



The link between crowdfunding and sustainability: A literature review in the field of entrepreneurs and academic spinoffs

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ABSTRACT

The aim of the paper is to analyze the literature that investigates the connection between fintech, crowdfunding, entrepreneurs, academic spinoffs, startups, SMEs, and sustainability to provide insights into how this relationship is influencing researchers. Crowdfunding serves as a crucial element of the fintech ecosystem, promoting financial inclusion and empowering businesses that use these technologies. The Latent Dirichlet Allocation (LDA) method was used to carefully analyze the literature in the field. The findings highlight how crowdfunding facilitates creative enterprises (academic spinoffs, startups, and SMEs) and corresponds with the increasing need for sustainable business practices, offering a foundation for future research in this multidisciplinary field.

1. Introduction

In recent years, crowdfunding has emerged as a powerful alternative for financing various activities, ranging from startup companies and academic spinoffs to small and medium-sized enterprises (SMEs). For startups, crowdfunding provides access to resources previously available only to a select few, enabling innovators to bring their ideas to fruition. For SMEs, it offers the flexibility to scale operations while remaining agile in a competitive market. For academic spin-offs, crowdfunding bridges cutting-edge research and practical applications, transforming academic concepts into impactful ventures. At the core of this transformation is the fintech ecosystem, a dynamic network of technological advancements that has revolutionized the financial sector. Crowdfunding, a vital component of fintech, promotes financial inclusion by dismantling traditional barriers to access and empowering businesses of all sizes. Together, crowdfunding and fintech support individual entrepreneurs and encourage sustainable business practices, which are crucial in today's global landscape. This has attracted significant attention from scholars, practitioners, and policymakers alike (e.g., Crosetto and Regner, 2018; Troise et al., 2022; Troise and Tani, 2020). Alongside its traditional uses, crowdfunding is increasingly recognized as a viable tool for funding sustainable ventures, with a growing body of research exploring its potential to support sustainability-driven businesses (e.g., Böckel et al., 2021; Cumming et al., 2024; Maiolini et al., 2024). As sustainability increasingly becomes more central in the field of crowdfunding – in fostering sustainable growth, especially for startups and SMEs – this study

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addresses the following research question: What are the key elements that characterize the link between crowdfunding and sustainability in the contexts of startups, academic spinoffs, and SMEs?

As sustainability becomes increasingly central to crowdfunding, this study seeks to expand the understanding of how these platforms align with sustainability standards. By analyzing significant clusters of literature that explore the connection between crowdfunding, entrepreneurs (Bruton et al., 2009), academic spinoffs and their evaluation (Iazzolino et al., 2020), and sustainability (Vismara, 2019), this research highlights how crowdfunding not only supports innovative ventures but also responds to the growing demand for sustainable business practices. This study provides the basis for future research in this dynamic, wide field.

1.1. Crowdfunding and sustainability

The success of crowdfunding campaigns now often hinges on sustainability-related signals, as investors are placing greater emphasis on environmental, social, and governance (ESG) factors in their financial decisions (Guterres, 2022). The problem of considering elements like ESGs and sustainability in an investment decision has a relevant impact on the techniques for evaluating investments or, more generally, on the analysis of firms' reliability. Some researchers have investigated the use of factors other than financial indicators for evaluating firms' reliability (Iazzolino et al., 2013). While the relationship between sustainability and crowdfunding is a relatively new area of inquiry, recent studies have begun to examine the role of sustainability in equity crowdfunding, with a particular focus on environmental impacts (Messeni Petruzzelli et al., 2019; Testa et al., 2020). According to Ortas et al. (2015), firms that prioritize sustainability have challenges in obtaining external investment. Vismara (2019) further expands this research by analyzing how sustainability considerations influence equity crowdfunding outcomes, signaling the increasing importance of this intersection. Research highlights the positive impact of crowdfunding on fostering sustainable and innovative ventures. It has been demonstrated that a perceived sustainable mission enhances campaign success, with ventures showing an average survival rate of over 70 % after one year, particularly those with female co-founders. Similarly, it has been revealed that equity crowdfunding (ECF) shapes companies' innovation paths. Agri-food businesses, while not leveraging crowd inputs for process-related innovations, utilize knowledge-based contributions to drive organizational innovation and promote social sustainability. These inputs also support product innovation, enhancing both economic and environmental sustainability. Similarly, another research from Hornuf et al. (2022) indicates that environmental goals positively impact campaign performance. According to Bock et al. (2022), backers prioritize ecological and social factors, which improve the success of crowdfunding projects. Crowdfunding platforms and investor behavior are pivotal in addressing financial gaps and fostering sustainable business models (Block et al., 2018; Lam and Law, 2016; Tiberius and Hauptmeijer, 2021). Studies emphasize crowdfunding's role in financing sustainable businesses (Caputo et al., 2022; Vismara, 2019), yet little is known about its interaction with sustainable business models (SBMs) as drivers of environmental and societal impact (Bocken et al., 2018; Pizzi et al., 2021). The rise of fintech, driven by digitization, is reshaping financial services and providing alternative funding avenues like online crowdfunding platforms, revolutionizing support for entrepreneurs (Bertoni et al., 2022; Huang et al., 2023).

2. Methodology

We used a machine learning method to carefully analyze scientific literature and pull out key concepts that were needed for this research's goals. The Latent Dirichlet Allocation (LDA) method was chosen to make machine learning more effective, especially for getting data from scientific journal papers (Blei et al., 2003). LDA is a topic modeling technique that extracts topics from text by identifying the main themes within a collection of documents and highlighting the keywords that characterize each topic. This process reveals multiple topics within a document, with each word linked to one of these topics (Saraceno et al., 2024). Since a topic is represented as a distribution of a set of words over a fixed vocabulary, LDA analyzes the words in each paper and calculates the joint probability distribution between the observed words and the unobserved hidden topic structure (Asmussen and Møller, 2019). Being a probabilistic modeling method, LDA is specifically designed to extract topics from a set of papers. Following Blei (2012), we selected k , i.e. the number of topics to be extracted, by evaluating multiple results from the LDA algorithm. Our selection of k and the LDA algorithm aimed to ensure a high level of topic coherence (Ammirato et al., 2024) while also facilitating straightforward interpretation of the results for human readers. Ultimately, we found that the most meaningful set of topics was achieved with $k = 2$.

We utilized the MySLR platform, which employs the LDA algorithm to simulate "human-like intelligence" as accurately as possible. This platform can efficiently process large volumes of data, interpret texts, understand their content, extract relevant information, and reveal hidden connections between articles. This methodology involves developing a model that identifies specific "topics" (or themes) within texts, determines the topic addressed by each text, and recognizes the presence of these identified topics across different papers (Ammirato et al., 2022).

We conducted targeted research on Scopus to provide a comprehensive overview of scientific studies regarding a particular financing method, namely crowdfunding, within the context of academic spin-offs or startups. The search was conducted using the Boolean operators "AND" and "OR" to combine the following terms: ("Academic spin-off*" OR "University spin-off" OR "Startup*" OR "Start-up*") AND ("Crowdfunding") AND ("sustainability" OR "sustainabl*" OR "Business model*" OR "Sustainable Business model*" OR "Circular business model*"). To select relevant papers, we developed the following inclusion and exclusion criteria: the papers must be written in English, within a time horizon from 2012 to 2024, and we excluded book chapters. We have not chosen a specific subject area because the topic of sustainability and crowdfunding is not limited to a particular disciplinary area but covers several areas. This multidisciplinary nature highlights the importance of an integrated approach, where different fields provide unique perspectives and tools to tackle challenges associated with sustainable development. Due to this, we examined the title and abstract of

each work and evaluated their content against our defined search terms to ensure they aligned with the scope of our study. The Boolean search returned sixty-one publications from Scopus.

We used text mining on a final batch of sixty-one publications to highlight the important research subjects related to crowdfunding in academic spin-offs and startups. We also achieved a satisfactory topic coherence value of (-1.19) , which facilitates the interpretation of results for human readers (Chen and Liu, 2014). Topic coherence measures the semantic similarity among the highest-scoring words within a topic. This coefficient measures the quality of topic modeling, allowing for the differentiation between semantically coherent arguments and simple statistical artifacts (Yi and Allan, 2008).

3. Results

Using the LDA procedure, we identified relevant keywords associated with the two topics. The two key clusters emerged from the software-driven analysis of the selected papers are “*Investing in the Future: How Crowdfunding Fuels Sustainable Growth for Startups and SMEs*” and “*Fintech for Good: Harnessing Crowdfunding to Empower Social Enterprises.*” These clusters represent distinct yet interconnected areas within the literature, focusing on how crowdfunding catalyzes sustainable business growth and supports socially responsible initiatives when crowdfunding campaigns involve startups and SMEs. Fig. 1 illustrates the most significant keywords, visually represented through a “word cloud”.

Topic 1 counts 28 papers and Topic 2 counts 33, as shown in Fig. 2. The analysis of the keywords allowed for the identification of the central themes of the two topics based on their relative weight. In general, within each topic, the papers do not all have the same weight. The weight of the keywords gives the weight of each paper on the topic. Specifically, the weight of each keyword is determined by its frequency of repetition within the topic, along with its associations with other words. The MySLR platform visualizes the final weight of the two topics in Fig. 2, considering the weight of each keyword, how often each keyword is repeated, and the associations among keywords. Documents for topic one weigh 28, while documents for topic two weigh 33. This figure (2) allows us to understand that each document has a relevant weight within the topics.¹

The platform can generate a graph that displays the number of articles published each year, as illustrated in Fig. 3. Interest in the topic grew significantly in the years 2019 and 2020, while in the years from 2012 to 2014, research in the specific application context was almost absent.

3.1. Topic 1: investing in the future: how crowdfunding fuels sustainable growth for startups, SMEs, and Academic Spin-offs

The first topic focuses on the role of crowdfunding in fostering the growth and sustainability of startups, SMEs, and Academic Spin-offs. The papers under this theme examine how crowdfunding platforms and investor behavior are critical to filling financial gaps and promoting innovative business models. Two primary areas were highlighted:

Backer and Investor Behavior. Research in this area investigates the motivations and behaviors of investors participating in crowdfunding campaigns. Studies show that factors such as backers’ intentions, updates during campaigns, and specific platform characteristics significantly influence campaign outcomes. Backer behavior in crowdfunding campaigns for academic spin-offs is influenced by a variety of factors, including motivations, social networks, brand identity, and investment dynamics (Troise et al., 2024). Understanding these elements can help campaign creators tailor their strategies to attract and retain backers effectively (Fortezza et al., 2023). Both reward-based and equity-based crowdfunding models are examined, with particular attention to how effective investor communication can shape campaign success. This sub-theme emphasizes the importance of understanding investor psychology and managing the relationship between founders and backers to maximize investment potential related to innovative companies such as startups or Academic Spin-offs.

Financial Ecosystems. Papers within this area focus on how equity and crowdfunding serve as integral components of the broader financial ecosystem, particularly in addressing the funding gaps startups, SMEs and Academic Spin-offs face. Research highlights the evolution of these crowdfunding models and their potential to democratize access to finance, allowing more flexible investment opportunities. Equity and crowdfunding platforms play a crucial role in bridging funding gaps for academic spin-offs by providing alternative financing options that traditional financial institutions often overlook. These platforms facilitate access to capital for innovative ventures, such as Academic Spin-offs that may lack the necessary collateral or operating history to attract conventional investors (Troise et al., 2024). The studies also explore the financial returns for investors, platform evolution, and the broader market dynamics that equity crowdfunding brings to the table. These insights underscore the role of crowdfunding as a key driver of financial innovation for businesses traditionally excluded from mainstream financial systems.

Examining the top 30 most relevant terms and their frequency within papers grouped around the chosen topic, “crowdfunding”, “sustainable” and “investment” reached the highest value² (Fig. 4).

3.2. Topic 2: fintech for good: harnessing crowdfunding to empower social enterprises

The second cluster examines how fintech innovations, in conjunction with crowdfunding, support sustainable business models and

¹ The blue column shows the number of documents assigned to each topic. The red column shows the sum of the weights of each document in the topics.

² Circle 1 represents topic 1, while circle 2 corresponds to topic 2.

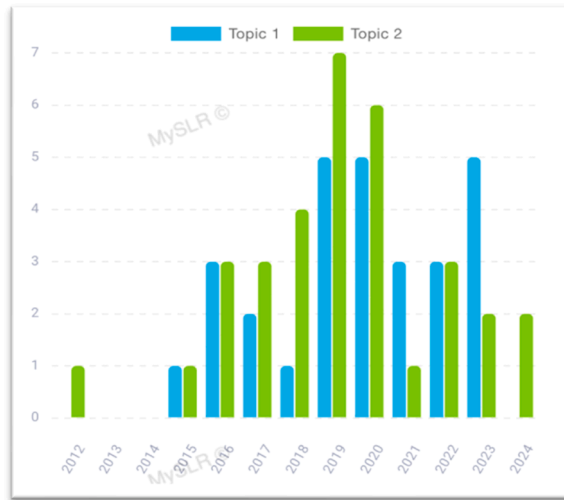


Fig. 3. Topic papers over time (MySLR Platform).

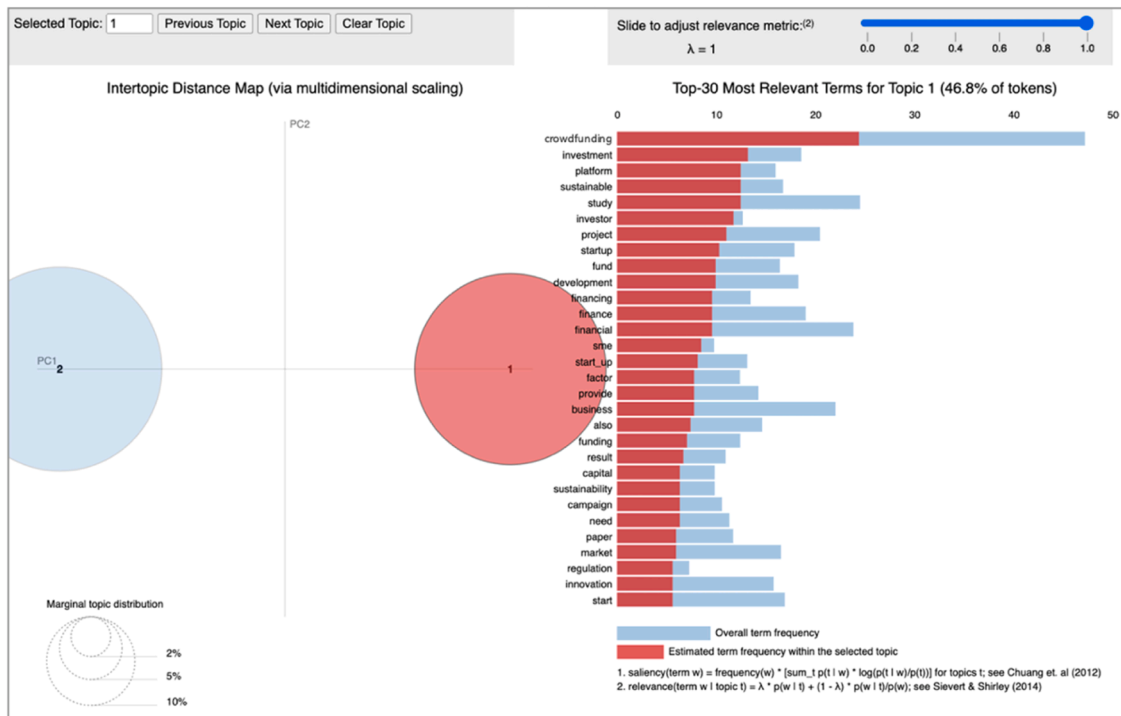


Fig. 4. Inter-topic distance map for topic 1 (MySLR Platform).

“fintech” reached the highest value³ (Fig. 5).

The machine learning component generated various graphical representations of the data, which helped us choose our scientific objectives. Fig. 6 presents the t-distributed Stochastic Neighbor Embedding (t-SNE) map, a statistical method for visualizing high-dimensional data by placing each data point on a two-dimensional plane. The map suggests that papers assigned to a particular topic have minimal relevance to other topics. In this graph, each point represents a document (scientific source) and indicates its similarity to a specific topic. Each topic is clustered together and represented by a distinct color (blue and red).⁴

³ Circle 1 represents topic 1, while circle 2 corresponds to topic 2.

⁴ The red dots represent the topic one, the blue dots represent the topic two.

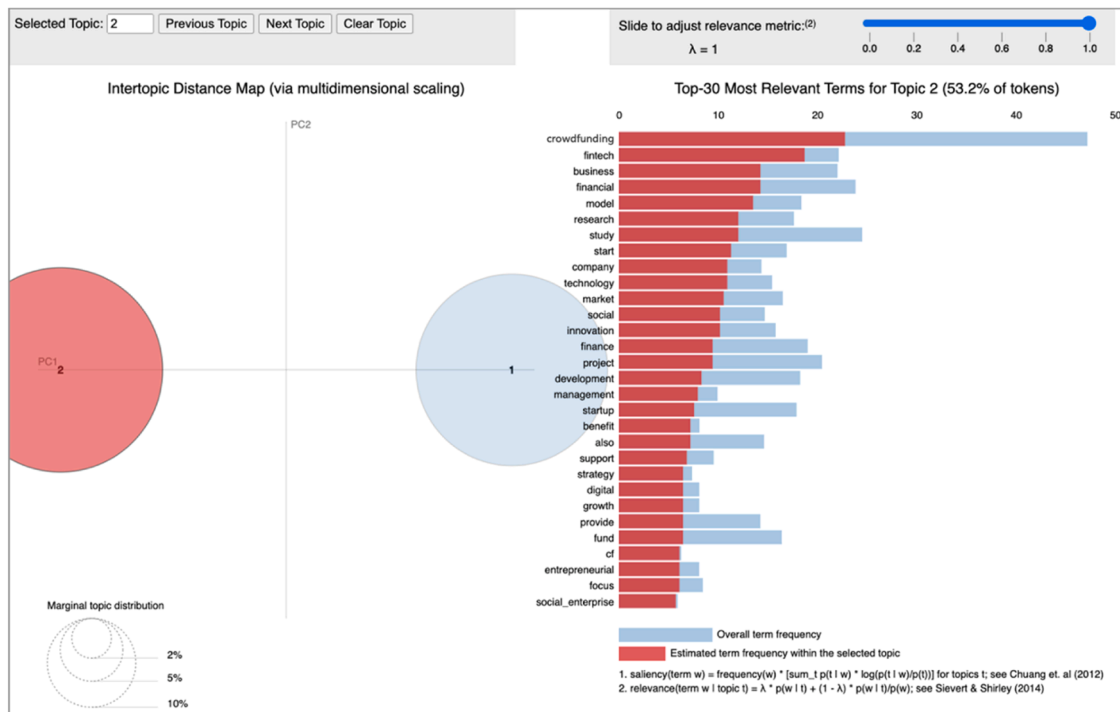


Fig. 5. Inter-topic distance map for topic 2 (MySLR platform).

4. Conclusions and future research directions

Equity crowdfunding has emerged as a significant player in the entrepreneurial finance ecosystem, providing a more intricate approach to capital funding by selling firms' equity shares on online platforms (Block et al., 2018). These crowdfunding platforms have become vital sources of digital information and growth, showcasing the convergence of technology and finance. Crowdfunding platforms connect entrepreneurs with investors as non-bank intermediaries, expanding capital allocation opportunities in sectors and regions traditionally overlooked by conventional financial institutions (Huang et al., 2023).

The findings highlight two key aspects linking crowdfunding, entrepreneurship, academic spin-offs, and sustainability. First, crowdfunding bridges funding gaps and fosters innovative business models for startups and SMEs by leveraging insights into backer and investor behavior, supporting socially and environmentally responsible projects. This is particularly relevant for academic spin-offs, which often use crowdfunding to commercialize innovative products. Second, integrating fintech innovations like blockchain, smart contracts, and Islamic fintech into crowdfunding enhances financial inclusion and supports ethical funding. Crowdfunding not only democratizes access to capital but also advances sustainable business models, contributing to sustainable entrepreneurship and addressing societal challenges.

The findings highlight the practical and policy implications of crowdfunding in fostering sustainable entrepreneurship. Practitioners can enhance campaign success by leveraging investor behavior insights and fintech innovations, while startups and academic spinoffs can use crowdfunding to validate innovation trajectories not yet ready to scale. Policymakers are encouraged to develop regulations that promote this kind of investment and improve access to innovative financial instruments that can have a specific role in the value chain of investments supporting innovative companies in the early phase of their development.

Furthermore, crowdfunding is seen not only as a financial tool but also as a means of testing new business concepts, particularly in sectors where traditional funding is scarce. Future research could highlight crowdfunding's role in promoting lean startup practices and facilitating business validation for small and medium-sized enterprises (SMEs) and startups, especially those focused on the relationship between entrepreneurship and sustainability in established industries or emerging one.

CRedit authorship contribution statement

Giovanni Baldissarro: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Elisa Farinelli:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Gianpaolo Iazzolino:** Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Riccardo Maiolini:** Writing – review & editing, Writing – original draft, Visualization, Validation,

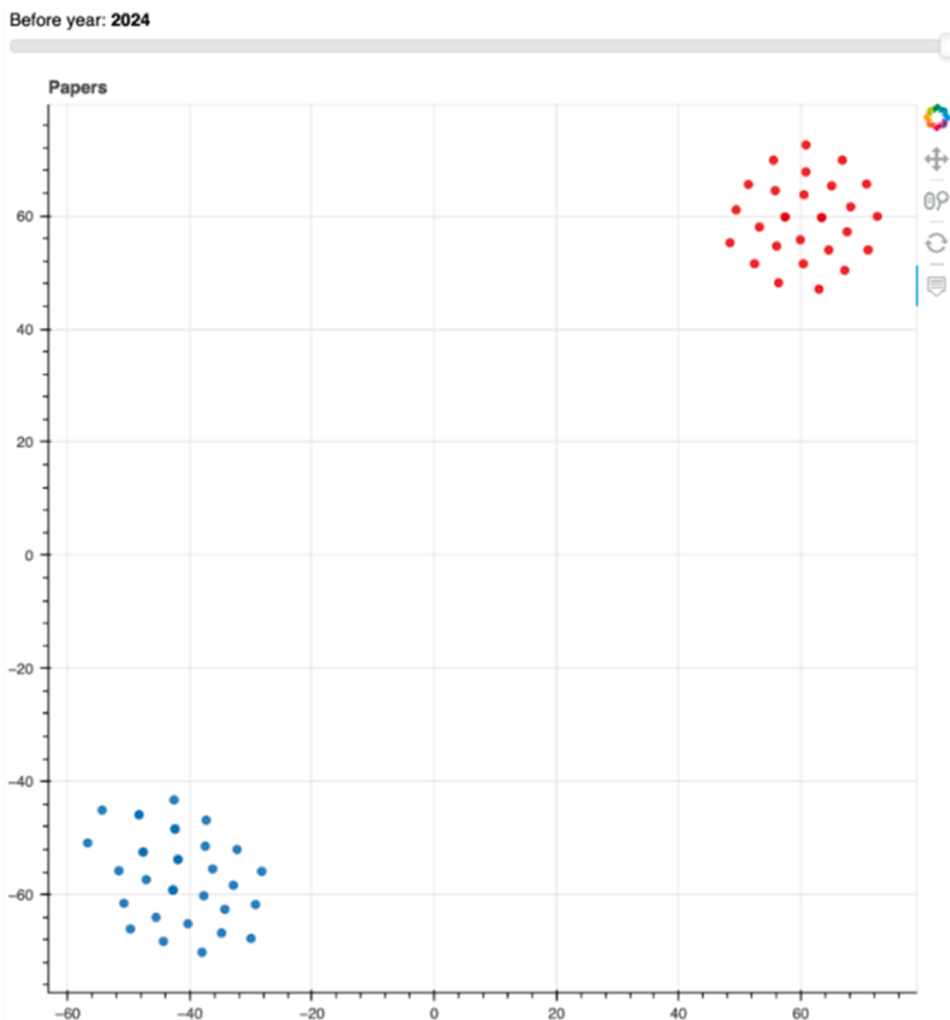


Fig. 6. t-SNE visualization of topics (MySLR).

Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.
Donato Morea: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

None.

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Data availability

Data will be made available on request.

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