

THE NEW MONITORING OF THE DETECTION “ANTHROPIC PRESSURE AND NATURAL RISKS” SUMMARY INDICATORS COMPARED AS TOOLS FOR MEASURING THE DATA COLLECTION OF THE EXTRACTION PHENOMENON¹

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Abstract. The survey “Anthropic pressure and natural risks” on mining activities from quarries and mines aims to update every year the Istat Mining Database on the extraction activities of non-energy mineral resources, natural mineral waters and thermal waters censusing the authorized extraction sites situated in Italy. Istat carries out the survey through two thematic survey models: - Quarries and mines: solid non-energy mineral resources: - Natural mineral waters and thermal waters. For the first time a monitoring system was developed with the processing of the data collected through the GINO++ platform. In the latest edition of the survey, an additional tool was introduced to control the sending of data from all the expected sites, from each institution, through the use of the site identification code. Where the site identification code was not unique, other identifiers based on the combination of other variables collected, were created ad hoc. This innovation had contributed to raise of the survey’s response rate of eight percentage points both in relation to the number of respondents and the number of completed questionnaires compared to those expected.

1. Introduction

The Territorial-Environmental Survey "Anthropogenic Pressure and Natural Hazards on Quarrying and Mining Activities", carried out by Istat from 2015, is an annual census about all the activities of exploitation of non-renewable natural resources present in the national territory.

The data are collected directly from the technical offices of the local public Institutions which are responsible for mining (Regions, Provinces, Autonomous Provinces of Trento and Bolzano, Mining Districts of Sicily).

¹The paper is the result of the common work of the authors. In particular, paragraphs 1 and 5 are attributed to Lucia Mongelli, paragraph 2 is attributed to Barbara Boninfante, paragraph 3 to Sabrina Angiona, paragraph 3.1 and 4 to Valentino Parisi, 4.1. to Stefano Moscatelli, paragraph 4.2 to Barbara Stobbia and for 2.1 Barbara Stobbia e Stefano Moscatelli developed graphs and cartograms.

In recent years, numerous initiatives have been implemented for the consistent maintenance of information flows to ensure the effectiveness and robustness of archives. Particular importance has been given to the improvement of data collection both to increase the amount of spatial data and to improve the flow of information (Vignani, D. 2017).

This work aims to present the important methodological innovations of the monitoring system introduced in the last edition of the survey (Ed. 2022) which allowed the construction of synthesis indicators on the progress of data collection and allowed the integration of a more effective preliminary validation process.

2. A brief overview of data sources

The statistics on the extraction of non-energetic mineral resources from quarries and mines are produced and disseminated with the aim of updating the Istat Mining Database. (Banca dati I.STAT 2013-2021)

The Istat Mining Database contains data and information (historical series years 2013-2018) on the extraction of minerals of category I (mines) and category II (quarries) by mining site and type of mineral resource, according to the classification of mineral substances reported in the current Royal Decree 1443/1927, reference point of the national legislation on mining and quarrying "Legislative rules governing the research and mining of the Kingdom".

Since 2017, the field of observation of the survey has been extended to data on withdrawals of mineral and thermal waters by mining site at a territorial level (ISTAT, ediz.2017-2023). Since 2018, the collection of statistical-geographical data has been strengthened to complete the georeferencing of the Istat geominerary database, with technical offices of local public Institutions (ISPRA, 2020).

Our data sources are the administrative archives held by the Technical Offices which are responsible for mining in the local public Institutions.

The archives contain the following types of data and information:

- ✓ Regional legislation;
- ✓ Regional Plans and Provincial Mining Plans (PRAE, PPAE),
- ✓ Authorizations for the cultivation of mining sites,
- ✓ Regional and provincial databases;
- ✓ Annual declarations submitted by the individual undertakings authorized to cultivate by the granting authorities They contain information about the exercise of their activities for extraction site.

2.1. Survey plan

Local public Institutions represent the survey units, while individual mining sites (quarries and mines) represent the analysis units.

This is a total survey that Istat carries out annually through two thematic survey models for self-completion of the respondent:

1. Quarries and mines: Solid non-energy mineral resources
2. Natural mineral and thermal waters

In the following, we can see the geolocation of the sites on the national territory (ISTAT, 2017-2022).

Mining sites (quarries and mines) are mainly concentrated in the North of the country, North-East 943 out of 3,968 total (23.8%) sites and North-West 933 (23.5%), followed by the Centre (21.7% of sites), South Italy (19.2% of sites) and Islands (11.8% of sites). (Vignani, D. 2019)

The natural mineral water and thermal water sites are mainly concentrated in the North-East of the country, 283 sites out of 822 total or 34.4%, followed by Southern Italy, 24.1% of sites, the Centre (21.0% of sites), the North-West (15.2% of sites) and the Islands (5.2%).

Figure 1 – *Quarries and Mines by municipality. Percentage values.*



Figure 2 – *Territorial distribution of sites. 2022 Edition Natural and Thermal Mineral Waters by municipality. Percentage values.*



3. Data collection

To support the data collection process, starting from the year 2020, Istat has introduced important methodological innovations for the detection "Anthropogenic pressure and natural risks" with the aim to improve, standardize the encodings and formats of the variables, and simplify the data collection process.

In particular, the technique CAWI (Computer Assisted Web Interviewing) has been introduced to acquire data in electronic format, through the Gino++ (Gathering information Online) portal of Istat (Torelli, R. 2011). This is according to the provisions of the Code of Digital Administration (d.lgs 82/2005 and subsequent additions and modification) in which data must be transmitted to Istat in computerised mode.

GINO++ is a generalized software that allows not only the collection of data but also the complete management of surveys via web (creation of web questionnaire, online data acquisition and/ or file upload and monitoring) (ISTAT, *Newsstat 4/2012*). In the Gino++ data acquisition system, the technical offices of the local public Institutions responsible for mining have two alternative ways of sending data: fill in web questionnaires in a guided manner or upload files in format .csv according to Istat records specially prepared.

In the "Documents and Instructions" area of the Gino Portal, the responding public Institutions find the support material to fulfill all the obligations provided by the survey: the facsimile of the web questionnaire of "Quarries and mines: solid non-energy mineral resources" and "Natural and Thermal Mineral Waters", Excel-format detection models, Excel-format track and technical specifications, compilation guide and non-energy mineral resources list by lithotype.

In addition, in Gino Institutions are available two support tools that facilitate and speed up the compilation and provision of data: the possibility to access the data entered in the previous edition and the list of all authorized mining sites that are present in the Istat Database. These two tools make it possible to avoid the provision of redundant data, such as mining sites ceased and communicated in previous years, and to facilitate the identification of missing sites and thus to detect unauthorized, undocumented sites.

In the Gino data acquisition system, rules (soft and hard) have also been implemented to report anomalies such as the use of unforeseen encodings and formats or the inconsistency between variables, which may occur during compilation. These rules contribute to improve the completeness, the quality of the data, the timeliness in providing it and to reduce the statistical annoyance on the respondent.

In Gino++, thanks to the monitoring function, it is possible to constantly monitor the activity of the respondents: the registration, the access by type of user, the data acquisition status. Thanks to the wide range of features present in the software and thanks to the information collected on the identification code of the extractive site, it was possible to implement the new monitoring tool for the investigation "Anthropogenic pressure and natural risks" which will be explained in the following paragraphs

3.1. The pre-validation process

The mining site identification code is one of the main information collected in each questionnaire. This is a mandatory field that may consist of the cadastral code of the site or the code in use by the institutional respondent, if it is present in the administrative archive. The site code is fundamental to identify the extractive site both during the monitoring of data collection and in the subsequent phase of data analysis in historical series.

In particular, during the data collection it allows, on the one hand, to verify the transmission by the Institution of the questionnaire containing the site data related to the year under survey, on the other hand, a precise and faster interlocution with the respondent if there is the presence of inconsistent data than those provided in previous years or missing or incorrect data.

It is therefore important that the site code is present for each survey unit and that: a) does not vary from year to year; b) is unique.

For this reason, at the beginning of the data collection, to Institutions that don't have in their archives the site identification it is recommended to create one for each site and to keep it over time. Despite the provided recommendations, not all Institutions comply with these indications.

In particular, in the 2021-2022 survey edition for about one third of the sites the identification code was not unique or there was a change of the site code from one year to the next which hasn't been accompanied of a code link table. The significant presence of cases of mismatch (ISTAT, 2013) or non-uniqueness of the site codes has not allowed the monitoring of the arrivals of the questionnaires per single site but to compare the data at the aggregate level through the comparison of questionnaires provided and questionnaires expected by the individual institution for province of the site location and type of site (quarry, mine, natural mineral water, thermal water).

The situation has definitely improved in the 2022-2023 survey edition: the percentage of unique or varied site codes compared to the previous year has fallen to 18% (10% for water, 20% for quarries and mines). Part of the lack of correspondence is due to the fact that the data relating to some sites, including the identification code, had not been provided by the institution in the previous year but recovered by the Production Service through other sources. These cases represent 8% of the units to be detected. Excluding such sites, the cases of mismatch of the code are equal to 10% of the sites (9% for water, 11% for quarries and mines).

4. Data collection monitoring tools

The monitoring is carried out weekly in the first months of the survey and twice weekly in the last month by processing the data collected through the GINO platform.

Each institution is required to fill in as many questionnaires as there are the sites of extraction of individual materials (of the territory of competence) in which each authorized extraction company operates. To verify the completeness of the data sent by the institution, the number of sent questionnaires containing the data of the reference year is compared with that of the expected questionnaires that are those communicated by the institution in the previous survey edition plus any other data for which the Production Service has recovered information after the data collection ends.

Considering that each institution must to complete a survey model for each new site, the transmission of a higher number of questionnaires than expected might suggest, in the first place, that the supply is complete and that the more questionnaires in more are referred to new sites. In order to verify that this is the case, the number of questionnaires sent and expected for province of location of the site and type's (natural mineral waters, thermal waters, quarries, mines), in some cases, it can highlight that the sending of data for some territories or for some types of sites is, in reality, incomplete.

To support the monitoring of the data collection trend, in 2022-2023 survey edition, for each expected site, Istat has verified the status of the questionnaire (unanswered, in processing, sent) and the reference year of the reported data through the coupling of the code of the extraction site reported in the questionnaire of the previous survey edition and in the current one, through relational databases (Atzeni P., et al. 2015).

Where there has been a change of site codes compared to the previous year or the institution has reported the same site identifier in several questionnaires, for the purpose of verification, other site identifiers have been defined which have taken into account the combination of the following information collected: site type, matter extracted, province, municipality, locality and geographical coordinates of the site and tax code of the undertaking authorized to extract the matter.

Particular attention was paid to sites for which, in the previous survey edition, the respondent had communicated, the validity of the permit for the extraction of the material by the entrusted company also in the year following the reference data year.

The one-to-one comparison between expected sites and received sites has allowed the Istat monitor to be able to provide the respondent with timely information on the sites for which the requested information has not been provided, with a view to the provision of all data by the end date of collection.

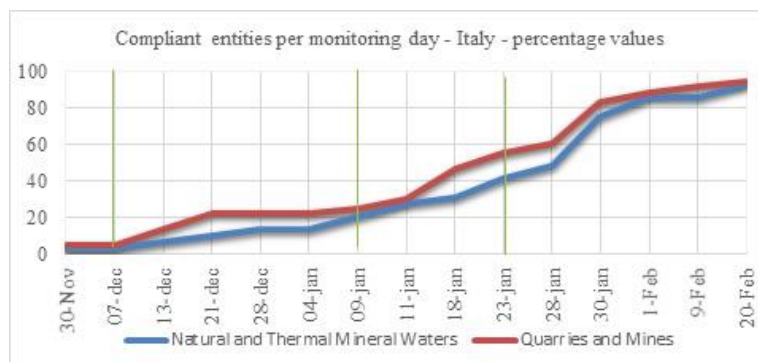
The monitoring also included: a) the expected and received questionnaires for the validity of the extraction authorization (expired in the reference year of the collected data, expired in previous years, active from that year, valid also in the following year); b) questionnaires sent with non-blocking errors, questionnaires being processed with blocking errors and questionnaires being processed with non-blocking errors.

4.1. Progress of the data collection

The survey began on October 20, 2022, expiring on January 31, 2023, Institutions involved were 29 for natural and thermal mineral waters and 36 for quarries and mines.

Through the processing of the data made available by the implemented monitoring system, it can be seen that the response rate has increased as the detection deadline approaches, also following the sending of reminders, in particular for those reminders sent close to the data transmission deadline (Figure 3).

Figure 3 – Response rate for Natural and Thermal Mineral Waters and Quarries and Mines. Italy. 2022-2023 edition. Percentage values.



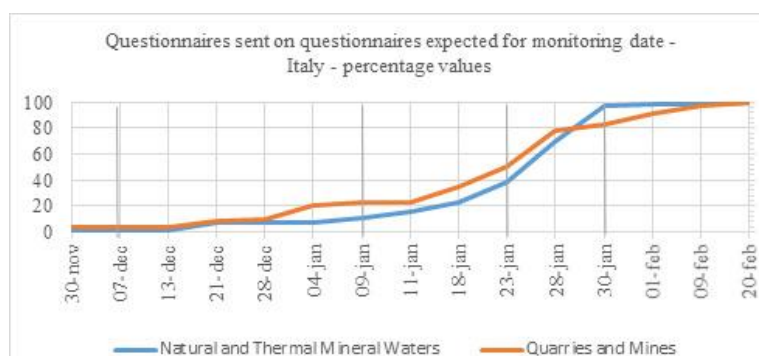
The graphs show a very slow start of the collection, quite common phenomenon, with a very small percentage of questionnaires sent compared to those expected until you get close to the two weeks before the deadline.

During the survey, four reminders were sent via email, in addition to the support provided by the survey contact persons for the data collection.

As can be clearly seen from the graphs, the most noticeable effects are found especially with the latest reminders. A total of 790 natural mineral water and thermal water questionnaires and 3,618 quarry and mine questionnaires were collected.

Figure 4 shows the trend of data collection, in particular the collection of questionnaires sent on the expected questionnaires in percentage terms for the two issues in the survey period.

Figure 4 - *Questionnaires sent on expected questionnaires. Natural and Thermal Mineral Waters and Quarries and Mines. Italy. 2022-2023 edition. Percentage values.*



The Umbria Region should be reported as a virtuous region, which completed the survey in the first week of data collection and two Institutions for each survey (for waters the Liguria Region and the Caltanissetta Mining District, for quarries and mines the Sardinia Region and the Caltanissetta Mining District), which replied after the end of the survey, as a consequence of the memorandum of 30 January 2023, for which it was been necessary to extend the survey until 20 February 2023.

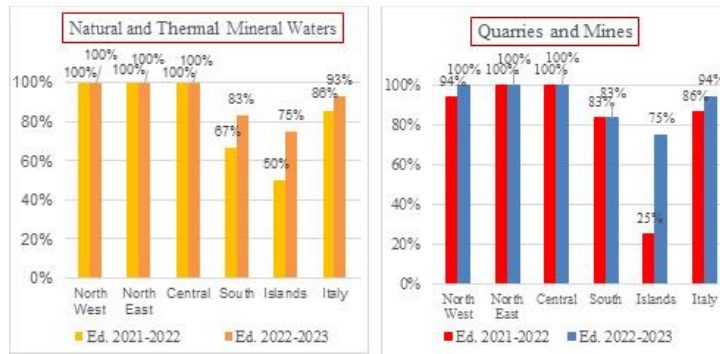
The Region of Calabria and the Mining District of Palermo were totally in default.

4.2. Response rate

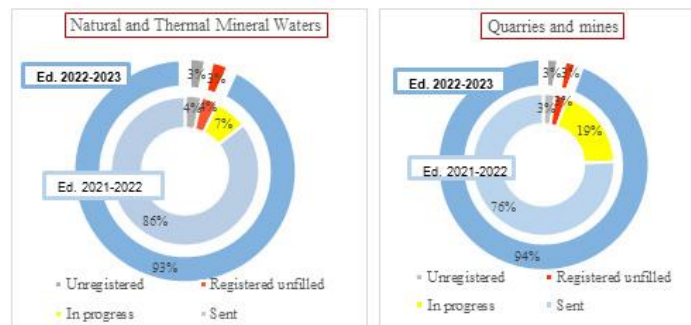
In the 2022-2023 edition, the response rate was slightly lower than 95% for both surveys, recording an increase, compared to the previous edition, of about 8 percentage points. The increase is due to the greater participation of the Agencies of the Northwest, of the South and above all of the Islands.

Figures 5 and 6 show the response rate of the survey for the two issues and by territory comparing the data of the 2021-2022 edition and the 2022-2023 edition.

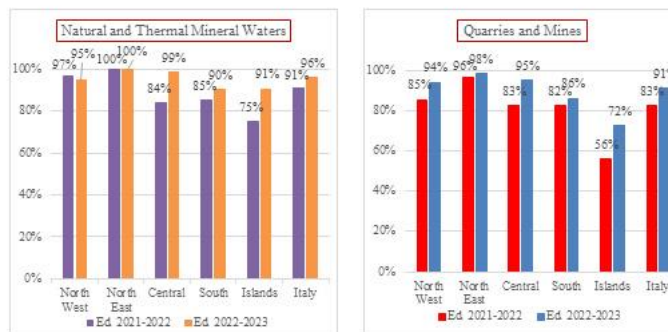
Figures 5 and 6 - Response rate for the two themes and geographical breakdown. 2021-2022 and 2022-2023 editions. Percentage values.



Figures 7 and 8 - Processing status of the questionnaires for the two topics. 2021-2022 and 2022-2023 editions. Percentage values.



Figures 9 and 10 – Coverage rate of expected questionnaires for the two themes. 2021-2022 and 2022-2023 editions. Percentage values.



In the 2021-2022 edition there was also a partial submission of data by two Institutions for the theme "quarries and mines".

In the 2022-2023 edition, unlike what happened in the previous edition, for both surveys, Mineral and thermal waters and Quarries and mines, all the Institutions that participated in the survey, sent the required data by the end of the collection with no Institution left in the state "in progress", Figures 7 and 8.

In the last edition of the survey, more than 90% of the expected questionnaires were received, with an increase, compared to the 2021-2022 edition, of 5 percentage points for the survey on mineral and thermal waters and 8 percentage points for the survey on quarries and mines, Figures 9 and 10.

5. Conclusion

The creation of a comprehensive and up-to-date information framework at territorial level is useful for economic and environmental analysis, allowing the planning of national policy strategies on raw materials, for their sustainable exploitation and for the identification of specific intervention measures at national and territorial level.

Data collection is one of the fundamental activities within the production process of a data; the study of operational strategies to improve the quality, timeliness and response rate, are, therefore, of primary importance.

Since the first edition of the survey, Istat has tried to introduce important changes in the data collection process, implementing methodological innovations that would allow to standardize the collected information and improve the quality of statistical production (ISTAT, 2013-2014, 2015-2016, 2017, 2018, 2020).

The 2022 edition was characterized by the introduction of some important innovations in data collection that have allowed to carry out the survey with greater efficiency and effectiveness. In this contribution we highlighted the role of monitoring to improve data quality.

The use of careful monitoring carried out throughout the survey, not only using the classic reports of the Gino++ Portal, but also through a timely comparison between expected sites and sent sites, identified any missing information to be requested from respondents.

The designed and implemented process was therefore effective, it performed very well the tasks for which it was created, and efficient as specified quantitatively in the analysis of the monitoring results.

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