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The Climathon as the enabler of lifelong sustainability and entrepreneurial education

Lydia Papadaki

Phoebe Koundouri

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Lydia Papadaki[12] and Phoebe Koundouri[1234]

[1] Sustainable Development Unit, ATHENA RC, Athens, Greece
[2] School of Economics and ReSEES Research Laboratory, Athens University of Economics and Business, Athens, Greece
[3] Department of Technology, Management and Economics, Technical University of Denmark, Copenhagen, Denmark
[4] UN SDSN Global Climate Hub, Athens, Greece

Abstract

Social sciences, particularly business and management, are now adopting hackathons, traditionally used in IT, to enhance entrepreneurship skills. These co-creative activities, lasting one or two days, involve teams generating ideas or facing challenges. Climathons aim to empower citizens to combat climate change through local activation and collaboration. This study investigates the effectiveness of a Climathon in promoting sustainable entrepreneurial mindsets. Two Climathons were held in Greece in 2023, Lavrio and Agia Paraskevi, to assess the effectiveness of these events. A self-assessment survey was developed and disseminated, with the Climathon participants seeking to provide answers to two research questions: first, whether a Climathon can be utilised as a mechanism to enhance awareness and motivate participants to embrace sustainable practices, and second, which soft skills essential for an entrepreneurial attitude are activated during a Climathon. Results indicated an increased participants' comprehension of sustainability after taking part in the Climathon. The study also found that awards and team leadership experience were significant predictors of sustainability education, which could impact workforce development and corporate training. Problem-solving skills were found to be non-significantly associated with sustainability education. Improving one soft skill could promote the development of additional talents, such as time management and collaboration. Finally, the study identified operational gaps in organising ideathons and suggested areas where future Climathons should focus, such as workshops, team challenges, and solution-creation sessions over expert talks.

Keywords: Innovation, entrepreneurship, Ideathon, soft-skills, competition, education

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1. Introduction

Alongside economic progress, social prosperity and the preservation of natural resources comprise the three pillars of sustainability. The three pillars together establish a comprehensive framework for sustainability, commonly known as the Triple Bottom Line: People (Social), Planet (Environmental), and Profit (Economic) (Alhaddi, 2015). In 1987, the United Nations Brundtland Commission defined sustainability as “meeting the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations, 2024). In 2015, global leaders convened and made a significant commitment to ensure the rights and welfare of all individuals on a healthy, flourishing planet by adopting the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals (SDGs) (United Nations, 2022). The 2030 Agenda is a global framework for poverty reduction, environmental protection, and inequality, with the 17 Sustainable Development Goals (SDGs) aiming to tackle issues like conflict, human rights violations, climate change, and environmental degradation, promoting inclusive development by integrating economic growth, social welfare, and environmental conservation.

Climate change hazards, such as biodiversity loss and air pollution impact indoor and outdoor jobs, leading to social exclusion and energy poverty. Air pollution causes respiratory, cardiovascular, mental, and chronic diseases, requiring sustainable transportation alternatives, while biodiversity loss severely affects the conditions of the flora and fauna, followed by local citizens, and then outdoor and indoor workers (Halkos et al., 2024). In the context of the EU policy framework seeking to make Europe the first climate-neutral continent by 2050 (European Commission, 2019a, 2020; European Council, 2022; European Union, 2021), that is expected to be implemented during the forthcoming years, the Twin (Green and Digital) Transition is expected to accelerate and initiate substantial structural changes in the labour markets of the European Union. Koundouri et al. (2023) argue that both Green and Digital jobs will continue to increase from 2022 to 2035 and they emphasize that the top six "Soft" Skills, which are jointly classified as Green and Digital, are estimated to be Critical Thinking, Judgement and decision-making, Complex Problem Solving, Monitoring, Writing, and Coordination. These skills are highly valued in the majority of occupations.

Traditionally, entrepreneurs possess these soft skills. Entrepreneurs think and act in a manner that enables them to identify and capitalize on possibilities in their environment to implement new ideas, products, processes, and organizational or marketing innovations (Fei & Shuangyan, 2024; Zahra & Nambisan, 2012). Consequently, skills pertinent to entrepreneurship are essential for company development in the fourth industrial revolution (Ayinde & Kirkwood, 2020) and for generating financial, cultural, and social value for others (European Commission, 2019b). The European Entrepreneurship Competence Framework (EntreComp) posits that an entrepreneurial mindset necessitates skills in idea generation and opportunity exploitation (imagination, future vision, creativity, etc.); resource management (self-awareness, efficacy, motivation, financial literacy, etc.); and action execution (initiative, planning, management, collaboration, etc.) (European Commission, 2019b). Although entrepreneurship is often viewed as the creator of social injustice and environmental degradation, it has the potential to drive sustainability. Entrepreneurship is vital for promoting national progress and development (Dhaliwal, 2016; Doran et al., 2018; Erken et al., 2018; Galindo-Martín et al., 2020), as well as for market innovations and technical

improvements that do not only improve quality of life, but reduce environmental impacts (Schaltegger & Wagner, 2011).

The relationship between entrepreneurship and sustainable development has been explored through numerous perspectives and publications, including ecopreneurship, social entrepreneurship, sustainable entrepreneurship, and, indirectly, institutional entrepreneurship, all of which aim at making profit by solving an environmental and/or societal problem (Battilana et al., 2009; Bull, 2008; Cohen, 2006; Cohen et al., 2008; Lehmann et al., 2003; Ridley-Duff, 2008). The competencies identified by the EntreComp are the foundation of sustainable thinking. The European sustainability competence framework (GreenComp) suggests that a sustainability mindset encompasses competencies in embodying sustainability values (valuing sustainability, supporting equity, promoting nature, etc.); embracing complexity in sustainability (systems thinking, critical thinking, problem framing, etc.); envisioning sustainable futures (futures literacy, adaptability, exploratory thinking, etc.); and acting for sustainability (political agency, collective action, individual initiative, etc.) (Bianchi et al., 2022).

Higher education is making some efforts to revise the curricula to incorporate sustainable entrepreneurship skills; however, these efforts are dispersed. In an effort to reduce this disparity, online courses have emerged in recent years, providing an opportunity for an increasing number of professionals to acquire the essential skills required by the market to facilitate the transition to sustainability. Among them, the CATALYST platform has developed 70 courses in 10 focus areas that not only address all 17 SDGs but also capture the key competencies in sustainability developed by (Wiek et al., 2011), which include Systems-thinking, Futures-thinking, Values-thinking, Strategic-thinking, and Interpersonal competencies (Papadaki et al., 2024).

Entrepreneurial teaching pedagogies that emphasize practice appear to produce superior learning outcomes, as well as to increase student satisfaction and engagement (Bakoush, 2022; Finch et al., 2014; García-Castanedo et al., 2024; Hahn et al., 2017). The focal point of this study is the concept of hackathons. Participants in hackathons work in teams to develop a solution to a given problem (Flus & Hurst, 2021). Hackathon events have been traditionally adopted in the IT domain of industry rather than in other fields. Nevertheless, there is a trend in the social sciences, particularly in business and management, to address these types of events, also known as ideathons, as a means of enhancing entrepreneurship-related skills. An ideathon is a co-creative activity that typically lasts one or two days. Participants work in teams to generate new ideas or confront a provided challenge (Endo et al., 2020; Pulyavina et al., 2022). Climathon, is an ideathon that seeks at empowering citizens to combat climate change. It is centered around local activation and collaboration with decision-makers and future leaders, for the creation of climate-resilient, zero-carbon cities (EIT Climate-KIC, 2024).

The primary objective of this study is to investigate the potential of a Climathon as a tool for promoting sustainable entrepreneurship. The primary objectives consist of the evaluation of the climathon's impact and the presentation of the primary steps and challenges associated with the organization of this type of event. This study discusses two Climathons that were held in Greece in 2023, specifically in Lavrio and Agia Paraskevi, utilizing the case study methodology. Consequently, we present the subsequent research questions:

RQ1. Is it possible to employ Climathon as a tool to not only raise awareness but also to encourage participants to adopt sustainable behaviors?

RQ2. Which are the soft skills required for an entrepreneurial mindset that are triggered in a Climathon?

The article is organized as follows. The subsequent section offers a theoretical introduction to the subject matter. We provide an explanation of the survey development and data collection process in the "Methodology and Data collection" section. The results are presented in the subsequent section, followed by a Discussion section, and ultimately, conclusions are presented.

2. Case studies description

A Climathon is typically organized as a collaborative event that is intended to resolve specific climate challenges for a specific city within a predetermined timeframe, which is frequently 24 to 48 hours. The event's theme and specific challenges are provided by the Municipal Authorities and are introduced during the introduction session, which initiates the process. The introductory section is followed by cross-disciplinary presentations that are relevant to the targeted challenge, as no prior knowledge is necessary. The participants are subsequently divided into teams of 3-6 individuals, who may consist of students, professionals, and community members. These teams are encouraged to utilize their diverse expertise and creativity to collaborate, ideate, and develop actionable solutions.

Mentors from a diverse range of disciplines provide feedback and circulate among the teams, guiding the development of the participants' concepts into fully developed business models. Teams present their solutions to a council of judges, who are typically composed of industry experts, local authority representatives, and academics, during the final pitching session of the climathon. Ensuring that the ideas generated have the potential to translate into real-world impact, winning solutions may receive prizes, funding, or opportunities for further development. Our case study concentrates on two Climathons that occurred in Attica region, Greece in 2023, specifically in Lavrio and Agia Paraskevi.

2.1. Climathon Lavrio

The town of Lavrio is a small city with 25,102 permanent residents (according to the 2011 census). Lavrio, located on the Athenian Riviera, has a warm climate with mild winters and hot summers. The city has a high historical and monumental density, having been active in silver mining since ancient times. The region experienced rapid development after 1864 when Franco-Italian interests Roux-Serpieri-Fressynet & C.E secured the right to exploit estuaries and recover ancient slags. The new city of Lavrio attracted Greek workers from various regions, including the Mediterranean, Cyclades, Crete, Laconia, Evia, Boeotia, Phocis, and many foreign workers from Cartagena, Spain, and Malta. The economic and industrial development of the area in the 19th and 20th centuries had significant environmental impacts. To address these challenges, the Technological and Cultural Park of Lavrio (TPPL) has important projects, hosting technology companies and leading research activities with the

support of the National Natural University of Athens (NTUA) (Karachaliou, 2009; Karachaliou et al., 2007). The Lavrio Land was recently included in the UNESCO Global Geoparks Network and the European Geoparks Network as a Geological and Cultural Heritage Monument.

According to climate projections developed by the National Observatory of Athens and the Academy of Athens, the number of days with temperatures > 35°C may increase in the Lavrio region by up to 20 days per year by 2100. The average sea level in the Mediterranean has risen by 6 cm in the last 20 years, and this trend is expected to accelerate, causing an increase of 43-84 cm by 2100 (MedECC, 2020).

The National Recovery and Resilience Plan Greece 2.0 program aims to upgrade urban spaces for aesthetic, economic, environmental, functional, and social revitalization. It includes interventions incorporating cultural and environmental elements, implementing climate change measures, and upgrading infrastructure. The program involves public space and building stock upgrades, restoration and promotion of cultural heritage elements, and smart-cities-type electronic applications. A development project will begin next month within the National Recovery and Resilience Plan "Greece 2.0" with funding from the European Union – NextGenerationEU. The project aims to regenerate and aesthetically upgrade the central area of the Municipality of Lavrio, transforming it into a multifunctional area for commercial activities, recreation, and walking. The project requires preservation of the area's style and character, use of environmentally friendly materials, and functional rearrangement of the city's historic center in accordance with an approved traffic study.

Climathon Lavrio[1] took place on Saturday, September 23 and Sunday, September 24, 2023 at the Lavrio Technological and Cultural Park, attracting 32 participants. The challenge for the 2023 Climathon in Lavrio was "The Lavrio of Tomorrow: Together, we devise solutions for the city of Lavrio with the objective of adapting and mitigating climate change." Participants were invited to formulate holistic proposals that will enhance the sustainability, climate neutrality and resilience of the region and the city and will concern various areas of interest. Figure 1 shows the study area on which this Climathon Lavrio focused. This Traffic Study addresses the entire operation of the city and the port in relation to the coastal road and unifies green spaces, resulting in the creation of a single municipal park of approximately 26 acres, in which regeneration works will be carried out. The first three successful teams were awarded either a 3-day or a 7-day cruise as well as cash prizes of 1200 euros for the first team, 500 euros for the second-place team and 300 euros for the third team.

[1] Climathon Lavrio was organized by the Ministry of Environment and Energy in collaboration with the Sustainable Development Unit - ATHENA RC and the Athens University of Economics and Business and supported by the Municipality of Lavrio, the Port of Lavrio Authority, the Hellenic Republic Development Fund, the NTUA Lavrio Technological and Cultural Park and Climate-KIC.

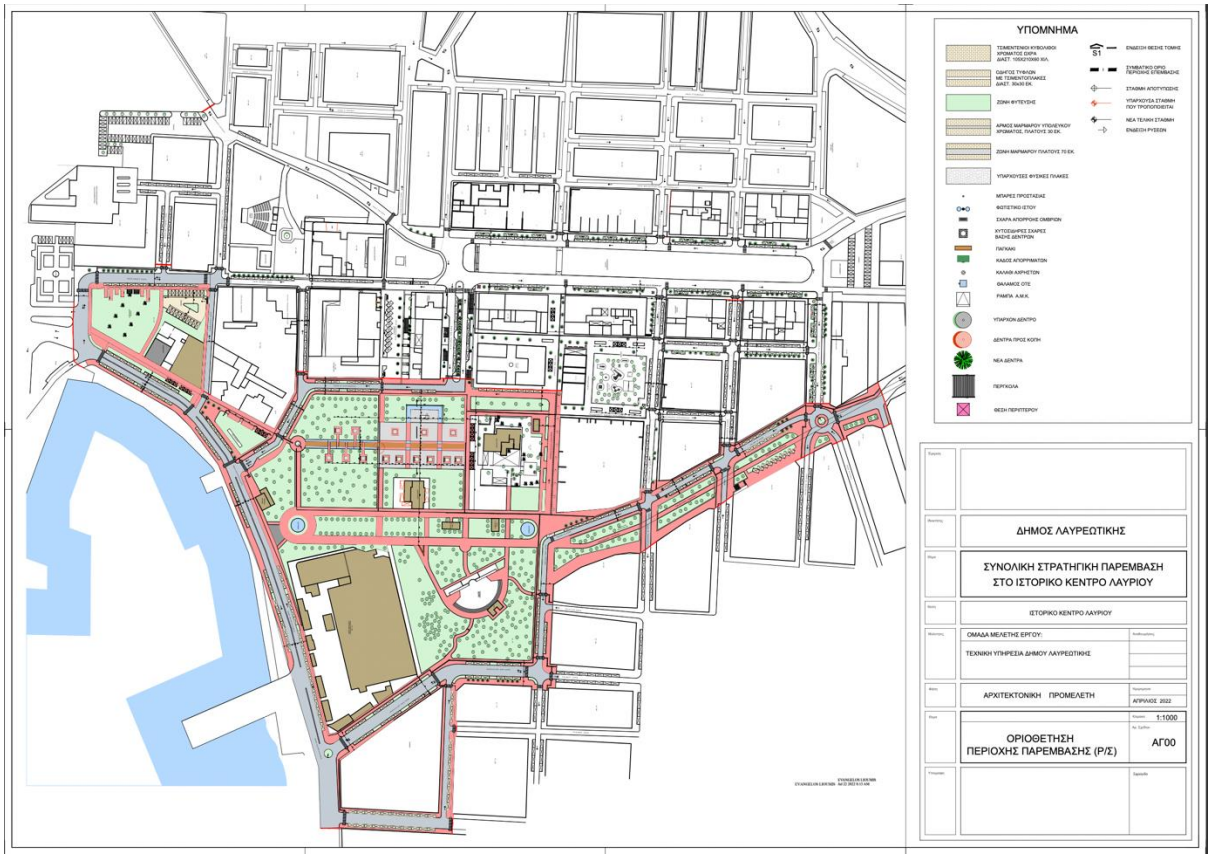

Figure 1 - Lavrio's urban plan

2.2. Climathon Agia Paraskevi

Agia Paraskevi has a unique setting within the Attika region. A peri-urban forest of high value in matters of biodiversity and protection of the water resources, a highly protected area, a Natura 2000 site, is part of city. The city of Aghia Paraskevi has, therefore, the difficult task of maintaining and protecting this unique ecosystem of Hymettus. In addition, it is a city of approximately 62,000 residents, with densely built parts. It faces all the challenges of the suburban areas of the Metropolitan Attika Region. The water and green open space management issues as well as issues related to water visibility, biodiversity presence and support, and contact of citizens with nature, are of vital importance. Solutions to any of those issues or holistic approaches combining any of the above-mentioned components will improve the sustainability of the city.

Climathon Agia Paraskevi[2] was held on Thursday, 30th of November and on Saturday, 2nd of December 2023 in the premises of the American College of Greece attracting 33 participants. The challenge of 2023 Climathon in Agia Paraskevi was “Water, Nature and Citizens” seeking for solutions that address any or a combination of the issues related to water resource management, nature and biodiversity in the city, the benefits and/or active participation of

[2] Climathon Agia Paraskevi was organized by the General Secretariat of Natural Environment and Water in collaboration with the American College of Greece, the Sustainable Development Unit – ATHENA RC, the Municipality of Agia Paraskevi, under the auspices of the Green Fund and the support of the Athens University of Economics and Business and the Program LIFE IP AdaptInGr

citizens and visitors of Agia Paraskevi in protecting the natural and the city environment. The Climathon Agia Paraskevi 2023 challenge was along the lines of the New European Bauhaus Initiative, which seeks to redesign cities resilient to Climate Change and at the same time make them prototypes of Sustainability, Beauty and Inclusiveness. Participants were asked to formulate innovative solutions for the city of Agia Paraskevi with sustainability and citizen addressing at least one of the following issues: How to manage the existing water resources within the city; how to revive waterways (streams, water sources, fountains); how to protect the precious peri-urban forest ecosystem and biodiversity; how to support biodiversity within the city; how to educate and engage citizens in the protection of relevant environmental attributes; how to improve the citizens well-being and everyday life through interventions related with water and/or biodiversity management; how to re-establish citizens' contact with nature in the city; and how to integrate innovative ideas.

Table 1 - Climathons overview

Climathon	Date	Challenge	Participants
Lavrio	Saturday to Sunday 23 and 24 September, 2023	Climate change adaptation and mitigation for the city of Lavrio	32
Agia Paraskevi	Thursday, 30th of November and on Saturday, 2nd of December 2023	Water, Nature and Citizens interface for the city of Agia Paraskevi	33

3. Methodology and Data collection

3.1. Aim

The aim of the present study is, therefore, to explore the effect of participating in a climathon in terms of developing soft skills, initiating entrepreneurship ideas, seeking sustainability-related studies and taking action in implementing sustainability practices in personal and professional life. It is investigated from the perspective of climathon participants using a self-assessment survey.

3.2. Design and setting

The survey was intended to collect information regarding the Climathon participants' perceptions about sustainability and about the relationship between their climathon experience and the development of soft skills after the Climathon. It was composed of 52 questions, which were a combination of checkboxes, multiple-choice, Likert scale, and open-ended to assure the collection of both quantitative and qualitative data. The questions were designed to achieve a balance between brevity and comprehensiveness, thereby promoting higher response rates and addressing the research objectives.

3.3. Target Audience and Sample

The survey targeted individuals who participated in one of the two Climathons presented above. In total, more than 150 people registered for these two Climathons, with 65 showing up during the events. The no-show-up phenomenon is common in organising events and competitions, such as the Climathon. Hackathons and ideathons face challenges in attracting participants, including novice fears, traditional format and timing, and perception of the event. Inexperienced participants may feel intimidated or unable to contribute meaningfully, assuming that these competitions are exclusively for technical participants, while the traditional 24-48-hour format may not appeal to diverse groups, especially those with family commitments or health concerns (Chau & Gerber, 2023; Huppenkothen et al., 2018; Warner & Guo, 2017).

3.4. Distribution Method and Data collection

The survey was distributed using Google Forms, a user-friendly platform that allows for broad reach and seamless data collection. Approximately one week after their participation in the event, the link to the survey was sent out via email to the individuals who had attended either of the two Climathons. Efforts were made to ensure that the survey reached all participants of the target audience. Data collection took place over a period of 5 months, spanning from October 2023 to February 2024. Participation was voluntary, and respondents were guaranteed anonymity to encourage honest and unbiased responses. A total of 38 responses were gathered during this period.

3.5. Data analysis

The data that was collected was exported from Google Forms and analyzed using R. Qualitative responses were coded and thematically analyzed to identify patterns and insights relevant to the research objectives, while quantitative data were analyzed using descriptive statistics, correlation heatmaps, paired comparisons and multiple linear regressions.

4. Results and Discussion

The purpose of this study is to investigate the impact that taking part in a climate change event has on the development of soft skills, the initiation of ideas for entrepreneurship, the pursuit of studies related to sustainability, and the implementation of sustainability practices in both personal and professional life.

4.1. Descriptive statistics of the sample

The questionnaire was distributed to 65 individuals, and it was completed and returned by 38 participants (58.4% response rate). Table 2 presents the descriptive statistics for the total sample, as well for each case study individually. The total proportion of females in the sample is 0.58, which is equivalent to 58%, suggesting that the sample is slightly more dominated by females. When compared to Agia Paraskevi, where the percentage of females is somewhat lower at 0.53, the percentage of females in Lavrio is significantly greater at 0.63, which

indicates some difference between the two places, with the gender distribution to be rather balanced. The average age of the sample is 28 years with the sample as a whole to have a standard deviation of 10.9 years, which indicates that there is a wide age range. Participants from Lavrio are, on average (30.28 years), older than those from Agia Paraskevi, who are 25.71 years old. According to the difference in standard deviations (13.15 in Lavrio against 7.80 in Agia Paraskevi), the age distribution in Lavrio appears to be more diverse than that of Agia Paraskevi, which is comprised of a younger and more uniform group of individuals.

The sample group has an average of 16.31 years of education, which indicates that the sample is well educated (equal to post-secondary education or above). The participants from Lavrio have a greater educational attainment (17.05 years) than those from Agia Paraskevi, (15.57 years). In terms of work experience, the participants have an average of 5.25 years of work experience, with a rather high standard deviation of 7.77 years. This indicates that there is a mix of participants who have both a little amount of work experience and a significant amount of work experience. Participants from Lavrio have reported having an average of 5.03 years of job experience, which is somewhat lower than the average of 5.47 years reported by participants from Agia Paraskevi.

Table 2 - Descriptive statistics for the sample (n=38). Sample mean (standard deviation in parentheses)

Characteristics	Mean (SD)	Mean (SD) Lavrio	Mean (SD) Agia Paraskevi
Gender (Female =1)	0.58 (0.50)	0.63 (0.50)	0.53 (0.52)
Age (years)	28 (10.9)	30.28 (13.15)	25.71 (7.80)
Education (years of education)	16.31 (2.65)	17.05 (2.25)	15.57 (2.87)
Work experience (years)	5.25 (7.77)	5.03 (7.89)	5.477.86)

4.2. Factors that encourage participation again in a Climathon

Regarding their experience, 65.78% (0.48) would participate again in a Climathon. A regression model was calculated for factors associated with participating again in Climathon. After starting with the full model, the dominant variables were determined and used for further analysis. The final model is statistically significant with p-value equal to 0.0001698. Predictors in this model were winning a prize, modifying their consumption (after the Climathon), being already involved in sustainability initiatives, pursuing studies on sustainability (after the Climathon), meeting interesting people (Climathon Participants), gender and work experience. These factors explain 49.2% (Adjusted R-squared: 0.4921) of the dependent variable. Table 6 shows that the dependent variable of participating again in a Climathon was positively associated with winning a prize, changing behaviour, pursuing studies on sustainability, meeting interesting people and work experience and negatively with being already involved in sustainability initiatives or being a female. Receiving a prize or undergoing significant personal development might increase participants' motivation or happiness, prompting them to participate in future similar events. On the other side, individuals already committed to sustainability may prioritize alternative activities or perceive a less necessity to participate in a Climathon for inspiration. The negative relationship between females and participation can be attributed to novice fear and lack of participation

diversity challenge, as identified by (Chau & Gerber, 2023). Nevertheless, the Climathon's networking or career opportunities combined with academic interest in sustainability can encourage participation in similar ideathons.

Table 3 - Regression analysis predicting factors associated with participating again in Climathon

Coefficients	Estimate	Std. Error	t value	Pr(>|t|)	Sig.
(Intercept)	-0.11883	0.20480	-0.580	0.56611	
Winning a prize	0.17652	0.05909	2.987	0.00556	**
Changing behavior as a consumer, after the Climathon (Yes = 1)	0.29528	0.12580	2.347	0.02570	*
Being already involved in sustainability initiatives	-0.28803	0.11971	-2.406	0.02249	*
Pursuing studies on sustainability, after the Climathon (Yes = 1)	0.22970	0.13240	1.735	0.09301	.

4.3. Climathon and sustainability action

Participants were requested to evaluate their understanding of sustainability concepts before and after their involvement in a Climathon, employing a Likert scale from 1 to 5, with 1 indicating "Limited Knowledge" and 5 denoting "Extensive Knowledge." Using paired comparison, we see that the mean before the Climathons was 3.84 (0.94), and post-event it was 4.13 (0.74), with a p-value of 0.00316, indicating statistical significance in the score changes at a 95 percent confidence interval. This implies that we can confidently attribute the observed change to the participation to the Climathon rather than random variation. Participating in a 24-hour competition focused on sustainability matters appears to have a modest, but positive improvement of individuals' views toward sustainability. The Climathon had a proportionate effect on both groups, as evidenced by the analogous change in Lavrio and Agia Paraskevi (0.32 (SD = 0.58) in both cases).

Agia Paraskevi participants reported a higher baseline knowledge score (4.05 (SD = 0.78)) than those from Lavrio (3.63 (SD = 1.06) (Baseline Knowledge (C1)). This gap may be indicative of variations in the participant profiles between the two locations or in prior exposure to sustainability concepts. For instance, individuals in Agia Paraskevi seem to be younger and thus more exposed to sustainability concepts. These results are in line with , which shows a negative relationship between age and prior knowledge to sustainability (C1), with the residuals being symmetrically distributed around zero, as indicated by the median residual that is close to zero (0.09199) (Figure 2). The model described in is statistically significant with p-value equal to 0.287, but age and education explain only 18.36% of the prior knowledge to sustainability. Work experience and gender seem to have no impact on C1.

Regarding post-event knowledge (C2), it appears that none of the demographic variables (age, education, work experience, and gender) appear to influence their capacity to comprehend novel sustainability concepts. Thus, the difference in scores across the two case studies cannot be attributed to demographic characteristics of the individuals. We see that the post-event knowledge score is higher for participants from Agia Paraskevi (4.32 (SD = 0.58)) than they are for Lavrio (3.95 (SD = 0.85)). This trend is consistent with the baseline scores, but it

also implies that the participation to the Climathon may have been marginally more beneficial for participants in Agia Paraskevi.

Table 4 – The difference between post- and prior-knowledge on sustainability matters, before and after participating in a Climathon.

	Mean (SD)	**Mean (SD) Lavrio**	**Mean (SD) Agia Paraskevi**
C2 - C1	0.29 (0.56)	0.32 (0.58)	0.32 (0.58)
C1 mean (SD)	3.84 (0.94)	3.63 (1.06)	4.05 (0.78)
C2 mean (SD)	4.13 (0.74)	3.95 (0.85)	4.32 (0.58)
p-value	0.00316	0.02955	0.05617

$$C1_i = 3.15 - 0.31AGE_i + 0.53EDU_i + \varepsilon_i \qquad [1]$$

$$(0.41) \quad (0.15) \qquad (0.20)$$

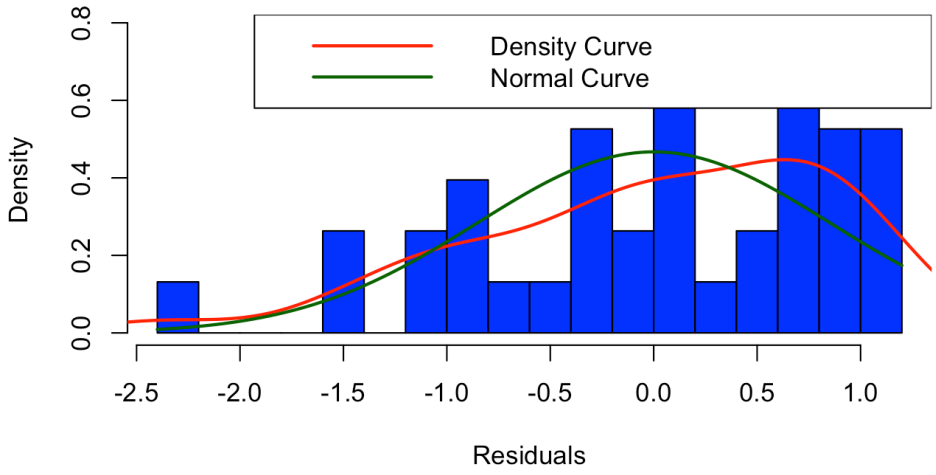

Figure 2 - Histogram of residuals for equation [1] with Normal and Density curves

The histogram in Figure 3 visualize the results of this paired comparison. The green bars prevail in the advanced knowledge ratings (e.g., 4 and 5), suggesting that several individuals indicated improved comprehension following the Climathon, while the blue bars are predominantly located at lower knowledge ratings (e.g., 1, 2, and 3), showing that participants recognized their knowledge as limited prior to the event. In terms of education, 31.57% (SD = 0.47) of the participants pursued studies on sustainability after participating in a Climathon. The standard deviation exhibits moderate variability that reveals that proportions are not exceedingly close to “yes” or “no”.

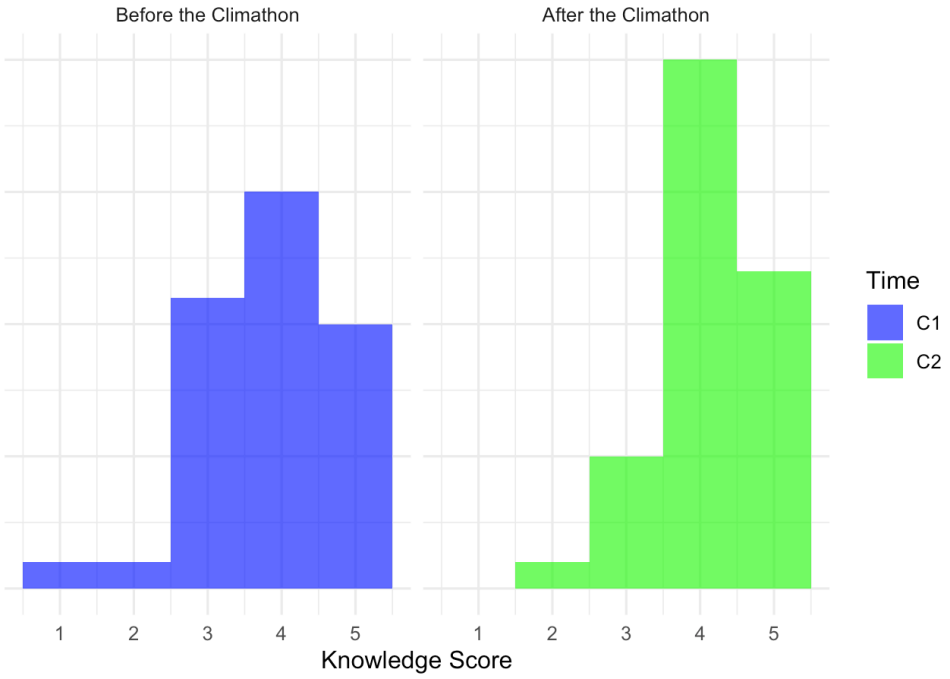

Figure 3 – Histogram with the knowledge scores before and after the participation in a Climathon. On the left: Knowledge scores before; on the right: Knowledge change after the Climathon.

Table 5 displays the extent to which participants participate in sustainability practices in their personal (C61-C71) and professional (C10a-C10d) lives. The scale ranges from 1 to 5, with 1 indicating "Rarely" and 5 indicating "Frequently" in variables C61-C71, and 1 indicating "Strongly Disagree" and 5 indicating "Strongly Agree" in variables C10a-C10d. In regard to the first bunch of statements (C61-C71), the most frequently and widely adopted sustainability behaviors were related to energy saving "Use energy-efficient appliances and turn off lights when not in use" (Mean = 4.39, SD = 0.72), as indicated by the highest score, with the low standard deviation indicating consistency across the participants. Recycling "Recycle materials like paper, glass, and plastic" (Mean = 4.13, SD = 1.09) seems to be the second most frequently preferred practice. However, there is more variability in this statement than in energy-use. We have also observed that these scores are not determined by demographics. Consistent engagement is also demonstrated by the monitoring and reduction of water consumption (Mean = 3.97, SD = 0.88) and food waste (Mean = 3.92, SD = 1.02).

On the other hand, the least practiced behaviours include reusing items when possible (Mean = 3.13, SD = 0.93) and consuming less meat and more plant-based foods (Mean = 3.16, SD = 1.48), which suggests that participants either do not believe that they should be prioritized in the actions taken towards sustainability or that are not easily achievable. The high standard deviation for plant-based diets suggests that the level of engagement varies among individuals, with some complying to a diet that is predominantly plant-based. The moderate engagement with significant variability of "Reduce air travel when possible" (Mean = 3.34, SD = 1.49) is likely due to differential access to or reliance on air travel. The efforts toward sustainable consumption are indicated by the reduction of overall consumption (Mean = 3.74, SD = 1.00) and the selection of locally-produced goods (Mean = 3.74, SD = 1.06), although there is still space for improvement. The moderate engagement with public transportation,

carpooling, or bicycling (Mean = 3.58, SD = 1.35) is indicative of significant variability, which may be influenced by geographic or infrastructural factors.

Table 5 – Engagement with sustainability practices

Variable	Skill	Mean (SD)
C61	Reduce your overall consumption	3.74 (1.00)
C62	Reuse items when possible	3.13 (0.93)
C63	Recycle materials like paper, glass, and plastic	4.13 (1.09)
C64	Use energy-efficient appliances and turn off lights when not in use	4.39 (0.72)
C65	Monitor and reduce water usage	3.97 (0.88)
C66	Use public transportation, carpool, or bike	3.58 (1.35)
C67	Reduce air travel when possible	3.34 (1.49)
C68	Reduce single-use plastic and disposable products	3.84 (1.08)
C69	Choose locally produced goods	3.74 (1.06)
C70	Consume less meat and more plant-based foods	3.16 (1.48)
C71	Reduce food waste by planning meals and using leftovers	3.92 (1.02)
C10a	I integrate sustainability principles into my daily work/study routine	3.79 (0.96)
C10b	I have influenced positive changes in my organization or academic institution by applying sustainability knowledge	3.29 (1.04)
C10c	I actively seek out opportunities to apply sustainability concepts and practices in my job or studies	3.79 (1.17)
C10d	I have contributed to sustainability-related projects, initiatives, or research	3.57 (1.21)

In regard to the second set of statements, the findings offer a comprehensive perspective on how participants perceive their involvement with sustainability practices in their professional or academic environments. The majority of participants concur that they incorporate sustainability principles into their daily work or academic pursuits (Mean = 3.79, SD = 0.96) and that they explore opportunities to apply sustainability practices into their work or studies (Mean = 3.79, SD = 1.17). The relatively high mean scores imply that sustainability is becoming an essential component of their daily routines. However, the standard deviations suggest that there is moderate variability in responses, indicating that some participants may still encounter difficulties with understanding how sustainability is relevant to their careers or where to find practical examples that they could adapt in their day-to-day routines.

Participants report moderate engagement in contributing to sustainability-related projects or initiatives (Mean = 3.57, SD = 1.21), with a mean score that is slightly lower than that of routine integration or those who are actively pursuing opportunities. The larger standard deviation (1.21) indicates that there are substantial disparities in the level of contribution, which may be attributed to the diverse profiles of Climathon participants, their interests and access to opportunities. Finally, promoting positive changes in organizations or institutions (Mean = 3.29, SD = 1.04) is less preferred than the other sustainability practices, indicating that a smaller number of participants are confident in their ability to drive systemic changes within their organizations or academic setting. The high standard deviation (1.04) is indicative

of the diverse levels of self-perceived impact, which are likely the result of the diverse roles, authority, or opportunities for action within their environments.

Table 6 - Regression analysis predicting factors associated with pursuing sustainability education

Coefficients	Estimate	Std. Error	t value	Pr(>|t|)	Sig.
(Intercept)	-0.39819	0.33640	-1.184	0.2450	
Winning a prize	0.13829	0.06328	2.185	0.0361	*
Age	0.10973	0.06325	1.735	0.0921	.
Problem solving skills	-0.21531	0.12346	-1.744	0.0905	.
Leading a team	0.30042	0.12273	2.448	0.0199	*

** Significant code: 0.001.
* Significant code: 0.01.
. Significant code: 0.05.

Table 6 presents the factors that are associated with the pursuit of sustainability education. The regression analysis indicates that receiving an award and possessing team leadership experience are strong positive predictors of engaging in sustainability education, suggesting that acknowledgment and leadership abilities may motivate individuals to pursue more learning. This has economic ramifications for workforce development and business training initiatives, since incentivizing accomplishments and cultivating leadership possibilities might augment sustainability-related skills. Nonetheless, problem-solving skills exhibit a negative although non-significant correlation, suggesting that persons proficient in this domain may see less necessity for formal schooling. Age has a little positive correlation, indicating that older persons may be somewhat more predisposed to sustainability education, either attributable to professional advancement or heightened awareness. These findings underscore the significance of organised trainings and educational activities that are centered around acknowledgement incentives and leadership cultivation in advancing sustainability-oriented human capital investment.

4.4. Climathon and entrepreneurial education

As previously mentioned in the introduction section, an entrepreneurial mindset is closely linked to soft skills such as collaboration, leadership, execution, resource management (including time, budget, and motivation), and creativity and imagination. When combined with sustainability-related competencies, these skills also encompass embodying sustainability values, critical thinking and problem-solving, envisioning sustainable futures, and taking action for sustainability. Climathon is one of the few activities encompassing nearly all these skills. Participants are expected to form teams and collaborate, develop sustainable visions, generate ideas for addressing the highlighted challenges using their problem-solving competencies, listen to the feedback provided by their mentors and peers, exhibit leadership skills, and complete all of this within a constrained time frame before presenting to the jury.

The aforementioned section defined the areas in which participants were most motivated to further acquire knowledge and take action in the field of sustainability. Table 7 displays the frequency of satisfaction from engaging in specific activities during the Climathon and Table

8 shows the enhancement of six soft skills during a Climathon, as participants self-reported[3]. We observe that the most pleasant activity in a Climathon is working in a team (71%), followed by presenting their solutions (60.5%) and discussing with the mentors (44.7%). Conversely, the lectures and presentations by experts (21%) were the least favored activity. Participants are likely to experience a sense of overwhelm when confronted with conventional top-down knowledge delivery. Consequently, they are inclined to pursue practical problem-solving and hands-on engagement, which they perceive as more dynamic and pertinent.

Table 7 - Frequency (percentage) of satisfaction from engaging in specific activities during the Climathon.

Climathon section	Percentage (SD)	Mean (SD) For 18-34 group
Speeches/Presentations	21% (0.41)	12.9% (0.34)
Working in a team	71% (0.46)	77.4% (0.42)
Discussing with the mentors	44.7% (0.50)	41.9% (0.50)
Presenting your solution	60.5% (0.49)	67.7% (0.47)
Team building exercises and workshops	28.9% (0.46)	25.8% (0.44)

Table 8 – Enhancement of soft skills during a Climathon. Likert scale: 1 (I do not agree) to 5 (I strongly agree), with 3 (neutral).

Variable	Skill	Mean (SD)	Mean (SD) if won a prize	Mean (SD) if didn't win a prize	Mean (SD) For 18-34 group
A61	Presenting your ideas to the public	3.76 (1.00)	3.85 (1.05)	3.58 (0.90)	3.77 (0.99)
A62	Listening new ideas and concepts	3.79 (0.93)	3.96 (1.87)	3.42 (1.00)	3.81 (0.91)
A63	Managing better your time	3.78 (0.87)	3.92 (0.74)	3.50 (1.09)	3.81 (0.87)
A64	Solving a problem	3.84 (0.89)	3.88 (0.86)	3.75 (0.97)	3.87 (0.88)
A65	Leading a team	3.87 (0.91)	3.88 (0.91)	3.83 (0.94)	3.90 (0.87)
A66	Understanding what other people feel	3.74 (0.98)	3.91 (0.85)	3.58 (1.24)	3.74 (0.96)

In addition, respondents argue that their participation in a Climathon helps them improve all of the soft skills that were highlighted, with team-leading and problem-solving reaching almost four out of five (Table 8). According to the findings, participation in a Climathon appears to stimulate the development of qualities associated to leadership (Mean = 3.87, SD = 0.91) and problem solving (Mean = 3.84, SD = 0.89). The collaborative and competitive nature of the Climathon is likely to have a significant impact on the development of qualities, as participants are required to navigate team dynamics, articulate ideas, and conceive practical solutions under time constraints. However, those who won a prize seem to assign a

[3] In Table 6, participants were requested to identify up to three sections that they found enjoyable during the Climathon. In Table 7, participants were asked to provide their opinion on the level of confidence they felt in performing these soft skills individually, with a score ranging from 1 (I do not agree) to 5 (I strongly agree), with 3 (neutral).

greater significance to active listening (Mean = 3.96, SD = 1.87), time management (Mean = 3.92, SD = 0.74) and empathy (Mean = 3.91, SD = 0.85). Successful participants acknowledge the significance of understanding a variety of viewpoints, such as those of mentors and teammates, as a critical component of success. In high-pressure environments such as a Climathon, the critical role of time management is demonstrated by the fact that winning teams may have excelled in the efficient structuring and prioritization of tasks, while empathy suggests that victors prioritize comprehending and appreciating the emotions and perspectives of others, a competency that is likely to be crucial for the development of effective solutions and collaboration.

Figure 4 displays the correlation matrix for the soft skills presented in Table 8. We observe that public speaking is strongly associated with listening new ideas and concepts (0.93), and time management with problem-solving skills (0.86), suggesting that these competencies may often go hand-in-hand. The correlation heatmap also shows that it is possible that individuals who are competent in public speaking are also likely to be confident leaders (0.86). This is because abilities such as expressing ideas and managing a team are closely tied to one another. There is a comparatively smaller association between understanding the feelings of others and technical or organizational abilities such as problem-solving (0.64). However, there is a higher correlation between understanding others' feelings and interpersonal skills such as listening to new opinions (0.80), reflecting the importance of empathy in effective communication. This matrix might be useful in identifying clusters of skills that develop together when treatments are being designed to improve specific talents. For example, improving one's ability to speak in public might instill confidence in one's ability to lead a team.

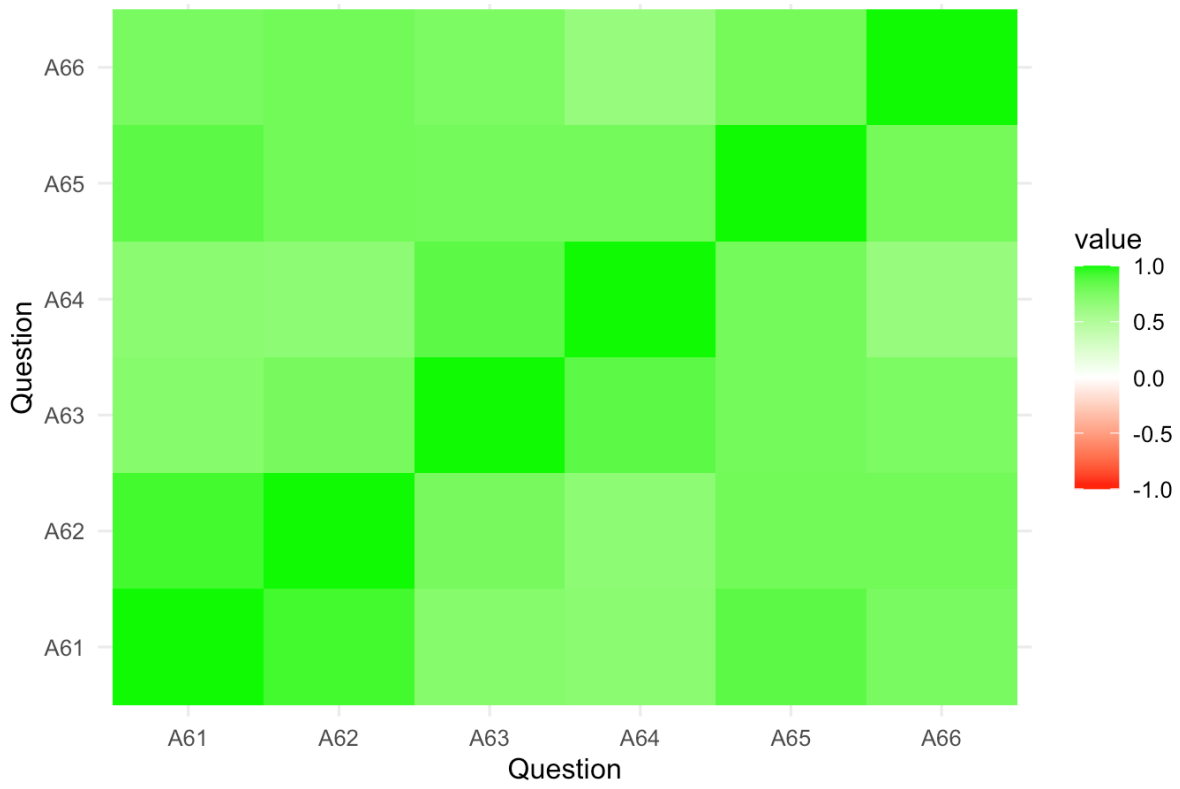

Figure 4 - Correlation Heatmap for soft skills

The study found a strong connection between participation and skill development, with activities like teamwork (71%) and presenting solutions (60.5%) aligning with the higher ratings for leadership (A64) and problem-solving (A65) skills. However, team-building exercises had lower participation (28.9%), possibly due to lower mean ratings for empathy-related skills (A66). Winning a prize consistently correlates with higher skill ratings across all domains, suggesting that tangible rewards may enhance participants' reflections on their skills. Gaps and opportunities for improving Climathons delivery were also identified, with lower participation in team-building workshops and speeches/presentations suggesting future Climathons could improve or eliminate these areas. Non-winners consistently rate their skills lower, suggesting a need for better post-event support or recognition for all participants.

Another objective of the Climathon was to inspire participants to get involved with entrepreneurial activities. A regression model was calculated for factors associated with participants' willingness to form a company after participating in a Climathon. The prominent variables were identified and employed for subsequent analysis after the full model was set up. The final model is statistically significant with p-value equal to 0.0009739. Predictors in this model were winning a prize and frequently meeting with the team to work on their idea after the Climathon. These two factors explain 28.8% (Adjusted R-squared: 0.2887) of the dependent variable. The relationship between the dependent variable and the meeting with the team after the Climathon is strongly positive, as indicated by this coefficient. Willingness to form a company increases by approximately 0.46 units for each unit increase in the team meetings frequency. The relationship is highly significant ($p < 0.001$), indicating that the dependent variable is significantly predicted by the team's engagement post-Climathon.

The regression estimates also show a negative relationship between winning a prize and forming a company, indicating that prize winners have a lower probability of getting engaged in entrepreneurial activities. This relationship can be explained by the fact that the satisfaction effect of obtaining a prize can diminish the motivation to engage in additional entrepreneurial activities, as the prize may be perceived as the finish line of their efforts rather than a stepping stone. This can result in a change in priorities, as the victors may choose to concentrate on other objectives rather than committing to entrepreneurship. Furthermore, prize recipients may not always offer the requisite resources or support for entrepreneurship, which can impede their capacity to establish a business. The dynamics of the team may also shift, with non-winners prioritizing their own accomplishments and victors viewing the entrepreneurial path as an additional risk. This is in line with the implementation barriers, as they were prioritized by all participants, with lack of capital being ranked as the most challenging one (55.6%), followed by operational challenged (36.1%) and risk and uncertainty (30.6%). However, the relationship is marginally significant ($p = 0.0925$), indicating that the effect may not be sufficiently robust to warrant definitive conclusions. Nevertheless, it suggests a potential trend that warrants further investigation.

Table 9 - Regression analysis predicting factors associated with participants' willingness to form a company after participating in a Climathon

Coefficients	Estimate	Std. Error	t value	Pr (>|t|)	Sig.
(Intercept)	0.12716	0.07945	1.601	0.11848	

Winning a prize	-0.07604	0.04396	-1.730	0.09250	.
Meeting with the team after the Climathon	0.45873	0.11400	4.024	0.00029	***

*** Significant code: 0
** Significant code: 0.001.
* Significant code: 0.01.
. Significant code: 0.05.

5. Conclusions and Implications

The main aim of this study is to examine the efficacy of a Climathon as a mechanism for stimulating sustainable entrepreneurial mindsets. This paper examines two Climathons organised in Greece in 2023, namely in Lavrio and Agia Paraskevi, to answer two research questions: first, whether a Climathon can be utilised as a mechanism to enhance awareness and motivate participants to embrace sustainable practices, and second, which soft skills essential for an entrepreneurial attitude are activated during a Climathon. A self-assessment and feedback survey was developed and shared with the individuals who participated in one of the two Climathons presented above. A total of 38 responses were gathered during this period, which corresponds to a 58.4% response rate. Both groups possess comparable levels of professional experience and gender representation; however, they differ in age and educational attainment. Lavrio members tend to be older and possess greater educational qualifications, indicating a disparity across the places. Participants in Agia Paraskevi are younger, exhibit slightly lower educational attainment, however, possess similar levels of professional experience. The comparisons between the two groups have taken into account these demographic variances.

The study indicated an increased participants' comprehension of sustainability after taking part in the Climathon. Participants from Agia Paraskevi had a superior baseline knowledge score compared to those from Lavrio, maybe attributable to variations in participant demographics or prior familiarity with sustainability principles. Demographic characteristics did not affect post-event knowledge, and 31.57% of individuals engaged in sustainability related studies following the event. The majority of participants integrate sustainability ideas into their everyday professional or academic activities; nonetheless, others continue to grapple with comprehending their significance. Participants also, indicated modest involvement in sustainability-related projects or activities, with a higher standard deviation reflecting variations in contributions. The study also shows that obtaining an award and having team leadership experience are major positive predictors of sustainability education, suggesting that recognition and leadership may drive people to learn more. This affects workforce development and corporate training since incentivising achievements and developing leadership abilities may improve sustainability skills. Problem-solving skills have a negative but non-significant association, suggesting that those skilled in this area may not need formal training.

The findings suggest that improving one soft skill may promote the development of additional talents. For example, enhancing time management (A63) might concurrently augment problem-solving (A64) and collaboration (A65). This knowledge is crucial for developing training programs, as concentrating on certain talents may produce wider advantages. The

modest link between interpersonal abilities (e.g., A66) and other competencies (e.g., A61, A63) suggests that personal attributes such as empathy are significant but may serve a more supplementary function in collaborative or leadership settings. Finally, abilities exhibiting marginally lower correlations (e.g., A66 with A64) may necessitate focused actions to augment their interrelation or synergy with other essential abilities. Based on Koundouri et al. (2023), skills identified in this setting, including critical thinking, complex problem solving, judgement and decision-making, and coordination, are categorised as both green and digital; and they are anticipated to be among the top six most essential soft, green and digital competencies pertinent to many occupations.

Finally, the results demonstrate that participants prioritize interactive and immersive elements, enabling active contribution and collaboration with peers. Sustainability issues necessitate pragmatic and inventive solutions. Activities such as cooperation and solution presentation simulate authentic collaborative problem-solving situations, rendering them very attractive and successful for participants. Younger cohorts, such as students and early-career professionals, are frequently characterised as action-oriented learners, favoring assignments that allow them to observe the immediate effects of their contributions. Future Climathons should prioritise workshops, team challenges, and solution creation sessions over extended expert talks. In addition, rather than conventional speeches, experts might assume a facilitative role, involving participants in case studies, panel discussions, or interactive forms such as debates or brainstorming sessions directly related to the participants' projects. Engaging in discussions with mentors (44.7%) is fairly pleasurable, however, there is potential for enhancement. Organized mentor-participant engagements, including directed feedback sessions or brief mentoring seminars, may enhance the perceived significance of this activity. In addition, subsequent Climathons (or ideathons) can capitalize on the effectiveness of cooperation and solution presentations by integrating them as core components of the event framework. This may encompass prolonged team-oriented tasks or joint project exhibitions.

6. Limitations

This study is associated with a number of limitations. The results are subjective since they are dependent on how each individual interprets the questions provided and subject to bias, as answers are prone to social desirability, overconfidence, or a lack of self-awareness.

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8. References

Acs, Z. J., Braunerhjelm, P., Audretsch, D. B., & Carlsson, B. (2009). The knowledge spillover theory of entrepreneurship. *Small Business Economics*, *32*(1), 15–30. https://doi.org/10.1007/S11187-008-9157-3/TABLES/7

Alhaddi, H. (2015). Triple bottom line and sustainability: A literature review. *Iran Business and Management Studies*, *1*(2), 6–10.

Ayinde, L., & Kirkwood, H. (2020). Rethinking the roles and skills of information professionals in the 4th Industrial Revolution. *Https://Doi.Org/10.1177/0266382120968057*, *37*(4), 142–153. https://doi.org/10.1177/0266382120968057

Bakoush, M. (2022). Evaluating the role of simulation-based experiential learning in improving satisfaction of finance students. *The International Journal of Management Education*, *20*, 1472–8117. https://doi.org/10.1016/j.ijme.2022.100690

Battilana, J., Leca, B., & Boxenbaum, E. (2009). How Actors Change Institutions: Towards a Theory of Institutional Entrepreneurship. *Https://Doi.Org/10.5465/19416520903053598*, *3*(1), 65–107. https://doi.org/10.5465/19416520903053598

Bianchi, G., Pisiotis, U., Cabrera, M., Punie, Y., & Bacigalupo, M. (2022). *GreenComp: The European sustainability competence framework*. https://doi.org/10.2760/13286

Bull, M. (2008). Challenging tensions: Critical, theoretical and empirical perspectives on social enterprise. *International Journal of Entrepreneurial Behaviour & Research*, *14*(5), 268–275. https://doi.org/10.1108/13552550810897641/FULL/PDF

Chau, C. W., & Gerber, E. M. (2023). On Hackathons: A Multidisciplinary Literature Review. *Conference on Human Factors in Computing Systems - Proceedings*, 21. https://doi.org/10.1145/3544548.3581234/SUPPL_FILE/3544548.3581234-TALK-VIDEO.MP4

Cohen, B. (2006). Sustainable valley entrepreneurial ecosystems. *Business Strategy and the Environment*, *15*(1), 1–14. https://doi.org/10.1002/BSE.428

Cohen, B., Smith, B., & Mitchell, R. (2008). Toward a sustainable conceptualization of dependent variables in entrepreneurship research. *Business Strategy and the Environment*, *17*(2), 107–119. https://doi.org/10.1002/BSE.505

Dhaliwal, A. (2016). Role Of Entrepreneurship In Economic Development. *Amrita Dhaliwal, IJSRM*, *4*(6), 2321–3418. https://doi.org/10.18535/ijsrm/v4i6.08

Doran, J., McCarthy, N., & O'Connor, M. (2018). The role of entrepreneurship in stimulating economic growth in developed and developing countries. *Cogent Economics & Finance*, *6*(1). https://doi.org/10.1080/23322039.2018.1442093

EIT Climate-KIC. (2024). *Climathon*. https://climathon.climate-kic.org/

Endo, K., Fujihashi, T., & Kobayashi, S. (2020). *Tablet-assisted education incorporating group activities in a university*. https://doi.org/10.1080/24751839.2020.1786923

Erken, H., Donselaar, P., Thurik, • Roy, & Thurik, R. (2018). Total factor productivity and the role of entrepreneurship. *The Journal of Technology Transfer*, *43*, 1493–1521. https://doi.org/10.1007/s10961-016-9504-5

European Commission. (2019a). *COM (EU) 2019/640 The European Green Deal*. https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

European Commission. (2020). *COM (EU) 2020/21 Sustainable Europe Investment Plan - European Green Deal Investment Plan*.

European Commission, D.-G. for E. S. A. and I. (2019b). *EntreComp: the European Entrepreneurship Competence Framework*. Publications Office. https://data.europa.eu/doi/10.2767/405164

European Council. (2022). *Fit for 55 - The EU's plan for a green transition*. https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/#what

European Union. (2021). *REGULATION (EU) 2021/1119 European Climate Law*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021R1119&from=EN

Fei, W., & Shuangyan, X. (2024). Structural model and characteristics of entrepreneurial opportunity recognition abilities among university students in China: a grounded theory approach. *Humanities and Social Sciences Communications 2024 11:1*, *11*(1), 1–11. https://doi.org/10.1057/s41599-024-03699-7

Finch, D., Peacock, M., Lazdowski, D., & Hwang, M. (2014). *Managing emotions: A case study exploring the relationship between experiential learning, emotions, and student performance*. https://doi.org/10.1016/j.ijme.2014.12.001

Flus, M., & Hurst, A. (2021). *Design at hackathons: new opportunities for design research*. https://doi.org/10.1017/dsj.2021.1

Galindo-Martín, M. A., Méndez-Picazo, M. T., & Castaño-Martínez, M. S. (2020). The role of innovation and institutions in entrepreneurship and economic growth in two groups of countries. *International Journal of Entrepreneurial Behaviour and Research*, *26*(3), 485–502. https://doi.org/10.1108/IJEBR-06-2019-0336/FULL/PDF

García-Castanedo, J., Corrales-Garay, D., Rodríguez-Sánchez, J. L., & González-Torres, T. (2024). The ideathon as an instrument for entrepreneurial education in university contexts. *The International Journal of Management Education*, *22*(1), 100926. https://doi.org/10.1016/J.IJME.2023.100926

Hahn, D., Minola, T., Van Gils, A., & Huybrechts, J. (2017). Entrepreneurial education and learning at universities: exploring multilevel contingencies. *Entrepreneurship and Regional Development*, *29*(9–10), 945–974. https://doi.org/10.1080/08985626.2017.1376542/ASSET/29897889-609C-4C63-A7DD-FDF78B22DC42/ASSETS/IMAGES/LARGE/TEPN_A_1376542_F0005_B.JPG

Halkos, G., Aslanidis, P. S., Landis, C., Papadaki, L., & Koundouri, P. (2024). A review of primary and cascading hazards by exploring individuals' willingness-to-pay for urban sustainability policies. *City and Environment Interactions*, *24*, 100178. https://doi.org/10.1016/J.CACINT.2024.100178

Huppenkothen, D., Arendt, A., Hogg, D. W., Ram, K., Vanderplas, J. T., Rokem, A., Designed, A. R., & Performed, A. R. (2018). *Hack weeks as a model for data science education and collaboration*. *115*(36), 8872–8877. https://doi.org/10.1002/2014EO480004/pdf

Karachaliou, T. (2009). *Βελτιστοποίηση της απόδοσης των πόρων για την εξυγίανση εδαφών. Η περίπτωση του Τεχνολογικού και Πολιτιστικού Πάρκου Λαυρίου. - Κωδικός: 18536*. https://thesis.ekt.gr/thesisBookReader/id/18536#page/1/mode/2up

Karachaliou, T., Damigos, D., & Kaliampakos, D. (2007). *Using the "dry-tomb" technique in the remediation of heavily contaminated land*. https://www.researchgate.net/publication/284182170_Using_the_dry-tomb_technique_in_the_remediation_of_heavily_contaminated_land

Koundouri, P. , Landis, C. , Toli, E. , Papanikolaou, K. , Slamari, M. , Epicoco, G. , Hui C., Arnold, R. , & Moccia, S. (2023). Twin Skills for the Twin Transition: Defining Green & Digital Skills and Jobs. In *AE4RIA, ATHENA Research Centre, Sustainable Development Unit.* .

https://www.dept.aueb.gr/en/ReSEES/news/ae4ria-huawei-report-%E2%80%9Ctwin-skills-twin-transition-defining-green-digital-skills-and-jobs

Lehmann, M., Christensen, P., & Larsen, J. M. (2003). *Self-Regulation and New Institutions: The Case of Green Network in Denmark*. https://vbn.aau.dk/en/publications/self-regulation-and-new-institutions-the-case-of-green-network-in-3

MedECC. (2020). *Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future. First Mediterranean Assessment Report* . https://doi.org/10.5281/zenodo.7224821

Papadaki, L. , Akinsete, E., Koltsida, P. , Taneva-Veshoska, A. , Tomik, A. , Toli, E. , Trajkovska, S. , & Koundouri, P. (2024). Catalysing Business Transformation: Leading Sustainable Development via Research Collaboration and Course Development. *ICSD 2024 Proceedings – International Conference on Sustainable Development*. https://ic-sd.org/2024/11/17/icsd-2024-proceedings/?mc_cid=9a75a77888&mc_eid=UNIQID

Pulyavina, N., Ritter, A., Sedova, N., & Taratukhin, V. (2022). Project-Based Education in COVID-19 Era. Disseminating Design Thinking in New Reality. *Communications in Computer and Information Science*, *1539 CCIS*, 43–51. https://doi.org/10.1007/978-3-030-95494-9_4/FIGURES/3

Ridley-Duff, R. (2008). Social enterprise as a socially rational business. *International Journal of Entrepreneurial Behaviour and Research*, *14*(5), 291–312. https://doi.org/10.1108/13552550810897669/FULL/PDF

Schaltegger, S., & Wagner, M. (2011). Sustainable entrepreneurship and sustainability innovation: categories and interactions. *Business Strategy and the Environment*, *20*(4), 222–237. https://doi.org/10.1002/BSE.682

United Nations. (2022). *Transforming our world: the 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs*. https://sdgs.un.org/2030agenda

United Nations. (2024). *Sustainability*. United Nations. https://www.un.org/en/academic-impact/sustainability

Warner, J., & Guo, P. J. (2017). *Hack.edu: Examining How College Hackathons Are Perceived By Student Attendees and Non-Attendees*. https://doi.org/10.1145/3105726.3106174

Wiek, A., Withycombe, L., & Redman, C. L. (2011). *Key competencies in sustainability: a reference framework for academic program development*. https://doi.org/10.1007/s11625-011-0132-6

Zahra, S. A., & Nambisan, S. (2012). *Entrepreneurship and strategic thinking in business ecosystems*. https://doi.org/10.1016/j.bushor.2011.12.004