from two (or more) data sources can be linked by common variables.
- I understand the principles of statistical integration where we build joint statistical data based on marginal observations arising from two (or more) data sources which may not include the same data units.
- I understand and can articulate a total-error framework for integrated statistical data, which provides a systematic overview of the origin and nature of the various potential errors.

Advanced:

- I can apply imputation/adjustment techniques in the presence of constraints from overlapping data sources and/or missing data.
- I can implement the Fellegi-Sunter (1969) probabilistic record linkage.
- I can implement a statistical data integration procedure to integrate data sources to form joint statistical data from two (or more) disjoint data sources.
- I know how to account for linkage and coverage errors in the analysis of linked datasets.

Where do Data Matching, Integration and Administrative Data fit into GSBPM model? *(dark blue is high and place blue is minor)*

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |
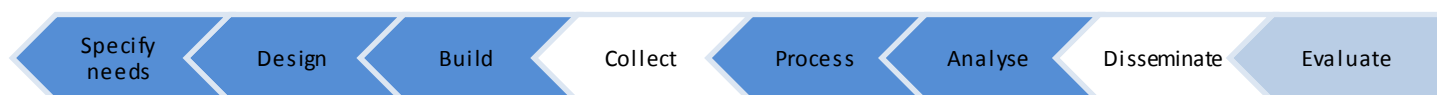
National Accounts

Basic:

- I understand the differences between Gross Domestic Product (GDP) and Gross National Product (GNP) and the three ways in which they can be measured (by output, income and expenditure approaches).
- I know the main players (sectors) in the National Accounts model of a country's economy.
- I know the difference between constant prices and current prices, and how to convert from one to the other.
- I understand the production frontier and how it affects the national accounts.

Intermediate:

- I understand the main (household, business, financial, central government) accounts and how they relate to each other.
- I understand the concept of input-output (supply-use) tables and how they provide a mechanism for balancing.
- I am able to analyse and interpret revisions in GDP and its components.
- I am able to undertake benchmarking and calendarisation for subannual inputs to the national accounts.
- I understand the principles of satellite accounts and how they fit with the main accounts.

Advanced:

- I know the details of the European System of Accounts (ESA) and/or the System of National Accounts (SNA).
- I am able to implement balancing in input-out (supply-use) tables.
- I am able to construct satellite accounts.
- I am able to assess the strengths and weaknesses of the data sources used (or with potential to be used) in the national accounts.
- I am able to interpret and explain the outputs from the national accounts.
- I understand how the outputs from the national accounts are used in econometric modelling, and therefore how changes in the accounts affect models.

Where does National Accounts fit into GSBPM model? *(dark blue is central and pale blue is minor)*

| Specify needs | Design | Build | Collect | Process | Analyse | Disseminate | Evaluate |