statistiche report

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INNOVATION IN ENTERPRISES | YEARS 2020-2022

Enterprises innovate more also among SMEs, more eco-innovations in large enterprises

Between 2020 and 2022, 58.6% of enterprises are engaged in innovation activities.

The propensity to innovate affects all enterprises, including the small ones, where the share of those involved in innovation activities is 55.8% among those with 10 to 49 employees.

Industry leads in innovation, with 65.1% of enterprises undertaking innovative activities. It is followed by Services at 56.1% and Construction at 46.7%.

32,8%

The share of product innovators

+57,0% in large enterprises

30,6

Billion euros spent in innovation-related expenditures in 2022

Research and Development (R&D) is the main activity, accounting for 63.0% of the total expenditure

40,1%

The share of enterprises introduced eco-innovations

Large enterprises leading at 62.1%

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Innovation concerns all enterprises, including the small ones

Between 2020 and 2022, 58.6% of enterprises in the industrial and service sectors with 10 or more employed persons are engaged in innovation activities[i].

The relationship between firm size and innovation propensity[ii] persists: the percentage moves from 55.8% in small enterprises (10-49 employees), to 74.3% in the medium-sized ones (50-249 employees), reaching 84.7% in the large ones (250+ employees)[iii] (Table 1.1).

Industry leads with 65.1% of enterprises involved in innovation investments[iv]. It is followed by Services at 56.1% and Construction at 46.7% (Table 1.1). Innovation propensity varies widely by sector. The most innovative industrial sectors include Pharmaceuticals, Electronics, and Automotive Manufacturing (over 80% of enterprises engaged in innovation – Table 1.2). Other relevant sectors are Chemicals, Machinery and Rubber and Plastic, where three out of four enterprises innovate. In Services, the most innovative sectors are Research and Development, Insurance, Advertising, Market Research, and IT, with over 75% of innovative enterprises in 2020-2022 period (Table 1.3).

Among enterprises with innovation activities between 2020 and 2022, 55.7% successfully introduced at least one product or process innovation. Large enterprises led (81.6%), compared to 53.0% among small enterprises. Industry exceeded the national average with a rate of 61.5% (Table 2.1).

KEY INDICATORS ON ENTERPRISES' INNOVATION

Years 2020-2022, percentages on total enterprises (unless otherwise indicated)

MACRO-SECTOR AND SIZE CLASS	Enterprises with innovation activity*	Innovators**	Product innovators	Process innovators	Innovative enterprises with co-operation agreements***	Innovation expenditure per employee (billion euros)**Year 2022
Industry in the strict sense	65,1	61,5	37,7	58,2	26,1	7,8
Construction	46,7	44,1	20,3	42,9	12,2	3,0
Services	56,1	53,9	32,1	51,1	21,6	3,4
10-49 employed persons	55,8	53,0	30,9	50,2	19,7	6,1
50-249 employed persons	74,3	71,2	42,6	68,2	33,4	4,2
250 employed persons and more	84,7	81,6	57,0	79,0	52,1	5,7
Totale	**58,6**	**55,7**	**32,8**	**53,0**	**22,7**	**5,4**

(*) Innovative activities completed, ongoing, or abandoned as of the end of 2022.
(**) Enterprises that successfully introduced product or process innovations, either in the market or within the company, during the 2020–2022 period.
(***) % on total enterprises with innovation activities.

One in three enterprises innovates products

32.8% of enterprises introduced at least a product innovation[v] during the 2020-2022 period, with investment varying by firms' size and sector (Table 2.1). While just 30.9% of small enterprises invested in new products, the percentage rose to 42.6% among medium-sized enterprises and 57.0% among large enterprises (Figure 1).

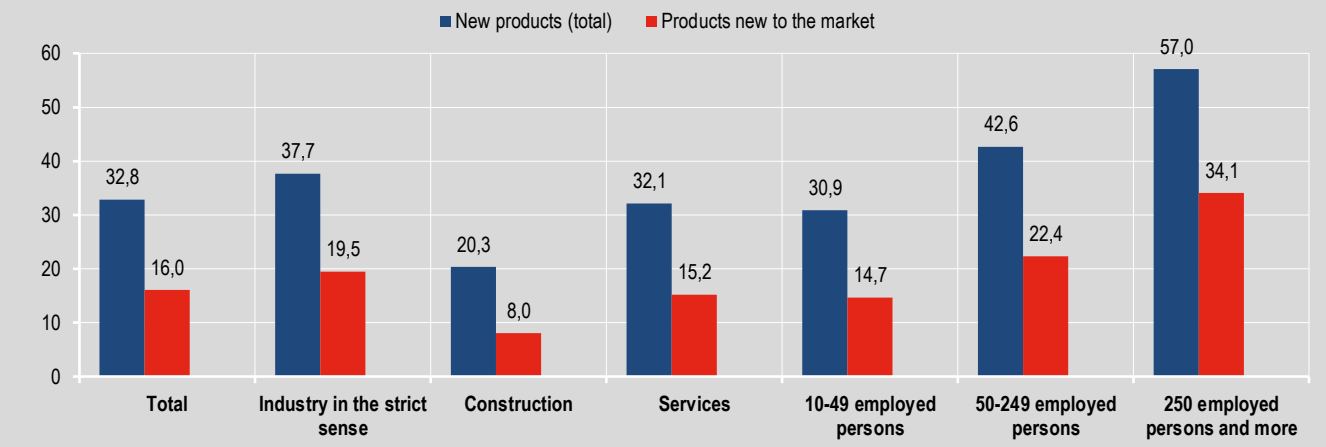
At sectoral level, industrial enterprises show the greatest propensity to introduce new products, followed by Services (32.1%) and Construction (20.3%) (Table 2.1). Among industry, the main players in product innovation are Electronics (with two out of three enterprises engaged in product innovation), Chemicals and Pharmaceuticals, Vehicles manufacturing and Machinery, all with more than half of their enterprises innovating products (Table 2.2). In Services, Advertising and Market research, Insurance, Research and development, and IT lead the ranking, recording percentages of product innovators greater than 50% (Table 2.3).

Although some sectors show a strong orientation towards product innovation, as overall, process innovation remains more common, with 53.0% of enterprises investing in new or significantly improved processes. Process innovation is also widespread among small enterprises, increasing among the medium-sized ones (68.2%) and reaches a peak among the large ones (79.0%) (Table 2.1). Process innovators account for over half of enterprises in Industry and Services, while they drop to 42.9% in Construction. Pharmaceuticals, Automotive and Electronics industries, as well as Insurance and Market research services, lead process innovation, with over 75% of process innovators (Tables 2.2 and 2.3).

Among enterprises engaged in product innovations, only half (that is, 16% of all the Italian enterprises), introduced products new to their respective markets[vi] (Table 3.1). A higher frequency is observed in Industry, and their presence significantly increases in large enterprises, where they represent 34.1% of the total.

The types of process innovations are highly diverse and refer to various aspects of business activities[vii]. The most common process innovations are related to methods for producing or developing goods or providing services (30.5%), followed by innovations in information systems (29.8%) and innovations in the methods of organizing work responsibility, decision making or human resource management (29.7%) (Table 4.1). Two out of ten enterprises invested in new marketing methods (22.6%), in new business practices for organizing procedures or external relations (19.9%), and in innovations in accounting and other administrative operations (19.6%). The least frequent innovations are those introduced in logistics, delivery or distribution methods (15.0%). Small enterprises innovate less than the national average in all the categories of process innovations. At the sectoral level, the most widespread process innovations are those in methods for producing or developing goods or providing services in Industry (40.5%), information systems in Services (30.7%) and in the work organization and human resources management in Construction (27.2%).

FIGURE 1. PRODUCT INNOVATORS BY TYPE OF INNOVATION, MACRO-SECTOR AND SIZE CLASS. Years 2020-2022, percentages on total enterprises



Source: Istat, Rilevazioni sull'Innovazione nelle Imprese

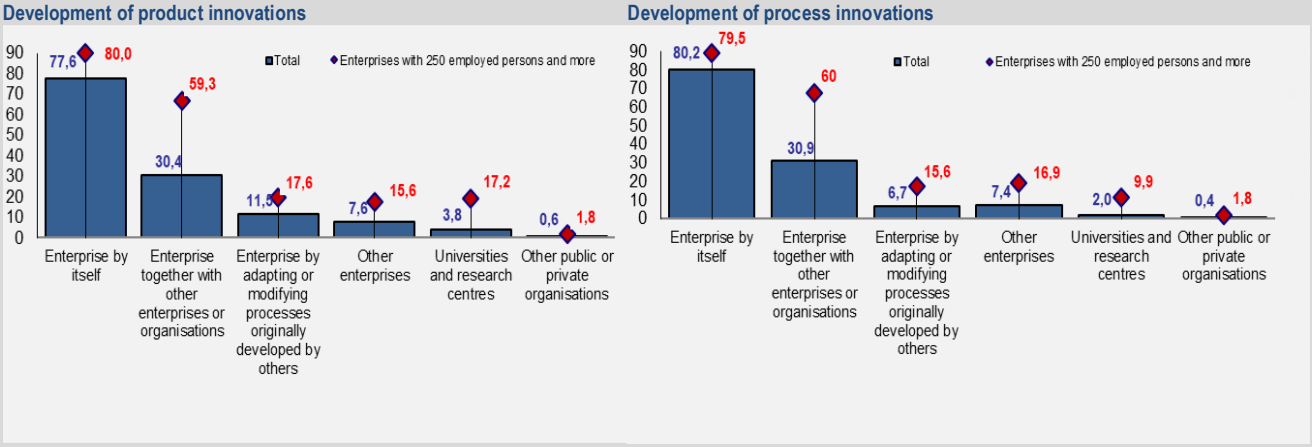
Collaboration with others in innovation development is still not widespread

Collaboration with external partners in innovation development is unusual, with most enterprises (77.6% of product innovators and 80.2% of process innovators) relying solely on internal resources (Figure 2). The decision to use external economic and knowledge resources through collaborations with others (enterprises or public and private institutions, such as universities, research centers and the nonprofit sector) involves less than a third of innovators, while only 10% rely on innovations developed externally (with most coming from other enterprises). Finally, 11.5% of product innovators and 6.7% of process innovators implement innovations by adapting or modifying existing products or processes (i.e., developed by others)[viii].

As firm size increases, the share of enterprises opting for external collaborations grows significantly, from 27.3% among small enterprises to 59.3% among the large ones in product innovation, and from 28.0% to 60.4% in process innovation (Tables 5.1). Among large firms, there is also an increase in purchasing innovation externally; specifically, 17.2% of large enterprises acquire new products/services from universities and the research sector (compared to 3.8% of all enterprises), and 9.9% purchase new processes (compared to 2.0% of the total).

At sector level, industrial enterprises tend to innovate without relying on external resources. This trend is particularly evident among enterprises developing products (85.3%) but is also present among process innovators (82.4%). Conversely, service enterprises are more inclined to collaborate with others or to adopt new technologies developed outside their own production scope. This approach is more pronounced in enterprises that have developed new products: 33.7% collaborate with external parties and 14.7% directly purchase new products from external sources. In the service sector, enterprises in Finance, Insurance, and Research and Development are the most open to external collaborations (with over half opting for this approach). However, the choice to collaborate with others in innovation activities also applies to the majority of industrial enterprises in Electronics, Other Transport manufacturing, and Pharmaceuticals, particularly in terms of product innovation (Tables 5.2 and 5.3).

FIGURE 2. INNOVATORS BY TYPE OF INNOVATION DEVELOPMENT, TOTAL AND LARGE ENTERPRISES. Years 2020-2022, percentages on total enterprises



Source: Istat, Rilevazioni sull'Innovazione nelle Imprese

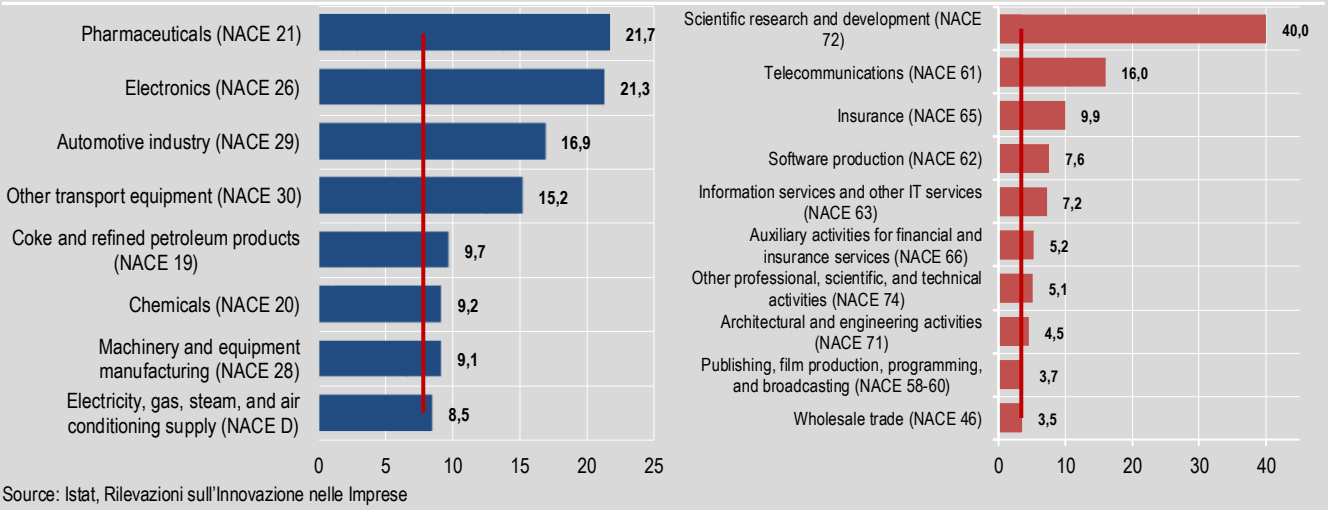
Innovation expenditure per employee is higher in small enterprises

In 2022, expenditure on innovation activities amounted to a total of €30.6 billion, and the innovation intensity, calculated as the expenditure per employee[ix], averaged €5,400 per employee (Table 6.1). This is higher in small enterprises (€6,100 compared to €4,200 for the medium-sized ones and €5,700 for the large ones) and in the industry (€7,800 compared to €3,000 for construction and €3,400 for services). The highest innovation intensity is shown in industrial large enterprises (€9,700). Specifically, within the industry, the best performances are in Pharmaceuticals (€21,700), Electronics (€21,300), and the manufacture of Motor Vehicles (€16,900), while Research and Development and Telecommunications have the highest expenditure per employee in services (respectively €40,000 and €16,000) (Figure 3).

Research and Development (R&D) is the main component of innovation expenditures: overall, 63.0% of total expenditures are represented by R&D, primarily carried out internally (53.9%), while only a small portion comes from R&D services purchased externally (9.1%) (Table 6.1). Among other innovation expenses[x], capital expenditure for innovation ranks second (14.7%). This is followed by expenses for internal personnel engaged in innovation activities (10.0%) and those for the purchase of goods and services for innovation (8.7%).

Significant differences emerge at dimensional level. On average, the incidence of R&D increases with the size of the business, rising overall from 44.0% for enterprises with 10-49 employees to 73.7% for those with 250 or more employees. Conversely, as business size increases, the share of other innovation expenses decreases (from 56.0% to 26.3%). Innovative activities are largely driven by R&D in the Industry, where, on average, two-thirds of innovation expenditure is allocated to such activities (conducted internally or commissioned to other enterprises or institutions) (Table 6.2). In services, R&D (both internal and external) represents a strategic component of innovative activities in Research and Development (90.9% of total expenditure) and in IT (81.7%) (Table 6.3). On the other hand, other innovation expenses (i.e., those not allocated to R&D activities) are the predominant mode of innovation in Construction (52.6%), in certain industrial sectors with high economies of scale such as Electricity and Gas supply (78.8%), and in Services such as Real Estate activities (85.6%), Retail trade (79.0%), and Transportation (75.7%).

FIGURE 3. INNOVATION EXPENDITURE PER EMPLOYEE OF HIGHLY INNOVATIVE SECTORS - INDUSTRY IN THE STRICT SENSE AND SERVICES. Year 2022, thousands euros (economic activities with expenditure values per employee above the sectoral average)



Source: Istat, Rilevazioni sull'Innovazione nelle Imprese

Tax credits and national financial support, the main public incentives for innovation

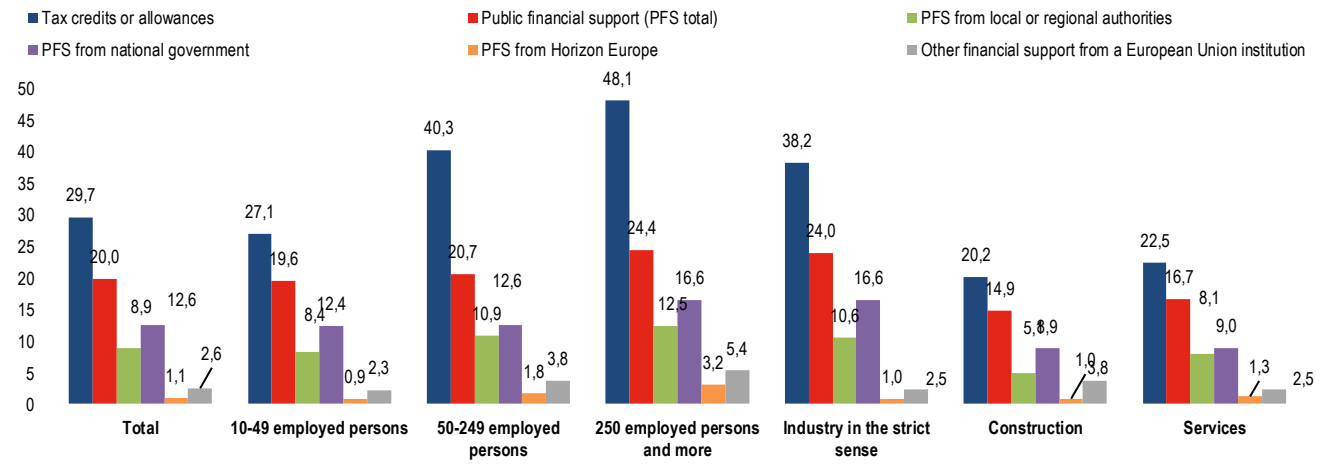
In the 2020-2022 period, the public support for innovation is rather limited: only 20.0% of enterprises engaged in innovative activities received public funding for innovation, primarily large enterprises (Figure 4). At dimensional level, the percentage of enterprises benefiting from public funding for innovation increases among the large ones (24.4% compared to 19.6% for the small ones) (Table 7.1). The percentage is higher in the Industry in the strict sense (24.0%) compared to Construction (14.9%) and Services (16.7%).

Public funding for innovation is primarily granted by local and central administrations[xi]: overall, 12.6% of enterprises with innovative activities reported to have received funds from central public administrations, and 8.9% from regional or local administrations, while only 1.1% received support from the European Union under the Horizon Program[xii] and 2.6% obtained other forms of funding from the EU.

The use of tax incentives is slightly more widespread, with 29.7% of enterprises with innovative activities benefiting of them. Even for this type of public support, large enterprises are the main beneficiaries: 48.1% compared to 27.1% of the small ones. At the sectoral level, it is the Industry that makes more use of incentives (38.2% compared to 22.5% in Services and 20.2% in Construction).

Also the use of other forms of financing is not common: only 20.6% of enterprises applied for and obtained loans for innovation activities carried out in the 2020-2022 period. Equity financing is also rare, affecting just 1.7% of enterprises engaged in innovation.

FIGURE 4. ENTERPRISES OBTAINING A PUBBLIC SUPPORT TO INNOVATION BY TYPE OF MEASURE.
Years 2020-2022, percentages on total enterprises with innovation activities



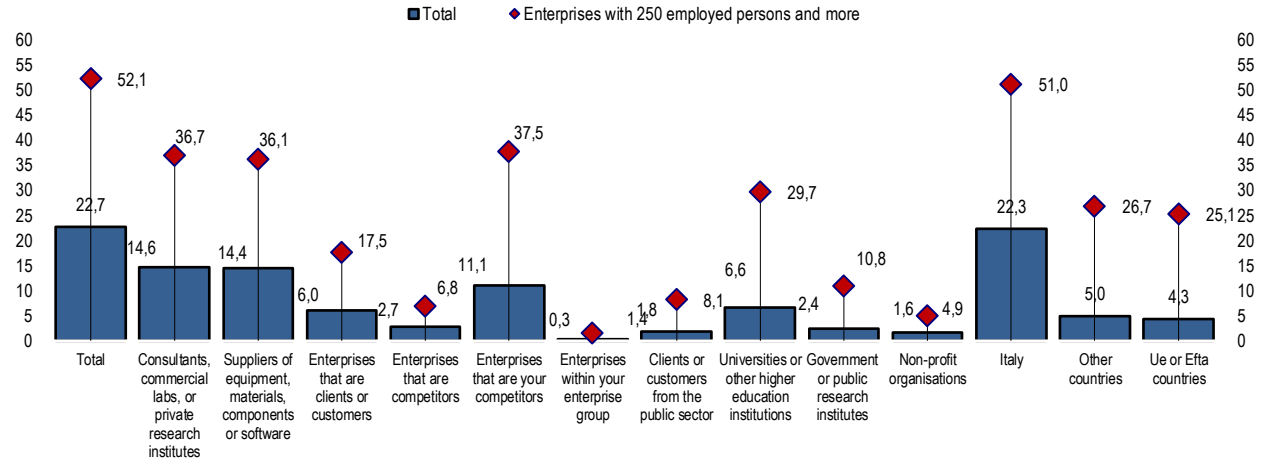
Source: Istat, Rilevazioni sull'Innovazione nelle Imprese

One in four enterprises reports a lack of resources for innovation

Most enterprises engaged in innovative activities from 2020 to 2022 are satisfied with their innovation choices: less than half (42.5%) state that they did not have other innovative activities because they did not need to, and only 25.9% claim they did not engage in additional innovation activities due to a lack of resources (financial, personnel, etc.), while 31.5% report other reasons (e.g. strategic reasons; not the right time to innovate; other priorities; risks too high; low expected returns) that limited their innovative activities (Table 9.1)[xiii].

The lack of resources appears to primarily affect small enterprises: a total of 27.0% of these enterprises report not having additional innovative activities due to a lack of resources, compared to 21.9% of large enterprises. Firms' size plays an even more significant role in the Construction and Services, where differences of over 8 percentage points are observed between small and large enterprises. Industry experiences the most pronounced issue of resource shortages as the main deterrent to undertaking further forms of innovation: 28.3% of firms cite this problem, compared to 20.3% in Construction and 24.8% in Services. Conversely, one in two Construction believes that there were no particular reasons that hindered the implementation of additional innovative activities; simply, there was no need to initiate further activities of this kind.

FIGURE 5. ENTERPRISES WITH COOPERATION AGREEMENTS FOR INNOVATION BY TYPE OF PARTNER, TOTAL AND LARGE ENTERPRISES. Years 2020-2022, percentages on total enterprises with innovation activities



Source: Istat, Rilevazioni sull'Innovazione nelle Imprese

Large industrial enterprises are more open to environmental actions in innovation

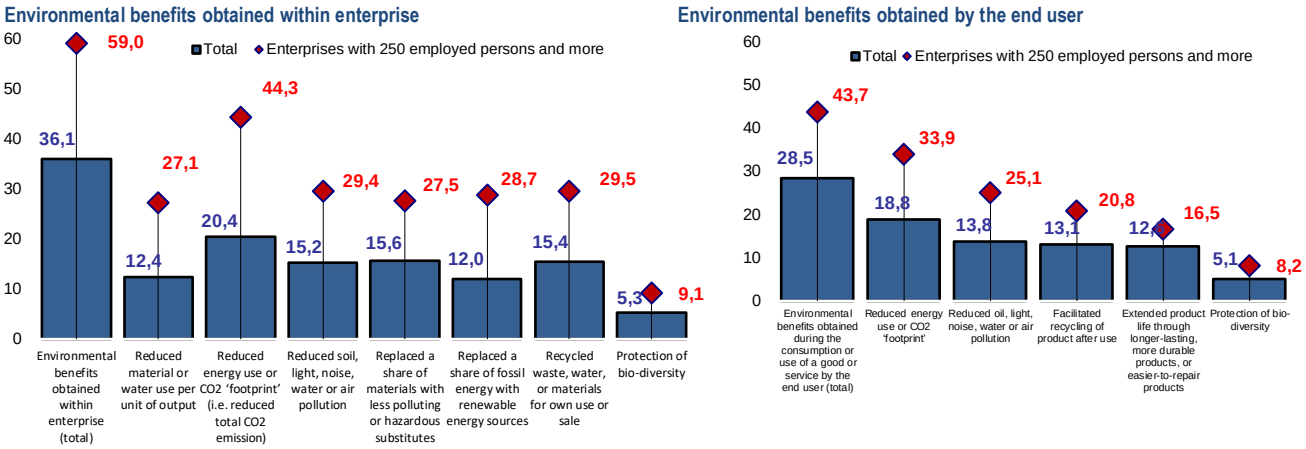
The objectives of undertaking low environmental impact actions and reconciling innovation with environmental protection involved 40.1% of enterprises that innovated products or processes in the 2020-2022 period. In 36.1% of these enterprises, the implementation of innovations resulted in positive environmental effects during production, while in 28.5%, benefits were obtained during the consumption and use of goods and services (Figure 6).

The most frequent actions involved reducing energy consumption and decreasing CO2 emissions, both during production (20.4%) and in the use/consumption of goods and services (18.8%). Less common were initiatives aimed at replacing traditional materials with less polluting or hazardous substitutes (15.6%) and reducing (soil, light, noise, water or air) pollution during production (15.2%) and consumption (13.8%). Similar percentages were recorded for the adoption of practices aimed at recycling waste and materials and water recycling (15.4%) or recycling products after use (13.1%). Commitment to biodiversity protection was more limited, both during production and by end-users (5% of innovating enterprises).

The greater attention of large enterprises to environmental sustainability is confirmed (62.1% compared to 37.9% of small enterprises), and the environment-friendly orientation is more pronounced in Industry, where 72.3% of large enterprises took environmental considerations into account in their innovative pathways (Table 10.1). The same differences are observed in the actions taken to reduce environmental impact within enterprises, especially concerning energy savings and the reduction of CO2 emissions (+29 percentage points for large enterprises compared to the small ones). Commitment to environmental sustainability is higher among innovative construction firms (49.1%), in Industry it concerns 44.1% of enterprises, while in Services it still affects only one in three.

The adoption of innovative low-impact environmental practices represents an opportunity for many enterprises to reduce costs related to energy, water and materials, as well as to build a strong and positive corporate reputation: 68.3% and 67.6% of innovative enterprises respectively considered these two aspects as important drivers for the introduction of eco-innovations[xiv].

FIGURE 6. ENTERPRISES THAT INTRODUCED ENIVIRONMENTAL-FRIENDLY INNOVATION.
Years 2020-2022, percentages on total innovators



Source: Istat, Rilevazioni sull'Innovazione nelle Imprese

An equally important push for sustainability comes from the need to comply with existing environmental regulations, which has affected 58.3% of innovators (Table 11.1). More than half of the enterprises (54.9%) considered voluntary actions and initiatives as important driving factors for the development or introduction of low-impact environmental innovations. The availability of grants, subsidies and other financial incentives, on one hand, and the existence of a current or expected market demand for environmental innovations, on the other, were seen as important drivers by 48.2% and 45.6% of enterprises, respectively.

Large enterprises are more sensitive to the improvement of corporate reputation (74.6% compared to 66.5% of small enterprises) and to the growing market demand for environmental innovations (52.6% compared to 44.6%), while small enterprises are more driven by cost reduction, which is important for 68.9% compared to 64.3% of large enterprises. The most receptive sector to these drivers is Construction.

Methodological note

Introduction

The Community Innovation Survey (CIS) is conducted based on EU Regulation No. 2152/2019, which aims at collecting information on the innovation activities of European enterprises. Specifically, the survey provides an integrated set of indicators able to quantify innovation (in terms of involved enterprises and expenditures sustained for it) and to qualify related innovative activities. Additionally, the survey seeks to analyze enterprises' strategies, behaviors and innovation performances, as well as the factors that hinder or support innovation and the complex systemic interactions that occur among participants in the innovation process. The survey's ultimate goal is to help measure the complexity and heterogeneity of innovation processes within enterprises. A dedicated section of the questionnaire focuses on environmental innovations.

The survey is conducted biennially (since 2004) based on standardized definitions and methodologies common to all EU countries and follows the conceptual framework outlined in the "Oslo Manual," which has been the reference for measuring technological innovation within enterprises since 1992 (OECD/Eurostat, 2015).

Significant innovations were introduced in the statistical units of survey and analysis, as well as in producing estimates for the 2020-2022 period. Consequently, starting from the current edition covering the 2020-2022 period, data are not fully comparable in historical series due to a new definition of "enterprise." Until the previous edition, the classical definition of enterprise under Regulation EC 696/93 was used, interpreting the enterprise as a single legal entity. From the current edition onwards, consistent with practices adopted by the Active Enterprise Statistical Register (Asia-Imprese) from 2019 and by other structural statistics systems, the full definition of Regulation EC 696/93 has been applied, recognizing the enterprise as a simple or complex unit, with single or multiple relationships to legal entities (for further details, see subsequent paragraphs).

The demand for quantitative and qualitative indicators on enterprises' innovation activities comes not only from the scientific community but also from policymakers seeking increasingly comprehensive, reliable, and timely information. In particular, the European Commission's need for indicators on enterprises' innovation processes to guide innovation support policies at European level has become increasingly urgent. The CIS is, in fact, one of the main tools for the systematization and updating of science and technology indicators used by the European Commission to evaluate policies. The statistics produced by the CIS are widely used for the annual update of the *European Innovation Scoreboard*, a tool created by the European Commission to compare the innovation performance of member states for monitoring and evaluating innovation policies carried out in each country.

Target Population and Units of Survey and Analysis

The target population for the survey includes all the enterprises with at least 10 employed persons active in 2022 in the following Nace sectors: extractive activities (B); manufacturing (C); electricity, gas, steam, and air conditioning supply (D); water supply, sewage, waste management, and remediation (E); construction (F); wholesale and retail trade and repair of motor vehicles and motorcycles (G); transportation and storage (H); information and communication services (J); financial and insurance activities (K); real estate activities (L); and professional, scientific, and technical activities (M, except division 75).

Starting from this CIS edition, the units of survey and analysis are "enterprises" as defined by the Asia-Ent Register (Ent=enterprise). Previously, these were considered as Legal Units (LU) that conducted productive activity for at least six months in the reference year. Changes in the definition process for the statistical unit of the enterprise were introduced to fully apply the EU Regulation 696/93 definition. Since certain legal units operate exclusively on behalf of another legal entity for administrative purposes without economic relevance, their activities are treated as auxiliary to the primary legal entity to which they belong, forming the "enterprise" entity used for economic analysis. An enterprise is thus identified on the basis of chains of control and links among its constituent units. According to this new interpretation of the enterprise

(ENT) definition from Regulation 696/93, an enterprise may be a simple or complex unit, meaning it may have a single or multiple relationships with LUs.

Although the Asia-Ent register and, consequently, the reference universe are mostly composed of simple enterprises (one enterprise corresponding to a single legal unit), they also include complex units in certain cases, which are combinations of multiple LUs. Additionally, in defining ENT, LUs may be considered as a whole if they participate exclusively in the activities of an enterprise. If they perform ancillary activities for multiple complex enterprises, they are considered on a pro-rata basis, dividing each LU across several enterprises according to the percentage of its association with each enterprise. Thus, ENT, as "groups" of LUs, can consist of one or more legal units, while a single LU may belong to one or more ENT based on its percentage association.

The target population for the survey comprises enterprises (ENT) active in 2021, covering 157,444 enterprises (source: Asia-Enterprises Register or Asia Ent). These are ENT with at least 10 employed persons and with an economic activity in the following sectors: B, C, D, E, F, G, H, J, K, L, M-excluding division 75).

Sampling Design

The sampling design is a stratified cluster sample. Clusters represent enterprises, which are stratified based on economic activity sector (Nace division), size class based on employed persons (three categories: 10-49, 50-249, and 250 or more employed persons), and region of residence (21 categories, corresponding to level 2 of the European NUTS classification), resulting in a total of 2,541 strata. For each enterprise, all associated Legal Units (LU) are selected, excluding those not within the survey scope (i.e., non-resident in Italy, ceased operations before July 1, 2022, fewer than 10 employed persons or with economic activity outside the relevant sectors).

The theoretical sample includes 24,963 enterprises and 38,993 LUs. The sample allocation was also determined in terms of enterprises. The number of enterprises to be surveyed in each stratum was determined using multivariate, multi-domain optimal allocation methodology, implemented in the R2BEAT software (Barcaroli et al., 2023), developed within the R environment.

Sample size and allocation across strata were designed to ensure that estimates of employed persons and turnover - variables closely tied to the survey's key metrics - do not exceed, for each domain of interest, a maximum error defined in terms of Coefficient of Variation (CV). The domains of interest and the CV-based error limits are as follows:

1. NACE Rev.2 Division (excluding Construction, for which the Section level is considered)
2. NACE Rev.2 Section x Size Class (three size classes are defined: 10-49 employed persons, 50-249 employed persons, and 250 or more employed persons).
3. Sector ('EU Core', 'EU Non-core') x Size Class x NUTS Region. Sectors are divided into 'EU Core' and 'EU Non-core' categories. The term 'EU Core' refer to specific sector classification defined for comparing data across European countries because the sectors included in it are surveyed by all the member states. EU Non-core is the complement to 1 of Eu core. Each of these categories is further subdivided by two size classes: 10-249 employed persons and 250 or more employed persons. Additionally, each of these strata is analyzed across 21 regions based on the NUTS 2 classification.

In each stratum, enterprises were selected with equal probability, and within each selected enterprise, information was gathered for all Legal Units (LU) that fall within the survey's scope.

Data Collection and Response Rate

The reference list for units to which the questionnaire was sent was the Statistical Archive of Legal Units active for at least six months (Asia LU). The initial sample consisted of 38,933 active LUs in 2021.

Data collection was conducted through a self-administered electronic questionnaire, formatted as multiple web pages grouped into various thematic sections. Respondents accessed the questionnaire via the Istat statistical Portal for enterprises using a personal username and password provided by Istat. Initial contacts and reminders were sent via certified email.

The data collection period ran from October to December 2023. The reference universe included 156,624 enterprises (ENT) and 193,026 legal units (LU) for 2021. Out of the theoretical sample of 24,963 ENT, 17,929 responded, reaching a response rate of 71.8%. For the theoretical sample of 38,933 LUs, 26,287 responded, with a response rate of 67.5%.

Data Processing: Procedure, Tools, and Techniques

Validation and Correction of Responding LUs' Data

The data from responding Legal Units (LU) underwent a multi-phase validation and correction process based on Eurostat's standard procedures. This involved three main steps:

1 Detection of non-sampling errors. The initial step focused on identifying deterministic errors, including domain errors, partial non-responses, anomalous values, inconsistencies, and coding errors. These errors were identified using Eurostat-specified edits, which are based on internal questionnaire rules.

2 Imputation of missing and erroneous values. Missing and incorrect values were addressed through a sequence of automated deterministic and probabilistic imputation procedures, selected according to variable type (quantitative or qualitative) and the error identified. This correction process comprised three stages:
- Logical-Deductive Imputation. An initial pass of logical-deductive imputation procedures eliminated internal inconsistencies within each record by applying a system of constraints and logical relationships between variables.
- Imputation of Quantitative Variables. For quantitative variables, a “ratio estimator” was used. This estimator is based on predefined relationships between the variables needing imputation and auxiliary variables with a high correlation to the target values.
- Imputation for Qualitative Variables. For qualitative (dichotomous or ordinal categorical) variables, the "hot deck donor" method was used. This involved finding the "nearest" donor record, whose values allowed the recipient to meet all edit checks. The donor was selected to minimize the distance between donor and recipient records.

3 Data Validation. The data was validated by comparing aggregated and weighted corrected data with historical or auxiliary data to identify any suspicious patterns or inconsistencies.

Transition from Corrected LU Microdata to ENT Microdata

After completing the validation and correction process for LUs, the next step was to estimate the variables at the enterprise (ENT) level based on the new enterprise definition, which considers an ENT as the "most suitable" combination of LUs. Key steps included:

1. Identification of the Representative Cluster. A "representative cluster" was identified for each ENT, representing the subset of LUs that comprise each enterprise.
2. Consolidation of Variables. Variables were categorized as additive or non-additive for consolidation:
   - Additive Variables. Variables like expenditures and employed persons were aggregated by summing the values for the LUs within each ENT, adjusted according to each LU’s share of the ENT.
   - Non-Additive Variables. For non-additive qualitative variables (dichotomous or categorical), different rules were applied. For binary variables (e.g., 1=success, 0=failure), if both values were present, the ENT inherited a "1" for success. For what concerns the variables with multiple non-ordered categories, they were converted to binary indicators, where "0" represented absence and "1" presence of each category. The binary rule applied as with other binary variables. Finally, for ordinal variables (e.g., importance levels), the value was derived as the weighted average of the responses from each LU, using the number of employed persons as weights. For example, if an ENT comprises three LUs of different sizes (10, 100, and 1000 employed persons) that rated a factor influencing the adoption of low-impact innovations differently (e.g., 3=high, 2=medium, 1=low), the ENT's final value for the variable (e.g., ENV_ENREP for "improvement of corporate reputation") was calculated as “1,” reflecting the weighted average of the responses.

Calibration of sample weights and sampling errors

To address non-response and ensure that estimates align with the totals from the ASIA UG and ASIA ENT registers for 2021, sample weights were adjusted through a calibration process. This adjustment ensured consistency across each of the survey's domains of interest (listed before) by meeting the following constraints:

- the number of enterprises,
- the number of Legal Units (LUs),
- the number of employed persons per enterprise.

A total of 483 constraints were applied in the calibration. Although the number of employed persons per LU was not directly considered, this approach controlled the estimate of the national LU employed persons' number, resulting in a minimal discrepancy of under 4,000 employed persons when compared with the total provided by the ASIA UG register.
The calibration was conducted using a linear distance function with a lower limit set at 0.1 to prevent negative weights. This calibration, along with the estimation and sampling error calculation, was executed in ReGenesees, a software developed in R for the design-based and model-assisted analysis of complex sample surveys (Zardetto, 2015).
The calibrated weights derived from this process were applied to produce enterprise-level (ENT) estimates. For LU-level estimates, a corresponding system of weights was generated to maintain consistency with enterprise weights. Specifically, to each LU was assigned the weight of its corresponding enterprise. For LUs associated with multiple enterprises, the weight was calculated by summing the weights of all enterprises with which the LU was associated.

To evaluate the accuracy of the survey's estimates, sampling error was calculated and expressed in terms of relative error or Coefficient of Variation (CV). These relative errors are presented in Table 1, showing the CIS key indicators across size classes and macro-economic sectors.

Table 1 – Relative errors for the CIS key indicators by size class and economic activity

Size class	Enterprises with innovation activities (% of total enterprises)	Product innovators (% of total enterprises)	Enterprises with new products for the market (% of total product innovators)	Enterprises that developed product innovations Internally (% of total product innovators)	Enterprises that developed product innovations in collaboration with other enterprises or institutions (% of total product innovators)	Process innovators (% of total enterprises)	Enterprises that developed process innovations internally (% of total process innovators)	Enterprises that developed process innovations in collaboration with other enterprises or institutions (% of total process innovators)	Enterprises with R&D activities (% of total enterprises)	Innovators with cooperation agreements (% of total enterprises)	Innovation expenditure per employee	Expenditures for external R&D services (% of total expenditure)	Expenditures for internal R&D (% of total expenditure)	Expenditures for other innovation activities (% of total expenditure)
TOTAL (NACE: B, C, D, E, F, G, H, J, K, L, M69-74)														
Total	0,8	1,8	2,3	1,1	3,1	1,2	0,9	2,6	2	3,5	15,1	3,5	17,4	15,4
10-249	0,8	1,9	2,4	1,2	3,4	1,2	0,9	2,7	2,1	3,8	17,2	2,5	25,2	17,9
250 and more	0,1	0,5	0,5	0,3	0,7	0,2	0,2	0,4	0,5	0,6	1,9	2,7	7,5	2,9
TOTAL EU CORE (NACE: B-C-D-E-46-H-J-K-71-72-73)														
Total	0,9	2,1	2,5	1,2	3,6	1,3	1	3	2,4	3,9	18,7	5	20,7	19
10-249	1	2,2	2,6	1,2	3,9	1,4	1	3,2	2,5	4,2	21,8	3,5	29,5	22,4
250 and more	0,1	0,6	0,5	0,3	0,8	0,2	0,2	0,4	0,6	0,7	2	3,2	7,7	3,1
INDUSTRY (NACE: B-E)														
Total	1,3	2,9	3,4	1,4	5,2	1,8	1,3	4,2	3,4	5,3	27,9	7,7	29,1	28,3
10-249	1,3	3	3,6	1,5	5,7	1,9	1,4	4,5	3,6	5,9	31,7	5,4	35,3	32,4
250 and more	0,2	0,7	0,6	0,4	1,1	0,3	0,3	0,5	0,8	0,9	3,3	5,3	7,6	3,7
CONSTRUCTION (NACE: F)														
Total	2,6	8	10,6	4,7	13,2	4,3	3	10	6,1	17,1	20,3	2,5	23,7	24,2
10-249	2,7	8	10,8	4,7	13,5	4,3	3	10,2	6,1	17,4	20,8	2,4	24,8	25,5
250 and more	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EU CORE SERVICES (NACE: 46-H-J-K-71-72-73)														
Total	1,2	2,7	3,3	2,1	4,5	1,7	1,3	3,7	3	5,2	15,1	3,9	27	15,6
10-249	1,3	2,8	3,4	2,2	4,8	1,8	1,3	3,9	3,1	5,6	18,5	2,7	39,8	19,7
250 and more	0,1	0,7	0,7	0,5	0,7	0,3	0,3	0,7	0,8	0,7	3,7	4,4	8,2	3,8
NON EU CORE SERVICES (NACE: 45-47-L-69-70-74)														
Total	1,8	4,2	5,8	3,8	6,8	2,6	2,1	5,2	4,2	8,8	15,7	2,5	18,1	22,4
10-249	1,8	4,3	5,9	3,8	7,1	2,7	2,1	5,5	4,3	9,4	16,6	2,4	21,6	26,5
250 and more	0,2	1,1	1,7	0,9	1,3	0,3	0,7	0,9	2,1	2	3	1,4	4,1	2,2

Output: Main indicators

The CIS objective is to provide useful indicators for analyzing strategies, behaviors, and innovative performance of European enterprises. The main phenomena observed are:

- the type of innovation (product, process);
- the types of innovation development;
- the activities performed and the expenditures incurred for innovation;
- the public support for innovation and forms of private financing for innovation;
- the cooperation agreements in innovation;
- the factors that hinder the initiation or implementation of innovative activities;

- the introduction of innovations with positive environmental impact.

Data Confidentiality Information

Data collected by the survey are protected by statistical confidentiality and are subject to personal data protection regulations. These data may be used, including in subsequent processing, exclusively for statistical purposes by entities within the National Statistical System and may be disclosed for scientific research purposes under the conditions and procedures established in Article 7 of the Code of Ethics for the processing of personal data within the National Statistical System. Estimates are disseminated in aggregate form so that it is not possible to trace back to the subjects who provide the data or to whom the data refer.

Coverage and Territorial Detail

Key innovation estimates are also available at the level of major territorial divisions and at the regional level.

Timeliness

As per EU Regulation No. 2152/2019, estimates for 2020-2022 were submitted to Eurostat within 18 months, i.e., by June 2024.

Data Dissemination

The data wuill be available on IstatData, the database of statistics currently produced by the Italian National Institute of Statistics.
The complete set of information will be available in the coming months at the ADELE laboratory. The ADELE Laboratory (for Elementary Data Analysis) is a "secure" environment where researchers from universities, institutes, research entities, or organizations—who are subject to the Code of Ethics for statistical processing outside the National Statistical System (annex A.4 of Legislative Decree 30 June 2003, No. 196)—can conduct statistical analyses that require the use of microdata.

Some innovation indicators are also disseminated through the following Istat publications:
Annuario Statistico Italiano;

Noi Italia;

Rapporto sulla competitività dei settori produttivi;

Rapporto Bes;

Rapporto SDGs: Informazioni statistiche per l'Agenda 2030 in Italia.

NOTE

[i] It should be noted that the estimates for 2022 are only partially comparable to those for previous years, as this edition introduces a redefinition of the statistical unit of analysis. Specifically, where necessary, legal entities (the focus of previous editions) have been re-aggregated or disaggregated based on information provided by the new Asia-Enterprises or Asia Ent (Enterprise) Registry. For more details, please refer to the Methodological Appendix.

[ii] The innovation rate is measured as the percentage of enterprises that engaged in activities aimed at introducing innovations during the 2020-2022 period, in relation to the total number of active enterprises in 2022.

[iii] In this Report, 'small enterprises' refer to enterprises with 10-49 employees, 'medium-sized enterprises' to those with 50-249 employees, and 'large enterprises' to those with 250 employees or more.

[iv] In this Report, Industry is defined as "industry in the strict sense," which includes the economic activities in the following Nace sections: B, C, D, and E.

[v] Product innovation consists of the introduction to the market of a new or significantly improved product or service compared to the range of products and services previously sold by the business. Product innovations also include significant changes in product design and new (or significantly improved) digital products and services. However, the resale of new products and services purchased from other enterprises and purely aesthetic changes are excluded.

[vi] Product innovations introduced for the first time in their respective markets are products and services that are new or significantly improved and have not been introduced to the market by other enterprises. These innovations may already be present in other markets different from those in which the enterprise operates. The target market should be understood in both geographic terms (regional, national, European, etc.) and in terms of type of products-services sold. Conversely, new or significantly improved products and services that are similar to those already

introduced to the market by other firms are only innovative for the business itself; that is, they are innovations relative to the range of products and services previously sold by the reporting enterprise but are not new products and services for the enterprise's reference market.

[vii] The different types of process innovations considered in the CIS concern the following business aspects: production processes and methods; logistics, distribution, and supply of products and services; information systems and information processing and communication processes; accounting systems and other administrative activities; corporate organization practices and the company's external relationships; work organization and human resources management; and marketing practices.

[viii] The questions regarding the methods for developing product and process innovations allowed for multiple answers.

[ix] The employed persons considered here are those of enterprises engaged in innovative activities.

[x] These expenditures include costs for the purchase of land and buildings, plants, machinery, equipment and movable goods, software, industrial patent rights, and intellectual property rights directly related to innovation (excluding R&D activities).

[xi] Funding from central State administrations (Ministries) or other institutions acting on their behalf.

[xii] Horizon 2020 is the European Union's Framework Programme for funding research and innovation, launched on January 1, 2014. Spanning seven years (2014-2020), it integrates all funding for research and innovation. Horizon Europe, the European Union's Framework Programme for research and innovation for the period 2021-2027, replaces Horizon 2020. The Programme spans seven years and has a total budget of €95.5 billion, including €5.4 billion allocated for the Next Generation EU recovery plan. It funds research and innovation activities – or R&I support activities – primarily through open and competitive calls for proposals. The Programme is implemented directly by the European Commission (direct management). Research and innovation activities funded by Horizon Europe must focus solely on civilian applications.

[xiii] The question on the reasons why the enterprise did not engage in other innovation activities did not allow for multiple answers. Other reasons given by enterprises include strategic reasons, other business priorities, and assessments on the unsuitability of innovating, high risks or expected returns being too low.

[xiv] The question on the drivers of low-environmental-impact innovation asked responding enterprises to rate the importance of various proposed factors (high, moderate, low, none). In this Report, we consider medium-high importance (i.e., the 'high' and 'moderate' responses). Multiple answers were allowed for this question.

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