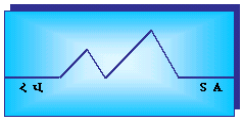

National Statistical Service of the Republic of Armenia

METHODOLOGICAL NOTES FOR INNOVATION STATISTICS

MANUAL

YEREVAN 2017

In present day world which is characterized by the information variety and intensity of informational flows, the possible **"combination"** of three participants of official statistics such as respondents, users and taxpayers, **"occupying the angels of statistical triangle"** having different dispositions, is of great importance, especially from viewpoint of perception requirements **"communication skills leveling"** by national and international levels.

The National Statistical Service of RA (NSS RA) would like to thank all the respondents who have supplied information for this statistical publication and from the above mentioned considerations welcomes any comments and suggestions from the respondents and taxpayers as statistical users for the future developments of statistical publication.

You are kindly asked to provide your comments and suggestions to the Public relations and statistical information dissemination division of NSS RA concerning the future development of the publications.

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AKNOWLEDGEMENTS

In August 2015 two-year EU Twinning program in statistics was launched. The beneficiary of the program was the National Statistical Service of the Republic of Armenia (NSSRA) and the implementing partner was Statistics Denmark.

The objective of the program was to support the modernization of official statistics of Armenia, introducing new statistical methodologies aligned with EU standards and strengthening dissemination of official statistics within public. The program consisted of six components, the fifth of which was Innovation statistics.

The purpose of fifth component was:

- Assessment of current situation, studying of production methods applied in the NSSRA
- Presentation of international and European standards, including definition of innovation
- Overview of Science, Technologies and Innovation statistics currently produced by the NSSRA
- Identifying of user needs
- Development of plan for how to develop innovation statistics.

The expected outcomes were:

- Questionnaire for collecting innovation statistics
- Conducted pilot survey and analyzed pilot results
- Methodology on innovation statistics
- Developed plan for regular production and publication of innovation statistics.

The NSSRA conducted "Pilot Survey of Innovation Activity of Legal Entities and Individual Entrepreneurs" within the framework of fifth component. The survey methodology and development of tools were implemented with the practical support of Ms. Mervi Niemi, Expert from Statistics Finland and Mr. Gediminas Samuolis, Expert from Statistics Lithuania.

In order to have a general overview of the entire survey process, by the proposal of the NSSRA, experts from Finland and Lithuania developed the current "Methodological Notes for Innovation Statistics", which is a brief description of innovation survey and its procedure for NSSRA experts, and clear definition of innovations and inovation activity for respondents.

The NSSRA wishes to express its gratitude to Ms. Mervi Niemi, Expert, Statistics Finland and Mr. Gediminas Samuolis, Expert, Statistics Lithuania for the development of this Manual, the staff of the Social Sphere and Nature Protection Statistics Division (Ms. Nelly Baghdasaryan, Head of the Division) for their active participation, as well as to Ms. Charlotte Juul Hansen, Twinning project Leader and Peter Bohnstedt Anan Hansen, Resident Twinning Adviser (Statistics Denmark), Mr. Gagik Gevorkyan and Ms. Anahit Safyan, Members of the State Council on Statistics for providing professional and organizational support to the development of the Manual.

Stepan Mnatsakanyan  President
National Statistical Service
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Introduction

The development of innovations and promotion of investment in research and development (R&D) increase the innovative capacity of enterprises and is the precondition for the successful growth of country's economy and enhancement of its competitiveness.

The main objective of the innovation survey is to collect data and publish information about innovation activity and innovative enterprises in Republic Armenia. Statistical information on innovation activities is also essential to advice national policy making, for example how to target innovation funding and other supporting measures.

The similar innovation surveys for enterprises are largely supported by national – and also some international, like EU – regulations and by international recommendations. Innovation surveyis nowadays (2016) carried out in almost 100 countries. In European Union regular innovation surveys have been carried out since the beginning of 1990's.

The EU framework of the Innovation survey is defined in the relevant legislation and in several manuals, the most important of which are:

- the Commission Regulation (EU) No 995/2012 and implementing Decision No 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on science and technology,
- the harmonised survey, Community Innovation Survey (CIS), and survey questionnaire accompanied by a set of definitions and methodological recommendations,
- the *Oslo manual* - internationally recognised standard methodology for collecting innovation statistics. Oslo Manual gives a comprehensive description on innovation; from theory to measurement issues.

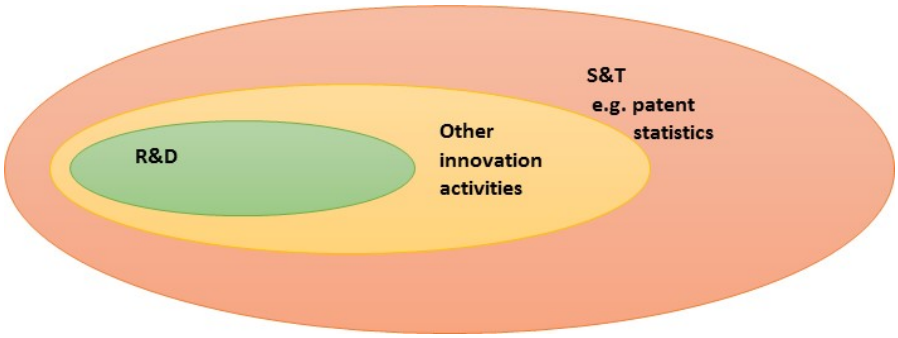
The Commission Regulation (EU) No 995/2012, implementing Decision No 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on science and technology, puts innovation statistics on a statutory basis for EU countries, and makes the delivery of certain variables compulsory.

The survey approach may vary from one country to another, but basically there exist internationally comparable data for main variables and indicators. The innovation indicators are part of Science and Technology indicators and guidance for compiling innovation statistics can be found from the so-called Oslo Manual, which is provided with the co-operation between OECD and Eurostat. 3rd edition of Manual was published in 2005 and the 4th edition is expected to being published in 2018.[1]

As a definition, innovation (and innovation activity) is a wider concept than R&D[2], and all R&D should be included in innovation activity. As regards a wider context, innovation statistics is crucial part of Science and Technology statistics:

[1]Also e.g. UNESCO/UN is providing useful material for measurement of innovation activity and producing innovation statistics.

[2] More on research and development, R&D, see Frascati Manual, OECD 2015



Main purposes of these methodological notes are:

- to summarize important information regarding the innovations and innovation survey with a links to most important documents related to collection, compilation and dissemination of innovation statistics,
- to help survey respondents and other stakeholders to understand innovation processes and how to measure them,
- to help to produce innovation statistics comparable with other countries,
- to be able to produce (some of the) necessary data for international questionnaires, e.g. UNESCO, EU and EACU, Custom union and etc.

The methodological notes focus on business sector enterprises but the main guidelines canbe adapted to other sectors too by modifying the most relevant sector specific elements/features.

These notes and approach described in the document are largely based on material of and work done in EU. In practice, as regards basic concepts and definitions, these notes, dated spring 2017, are valid only as far as the 3rd version of Oslo Manual is the valid one for giving guidelines for measuring innovation. Basics for the surveying innovation needs to be updated according to new versions of the Manual.

1. Main concepts and definitions

Becauseof the comparability for example, in statistics it is recommended to use concepts and definitions accepted internationally where available. For compiling innovation statistics there exist Oslo Manual which covers main definitions and guidelines for collecting and interpreting innovation data.

Innovation

According to Oslo Manual, an innovation is the implementation (introduction)of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method.

- minimum requirement for an innovation is that product, process, marketing method or organizational method is new (or significantly improved) to the enterprise. This includes

products, processes and methods that enterprises are first to develop, but also those that have been adopted from other enterprises or organizations,

- a common feature of an innovation is that it must have been implemented. For new or improved product implementation means introducing it on to the market. For processes, and marketing or organizational methods implementation means bringing them into actual use in enterprise's operations.

"NEW OR SIGNIFICANTLY IMPROVED"
"NEW TO THE ENTERPRISE"
"CAN BE DEVELOPED BY THE ENTERPRISE OR BY OTHERS"
"NEED TO BE TAKEN INTO USE"

Definitions used in EU survey, also used in first Armenian innovation survey

Product innovation (good or service)

A product innovation is the market introduction of a **new** or **significantly** improved **good or service**with respect to its capabilities, user friendliness, components or sub-systems.

- product innovations (new or improved) **must be new to your enterprise**, but they **do not need to be new to your market**,
- product innovations could have been originally developed by your enterprise or by other enterprises or organisations.

A **good** is usually a tangible object such as a smartphone, furniture, or packaged software, but downloadable software, music and film are also goods. A **service** is usually intangible, such as retailing, insurance, educational courses, air travel, consulting, etc.

Process innovation

A process innovation is the implementation of a **new** or **significantly** improved production process, distribution method, or supporting activity.

- process innovations **must be new to your enterprise**, but they **do not need to be new to your market**,
- the innovation could have been originally developed by your enterprise or by other enterprises or organisations,
- exclude purely organisational innovations.

Ongoing or abandoned innovation activities for product or process innovations

Innovation activities include the acquisition of machinery, equipment, buildings, software, and licenses; engineering and development work, feasibility studies, design, training, R&D and marketing when they are specifically undertaken to develop and/or implement a product or process

innovation. This includes also all types of R&D consisting of research and development activities to create new knowledge or solve scientific or technical problems.

Organisational Innovation

An organisational innovation is a new organisational method in your enterprise's business practices (including knowledge management), workplace organisation or external relations that has not been previously used by your enterprise.

- it must be the result of strategic decisions taken by management,
- exclude mergers or acquisitions, even if for the first time.

Marketing innovation

A marketing innovation is the implementation of a new marketing concept or strategy that differs significantly from your enterprise's existing marketing methods and which has not been used before.

- it requires significant changes in product design or packaging, product placement, product promotion or pricing,
- exclude seasonal, regular and other routine changes in marketing methods.

EU survey, CIS, has also defined some specific definitions for survey purposes, like:

Innovations with environmental benefits

An innovation with environmental benefits is a new or significantly improved product (good or service), process, organisational method or marketing method that creates environmental benefits compared to alternatives.

- the environmental benefits can be the primary objective of the innovation or a by-product of other objectives,
- the environmental benefits of an innovation can occur during the production of a good or service, or during its consumption or use by the end user of a product. The end user can be an individual, another enterprise, the Government, etc.

More information on main types of innovations can be found from the Oslo Manual.

Some examples of innovations are listed in Annex A for this document (examples can originally be found from EU notes for CIS model questionnaire, and from Oslo Manual, but sometimes also from the context of some national surveys by searching websites).

Main problematic point in decision on innovation activity is to innovation data at thelevel of the firm. It does not cover industry- or economy-wide changes such asthe emergence of a new market, the development of a new source of rawmaterials or semi-manufactured goods, or the reorganization of an industry.

Respondents can define their market in either geographic terms or by product line. In either case, a product innovation that is new to their market must be the first time it is available on the

market in question. For example, if the respondent's market is Europe, it must be the first time the product appeared anywhere in Europe, although it might have already been available in the United States. If the respondent thinks in terms of a product such as an MP3 player, then it must be the first time the innovation is used for this product. It may have been used previously in a different product market, such as for computers.

Some examples of changes which are not considered as innovations:

- minor changes or improvements,
- routine upgrades,
- seasonal changes (such as for clothing lines),
- customisation for a single client that does not include significantly different attributes compared to products made for other clients,
- simple resale of new goods and services purchased from other,
- increase in production or service capabilities through the addition of manufacturing or logistical systems which are very similar to those already in use or simple capital replacement or extension.

See more on changes considered not as innovation, Oslo Manual &Methodological notes for EU Community Innovation Survey.

Innovation activities (Oslo, e.g. paragraph 149)

Innovation activities are all scientific, technological, organizational, financial and commercial steps which actually lead, or are intended to lead, to the implementation of innovations. Some innovation activities are themselves innovative, others are not novel activities but are necessary for the implementation of innovations.

Innovation activities include the acquisition of machinery, equipment, buildings, software, and licenses; engineering and development work, feasibility studies, design, training, R&D and marketing when they are specifically undertaken to develop and/or implement a product or process innovation. This includes also all types of R&D consisting of research and development activities to create new knowledge or solve scientific or technical problems.

During a survey period, innovation activities can be:

- successful, in having resulted in the implementation of an innovation (although the innovation need not have been commercially successful),
- on-going, with work in progress that has not yet resulted in the implementation of an innovation,
- abandoned before the implementation of an innovation.

For more information on separating R&D and other innovation activities, see Oslo Manual, but also Frascati Manual.

Innovation active enterprise, enterprise with innovation activity (Oslo, e.g. paragraph 215)

Innovation active enterprise, or enterprise with innovation activity, is an enterprise that has had innovation activities during the period under review, including those with ongoing and abandoned activities. I.e. enterprises that have had innovation activities during the period under review, regardless of whether the activity resulted in the implementation of an innovation, are innovation active.

- an enterprise with innovation activity relating to product and process innovationsis an enterprise that during the last three years has introduced a product innovation in to market or implemented a new process (either a production method or similar), or which has been working towards achieving these (i.e. having projects for developing product or process innovations),
- an enterprise with innovation activity is one that during the period under review, i.e. during the last three years, has introduced a product innovation in to market or implemented a process innovation or which has been working towards achieving these, or which has implemented organisational or marketing innovations.

Innovative enterprise (Oslo, e.g. paragraph 152)

An innovative enterprise is one that has implemented an innovation during the period under review.

Product innovators are those who introduced, during the period under review, new and significantly improved goods and/or services with respect to their fundamental characteristics, technical specifications, incorporated software or other immaterial components, intended uses, or user friendliness. Changes of a solely aesthetic nature and the simple resale of new goods and services purchased from other enterprises are not considered as innovation.

Process innovators implemented new and significantly improved production technologies or new and significantly improved methods of supplying services and delivering products during the period under review. The outcome of such innovations should be significant with respect to the level of output, quality of products (goods or services) or costs of production and distribution. Purely organisational or managerial changes are not included.

Organisational innovators implemented a new organisational method in the enterprise's business practices, workplace organisation or external relations.

Marketing innovators implemented a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.

Defining an enterprise as an enterprise with innovation activity

In European Community Innovation Survey – like was in the Armenian pilot survey – there exist some questions as a filter questions for defining enterprises with innovation activity:

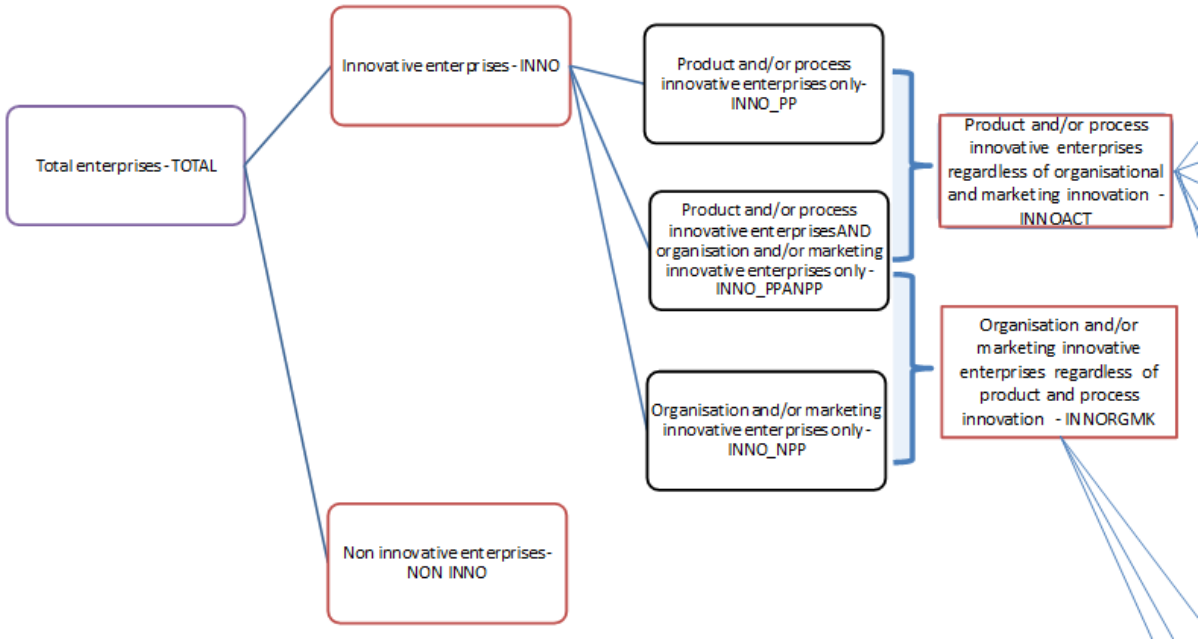
1. introduction of product innovations during the three years' survey period,
2. implementation of process innovations during the three years' survey period,

3. ongoing or abandoned activities for product or process innovations during the three years' survey period,
4. implementation of organizational innovations during the three years' survey period,
5. implementation of marketing innovations during the three years' survey period.

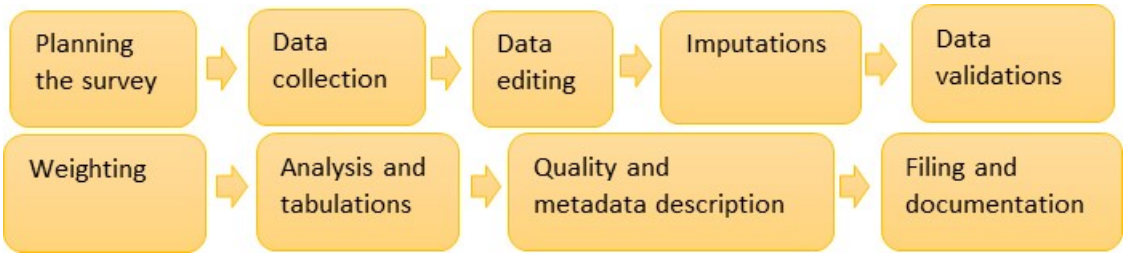
If an enterprise has given a positive answer to any of the first three of the filter questions, then an enterprise is interpreted to be an enterprise with innovation activity for product and process innovations (technological innovators).

If an enterprise has given a positive answer to any of these questions an enterprise is interpreted to be an enterprise with innovation activity during the survey period.

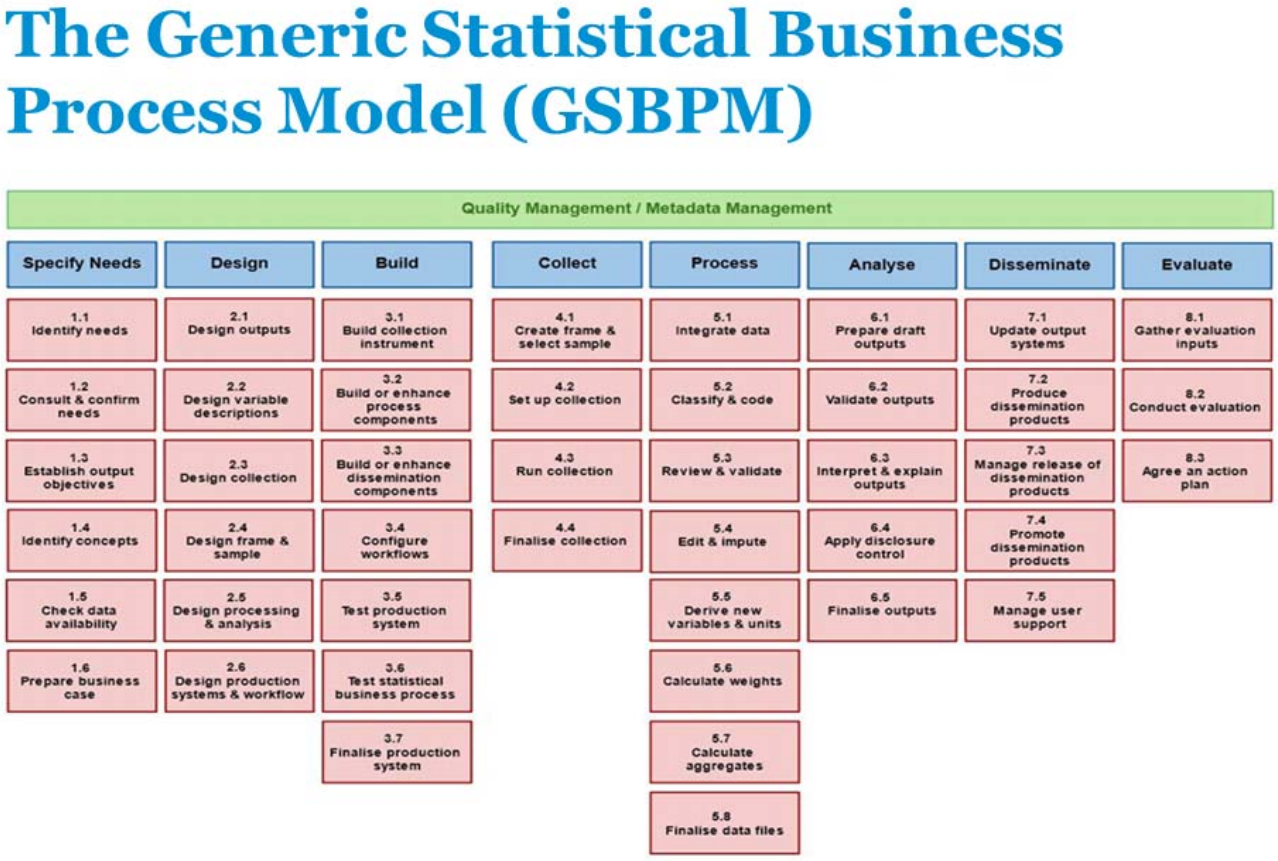
Example of defining different types of "innovators" in the context of CIS (Source: Eurostat tabulations for CIS data):



Following sections 2 to 11 of this document describe the phases of the statistical process and give some practical guidelines, references and linkages and checklists for helping the compilation of innovations statistics. Production of innovation statistics can in practice be split in to next steps:



The Generic Statistical Business Process Model (GSBPM) (https://statswiki.unece.org/display/metis/The+Generic+Statistical+Business+Process+Model) gives a general approach for statistical process and is a helpful tool for management the steps of the whole process. All the steps are not necessarily needed in every process, and in practice, the order of the steps may vary from process to another.



2. Planning the survey

Main purposes of the survey:

- collection of important information regarding the Innovations,
- to produce statistics comparable to European statistics AND necessary data for international questionnaires, e.g. UNESCO, EU and EACU, etc.

Defining the content of the survey:

- check international framework (which kind of information is collected internationally -> comparable information, benchmarking):
  - EU context and CIS,
  - other countries experience in innovation surveys,
- map national user needs,
- evaluate all the possible aspectsrelating to innovation activity that may be critical and interesting to the users of data and which could be useful to be included in to the survey (in addition to core questions, e.g. innovation capabilities, effects of innovation activity, effects

of legislation on innovation activities and innovations, environmental challenges and innovations, etc.),
- changing and developing phenomenon needs updating the statistics too, e.g. in EU context there exist changing modules (rotation, ad hoc modules etc.),
- do evaluate when there is a need for new questions on new topics?,
- is it possible to use administrative sources to avoid dublicate data collection (think about administrative response burden)?.

Defining the target population:

The target population of the survey is market active enterprises in Armenia and the frame for sampling should be constructed from the business enterprise register of the NSSRA.

- check the population in reference statistics if comparability needed, e.g. core NACE classes in EU countries, minimum requirement 10+ employees (for more information, EU's Methodological recommendations),
- add nationally important NACE classes and industries, or size classes.

Population, frame from the Business Register (BR), statistical unit should be an enterprise (for more information, Oslo Manual and EU's Methodological recommendations)

It is **mandatory** to include the following NACE Rev.2 sections and divisions in the core target population of the EU innovation surveys:

- Mining and quarrying (NACE B: 05-09)
- Manufacturing (NACE C: 10-33)
- Electricity, gas steam and air conditioning supply (NACE D: 35)
- Water supply; sewerage, waste management and remediation activities (NACE E: 36-39)
- Wholesale trade, except of motor vehicles and motorcycles (NACE G: 46)
- Transportation and storage (NACE H: 49-53)
- Information and communication (NACE J: 58-63)
- Financial and insurance activities (NACE K: 64-66)
- Architectural and engineering activities; technical testing and analysis (NACE M: 71)
- Scientific research and development (NACE M: 72)
- Advertising and market research (NACE M: 73)

Depend on national needs the following NACE Rev.2 sections and divisions can also be included in the core target population:

- Construction (NACE F: 41-43)
- Wholesale and retail trade and repair of motor vehicles and motorcycles (NACE G: 45)
- Retail trade, except of motor vehicles and motorcycles (NACE G: 47)
- Legal and accounting activities (NACE M: 69)
- Activities of head offices; management consultancy activities (NACE M: 70)
- Other professional, scientific and technical activities (NACE M: 74)

- Employment activities (NACE N: 78)
- Security and investigation activities (NACE N: 80)
- Services to buildings and landscape activities (NACE N: 81)
- Real estate activities (NACE L: 68)
- Accommodation and food service activities (NACE I: 55-56)
- Rental and leasing activities (NACE N: 77)
- Agriculture, forestry and fishing (NACE A: 01-03)
- Travel agency, tour operator reservation service and related activities (NACE N: 79)
- Office administrative, office support and other business support activities (NACE N: 82)
- Veterinary activities (NACE M: 75)

Deciding on census/sample

Business enterprise innovation survey is quite extensive and requires significant human resources in the data collection, data treatment, analysis and publishing. If a responding enterprise has difficulties in filling the questionnaire assistance should be provided, which requires resources. The different data collection methods (online surveys, postal surveys, interviews) can by obtained, but final decision (taking into account the resources) is a sample survey.

Opportunities to carry out the innovation survey is census, sample survey or combination of these or of (other) multiple data sources (sample survey with census part of target population together with administrative sources)

Sample size should be determined from balancing user needs and available resources. It was emphasized by the MS experts that the sample should be representative for the target and frame population concerning innovation and should aim at covering innovative as well as non-innovative enterprises.

The majority of the EU countries carry out a combination of sample survey and census of the enterprises included in the frame population. In most of the cases where a combination of sampling with census is used, the employment size class is the main variable used to define a threshold. Usually larger enterprises are enumerated, while smaller enterprises are sampled. The threshold to separate “large” from “small” enterprises can be as high as 250 employees. Moreover, some countries implement census to previously known R&D performers or to specific NACE groups/classes, irrespective of the size class.

The selection of the sample should be based on random sampling techniques, with known selection probabilities, applied to strata. It is recommended to use simple random sampling without replacement within each stratum.

Stratification

The target population should be broken down into similar structured subgroups or strata which should be as homogeneous as possible and form mutually exclusive groups. Appropriate stratification will normally give results with smaller sampling errors than a non-stratified sample of the same size and will make it possible to ensure that there are enough units in the respective domains4 to produce results of acceptable quality.

The stratification variables to be used for the innovation survey, i.e. the characteristics used to break down the sample into similarly structured groups, should be:

- the economic activities (NACE),
- enterprise size according to the number of employees (10–49, 50–249, 250+),
- sometimes specific sampling; as a supplement stratification by region could be considered if it is thought to have special influence on innovation statistics (and the number of observations is high enough in the population).

Sample size

No minimum sample size defined needed, as long as the sample size chosen will meet the precision levels required. However, if a particular stratum has less than six enterprises, then all the enterprises in this stratum should be selected for the survey.The expected response rate should be borne in mind i.e. the sample size should take into account the non-response rates experienced in previous or other surveys and compensate accordingly.

Deciding the data collection method

- electronic questionnaire (some guidelines and recommendations available, good practices),
- postal questionnaires,
- interviewers.

Combining surveys (e.g. R&D and innovation survey together) is not recommended (see more, e.g. EU's Methodological recommendations)

Survey period

Three years, in EU e.g. 2014–2016, 2016–2018 and so on, the latest year as a reference year.

More about preparing the survey, see Oslo Manual and e.g. EU's Methodological recommendations, also Business Register at Armstat.

3. Data collection

Generally, information service regarding all statistics (also innovation) for respondents is a good idea (a letter or e.g. a website for information on all surveys for each enterprise during the year).

Training of people participating in data collection

- basic concepts (getting familiar with the definitions used in the survey),
- data editing rules.

Length and the timing of the data collection period

- not a holiday season,
- decision on the length of the data collection period,
- number and types of reminders (letters, phone, email).

Follow up register for following the situation with responding (coding with all the information useful during the data collection):

- contacting at least the largest enterprises and enterprises with biggest weightsstill missing in the end of data collection,
- response rate, non-responding -> non-response survey if needed (< 70% response rate in EU), for more information EU Methodological recommendations.

Because of the long observation period (3 years), there may be substantially many changes in the population during that period. Main recommendation related to population changes:

- enterprises that were liquidated before the period should not be considered as part of the target population,
- enterprises that were liquidated during the period should also be deleted from the sample and target population, unless it is decided that their liquidation was so late in the survey period that they should be included in the target population,
- enterprises that are outside the target population, i.e. in NACE sections not covered by survey should be excluded from all processing if they are in the sample. In addition, the target population should be adjusted before the calculation of weights, in order to exclude these and other types of non-relevant enterprises,
- subsidiaries of multinationals requesting contact with the parent organization. While the subsidiaries may get the information from abroad, the information should only relate to the particular national subsidiary. There is a general difficulty with getting multi-national organizations to report information at national level but they will have to make every effort to delineate their data for national units at least. Only domestic units of multi-national corporations should be included in the survey,
- enterprises changing NACE section should be recoded accordingly and considered as part of the new NACE section rather than the old one,

- two or more enterprises join to form of one enterprise. If this happened before or at the beginning of the survey period (and one or more of the units is in the sample) then the new unit should respond with a single form for both (or more) enterprises. Additionally, the population should be changed to delete the two (or more) individual units and to include the new unit only. If neither unit was in the sample, then the population should simply be amended to reflect the changes. If the merger happened late in the survey period, then the original units can be treated as they are, i.e. separately, and ignore the merger. Care will have to be taken however that neither unit returns information for more than its' original elements and they do not send in responses covering the other merged elements as well,
- enterprises that split to form new units. If this happened early in the survey period, then the target population should be amended to reflect the new units. Any such enterprise that is part of the sample should return forms for each new unit separately. If the split happens late in the survey period or if the enterprise cannot supply information on each new element separately, keep the unit as it was before the split.

4. Data editing

Throughout the processing cycle, there should be a systematic and sustained follow up with the responding enterprises to make sure that the data provided is of good quality and passes all edit checks. Data quality checks have to be done at the micro- and macro-level. Data processing should include editing for logical errors:

- the edited dataset should not have routing conflict between filter and underlying questions,
- ttem-non response should be kept and recorded. No imputation should be made from other units (see EU model questionnaire),
- 'illegal' data values should not enter the final dataset and rather be recorded as item non-response.

Filing also the raw data (it may be valuable for later use or checking the details from the data or when interpreting and analyzing the data). This means to keep (store) also the original data (without any editing) received from respondents.

The data may cover many types of errors, like

- sampling errors,
- coverage errors,
- measurement errors,
- nonresponse errors,
- processing errors.

See more on data quality e.g. http://ec.europa.eu/eurostat/web/quality/quality-reporting

Basic check for incoming data:

- correct values, no wrong coding,
- no dublicates.

Frequencies (give a good understanding of the features and of the missing values of the raw data)

Use of the data from administrative sources like BR, check also the investment data for to compare innovation expenditure for acquisitions and total investments

If R&D data from enterprises available, use of it for editing (also filling the missing information) and for quality checking!

Localize missing values, and use of different types of sources to fill the missing values

Identify most important units e.g. regarding monetary variables (selective editing!)

Within editing many kinds of checks need to be done:

- completeness checks (identifying missing values),
- out of scope units (responses from units that should not belong to the target population),
- data validation checks (answers are within the range of answers allowed),
- relational checks (relationships between two variables, like sum of subcategories equaling to total, no inconsistencies),
- routing errors (interpretation of filtering ok).

Edited values should be flagged so that the “history” of a data can be traced later on. The principals of editing and flagging rules can be found from Eurostat SAS guide that gives an exhaustive idea of the nature of CIS data.

Few examples for coding and logical errors and editing rules can be found from Annex B.

Different type of editing can be mixed and carried out at the same time (the error list can cover all types of errors & also information on missing values).

Some further guidance/material:

- Eurostat SAS guide,
- Eurostat CIS Methodological recommendations.

5. Imputations

After every attempt is made to get the information from the enterprises concerned imputations shall be done to correct for remaining item non-response. Imputed values should be flagged as this enables proper non-response analysis to be done.

Before carrying out technical (automatic) imputation, need, as far as possible, make use of administrative, historical (previous surveys) or other available data sources. The abovementioned SAS guide gives some hints for imputations.

Like it is mentioned in EU Methodological recommendations, editing may be used to impute metric (or measurement) variables separately from ordinal (orranking) variables.

(1) Metric variables

A weighted mean of each metric variable, by NACE and size class, is calculated and applied as aratio to the enterprises with the missing values, within the stratum concerned.

(2) Ordinal, nominal and percentage variables

This imputation shall be done after the metric estimation. The technique used is nearestneighbourhot decking using entropy. This technique will use data from clean records (a donorwith a record not violating any error check), in order to copy the missing data. The donors arechosen in such a way that the distance between the donor and recipient be minimised.

More on imputations can be found from the annex for Methodological recommendations (or guidelines). Eliminating outliers and confirming sufficient number of observations.

Flagging all the edited and imputed cells! Build a system for flagging variables and coding of them!

No missing values allowed in a data!

Some further guidance/material:

- Eurostat SAS guide,
- Eurostat CIS 2014 Methodological recommendations.

6. Data validation

Data to be accepted, validation rules for innovation data, quite similar to those on the list of errors, the aim is to check that the data is ok (no errors or missing values anymore), innovation data should not cover any missing information.

Macro editing also important! Preliminary weighting, totals and subtotals, compare to results from previous surveys, comparisons to other business data etc.

Quality measurement at every step of the process, also here (see above, no missing data, no inconsistencies, statistical quality assessments, confidentiality levels, coefficients of variation etc.), See more under further chapters

7. Weighting

By Eurostat and OECD recommendation the survey results should be weighted in order to adjust for the sampling design and for unit non-response to produce valid results for the target population. The strata's from the sampling may be used also for the weighting with possible combinations of strata's with thin coverage. In the case of non-response, the weightings should adjust for statistically significant differences in the proportion of each of the mutually exclusive types of innovative firms.

For weighting shall be used traditional weighting technique like in other surveys in NSSRA. According to the EU methodological recommendations,the basic method for adjusting for different probabilities of selection used in the sampling process is to use the inverse of the sampling fraction i.e. using the number of enterprises or employees. This would be based on the figure N_h/n_h where N_h is the total number of enterprises/employees in stratum h of the population and n_h is the number of enterprises/employees in the realized sample in stratum h of the population, assuming that each unit in the stratum had the same inclusion probability. This will automatically adjust the sample weights of the respondents to compensate for unit non-response.

In general, the variables to use for calibration are turnover and the number of enterprises, both by NACE and size classes but others can also be used.

The estimated standard error should not exceed 5 percentage points for the overall population and should not exceed 5 percentage points for to the different subgroups of the population. If the analysis shows larger standard errors, this may indicate that there are problems in the way the stratification of the population or the way the sample has been taken.

EU countries used various programs for the estimation process of CIS data. The most commonly used were the software package CLAN, SAS programs (usually self-developed), CALMAR, SPSS, R, STATA.

8. Tabulations and analysis

Innovation data should be reported at least by enterprise size classes and by industries.

Based on EU Community innovation survey the most core like subjects to be covered are the following:

(a) innovation activities, types of innovation activity,
(b) product innovations,
(c) turnover from product innovations,
(d) type of cooperation for innovation,
(e) expenditures related to product and/or process innovation activities,
(f) type of developers for innovation,
(g) objectives for innovation,
(h) sources of information for innovation,
(i) hampering factors for innovation.

Surveys and tabulations can however cover lot more content and many other issues depending on the user needs. For example, some questions on implementation of environmental friendly innovations and some questions for non-innovators were covered by Armenian 2015 pilot.

Based on EU regulation the most important indicators from innovation data are the following:

Innovation activities:

- share of innovation active enterprises,
- share of non-innovation active enterprises.

For innovation active enterprises:

- process innovator,
- product innovator,
- organisational innovator,
- marketing innovator,
- ongoing product or process innovation activities only,
- abandoned product or process innovation activities only,
- ongoing and abandoned product or process innovation activities,

- product and/or process innovator (including enterprises with abandoned and/or ongoing activities).

Product innovations:

- new or significantly improved to your market,
- only new or significantly improved to your firm.

Net turnover from product innovations:

- From product innovations new or significantly improved to your market
- From product innovations only new or significantly improved to your firm

Expenditures related to product and/or process innovation activities:

- in-house R&D,
- external R&D,
- acquisition of machinery, equipment; software and buildings,
- acquisition of knowledge from other enterprises or organisations,
- all other innovation activities including design, training, marketing, and other relevant activities.

Type of developers for innovation (separate simultaneously process and product innovators):

- your enterprise by itself,
- your enterprise together with other enterprises or organisations,
- your enterprise by adapting or modifying goods or services originally developed by other enterprises or organisations,
- other enterprises organisations.

Objectives for innovation broken down into “highly important” and “not relevant”. Factors to be defined, like:

- decrease in costs,
- increase in market share,
- increase in profit margins,
- increase in turnover.

Sources of information for innovation broken down into “highly important” and “not relevant”. Factors to be defined, like:

- information from clients or customers from the private sector,
- information from clients or customers from the public sector,
- information from competitors or other enterprises in your sector,
- information from conferences, trade fairs, exhibitions,
- information within the enterprise or enterprise group,
- information from Government, public or private research institutes,

- information from consultants or commercial labs,
- information from scientific journals and trade/technical publications,
- information from professional and industry associations,
- information from suppliers of equipment, materials, components,
- information from universities or other higher education institutes.

Type of cooperation for innovation. Factors to be defined, like:

- other enterprises within your enterprise group,
- suppliers of equipment, materials, components or software,
- clients or customers from the private sector,
- clients or customers form the public sector,
- competitors or other enterprises in your sector,
- consultants or commercial labs,
- universities or higher education institutes,
- government, public or private research institutes.

Hampering factors broken down into “highly important” and “not relevant”. Factors to be defined, like:

- high costs of access to new markets,
- innovations introduced by competitors,
- dominant market share held by competitors,
- lack of adequate finance,
- lack of demand,
- strong price competition,
- lack of qualified personnel,
- strong competition on product quality,
- high costs of meeting regulations.

In practice, surveys do usually cover many other issues and subjects too meaning at the same greater variety and higher number of tabulations also. In the case of pilot survey in Armenia for 2015, tabulations could cover:

- implementation of different types of innovations with environmental benefits,
- reasons to implement innovations with environmental benefits broken down for example into “highly important” and “not relevant”,
- reasons for not to innovate,
- reasons for not to conduct innovation activity broken down for example into “highly important” and “not relevant”,
- obstacles for innovating broken down for example into “highly important” and “not relevant”.

Innovation data provide huge amount of possibilities for tabulations. Data can be tabulated for example by R&D/non-R&D, by in-house/adapting innovations etc. depending on the user needs for example.

To define the very basic indicators and main tables the starting point with EU harmonized variable coding is as follows:

Prevalence of innovation activity, share of enterprises (= share of those enterprises with following innovation activity)

INPDT = (INPDGD=1 or INPDSV=1) (Enterprises with product innovations)

INPCS = (INPSPD=1 or INPSLG=1 or INPSSU=1) (Enterprises with process innovations)

INNOACT = (INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) (Enterprises with innovation activity relating to products or processes)

INORG = (ORGBUP=1 or ORGWKP=1 or ORGEXR=1)(Enterprises with organizational innovations)

INMKT = (MKTDGP=1 or MKTPDP=1 or MKTPDL=1 or MKTPRI=1) (Enterprises with marketing innovations)

INNO = (INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1 or ORGBUP=1 or ORGWKP=1 or ORGEXR=1 or MKTDGP=1 or MKTPDP=1 or MKTPDL=1 or MKTPRI=1) (Enterprises with innovation activity)

The rules for EU core tabulations are presented in Annex F.

9. Metadata & quality description

By European Statistics Code of Practice to guarantee the quality of results, statistics shall be developed, produced and disseminated on the basis of uniform standards and of harmonised methods. In this respect, the following quality criteria shall apply:

1. **Relevance:** it is the degree to which statistics meet current and potential users' needs. It includes the production of all needed statistics and the extent to which concepts used (definitions, classifications etc.) reflect user needs.
2. **Accuracy:** it denotes the closeness of computations or estimates to the exact or true values.
3. **Timeliness and punctuality:** they refer to time and dates, but in a different manner: the timeliness of statistics reflects the length of time between their availability and the event or phenomenon they describe. Punctuality refers to the time lag between the release date of the data and the target date on which they should have been delivered, with reference to dates announced in the official release calendar.
4. **Accessibility and clarity:** they refer to the simplicity and ease for users to access statistics using simple and user-friendly procedures, obtaining them in an expected form and within an acceptable time period, with the appropriate user information and assistance.
5. **Comparability:** it aims at measuring the impact of differences in applied statistical concepts and definitions on the comparison of statistics between geographical areas, non-geographical

domains or over time. It is the extent to which differences between statistics are attributable to differences between the true values of the statistical characteristics.

6. **Coherence:** the extent to which statistics are in agreement with relevant or related statistics originating from different statistical procedures.

Quality is a multi-dimensional concept and include all aspects of how well statistics are fit for their purpose. In order to meet the standards of the European Statistics Code of Practice, comprehensive quality reports for the full range of statistical processes and their outputs shall to be prepared. The quality report is one type of documentation for statistical processes and enable the process quality monitoring. This should include the information which enable to identify the statistical process and outputs quality problems as well as potential improvements. It is recommended that quality reports should be updated after each survey. A quality report may be:

- producer-oriented - detailed report prepared for the own internal needs,
- user-oriented - less detailed and focused on the output quality.

Typical EU quality report structure is presented in Annex C.

Accuracy of statistics is the outcome of many factors which makes very difficult its quantification with precision. In EU quality report an indirect assessment is done and information on sampling and non-sampling errors which affect CIS statistics is presented. Quality indicators shall be published, documented and publicly available for all users. Indicators useful as user-oriented quality indicators and shall be included in the Quality report:

- sampling errors – indicators:
    - coefficient of variation,
    - confidence interval,
- unit non-response – rate,
- item non-response rate,
- time lag – final results,
- punctuality – delivery and publication,
- length of comparable time series,
- data revision –if planned.

For more information, see e.g. ESS Handbook for Quality reports 2014 or ESS Quality and Performance Indicators 2014, available http://ec.europa.eu/eurostat/web/quality/quality-reporting.

See also material for DESAP (generic checklist for a systematic quality assessment of surveys in the EuropeanStatistical System (ESS)), may be useful for evaluating the statistical process, material available at http://ec.europa.eu/eurostat/web/quality/quality-reporting.

10. Dissemination

Statistical information shall be prepared and disseminated following impartiality and objectivity principles, i.e. in a systematized, reliable and unbiased manner, following professional and ethical standards and transparent policy and practice towards users and respondents.
Statistical information dissemination forms and modes shall be as follows:

- information releases,
- statistical publications (pocketbook),
- indicators in the database and on gis maps,
- responses to user enquiries,
- posts in social networks and other possible information media.

With the aim of providing for statistical users as comprehensive information about statistical indicators as possible, standardized statistical survey (indicator) metadata descriptions and other related information is published together.

11. Filing and documentation

File (save) the data with its metadata. It is a good idea to file separately also the unedited raw data. Sometimes e.g. researches may need the information from raw data in order to be able to better understand the features of phenomenon measured.

Documentation is needed at every step of the process. The documentation of the survey should include assessment of the reliability of results and comparisons of results with other similar surveys and compliance with methodology. Detailed information on the quality of CIS survey shall be found in the Quality Report.

In practice, detailed and effective documentation is needed for good working instructions.

Sources and reference material

Eurostat, Quality issues, like ESS Handbook for Quality reports 2014 and ESS Quality and Performance Indicators 2014, http://ec.europa.eu/eurostat/web/quality/quality-reporting
Eurostat, see also material for DESAP, available also at http://ec.europa.eu/eurostat/web/quality/quality-reporting
Eurostat, Methodological notes for CIS 2012 questionnaire and for CIS2014 questionnaire
Eurostat, Methodological recommendations for the Community Innovation Survey2012–2014
Eurostat, Community Innovation Survey, User Guide for Windows, SAS application, CIS4_User guide_v2.2.doc
Eurostat, Harmonised survey questionnaires for CIS
Eurostat, Code of Practice, http://ec.europa.eu/eurostat/web/quality/european-statistics-code-of-practice
Oslo manual http://www.oecd.org/science/inno/2367580.pdf, Eurostat& OECD
Frascati manual http://www.oecd.org/sti/inno/Frascati-Manual.htm, OECD
Eurostat, metada on Innovation survey - http://ec.europa.eu/eurostat/cache/metadata/en/tsdec340_esmsip.htm
Eurostat, Database (incl. S&T),http://ec.europa.eu/eurostat/data/database
UNECE, GSBPM, https://statswiki.unece.org/display/metis/The+Generic+Statistical+Business+Process+Model

ANNEX A

Examples of innovations
(source: Methodological Notes for EU Community Innovation Survey)

Examples of product innovations

Examples of new or significantly improved goods

- Replacing existing materials with materials with improved characteristics (breathable textiles, light but strong composites, environmentally-friendlyplastics, etc).
- Introducing new or improved components in existing product lines (cameras inmobile telephones, fastening systems in clothing, etc).
- Equipment that incorporate software that improves user friendliness orconvenience, such as toasters that automatically shut off when the bread is toastedor GPS systems that identify the location of specific types of shops or services.
- Adding new functions: double sided printing, bicycle lights that can be rechargedthrough a UBS port, rubbish bins that signal when they are full, products that canfold for easy storage, etc.
- Wearable technology, clothing and accessories incorporating computer and advanced electronic technologies.

Examples of new or significantly improved services

- Improving customers' access, such as a home pick-up and drop-off service forrental cars, same-day delivery of online purchases, etc.
- DVD subscription service where for monthly fee customers can order a predefined number of DVDs via the Internet with mail delivery to the home, withreturn via a pre-addressed envelope.
- First time introduction of internet services such as banking, bill-payment systems, electronic purchase and ticketing of travel and theatre tickets, social networking sites, etc.
- New forms of warranty, such as an extended warranty on new or used goods, orbundling warranties with other services, such as with credit cards, bank accounts, or customer loyalty cards.
- Installing gas heaters in outdoor restaurant and bar terraces or video on demand screens in the back of airline, bus or train seats.
- Improving customers' access, such as a home pick-up and drop-off service for rental cars, same-day delivery of online purchases, etc.
- "Sharing economy" services such as Uber, Lyft, AirBandB, Listia (recycling and reusing goods), TaskRabbit, etc. First time introduction of internet services such as banking, bill-payment systems, electronic purchase and ticketing of travel and theatre tickets, social networking sites, online backup services, cloud-computing, on-demand internet streaming media etc.

Examples of process innovations

Examples of innovative methods of producing goods or services

- Installation of new or improved manufacturing technology, such as automation equipment or real-time sensors that can adjust processes.
- New equipment required for new or improved products.
- Computer-assisted product development or other technology to improve research capabilities, such as bio-imaging equipment.
- More efficient processing that reduces material or energy requirements per unit ofoutput.

Examples of innovative logistics, delivery or distribution methods

- Introduction of bar-coding or passive radio frequency identification (RFID) chipsto track materials through the supply chain.
- GPS tracking systems for transport equipment.
- Automated feed-back to suppliers using electronic data exchange.

Examples of innovative supporting activities

- Introduction of software to identify optimal delivery routes.
- New or improved software or routines for purchasing, accounting or maintenance systems.

Examples of organisational innovations

Examples of business practice innovations

- Establishment of formal or informal work teams to improve the access and sharing of knowledge from different departments, such as marketing, research, production, etc.
- Introduction of quality control standards for suppliers and subcontractors.
- Supply management systems to optimize the allocation of resources from sourcing inputs to the final delivery of products.
- First introduction of group or individual performance incentives.
- First introduction of teleworking or a “paperless” office.

Examples of work organization innovations

- Reduction or increase in the hierarchical structure for decision making.
- Change in responsibilities, such as giving substantially more control and responsibility over work processes to production, distribution or sales staff.
- Introduction of a High Performance Work System (HPWS) characterised by aholistic organisation featuring flat hierarchical structures, job rotation, selfresponsible teams, multi-

tasking, a greater involvement of lower-level employees in decision making and the replacement of vertical by horizontal communication channels.

- New training or education systems, such as regular videos on each employee's work station that describe ongoing challenges for the enterprise or provide skill upgrading, with the goal of improving the ability of employees to recognize problems and take responsibility.
- Creation of a new division, for example by splitting the management of marketing and production into two divisions, or alternatively a change to integrate divisions.

Examples of external relations innovations

- First use of outsourcing of research or production if it requires a change in how work flows are organised within the enterprise.
- First use of alliances that require staff to work closely with staff from another organisation, including temporary staff exchanges.

Examples of marketing innovations

Examples of design & packaging innovations

- Novel designs of existing products such as flash card memory sticks designed to be worn as jewelry.
- New designs for consumer products, such as appliances designed for very smallapartments.
- Adapting packaging for specific markets (different covers and typeface forchildren and adult versions of the same book).

Examples of product promotion innovations

- Bundling existing goods or services in new ways to appeal to market segments.
- Developing trademarks for new product lines.
- First use of product seeding through opinion leaders, celebrities, or particular groups that are fashion or product trend setters.
- First use of product placement on television, in books, films, etc.
- First use of viral or social network marketing.

Examples of product placement innovations

- First use of in-store sales that are only accessible to holders of the store's credit card or reward card.
- First use of media programming for a specific institution, such as closed circuit television for hospitals, buses, or trains that contain programs to stimulate specific product sales.
- First use of direct marketing via email, telephone or mail using a customer database obtained through individuals that visit websites for information or join "frequent user or buyer" reward plans.

- First use of exclusive retailing, such as only selling high-end products in special stores.

Examples of pricing innovations

- First use of variable pricing, with the price varying by time of purchase, location of purchaser, etc.
- First use of penetration pricing or loss leaders to establish market share and brand recognition.
- First use of discount systems such as loyalty cards.

ANNEX B

Examples of editing rules

Source for CIS editing rules: EUROSTAT, Community Innovation Survey, User Guide for Windows, SAS application, CIS4_User guide_v2.2.doc
(Quite an old source, but gives a logic of editing rules with good comprehensiveness)

Innovation data covers several types of variables, metric and different types of ordinal variables.

The following examples give an idea of types of editing checks to be applied to data. (Examples not in logical order according to the order of questions on the questionnaire.)

Edited and imputed values should be flagged!

A case, where there are several options or subcategories under the question (like question on co-operation partners, hampering factors, reasons for innovations with environmental benefit etc.), enterprise markets as an example here

If any of the market options are answered and the others are blank, then these will be set to no.

e.g.: if Marloc=1 and (Marnat=. And Mareur=. And Maroth=.) Then do:

Marnat=0; (Flagging again!)

Mareur=0;

Maroth=0;

End;

Etc.

If all the market answers are missing (*Marloc=. And Marnat=. And Mareur=. And Maroth=.),* then estimate.

Filtering always gives basic rules for editing and for consistency and logical checks.

Example: Product innovations and Turnover due to new to products new to the market (Turnmar), new to the firm (Turnin) and unchanged products (TurnUng)

If the enterprise is not a product innovator, then all product innovation related questions should be missing.

If (InPdgd=0 and Inpdsv=0) then for example Newmkt=. and Newfrm=. and Turnin=. and Turnmar=. and Turnung=.

If Newmkt is no, then there should be no turnover for products new to the market or if Newfrm is no then there should be no turnover for products new to the enterprise.

If Newmkt=0 and Turnmar=. Then Turnmar=0

If Newfrm=0 and Turnin=. Then Turnin=0

If there is turnover for products new to the market, then Newmkt should equal 1 and if there is turnover for products new to the enterprises then Newfrm should be yes.

If Newmkt=0 and Turnmar ne. Then Newmkt=1

If Newfrm=0 and Turnin ne. Then Newfrm=1

If the enterprise is a product innovator and only one of the subcategories of turnover is missing, then the missing one is deduced

If (InPdgd=1 or Inpdsv=1) then;

If (Turnung > 0 and Turnmar > 0 and Turnin=.) and sum(TurnUng,TurnMar<=1)then do; Turnin=1-Turnung-Turnmar

If (Turnung=. and Turnmar > 0 and Turnin > 0) and sum(TurnMar,TurnIn<=1) then do; Turnung=1-Turnin-Turnmar

If (Turnung > 0 and Turnmar=. and Turnin>0) and sum(TurnUng,TurnIn<=1) then do; Turnmar=1-Turnung-Turnin

If (TurnUng>0 and TurnMar in (0,.) and NewMkt=0) and sum(TurnUng, TurnIn)<=1 then do; TurnIn=1-TurnUng

If (TurnUng>0 and TurnIn in (0,.) and NewFrm=0) and sum(TurnUng,TurnMar)<=1 then do;TurnMar=1-TurnUng

If the enterprise is a product innovator, TurnIn and TurnUng and Turnmar are provided but do not sum to 1, then normalise the figures to sum to 1.

If InPdgd=1 or Inpdsv=1 and sum (Turnmar, TurnUng, Turnin) ne 1 and >0 and ne ., then

TurnIn=TurnIn/ (TurnIn + TurnUng+ Turnmar)

TurnUng=TurnUng/ (TurnIn+ TurnUng+ Turnmar)

Turnmar=Turnmar/ (TurnIn + TurnUng+ Turnmar)

If the enterprise is a product innovator and all the turnover figures Turnmar, TurnUng and Turnin are missing then estimate. In general, when editing, first try to find more information or deduce with the help of other data, when the missing values can't be deduced do estimate

Example: Innovation activity and expenditure

If intramural R&D expenditure (RRdInX) is provided, then RRdIn should be yes

If RRdInX > 0 and RRdIn <> 1 then RRdIn=1

If extramural R&D expenditure (RRdExX) is provided, then RRdEx should be yes:

If RRdExX > 0 and RRdEx <> 1 then RRdEx=1

If expenditure on acquisition of machinery (RMacX) is provided, then RMac should be yes:

If RMacX>0 and RMac <> 1 then RMac=1

If expenditure on other external knowledge (ROekX) is provided, then ROek should be yes:

If ROekX>0 and ROek <> 1 then ROek=1

Check also the correspondence between sum (*Rtr, Rmar, Rdsg, Rpre*) and *Rotrx*

In the case of missing values for innovation activities either add 0 for missing values if only some of them are missing or estimate if all of them are missing

Follow the logic between questions on activities and expenditure (do notice that activities are for 3 three years period and expenditure only for statistics year, i.e. the last year of that 3 years period which in practice means that there may have been some activities but not necessarily expenditure)

Use other sources for editing expenditure as far as possible (R&D expenditure, investment data) before estimating the figures.

If engagement in R&D activity is missing then, if enterprise is engaged in intra-mural R&D, *RdEng* should be estimated

If the enterprise is not engaged in innovation activities, then RdEng should be missing:

If InnoAct=0 and RdEng≠. then RdEng=.

Innovation co-operation

If the enterprise is not engaged in innovation activities (relating to products and processes), then the question on innovation co-operation should be not applicable:

If InnoAct=0 and Co <>. then Co=.

If the enterprise is engaged in innovation activities and at least one alternative on location/type is answered, then the enterprise should be engaged in innovation co-operation:

If InnoAct=1 and c011 + c012 +.....+ c084 +c085>=1 then do;

if Co=. then Co=1 or if Co=0 then Co=1

Location/type of partners for innovation co-operation

If the enterprise is not engaged in innovation activities or has no innovation co-operation, then locationof innovation partners should be not applicable:

If InnoAct=0 or Co=0 then Co11=Co12= ...=Co84=Co85=.

If the enterprise is engaged in innovation co-operation and all location of partners are missing, then the location of partners has to be estimated

Marketing and organisational innovations

Like questions on product innovations, process innovations and activities for ongoing and abandoned activities, questions on marketing and organizational innovations are mandatory in the EU context.

In ideal case, there should be genuine answer from respondents for these questions and in the case of missing values, more information from respondents should be asked.

However, questions can be edited to some extent, like:

If at least one of organisational innovations has been ticked yes while the others are left missing, then missing should be considered as no:

sum(*OrgBup*,*OrgWkp*,*OrgExr*) > 0 and (*OrgBup*=. or *OrgWkp*=. or *OrgExr*=.) then the missing ones should be 0.

The same is for marketing innovations. If at least one of marketing innovation has been ticked yes while the other is left missing, then missing should be considered as no

Specific example for editing Armenian pilot data:

Non-innovators

The basic rules for the data for non-innovators are the following:
If an enterprise is with innovation activity (yes to 3.1, 4.1, 5.1, 9.1 or 10.1) then *N_HCOMP_HBAR* should be empty (*N_HCOMP_HBAR*=.). If an enterprise is not with innovation activity (no to all 3.1, 4.1, 5.1, 9.1 and 10.1) then*N_HCOMP_HBAR* should have one yes tick and values in (1, 2)

If *INNO*=1 then *N_HCOMP_HBAR*=.

If *INNO* ne 1 then *N_HCOMP_HBAR* in (1, 2)

Possible inconsistencies as regards 13.1:
Enterprise is with innovation activity and have ticked yes to *N_HCOMP_HBAR*-> should be empty (delete)
Enterprise is without innovation activity and *N_HCOMP_HBAR*is missing

- If also questions 13.2 and 13.3 are empty, then more information on editing 13.1 is needed (deduce if more information is received) or do estimate 13.1.
- If there are yes tick(s) for 13.2 (and 13.3 fully empty) then edit *N_HCOMP_HBAR*=1
- If there are yes tick(s) for 13.3 (and 13.2 fully empty) then edit *N_HCOMP_HBAR*=2

If both options for *N_HCOMP_HBAR*in 13.1 are ticked yes, one needs to be deleted.

If there exist information in the following questions 13.2 or 13.3 that may help in editing the 13.1, like

- If sum(*N_HLDEM*,*N_HPRIOR*,*N_HCOMPL*,*N_HIDIN*) notin(.,0) and 13.3 missing then *N_HCOMP_HBAR*=1
- Ifsum(*N_HFENT*,*N_HCRE*,*N_HPER*,*N_HSUBS*,*N_HPAR*,*N_HDEM*,*N_HCOMPH*, *N_HTEC*,*N_HINF*) not in (.,0) and 13.2 missingthen *N_HCOMP_HBAR*=2
- If both questions 13.2 and 13.3 answered and not missing, needs to be evaluated which of these representing more important reasons for non-innovating -> choose more correct option for 13.1 (in case of equal answers to 13.2 and 13.3 perhaps one possibility is to deduce that innovation has been considered but barriers have been too large, and based on this the answer for 13.1 could be 2, i.e. *N_HCOMP_HBAR*=2)

Question 13.1 should be edited and ok now.

Editing the question 13.2:

if *N_HCOMP_HBAR*=1 and one or some of the *N_HLDEM* or *N_HPRIOR* or *N_HCOMPL* or *N_HIDIN* are ticked yes (=1,2,3 or 0) then the missing ones of those *N_HLDEM* and *N_HPRIOR* and *N_HCOMPL* and *N_HIDIN* should be ticked as not relevant (=0)

if *N_HCOMP_HBAR*=1 and all of the *N_HLDEM* and *N_HPRIOR* and *N_HCOMPL* and *N_HIDIN* are missing then either ask for more information on that from an enterprise or do impute/estimate the whole 13.2

Question 13.2 should be edited and ok now.

Editing the question 13.3:

if *N_HCOMP_HBAR*=2and one or some of the *N_HFENT* or *N_HCRE* or *N_HPER* or *N_HSUBS* or *N_PAR* or *N_HDEM* or *N_HCOMPH*or *N_HTEC* or *N_HINF*are ticked yes (=1,2,3 or 0) then the missing ones of those *N_HFENT* and *N_HCRE* and *N_HPER* and *N_HSUBS* and *N_PAR* and *N_HDEM* and *N_HCOMPH*or *N_HTEC* or *N_HINF*should be ticked as not relevant (=0)

if *N_HCOMP_HBAR*=2and all of the *N_HFENT* and *N_HCRE* and *N_HPER* and *N_HSUBS* and *N_PAR* and *N_HDEM* and *N_HCOMPH*or *N_HTEC* or *N_HINF*are missing then either ask for more information on that from an enterprise or do impute/estimate the whole 13.3

Question 13.3 should be edited and ok now.

ANNEX C

Typical content and structure of quality/metadata report

NAME OF THE STATISTICAL SURVEY (INDICATOR)
1 CONTACT
1.1 Contact organisation
1.2 Contact organisation unit
1.3 Contact person
1.4 Contact person, position, area of responsibility
1.5 Contact person's postal address
1.6 Contact person's email address
1.7 Contact person's phone number
1.8 Contact person's fax number
2 METADATA UPDATE
2.1 Metadata last certified
2.2 Metadata last posted
2.3 Metadata last update (version, check)
3 STATISTICAL PRESENTATION
3.1 Description of statistical information (main characteristics, purpose)
3.2 Classification(s), classification system
3.3 Sector coverage
3.4 Definition(s)
3.5 Statistical unit
3.6 Statistical population
3.7 Geographical coverage
3.8 Time coverage
3.9 Base period
4 MEASUREMENT UNIT(S)
5 REFERENCE (REPORTING) PERIOD
6 INSTITUTIONAL MANDATE
6.1 Legal acts and other agreements
6.2 Statistical data exchange
7 CONFIDENTIALITY (LEGAL ACTS PROVIDING FOR STATISTICAL DATA CONFIDENTIALITY)
7.1 Confidentiality policy
7.2 Data confidentiality regulations
8 RELEASE POLICY
8.1 Release calendar
8.2 Link to the release calendar
8.3 Release procedure
9 FREQUENCY OF DISSEMINATION
10 DISSEMINATION FORMAT
10.1 Press releases
10.2 Publications
10.3 Databases

10.4 Access to micro-data
10.5 Other
11 METHODOLOGICAL DOCUMENTATION
12 QUALITY MANAGEMENT
12.1 Quality assurance
12.2 Quality assessment
13 RELEVANCE
13.1 User needs
13.2 User satisfaction
13.3 Completeness of statistical information
13.3.1 Degree of completeness of required information
14 ACCURACY AND RELIABILITY
14.1 Overall accuracy
14.2 Sampling error
14.3 Non-sampling error
14.3.1. Non-response error
14.3.1.1 Unit non-response rate
14.3.1.2 Item non-response rate
15 TIMELINESS AND PUNCTUALITY
15.1 Timeliness
15.2 Punctuality
15.2.1 Percentage of statistical information released on time
16 COMPARABILITY
16.1 Geographical comparability
16.2 Comparability over time
16.2.1 Length of comparable time series
17 COHERENCE
17.1 Cross domain coherence
17.2 Internal coherence
18 ADMINISTRATIVE BURDEN FOR RESPONDENTS (TIME USED BY ONE RESPONDENT TO FILL IN A STATISTICAL QUESTIONNAIRE)
19 REVISION OF STATISTICAL INFORMATION
19.1 Revision policy
19.2 Revision practice
20 STATISTICAL DATA PROCESSING
20.1 Statistical data source
20.2 Periodicity of statistical data collection
20.3 Statistical data collection
20.4 Statistical data validation
20.5 Production of statistical information
20.6 Adjustment
21 COMMENTS, LINKS TO RELATED METADATA

ANNEX D

Questions in Armenian innovation pilot survey, 2015, which are with the status of mandatory core questions in EU harmonized model questionnaire
(more on legally mandatory questions in EU context under chapter 8. Tabulations and analysis)

2.1 What was your enterprise's total turnover for 2015? (Give turnover in '000 AMD currency units). Turnover is defined as the market sales of goods and services (include all taxes except VAT/for credit institutions: interests receivable and similar income; for Insurance services give gross premiums written).

2.2 What was your enterprise's average number of employees in 2015?

3.1 During the three years 2013 to 2015, did your enterprise introduce:

	Yes	No
Goods innovations: New or significantly improved goods (exclude the simple resale of new goods and changes of a solely aesthetic nature)	☐	☐
Service innovations: New or significantly improved services	☐	☐

3.2 Who developed these product innovations? *Tick all that apply*

	Goods innovations	Service innovations
Your enterprise by itself	☐	☐
Your enterprise together with other enterprises or organisations*	☐	☐

3.3 Were any of your product innovations (goods or services) during the three years 2013 to 2015:

		Yes	No
New to your market?	Your enterprise introduced a new or significantly improved product onto your market before your competitors (it may have already been available in other markets)	☐	☐
Only new to your enterprise?	Your enterprise introduced a new or significantly improved product that was already available from your competitors in your market	☐	☐

Using the definitions above, please give the percent of your total turnover in 2015 from:

New or significantly improved products introduced during the three years 2013 to 2015 that were **new to your market** ☐☐☐ %

New or significantly improved products introduced during the three years 2013 to 2015 that were **only new to your enterprise** ☐☐☐ %

4.1 During the three years 2013 to 2015, did your enterprise introduce:

	Yes	No
New or significantly improved methods of manufacturing for producing goods or services	☐	☐
New or significantly improved logistics, delivery or distribution methods for your inputs, goods or services	☐	☐
New or significantly improved supporting activities for your processes, such as maintenance systems or operations for purchasing, accounting, or computing	☐	☐

4.2 Who developed these process innovations?

	Tick all that apply
Your enterprise by itself	☐
Your enterprise together with other enterprises or organisations*	☐

5.1 During the three years 2013 to 2015, did your enterprise have any innovation activities that did not result in a product or process innovation because the activities were:

	Yes	No
Abandoned or suspended before completion	☐	☐
Still ongoing	☐	☐

6.2 How much did your enterprise spend on each of the following innovation activities in <u>2015</u> only? Innovation activities are defined in question 6.1 above. Include current expenditures (including labour costs, contracted-out activities, and other related costs) as well as capital expenditures on buildings and equipment.(Give expenditure data in 000's AMD)

Please fill in '0' if your enterprise had no expenditures for an activity in 2015

Please estimate if you lack precise accounting data

In-house R&D (Include current expenditures including labour costs and capital expenditures on buildings and equipment specifically for R&D)

External R&D

Acquisition of machinery, equipment, software & buildings (Exclude expenditures on these items that are for R&D)

Acquisition of existing knowledge from other enterprises or organisations

All other innovation activities including design, training, marketing, and other relevant activities

Total of the above innovation activities

8.1 During the three years 2013 to 2015, did your enterprise co-operate on any of your innovation activities withother enterprises or organisations? Innovation co-operation is active participation with other enterprises or organisations on innovation activities. Both partners do not need to commercially benefit. Exclude pure contracting out of work with no active co-operation.

No ☐***(Go to section 9)***

Yes ☐*(Go to question 8.2)*

8.2 Please indicate the type of innovation co-operation partner by location

(Tick all that apply)

Type of co-operation partner	**Armenia**	**Europe***	**United States**	**China or India**	**All other countries**
A. Other enterprises within your enterprise group	☐CO11	☐CO12	☐CO13	☐CO14	☐CO15
B. Suppliers of equipment, materials, components, or software	☐CO21	☐CO22	☐CO23	☐CO24	☐CO25
C. Clients or customers from the private sector	☐CO311	☐CO312	☐CO313	☐CO314	☐CO315
D. Clients or customers from the public sector	☐CO321	☐CO322	☐CO323	☐CO324	☐CO325
E. Competitors or other enterprises in your sector**	☐CO41	☐CO42	☐CO43	☐CO44	☐CO45
F. Consultants or commercial labs	☐CO51	☐CO52	☐CO53	☐CO54	☐CO55
G. Universities or other higher education institutes	☐CO61	☐CO62	☐CO63	☐CO64	☐CO65
H. Government, public or private research institutes	☐CO71	☐CO72	☐CO73	☐CO74	☐CO75

9.1 During the three years 2013 to 2015, did your enterprise introduce:

	Yes	No
New **business practices** for organising procedures (i.e.first time use of supply chain management*, business re-engineering, knowledge management, lean production**, quality management, etc.)	☐	☐
New methods of **organising work responsibilities and decision making** (i.e. first time use of a new system of employee responsibilities, team work, decentralisation, integration or de-integration of departments, education/training systems, etc.)	☐	☐
New methods of **organising external relations** with other enterprises or public organisations (i.e. first time use of alliances, partnerships, outsourcing or sub-contracting, etc.)	☐	☐

10.1 During the three years 2013 to 2015, did your enterprise introduce:

	Yes	No
Significant changes to the aesthetic **design** or **packaging** of a good or service (*exclude changes that alter the product's functional or user characteristics – these are product innovations*)	☐	☐
New media or techniques for **product promotion** *(i.e. first time use of a new advertising media, a new brand image, introduction of loyalty cards, etc.*)	☐	☐
New methods for **product placement** or sales channels *(i.e. first time use of franchising or distribution licenses, direct selling, exclusive retailing, new concepts for product presentation, etc.)*	☐	☐
New methods of **pricing** goods or services *(i.e. first time use of variable pricing by demand, discount systems, etc.)*	☐	☐

ANNEX E

Descriptions for some terms used in innovation survey

(source: Methodological notes for CIS questionnaire (CIS2014))

Term (CIS year)	In which question used (Armenian questionnaire)	Description
Geographic markets (CIS2014)	Question 1.1	A local or regional market does not include the entire country where the respondent is located whereas a national market should include the entire country.
Goods and Services (CIS2014)	Preamble to question 3	Three conditions determine whether or not a product is a good or a service, but not all conditions need to be met to define a product as a good or a service. The conditions concern tangibility, ownership over time, and durability. A service is usually intangible, ownership is limited to the time of use, and it is not durable over time (it cannot be stored or used for years or physically moved from one location to another). As an example, an airline ticket is a service since it is non-durable (the service is consumed during the period when it is used), the purchaser does not have the right to reuse the service again without buying a new ticket (no ownership), and the ticket does not give the user a tangible object that she or he can keep. In contrast, goods such as furniture, appliances, electronic equipment, clothing, etc. can be owned, are tangible, and durable. Not all services meet all three conditions, nor do all goods. Goods include food purchased in a supermarket and diesel purchased from a refinery, even though they can be used only once, and downloaded movies and music, which are intangible. Services include banking, retailing, hotel accommodation, insurance, educational courses, air travel, entertainment such as tours, theatres, and sporting events, repair and renovation work, consulting, etc. Some service enterprises, such as in construction, could be providing a service, such as building houses under contract, or producing a product, such as building houses for sale. There are many examples of services that do not meet all three conditions. For example, a restaurant meal is a service that does not confer ownership and it is not durable, but the meal is tangible. Automobile and tool rental or leasing are also considered a service, even though these are both tangible and durable. A person could lease an automobile for a year and store it and transport it, but it is still considered to be a service because the user does not own the automobile. This suggests that ownership (or lack of it) could be the main factor in determining whether or not a product is a good or service, followed by durability. In many cases, whether or not a good or service will depend on the respondent's business model. Consequently, the respondent will need to determine if their products are closer to a good or to a service.

Term (CIS year)	In which question used (Armenian questionnaire)	Description
Originally developed (CIS2014)	Preamble to questions 3 and 4	The original producer of a working prototype or commercial version of a product or process. The product or process could also have been entirely developed outside the respondent's own enterprise or enterprise group.
Product capabilities (CIS2014)	Question 3	The functions of a product, or what it can do or be used for
Resale (CIS2014)	Question 3.1	These are goods purchased from another enterprise and sold on as is without any changes. However, new innovative products that are purchased from suppliers and then included as a *component* of a product produced by the enterprise are innovations. An example is an improved braking system purchased from a supplier and installed in trucks manufactured by the enterprise.
Your enterprise by itself (CIS2014)	Questions 3.2 and 4.2	The innovation was entirely developed by the enterprise, without the active assistance of other enterprises (including enterprises that are part of its enterprise group) or institutions. However, the enterprise could have drawn on scientific research or other external sources for information such as technical and trade journals, attending conferences or trade fairs, the provision of routine testing services from external enterprises, or limited advice from outside experts or consultants.
Together with other enterprises or institutions (CIS2014)	Questions 3.2 and 4.2	'Together' requires active participation in development work by the enterprise and by another enterprise or institution. It includes collaboration but it does not require it. For instance, the enterprise could contract out some development work to a consulting firm or institution. Do not include contracts for routine activities, such as testing the strength or composition of materials, blood tests, etc.
Adapting or modifying (CIS2014)	Questions 3.2 and 4.2	This occurs when an enterprise builds on a product, service or process that was originally developed by another enterprise or institution. For example, an enterprise could adapt a component to fit its own product, make minor modifications to a product by adopting the characteristics of a product developed by another enterprise, or modify new process equipment to meet its own requirements.
Other enterprises or organisations (CIS2014)	Questions 3.2 and 4.2	The enterprise adopted an innovation that was developed by another enterprise or institution, with no further changes. Essentially, the innovation was adopted 'off the shelf'. This can occur when a company uses a new processing chip purchased from a chip manufacturer or when a company purchases new packaging equipment.
New to market (CIS2014)	Question 3.3	Respondents can define their market in either geographic terms or by product line. In either case, a product innovation that is new to their market must be the first time it is available on the market in question. For example, if the respondent's market is Europe, it must be the first time the product appeared anywhere in Europe, although it might have already been available in the United States. If the respondent thinks in terms of a product such as an MP3 player, then it must be the first time the innovation is used for this product. It may have been used previously in a different product market, such as for computers.

Term (CIS year)	In which question used (Armenian questionnaire)	Description
Abandoned or suspended (CIS2014)	Question 5.1	Work on these activities must have been underway during the reference period of 2010 to 2012 before they were abandoned or temporarily suspended.
Design (CIS2014)	Question 6.1	The question on design covers the design of goods and of services. The concept of *goods* design varies by country and can be called object design, industrial design, and mass production design. Generally, the design of goods can cover one or more of the following aspects of three-dimensional objects such as furniture, consumer electronics, transport vehicles, cooking equipment, stadiums, etc.: 1) shape and appearance, 2) ergonomic characteristics, 3) ease of use or readability, such as the position and appearance of information content such as switches, dials, and other displays (for instance the dashboard of an automobile or the user interface on the iPod), and 4) low cost mass production characteristics that reduce the cost of meeting the first three design characteristics. The concept of *services* design is relatively new. The concept of the appearance of an object is replaced by the design and layout of spaces such as hotel rooms, restaurants, airports, etc. The concept of ease of use or readability of objects is replaced by the design of websites or of signage and other information to guide people through airports, train stations, hotels, etc. All design activities reported here should be limited to the design of new or significantly improved goods or services. Simple aesthetic changes to goods or packaging is included under question on marketing innovation. However, it may be difficult for respondents to distinguish between the concept of design in question 6.1 and aesthetic or stylistic changes for marketing purposes only. In general, updating an object or a space is a simple aesthetic change, for instance redecorating a hotel or changing the shape of the fenders on an automobile so that the automobile has a new style. Design, as covered in question 6.1, is more extensive, and involves either designing the appearance or shape of an object or service that is new to the enterprise, or changes to the shape or appearance of an existing object in a way that also improves ergonomic, ease of use or readability, or mass production characteristics. Many changes to packaging are only aesthetic. However, changes to the design of packaging to improve ergonomic, ease of use, or mass production characteristics fit under the concept of design covered in question 6.1. Of note, the concept of design activities in question 6.1 excludes the preparation of blueprints and other technical specifications, which are part of R&D.

Term (CIS year)	In which question used (Armenian questionnaire)	Description
Other innovation activities (CIS2014)	Q 6.1	The 'other' category includes innovative activities that are not part of R&D or the other options in question 6.1, but which are necessary supporting activities for innovation such as feasibility studies or tooling up. In addition, this category includes activities such as industrial engineering that combine existing knowledge in new ways. Examples of using existing knowledge in new ways include many large scale civil engineering projects, incremental improvements to products and processes, or creating new functions for an existing product by adding additional components.
Cooperation (CIS2014)	Question 8.1	Cooperation can include R&D but projects that do not include R&D are also covered here. For example, an enterprise could cooperate with a supplier over the installation of new production machinery, particularly if engineering problems need to be solved or if the production machinery needs to be adapted to the enterprise's production system.
Clients or customers from the public sector (CIS2014)	Question 8.2	Clients or customers from the public sector include government owned organisations such as local, regional and national administrations and agencies, schools, hospitals, and government providers of services such as security, transport, housing, energy, etc.
Most valuable for innovation (CIS2014)	Question 8.3	The value of a cooperation partner is subjective and depends on the enterprise's own interpretation. It can be measured in terms of new ideas or technology obtained from the cooperation, in terms of the amount of money saved or earned as a result of the cooperation, in terms of market share gained as a result of the cooperation, etc.
Primary objective of environmental innovations (CIS2014)	Question 12	The primary reason for an innovation can be to obtain environmental benefits, such as when an enterprise introduces an innovation to reduce production of a specific pollutant or the ability to recycle a product after use in response to government legislation. An enterprise can also introduce an innovation for primarily environmental reasons as part of entering new consumer markets. However, environmental benefits can also be a by-product of other goals. In response to high aircraft fuel prices, an enterprise could improve jet engine efficiency, with benefits in terms of reduced greenhouse gases. Or, an enterprise could introduce recycling of expensive heavy metals to reduce costs, preventing the release of toxins into the environment.
Environmental benefits within your enterprise or obtained by end user (CIS2014)	Question 12.1	Environmental benefits can occur within the enterprise itself, such as through reduced pollution or from material savings etc., or the benefits could be obtained through its use by the end user, in many cases a final consumer. For instance, an enterprise could sell recyclable plastics to a bottle manufacturer. The environmental benefits occur when the end user who purchases bottled drinks returns the bottle for recycling. Similarly, the environmental benefits of low energy consumer appliances are obtained during their use by the consumer.
Voluntary actions or initiatives within your sector (CIS2014)	Question 12.2	These consist of voluntary sector-wide agreements by a group of firms or an industry association to reduce environmental damages or which set goals for reducing damage, for instance to reduce emissions of water or air pollutants.

ANNEX F

The list of main Innovation statistics indicators

Main Innovation statistics indicators are identified in The Commission Regulation (EU) No 995/2012, implementing Decision No 1608/2003/EC of the European Parliament and of the Council concerning the production and development of Community statistics on science and technology:

1. Enterprises by types of innovation

Code	Label	Detailed rules
TOTAL	Total enterprises	
INNO	Innovative enterprises (including enterprises with abandoned/suspended or on-going innovation activities)	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1 or ORGBUP=1 or ORGWKP=1 or ORGEXR=1 or MKTDGP=1 or MKTPDP=1 or MKTPDL=1 or MKTPRI=1)
INNO_PP	Product and/or process innovative enterprises only (including enterprises with abandoned/suspended or on-going innovation activities)	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (ORGBUP <> 1 and ORGWKP <> 1 and ORGEXR <> 1 and MKTDGP <> 1 and MKTPDP <> 1 and MKTPDL <> 1 and MKTPRI <> 1)
INNO_NPP	Organisation and/or marketing innovative enterprises only	(INPDGD <> 1 and INPDSV <> 1 and INPSPD <> 1 and INPSLG <> 1 and INPSSU <> 1 and INABA <> 1 and INONG <> 1) and (ORGBUP=1 or ORGWKP=1 or ORGEXR=1 or MKTDGP=1 or MKTPDP=1 or MKTPDL=1 or MKTPRI=1)
INNO_PPANPP	Product and/or process AND organisation and/or marketing innovative enterprises only (including enterprises with abandoned/suspended or on-going innovation activities	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (ORGBUP=1 or ORGWKP=1 or ORGEXR=1 or MKTDGP=1 or MKTPDP=1 or MKTPDL=1 or MKTPRI=1)
NON_INNO	Non-innovative enterprises	(INPDGD <> 1 and INPDSV <> 1 and INPSPD <> 1 and INPSLG <> 1 and INPSSU <> 1 and INABA <> 1 and INONG <> 1 and ORGBUP <> 1 and ORGWKP <> 1 and ORGEXR <> 1 and MKTDGP <> 1 and MKTPDP <> 1 and MKTPDL <> 1 and MKTPRI <> 1)
INPDT	Product innovative enterprises (regardless of any other type of innovation)	INPDGD=1 or INPDSV=1
INPCS	Enterprises with process innovations	INPSPD=1 or INPSLG=1 or INPSSU=1
INNOACT	Enterprises with innovation activity relating to products or processes	NPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1
INORG	Enterprises with organizational innovations	ORGBUP=1 or ORGWKP=1 or ORGEXR=1
INMKT	Enterprises with marketing innovations	MKTDGP=1 or MKTPDP=1 or MKTPDL=1 or MKTPRI=1

2. Innovative enterprises by types of innovation

Code	Label	Rule
TOTAL	Total enterprises	
INPDGD	Enterprises that introduced goods innovation (product innovation)	INPDGD=1
INPDSV	Enterprises that introduced service innovation (product innovation)	INPDSV=1
INPSPD	Enterprises that introduced new methods of manufacturing / producing (process innovation)	INPSPD=1
INPSLG	Enterprises that introduced new methods of logistics, delivery, distribution (process innovation)	INPSLG=1
INPSSU	Enterprises that introduced supporting activities (process innovation)	INPSSU=1
INABA	Enterprises that had innovation activities that were abandoned or suspended	INABA=1
INONG	Enterprises that had innovation activities that were still ongoin in the end of observation period	INONG=1
ORGBUP	Enterprises that implemented new business practices (organisation innovation)	ORGBUP=1
ORGWKP	Enterprises that implemented new methods of organising work responsibilities and decision making (organisation innovation)	ORGWKP=1
ORGEXR	Enterprises that implemented new methods of organising external relations (organisation innovation)	ORGEXR=1
MKTDGP	Enterprises that introduced significant changes to the aesthetic design or packaging (marketing innovation)	MKTDGP=1
MKTPDP	Enterprises that introduced new media or techniques for product promotion (marketing innovation)	MKTPDP=1
MKTPDL	Enterprises that introduced new methods for product placement (marketing innovation)	MKTPDL=1
MKTPRI	Enterprises that introduced new methods of pricing goods or services (marketing innovation)	MKTPRI=1

3. Hampering factors (Please remark that in CIS this is only for INNOACT)

Code	Label	Rule
INNO	Innovative enterprises (including enterprises with abandoned/suspended or on-going innovation activities)	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1 or ORGBUP=1 or ORGWKP=1 or ORGEXR=1 or MKTDGP=1 or MKTPDP=1 or MKTPDL=1 or MKTPRI=1)
HFENT_HIGH	Enterprises that consider lack of funds highly hampering innovations activities	INNO=1 and (HFENT=3)
HFENT_NU	Enterprises that consider lack of funds no hampering innovations activities	INNO=1 and (HFENT=0)
HFOUT_HIGH	Enterprises that consider lack of finance highly hampering innovations activities	INNO=1 and (HFOUT=3)
HFOUT_NU	Enterprises that consider lack of finance no hampering innovations activities	INNO=1 and (HFOUT=0)

Code	Label	Rule
HCOS_HIGH	Enterprises that consider high innovation costs highly hampering innovations activities	INNO=1 and (HCOS=3)
HCOS_NU	Enterprises that consider high innovation costs no hampering innovations activities	INNO=1 and (HCOS=0)
HPER_HIGH	Enterprises that consider lack of qualified personnel highly hampering innovations activities	INNO=1 and (HPER=3)
HPER_NU	Enterprises that consider lack of qualified personnel no hampering innovations activities	INNO=1 and (HPER=0)
HTEC_HIGH	Enterprises that consider lack of information on technology highly hampering innovations activities	INNO=1 and (HTEC=3)
HTEC_NU	Enterprises that consider lack of information technology no hampering innovations activities	INNO=1 and (HTEC=0)
HINF_HIGH	Enterprises that consider lack of information on markets highly hampering innovations activities	INNO=1 and (HINF=3)
HINF_NU	Enterprises that consider lack of information on markets no hampering innovations activities	INNO=1 and (HINF=0)
HPAR_HIGH	Enterprises that consider difficulty in finding cooperation partnersfor innovation highly hampering innovations activities	INNO=1 and (HPAR=3)
HPAR_NU	Enterprises that consider difficulty in finding cooperation partnersfor innovation no hampering innovations activities	INNO=1 and (HPAR=0)
HDOM_HIGH	Enterprises that consider market domination by established enterprises highly hampering innovations activities	INNO=1 and (HDOM=3)
HDOM_NU	Enterprises that consider market domination by established enterprises no hampering innovations activities	INNO=1 and (HDOM=0)
HDEM_HIGH	Enterprises that consider uncertain demand for innovative goods or services highly hampering innovations activities	INNO=1 and (HDEM=3)
HDEM_NU	Enterprises that consider uncertain demand for innovative goods or services no hampering innovations activities	INNO=1 and (HDEM=0)
HPRIOR_HIGH	Prior innovations by own enterprise is highly important reason for not to innovate	INNO=1 and (HPRIOR=3)
HPRIOR_NU	Prior innovations by own enterprise is no reason for not to innovate	INNO=1 and (HPRIOR=0)
HMAR_HIGH	No demand for innovations is highly important reason for not to innovate	INNO=1 and (HMAR=3)
HMAR_NU	No demand for innovations is no reason for not to innovate	INNO=1 and (HMAR=0)

4. Activities and expenditure

Code	Label	Rule
INNOACT	Enterprises with innovation activity relating to products or processes	NPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1
RRDIN_YES	Enterprises engaged in in-house R&D activities	INNOACT=1 and (RRDIN=1)
RDENG_CONT	Enterprises engaged in continuous R&D activities	INNOACT=1 and (RRDIN=1) and (RDENG=1)
RDENG_OCC	Enterprises engaged in occasional R&D activities	INNOACT=1 and (RRDIN=1) and (RDENG=2)
RRDIN15	Expenditure in in-house R&D	(from regular data collection only?)
RRDEX_YES	Enterprises engaged in external R&D activities	INNOACT=1 and (RRDEX=1)
RRDEX15	Expenditure in external R&D	(from regular data collection only?)
RMACES_YES	Enterprises engaged in acquisition of machinery, equipment and software	INNOACT=1 and (RMAC=1)
RMACES15	Expenditure in acquisition of machinery, equipment and software	(from regular data collection only?)
ROEK_YES	Enterprises engaged in acquisition of external knowledge	INNOACT=1 and (ROEK=1)
ROEK15	Expenditure in acquisition of external knowledge	(from regular data collection only?)
RTR_YES	Enterprises engaged in training for innovation activities	INNOACT=1 and (RTR=1)
RMAR_YES	Enterprises engaged in activities for market introduction of innovation	INNOACT=1 and (RMAR=1)
RDSG_YES	Enterprises engaged in design activities	INNOACT=1 and (RDSG=1)
ROTHE_YES	Enterprises engaged in other activities	INNOACT=1 and (RPRE=1)
ROTREX15	Expenditures for all OTHER innovation activities	(from regular data collection only?)
EXPTOT15	Total innovation expenditure in 2015	(from regular data collection only?)

5. Enterprises by location of product development

Indicator label	Indicator label Type of innovators INPDT	Detailed rules	Simplified rules (including the codes for the type of innovators)
Enterprises that introduced goods innovation (product innovation)	INPDGD	INPDGD=1	INPDGD=1
Enterprises that introduced services innovation (product innovation)	INPDSV	INPDSV=1	INPDSV=1
Enterprises that developed goods innovation by itself	INPDTG1	INPDGD=1 and INITGD=1	INPDGD=1 and INITGD=1
Enterprises that developed goods innovation together with other enterprises or institutions	INPDTG2	INPDGD=1 and INTOGD=1	INPDGD=1 and INTOGD=1

Indicator label	Indicator label Type of innovators INPDT	Detailed rules	Simplified rules (including the codes for the type of innovators)
Enterprises that developed goods innovation by adapting or modifying goods originally developed by other enterprises or institutions	INPDTG3	INPDGD=1 and INADGD=1	INPDGD=1 and INADGD=1
Enterprises that introduced goods innovations developed by other enterprises or institutions	INPDTG4	INPDGD=1 and INOTHGD=1	INPDGD=1 and INOTHGD=1
Enterprises that developed service innovation by itself	INPDTS1	INPDSV=1 and INITSV=1	INPDSV=1 and INITSV=1
Enterprises that developed service innovation together with other enterprises or institutions	INPDTS2	INPDSV=1 and INTOSV=1	INPDSV=1 and INTOSV=1
Enterprises that developed service innovation by adapting or modifying service originally developed by other enterprises or institutions	INPDTS3	INPDSV=1 and INADSV=1	INPDSV=1 and INADSV=1
Enterprises that introduced service innovations developed by other enterprises or institutions	INPDTS4	INPDSV=1 and INOTHSV=1	INPDSV=1 and INOTHSV=1
Enterprises that introduced product innovation new to the market	NEWMAR_YES	(INPDGD=1 or INPDSV=1) and NEWMKT=1	INPDT and NEWMKT=1
Enterprises that introduced product innovation only new to the firm	NEWFRM_YES	(INPDGD=1 or INPDSV=1) and NEWFRM=1	INPDT and NEWFRM=1

6. Enterprises by location of process development

Indicator label	Indicator label Type of innovators INPCS	Detailed rules	Simplified rules (including the codes for the type of innovators)
Enterprises that introduced new methods of manufacturing / producing (process innovation)	INPSPD	INPSPD=1	INPSPD=1
Enterprises that introduced new methods of logistics, delivery, distribution (process innovation)	INPSLG	INPSLG=1	INPSLG=1
Enterprises that introduced supporting activities (process innovation)	INPSSU	INPSSU=1	INPSSU=1
Enterprises that developed process innovation by itself	INPSDV1	(INPSPD=1 or INPSLG=1 or INPSSU=1) and INITPS=1	INPCS and INITPS=1
Enterprises that developed process innovation together with other enterprises or institutions	INPSDV2	(INPSPD=1 or INPSLG=1 or INPSSU=1) and INTOPS=1	INPCS and INTOPS=1
Enterprises that developed process innovation by adapting or modifying process originally developed by other enterprises or institutions	INPSDV3	(INPSPD=1 or INPSLG=1 or INPSSU=1) and INADPS=1	INPCS and INADPS=1
Enterprises that introduced process innovations developed by other enterprises or institutions	INPSDV4	(INPSPD=1 or INPSLG=1 or INPSSU=1) and INOTHPS=1	INPCS and INOTHPS=1

7. Innovative enterprises involved in innovation cooperation (coding in the table according to EU coding)*

Indicator label	Indicator label - Type of innovators INNOACT	Detailed rules	Simplified rules (including the codes for the type of innovators)
Enterprises engaged in any type of cooperation	CO_ALL	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO=1)	INNOACT and (CO=1)
Enterprises engaged in cooperative arrangements with other enterprises within your enterprise group	C01	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO11=1 or CO12=1 or CO13=1 or CO14=1 or CO15=1)	INNOACT and (CO11 =1 or CO12=1 or CO13=1 or CO14=1 or CO15=1)
Enterprises engaged in cooperative arrangements with competitors or other enterprises of the same sector	C02	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO41 =1 or CO42 =1 or CO43=1 or CO44=1 or CO45=1)	INNOACT and (CO41 =1 or CO42 =1 or CO43=1 or CO44=1 or CO45=1)
Enterprises engaged in cooperative arrangements with clients or customers from the private sector	C031	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO311 =1 or CO312=1 or CO313=1 or CO314=1 or CO315=1)	INNOACT and (CO311 =1 or CO312=1 or CO313=1 or CO314=1 or CO315=1)
Enterprises engaged in cooperative arrangements with clients or customers from the public sector	C032	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO321 =1 or CO322 =1 or CO323=1 or CO324=1 or CO325=1)	INNOACT and (CO321 =1 or CO322 =1 or CO323=1 or CO324=1 or CO325=1)
Enterprises engaged in cooperative arrangements with suppliers of equipment, materials, components or soft	C05	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO21 =1 or CO22 =1 or CO23=1 or CO24=1 or CO25=1)	INNOACT and (CO21 =1 or CO22 =1 or CO23=1 or CO24=1 or CO25=1)
Enterprises engaged in cooperative arrangements with universities or other higher education institutions	C06	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO61 =1 or CO62 =1 or CO63=1 or CO64=1 or CO65=1)	INNOACT and (CO61 =1 or CO62 =1 or CO63=1 or CO64=1 or CO65=1)
Enterprises engaged in cooperative arrangements with Government, public or private research institutes	C09	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO71 =1 or CO72 =1 or CO73=1 or CO74=1 or CO75=1)	INNOACT and (CO71 =1 or CO72 =1 or CO73=1 or CO74=1 or CO75=1)
Enterprises engaged in cooperative arrangements with consultants or commercial labs	C10	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO51 =1 or CO52 =1 or CO53=1 or CO54=1 or CO55=1)	INNOACT and (CO51 =1 or CO52 =1 or CO53=1 or CO54=1 or CO55=1)
Enterprises engaged in cooperative arrangements with universities, other higher education institutions, Government, public or private research institutes	C11	(INPDGD=1 or INPDSV=1 or INPSPD=1 or INPSLG=1 or INPSSU=1 or INABA=1 or INONG=1) and (CO61 =1 or CO62 =1 or CO63=1 or CO64=1 or CO65=1 or CO71 =1 or CO72 =1 or CO73=1 or CO74=1 or CO75=1)	INNOACT and (CO61 =1 or CO62 =1 or CO63=1 or CO64=1 or CO65=1 or CO71 =1 or CO72 =1 or CO73=1 or CO74=1 or CO75=1)

*Note, that coding for Armenian question on coop differed slightly from the one used in EU context. EU coding is as follows:

Type of co-operation partner	**[Your country]**	**Other Europe****	**United States**	**China or India**	**All other countries**
A. Other enterprises within your enterprise group	☐*Co11*	☐*Co12*	☐*Co13*	☐ *Co14*	☐*Co15*
B. Suppliers of equipment, materials, components, or software	☐*Co21*	☐*Co22*	☐*Co23*	☐ *Co24*	☐ *Co25*
C. Clients or customers from the private sector	☐ *Co311*	☐*Co312*	☐*Co313*	☐*Co314*	☐ *Co315*
D. Clients or customers from the public sector*	☐*Co321*	☐*Co322*	☐*Co323*	☐ *Co324*	☐ *Co325*
E. Competitors or other enterprises in your sector	☐ *Co41*	☐*Co42*	☐ *Co43*	☐*Co44*	☐ *Co45*
F. Consultants or commercial labs	☐*Co51*	☐ *Co52*	☐ *Co53*	☐*Co54*	☐ *Co55*
G. Universities or other higher education institutes	☐*Co61*	☐*Co62*	☐*Co63*	☐*Co64*	☐ *Co65*
H. Government, public or private research institutes	☐*Co71*	☐*Co72*	☐ *Co73*	☐ *Co74*	☐*Co75*

The Armenian data can be recoded like follows:

Type of co-operation partner	**[Your country]**	**Other Europe****	**United States**	**China or India**	**All other countries**
C. Clients or customers from the private sector	*CO31 ->Co311*	*CO32 ->Co312*	*CO33 ->Co313*	*CO34 ->Co314*	*CO35 ->Co315*
D. Clients or customers from the public sector*	*CO41 ->Co321*	*CO42 ->Co322*	*CO43 ->Co323*	*CO44 -> Co324*	*CO45 ->Co325*
E. Competitors or other enterprises in your sector	*CO51 ->Co41*	*CO52 ->Co42*	*CO53 -> Co43*	*CO54 ->Co44*	*CO55 ->Co45*
F. Consultants or commercial labs	*CO61 ->Co51*	*CO62 -> Co52*	*CO63 ->Co53*	*CO64 ->Co54*	*CO65 ->Co55*
G. Universities or other higher education institutes	*CO71 ->Co61*	*CO72 ->Co62*	*CO73 ->Co63*	*CO74 ->Co64*	*CO75 ->Co65*
H. Government, public or private research institutes	*CO81 ->Co71*	*CO82 ->Co72*	*CO83 -> Co73*	*CO84 -> Co74*	*CO85 ->Co75*

For other questions and variables not mentioned here the similar logic for tabulating can be used.

It is of course useful to provide also the very basic information on innovators, prevalence of implementing different types of innovations, by size classes and NACE classes.

And tabulate also some information on non-innovators, like:

Code	Label	
NON_INNO	Non-innovative enterprises	
N_HCOMP	Enterprises that did not have compelling reason to innovate	NON_INNO and N_HCOMP_HBAR=1
N_HBAR	Enterprises that considered innovating but too large barriers	NON_INNO and N_HCOMP_HBAR=2
N_HLDEM_HIGH	Enterprises for which the low market demand was a highly important reason to not innovate	NON_INNO and N_HLDEM=3
N_HLDEM_NU	Enterprises for which the low market demand was not an important reason to not innovate	NON_INNO and N_HLDEM=0