

Minor Thesis Report Part 1:

Assessing the effectiveness of COBIOM as a responsible innovation hub for swarming.

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COBIOM
Swarm Innovation for the Impact Economy



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Executive Summary -

Increased specialisation in the work force creates a need for more fluid and adaptable teams. The COBIOM swarm innovation platform acts as a virtual space to form 'swarms' which co-work on projects of their choosing. This is being used to tackle big sustainability problems that contribute towards climate change. Funded by Climate-KIC, this investigation observed and quantified how participants in the European Biomimicry Design Challenge (EBDC) 'swarmed' and their appraisal of the COBIOM platform. Pre-liminary results depict that participants of the EBDC swarmed effectively (7/10) and produced a reasonable quality of work (6/10). Results show the effectiveness of teams was not dependant on building relationships but that this method of working did foster good relationships within team members. Active member members decreased during the processes and this was influenced by a lack of time which was partially related to the perception of the EBDC as lacking tangible gains. Unfortunately, the swarming reward points system, did not improve or activate performing in swarming. Despite technological problems, the EBDC was a successful prototype to allow COBIOM to test the platform and to foster swarming to take place. This is shown by a conversion rate of 83% of participants continuing to further projects and 2/5 projects continued onto further business development. To increase successful swarming on the COBIOM platform the following recommendations are provided.

Key Recommendations for COBIOM:

1. Invest time in fixing bugs and maintaining the platform to enables more fluid use of the COBIOM platform. This enables busy professionals to stay focussed and creates a more professional image of the platform.
2. Design a visual hierarchy to guide users into the different layers of the COBIOM platform to ease navigation on the platform. This could be as simple as colouring each layer differently and consistently across projects. This prevents people feeling frustrated with the platform before they have started working and allows them to stay informed more easily, encouraging continuous participation.
3. If you want to create a more professional community the gamification mechanism will have to create more tangible gains / be backed up by fiscal value, this may require financial investment from COBIOM. This will prevent the perception that cworking on COBIOM develops intangible assets and skills rather than tangible assets.
4. Involve platform users in the other projects COBIOM takes part. This will validate the community and show that COBIOM is a productive work environment where change happens. This could be especially useful for organisations such as Oatly who have recognition that COBIOM could grow from.
5. Use the network of multipliers at your disposal to broaden the net of individuals you attract for each project such as the EBDC. Leveraging their influence will attract people they inspire who are likely to also be change makers.
6. Compliment this by making it clear and apparent what COBIOM are doing through social media with easy access links to enable soft entry to the platform. This creates less friction on getting new people into the platform.

Introduction

COBIOM wants to create a paradigm of community collaboration using radical collaboration. This is a combination of community culture, tools and technology designed to promote working in large informal teams that act as swarms. The community culture is signed up to when users join and is set out in the “Community Framework”. This describes the ethos of the platform but also explicitly mentions the legal implications of breaking the framework. The tools are namely: a joint calendar, joint whiteboard (Miro), video streaming service and organisation of virtual workspaces, embedded into the platform. The tools enable co-working and keep users on the platform, increasing engagement. The technology is a reward system designed to benefit those who share information. An algorithm monitors information posted for re-use throughout the swarm which then provides in platform currency to the poster. This currency is project specific and is used to proportionately distribute rewards for project completion. This is an example of gamification which has been shown to be an effective mechanism to increase participation (Hamari, Koivisto and Sarsa, 2014). Using this paradigm COBIOM hopes to achieve a work space where co-operation beats competition through radical collaboration.

Radical collaboration has been shown to increase productivity in farming environments where so-called ‘green zone chickens’ (collaborative chickens) increased egg production 260% compared to normal chickens which display some competitive behaviours (Atkins *et al.*, 2019). This has been shown to extend to humans where organisations are 31.5% more effective at solving their problems after becoming more ‘green zone’ organisation. This has worked for a range of organisations from Pfizer to NASA to Sony Ericson (Tamm and Luyet, 2005). Radical collaboration is also used by some educational institutions to increase cross-field collaboration. This is performed at Cornell and is responsible for their high patent output which places them in the top 20 innovative Universities in the world (Ewalt, 2017). Inversely, workplaces which have been shown to have a toxic work place culture are shown to be less productive, partially due to increased burnout (Anjum *et al.*, 2018).

One of the key aspects of radical collaboration is swarming, and has been increasingly present in business. Swarming is typically characterised by flexibility or adaptability, robustness or functional redundancy and self-organisation. This is considered a nature based approach as it takes inspiration from organisms with low collective intelligence that work well together under simple rules (Bonabeau and Meyer, 2001). It is becoming increasingly prevalent in agile businesses under the assumption that specialisation means that a small, dedicated group in a business will limit the scope of what the team can achieve. As such, teams may form and dissolve rapidly and people will form much larger more informal teams (Levit, 2015). The swarming processes occur within an organisation where a swarm comes together rapidly, solves a problem, dissolves and move on to the next problem (Twomey *et al.*, 2017). Swarming taps into distributed leadership or emergent leadership which is more suitable when a working group is more permeable and less hierarchical which can increase empowerment (Kirk and Shutte, 2004) This can build capacity in teams. In laboratory settings swarm intelligence has been found to increase subjective value judgements from 69% accuracy to 84% accuracy in smaller groups and that this effect can be amplified by increasing group size to an accuracy of 91% (Willcox *et al.*, 2020). In business environments swarming has been used practically to converge distinct customer profile databases into a unified, fit for purpose database. By engaging different parts of the corporate structure into designing the software, the various departments involved were better served and more familiar with the digital service and so uptake was better (Twomey *et al.*, 2017).

It is possible to still swarm in a practical business way without being radically collaborative. However, COBIOM believes that just as in nature where synergies are seen between species, especially at an ecosystem level, more can be achieved when swarming occurs in a transparent trans-corporation environment.

COBIOM is hosting the European Biomimicry Design Challenge (EBDC) as a soft entry point into the platform. This is a hackathon format which has been shown build capacity, innovate, and stress test ideas in a time limited manner (Almishari *et al.*, 2017). The EBDC will test the functionality of the platform and showcase a body of work. The EBDC focusses around 5 challenges. 4 of these are set-up to help reduce climate change and involve capturing carbon, Nature inspired travel, Nature inspired packaging and replacements for leather. There is an additional challenge on bio-inspired communities. These challenges will be COBIOM's opportunity to host swarms of individuals on multiple projects and will be the focus for answering the following questions: How do individuals react to swarming, are some groups / demographics more adept to swarming, what motivates people to swarm and how can the COBIOM platform best facilitate this. To do this several criteria will be assessed including how effective participants rate the swarming process, what sort of individuals does this process attract and how could this process be made better to suit their needs. Monitoring the EBDC and its participants will provide insight into user perspectives on working in swarm "Network teams". Similarly, a snapshot of how large groups swarm will be received based on the results from a workshop co-hosted with Climate-KIC. Through speaking to participants, a body of qualitative and quantitative preliminary data has been compiled. This suggests participants of both the EBDC, and the workshop enjoyed swarming on the COBIOM platform and found it to be an effective method of working. However, it also showed suggested it may only be a subtype of individuals who are attracted to this method of working, and who are proficient at it. The intended use of this data is to act as an advisory report for COBIOM to use to inform further challenges and further operations as they attract more swarms and are involved in project management.

Methods

Procedure and Measures:

Interviews:

Semi-structure interviews were used with the participants. These are useful for collecting qualitative data and combined with other methods to create a rich picture of what an interviewer is observing (Halcomb, 2015). In total 2 interviews were used measuring demographics and background, motivation, and problems N = 11 and experience and perspectives N = 11. During the interviews, participants were guided with questions concerning the COBIOM experience. The advantage of a semi-structured interview is they can create greater depth and breadth of information and tangents were encouraged during interviews as they offered the researcher insight they might not have considered to ask (Klandermans and Staggenborg, 2002).

Full interview questions found in the appendix.

Surveys:

Surveys were used twice during the research. The first survey was used to collect data on how students reacted to swarming during a swarming workshop and whether this was related to views they had on co-working and problems with co-working N=40. This method was used as it is effective and cost efficient with a larger group via the internet (Fricker and Schonlau, 2002). A range of metrics were used including agree / disagree questions which is commonly used in surveying (Höhne, Revilla and Lenzner, 2018) and a rank of 1/ 10 which provides some quantitative data.

The second survey collected data on experience of participants with network teams N = 11. This tested the hypothesis that most participants had experience working in network teams and were interested in learning rather than tangible gains. This used a combination of binary responses and rating systems to receive quantitative data on participants experiences and motivations.

For full survey questions please see the appendix.

Data collection:

Data was collected from google analytics which measured each individual daily user. Google Analytics allows the research to export traffic to the website in MS Excel format, which was then used to plot graphs and look for trends of website traffic including average weekly visits and when visits were occurring (Plaza, 2011). The time series used was from between 1st of December, before the website was brought onto the domain address (COBIOM.com) and until May 1st when the EBDC had concluded. The analytics stopped accurately recording between March 4th and March 30th due to an unknown error.

Attendance was used to measure engagement of participants as engagement is required for effectiveness in teams (Kataria, Garg and Rastogi, 2013). Attendance also provides data concerning motivation and commitment to the challenges. This was done by attending meetings and counting participants. When this was not possible, google analytics data was used to measure platform use during the meetings.

Results

1. Students described swarming as an effective mechanism of co-working

A large-scale swarming event was hosted for students (n=40) during a Climate KIC Spark Lecture. After the event students were surveyed to indicate if they agreed or disagreed with a series of statements on co-working and how effectively they perceived swarming to be (Appendix Survey 1). The event was analyzed to produce a preliminary dataset on how groups swarm.

The average of all participants who took part in the swarming lecture rated the effectiveness of swarming as 7/10 (Table 1.1). Participants who agreed *skills-based teams* are more important than *relationship-based teams* found swarming more effective with an average score of 7.2 (Table 1.1). Inversely, those who disagreed *skills-based teams* are more important than *relationship-based teams* gave the swarming effectiveness a lower score of 6.8 (Table 1.1). This shows that those students who value skills-based collaboration more than relationships are better adapted to swarming finding it more effective. A similar marginal change in effectiveness was seen based on whether participants agreed static teams would become less likely in the future. Those who believed static teams would persist giving a swarming efficacy rating of 6.7, whereas those who believed static teams would become less prevalent rate swarming with a 7.1 (Table 1.1). However, large standard deviations within results prevents a certainty within these results.

Table 1.1 Changes in effectiveness rating dependant on views on co-working. The average of all participants is in Red. All participants are then split into sub populations dependant on their answers to the two co-working questions:

Relationships are more important than complementary skills for effective teams.

Static teams will become less common in a specialised workplace.

	Average rating of <i>all</i> participants (N = 40)	Ratings of students who Agree that: established relationships are more important than complementary skills for effective teams (N = 23)	Ratings of students who Disagree that: established relationships are more important than complementary skills for effective teams. (N = 17)	Rating of students who agree that: Static teams will become less common in a specialised workplace (N = 31)	Rating of students who disagree that: Static teams will become less common in a specialised workplace (N = 9)
Effectiveness of swarming rating.	7 / 10	6.8 / 10	7.2 / 10	7.1 / 10	6.7 / 10
S/D	1.99	1.4	2.3	1.6	2.5

This first workshop creates a snapshot depicting swarming as an effective co-working method. Additionally, there are sub-groups who may be more suitable for swarming. These sub-groups typically believe that static teams will not be suitable in the future of work and that skills-based teams are more effective. The differences between groups are marginal and not statistically significant at this scale however irrespective of the sub-groups, the average rating of 7 / 10 suggests that swarming can be an effective method of co-working.

More insight can be gained by comparing what participants considered to be the greatest challenges in co-working (table 1.3) versus which statements they agreed or disagreed with (Table 1.4). Using these problems to cross examine perspectives on future working we see 92% of people who cite varying goals are their main problem agreed that forming swarms was likely to be a common way of working (Table 1.4). This suggests that whilst this group may be more open to forming sporadic groups, they need very specific goals to be successful.

Table 1.3. Nominal order of the greatest blockers to collaboration as indicated by student participants of the SPARK lecture. N=40. Numbers indicate the number of participants who mentioned the item as blocker in collaboration

Lack of communication	20 / 40
Varying or unclear goals	13 / 40
Lack of cohesion	5 / 40
Internal competition	2 / 40
Other	0 / 40

There is little divergence from the average response whether people find themselves in relationship teams or skills teams. As this group is split very closely it is possible the range of teams within this group means all problems are seen.

85% of people who site lack of communication to be their main problem in group working suggested group decisions take longer but are more likely to be correct (Table 1.4). This is 10% higher than the average response. This suggests there is a subsection of participants who need in-depth discussion to feel satisfied with the cohesion of their team and their results.

Table 1.4 Comparison of how greatest **problem** is related to whether students agree with 3 co-working statements. Work statement is depicted with the average of people who agreed or disagreed with that statement. This is compared to the agree/disagree rate based on what problem participants identified as most prevalent. Fraction refers to how people agree vs how many people surveyed. The fraction is converted into a percentage below. $N = 40$.

Problem/ Work statements	Average	Lack of communication	Lack of cohesion	Varying or unclear goals	Internal competition
In an increasingly specialised work force, having a consistent, static team for every work project will become less common.	31/40 Agree	14/20	4/5	12/13	1/2
% That agreed to the statement	77.5%	70%	80%	92%%	50%
To form an effective team a previously established positive relationship is more important complementary skill sets.	23/40 Agree	11/20	3/5	8/13	1/2
% That agreed to the statement	57.5%	55%	60%	61.5%	50%
Decisions take longer in a larger group, but the consensus is more likely to be correct	30/40 Agree	17/20	3/5	5/13	2/2
% That agreed to the statement	75%	85%	60%	38.4%	100%

The combination of these results creates a preliminary picture that certain workers may be more attracted to swarming. These workers will have experience with coworking and a forming skills based teams or a positive perspective on this method of team forming. It also suggests that clear open discussion about the objectives of the swarming process may be necessary to form swarms, and this can be facilitated by defined goals within the projects. Broadly it creates a positive appraisal of swarming and suggests this can be an effective mechanism of working. The analysis was gained in a 1.5-hour workshop which created a freeze frame of how people see swarming. To test these preliminary findings the longer EBDC was conducted to see how participants rate the efficacy of swarming over the course of several months.

2. EBDC participants described swarming as an effective mechanism of co-working

The Spark workshop created a snapshot of how swarming on the COBIOM platform could work but a longitudinal study was required to create in depth analysis. To assess the swarming process of the EBDC, interviews were conducted that collected quantitative and qualitative data of the participants (N = 11).

Participants felt that the EBDC and their swarming experience had been an effective mechanism to work together giving an average answer of 7.0 for effectiveness (Table 2.1). This suggests that participants felt able to work together in this swarming format over the course of several months. Participants enjoyed the process, providing a score of 9.0 / 10. This accounts for the high value of 8.3 / 10 for the question: "How likely would you be to take part in a similar process in the future from 1 to 10". Part of the reason the participants liked the process was due to the combination of structure and freedom. This can be seen in the answer to how hierarchical did you find the EBDC to be: 4.3. Enjoyment also stemmed from becoming increasingly close with the other participants as they increased their comfortability score from an average of 4.5, meaning slightly uncomfortable, to 6.4 meaning quite comfortable. One area the EBDC scored slightly lower in is the quality of work produced. The result was 6.6/10, which still means they perceived it to be slightly higher than average (5) quality than that which they produced in other teams (Table 2.1)

Table 2.1. Averaged results from a survey performed on EBDC participants in the weeks following the EBDC. Participants were asked the exact question as it is written. Key insights were gleaned from participants unprompted explanations of their answers.

Question	Averaged Answer N = 11	Key Insights
On a scale of 1 – 10 how effective did you find your group to be. Where 1 is ineffective and 10 is very effective and 5 is competent.	7.0	Some groups became too small to be effective, especially as the participants who remained were part of other challenges. This was felt acutely in the final weeks.
On a scale of 1 – 10 how much did you enjoy this method of working, with loose informal groups formed around a shared purpose rather than shared background or institution	9.0	The atmosphere in the challenges was positive and that kept participants engaged. Meeting new people from around Europe and networking was a good experience.
Compared to traditional relationship or institution-based teams you have been part how was the quality of work produced on a scale of 1 – 10. Where 1 is much lower quality, 5 is similar quality, 10 is much higher quality.	6.6	Participants were content with the level of quality that came out and rated it as higher than work that would usually be produced.
On a scale of 1 – 10 how suited were your team mates to the challenge. Where 1 is unsuited or incapable, 5 is averagely suited and capable and 10 is high suitable and specialised.	6.0	The open nature of the processes meant some participants felt suitability was more of an attitude than a skill set.
On a scale of 1 – 10 how comfortable did you feel with your teammates at the beginning and end of the processes. Where 1 is completely uncomfortable, 5	4.5 – 6.4	Many participants commented on the great atmosphere.

is averagely comfortable, 10 is completely comfortable. ¹		
On a scale of 1 – 10 how hierarchical did you find your group to be. Where 1 is completely communal (work chosen), 5 is hierarchical but open to suggestions (work suggested) and 10 is completely hierarchical (work dictated).	4.2	Participants commented on the pleasant combination of structure and freedom provided for them. The BECCUS participants felt there was more structure than the other groups.
From 1 – 10, how likely would you be to take part in a process similar to this in the future.	8.3	Most participants are already taking part in the Green Chemicals initiative run on the platform. Time was cited as the main reason preventing people getting more involved.

The results from the combination of quantitative and qualitative research suggests that Swarming is considered an effective work mechanism. This works in either a snapshot session or throughout a whole process. This promotes swarming on the COBIOM platform as a useful and productive mechanism to go forward. This semi-structured interview captured the views of those who completed the program, but further research was required to capture the whole populations perspective on the challenge.

¹ Participants were also provided with a scale to try to normalise results

3. Participant numbers reduced and then stabilized during the EBDC.

Daily usage of the platform and attendance to group meetings before and during the EBDC was analysed to measure the uptake of swarming over the period from December 1st 2020 until May 1st 2021. This allows an analysis of the general up taking of swarming and not just the participants at the end of the process. Daily usage and meeting attendance depicts that whilst participants did drop out, those who remained became increasingly active suggesting a subset of participants were able to swarm effectively.

Pre-EBDC there was an initial interest in the platform when it launched in early December 2020 attracting 57 visits from December 7th and January 4th (Figure 3.1). This was mostly due to people signing up for challenges as 122 people joined the EBDC from between the platform starting and the challenge². The initiation of the program set a record of 16 daily visitors. Visitors catching up on the video recording saw this number rise to 48 visitors over the week as potential participants caught up on the recording. Over the following weeks from 10/01/21 – 23/02/21 A cyclic pattern emerged of an average of 15.75 users per week emerged as users settled into the challenges (supp fig.3). This data shows there was an initial strong interest in the EBDC but many of the sign-ups did not engage with the programme. However, most of those who did engage continued for the duration of the programme.

An error in the analytics programme prevented users being captured from between 11.03.21 – 29.03.21. After this period, we see a large increase in activity which represents the end of the programme including a final closing symposium on April 16th where 38 daily users were recoded (Figure 3.1).

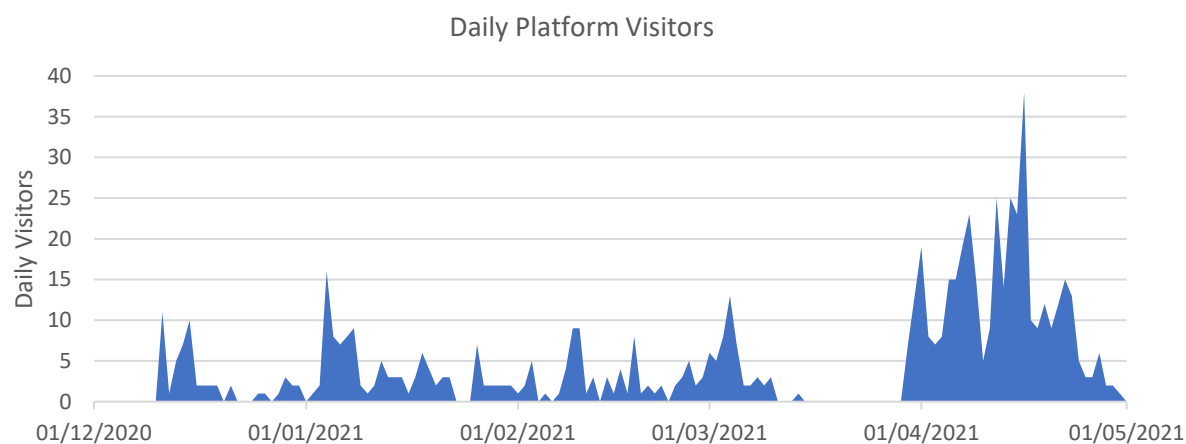


Figure 3.1: Individual daily users of any page of the COBIOM platform as measured by google analytics. Measuring period exists between 1.12.2020 and 1.5.21, with a short interruption between 11-3 and 29-3.

² Google Analytics was not turned on until December 10th and did not capture the initial users.

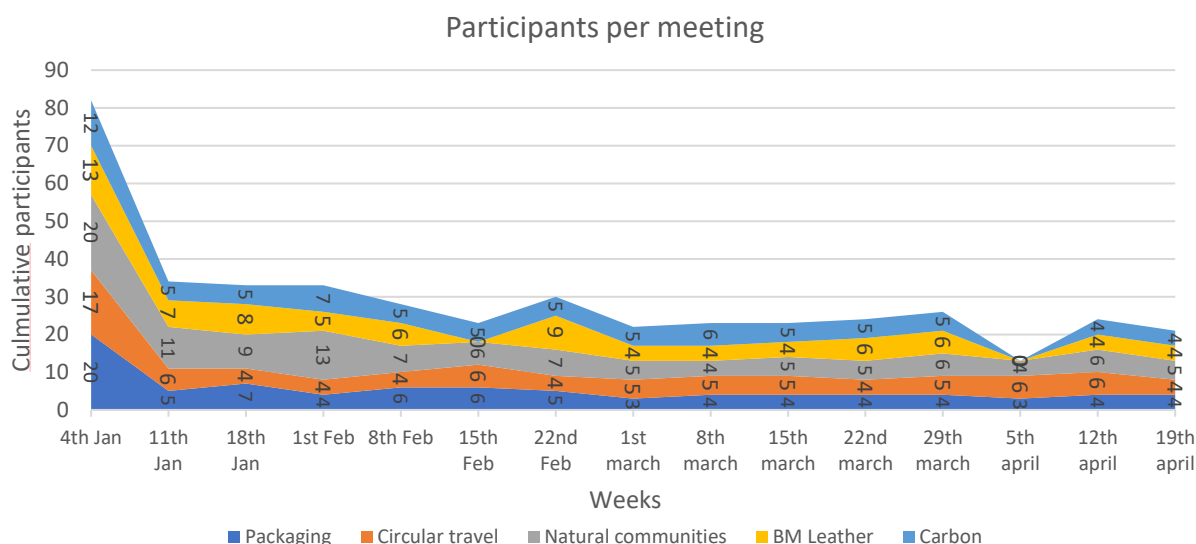


Figure 3.2: Individual daily users of any page of the COBIOM platform as measured by google analytics. Measuring period exists between 1.12.2020 and 1.5.21.

Measuring the number of people who joined meetings each week gives an impression of the number of active swarm participants. This ignores the larger organised events and focusses on who attended the meetings for each group each week. We see intense interest for the initial meeting with a cumulative participation of the EBDC of 82 but this gradually decreases for each group (Fig.3.2). On the second week the cumulative weekly attendees were 35 and by the end of the BM phase on the 15th of March it was 24. The final cumulative participant number for the last meeting was 21 (Fig3.2).

Initially, the data from 2.1 and 2.2 seem to contradict each other because between January the 11th until Monday the 1st of Feb there are only 13 weekly users but an average of 34 meeting attendees per week. This is due to users attending multiple meetings as they are involved in different projects (Table 3.2)

Participant	Challenge freq
1	1
2	1
3	1
4	0
5	1
6	2
7	1
8	2
9	3
10	5
11	0
12	0
13	0

Table 3.2 – The challenge attendance frequency of individual platform users who responded to an early survey on the EBDC.

In conclusion, this data suggests that a subsection of participants found the swarming processes to be productive and maintained their activity over the duration of the challenge. However, there was a large drop off in participation from the initial meetings which stabilised by February. Some changes occurred as participants began to become involved in fewer challenges as the process went on. There were sporadic spikes of activity which exceeded the numbers of participants which was due to a consistent interest of those who had signed up to observe the process and output on key dates

(Supp tab. 1). By analysing those who remained it be possible to create insights into who continued to swarm.

4. Early participant interview: Demographic, Aims and Problems

Participant interviews were used to understand participant's motivation for joining the EBDC. This helps to understand why some participants continued with the programme and their aspirations for the challenge. Moreover, it was performed to be able understand the skillsets and background present in the challenge to enable the characterisation of the participants. Participants had a range of experience (Table 4.1), wanted to practice biomimicry (table 4.2) but experienced some technical issues with the site (Table 4.3)

4.1 Demographics – Who joined the EBDC -

Table 4.1. Demographics on professional experience of those who responded to the survey of the EBDC. $N = 12$.

Students refers to someone still in full time education, Graduates to someone who has left fulltime education in the 2 last years, and

Students	Graduates	Professionals
3	5	4

A breakdown of the demographics of those who entered the EBDC demonstrates there is an even distribution of participants regarding professional experience (Table 4.1). Students (3), graduates (5) and professionals (4) are evenly distributed.

4.2 Why did people join the EBDC?

Table 4.2. nominal ordering of responses to the question: If you have joined the EBDC, what did you hope to get out of it? $N=11$

Reason	Order	Score
Practice Biomimicry	1	6
To network with BM professionals	=2	3
To be part of an innovative processes	=2	3
To bring what I learn to my own field	4	2

People joined the EBDC predominantly to practice Biomimicry, with over half of the participants citing this as a reason to be a part of the challenge (Table 4.2). Other reasons included wanting to network with BM professionals, experiment with the new mechanism of working and innovation and being able to apply BM back to their own field. Wanting to be part of an innovative processes may be a reason why some participants continued with the process even if they experienced other difficulties.

4.3 – Difficulties within the EBDC

To understand the barriers that could prevent swarming participants were asked what potential reasons may have caused them to drop out of the EBDC (N=12). This can be used to understand what may have caused other participants to drop out and increase retention if problems are fixed.

6 of 12 participants asked cited technical issues as problematic for them (table 4.3). Technical problems cited including an inability to enter the platform, tool failure and inability to send messages. This caused frustration with participants and was also cited in several interviews as a reason for people with limited time to get involved. This also combined with the issue of some participants in staying informed as they were unable to navigate the swarm. However, 3/12 of those asked said they had no problems at all suggesting some problems may be related to individual's technical ability as well as issues with the platform.

EBDC difficulties	Order	Frequency
Technical Issues	1	6
Staying informed	=2	3
No problems	=2	3
Difficulty with collaboration	4	2

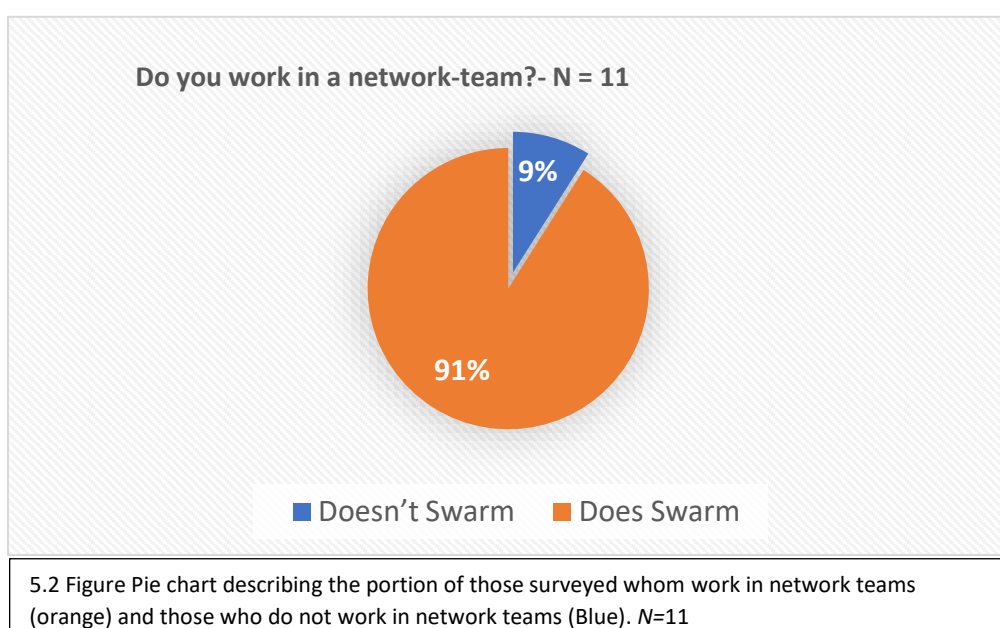
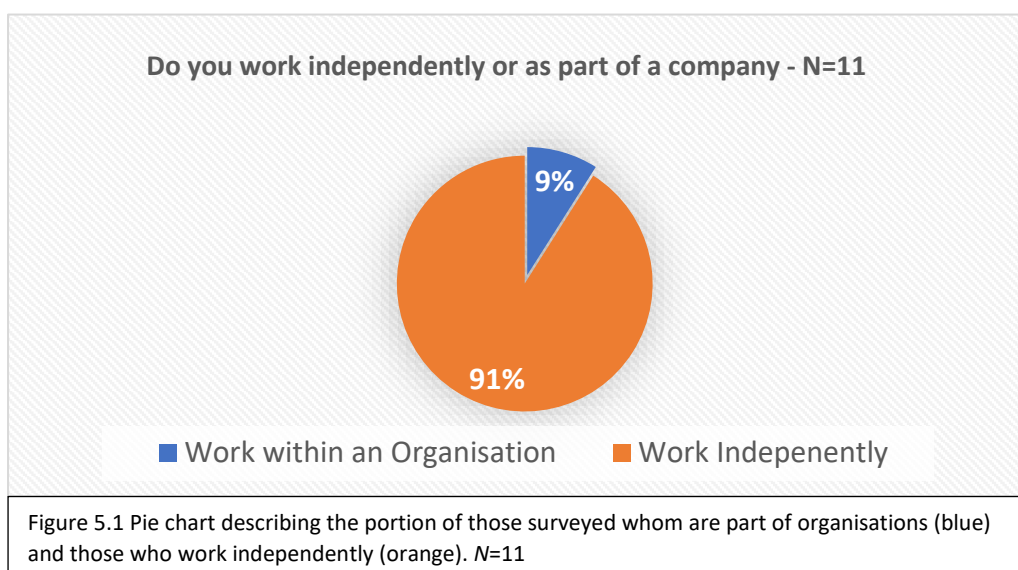
Table 4.3. nominal ordering of responses to the question: Were there any hurdles that may have prevented you joining the EBDC or have cause you to leave? N=12

In conclusion our pre-liminary data show that those participants who showed an initial interest in the EBDC, are innovative forward-thinking individuals who want to try out new work styles. COBIOM can help them achieve this even more by reducing technical barriers to participation and keeping members up to date. By extrapolating the difficulties some had with the EBDC, one early conclusion is that participants who left may have done so due to having technical problems and staying informed.

5. Participants have experience in network teams.

Once the demographics of those involved were understood, further surveys were used to assess the previous experience of those involved within network teams to see if this influenced participation. (N=11). Most participants had experience with working in network teams before this programme and had taken part in other challenges. (Figure 5.3)

Most participants were working independently (91%) rather than with a company (9%) (Fig5.1). This suggests that participants typically work with others in a 'project by project' association and so are more suitable for swarming. It is therefore not by surprise that 91% of 11 respondents are involved with Network teams: an informal typically large team of associates rather than colleagues (Fig 5.2). This shows that the participants are experienced at networking professionally and working within these networks in a similar set up to the EBDC.



Participants also had experience working in other projects. While 18.2% of the 11 participants did not take part in any projects outside their main source of work annually (besides the EBDC), 54.2% took part in 1-2 projects per year, 18.2% took place in 3 - 5 and 9.1% took part in 6 – 10 challenges a year (Figure 5.3). This suggests that that majority of participants are participating in projects outside of their main source of work, and over a quarter are taking part in more than 3 projects per year.

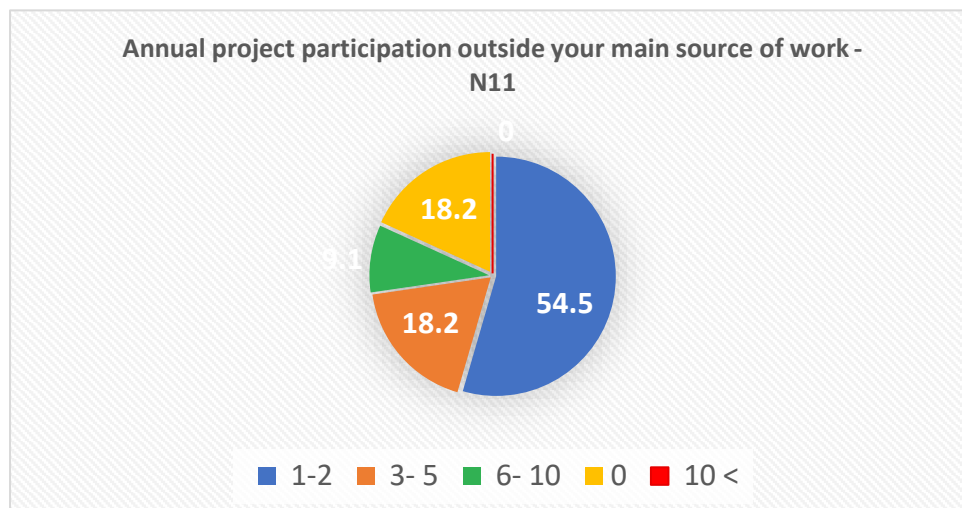


Figure 5.3 Pie chart describing the portion of those surveyed whom work in projects outside of their main source of income. Where yellow is 0, blue is 1-2, Orange is 3-5 and green is 6-10 projects on average per year. $N = 11$.

Understanding the motivation of participants can help COBIOM to understand what market it appeals to and cross reference this with the participants it wants to attract. Moreover, it allows them to assess if the recruitment strategy is effective.

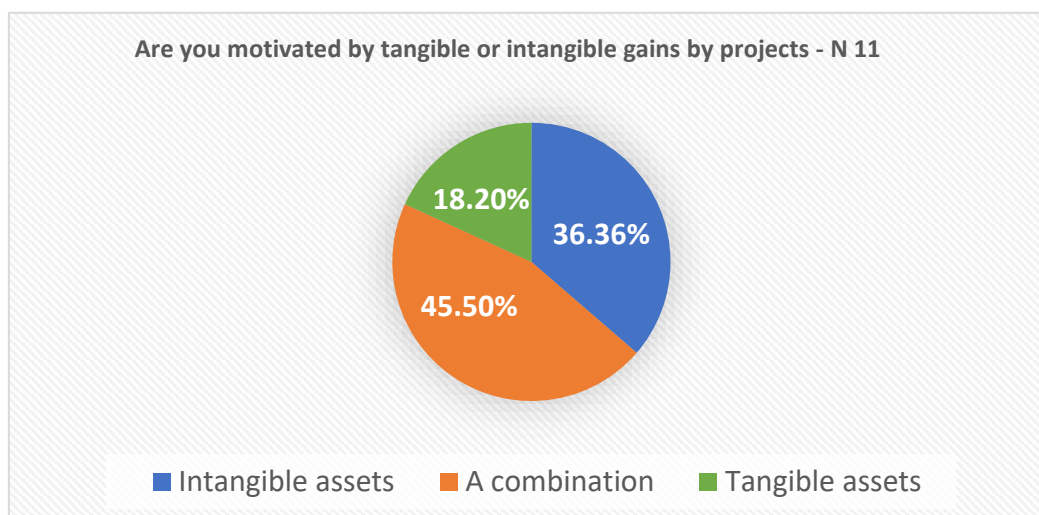


Figure 5.4 Pie chart describing the distribution of participants who are interested in tangible and intangible assets, where tangible assets were defined as intellectual property or financial gains and intangible assets were described as learning and networking. $N = 11$.

The EBDC attracted participants who were interested in both tangible and intangible gains by the project. However, of the 11 EBDC participants who were surveyed, there is a slight preference for intangible assets (26.40%) or a combination of intangible and tangible assets (45.5%) rather than purely tangible assets (18.2%) (Figure 5.4). This suggests that whilst the participants are taking part

in challenges such as the EBDC, they do not use them to supplement their income but instead hope to gain new insights skills or collaborations.

This shows that most of our users are familiar with working in looser team formats and frequently are working alone and independently of an organisation. This may also explain why 81% suggested they expect to be paid for value added instead of time (Supp. Fig. 4).

In conclusion, the participants of the EBDC are independent workers, and have experience working in network teams. Their motive to take part in the EBDC is mainly the learning experience of working in this form of collaboration as well as BM. The advantage of that is they are more likely to be better adapted to swarming than typical workers and will be a more representative sample of the network workers COBIOM aims for. One reliability issue this adds is that to other workers who do not have the same motivation and experience it may be more difficult to encourage them to swarm on the COBIOM platform. As a result, mechanisms of engagement must be explored to increased wide adoption of the COBIOM platform and swarming process.

6. Efficacy of incentivisation using token-based rewards.

One key aspect of the COBIOM platform is that it incentivises engagement and radical collaboration through its tokenised reward system. This can attract people to engage with challenges and ensures contributors are rewarded for their time. The Karma coins are given for all activities and represent general platform use, the EBDC coins are specific to information shared in the challenges and represent a desire to gain rewards through posting in gamified discussion forums.

Measuring token acquisition shows that there was not a strong drive to collect tokens. By correlating these two coins a relationship between time on the platform and activities to generate rewards can be seen of $R^2=0.50$ for the top 30 most active participants (figure 6.1).

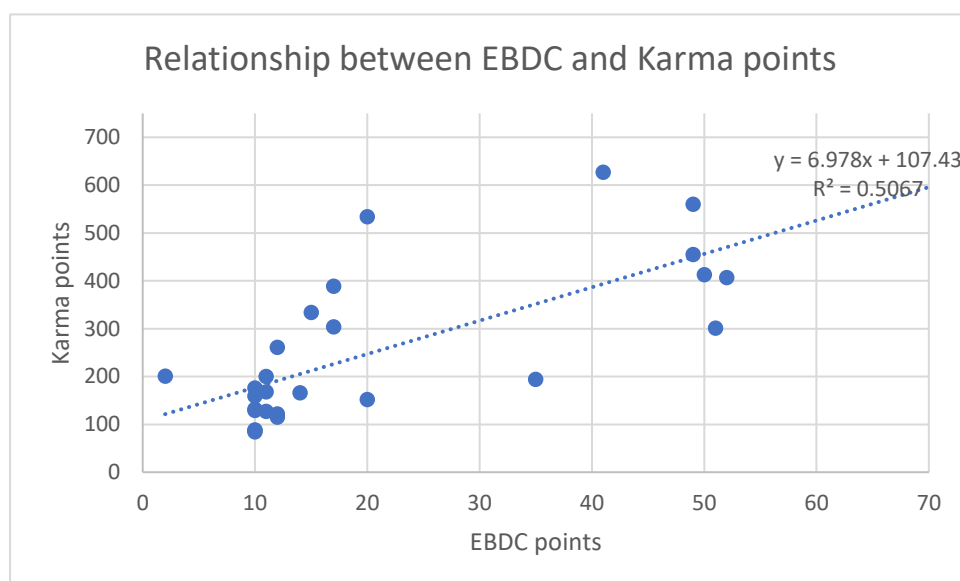


Figure 6.1. Relationship between EBDC counts and Karma points gained by top 30 most active participants on the platform.

There is a relationship between Karma coin gain and EBDC coin gain with an approximate 50% relationship between the two (Figure 6.1). However, the difference in axis is of a factor of 10 exemplifies that for every EBDC point gained, participants had gained on average 7.3 karma points. This shows that participants who were active, were not necessarily gaining many EBDC points. The disparity between points can also be seen in box and whisker plot (Figure 6.2). The blue box which represents the Karma points has a much wider distribution reflecting the range of score from the range of activity of the participants. The orange box which represents the EBDC points are narrowly distributed representing that very few points were gained and so there is little distribution. The narrow band between the bottom value and bottom quartile are due to many low values of between 10 – 15. This occurs due to participants receiving the 10 points for signing up and not progressing further. The disparity of point types is also visualised in supplementary figure 5.

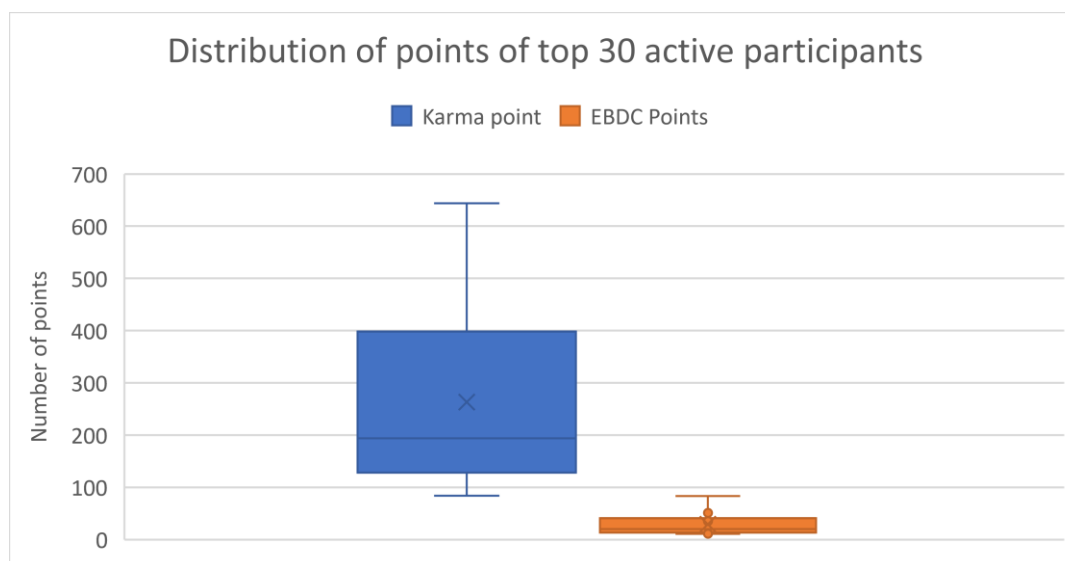


Figure 6.2 Box and whisker plot showing the difference in the distribution of points between the Karma points (Blue) and the EBDC coins (Orange).

To understand why participants were not getting EBDC coins, participants were asked to describe how the coin mechanism worked on the platform and how much they perceived themselves to understand the coins out of 5. The average score was 1.75 out of 5 for the participants asked (Table 6.1). These results suggest the EBDC tokens were poorly understood and not actively sought after.

To conclude, participants did not understand the coin mechanism, and the 30 most active participants, as delineated by karma points, were not rewarded with EBDC coins. This suggests the coin mechanism is not working as an incentivisation tool for participants. This could have implications for retention of new members of the platform or those that wish to start earning money through swarming on the COBIOM platform. This may be necessary for COBIOM to be an effective innovation hub for swarming.

Table 6.1 Participant evaluation of coin comprehension from participant interview. 0 is low and 5 is high. N=12.

Participant	Coin evaluation (5)
1	0
2	0
3	0
4	2
5	3
6	0
7	1
8	4
9	3
10	2
11	4
12	2
Average	1.75

Discussion and recommendations:

The European Biomimicry Design Challenge (EBDC) was conceived with the purpose of being a focal point for the current biomimicry community as well as living lab experiment for COBIOMS Swarm Innovation Platform. This also acted as a trial for radical collaboration and swarming. This was used to answer the central questions: How do individuals react to swarming, are some groups / demographics more adept to swarming and how can the COBIOM platform best facilitate this. Data from participant satisfaction, engagement, and demographics of those who took part in the EBDC was analysed. Finally, the use of gamification and whether this had been a useful motivator was discussed. The outcome of the participants survey suggests participants enjoyed the experience and found it an effective way of working. However, there was strong initial user drop off and difficulties with the gamification system. This discussion will aim to analyse the success of the EBDC and suggest recommendations for further improvements to future projects run on the Swarm Innovation Platform.

Swarming Effectiveness:

Swarming is described as a process where large informal groups solve complex tasks using a range of skill sets. Whilst the demographics of the group included a similar number of students, professionals and graduates they were smaller than an ideal swarm (Table 4.1, Figure 3.2). Despite the low numbers, participants believed they had a competent well put together group which they gave on average a competency score of 6 (Table 2.1). The efficacy is once again solidified by the effectiveness and quality scores of the work produced which are 7 and 6.6, respectively. This is despite having very few numbers in each group (Figure 3.2). The connection between reported efficacy and competency fits into theories of team composition which suggests effectiveness may be determined by member's skill, job and organisation ability (Mathieu et al., 2014). This is corroborated by a score of 7 provided by the results from the Climate-KIC spark lecture where swarming was introduced to Climate-KIC students (1.1). Combined, these scores show that swarming can be an effective tool for both short term and long-term working arrangements. This confirms that swarming is an effective coworking method and that COBIOM is a suitable platform for supporting this work.

Limitations to research

One issue concerning the conclusions drawn from this research are that personal biases in the researcher may have also affected the results of the surveys. The method of interviewing relied on face-to-face video calls and asking for insights based on set questions. This could have created bias in several ways. Firstly, social desirability bias occurs when participants provide answers they believe are desired instead of their actual feelings (Vogt, 2015). This may have caused higher scores given to effectiveness. This could additionally have prevented participants feeling as comfortable criticising the process, especially as the interviewer was involved in the organisation and execution of meetings. Interviewer effects have also been specifically cited as influencing participants through the use of leading questions and errors in recording (Mangione, Fowler and Louis, 1992). This is especially relevant to this researcher as all interviews were conducted in his native English with people who were not native English speakers. This led to some interpretation and follow up questions for clarity which in turn leads to changes in reliability. One important benefit of the survey of Climate-KIC students is that due to a lack of relationship and lack of interaction with the interviewer, they are less likely to be affected by the interviewer effects and have less pressure to provide a socially biased answer. The Climate-KIC responses can then act as a baseline to compare the participants responses from.

Sampling may have also led to inaccuracies in results. Higher access to participants who progressed with the programme has created a bias towards those participants who found the experience rewarding and convenient. This may have led to a higher perceived efficacy rate as those who found the process ineffective or the output low quality may have left the programme and were thus less inclined to respond (Etter and Perneger, 1997). This could create an artificially positive reflection of the process. This could be compounded by response bias within the population of participants as some individuals are found to be more likely to respond to web surveys than others (Frippiat and Marquis, 2010). One of perhaps the greatest issues in this data collection method was the small sampling size. Whilst the google sprint methodology suggests that in agile business using small data can be beneficial, it is widely considered invalid in science due to an inability to statistically prove a significant difference from the null hypothesis (Box, 1976; Knapp, Zeratsky and Kowitz, 2016). As a result of this disparity between business methodology and science methodology this report can advise COBIOM but not the scientific field on the processes of swarming. One way to get around issues pertaining to limitations with surveys and interviews is to look at engagement as an indirect indicator of effectiveness.

Participant engagement

One mechanism to see the overall perception and effectiveness of swarming is to look at participant engagement. Participant engagement reduced in number and became more concentrated over the course of the EBDC (Figure 3.1, 3.2). This could be related to a range of factors including those gleaned from participant interviews in which people stressed they had been struggling with the time commitment. Other options are also found from literature which suggests that many teams go through different developmental stage which can affect participation (Figure 7.1) (Tuckman, 1965). This is described as forming, where a team comes together, storming, where personalities clash and group dynamic is established, norming where roles are established relationships built and work increases and performing, when formed groups start being effective. Hackathon formats are specifically susceptible to the effects of relationships due to time frame limits (Brown, 2016).

Interestingly the curve of productivity and energy follows the rough same shape of the daily platform users (Figure 2.1), peaking at the beginning before a dropping down, only to pick back up again at the end. The drop off in participants could reflect participants going through these stages. A lack of institutional pressure or pre-established working relationship could then contribute to a lack of cohesion leading to a large drop off of participants (Forsyth, 2017). The lack of cohesion could be evidenced by the initial discomfort of participants at the beginning of the challenge (Table 2.1). Those that remained could have experienced social cohesion and therefore have been motivated to stay due to shared values or perspectives (Forsyth, 2017). These potentially could have been enhanced by ice breakers (Braune *et al.*, 2021). Additionally, task cohesion may have been formed and this taps into the insight gained from the relationship between swarming and goal orientation (Table 1.3). A goal focussed approach has been shown to influence cohesion through providing increased motivation, satisfaction and communication (Widmeyer and Ducharme, 1997)

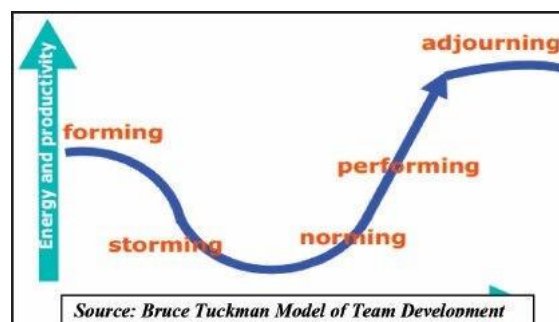


Figure 7.1 Diagram from Tuckman, 1965 describing the process of group formation and the different productivities within each phase.

Interestingly, engagement and efficacy could be linked in an unexpected way. One insight gained from participant interviews was that some groups started to feel more comfortable as fewer members were present. This can be seen in the increased feelings of comfortability that participants reported between the beginning and the end of the process (Table 2.1). Smaller teams are associated with less of a demand for formal leadership and autocracy, so it is possible the smaller team allowed closer relationships and more lateral decision making (Carron and Spink, 1995). Smaller teams also require fewer relationships which can lead to more effective teams (Ridley, 2016). Additionally, one participant reflected he/she believed their team became more effective as it became smaller and only those who were more committed participated in meetings. This reflects teamwork theory which suggests that in self-managing teams it is important to be diligent and focussed as no one is forcing the individuals to work and there is less room for free riding (Deeterschmelz, Kennedy and Ramsey, 2002; Forsyth, 2017). It also fits into evidence that whilst larger teams can be more effective, each member in a smaller team tends to contribute more (Deeterschmelz, Kennedy and Ramsey, 2002). This has implications for swarm size. Swarms can be large but could be encouraged to try to break-off into sub swarms that have a more defined focus rather than larger, broader swarms.

Recommendations to increase engagement comes from qualitative evidence from interviews and speaking to participants throughout the EBDC: The most useful way to get information is through the dashboard so this should be regularly updated with post meeting updates. This helps participants who may miss a meeting and then feel unable to catch up to catch up. This is especially important if lots of work has been produced on Miro as this is difficult to understand post meeting. Participants also mentioned they also received email notifications to keep them updated but these were too numerous and received low engagement and were often deleted. To deal with these issues a video or guide could be produce at the beginning of a project, and to determine the optimal number of notifications of updates. This could lead the users through the tools, coins, and culture of the platform.

Other techniques could be to use shorter meetings up 40 minutes and choose days early in the week such as Tuesday and Wednesday which have shown to be the best attended days (Steward, 2021). Releasing recordings online is a useful way to capture additional viewers. However extra viewership drops by half from day 10 to day 20 and so this should be done rapidly (Steward, 2021). A combination of these methods could increase conversion from signing up to conversion.

Technical issues

Another angle on engagement to the programme is that it was influenced by the technology and organisation of the EBDC, according to our survey (table 4.3). This was highlighted in participant interviews, where participants referenced having difficulties accessing the platform and finding where specifically work happened (and when). This is a common issue in online work events especially when lots of tools are used (Braune *et al.*, 2021) Anecdotally, this was more apparent in those who had less time and were less likely to try to troubleshoot the issues. One way in which this manifested was individuals dropping out of groups early on after they missed a meeting. This provides a clear avenue for improvement for COBIOM.

A number of factors can influence and improve web navigation and ease of use. These include the number of links to the website from other sites (Ilfeld and Winer, 2002). This is relevant to COBIOM as early interviews from users mention a difficult entering the website and getting linked from the COBIOM advertisements to the COBIOM platform. This included difficult entering the EBDC from the COBIOM landing page, which also worked as a landing page for companies interested in consultancy

work and other products. Therefore, a recommendation would be increasing the links on social media posts and using highly specific links which take users to relevant parts of the platform.

Another recommendation would be to improve the platform to allow for easier navigation. Conversion rate optimisation theory suggests easy navigation as the second most important factor for encouraging website interaction (King, 2008). Similarly, Duolingo's volunteer community suggests ease of contribution as one of the motivators to building a community based project (Jones, 2014). An example of how navigation is currently confusing on the website can be seen in supplementary figure 1 and 2. The most recent initiative, the green chemicals initiative, is mentioned twice on the website. There is a project – the green chemical initiative, and a swarm called Green Chemicals. One of which is a sign-up page and the other of which is a locked swarm (private group). This prevents easy engagement and has been mentioned to cause confusion. Whilst these methods may be useful for allowing ease of access, it may not keep potential experts engaged. To do this incentivization methods can be used.

Increasing participant retention and reducing drop-out rate through gamification

Gamification was used to try to incentivise participants. Participants could gain tokens for activity in forums, sending messages and engaging with posts. Gamification is a popular practice for “supporting user engagement and enhancing positive patterns in service use, such as increasing user activity, social interaction, or quality and productivity of actions” (Hamari, 2013; Hamari, Koivisto and Sarsa, 2014). However, this is often described qualitatively in user feedback rather than quantitatively by increased results. It appears gamification in the EBDC was ineffective as many of the most active participants did not receive a large amount of EBDC points (Figure 6.1 and 6.2). This may have been based in lack of comprehension of how the points system worked (Table 6.1). Results from interviews suggested people were also unsure of what value the points had. This could be potentially explained by a focus on learning and networking rather than using the EBDC as a mechanism to gain tangible assets and IP (Table 4.2, figure 5.4). Low emphasis on tangible assets means participants may have been uninterested in the value the tokens had. This fits into research suggesting that gamification is more attractive to achievement orientated players whilst our users appeared to be more explore type users (Hamari and Tuunanen, 2014). This may change as the COBIOM projects become more financially valuable and so attract more tangible based participants. Another interesting perspective is that gamification has been found to incentivise those who are already doing well and perform well but is not necessarily effective at motivating those who are under performing (da Rocha Seixas, Gomes and de Melo Filho, 2016). The issues with gamification, motivation of participants and experience of working in non-profitable projects outside their main source of work suggests indeed a specific demographic of users was attracted to the EBDC.

A recommendation to improve the understanding of gamification is to increase the achievement drive. This could be done through having a weekly a points champion or creating mini point sprints to make points more visible. Duolingo has been shown to do this effectively through badges, points and leader boards (Duy, Long and Hiroyuki, 2016). This will likely attract more achievement based users which are often useful for contribution as they are activated by validation (Marczewski, 2015). Badges or points can also be used to create an element of exclusivity and determine swarm access for paid projects. This model is used in the community platform reddit as a form of moderation for new users (Law, 2021). For more intangible asset users the points can be used for discounts on other learnings such as the course offered through the Biomimicry Academy. Inversely, The Biomimicry Academy could offer badges for completed courses to increase engagement with its courses. To engage the explorer types, frequent expert symposiums could be continued to be utilised to show

COBIOM is a place for learning and continuous development. COBIOM could also start to host webinars on alternative topics, perhaps using them to determine what projects can be focussed on next. As well as increased gamification different outreach could be used to attract a more diverse range of participants.

Attracting participants for challenges.

To address the target audience to promote COBIOM and swarming public outreach was required. This can be analysed in the context of getting a wider demographic and more users onto the platform. Public outreach refers to mechanism by which the potential user base was engaged and can be measured by people signing up to the platform and daily platform visitors. Swarming uptake can then be measured in terms of how many people attended the kick-off meeting and can also be seen in the daily platform visitors. Of the 122 participants who signed up, there were approximately 30 individual participants who then arrived for the first meetings, as signified by the 57 weekly users from the kick-off week.³ According to statistical evidence from research, typical attendance rate is around 40 – 50%, therefore COBIOM slightly underachieved in conversion of sign-ups to participations (Steward, 2021). This section will discuss how potential users / participants were reached and motivated to take part and how this could be improved.

A high number of daily users were counted during the first weeks of the platform launch, with 58 visitors captured of the 122 participants who signed up for the challenge. This coincides with first COBIOM announcement post on LINKEDIN during December and Fabians Feutlinske initial post announcing the EBDC. At this time, COBIOM's LinkedIn page had approximately 650 followers and was receiving approximately 100 – 150 page views per month. Fabian had approximately 1500. These two accounts worked in tandem, as well as with the Biomimicry Academy, sharing each others content with 5 unique posts in November and 5 in December with a following 9 in January during the lead up to the challenge starting. Multipliers of the outreach programme included a well-known Dutch Biomimicry expert and the Biomimicry Institute which has over 12,000 followers. The use of multipliers / influencers has been shown to be an effective tool for swaying consumer (participant) behaviour (Liu *et al.*, 2015) and this is especially relevant when the social media network overlaps with the ideal target audience which in this case was true. One potential issue with this strategy is that the followers of these different entities, The Biomimicry Academy, COBIOM and Fabian, have a strong overlap. As a result, these different channels were broadcasting to similar individuals.

Mechanism to capture a greater portion of relevant participants through social have been described in a lean business context (Kumar *et al.*, 2013). This can involve targeting small numbers of seed participants which can spread information via word of mouth⁴ reviews. A mechanism like this could potentially increase viewership of the challenges and initiatives to people outside the COBIOM network and increase the signing up to levels more similar to average webinar sign-ups which are approximately 260 (Steward, 2021). This mechanism was performed to a limited extent in the marketing for the green chemicals initiative which led to 8/32 of sign-ups being from targeted individuals from relevant fields. Whilst still a low number it makes up 8/13 of the first time COBIOM users for the challenge and so accounts for over half the new users suggesting it could be effective if optimised.

³ Some users went twice in one week to different challenges.

⁴ This includes virtual word of mouth

User engagement surveys suggested most users had begun to engage with the topic around December through a combination of social media platforms including Facebook, LinkedIn, and work platforms such as Slack. Engagement with users gave interesting insights such as: Lack of information on the running of the EBDC and very low platform activity. As a result, participants signed up to an 'empty' platform. Looking back at figure 3.1, this may explain the depression on views on the platform from between the 15.12.2020 – 1.1.2021 despite the post from social the social media platforms. This idea is corroborated by online communities expert Ben Winn who states that open forums shouldn't be activated until the community is ready to engage in discussions and content is prepared (Winn, 2021).

Therefore COBIOM should consider a more targeted acquisition and public out reach campaign for future projects. This can include a conscientious use of multipliers. Additionally, they should have a highly active and easy access swarm space to allow engagement. Using these methods could attract a wider audience and more relevant audience to the COBIOM website.

Conclusion

In conclusion, the COBIOM team has created a suitable platform for radical collaboration and swarming to take place. This is through a positive and inclusive culture on the COBIOM platform. This this has led to the participants an enjoyable experience which they have found productive. The swarms did experience a high drop off rate and the main demographic of those who remained in the process did not seek to use the challenge for tangible output which may explain why 3/5 challenges were completely dropped after its conclusion. For COBIOM to attract more tangible rewards-based participants for future challenges a more transparent token reward system ought to be implemented so that participants are aware of the stake they may receive. Small modifications to the website, including a visual hierarchy of the different layers to the website may also be helpful for busy professionals to help keep them focussed. To maintain the current community COBIOM can continue to host educational and inspirational talkers to maintain the platform as a learning environment was well as a coworking environment. To out-reach to a larger user base they should focus on making the platform accessible and use multipliers to If COBIOM can maintain its active user base and increase incentivisation of contribution for experts it will continue to develop as an effective innovation hub for swarming.

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Appendix – Full Survey Questions:

Semi – Structured interview 1

Section 1: Who makes up our community:

Question 1: Current occupation and experience?

Question 2: What field do you work in and what job title would you give yourself?

Question 3: Is Biomimicry your main topic of interest, if yes is it your main source of income?

Question 4: What kind of impact would you like to have in the world and what would be your version of success.

Question 5: Does your career require (or is enhanced by) a high degree of personal networking and if yes, how do you like to do this.

Section 2: The EBDC

Question 6: Have you joined the EBDC?

Question 7: If you have joined the EBDC, what did you hope to get out of it?

Question 8: How did you hear about the EBDC?

Question 9: Were there any hurdles that may have prevented you joining the EBDC or have cause you to leave?

Question 10: Do you think collaboration in this way works (loose teams) (1-5).

Question 11: Which swarms are you a part of? (How many quant (1-5))

Question 12: On a scale of 1 – 5 (5 high) do you understand the co-operation system on Cobiom and the reward system?

Section 3: Using the platform

Question 13: How do you keep up to date with what is going on in the EBDC

Question 14: Do you feel able to navigate around the platform? If no, which parts do you have trouble finding (or leave any other problems you have).

Question 15: Have you watched the videos on how the platform works in the how to section of the platform?

Final Question: Is there a tool / functionality that you would like to add to the Cobiom Platform?

Semi Structured Interview 2

How many sessions did you attend (roughly)?

(There were roughly 15 sessions per group)

Did the number of groups you were associated with change? (Did you leave a group or join a group)

If you left a group, please suggest a reason why

If you did not join another group, what prevented you

If you dropped out the EBDC, please choose a reason:

Time difference made it difficult to co-work

Poor organisation in the EBDC

Disliking the work style / tools

Other commitments prevented me being more involved

Did not feel included or that I could contribute

IF OTHER please state:

Please answer the following questions as best you can, even if you did not take part in the whole processes. I am interested in qualitative information too so feel free to add any insights after each numerical value.

On a scale of 1 – 10 how effective did you find your group to be. Where 1 is ineffective and 10 is very effective and 5 is competent.

On a scale of 1 – 10 how much did you enjoy this method of working, with loose informal groups formed around a shared purpose rather than shared background or institution

Compared to traditional relationship or institutional based teams you have been part of what was the quality of work produced like on a scale of 1 – 10. Where 1 is much lower quality, 5 is similar quality, 10 is much higher quality.

On a scale of 1 – 10 did how suited were your team mates to the challenge. Where 1 is unsuited or incapable, 5 is average suited and capable and 10 is high suitable and specialised.

On a scale of 1 – 10 how comfortable did you feel with your teammates at the beginning and end of the processes. Where 1 is completely uncomfortable, 5 is averagely comfortable, 10 is completely comfortable.

(1 may look like: Camera off, not wanting to say something stupid, speaking when spoken to, 5 would be camera on, exchanging pleasantries during the call feeling able to criticise the ideas of others without causing offence. 10 may look like arranging to try and meet in the future and taking freely about personal lives)

On a scale of 1 – 10 how hierarchical did you find your group to be. Where 1 is completely communal (work chosen), 5 is hierarchical but open to suggestions (work suggested) and 10 is completely hierarchical (work dictated).

If you had problems with the EBDC that may have caused you to stop participating, please state:

If you dropped out the EBDC, please choose a reason:

Time difference made it difficult to co-work

Poor organisation in the EBDC:

Disliking the work style / tools / platform:

Other commitments prevented me being more involved

Did not feel included or that I could contribute

IF OTHER please state:

From 1 – 10, how likely would you be to take part in a process like this in the future.

Any closing thoughts?

Survey 1:

How enjoyable did you find the content that was presented	(1-5) where 1 low and 5 is high
In an increasingly specialised work force, having a consistent, static team for every work project will become less common.	Agree / Disagree
To form an effective team a previously established positive relationship is more important complementary skill sets.	Agree / Disagree
Decisions take longer in a larger group but the consensus is more likely to be correct.	Agree or disagree
Now you have been introduced to the process of swarming, do you think it is an effective mechanism of working?	(1=less effective; 5=average; 10=highly effective)
Of these Characteristics, which would you say is the greatest blocker to team working:	Lack of Communication between team members Lack of Cohesion between members Unclear goals Varying interpretations of goals Internal Competition
Any other comments are welcome	

Survey: 2

Question	Response format
I have taken part in the EBDC	(Yes / NO)
Do you work independently or as part of a company	(Single sentence)
In your working environment do you have choice over your assignments	(1 – 5) 1 is complete choice 5 is completely assigned.
Are you part of any formal networks e.g., UtrechtInc, Impact Hub, SystemsIO, BMA? (If yes, please name these networks if you feel comfortable doing so.)	(Single Sentence)
How many projects (such as the EBDC) per year do you participate in outside your main source of work / income	(0, 1-2, 3-5, 6-10, 10<)
How regularly do you work in a network-team: (an informal typically large team of associates rather than colleagues)	(0-5) where 0 is never and 5 is always
In your formal employment, are you in a fixed/static team, that is expected to adapt to your projects or do the members of your team change with each project	(1-5) where 1 is static and 5 is fluid.

When you engage in a project outside of your formal employment are you more motivated by intangible gains, like knowledge and networks, or tangible assets like intellectual property rights or earning money.	(1 -5) where 1 is purely intangible and 5 is purely tangible.
When you engage in any type of project do you expect to be paid depending on the value you added personally or the time you committed	(Value / Time)
When you are working on group projects/assignments, what do you find to be the barriers to successful collaboration?	Single Sentence.