



Sinergie SIMA
Management Conference



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Conference Proceedings

Short papers

Bari (Italy)

29-30 June 2023

Sinergie-SIMA Management Conference Proceedings
Rediscovering local roots and interactions in management
29-30 June 2023
Mercure Villa Romanazzi Carducci (Bari)

ISBN 978-88-94-7136-3-3

The Conference Proceedings are published online on <https://www.sijmsima.it>

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Via Interrato dell'Acqua Morta, 26
37129 Verona - Italy



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Mapping the Environmental Incubators Ecosystem of Climate Tech Ventures in Europe

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Framing of the research. Tackling grand environmental challenges such rising sea levels, drought and extreme weather, soil degradation or collapsing food systems will require an immense effort to invent, refine, and deploy technologies aimed at reaching these objectives (UNFCCC, 2018). Historically, small and new established ventures have played an important role in promoting technological innovation, often leading to the introduction of paradigm-shifting technologies, which change in the way we live. These ventures, however, face many challenges in maturing to a point where they survive and have positive social, environmental and economic impacts. A weak entrepreneurial support system which does not offer linkages to appropriate technology markets and financial support for entrepreneurial activities have often been proposed as one of the main causes of green ventures failure (Volkman et al., 2021; Theodoraki et al., 2022; van Rijnsoever, 2022)

Among the different actors populating the ecosystem aimed at supporting the development of ventures with the potential to create a positive impact on society, environmental incubators have the potential to play a multidimensional role in supporting climate-resilient and low-emission technologies to be developed, accepted and used by society (UNFCCC, 2018). Environmental incubators, defined as any sort of environment designed to support ventures that aim to introduce a positive environmental impact, are created for hatching ventures by providing financial and nonfinancial support with the goal of fostering tenants' hybrid objectives (Hirschmann and Moritz; 2022). These incubators call for innovation in environmental specific topics such as waste management, hydrogen development or the promotion of smart mobility services. Given their increased level of specialization, they provide tenants with access to the more diverse information and to the network of contacts they need to recognize and capitalize on eco-friendly opportunities (Millette et al., 2020).

The few studies on the relationship between environmental incubators and performance of the tenants are mixed. For instance, the benchmarking study carried out by the European commission (2002) is a clear evidence of the fundamental role played by incubators for sustaining entrepreneurship and innovation especially in those fields requiring cutting-edge solutions such as climate change. The study shows that the survival rate of tenants was significantly higher than those off-incubation respectively 80-90% against 30-50% over a period of 5 years. Relatedly, a recent study by Sansone et al. (2020) focused on the Italian context, found no difference in term of subsequent performance for ventures included in an incubator interested in supporting firms aimed at eliciting a positive societal change vis-à-vis those include in programs promoted by traditional business incubators.

Importantly, much of the research has treated environmental incubators as largely homogenous in their business models, in the admission criteria and in the typologies of services offered to tenants. In doing so, it has considered the potential treatment effect along only one or two dimensions, ignoring the significant variation in incubators along multiple design features. However, heterogeneity is one of the distinctive traits of these actors. For instance, variation has been observed in the type of service offered by these incubators (Sansone et al.; 2020), finding an increased propensity to offer, among others, services related to support the tenants in measuring their impact and training activities related to business ethics and social responsibility. In addition, heterogeneity has been observed in the selection criteria adopted to assess ventures to be included in the incubation programs (Hirschmann et al., 2022). Such heterogeneity is likely to be salient both for understanding their impact on and across ventures and their differentiated role in the ecosystem in which they operate (Woolley and MacGregor, 2022).

Purpose of the paper. In this paper we seek to fill this gap by mapping the landscape of European incubators and analysing variations in their critical design features. In so doing, our work highlights potential fruitful avenues for broader research community interested in a set of key questions: how do environmental incubators program vary? The goal of this paper is thus to provide a broader and deeper understanding of environmental incubator programs and

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their features, and to set forth a research agenda that leverages environmental incubators as laboratory to explore the development of green ventures and technological solutions aimed at tackling environmental grand challenges.

Methodology. We deployed a qualitative and quantitative cross-sectional research approach for analysing environmental incubators placed in Europe with programs that include ventures dealing with climate-tech solutions. To do so, we relied on a list of green incubators active in 2022 provided by NetZero Insights, a data provider specialized in mapping the ecosystem supporting environmental ventures. The list is available on NetZero website, and it is constantly updated in order to support climate founders to keep track of relevant open incubation opportunities. The initial list has been downloaded in May 2022 and enclosed a sample of 101 European incubators and their 135 programs aimed at promoting green ventures. After having downloaded the list, we checked the quality of information provided by the platform in order to exclude incubators which do not fulfil our requirements. In particular, we verified if incubators are headquartered in Europe (even if operating on a global scale) and proposed incubation programs focused on supporting the development of green ventures. After the initial check we did not eliminate any incubators enclosed in the starting list.

To retrieve information about incubators and programs carried out, we content-analysed websites and sustainability reports. The collected information about incubators and their programs has been independently assessed by researchers and clustered at the incubator or program level. Specifically, at the incubator level we collected data about: the foundation year of each organization, the legal form adopted, the presence of a sustainability or impact report; the headquarter country(ies); the market scope, which can vary along four dimensions: regional, national, European or global level; incubator portfolio, which count the number of ventures belonging to the current portfolio of the incubator; and source of revenues, which refers to the origin of incubator resources whether external such as “Corporate Sponsorship”, “Government”, “VC Fund” and “University Based” or internal like “Fundraised Fee”, “Office Space Renting”, “Participating Fee”, or both.

At the program level, we assessed the number of selected ventures, which stands for the maximum number of firms that will be allowed to participate to each incubator program per session; the program(s) duration (measured in month); if the incubator requires a stake to their tenants in return for the service offered; the presence of financial contributions, which is a dummy variable that takes value 1 if the program provides financial contributions to the tenants under the nature of grant, best-in-class award or venture capital investment. With respect to this latter variable, we also collected more details about the type of contribution and the amount of this contribution (where the currency was different from EUR, the current currency conversion rate is applied updated to 1st November 2022).

In addition to these variables, we collected data about the sectors in which the program is specialize; the phase of intervention, which is a variable that assesses the stage of maturity of the ventures and ranges from “Early” phase, in which tenants are still defining their business model, to “Mature” phase; the activities and services offered by each program, which include an assessment of all the services provided by the program. With respect to services and activities offered, we first collected rough data about every type of service offered and subsequently each researcher independently aggregated these raw data into clusters. Table 1 reports, for each cluster an example of the services aggregated. Similarly, we retrieved information about the selection criteria, which incorporates all the requirements ventures must meet to be eligible for the program. With respect to the selection criteria adopted, we first collected rough data about every type of selection criteria used and subsequently each researcher aggregated raw data into clusters. Table 2 reports, for each cluster identified, an example of the criteria aggregated.

Tab. 1: Supporting activities offered by incubators and example of variables retrieved by environmental incubators website and sustainability reports

Coaching & Mentoring	- Coaching - Individual Coaching - Mentoring - 1 to 1 Mentoring
Communication	- Promotion on Social Media - Visibility & Media Support
Follow-On Support	- Further Funding After the Ending - Post-Program Support
Fundraising Support	- Access to Equity Agreement with Investors - Access to Financial Partnership with Corporations - Access to Investment Opportunities - Crowdfunding - Matchmaking and Access to Investors - Pitch Practice Support
HR, Tax & Legal	- HR Services - Supporting for Legal Procedure - Legal Advice
Impact Assessment	- Impact Measurement & Validation Support - Tools and Methodologies for Estimating the Impact
Managerial Training and Development	- Business Development - Business Model Canvas - Consultancy (Internal)

	- Masterclasses - Online Materials - Pricing Model - Seminars - Strategy Planning - Supply Chain Development - Trainings - Webinars - Workshops
Networking	- Access Facilitation with Institutions - Access to Connections - Access to Events - Access to the Alumni Community - Demo Day
Office Space	- Co-working Space - Physical Space
Product Development	- Access to Industrial Facilities & Tools - Piloting & Prototyping Support with Partners - Real Environment Testing - Access to Technological Infrastructures
Others	- Data Analysis Support - Market Analysis Support - Membership for Accessing Extras - Accommodation - Travel Cost Coverage

Tab. 2: Selection criteria adopted, and example of variables retrieved by environmental incubators website and sustainability reports

Characteristics of the Team	- Complementarity of Team Skills - English Proficiency - Full Time Participation - Motivation - One Founder is Part of Minority Group - Pitching Presentation Skills - Previous Experience - Skills and Abilities of the Members
Economic Viability - Feasibility	- Previous Funding - Realism - Solidness of the Business Model - Solvency
Founders Equity	- Minimum % of equity owned by the founder / team of founders
Geography	- Based Being based in a specific location
Impact Potential	- Environmental Impact - Proven Evidence of Impact
Innovativeness	- Level of Innovation - Technological Advantage
IP Rights	- IP Rights
Minimum Development Product	- Stage of product development - MVP Proven Prototype / MVP
Programme Suitability	- Fit with the Thematic - No older than 5 years - Alignment with the Programme
Partnership	- Ready to Establish Collaboration with Companies - Having a Partnership with a Corporate - Having a Partnership with another venture
Scaling potential	- Scaling Potential - Scalable Idea - Looking to Scale Internationally

Following the exploratory nature of the study, we mobilized the descriptive statistics for summarizing the data in one-way comparisons as well as combining the variables for cross comparisons.

Results. We find several patterns characterizing the current landscape of European incubators and their design features in sustaining ventures and we hope as well to provide guideposts for future research, policymakers, and practitioners.

Firstly, we analyse geographical distribution, maturity and main operating sectors of environmental incubators. With respect to geographical distribution, our data presented in Table 3 shows that environmental incubators are evenly spread across Europe with a peak concentration in Spain, Germany, United Kingdom, and Italy. These results

are consistent with those observed in previous literature focused on traditional incubators and with the notion that concept of business incubation in Europe appeared earlier in countries such as United Kingdom, Germany, and France (Aernoudt, 2004). We grouped the HQ Country based on the classification provided by United Nations Statistics Department (1970).

Tab. 3: Incubators geographical distribution across European regions and Countries

		Frequency	Percentage
Eastern Europe	Bulgaria (1) Hungary (3) Poland (1) Romania (1) Ukraine (1)	7	6.63%
Northern Europe	Denmark (3) Estonia (1) Finland (1) Ireland (1) Latvia (3) Lithuania (1) Norway (3) Sweden (5) UK (10)	28	29.70%
Southern Europe	Croatia (1) Cyprus (2) Greece (1) Italy (7) Portugal (4) Spain (14)	29	28.71%
Western Europe	Austria (1) Belgium (2) France (5) Germany (11) Netherlands (5) Switzerland (5)	29	28.71%
Multiple HQ		8	7.92%

Similarly, our data confirms that the incubators aimed at supporting ventures with a social or an environmental purpose is a relatively new phenomenon (Hirschmann et al., 2022; Grilli and Marzano, 2023). Our sample population, in fact, is mainly composed by young organizations: 84,16% of incubators was founded within the last decade and the 47.52% in the last five years. Interestingly, only the 20.8% of the incubators publish a sustainability or an impact report in which are summarized the results of its activities. The environmental incubators mostly intervene in Carbon Reduction, Agri Food, Mobility, and Energy. Environmental incubator can either be publicly or privately funded (Hirschmann et al., 2022). Public sources such as government grants aims to boost the ecosystems encouraging the birth of enterprises for solving societal problems (Surana et al., 2020). Governmental sponsored environmental incubators represents the 38.61% of the incubators in our sample, while the other mainly rely on private sponsorships, often supported by well-established corporations which tend to engage with incubators as source of learning and for arranging potential valuable alliances.

The second step of the analysis regards the assessment of the key design choices related to cohorts of incubates, including the selection criteria adopted, the average duration of the program and the size of the cohort of the ventures included in each program. Our data indicate that the 54.5% of environmental incubators have a predefined number of seats available per program, equal on average to 15, while the remaining part does not report limits in the number of ventures accepted in each program. The reported duration of each program is, on average 5 months. With respect to the stage of maturity, the 57.43% of environmental incubators select early-stage ventures, while the 26.7% of the total do not poses acceptance conditions based on the stage of development, incubating ventures at any stage of maturity. On average, environmental incubators take into account two criteria when evaluating ventures to be selected. Among the most frequent selected criteria adopted, we identified: (1) the characteristics of the entrepreneurial team, which comprehend the embedded skills, abilities, experience, and motivations of the working team (47.5%); (2) the program sustainability, which regards the fit between the venture and the area of intervention of the incubation program (39.6%) and; (3) the scaling potential, which relates to the market growth possibilities of the venture (37.6%). Interestingly, only the 25.7% of the incubators indicates explicitly as a selection criterion an assessment of the potential capacity of the venture to generate a tangible environmental impact for society.

Incubators may provide capital provision to participating ventures; the financial contribution varies for amount, typology, and source. Half of the incubators in the sample population entails the provision of funding, and some of those (43%) ask for equity stake in return. The widely varying amount as well as the percentage of equity stake ranging across programs and are generally meant for sustaining business growth. The convertible loan works well as financial

instrument for the specificity of the incubator - incubatee agreement. The array of offering, described as design features depends on the design choices made by each incubator for each program. The cluster of services may vary substantially, it can be even customized according to peculiar requests. In the European environmental incubator landscape, almost all incubators provide more than one service with an average of about 4 services provided. Among the most offered, we find (1) managerial training, (2) networking, (3) coaching and mentoring, (4) fundraising support, and (5) office space. The latter might have been affected by the switch towards virtual and blended modalities of work more and more adopted since the pandemic.

The third phase of the analysis, which is in a preliminary phase, is concerned with the identification of the relevant patterns based on specific environmental incubators' characteristics. Following Woolley and MacGregor (2022), who studied traditional incubators effectiveness based on sponsorship types, we firstly distinguished incubators based on the presence of funding at the governmental level. Our preliminary results reveal that, on average, governmental sponsored environmental incubators tend to be more locally focused as compared to those not supported by governmental funding. As reported in Table 4, in fact, the former type of environmental incubators has a narrower market scope focusing mainly at regional (10.26%) or national level (41.06%); on contrary, the majority of environmental incubators which do not rely on governmental support is mostly focused at European (24.19%) or global level (51.61%).

Tab. 4: Environmental incubators market scope based on the presence of governmental sponsorship

	Governmental sponsored environmental incubators			
	NO		YES	
	N	%	N	%
Regional	2	3.23%	4	10.26%
National	13	20.97%	16	41.03%
European	15	24.19%	11	28.21%
Global	32	51.61%	8	20.51%
Total	62		39	

Additionally, while the two types of incubators tend, on average, to admit the same number of ventures in their programs (15 on average), their programs tend to differ substantially in term of duration and typology of services offered. Specifically, the average duration of program offered by governmental sponsored environmental incubators is 6 months, 2 months longer than those proposed by incubators not supported by governmental funding. With respect to the type of service offered, our preliminary results point to a different orientation among the types of incubators. In particular, recipients of government sponsorship tend to focus more their attention on offering managerial training (100%) and coaching (95.6%), while those not receiving this type of support put more emphasis on networking activities (92.1%) and fund-raising support (87.1%).

Taken together, our preliminary results suggest the existence of differences among environmental incubators based on the financial support received by external sources. Similarly, other dimension will be investigated in order to assess the presence of similarities and dissimilarities between environmental incubators according to different dimension such as the region of HQ or the typology of services offered.

Research limitations. Our research presents several limitations, most of them related to its current stage of development. In fact, although preliminary data presented suggests the presence of substantial heterogeneity among environmental incubators based on the presence of governmental sponsorship, additional analyses are required to fully understand variations in environmental incubators critical design features. For these reasons, data will be further analyses in order to identify patterns and trends across European incubators. For instance, additional information can be provide to study incubators based on their geography, the type of services offered, or whether they require equity. In doing so, our research will provide a more nuanced view of the European landscape, informing researchers, entrepreneurial teams and institutions.

More in general, our analysis is focused only on one of the actors supporting the environmental ventures ecosystem. However, we note that it is important to recognize that environmental incubators are only one of many types of intermediaries that are emerging and may exist in a country. Cataloguing the vast number of programs, as well as creating taxonomy of entrepreneurship and innovation programs that allows us to compare across different types of action supporting the development of environmental ventures and green technologies, is another important endeavour. Once we have a catalogue of programs in a region and a way of comparing programs with one another, it becomes possible to systematically understand how the spatial distribution of entrepreneurship support programs alters the likelihood of entrepreneurial entry, the probability of success conditional on entry, and the fate of regional innovation ecosystems.

Managerial implications. From a managerial point of view, our preliminary results have important implications for environmental ventures and public institutions. First, data reveal the existence of distinctive of environmental incubators designs, which might prioritize different objectives and, consequently, different types of ventures. Hence, to increase the chance to be selected by an incubation program and from benefit type of services offered, environmental ventures have to extensively search for the best-fitting program/incubator being aware of all the trade-off they can face in term of service offered vis-as-vis request from the incubator in term of equity. Similarly, policymakers that support environmental incubators should also be aware of the heterogeneity of such incubators in terms of objectives, service

offered and requests in order to define supporting criteria that are in line with the overall policymaker objectives, which are typically different from those of other corporate sponsors.

Originality of the paper. *To the best of our knowledge, this paper represents the first attempt to systematically map the environmental incubators ecosystem at the European level. Results presented shed further light on the critical design features of environmental incubator and how these features vary according to key dimensions such as the presence of public funding. Since the nascent phenomenon, the work contributes to broaden the knowledge of the field in addition to having managerial and institutional implications.*

Keywords: *Environmental Incubators; Venture supporting ecosystem; Green innovation*

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