



Institute for European
Analysis and Policy

Beyond Borders

Assessing the Impact of Digital and Green Innovation on
Firms' Export Capabilities

16 July 2024



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Dubai Hub for Made in Italy

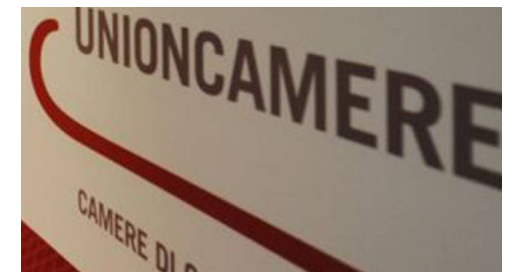
- Dubai Hub for
- Made in Italy



CENTRO STUDI DELLE
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Unioncamere survey



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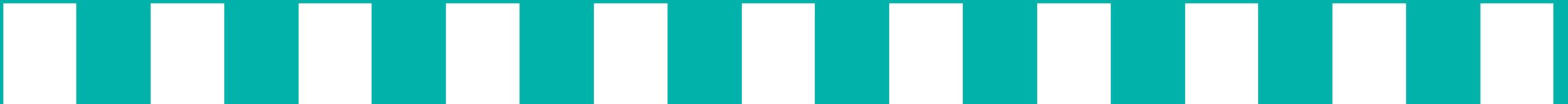
Outline of the presentation

Luiss Institute for European
Analysis and Policy

This project was realized as part of the research “*Innovation, Digitalization, and International Competitiveness: The Role of Policies for the Internationalization of Italian Companies,*” with the contribution of the Analysis, Planning, and Historical Documentation Unit of the **Ministry of Foreign Affairs and International Cooperation**, pursuant to Art. 23-bis of Presidential Decree 18/1967.

- **Theoretical framework and research gap**
- **Research question and design**
- **Data and real research setting**
- **Empirical analysis and results**

Theoretical framework and research design



Innovation and internationalization: a mutually beneficial relationship

- **Innovation** can **facilitate** companies' **entry into international markets** (Altomonte et al., 2013)
- The access to new resources and markets through **internationalization stimulates the innovative environment** of companies (Braga et al., 2017)
- O'Cass & Weerawardena (2009) emphasize the importance of available resources in maximizing the innovation-internationalization relationship, with **variations depending on firm size**
- Laurens et al. (2022) explore how multinational **R&D and geographic diversification enhance innovation productivity**, underlining the strategic importance of global operations and collaborations

Innovation and internationalization: a mutually beneficial relationship

- landolo & Ferragina (2021) **warn against oversimplifying the innovation-internationalization dynamic**, emphasizing the need for careful consideration of this interaction and potential causal challenges
- **Internationalization allows** companies to **assimilate critical knowledge** and practices for innovative development, a role highlighted by Cho & Kim (2017) as a **channel for innovation**

This set of research suggests that the path to competitive advantage on a global scale is closely linked to a firm's innovativeness and strategic engagement with international markets.

But there are still mixed results and an open debate



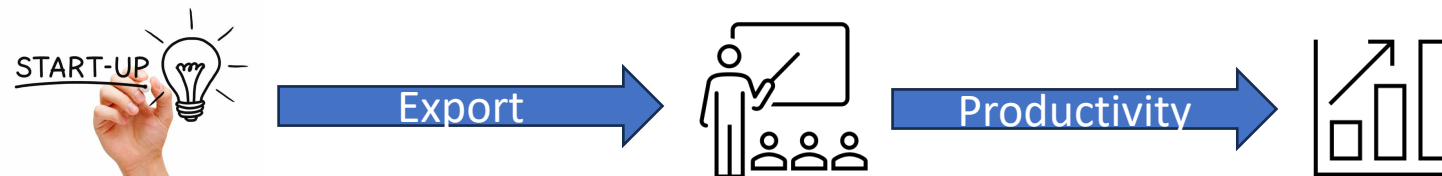
Exporting and firm performance: self-selection and learning effects

The two main conflicting theories on which the debate is still open are

- **self-selection hypothesis** suggesting that more productive firms are naturally inclined to export



- **learning-by-exporting hypothesis** proposes that firms enhance their productivity and innovation capabilities through the act of engaging in international markets



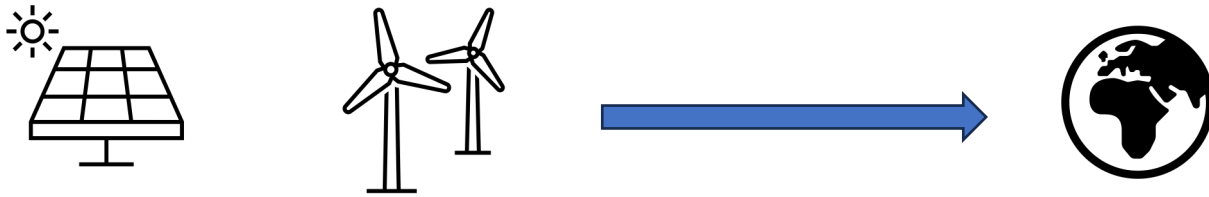
There are two determinants not yet fully explored: **digital and green innovation**

Digital innovation as drivers of export performance



- Digital innovation, identified as a **key facilitator of international trade**, includes the adoption of digital technologies and the transformation of business processes, models and ecosystems (Autio et al., 2018).
- Digital technologies **enable firms to overcome traditional barriers** to entry in foreign markets, enhance market intelligence, streamline operations, and offer innovative products and services (Luo et al., 2016)
- Digital innovation enhances internal processes and amplifies market reach and customer engagement strategies thus **positively impacting export performance** (Kotabe et al., 2017)

Green innovation as drivers of export performance



- **Green innovation**, defined as the development and implementation of environmentally friendly products, processes, and practices, has gained traction as a crucial **determinant of export success** (Kong et al., 2022; Sun et al., 2023)
- Driven by **global concerns** over environmental degradation and **consumer demand** for sustainable products, the shift towards sustainability is highlighted by Lozano (2015) as essential for export success
- Chen et al. (2006) indicate that **green innovation enhances competitive advantage** by differentiating product offerings, improving efficiency, and aligning with international environmental standards, facilitating market access
- Firms adopting **green innovations** are perceived as more responsible and trustworthy, leading to **increased export opportunities**, as shown by Boso et al. (2013)

Research hypotheses and design

Research Question 1

How do digital and green innovations impact the export performance of firms?

Quantitative research with **empirical analysis** of real data of Italian companies from 2017 to 2023

Investigating: digital and green innovation as export determinants; export barriers; enabling conditions

Research Question 2

How do international innovation hubs help companies to export?

Qualitative research by conducting **interviews** with 20 companies in the hub

Investigating: expanding market presence; strategic partnerships; innovation and adaptation; network effect

Data and research setting

Firms' export capabilities: Digital and Green innovation and the role of Public institutions

Investigating firm's export capabilities: The dataset

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Survey conducted by the **Centro Studi Tagliacarne-Unioncamere** (Italian Union of Chambers of Commerce) in 2023

Sample. 2,500 Italian manufacturing companies with between **5 and 499 employees**. The sample corresponds to 2.0 percent of the corresponding total Italian company population.

Sampling. Three dimensions of firms were considered in the stratification: i) sector (nine economic activities of section C of the manufacturing industry of the Nace Rev. 2 classification); ii) size class in terms of employees (5-9, 10-49, 50-249, 250-499); iii) geographical location (North-West, North-East, Center, South).

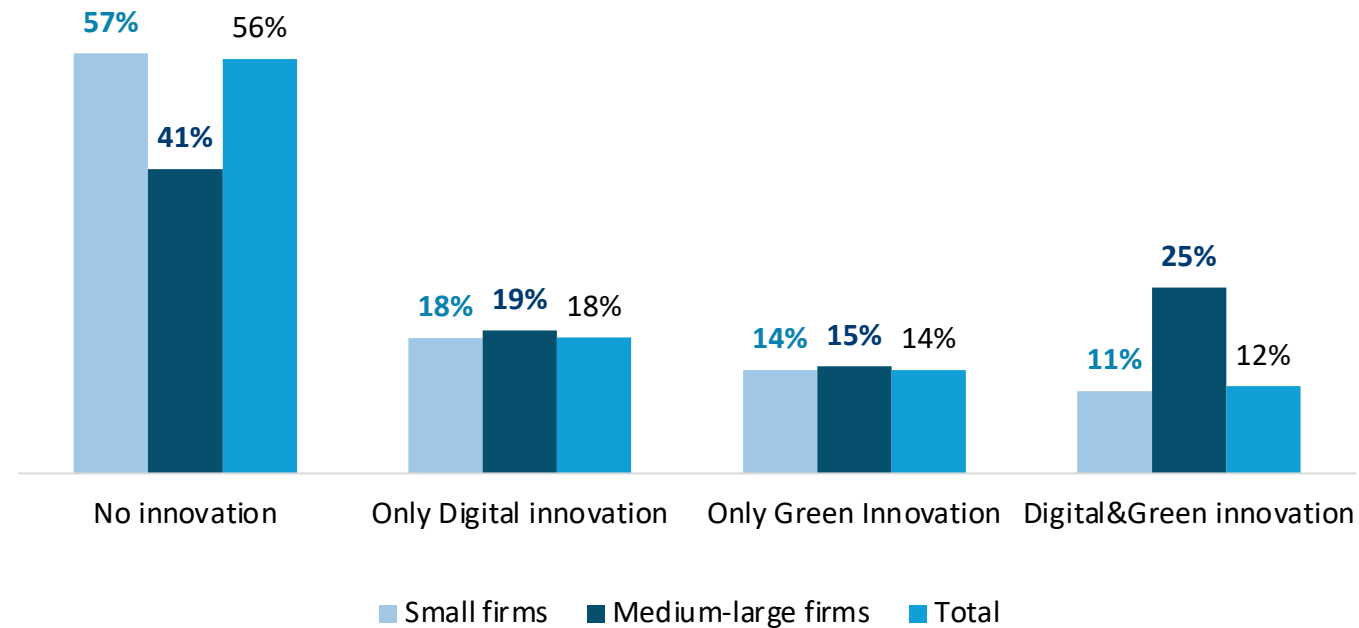
Method. CATI (Computer-Assisted Telephone Interviewing) by a professional contractor to collect both qualitative and quantitative information about the company.

Questionnaire. The questionnaire presented to the companies covered several topics (**digitalization, innovation, training activities, governance, economic performance**).

Enrichment information. The information on the **structural characteristics of the company (e.g., age, economic sector)** came from the **administrative archive**.

Digital and green innovation: Does size matter?

The innovation strategies, by size class
% of firms



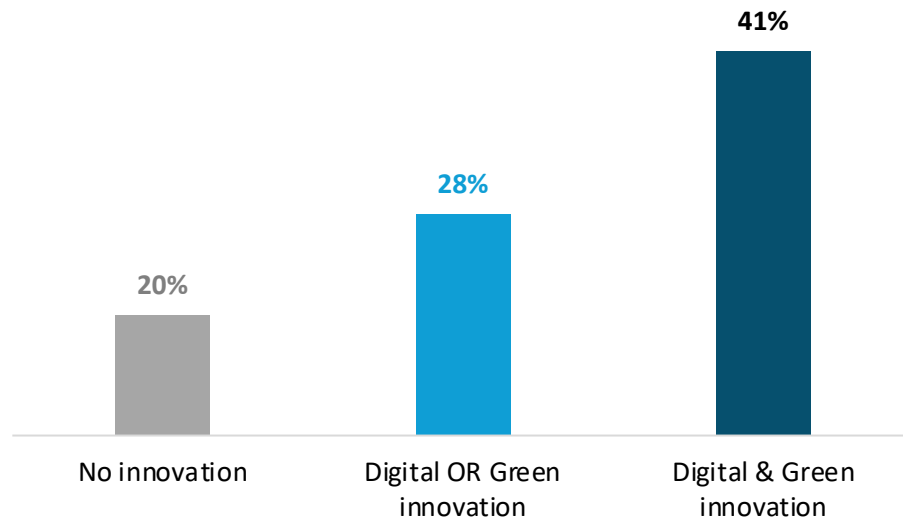
Small: 5-49 employees. Medium-large: 50-499 employees.

Source: *Centro Studi Tagliacarne survey*

Digital and green innovation for export: the importance of a synergic strategy

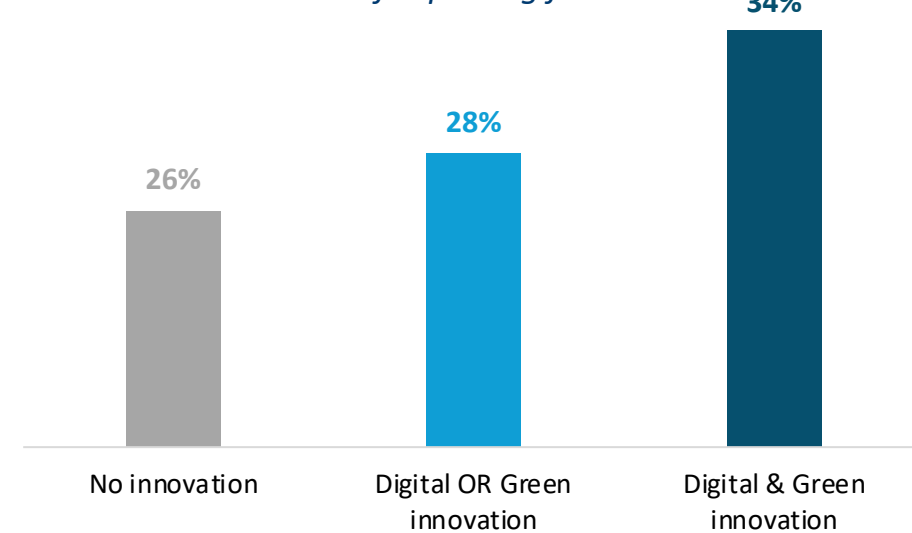
Export capability

Exporting firms, by innovation
% of firms



Export growth capability

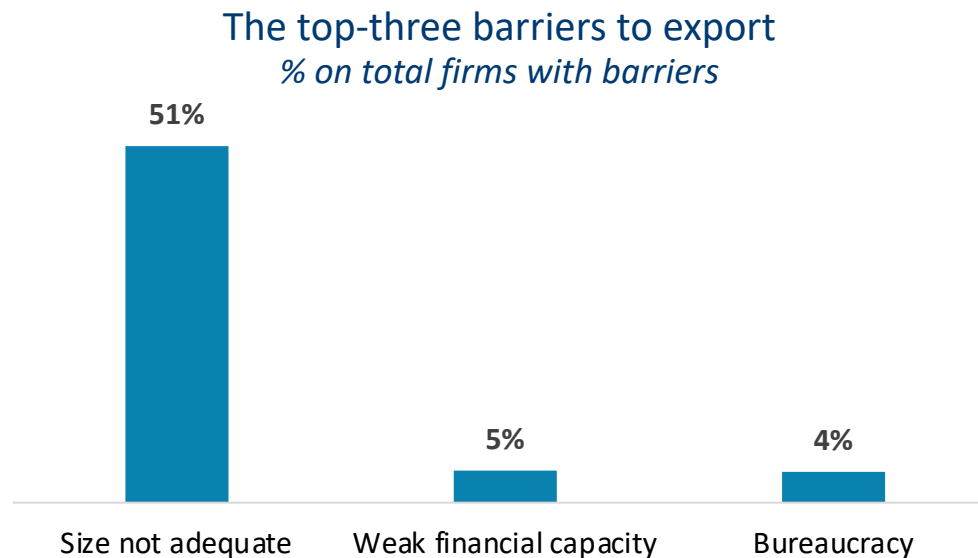
Firms with export growth in 2023, by innovation
% of exporting firms



Source: Centro Studi Tagliacarne survey

The barriers to export: the 50-50 evidence

- 46% of Italian manufacturing firm have barriers to export
- of which 51% states that the barrier concerns the firm's size inadequate... *that is in practice the only barrier!*



Source: Centro Studi Tagliacarne survey

Econometric results: DIGITAL innovation on export capabilities

DIGITAL innovation effect			
	Export	Export growth 2023	Export growth 2024
DIGITAL innovation	0.058*** (0.016)	0.037** (0.017)	0.020 (0.017)
<i>+ controls</i>			
Obs	2,448	2,448	2,448

Does the DIGITAL technological intensity matter?

	Export	Export growth 2023	Export growth 2024
DIGITAL innovation 1 technology	0.074*** (0.019)	0.032* (0.020)	0.021 (0.020)
DIGITAL innovation 2 technologies	0.111*** (0.024)	0.089*** (0.025)	0.103*** (0.025)
DIGITAL innovation 3 or more technologies	0.124*** (0.032)	0.100*** (0.036)	0.142*** (0.032)
<i>+ controls</i>			
Obs	2,448	2,448	2,448

Dependent variable at the top of the column. The table displays marginal effect of probit regression. Standard error in parentheses. Controls: geographical location, sector, size, firm age, family governance, human capital (share of graduated employees).
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Centro Studi Tagliacarne survey data



Econometrics results: DIGITAL innovation on export capabilities

The role of the training			
	Export	Export growth 2023	Export growth 2024
DIGITAL innovation WITHOUT skills training	0.040 (0.029)	-0.015 (0.032)	-0.018 (0.032)
DIGITAL innovation WITH skills training	0.064*** (0.018)	0.046** (0.018)	0.027 (0.018)
+ controls			
Obs	2,448	2,448	2,448

Dependent variable at the top of the column. The table displays marginal effect of probit regression. Standard error in parentheses. Controls: geographical location, sector, size, firm age, family governance, human capital (share of graduated employees). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: elaboration on Centro Studi Tagliacarne survey data

Econometrics results: GREEN innovation on export capabilities

GREEN innovation effect			
	Export	Export growth 2023	Export growth 2024
GREEN innovation (a)	0.054*** (0.016)	0.035 (0.023)	0.022 (0.023)
+ controls			
Obs	2,448	2,448	2,448

(a) Eco-process and/or eco-product innovation

Eco-process and eco-product innovation: the role of synergies

	Export	Export growth 2023	Export growth 2024
GREEN only eco-product innovation	0.036*** (0.018)	0.039 (0.026)	0.024 (0.026)
GREEN only eco-process innovation	0.060 (0.045)	0.020 (0.065)	0.088 (0.067)
GREEN eco-product & eco-process innovation	0.134*** (0.029)	0.025 (0.037)	-0.003 (0.036)
+ controls			
Obs	2,448	2,448	2,448

Dependent variable at the top of the column. The table displays marginal effect of probit regression. Standard error in parentheses. Controls: geographical location, sector, size, firm age, family governance, human capital (share of graduated employees).
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: Centro Studi Tagliacarne survey data

Econometrics results: DIGITAL & GREEN innovation on export capabilities

The role of synergies			
	Export	Export growth 2023	Export growth 2024
Only DIGITAL	0.076*** (0.029)	0.022 (0.023)	0.018 (0.023)
Only GREEN	0.089*** (0.026)	0.028 (0.027)	0.038 (0.027)
DIGITAL & GREEN innovation	0.094*** (0.022)	0.068*** (0.022)	0.047*** (0.022)
+ controls			
Obs	2,448	2,448	2,448

Dependent variable at the top of the column. The table displays marginal effect of probit regression. Standard error in parentheses. Controls: geographical location, sector, vsize, firm age, family governance, human capital (share of graduated employees). *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Source: elaboration on Centro Studi Tagliacarne survey data

Up to the highest digital and green innovation: Strategic and Net-Zero Technologies

EU STRATEGIC AUTONOMY refers to the capacity of the EU to act autonomously – that is, without being dependent on other countries – in strategically important policy areas

4 RISKS: risks to the resilience of supply chains; risks to the physical and cyber-security of critical infrastructure; risk for technology security and of technology leakage; and risk of weaponisation of economic dependencies or economic coercion.

3 PRIORITIES

Promoting the EU’s competitiveness and growth by strengthening the Single Market, supporting a strong and resilient economy (e.g. supply chains, critical raw materials), and strengthening the EU’s scientific, technological and industrial bases.

Protecting the EU’s economic security economic security risks, trade defence, foreign subsidies, 5G/6G security, Foreign Direct Investment screening and export controls

Partnering and further strengthening cooperation with countries worldwide who share EU’s concerns and those with which EU have common economic security interests.

Technologies for the Strategic Autonomy of the European Union

STEP Technologies *including* → (Strategic Technologies for Europe Platform)

e.g.
Microelectronics, including processors
High frequency chips
Advanced semiconductors technologies,
Artificial intelligence technologies,
Advanced sensing technologies,
Robotics and autonomous systems,
Quantum technologies,
High Performance Computing,
Data analytics technologies
Digital controlled micro-precision manufacturing
Internet of Things and Virtual Reality
Space technologies

NZIA Technologies Net-Zero Industrial Act

e.g.
Solar technologies
Onshore wind and offshore renewable technologies
Battery and energy storage technologies
Heat pumps and geothermal energy technologies
Carbon capture and storage technologies
Sustainable alternative fuels technologies

Source: EU documents

Firms on the highest level of digital and green innovation: STEP and NZIA patents

How many firms with patents on Strategic and Net-Zero Technologies

- **4,200** firms with patents* on Strategic (**STEP**) Technologies
- of which **1,300** with patents* on Net-Zero (**NZIA**) Technologies

How many of them export?

- **44.3%** of firms with STEP technologies patents
- **44.6%** of firms with NZIA technologies patents

The effect of Strategic Technologies patents on firms' export capabilities

- **+8%** is the greater probability of exporting of the firms with STEP technologies patents compared to the other firms**

* Patents with filing date in the last 15 years.

** The probability of exporting refers to the marginal effect of a probit regression where the binary dependent variable takes value 1 if the firm exports and the independent variable is binary taking value 1 if the firm has STEP technologies patents (last 10 years). The marginal effect is statistically significant at 1%. The regression was carried out by comparing the firms with STEP technologies patents with a control group to isolate the effect of STEP technologies patents from potential other effects related to e.g. firm's structural characteristics. The control group was built through the Nearest-neighbor matching method (Abadie, A & Imbens, G. 2006. Large sample properties of matching estimators for average treatment effects. *Econometrica*, 74(1), 235-267) where the propensity score was estimated by a probit regression taking into account the following firm's structural characteristics: sector (2-digit NACE Rev.2), geographical location (NUTS-2), size (4 size class) age (years since establishment), governance (foreign control).

Source: elaboration Centro Studi Tagliacarne on Istat, UE and Moody's data, International Patent Classification

Serving companies

21% of firms uses services supporting companies' internationalization provided by Public institutions*

Supporting export capability

18% of new exporters in the three-year period 2022-2024 uses services supporting companies' internationalization provided by Public institutions

Supporting export growth capability

53% of exporting firms with export growth in the two-year period 2023-2024 uses services supporting companies' internationalization provided by Public institutions

* Ministry of Foreign Affairs and International Cooperation, Italian Chambers of commerce, Foreign Chambers of commerce, ICE-ITA (Italian Trade Agency), SACE (Italian Export Credit Agency), SIMEST, Regions and Public institutions.

Source: Centro Studi Tagliacarne survey

How many firms export in Africa

- 42.000 firms exports in Africa (34.8% of total exporting firms)

How much Italy exports to and import from Africa

- Export 21,1 billion euro in 2023 (1.6% of total Italian export), of which 87.7% manufacturing goods
- Import 42.7 billion euro in 2023 (6.6% of total Italian import) of which 71.1% energy products

In 2023 Africa has become the first partner of Italy concerning the energy (31.6% of Italy's energy import come from Africa, 30.3 billion euro, by overcoming the Middle-East 28.2 billion euro)

Source: elaboration Centro Studi Tagliacarne on Istat data

Ringraziamo le tesiste

Thanks for your attention

Acknowledgements

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The opinions expressed in this work are those of the authors and do not necessarily reflect the views of the Ministry of Foreign Affairs and International Cooperation.

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