11th Scientific Meeting of the SIS Group
"Statistics for the Evaluation and Quality in Services"

BOOK OF SHORT PAPERS

Editors
Andrea Bucci
Alfredo Cartone
Adelia Evangelista
Andrea Marletta

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STATISTICAL METHODS FOR EVALUATION AND QUALITY: TECHNIQUES, TECHNOLOGIES AND TRENDS (T^3)

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BOOK OF SHORT PAPERS

Editors: Andrea Bucci, Alfredo Cartone, Adelia Evangelista and Andrea Marletta

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University 'G. d'Annunzio' of Chieti-Pescara

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Preface

Statistical thinking, design and analysis play a crucial role in social life and are useful to society at large. Besides, promoting advanced methodological research is useful to facilitate the dissemination of ideas related to various fields of interest. For this purpose, experts in statistics, data analysis, data mining, statistical methods for decision making, machine learning and related methods come together to understand and analyse phenomena through data.

In line with this objective, the Statistics Group for the Evaluation and Quality of Services (SVQS; www.svqs.it) of the Italian Statistical Society (SIS) has been organizing the Innovation and Society (IeS) conference biennially since 2009, focusing on new developments and ideas in statistics applied to the evaluation and quality of public and private services, attracting national and international statisticians and data scientists. The meeting contributes to spot light on the main statistical approaches and methodologies for the evaluation of public services currently in use in different contexts, as well as to facilitate discussion on the impact of innovative statistical evaluation systems for these services, involving various economic and social policy actors.

The conference "Statistical Methods for Evaluation and Quality: Techniques, Technologies and Trends (T^3)" recorded valuable contributions that are reported in this volume. The papers underscore how the growing availability of data has tasked social and economic actors, organizations, and researchers with the management and analysis of large volumes of unstructured and heterogeneous data. In recent years, many tools for both qualitative and quantitative models have been developed to better describe and understand complex systems and their underlying behaviors, and the papers reported in this volume bear witness to this.

Techniques, technologies and trends: the study of data complexity presents the potential to provide analyses with increased frequency and timeliness, accuracy and objectivity, and to define sustainable models. Traditional quantitative methods for capturing socioeconomic data have often shown limitations in their ability to examine underlying systems, and with the three 'T' just mentioned, the outlines of future developments are starting to emerge.

The volume reports 127 contributions in the following areas:

- Advanced statistical methods for pattern recognition
- Advances in statistical learning from high-dimensional data
- Data analysis for web sources
- Distance and depth-based statistical learning methods for robust data analysis

- Economics and environment
- Education and labour
- Inequalities in the labour market
- Innovations and challenges in official statistics
- Labour market: trends, perspectives and new challenges
- Methodological and applicative contributions for evaluating sustainable development
- Methodological developments and applications for the assessment of student competencies
- Networks data analysis: new perspectives and applications
- New advanced statistical methods for data science
- Recent advances in statistical learning and data analysis
- Statistical analysis and modeling of environmental pollution data
- Statistical methods and complexity for evaluation in finance
- Statistical methods and composite indicators for healthcare
- Statistical methods and models for land monitoring with spatio-temporal data
- Statistical methods for environmental monitoring and sustainability
- Statistical methods for the analysis of university student choices and academic performance
- Statistical methods for the assessment of transport services and sustainable emissions
- Statistical methods for education and educational services
- Statistics in sports
- Tourism and territory.

The Conference event attracted many contributions as well as numerous Authors, not just from Italy but also from abroad. Over the three-day meeting, the Community has the opportunity to witness some of the state-of-the arts, new trajectories, and methodological challenges in 24 solicited sessions, 7 sessions of free contributes, two round tables - organized by Maurizio Vichi and Matilde Bini respectively - and three keynotes sessions with Ron S. Kennet of Samuel Neaman Institute of Israel, Luigi D'Ambra of Federico II University of Naples, and the former Minister Enrico Giovannini from University of Tor Vergata.

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Evolutionary trends of start-ups in Italy: a case study

Tendenze evolutive delle start-up in Italia: un caso studio

Pierdomenico Duttilo, Giulia Caruso, Barbara Iannone and Stefano Antonio Gattone

Abstract Start-ups play an essential role within a country's economy. They develop new ideas and technologies that can bring about a radical change within markets. It is therefore of paramount importance to analyse them, in order to identify and explore trends regarding start-ups. To this end, we analysed which sectors start-ups focus on in Italy, identifying regional differences. Finally, we define the trend in the creation of new start-ups and the mortality rate.

Abstract *Le start-up rivestono un ruolo essenziale all'interno dell'economia di un Paese. Esse, infatti, sviluppano nuove idee e tecnologie in grado di imprimere un cambio radicale all'interno dei mercati. Si rivela quindi di fondamentale importanza analizzarle, per individuare ed esplorare le tendenze che le riguardano. A tal fine, abbiamo analizzato quali sono i settori su cui si concentrano le start-up in Italia, individuando le differenze regionali. Abbiamo infine definito la tendenza alla formazione di nuove start-up e il tasso di mortalità.*

Key words: start-ups, evolutionary trends, innovation.

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1 Introduction

Innovation is crucial to productivity and economic growth. The literature highlights the importance of start-ups in stimulating it through investments in cutting-edge projects, while large incumbent firms focus most of their efforts on internal innovations aimed at improving existing products [1, 2, 4, 9, 12]. Thus, recent research suggests that start-ups can be an important trigger for economic growth [3, 12]; they develop new ideas and technologies that can drastically change markets and established industries.

According to the Global Startup Ecosystem Report [8], the global startup economy is growing. In particular, there has been a sharp increase in startup activity since 2009 [7]. Globalisation and technological innovation have extended the spread of start-ups from the US to the entire world [13].

In order to create new opportunities for business creation, in Italy, in 2012, Decree Law 179/2012 introduced a series of measures for the creation and development of innovative start-ups [6].

The aim is to foster sustainable growth, technological development, new entrepreneurship and employment, especially of young people, with regard to innovative start-ups [10]. Moreover, this decree aims to contribute to the development of a new entrepreneurial culture, the creation of a more innovation-friendly environment, as well as to promote greater social mobility and to attract talent, innovative firms and capital from abroad to Italy [6].

Our study aims to explore the global trends of start-ups in Italy, using data from Registro Imprese.it [11]. We propose an objective classification of start-ups in Italy in the years 2013 to 2023. In addition, we present a case study that highlights the importance of a new business model.

The document is organized as follows. Section 2 provides some references to the literature on the topic. Section 3 describes some background data on startup classifications and the methods used. In section 4 we draw some conclusions.

2 Start-ups classification

The regional distribution of Italian start-ups (Figure 1) shows that the first Italian region for start-ups concentration is Lombardia (3731) followed by Lazio (1848), Campania (1397), Emilia-Romagna (1040) and Veneto (939). Moreover, the figure highlights two important start-up clusters, located in the north and central south of Italy. Figure 2 shows the emergence of new start-ups in the years from 2013 to 2023 (bimonthly data). Data refers to the entry of new start-ups in the special section of the business register. Due to the Covid-19 pandemic, start-up initiatives have been postponed in 2020. Thus, in 2021 a strong recovery was recorded. In 2022, on the other hand, a sharp decline in the birth of new start-ups is observed. This recent contraction is caused by the geopolitical and economic scenario i.e., the Russian-Ukrainian conflict, the energy crisis, the inflation and the cost of debt [5]. There were

425 new start-ups in the first two months of 2023. By contrast, there were 445 and 495 new start-ups in the first two months of 2022 and 2021, respectively.

Fig. 1 Regional distribution of Italian start-ups

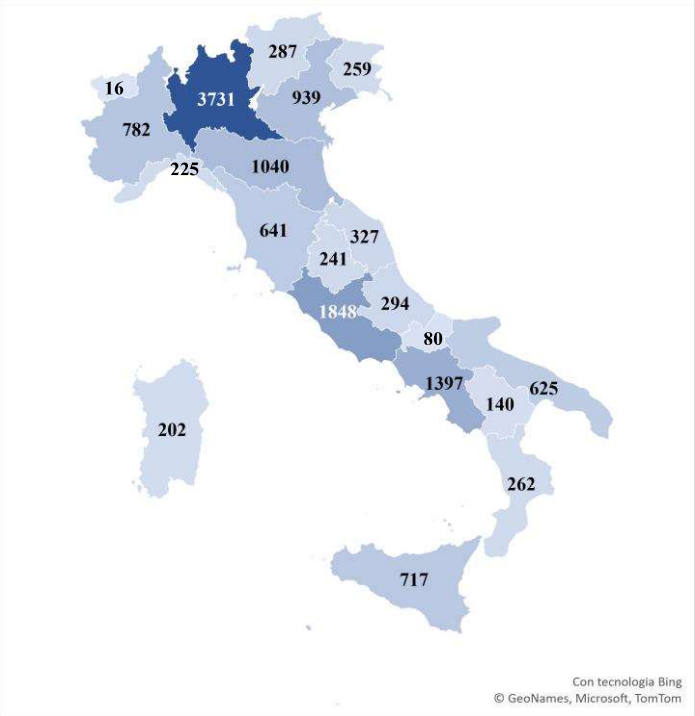
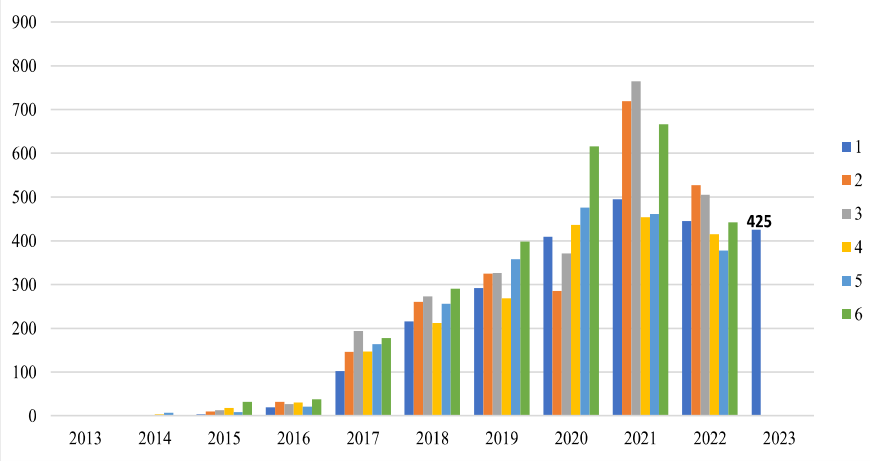


Fig. 2 The emergence of new Start-ups (bimonthly data)



The mortality rate in Figure 3 was calculated taking into consideration the year of establishment and that of the latest available financial statements. Specifically, if the closing year of the last available financial statements is less than 2021, the activity of the start-up is considered concluded (operational otherwise). The mortality rate is homogeneous among North regions (except for Valle d'Aosta), while South-central regions like Abruzzo, Molise, Sardegna, Umbria and Puglia have a low mortality rate compared to other regions in the same area. The national mean is equal to 4,21%.

Fig. 3 Mortality rate of Italian start-ups (04/21/2023)

Table 1 shows the frequency distribution of the Italian start-up sector. The mode sector is represented by the service industry, which is followed by industry and crafts, commerce and other sectors, such as tourism, agriculture and fishing.

Table 1 Frequency distribution of the Italian start-up sector

Sector	Absolute frequency	% frequency
Service industry	11213	79,79%
Industry and crafts	2115	15,05%
Commerce	456	3,24%
Other (tourism, agriculture and fishing)	212	1,91%
Total	13996	100%

3 Conclusions

Our findings are valuable for the following reasons. Startup founders, investors, and policy makers will find our results on startup class trends over time and space useful for their decisions about where to locate companies, where to invest, or who to invite to collaborate. In addition, our paper includes many empirical findings that can be linked to previous literature on entrepreneurship, sometimes corroborating previous outcomes with new evidence and sometimes challenging conclusions drawn previously. Finally, this work presents a case study that highlights the importance of a new business model.

References

1. Acs, Z.J. and Audretsch D.B: Innovation, market structure and firm size. The Review of Economics and Statistics, \textbf{69}, 4, 567-574 (1987)
2. Akcigit, U., Kerr W.R.: Growth through heterogeneous innovations, NBER Working Paper No. 16443 (2012)
3. Audretsch D.B., Falck O., Heblich S., Lederer A.: Handbook of Research on Innovation and Entrepreneurship. Edward Elgar Publishing Limited, Willinston, US (2011)
4. Baumol W.J.: Entrepreneurial enterprises, large established firms and other components of the free-market growth-machine. Small Business Economics, \textbf{23}, 9-21 (2004)
5. Cerved report PMI (2022). Available from https://research.cerved.com/rapporti/rapporto-cerved-pmi-2022/. Cited 13 March 2023
6. Decreto-legge 18 ottobre 2012, n. 179 https://www.mise.gov.it/images/stories/Art25-dl179-2012.pdf)
7. Florida, R. and Hathaway I.: Rise of the global startup city: The new map of entrepreneurship and venture capital (2018). https://startupsusa.org/global-startup-cities/report.pdf. Cited 1 April 2023
8. Global entrepreneurship network. The Global Startup Ecosystem Report GSER 2020. The New Normal for the Global Startup Economy and the Impact of COVID-19. (2020). Available from https://startupgenome.com/reports/gser2020. Cited 30 March 2023
9. Kerr, W.R. and Nanda, R.: Financing Innovation, NBER, Working Paper No. 20676 (2014)
10. Palazzo, L., Sabatino, P., Ievoli, R.: Determinants of social startups in Italy (2021) https://doi.org/10.36253/978-88-5518-304-8.18.
11. Registro Imprese.it https://www.registroimprese.it. Cited 13 March 2023)
12. Russo P. F. & Magri S. & Rampazzi C.: Innovative Start-Ups in Italy: Their Special Features and the Effects of the 2102 Law. Politica economica, Società editrice il Mulino, issue 2 (2016)
13. Savin, I., Chukavina, K. & Pushkarev, A. Topic-based classification and identification of global trends for startup companies. Small Bus Econ \textbf{60}, 659–689 (2023) https://doi.org/10.1007/s11187-022-00609-6