



Aparajita

Enabling Sustainable Development Goals of Bangladesh
for 2030- BdOSN

2022

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1. Introduction

Increasing the number of women in STEM, particularly, women in computing through academic studies [59, 60, 61] as well as outreach activities [38, 41] has been of great interest. This work, set in Bangladesh, is based on previous exploration showing the low number of participation of women in STEM [64] and in computing/ ICT fields [63]. A conscious effort is made through rigorous training and engagement of women in ICT to increase their participation over a four year long time frame - aiming to explore the impact of the program.

Bangladesh is placed in a unique position where a great priority is given on educating female children through national level programs [65]. The number of female students are comparable to male students at primary and secondary level [65]. However, the picture changes at tertiary level as recent studies have shown [66]. The comparison shows a sharp drop out at tertiary level education which lowers further at job sector entrances when participation of women is very low.

The situation is different with the recent pandemic of COVID-19 that has shaken the world [62]. The pandemic has required strict social isolation which created a deeper technology dependency [67, 68]. This work taking place after the pandemic shows technology based innovation of female entrepreneurs that was not socially acceptable before [25].

Enabling Sustainable Development Goals of Bangladesh for 2030 (ESDG4Bd) is an initiative taken by Bangladesh Open Source Network (BdOSN) to enable aspiring young women ICT professionals to be more career focused in ICT and related fields. The project ESDG4Bd began its journey in April 2019 and would continue until March 2022, initially having a duration of 3 years. The project was later extended for another 6 months, running the project for a total of 3 years and 6 months. The ESDG4Bd initiative had to make significant adjustments during two years when it operated under the restrictions imposed due to Covid-19 pandemic. They continued their activities, hosting events online.

The activities under the project focused on exposure, capacity building and confidence building among women in ICT and related fields. The National Girls Programming Contest (NGPC), a national level programming competition held annually in which competitors sign up through an online preliminary qualifying round, is considered an academic skill development unit. This competition aims to involve female students in competitive programming activities where there has not been a lot of female presence [36, 37]. Another program engages the entrepreneurial community through a formal training process that educates the community across the nation through Girls' Innovation and Entrepreneurship Boot Camp (GIEBC) through a series of lectures, hands-on activities spread across

numerous camps, and learning procedures. The 3.5 year long initiative also conducted an annual conference for women connected to technology that included a series of workshops, discussion sessions working as a networking event named Ada Lovelace Celebration (ALC) for Women in ICT [38]. Apart from these, some of the other activities include career talk, job exposure visit, grant sourcing mentorship, internship and networking activities. The section 'The ESDG4Bd Project' contains more details on the events organized under the initiative.

The Bangla phrase "Aparajita (অপরাজিতা)," which means "the one who cannot be defeated," serves as the inspiration for the project's name. It looks at the three and a half year-long initiative that BdOSN has taken to engage, train women all across Bangladesh. In order to better understand the impact of the initiatives and suggestions for how to improve the ongoing effort, this work conducted both qualitative research with n = 35 participants from NGPC and GIEBC through focus groups and one-to-one interviews. Along with the qualitative research we conducted quantitative research with n= 76 participants to get better understanding. During our qualitative study, we found that exposure to these events has helped our participants with their networking with other females in ICT and entrepreneurship. The participants mentioned that these events have boosted their confidence and enhanced their skills in their relevant field. Most significant impact of these events was their role to prepare women for the professional fields. From quantitative findings we observed that a higher impact on the participants' individual performance where participants reported an improvement in their personal competencies, job performance, and professionalism. However, personal barriers such as lack of confidence appeared as a hindrance to performance as evident from our regression analysis. As we found among our qualitative study participants, these events work as an enabler for women's confidence in their professions which address the personal barrier of lacking confidence as found in the quantitative study. The study sheds light on how effective such programs may be in boosting women's involvement in ICT.

2. Background



Figure 1. Women in Nationalistic movement [46]

2.1 Education and Gender

The picture in terms of education level, participation of male and female students presents an encouraging picture across Bangladesh.

Gender Distribution: Bangladesh is one of the countries that have close gender distribution across the population as can be seen in Figure 2(a). A densely populated country of 158 million people has a majority of its population living in rural areas (114 million). The country is in a unique position where the majority of its population are younger generation population. We have 18% male, 21% female within group of 18-29 year old group in rural areas and 20% male and 25% female under the same age group [42].

Gender Sensitive Policies: The Government of Bangladesh has gender sensitive policies to increase female enrollment which is achieved in Primary and Secondary education level. For example, the free primary education (up to grade six) for children is extended to grade eight for female students in Government Schools. However, the number of female graduation rate in tertiary education level is only 35% of the population earning degrees.

The education and literacy rate varies in urban and rural populations according to the 2015 consensus report [42]. The gender disparity is minimal across rural and urban populations, which is encouraging from a developing country perspective as can be seen in Figure 2 (b). However, the alarming picture is shown in Figure 2 (c) where only half of the female educated population enters the workforce. The education and literacy rate varies in urban and rural populations according to the 2015 consensus report [42]. The gender disparity is not visible across rural and urban populations which is encouraging from a developing country perspective as can be

seen in Figure 2 (b). However, the alarming picture is shown in Figure 2 (c) where only half of the female educated population enters the workforce.

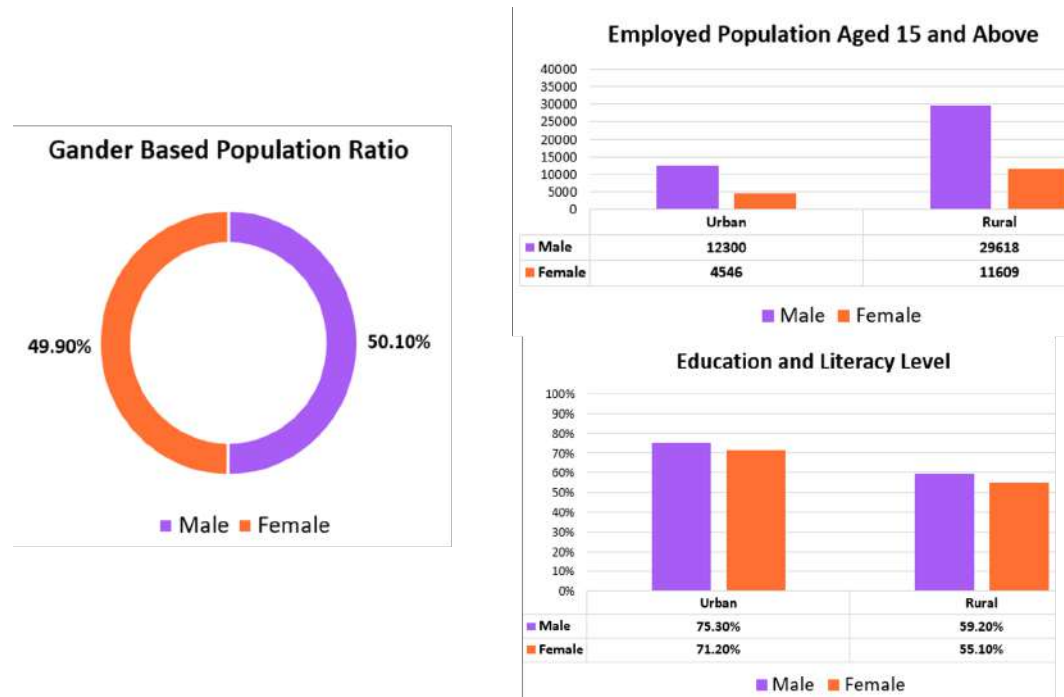


Figure 2. (a) Male-Female Population ratio in Bangladesh (b) Male-Female Education ratio in Bangladesh (c) Male-Female Workforce ratio in Bangladesh

Participation in Education and Reason behind Dropout: We have collected the corresponding data from the data of Bangladesh Bureau of statistics [43]. The rate of participation varies with a large number of dropouts at various level of education. It is encouraging that the number of male and female student intake rate is 97% and 98% for male and female students respectively. The dropout rate after primary school comes to 24% and 17% for male and female students after primary school. The reasons behind dropout vary from *failing in primary exams, not finding it interesting, getting into jobs* irrespective on gender. However, 12% of the dropout female students mention *marriage* as the reason behind primary school dropout. The participation of male and female students comes to 62% and 71% at secondary school level. The dropout rate is 17% and 24% for male and female students at secondary education level having 54% and 46% of male and female enrolment at tertiary level. At this level the gender disparity shown as a reason behind dropping up comes

from *location of educational institute* (mentioned by 7% female students while 1% male students considered this reason) and *getting involved in chores* (33% mentioned by female and 1% mentioned by male students). Along with the mentioned issues, child marriage remains a major reason behind dropout of female students. There are 33% female students at secondary education level who have been *married early* (before the age of 15). The child marriage comes with additional impact of abuse consisting of *sexual abuse, control, economic dominance* etc. There is *early motherhood* experienced by women aged below 15 in rural (3.1%) as well as urban (2.8%) areas.

The focus of our study is on the laboratory classes of Computer and Electrical Engineering discipline. Students pursuing for higher education in this area have already proven themselves through standardized tests along with rigorous admission tests. In laboratory based learning environment students are required to engage in individual assignments as well as group assignments/ projects. The resources are equally accessible to the students regardless of their gender. A logical visit to a laboratory class would show a class room where each student has his or her own computer to complete the class work. The laboratory classes of Electrical Engineering part require sharing of resources where the tables provide enough space to accommodate the group members. It must be noted that most of the faculty members and lab assistants are male which is a phenomenon in all the engineering universities.

2.2 Society and Gender

A high-level overview gives us hope in gender neutrality in all aspects including education as Bangladesh is one of the very few nations that only had female Prime Ministers since 1991. However, the female leaders being in power and major opposition teams never challenged the patriarchal views.

Domestic Decision Maker: Head of household is a traditional concept practiced that emphasized patriarchal view. In a survey conducted at national level [Bangladesh Bureau of Statistics, 2015] shows that only a small percentage of women declared themselves as head of the house. In the eastern culture, father is considered the head and the earning member of the family. It is interesting to notice a percentage of women declaring themselves as head where the percentage is still low regardless of the household location (rural or urban) as can be seen in Figure 3.

Physical Safety: Apart from society-imposed barriers, there are barriers that restrict access of women. Physical safety hampers the opportunities for women as women are traditionally victims of abuse. High number of female victims of sexual harassment show how basic rights of women are violated in Bangladesh. In the year of 2017, there have been 834 reported cases of rape [44]. There are

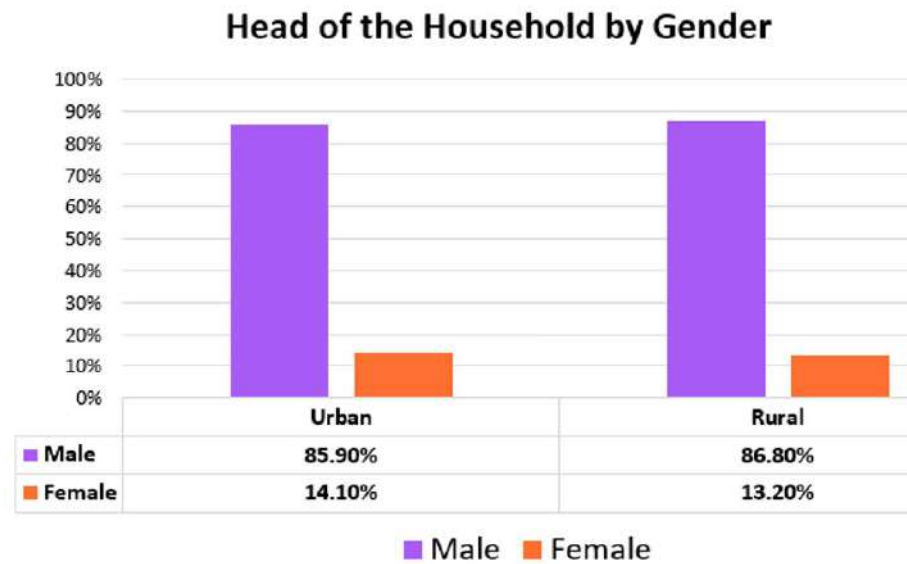
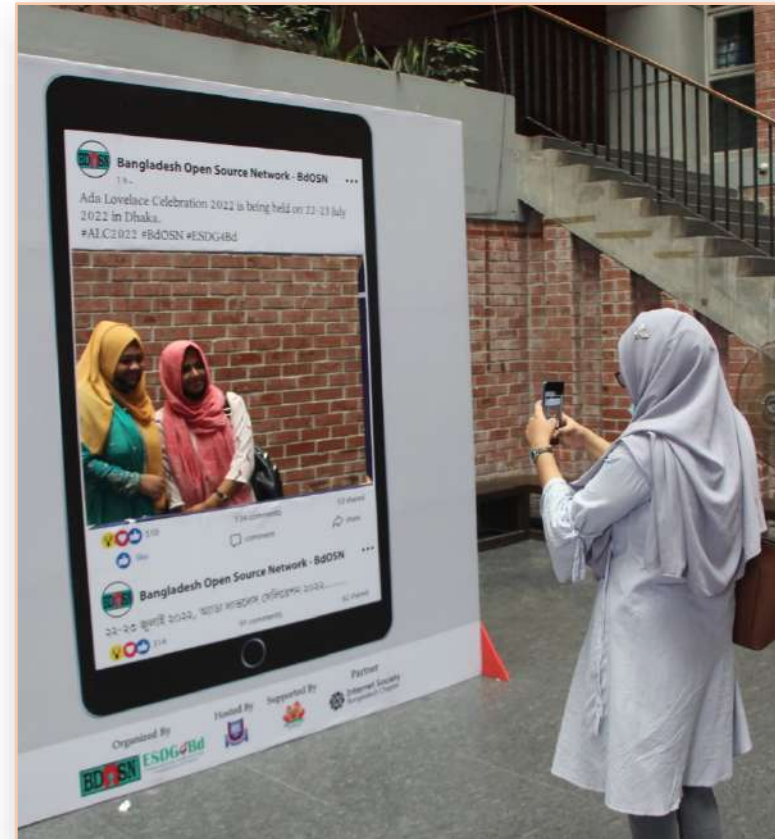


Figure 3. Head of Household in a survey conducted by Bangladesh Bureau of Statistics

stories where female students dropped out of school once she was sexually harassed [22, 45]. The problem imposes direct barriers for women to enter the exciting world of learning and working.

“During COVID-19 pandemic, they organized the events online and it was convenient for me because if it was offline, I would not be comfortable with that. Staying 2 days in another place is not convenient for me. I was eager to participate in other programs but as I am a 4th year student, we have projects and other academic work to do. I am not comfortable staying alone in unknown places, it is my personal preference.”- P3, Student, Dhaka



3. Related Work



Figure 4. Students working in a laboratory towards NGPC

The women in South Asian regions have limited access to technology usage [18]. Also, lack of technology familiarity negatively impacts the experiences of using technology as women are more prone to abuse on various technology platforms [31, 32]. Recent studies have emphasized ways to improve and engage women more in

technology learning and exploration in this region that reflect the socio-cultural values and norms [33-37]. In the learning domain, studies have shown how female learners in the technology field were constrained by various social and cultural norms in Bangladesh [36, 37]. Regarding women using technology platforms, there are similar barriers for women, as seen for women from Afghanistan [34], India, Pakistan, and Bangladesh [31, 32]. This work focuses on understanding the specific initiatives of engaging women in technology learning, and usage space that has taken place in Bangladesh studied by the *Aparajita project* through an initiative by Bangladesh Open Source Network (BdOSN) [30].

The *Aparajita project* is named after a Bangla word that means the one who cannot be defeated. It looks at the three year long initiative BdOSN has taken to engage, train women all across Bangladesh. It considers an academic skill development unit which conducts a yearly national level programming contest named the National Girls Programming Contest (NGPC) which takes place once a year where participants join through a preliminary qualification round online. The goal of this contest is to engage the female students into the competitive programming practices where the number of female representations has been low [36, 37]. The other initiative takes place to engage the entrepreneur community through a formal training process that trains the community all across the country through

Girls' Innovation and Entrepreneurship Boot Camp (GIEBC) through a series of classes, practical sessions over several camps and learning processes. Apart from these initiatives, the three year long initiative conducted an annual conference for women connected to technology that included a series of workshops, discussion sessions working as a networking event named Ada Lovelace Celebration for Women in ICT [38]. This work engages in a qualitative study that has covered $n = 35$ participants from NGPC and GIEBC through focus group discussions and one to one interviews that shares the impact of the initiatives along with ideas on how to improve the ongoing effort. We found that exposure to these events has helped our participants with their networking with other females in ICT and entrepreneurship. The participants mentioned that these events have boosted their confidence and enhanced their skills in their relevant field. The study sheds light on the potential of such initiatives to increase women's participation in ICT.

3.1 Theoretical Framing

Theoretically framing our research into one existing framework is challenging. The problem intersects where effects of multiple topics coexist. The major reference is drawn from the concept of *masculinity* which is very strong concept and has been long practiced in the East. This practice impacts the core decision making such as social layout and power structure where patriarchal values dominate. Feminist movements covered by the vast *feminist HCI* literature, goes side by side along with the discussion of masculinity.

Masculinity: Conflict of power, domination drives the masculinity force [47]. The core patriarchal values often vary in definition [48]. Historically masculinity was portrayed as kinship which has changed its definitions over time. Patriarchal values are studied using justification of psychological and biological abilities considering a male to be normal [49]. The theory that discusses such biological differences of the sexes, falls under the categorical theory. Since then, there have been numerous research articles working on masculinity theories which are closely related to the social cultural aspects. The theory of interest where our work relates to is known as the reproductive arena where visual physique is influenced by the historical process as being agents that are actively taking part in gender roles. In our work, we focus mainly on the context of Bangladesh where in most houses father is considered to be the income generator who dominates decision making mostly. In Bangladesh, patrilineal descent (influence of patriarchy) patrilocal residence where women move to live with her husband and relatives, is practiced [50]. It plays a major role in dominance and subordination. The subordination indicates a lower position of women in general. There are active processes involved that active practices of various activities involving discrimination, disregard, insult, control, exploitation, and oppression, violence within the family, workplace and beyond. Many of these practices can take place actively and/ or passively. In the context of framing the problem we are focusing on,

the subordinate position of women negatively impacts encouraging women in leadership and role model positions. The limited number of key change makers is not socially regarded compared to their male counterparts.

Feminism: Shaowen Bardzell [51] lays down a category of work referred to Feminist HCI, where economic, political, social and psychological oppression of women are discussed. Francesca Bray [52] portrays a vivid picture of gender and technology along with the social perspective. Judy Wajcman [53] discusses how gender issues merge with technology representation. Sherry Turkle reaches further backward in time to find out social models that cause women to have a fear of technology.

Feminist HCI has played a bold role in discussing issues regarding to women's right, incorporation and involvement. During the third wave of feminism, Feminist HCI community is concerned about inclusion [54]. However, the problem is harder to solve when there is the inherent barrier of silence [45], especially, in urban female communities. We focus on generating conversations through active participation and awareness generation in our work.

The study on where to place the problem is a research worthy of exploration in its own merit. We want to shed light on the existence of ongoing frameworks that is connection to our problem of interest.

4. The ESG4Bd Project



Figure 5. An ESG4Bd Activity

The ESG4Bd program has run for three and half year with a total of 281 events and 17942 participants joining them in total. It consisted of year long activities along with annual activities.

4.1 Full List of Activities

The full list of activities and number of each activity over the 3.5 years time frame is given below. The total year wise breakdown is presented in the appendix section A1 table.

Table 1: Full list of Activities

ESDG4Bd Project (April 2019-March 2022) Activities	Total Activities	Total Participants
ICT camp + Programming camp	105	4101
Career talk	43	1993
Hands-on workshop on job preparation	30	1392
Programming - warm-up and mock contest	42	3380
Project competition	1	27
Job exposure visit	14	234
Networking activity	4	304
Job attachment 3-7 days	1	1
Internship - 1 to 3 months	19	19
Innovation boot-camp [3-days residential 50 each batch]	5	233
Possible funding/grant sourcing mentorship	1	32
Mentors workshop	4	67
Ada Lovelace celebration	4	2335
Conferences, seminars, policy dialogue sessions and workshops	2	1335
Career counseling support and job fairs	1	700
National girls programming contest [online & onsite]	3	1307
Web-portal development and maintenance for Female in tech community	3	2700
Report dissemination events	0	0
Safeguard policy development oriented workshop	1	117
Total	281	17942

The chart (Figure 6.) below gives a picture of the number of activities taking place in total here.

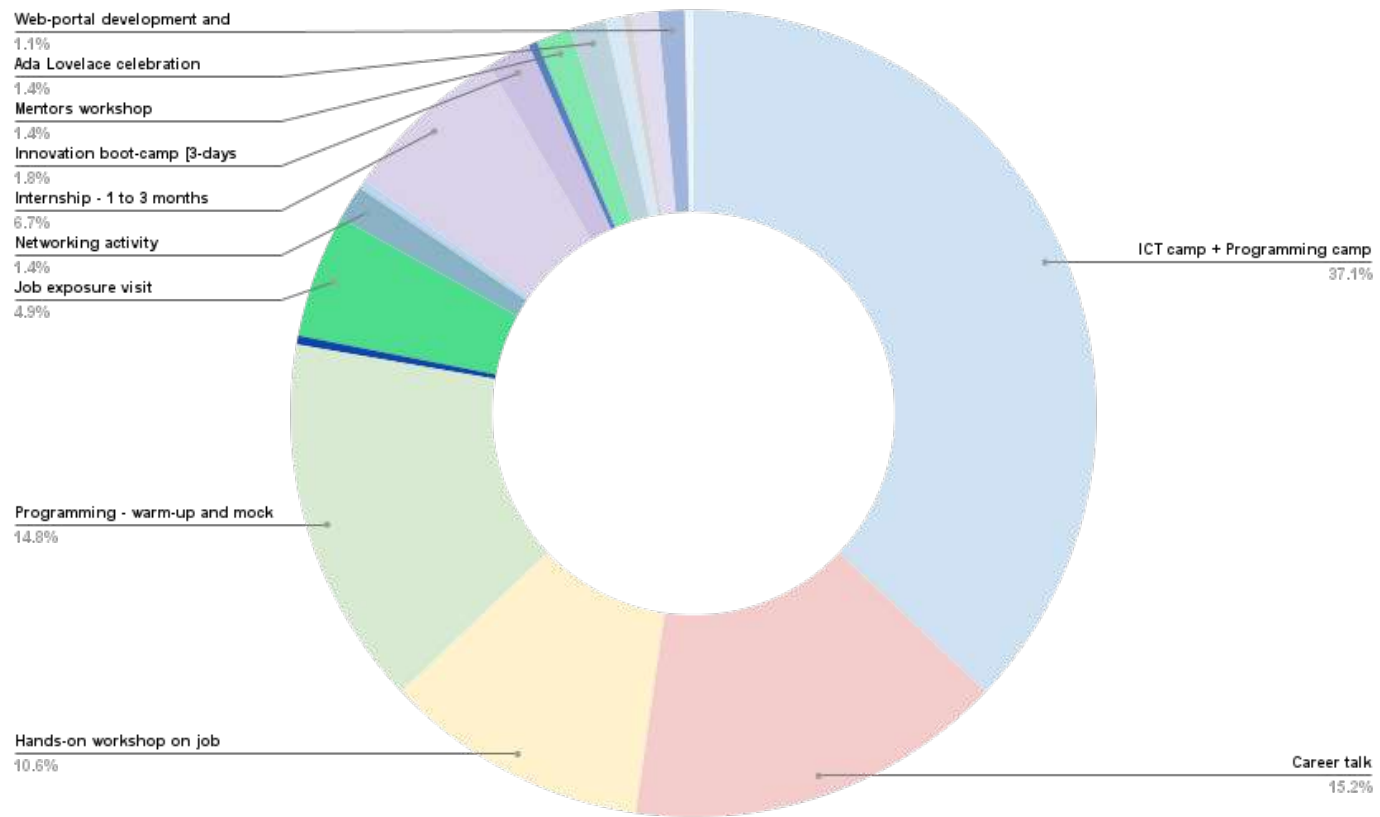


Figure 6. Graphical display of number of activities and event number around that particular activity

4.2 Year Long Activities

There are year long activities consisting of ICT based and entrepreneurship and soft skill based activities that are discussed in the following subsections.

Camps Including ICT Camp and Programming Camps:

A total of 105 ICT and Programming camp related activities involving 4101 participants were conducted during the span of 3.5 years. Year by year number of participants and total number of activities are shown below (Figure 7).

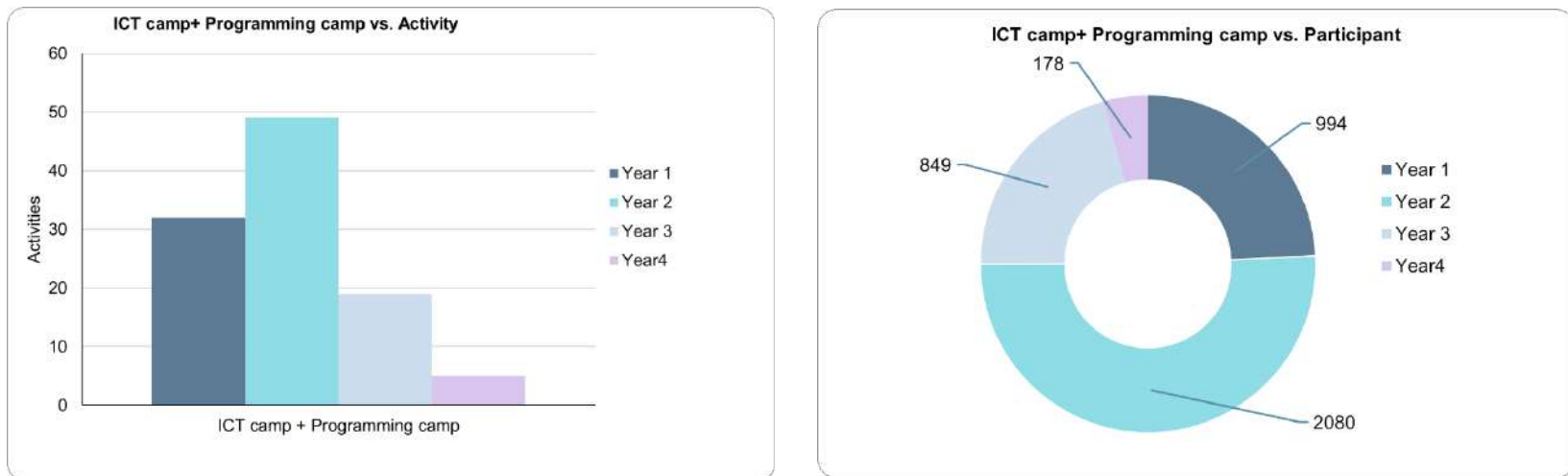


Figure 7. (Left) Number of Activities (right) Number of participants for camps

Carrier Talk:

Different career talks related events held under the ESDG4Bd program. The total number of such events accumulated to 43 where 1993 participants attended them. Year by year breakdown of the individual number of events and number of participants are shown here (Figure 8).

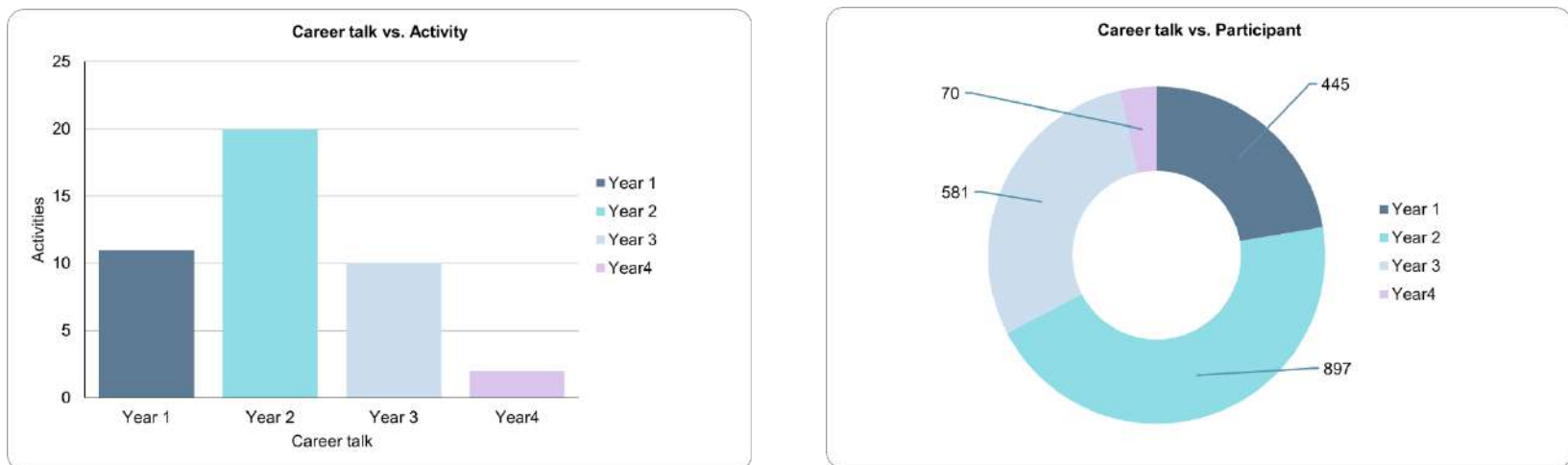


Figure 8. (Left) Number of Activities (right) Number of participants for career talk

Hands-on Workshop on Job Preparation:

Hands-on workshops were also done under the program for preparing participants for the job sector. 30 activities were done involving 1392 participants during the 3.5 year span. The number of participants and total number of activities are shown below (Figure 9).

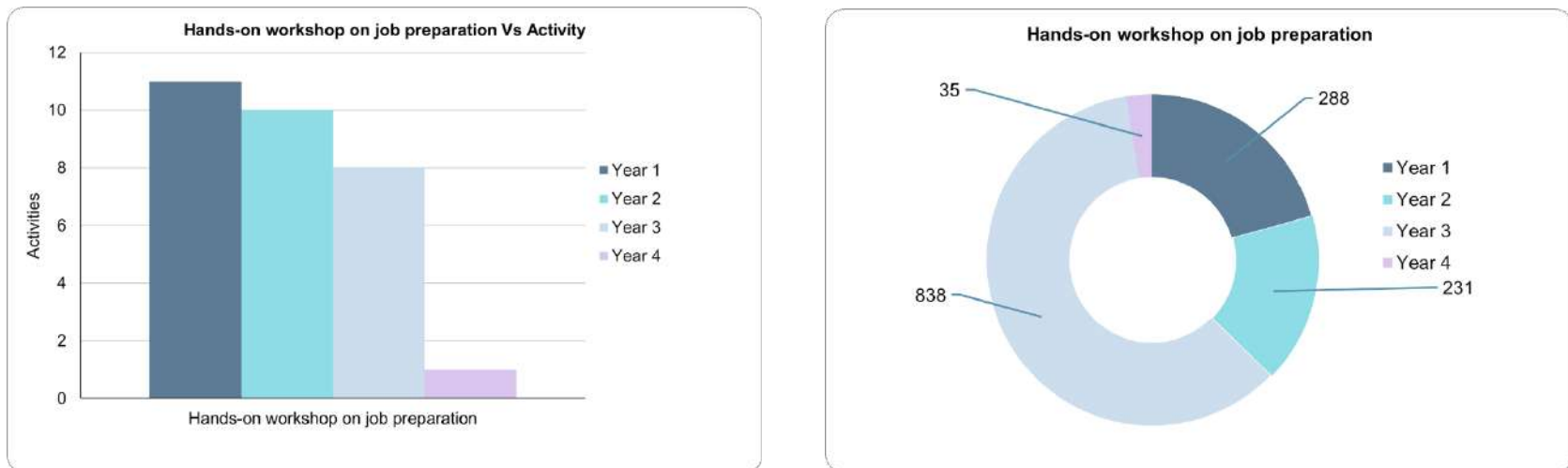


Figure 9. (Left) Number of Activities (right) Number of participants for workshops

Programming, Warm-up and Mock Contest:

Programming, warm-up, and mock contest activities are among the diverse activities done. 3380 participants from all over the country participated in those contests. Year by year breakdown of the activities and participants are shown below (Figure 10).

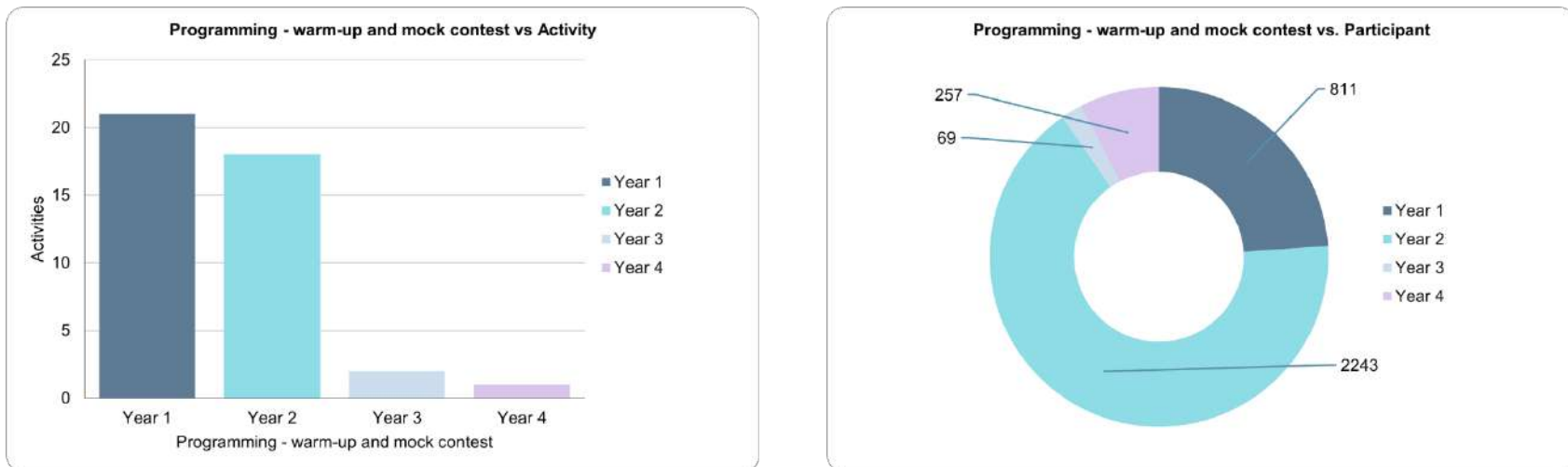


Figure 10. (Left) Number of Activities (right) Number of participants for the programming, warm-up and mock contest activities

Project Competition:

A project competition activity was done on the third year of the project where 27 participants were involved.

Job exposure visit:

Students and other interested participants were taken to different IT companies for job exposure visits. A total of 14 such events were organized under the program where 234 participants were involved. The detail breakdown of participants and activities are given below (Figure 11).

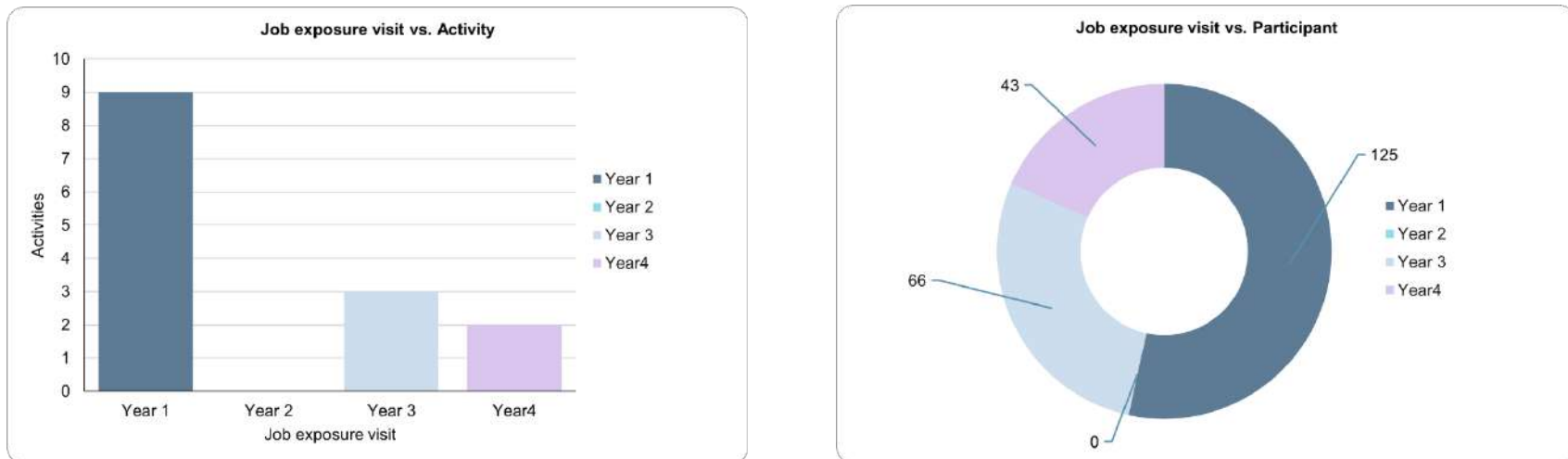


Figure 11. (Left) Number of Activities (right) Number of participants for visits

Networking Activity:

A total of 4 networking activities were held in the 2nd and 3rd year of the program involving 304 participants. Year by year breakdown showing activities and participants in the activities are given below (Figure 12).

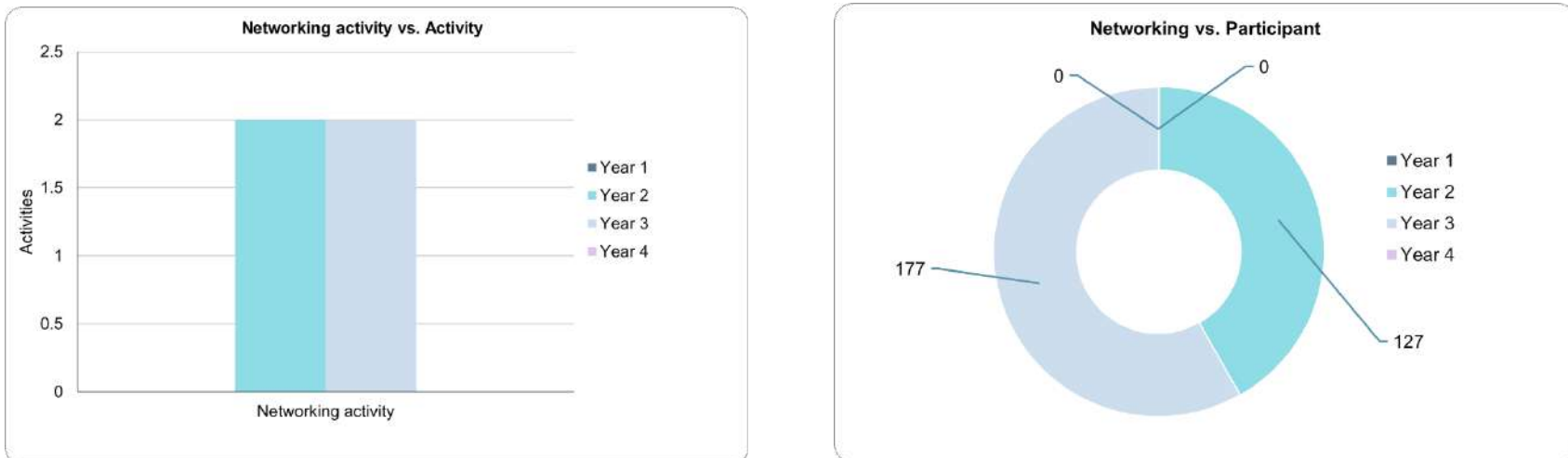


Figure 12. (Left) Number of Activities (right) Number of participants for camps

Internship - 1 to 3 Months

19 internships were arranged under the program. The year wise breakdown is provided below (Figure 13).

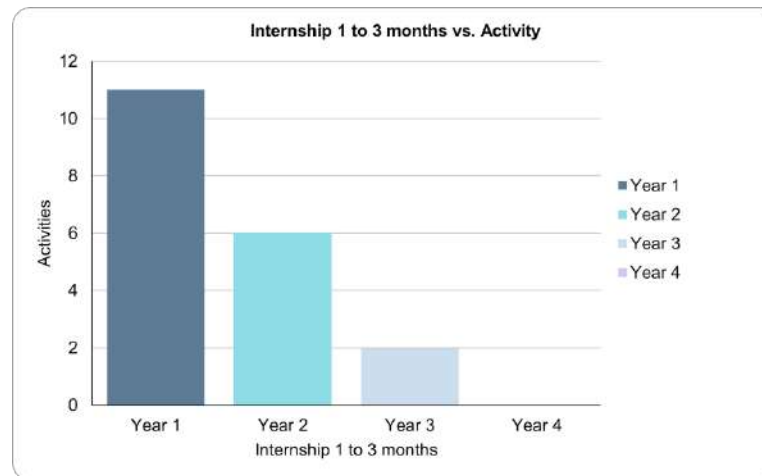


Figure 13. Number of Activities (Internships)

Possible Funding/Grant Sourcing Mentorship:

A mentorship related event was organized in the last year of the program mentorship activity where 32 participants were mentored.

Innovation boot-camp

5 innovation boot-camps are arranged under the ESG4Bd program which are named Girls' Innovation and Entrepreneurship Boot Camp (GIEBC). These boot camps involved 233 participants. The 3 day long boot camps were organized twice a year which continued for the first two years. However, due to the COVID-19 pandemic no boot camps could have been organized in the 3rd year of the program. Year by year breakdown of the number of participants and total number of activities are shown below (Figure 14).

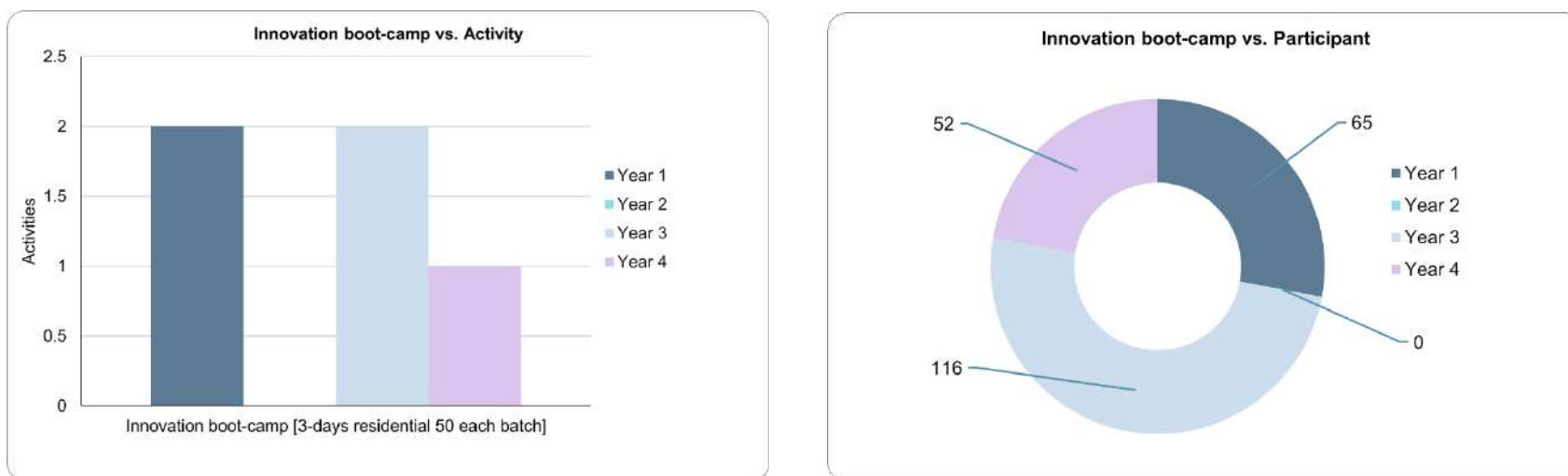


Figure 14. (Left) Number of Activities (right) Number of participants for camps

Mentors Workshop:

During this span of 3.5 years 4 mentors workshop were held where 67 participants were mentored. Please see the graphs (Figure 15) below for the detailed breakdown.

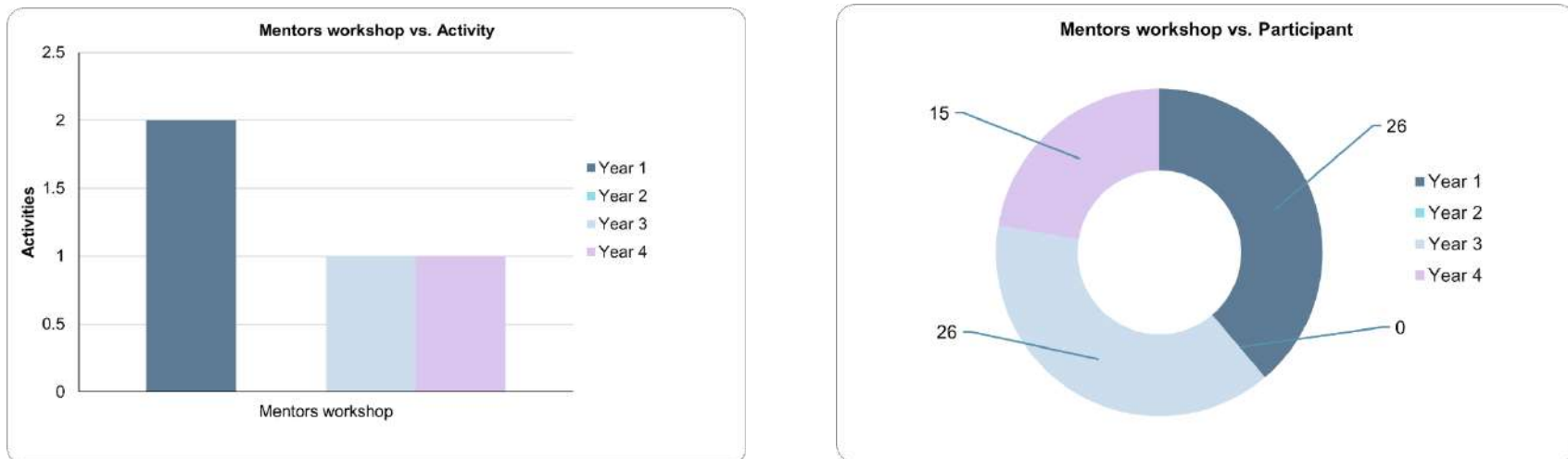


Figure 15. (Left) Number of Activities (right) Number of participants for workshops

Ada Lovelace Celebration (ALC):

Ada Lovelace Celebrations were also organized by BdOSN where 2335 participants attended for celebrating Digital Bangladesh with the women in technology. The number of participants and total number of activities are given as year by year breakdown below (Figure 16).

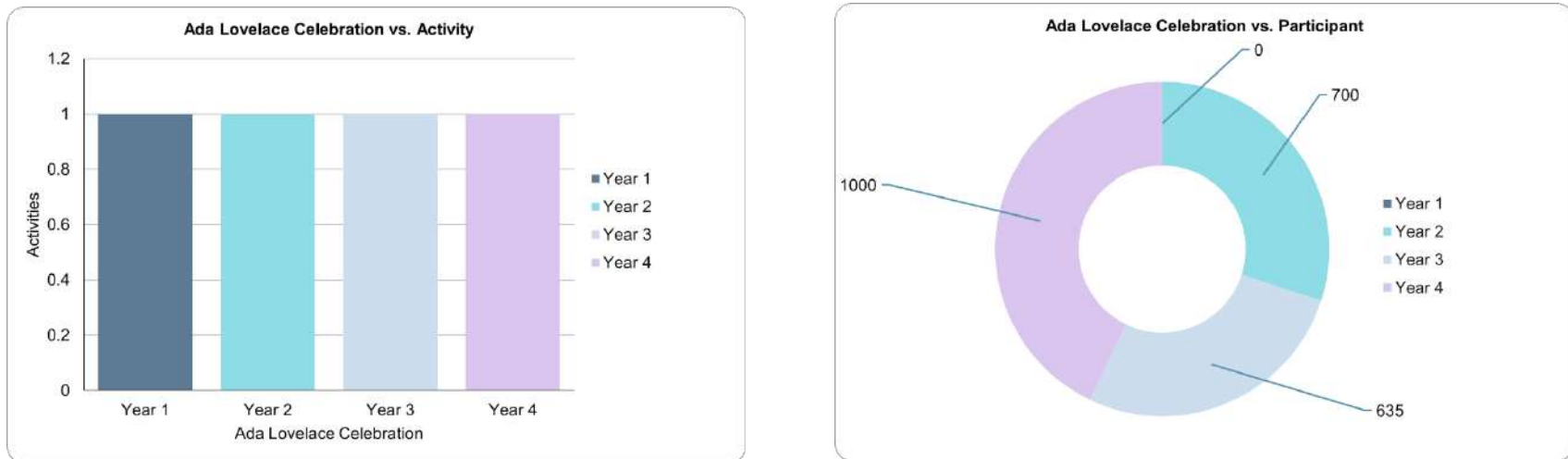


Figure 16. (Left) Number of Activities (right) Number of participants

Conferences, Seminars, Policy Dialogue Sessions and Workshops:

The year by year breakdown of the two events where Conferences, seminars, policy dialogue sessions and workshops were held. A total of 1335 participants attended those two events. The detail breakdown of activities and participants are presented below (Figure 17).

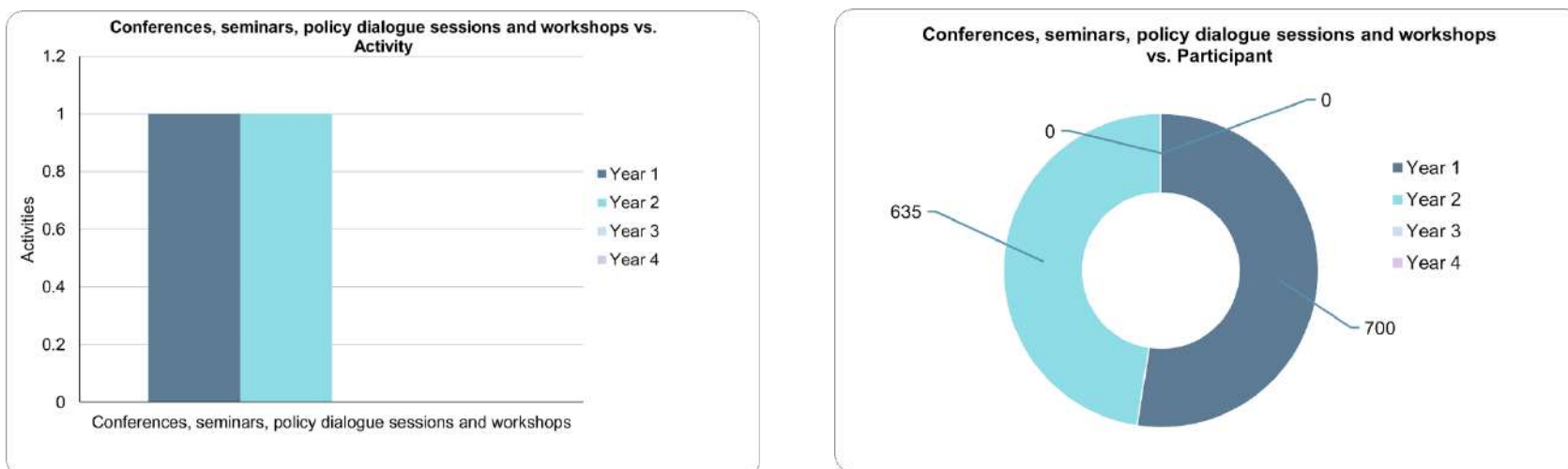


Figure 17. (Left) Number of Activities (right) Number of participants

Career Counseling Support and Job Fairs:

A job fair was also arranged by BdOSN under the ESDG4Bd program in its first year. 700 participants attended the job fair.

National Girls Programming Contest [online & onsite]:

BdOSN has also arranged National Girls Programming Contests (NGPC) for three consecutive years. They have arranged those competitions onsite. They also arranged one of the NGPC online due to the COVID-19 pandemic. 1307 students attended the NGPCs arranged by BdOSN. The number of participants and total number of activities are given as year by year breakdown below (Figure 18).

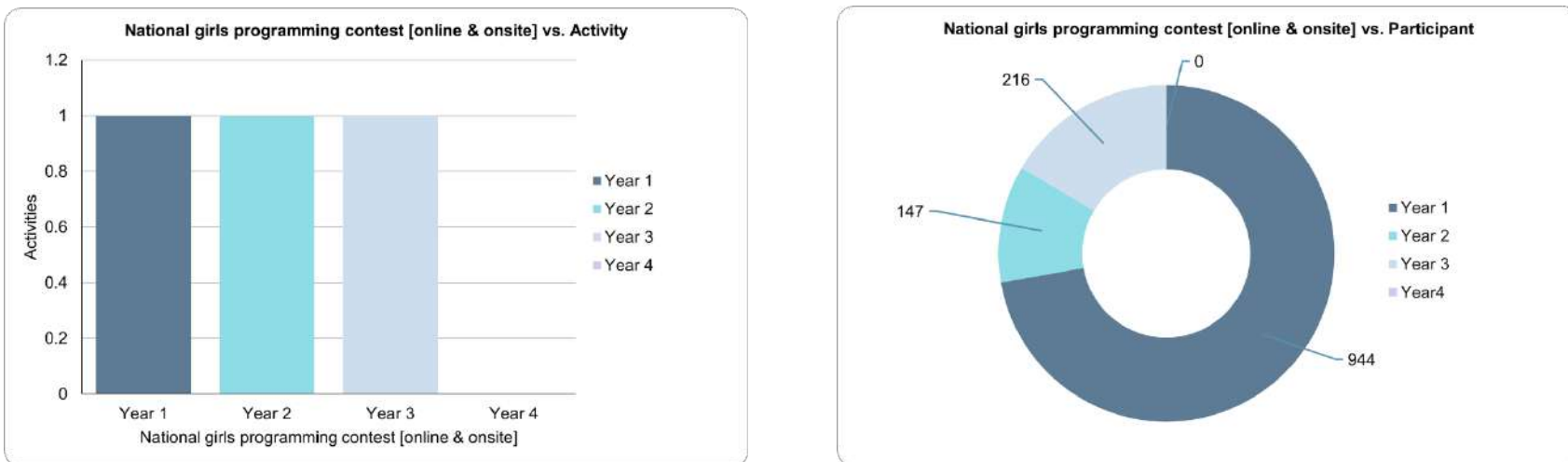


Figure 18. (Left) Number of Activities (right) Number of participants

Web-portal Development and Maintenance for Female in Tech Community:

Events for web-portal development and maintenance for females in the technology community were organized by BdOSN. The number of participants and total number of activities are given as year by year breakdown below (Figure 19).

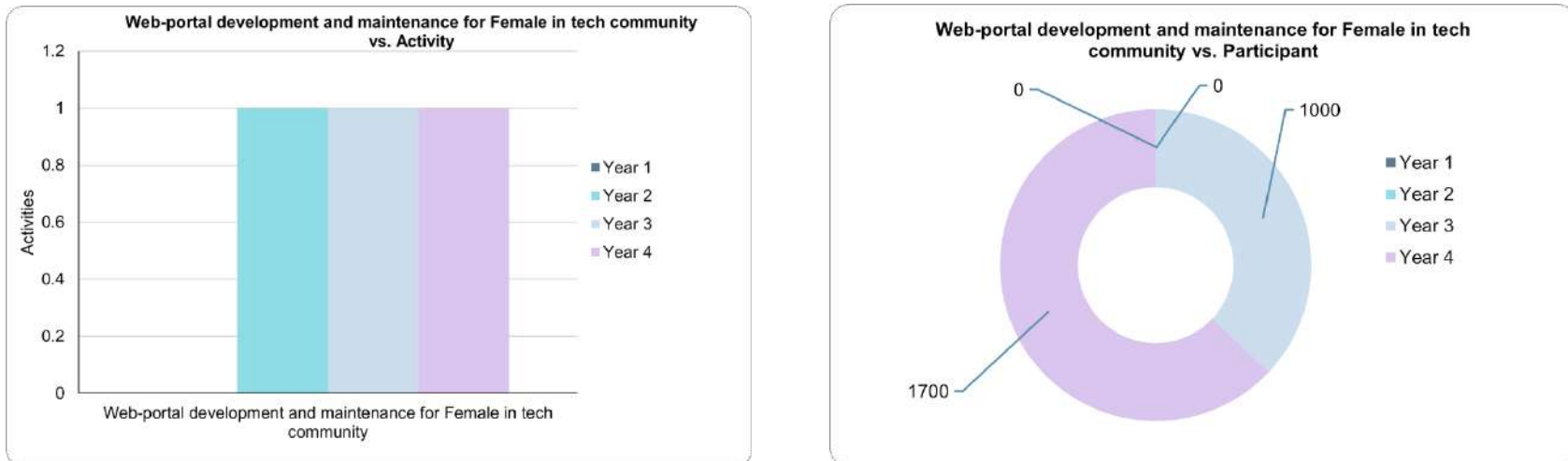


Figure 19. (Left) Number of Activities (right) Number of participants

Safeguard Policy Development Oriented Workshop:

The safeguard policy development oriented workshop related activity list is given below (Figure 20). The number of participants and total number of safeguard policy development oriented workshop are shown below:

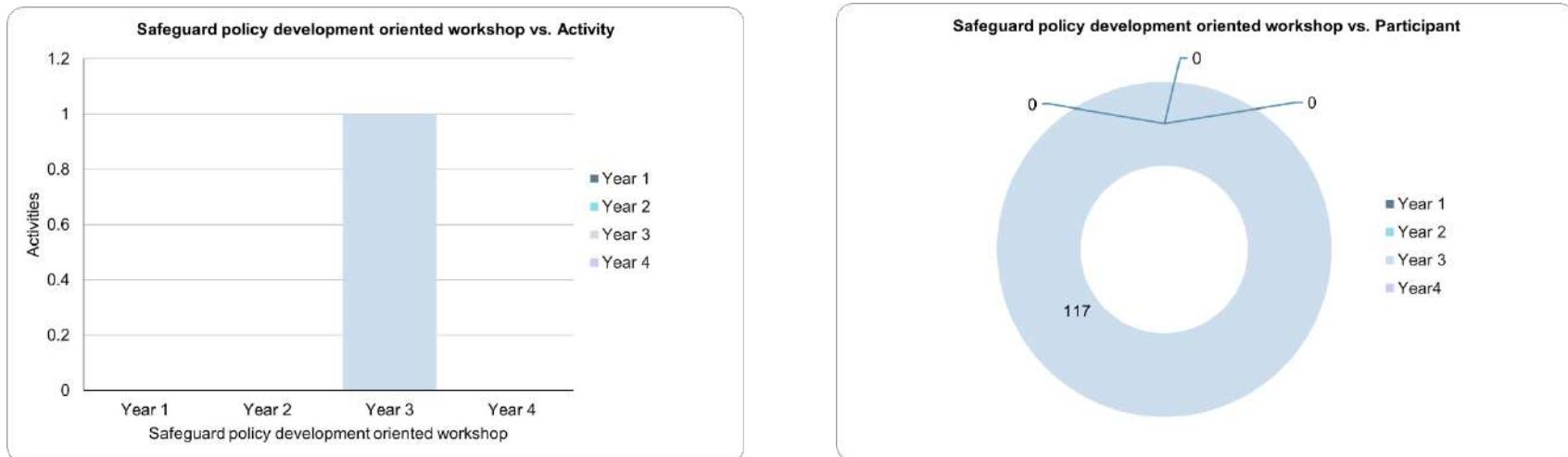


Figure 20. (Left) Number of Activities (right) Number of participants for safeguard policy development oriented workshop

4.3 Annual Activities

The activities consisted of technical training as well as soft skill training to support women in ICT all across the country along with a yearly leadership and networking conference named Ada Lovelace Celebration (ALC) and National Girls Programming Contest (NGPC). The number of participants are shown in Figure 21 below over the last three years.

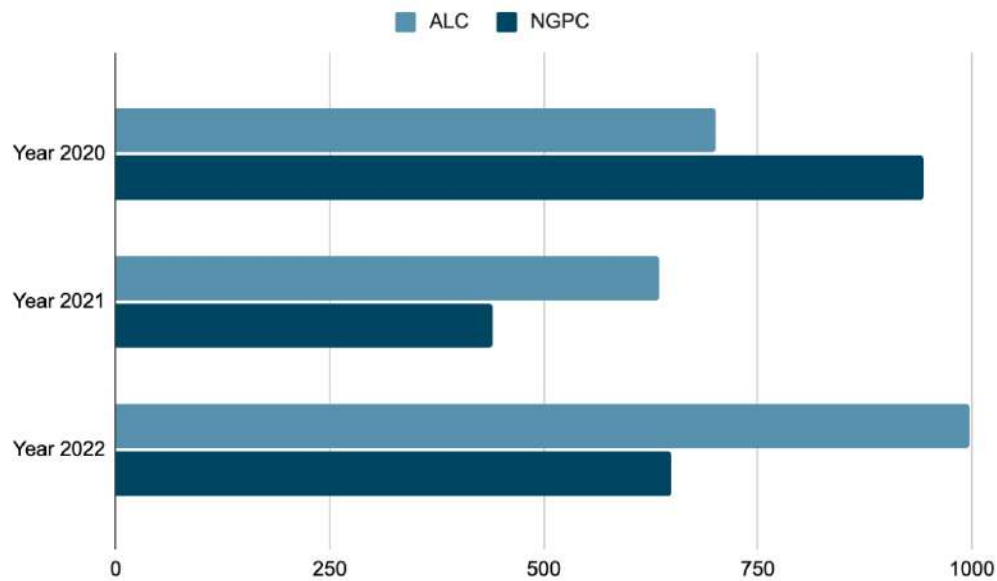


Figure 21. Number of Participants on ALC and NGPC

Ada Lovelace Celebration (ALC):

The Ada Lovelace Celebration is designed to engage female professionals and learners to engage in networking and activity oriented sessions inspired for the initiative titled Grace Hopper Celebration for Women in Computing [41]. The [ESDG4Bd](#) project organized three yearly celebrations in 2020, 2021 and 2022 respectively where the 2021 event took place online considering the Covid-19 pandemic situation in Bangladesh.



Figure 22. Ada Lovelace Celebration 2022 Initiation program (left) poster competition (middle) programming contest (right)

National Girls Programming Contest (NGPC):

The celebration was paired with poster competitions, discussion sessions on technology related topics and soft skill development based topics, experience sharing and one major event to engage female students such as National Girls Programming Competition (2020 and 2022) or Datathon (2021) where female students are mentored, engaged prior to the actual event.

5. Methodology

5.1 Participants Recruitment Process

We conducted an in-depth qualitative study in a semi-structured format exploring how women-centric training impacted their career and how to improve the ongoing efforts.

For this qualitative study we recruit $n=35$ participants, where $n=26$ undergraduate female students and $n=9$ female entrepreneurs who already have small and medium businesses. This study considers several university students from Bangladesh's different divisions (Dhaka, Rajshahi, Khulna). The participants connected with Information Communication Technology (ICT) and had IT, robotics, programming, and employment readiness training. The participant recruitment process was assisted by BdOSN [30], as they have a database of the trainee participants.

BdOSN is a non-profit, voluntary organization with a 16-years track record of planning and implementing nationwide projects targeting young girls, youth and women related to STEM (Science, Technology, Engineering and Mathematics) education, ICT skills and capacity building and entrepreneurial development initiatives [30].

5.2 Discussion Method and Study Moderation

Considering the COVID-19 pandemic, we asked participants about their preferred mode of discussion - online or offline (in-person FGD). Prioritizing the participants' utmost comfort zone, we invited 5 participants to join the FGD [3, 4], where 2 interviews are conducted offline. In addition, we conduct 9 one-to-one interviews depending on the availability of the participants. All the one-to-one interviews were online and conducted with the 7 entrepreneurs and 2 students at their preferred time in their preferable platform (e.g., google meet, phone call, WhatsApp, zoom).

The FGDs and one-to-one interview were conducted in Bengali, the native language of both the participants and the researchers. Each FGD took around 1.5 hours and one-to-one interview around 20 minutes to complete, consisting of 10 questions and follow-up questions based on their responses. We asked participants open-ended questions allowing discussion and storytelling instead of a straightforward, structured question-answer format. The questionnaire helped us to guide the conversation toward the research objective [9]. Participant recruitment followed the purposive sampling method [5, 6]. The research team was present at all the interviews, where one of the researchers started the discussion while the others took notes and assisted in asking follow-up questions.

5.3 Qualitative Content Analysis

All the discussions conducted in the Bangla language were transcribed and translated into English from audio records of the interviews for further coding analysis. We followed deductive content analysis in the coding phase, starting with open coding [7, 8] by using Atlas.Ti software [29] where all the researchers cooperate. After multiple rounds of coding analysis, we generated affinity diagrams for grouping and categorizing the major codes after several discussions among researchers were able to identify the key themes from the findings.

5.4 Quantitative Analysis

To quantify the effectiveness of the training, we used the general training effectiveness scale [55] which consists of 10 items (Table 2) and the items present the learning, individual, and organizational performance. Following the previous studies [56, 57], we used a 5-point Likert scale (Strongly disagree, Disagree, Neutral, Agree, and Strongly agree) to measure each item where for each item, score can be from 1 to 5 (Table 2).

Table 2: Items of the General Training Effectiveness Scale [55] used to quantify the effectiveness of the training.

Subscales	Item #	Item	Response
Learning performance	1	I can list down all the important things emphasized in this training.	<ul style="list-style-type: none"> • Strongly disagree (score 1) • Disagree (score 2) • Neutral (score 3) • Agree (score 4) • Strongly agree (score 5)
	2	I know how to solve certain job problems using the skills taught in this training.	
	3	I know how to work more efficiently using the knowledge learned in this training.	
	4	I have the capability to perform the skills taught in this training.	
Individual performance	5	My personal competencies have improved after attending this training.	
	6	I am being more professional in certain tasks after attending this training.	
	7	My job performance has improved as a result of applying the skills emphasized in this training.	
Organizational performance	8	The productivity of my department has improved due to the skills that I learned and used in this training either directly or indirectly.	
	9	What I have learned in this training has improved my job performance and subsequently my organizational performance.	
	10	I have contributed to improving my organization’s reputation due to the outcome of this training either directly or indirectly.	

A participant's score can have a score from 10 to 50 where a higher score presents higher effectiveness. Among these 10 items, there are 3 subscales where from item 1 to item 4 presents the learning performance, item 5 to item 7 presents the individual performance, and item 8 to item 10 presents the organizational performance.

In the learning process, there can be several barriers. To understand how the barriers affected the outcome of the training, we divided these barriers into 3: infrastructural barrier (e.g., having no laboratory), social barrier (e.g., facing barriers which are set by different persons of the society), and personal barriers (e.g., having lack of confidence to do something) (Table 3). Like measuring the effectiveness of the training, in this case also, we used a 5-point Likert scale (Never, Rarely, Sometimes, Often, and Always) where a participant can have a minimum score of 1 and maximum score of 5 (Table 3). The total score's range for these 3 items is 3 to 15.

Table 3: Questions regarding the barriers.

Type of barrier	Question	Response
Infrastructural barrier	1. Did you face any infrastructural barrier (e.g., no laboratory)?	<ul style="list-style-type: none"> • Never (score 1) • Rarely (score 2) • Sometimes (score 3) • Often (score 4) • Always (score 5)
Social barrier	2. Did you face any social barrier (e.g., someone of your family member or teacher has set a barrier in your work / goal)?	
Personal barrier	3. Did you face any personal barrier (e.g., you have thought that you cannot do it)?	

To understand the association of different variables, we used different visualization techniques (e.g., Spider, Waffle, Sankey, Bubble) and did linear regression analysis. In the case of regression analysis, having a multicollinearity problem can inflate the regression coefficient. Therefore, we calculated the variance inflation factor (VIF). Having a VIF value less than 10 is considered as safe [58] and we used this threshold while developing the regression models. For regression analysis, we used the packages (e.g., usdm) of R programming language and for visualization, we used different packages (e.g., sankeyD3, waffle, fmsb, plotly) of Python and R programming languages. In addition, to visualize the participants' living location in Bangladesh, we used the ArcMap 10.8 software.

5.5 Research Ethics and Safety Protocols

The institutional review board approved this research. Each participant in the qualitative study received a gift equivalent to BDT 1000 (11 USD) and BDT 100 (1.10 USD) for quantitative study. We maintained appropriate social distancing and safety guidelines provided by the WHO [2] and the Ministry of Health, Bangladesh [1].

6. Qualitative Findings



Figure 23. Participants from BdOSN activities

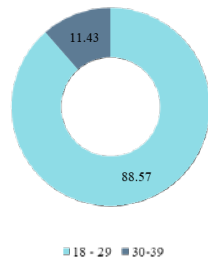
The study findings show an overarching demonstration on how the practice and training sessions have helped the participants to transition better towards their professional lives. Some of the events are shared in Figure 23 presenting events organized by BdOSN.

6.1 Demographic Details

We performed a total of 6 FGD and 9 one-to-one discussions which covered 74.28 percent and 25.72 percent of our research participants respectively. Figure 11 (a) reveals that 88.57 percent of participants were 18 to 29 years old, whereas 11.43 percent were between 30 and 39. Figure 24 (b) indicates that about one-fourth (25.7%) of the participants were engaged with entrepreneurship and the remaining of the others (74.3%) were students. Moreover, from Figure (c) we can observe that 80 percent participants of our study were married while 17.1 and 2.9 percent individuals were unmarried and divorced respectively.

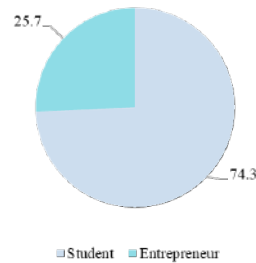
Apart from that, we explored five divisions of Bangladesh (Figure 25 (a)), where the majority (65.7%) were from Dhaka, an equal percentage of participants were from Rajshahi and Khulna which is 14.3 percent, and only 2.9 percent of the participants from Rangpur and Mymensingh each. Furthermore, all the participants of our study were from urban regions. Figure 25 (b) reveals that among all participants, 68.6 percent are students and currently doing their Bachelor of Science (B.Sc) degree, and only 5.7 percent are studying Bachelor of Business Administration (BBA).

Percentage of Participants of Different Age Group



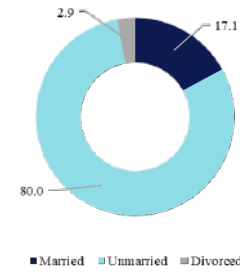
a. Age

Percentage of Participants in terms of Profession



b. Profession

Percentage of Participants Marital Status

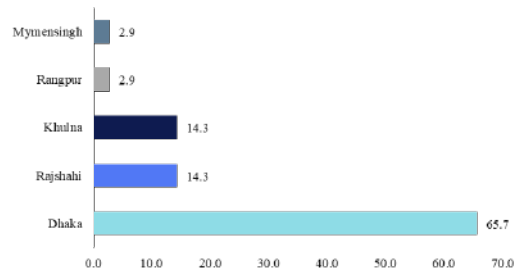


c. Participants marital status

Figure 24. Percentage of Participants in terms of (a) Age. (b) Professions (c) Marital status

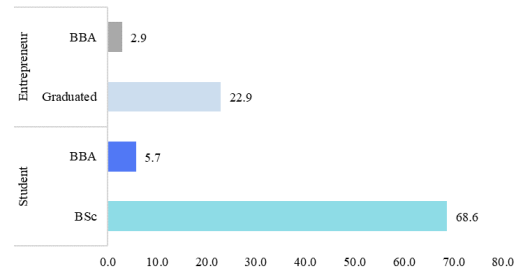
Figure (b) also shows 22.9% graduate Entrepreneurs and remaining 2.9 percent BBA Entrepreneurs joined in our study. Similarly, Figure 25 (c) shows the division-wise profession of total participants, where we see 45.7 percent students and 20 percent entrepreneurs were from Dhaka division, no entrepreneurs from Khulna and Rajshahi, and no students from Rangpur, and Mymensingh.

Percentage of Participants from Different Divisions



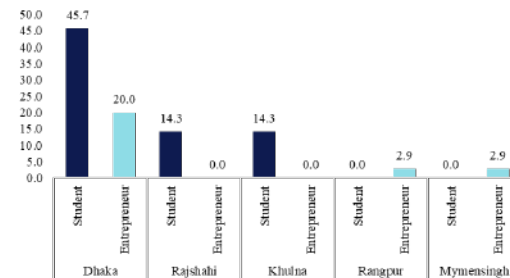
a. Divisions

Percentage of Participants in terms of their Profession & Education



b. Profession wise Education Background

Percentage of Professions among Different Divisions



c. Divisions wise Professions

Figure 25. Percentage of Participants in terms of (a) divisions (b) Profession wise educational background (c) division wise professions background

We were also interested to explore participants' technology usage behavior in figure 26. For instance, their mobile phone, internet, social media, and MFS usage. Our study shows that all 35 participants used a mobile phone, the internet, and social media, with the exception of one who did not have an MFS account.

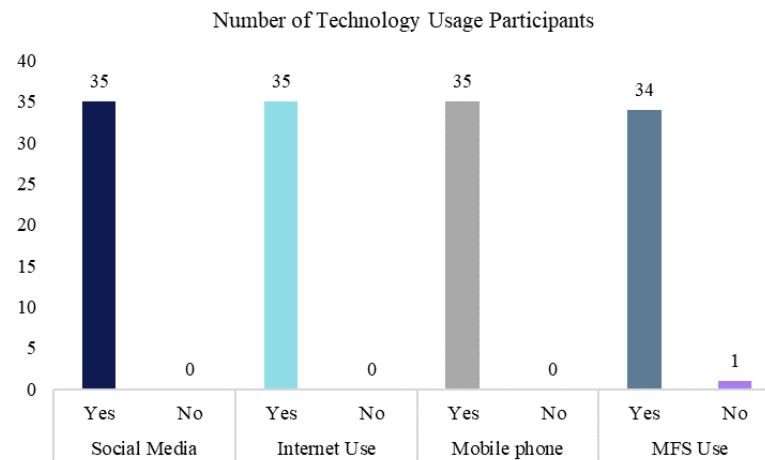


Figure 26. Number of participants' technology usage of our study.

6.2 Enhancing Professional Skill

The findings around impact of the program shows advancement in networking opportunities, confidence enhancement and skill development as shared by the participants. The participants shared the aspects of their professions which were aided through attending these activities. We discuss the topics in the following subsections. As a summary, the participants discussed about being inspired as one participant clearly shared:

"They took us to an IT company. We came to know what kind of works are there and about the opportunities if you know those works properly. They showed us. From there, I was inspired from there and learnt web development from BITM." - P10, Student, Dhaka

6.2.1 Networking

The participants unanimously shared about their networking opportunities which are challenging for female participants, particularly, the ones living outside capital. The advantage of networking opportunities were enthusiastically shared by participants engaged in entrepreneurship as one shared how she found her business partner from one of the workshops she has attended.

“I got acquainted with another entrepreneur through BdOSN. I partnered with her and now have a shop in Aziz Supermarket.”- P29, Entrepreneur, Dhaka.

Similar stories are shared by the students who were trying to start a business. These events were the medium for them to connect with females with similar vision from different domains. A participant shared how she and her classmate got connected with students from different backgrounds who belong to another university which completed the team with a blend of people with IT backgrounds and people from business backgrounds.

“As I said, I am a student of the entrepreneurship department. So, I needed some technical support. There were 2 students from our department. We went there. As we both were from a business background our main target was to find people from IT background and to get some technical support. We found a group of 6 people from Jahangirnagar University and still now we are connected.”- P32, Student, Dhaka

Another participant who is an entrepreneur shared about receiving new business orders through the networking opportunities. She shared that she met a female customer in one of the events who ordered in advance for the following month. The participant emphasized how these events are another different kind of platform for the entrepreneurs to do business and get orders. Another entrepreneur shared how networking in such events help her to grow her business as follows.

“Meeting others, getting to learn from others is very important. At the end of the day, we are doing business. Your business depends on you but over here you get to share, this is positive. If i meet girls, speak to them, they will form a network among them. This network will eventually become a very big strength.” - P23, Entrepreneur, Dhaka

Girls who regularly participated in programming contests mentioned that these events helped them build a community of female coders as they got acquainted with others participating in the same event. Another participant stated that she was a final-year student who didn't know how to connect with others since she aspired to be an entrepreneur. When she attended the girls innovation bootcamp, she met new people and created a team.

A participant new to business along with her studies shared how the network acted as a support system for her at the early stages of her initiation.

“There were lots of opportunities for networking. I still have connections with most of them. Participants had to choose an idea, surprisingly my idea is one of the best. Although my business had no sustainability opportunities, people were liking them. I was the youngest there. As I am the eldest in my family and reading in university, they give me a vibe like I have grown up. I received a lot of love there. We have to do there, idea submission, presentation and wall magazine and lots of work. But we enjoyed these”. - P4, Student, Dhaka

A participant who has not started a business, curious about the system, shared how the network helped her. Similarly, a participant shared how the seniors from the network can alleviate the requirements of mentors as follows:

“We can get many diverse benefits from bootcamps like in my case networking. Although we are not in touch with the mentors of this program, I am still in touch with some senior Apu and have learned a lot from them. I think camping boosts networking.”- P17, Student, Khulna

Networking aspects of these events were termed most frequently as positive impacts of these events by the participants. They feel these events help them to build connections that help them throughout their professional journey.

6.2.2 Confidence Enhancement and Pressure Handling

The participants shared that the competition and training sessions helped to build confidence among them. Moreover, solving problems within time constraints challenged their capabilities, teaching them to work under pressure. An entrepreneur mentioned seeing other women fighting for their dreams in itself was inspiring for her. The bootcamp she attended gave her the mental strength to face various challenges in her entrepreneurial journey. The students appreciated the opportunity to come forth and compete with others at a national platform. As one student mentioned, participating in these events made her feel that she is ready to tackle more difficult challenges. Another student shared how attending one of the training sessions pulled her out of a difficult point in her life instilling confidence and positive thinking.

“A lot of confidence grew up in me. The 1st year of my undergraduate was traumatic. All of my positive energy had reached the bottom. I am accepted by the people, this thought had left me. I was going through frustration. The bootcamp worked as a fuel to develop my confidence and positive thinking.”- P2, Student, Dhaka

A student who struggled to adjust in group works previously shared that she had a fear working in groups as she was skeptical about her ability to adjust. But once she attended the bootcamp her thought that she would not be able to adjust was gone and she felt confident about working in groups. Another participant expressed how working in groups with people from different backgrounds, age, and experience helped her to build their confidence while working in groups as follows.

“We did not have the chance to work in teams with people from different age groups. In schools and colleges and here (university) also we form teams with people of the same age group. So that was a different experience to be able to do team work with people of different age groups. So, I was able to know about their thinking and how their experience could help us. It was positive for me but I had to do the adjustments. But the overall experience was good. - P27, Student, Dhaka

One of the participants, a student, said she had never worked so intensively before the datathon in terms of managing pressure. She explained how she developed skills for addressing time-constrained work pressure. She continued by saying that she had never worked in this manner while a student.

“You need to submit your work within 2 hours in the datathon contest. It’s not like that you have one week for this and you can work and relax. I didn’t work before under pressure like I have done there. This competition helped me to cope up with pressure handling.” - P5, Student, Dhaka.

A participant working as an entrepreneur shared how her confidence level has enhanced as follows:

“The knowledge gained from there helped us in other entrepreneurship events and we even became champions in one of the last events. We actually do google search on various terminology on entrepreneurship without understanding those we use, but bootcamp taught us these things in practical terms. Previously I just wrote my ideas grossly but now after bootcamp I do it more in a proper way. Things are not like that during corona or not during corona, it just boosts my mind in a bigger way.”- P34, Entrepreneur, Dhaka.

The participants shared about how the events have introduced them to challenges and improved their level of confidence and ability to handle pressure.

6.2.3 Skill Development

In our qualitative study, we found that the training programs and workshops helped a lot to develop participants' skills as students and entrepreneurs. These skills helped the student participants for job placement after their graduations and entrepreneurs to extend their business and develop business models. Throughout our discussions participants shared how these events enriched their skillset and prepared them better for their professional life. A participant joining an entrepreneur workshop being a student of engineering herself shared how the training enabled her to develop a better understanding of the business model which she was not familiar with before.

"I learned a lot there because I wanted to make my idea a reality. I am an engineering student and my business-related ideas are very limited. Through these 3 days of bootcamp I learned a lot of new things that I needed to know."

- P19, Student, Khulna

Another participant who is a student stated that she comes from a very conservative home and was never permitted to perform collaborative activities while staying with friends, but by participating in bootcamp, she learned how to do teamwork, which helped her significantly. Besides entrepreneur participants training also helped the students participants. Few participants shared how training for final year students helped them prepare for their job life.

"In this segment of training and job preparation, I would say that not only girls, but any undergrad student may have various information gaps at the time of entering the job life, and this BbOSN can play a role in filling this gap. BdOSN feels that the information gap is high in girls so they can work on these." - P16, Student, Khulna

The participants shared unanimously, the training they received from BdOSN helped their skill development. It was clear from the study findings that the guided training helped the participants to gain a better understanding. A participant who is an entrepreneur shared that the workshop she attended covered fund raising skill, fund management, team management and product branding knowledge which helped her in the journey of entrepreneurship. Another entrepreneur summed up the learnings she got during the bootcamp she attended as follows.

“It was a bootcamp. So we gave ideas on the first day. Then taking those ideas into business ideas. After that comes business model, canvas, and business pitch deck all these things we learnt in the bootcamp. In the different sessions, the back to back sessions we learnt those. Then Digital Marketing, for example, marketing is a big thing for a business. Many channels work together in a business, it's not like that I am sitting with a business. It does not work like that. I have made a product and now how to reach customers and how they will receive that. I learnt those things from the sessions which were held during those three days. They covered many things there. - P34, Entrepreneur, Mymensingh



Figure 27. ALC Participation

Apart from building business related knowledge, the participants also emphasized how the learnings from these events helped them to choose their business strategies. Few entrepreneurs shared that they improved their business model using the knowledge gained. The participants explained the information gap as one area where these events contribute

most. There were students among our participants as well who were able to navigate their career path in different ways through the exposure they got in these events. Female participation in different sectors have also motivated them to follow their role models. As a student from Dhaka shared that she got a clear picture of how to start her career. A participant emphasized the role of these events in her career as follows.

“We have gotten a lot of help from the activities with bdosn. We are learning through those even now. We have regular communication with them. We can say this as a place of our own where we can consult if we face any issues. They are like our mentors. - P24, Entrepreneur, Rangpur.

These events have enriched the skills of our participants and enabled them to explore their profession with greater confidence.

6.3 Challenges

The challenges include concerns around the locations of the events, the timing along with societal barriers that impact women in many ways.

6.3.1 Central Location of Dhaka for Trainings

The participants appreciated the training and other sessions while referring to the limitations of having most of the events organized in Dhaka, the capital of Bangladesh. It added challenges to students and entrepreneurs residing outside Dhaka as the participants shared. A participant explained how the accommodation and travel requirements change when the program takes place in Dhaka as follows:

“I do not face any problem. Most of the program was arranged in Dhaka so I attended there from my home. It was to my advantage. Once I visited KUET for the contest so the arrangers of the contest facilitated the accommodations for the female participants if needed. If they do not facilitate or communicate with us then we have our internal connections in RUET with senior sisters who arrange accommodation for us. We have to bear transportation costs most of the time. But the registration cost is partially paid by the university.” - P11, Student, Rajshahi

A student participant P14, shared her challenges of catching up after the journey to Dhaka to attend some events as she shared: *“No one has any problem after going to Dhaka. But the problem is going there and back from there for everyone. If our university was in Dhaka then we will come back in a day. But now a whole day is wasted for all these.”*

A participant as an entrepreneur P34, shared her enthusiasm along with difficulties to attend sessions taking place in Dhaka: *“As I am living in Kishoreganj, coming for an event all of a sudden is tough for me. Maybe many things would be easier for me if I was able to attend them online now. It is not like that I cannot come at all. If I feel that the event is very important for me to attend, I do it. But then again there are some things that it would be better to do but I may not be able to come.”*

Similar concept is shared by another participant P24, working as an entrepreneur, living outside Dhaka: *“But as it seems, one issue is they do all their activity, I mean physical meetups in Dhaka. As I am living outside Dhaka, I miss those events.”*

A participant shared that she assesses these events as a very good opportunity for them as there are not many female oriented events taking place and feels that attending these events can help her greatly. However, the problem lies with commuting and accommodation which was common among students living outside Dhaka who participate in the programming contests as well. They shared how they look for someone who has relatives in Dhaka in their group due to the accommodation issues. A student from Rajshahi summed up their challenges as follows:

“The last training camp that was held, the 3 day camp, we had the plan to go there. We have to live there for 3 days, counting the travel to and from, we would have to skip classes for 1 week. There are many important exams in a week which is why I could not join. If it was in Rajshahi we could take the exam and then attend the camp. But since it was in Dhaka, we could not join the long programs.” - P13, Student, Rajshahi

The above section presents the challenges faced by the participants living outside Dhaka to attend the events. A participant also shared that facilitation of accommodation helped her to join an event. She shared that she could join the event very comfortably as the organizers arranged her accommodation and food.

“They had even made arrangements for our accommodation. We did not have to do anything separately. The stall rent was only 2000tk. My husband said that he felt like he went to visit his in-laws’ home. Because before we went they made arrangements for our accommodation. The girl is working so hard and coming here, where will she live? So they made accommodation for me at a bungalow. The rent was only 100 or 150tk due to his reference. Just think about it. The food was totally free. They are taking the trouble to come from Dhaka, we are going to add expenses? Only a family thinks this way.” - P22, Entrepreneur, Dhaka

It is clear that centralized event organization creates problems for the participants residing outside Dhaka.

6.3.2 Not Syncing with Academic Calendar

The challenges participants shared, among those especially the student participants, was a concern around the academic calendars of students where often the programs are not aligned with it. The interested participants shared their willingness to join various activities but were often unable to participate for academic commitments. A participant shared her concern as follows:

“The main problem is that we have to join the contest after managing all these academic things here. Most of the time the contest aligns with the semester final exam. Sometimes it happened that after finishing the contest, we had to come back to university. By any chance if the contest doesn’t go well and then again join the exam or if the contest started in the middle of exam that is the main problem for us not the social ones.”- P13, Student, Rajshahi

Another student participant P12 shared how she managed the events as: *“Between two final exams we have 5 days of break. We had a data science exam at that time. We went for the contest and came back the night before the exam. For these our academic education suffers a lot. Due to these reasons, we have to face the problems that those who live in Dhaka do not have to face.”*. The challenges often covered situations such as transport related ones as shared by another student participant:

“I remembered an incident. In 2018 when we were coming from MIST IGPC by train on the day before the exam. But our train got stuck at Abdullahpur because a lorry truck overturned in front of our train. We faced a problem at that time. But we had a big team with senior brothers. We came back from Abdullahpur by road. As we had our semester finals the next day.”- P15, Student, Rajshahi

A student participant P10 shared how she was not able to continue her participation in the activities considering these challenges: *“I could not keep that up as I learnt that very early in my CSE journey. Then I was confused whether to complete my BSc. or to keep up the web development. In that process, the web development was not continued. I also could not apply my learning.”*

It was evident that the support around adjusting the program schedules with various academic calendars could greatly benefit the participants.

6.3.3 Social Norms and Personal Preferences around it

The social practices and concern around women played a negative role for the participants as the study shows. In some cases, there were others referring to the norms and in few cases the participants obeyed by the societal practices. It creates a lot of barriers, which hinder their journey. A participant, a student, shared how she required her father to accompany her: *“My challenge was how I could manage my father”*. Another participant shared her own preferences as follows:

“As it was online it was convenient for me because if it was offline, I would not be comfortable with that. Staying 2 days in another place is not convenient for me. I was eager to participate in other programs but as I am a 4th year student we have projects and other academic work to do. I am not comfortable staying alone in unknown places, it is my personal preference.”- P3, Student, Dhaka

On the other hand, participants who are married have more pressure than those who are single. They need to convince both the maternal and inlaws family. Participant working as an entrepreneur shared her challenges around in-laws as she shared:

“When I need to go outside of Dhaka, I have two babies. I cannot even keep their updates because of my busy schedule. My husband is fine with it. But when I go to my in-laws’ house they regretted saying my life is so miserable as I cannot give time to my children. I don’t know whether to laugh at them or cry.” - P22, Entrepreneur, Dhaka

It shows how the social norms are barriers for many which should be discussed and addressed to ensure opportunities for women.

6.4 Suggestions

The suggestions coming from participants were insightful and sincere as the participants wished for a sustainable platform to connect and engage in future. The suggestions came from ideas that could enhance the current training and activities while some pointed to the limitations participants faced that could be avoided in future.

6.4.1 Enhanced and Advanced Activities

The participants joining the entrepreneurship activities as well as activities designed for students both suggested enhancing the current activities to include advanced topics.

Training for Entrepreneurs: The group of entrepreneurs shared how they benefited from the training while the follow up training has remained at the introductory level that discusses initiation of businesses and related topics. Now many of them are seeking guidance on the advanced level of contents. For example, an entrepreneur shared her view as follows:

“We are stuck at our growing stage after 3-4 years of business. At the initial stage, we do not have any problems. We got support from everywhere. As far as I know, Munir Sir’s group is supporting a few at their growing stage. With them, they created a hat or something like that (Cohort) where they are supporting a few selected people. Their event is good for the people who are starting their businesses. If possible, they can add something for entrepreneurs who are in the growth stage. We need other support during this stage apart from the workshops. Such as fundraising networking or special advice, consultancy, and network build-up from them. As I am from a nutrition background, I saw very few activities from BdOSN.”- P33, Entrepreneur, Dhaka

There were suggestions from participants to diversify the efforts offered in the training process as one participant suggested addition of educational sector as follows:

“Personally I never saw BdOSN do something regarding education. As I studied in the education sector I think If the planning is done with the education sector then it will be good. Munir Sir is also in this sector so he can support as well. Again, I want to say the same thing. If they divide the program by criteria it will help everyone. For example, I am working with the food I don’t need to know about garments products.”- P30, Entrepreneur, Dhaka

Connecting ICT Practitioners with Entrepreneur: There were requests from participants who looked into the training of business and found how the technology background and business innovation could intersect as follows:

“They were mainly in business and they could not add innovation there. As I am from the CS background my focus was in innovation. Those who are in business and those who are in innovation BdOSN could separate them or on a separate day. Few things were similar. With similar things both parties got help such as accounting related knowledge, business model related. When they talked about the 4th industrial revolution and new technologies, I think these were not helpful for the other entrepreneurs. But we want to know about these. How could we start a business etc. We want to explore more. They could do more programs with us.”- P26, Student, Dhaka

Sometimes the connection of ICT practitioners may demotivate the entrepreneurs when they enter the same competition and are being judged on variables that are not favorable for the entrepreneurs from different backgrounds. A suggestion came to eliminate such competitions which may demotivate young entrepreneurs.

“One more thing is that, when we are in a training session, I think there is no need to introduce competition there. As I am new there, I am learning something new with the idea. They can give feedback on how much we learned but judging as first and second is demoralizing to the other participants.”- P26, Student, Dhaka.

Extending Training to Online Sessions: The participants shared their preferences of online training sessions to minimize their movement, particularly for the logistic limitations. A entrepreneur participant living outside Dhaka and shared how online activity could help her,

“As I am living in Kishoreganj, coming for an event all on a sudden is tough for me. Maybe many things would be easier for me if I was able to attend them online now.”- P21, Entrepreneur, Dhaka.

Sometimes it is not comfortable for the participants to attend the training and staying at another place for two days despite being living in Dhaka city. This tune has been observed from a student participant. She mentioned because of the COVID-19 pandemic the session was conducted online and she able to join there but if it was offline, she would not have been comfortable there.

This is how extending training sessions to online platforms can be accessible for those who have limited logistics supports.

6.4.2 Parent Counseling

The participants suggested sessions and activities that involve their parents to ensure their participation and improved access to resources and activities. The parents are often concerned about cyber abuse and possible harassment that their daughters as participants may face and have mixed feelings about allowing their participation. Highlighting the positive aspects of the activities would enable a better understanding and support for the participants as suggested by a participant here:

If they can add parent counseling then girls like me who live far from their parents in town, we don't tell them everything freely. We hide many things. We have many barriers in study, we need to understand them so that this course will be good for us. Sometimes they feel risky, they get scared. Even though they are scared about cyber security. - P9, Student, Dhaka.

Parental counseling will provide a fresh perspective that will improve their involvement and understanding of their children's career choices.

6.4.3 Addition of Follow Up Sessions

The participants shared about how a follow up session from BDO SN could be helpful for the participants to stay connected and motivated at the same time. A participant shared it in a tone of frustration of how the community easily *forgets about the participants* once a program is over. The concern came mostly from the student participants. A student participant shared her opinion as follows:

“There is no follow-up system. What is missing here is the follow-up of the participants who came up with different ideas and whether they need any help or direction later.”- P19, Student, Khulna



Figure 28.
Participants in
NGPC

A similar concern was raised by a participant P17 from a different focus group sharing the concern on missing follow up activities: *“The program which I attended had no further follow-up, so I think it was not very impactful.”*

However, a participant P30 from the entrepreneurship group was satisfied with the follow up and connectivity she had, shared as: *“We have a group from there deepa apu knock us and let us know about events or workshops. I think this is the positive side. Deepa apu is doing regular follow-up and If I need any suggestion, I ask her.”*

“As I said, I am a student of the entrepreneurship department.

So, I needed some technical support. There were 2 students from our department. We went there. As we both were from a business background our main target was to find people from IT background and to get some technical support. We found a

group of 6 people from Jahangirnagar University and still now we are connected.” -

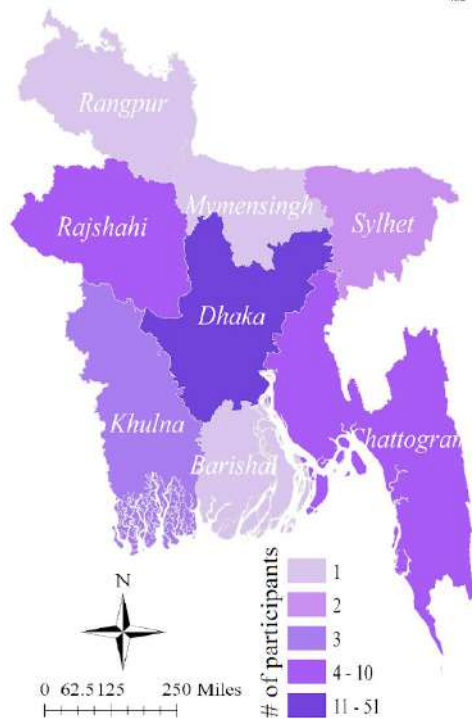
P32, Student, Dhaka



7. Quantitative Findings

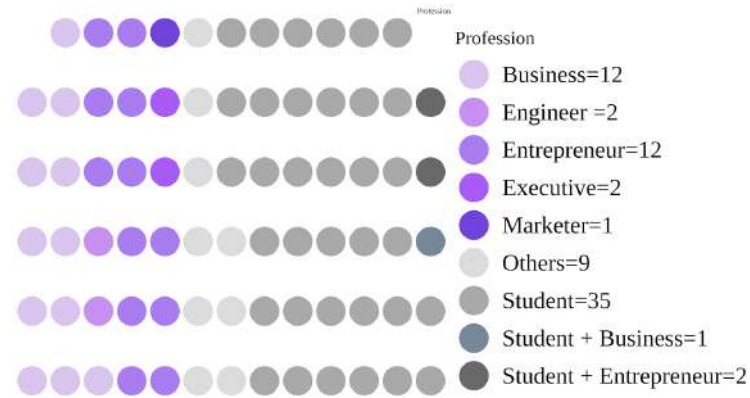
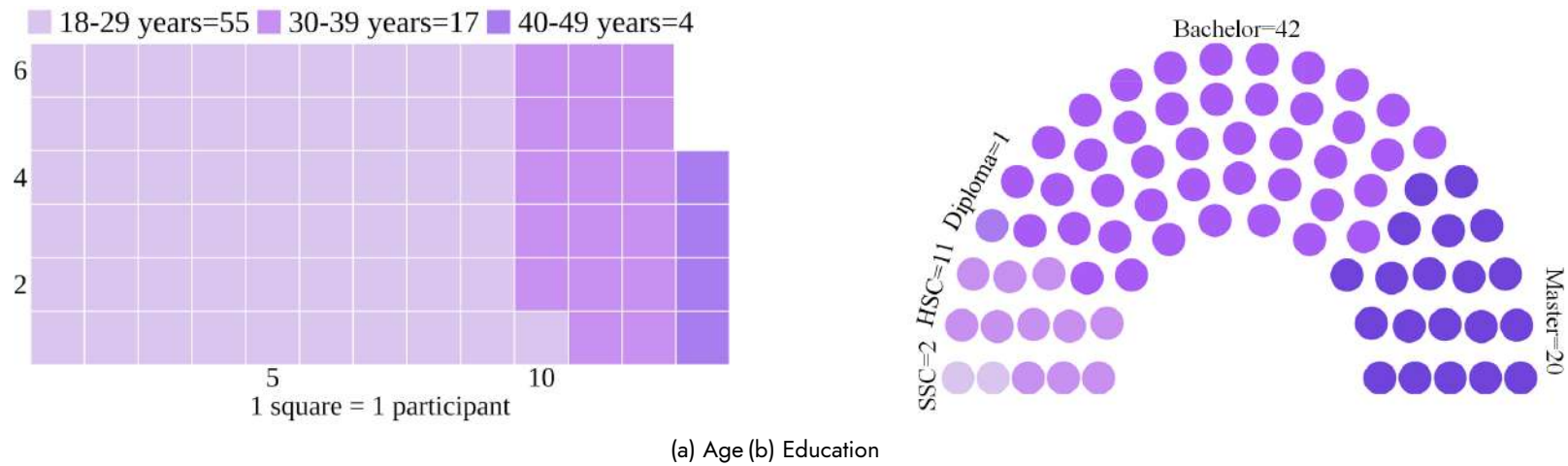
7.1 Understanding the Participants

In the quantitative study, there were 76 participants where most of them (N=51, 67.11%) were from Dhaka division and least participants were from the Mymensingh (N=1, 1.32%), Rangpur (N=1, 1.32%) and Barishal (N=1, 1.32%) division (Figure 29).



Most (N=55, 72.37%) of the 76 participants' ages were below 30 years (Figure 30(a)) and also most (N=42, 55.26%) participants had or were studying for a bachelor's degree (Figure 30(b)). On the other hand, a few of the participants were above 40 years (N=4, 5.26%) and a few of them had a master's degree (N=20, 26.32%). Exploring the participants' professions (Figure 30(c)), we find around half of the participants (N=35, 46.05%) were students. There were 2 participants (2.63%) who continued their study along with entrepreneurship.

Figure 29. Map of Bangladesh presenting the participants' living location.



(c) Profession. Here, Others present the Nutritionist, Teacher, Private job, Information service officer, Physiotherapy consultant, Assistant program officer, Office admin, and 2 participants reported no profession who were searching for a job.

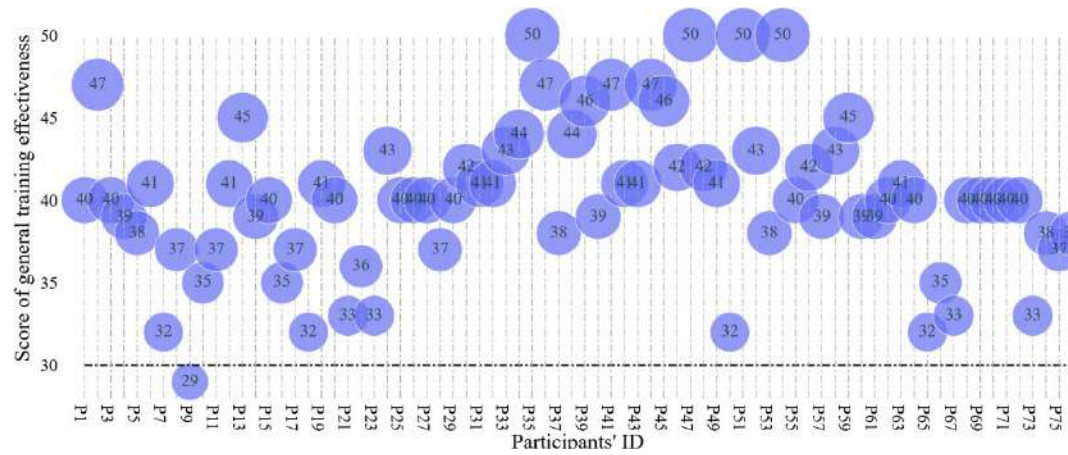
Figure 30: Demographic characteristics of the 76 participants who participated in the quantitative study.

7.2 Understanding the Impact of the Activities

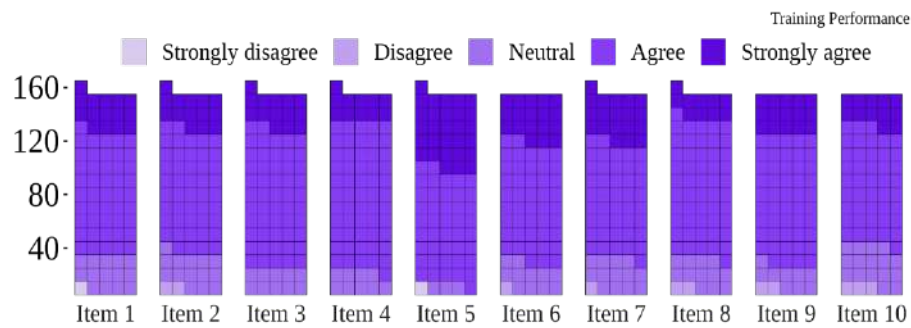
To understand whether there was an impact of the different activities of the ESDG project on participants' learning, individual, and organizational performances, we used the general training effectiveness scale where a higher score presents a higher effectiveness (for details, please, see the Quantitative Analysis subsection of Methodology). We find that on average, there is a score of 40.08 (Standard Deviation (SD): 4.54) where a participant could have a score of maximum 50. Except one participant (P29: score 29), all other participants had a score above 30 (Figure 31(a)) and having a score above 30 means there was at least one item for which a participant agreed that the training related activities helped her/him in having a better performance. All these presented a positive impact of the ESDG project's activities.

Among the participants' responses for 10 items of the explored scale, Strongly agree responses were higher for the 5th (My personal competencies have improved after attending this training.), 6th (I am being more professional in certain tasks after attending this training.) and 7th (My job performance has improved as a result of applying the skills emphasized in this training.) items (Figure 31(b)). These 3 items presented the individual performance (please, see Table 3 for details) and the agreement of having higher individual performance, compared to the learning and organizational performance, is also reflected when we compared among these 3 subscales (Figure 31(c)). In case of individual performance related items, 29.07% responses were Strongly agree where 17.76% and 16.37% responses showed strong agreement in case of learning and organizational performance related items (Figure 31(c)). These indicate that the ESDG project particularly helped the participants in having better individual performance.

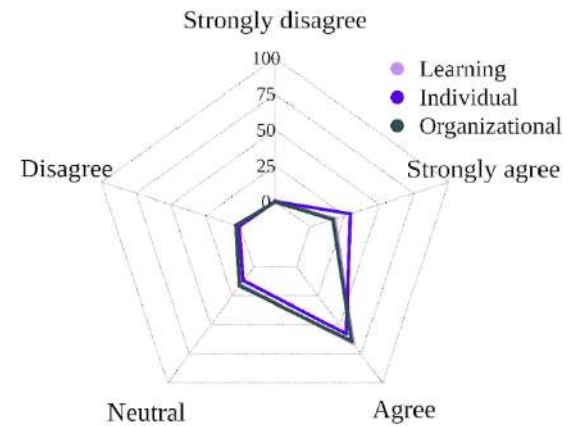
Compared to the 5th item, higher responses were neutral (Figure 31(b)) for the 2nd item (I know how to solve certain job problems using the skills taught in this training.) and the 10th item (I have contributed to improving my organization's reputation due to the outcome of this training either directly or indirectly.) where the 2nd item was related to learning performance and 10th item was related to organizational performance. However, in each of the 10 items, most responses (Agree and Strongly agree) showed an agreement to the improvement of the participants' performance (Figure 31(b)).



(a) Each of the participants (P1 to P76) total score of general training effectiveness scale. The black colored dashed line presents the score 30.



(b) Responses¹ of the 10 items of the general training effectiveness scale. Here, each square presents a participant's response.

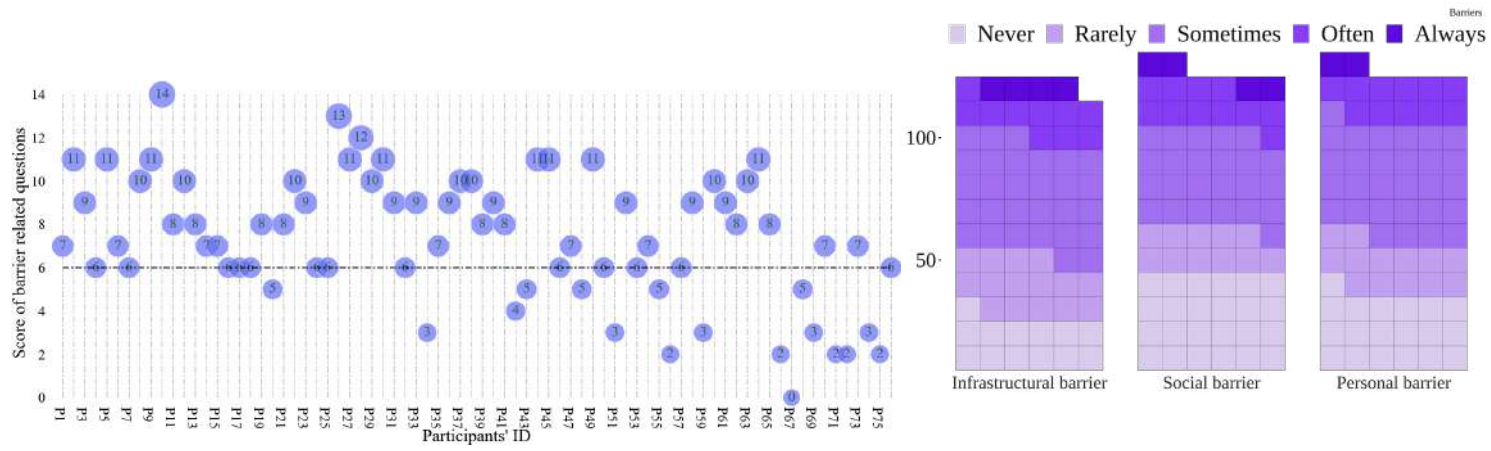


(c) Difference in participants' responses (in percentage) in learning, individual, organizational subscale of the scale.

Figure 31. Participants' responses to the general training effectiveness scale.

¹Among the 76 participants' responses for each of the 10 items, there was a missing value (Participant ID P8 and P66) in the 6th, 9th, and 10th items.

To understand the participants' infrastructural, social, and personal barriers which may have an impact on the outcome of different activities, we explored 3 questions' responses as discussed in the Quantitative Analysis subsection of Methodology. We find that most participants' scores were above 6 (Figure 32(a)). As response Never, Rarely, and Sometimes have scores of 1, 2, and 3 respectively, having a total score more than 6 from 3 items present that there was at least 1 barrier that were faced by these participants (score > 6) Sometimes. This scenario was also reflected when we explored the frequency of the barriers appearing (Figure 32(b)) where a higher number of responses were sometimes and more than that. Particularly, in the case of infrastructural barriers, where 43 (56.58% reported facing this barrier at least Sometimes (Figure 32(b)) and in case of personal barriers where a similar percentage (N=42, 55.26%) of participants faced personal barriers Sometimes.



(a) Total score² of each participant in the 3 questions related to barriers. Here, the black colored dashed line presents the score 6. (b) Frequency of facing the 3 barriers. Here, each square presents a participant's response.

Figure 32: Participants responses to the 3 questions related to the barriers.

After exploring by visualization techniques, through regression analysis, we explored the relation of the demographic characteristics (e.g., Age) and the 3 barriers with the general training effectiveness showed in Table 4. While conducting regression analysis, we removed the 7 participants' data for which there were 12 missing values.

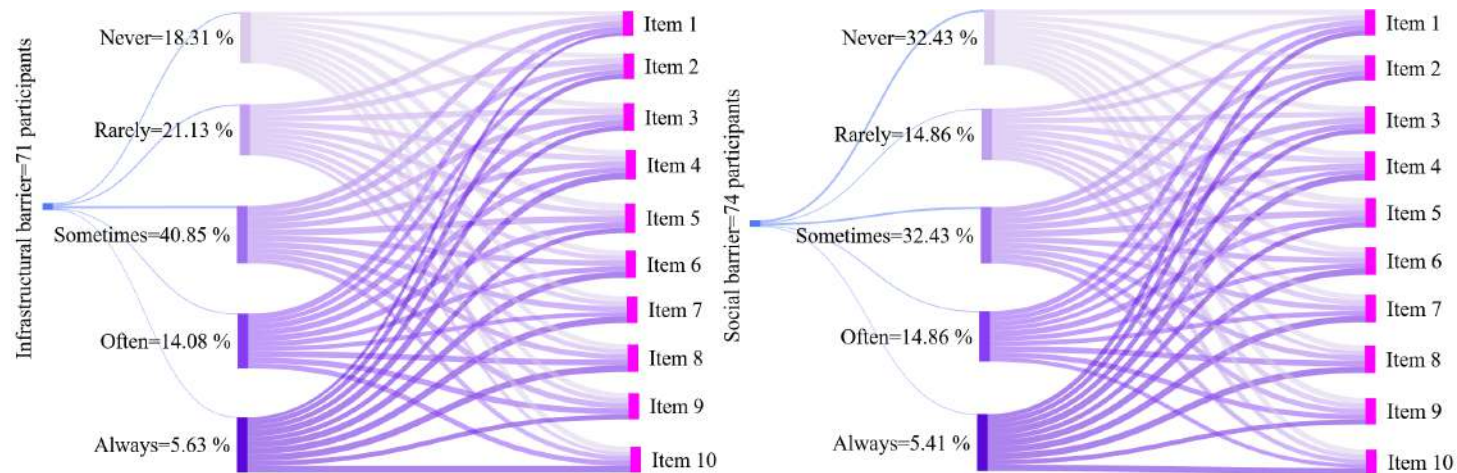
²Among 76 participants' responses regarding the barriers related questions, there were missing values for P56, P66, P67, P71, P72, and P75. Therefore, though the possible minimum total score is 3, for these 6 participants, the score varied from 0 to 2 where 0 presents no responses for the 3 questions.

We found that the average variance inflation factor (VIF) value was 1.26 (SD=0.12, Minimum=1.11, Maximum=1.47) which was below 5 and showed that there was no multicollinearity problem in the regression models. Our regression analysis showed that age has a significant positive association ($p=0.005$) with the effectiveness of the training which indicates relatively older participants had a higher effectiveness score. On the other hand, in the case of personal barriers, we found that a higher frequency of facing the personal barriers had an association ($p=0.019$) with a lower effectiveness score which presented a negative relation.

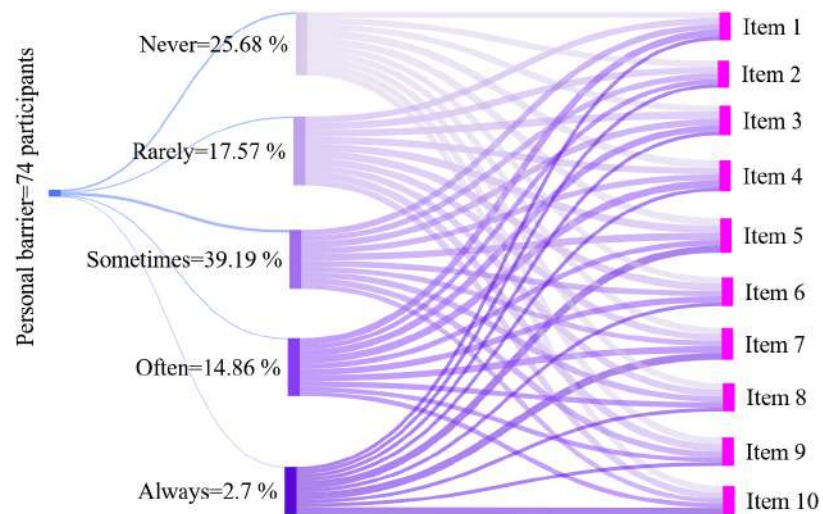
Table 4: Relation of general training effectiveness with the demographic characteristics and barriers. Gray colored cells present statistically significant ($p<0.05$) associations.

Independent variable	Sample size	Coefficients	Standard error	T-value	P-value
Age	69	2.59	0.90	2.88	0.005
Education	69	0.66	0.57	1.17	0.25
Infrastructural barrier	69	0.094	0.50	0.19	0.85
Social barrier	69	0.27	0.46	0.60	0.55
Personal barrier	69	-1.20	0.50	-2.396	0.019

To understand more about the impact of the barriers on the effectiveness of training activities, we explored how the participants agreed with an item of the scale when they faced a particular barrier. To do that at first, we calculated the percentage of participants who faced a barrier for a certain period of time. For instance, 71 participants responded to the infrastructural barrier related question and among them 5.63% participants reported Always facing this barrier (Figure 33(a)). Later, we explored what is the percentage of participants who at least agreed (have score at least 4) with an item of the scale. For instance, among the aforementioned 5.63% participants, 100% participants agreed with the 8th item (The productivity of my department has improved due to the skills that I learned and used in this training either directly or indirectly.) (Figure 33(a)). Exploring in this way, we found that regardless of the frequency of facing the infrastructural (Figure 33(a)) and social barriers (Figure 33(b)), participants agreed with the items of the scale and there was no linear relation. This is in line with the findings of regression analysis (Table 4) where we found no statistically significant linear association of the scale's scores with these two barriers which indicates that the participants overcame these problems in some ways and thus, there was no negative impact of these barriers. Surprisingly, we found a negative impact of the personal barriers (e.g., having lack of confidence to achieve something) (Table 5 and Figure 33(c)). For instance, we found a relatively lower agreement with the items of the scales in case of the participants who Always faced the personal barriers (Figure 33(c)).



(a) Infrastructural barrier (b) Social barrier



(c) Personal barrier

Figure 33: Relation between the 10 items of general training effectiveness with the frequency of facing a barrier.

8. Lesson Learned

Based on the qualitative study findings the following improvements can be implemented for more inclusive event design.

8.1 Generating Awareness among Parents

Parental support is an important factor in increasing women's participation in ICT and related events. The young female population in Bangladesh are mostly dependent on their families for financial support. As a result, parents have an influence over where and how they travel, the courses and training programs they participate in and the devices they use. While a participant may understand the benefits of attending guided learning events for her future development, convincing her parents remains a challenge she has to overcome, as shown in our findings. Parents on the other hand, feel concerned about exposing their daughters to a potential danger that they have limited understanding of. Therefore, including awareness counseling for parents will help elevate their unease about ICT, making it easier for the girls to participate in events and improving their access over time.

8.2 Networking Sessions for Women during the Events

The participants of the study repeatedly expressed their appreciation for the networking opportunities that were created through the activities. Since the participation of women in ICT and entrepreneurial activities is generally sparse, they usually have low visibility in such communities. As a result, women rarely have the chance to connect, share and learn from others, especially other women, in the same profession. Events which are open to all female entrepreneurs and women in ICT bring them together and along with experts from their relevant fields. This provided them the rare opportunity to seek advice from the experts, share experiences and form mutually beneficial partnerships. In addition, they were able to identify female figures, role models, whose stories were relatable and touched them and helped them envision their career.

It was evident from our study that networking opportunities benefited the participants as well as other aspiring women in their field. For example, repeated participation in contests enabled the student participants from Rajshahi to build their own programming community for girls. The community included both contest participants and aspirants who were not connected to any such events.



Figure 34.
Session During
2nd Bootcamp

It had a far-reaching effect in inspiring more female students into coding. Therefore, greater emphasis should be placed on providing networking opportunities during such events. Sessions for open discussion among participants and guest speakers can nurture communication and sharing, allowing participants to form mutually beneficial connections and build communities to include more women.

8.3 Decentralizing Events from the Capital

A major complaint among the participants living outside the Dhaka city was that most of the events are concentrated within the capital city. This creates major inconveniences for them as in many cases they need to travel far, requiring acquiescence from their guardian; and arrange accommodation, which can burden them financially. Moreover, students have the additional difficulty of making up for the classes they may miss. Spreading out events in other divisional cities will reduce these inconveniences for many. Additionally, it has the potential to reach a greater number of women from different parts of the country, opening up better opportunities for them in ICT and entrepreneurship.

8.4 Scheduling Events for Students

The student competitions such as programming contests and datathons played a major role in building confidence among girls. It gave them the drive to improve their skills and courage to compete at larger platforms. However, managing academic studies and competitions remain a challenge for them. Although they can make up for regular classes, missing any major exam has lasting consequences on the students' academic records. Therefore, having a fixed annual schedule for competitions will allow aspiring participants to better plan their studies and exams around the events. They can seek institutional support to avoid schedule conflicts between major exams and competitions.

9. Conclusion



Figure 35. Career Talk Session

The Aparajita project explores the three year long initiative taken by BdOSN in engaging and training women all over Bangladesh in ICT and entrepreneurship. It tries to understand the impact of these initiatives on the participants and how the ongoing effort can be improved through both qualitative and quantitative approaches. The qualitative study conducted on $n=35$ women showed improved networking among the participants, overall skill development and increased confidence and ability to handle pressure.

Moreover, it highlights the challenges in participating in the events, which includes the activities being centered towards the capital, time conflicts with academic studies for students and social norms. In addition, the participants put forth their suggestions to include advanced activities, parent counseling and follow-up sessions. The quantitative analysis on $n = 76$ participants showed evidence of improvement in their personal competencies, job performance, and professionalism, having a higher impact on individual performance. Personal barriers such as lack of confidence appeared as a hindrance to performance. Taking insight from both qualitative and quantitative data, participation in these events promote women's confidence which addresses the personal barrier.

Considering the overall impact, challenges and suggestions from the participants, there is a scope of improving the effort by generating awareness among parents, allocation sessions for networking, organizing events in other divisional cities, having a fixed annual schedule for student competitions and organizing knowledge sharing sessions to bridge the information gap on fund sourcing and market for entrepreneurs.

“It was a bootcamp. So, we gave ideas on the first day. Then taking those ideas into business ideas. After that comes business model, canvas, and business pitch deck all these things we learnt in the bootcamp. In the different sessions, the back-to-back sessions we learnt those. Then Digital Marketing, for example, marketing is a big thing for a business. I have made a product and now how to reach customers and how they will receive that. I learnt those things from the sessions which were held during those three days. They covered many things there.” - P34, Entrepreneur, Mymensingh



Appendix

Table A1. Total Event Organized by ESDG4Bd

ESDG4BD Project (April 2019-March 2022) Activities	Total Activities	Year 1		Year 2		Year 3		Year 4	
		Activity Count	Participant Count	Activity Count	Participant Count	Activity Count	Participant Count	Activity Count	Participant Count
ICT camp + Programming camp	105	32	994	49	2080	19	849	5	178
Career talk	43	11	445	20	897	10	581	2	70
Hands-on workshop on job preparation	30	11	288	10	231	8	838	1	35
Programming - warm-up and mock contest	42	21	811	18	2243	2	69	1	257
Project competition	1	0	0	0	0	1	27	0	0
Job exposure visit	14	9	125	0	0	3	66	2	43
Networking activity	4	0	0	2	127	2	177	0	0
Job attachment 3-7 days	1	1	1	0	0	0	0	0	0
Internship - 1 to 3 months	19	11	11	6	6	2	2	0	0
Innovation boot-camp [3-days residential 50 each batch]	5	2	65	0	0	2	116	1	52
Possible funding/grant sourcing mentorship	1	0	0	0	0	0	0	1	32
Mentors workshop	4	2	26	0	0	1	26	1	15
Ada Lovelace celebration	4	1	0	1	700	1	635	1	1000
Conferences, seminars, policy dialogue sessions and workshops	2	1	700	1	635	0	0	0	0
Career counseling support and job fairs	1	1	700	0	0	0	0	0	0
National girls programming contest [online & onsite]	3	1	944	1	147	1	216	0	0
Web-portal development and maintenance for Female in tech comm	3	0	0	1	0	1	1000	1	1700
Report dissemination events	0	0	0	0	0	0	0	0	0
Safeguard policy development oriented workshop	1	0	0	0	0	1	117	0	0
Total	281	104	5110	109	6366	53	4084	15	2382

Total Event: 281; Total Reached Audience: 17942

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Photo Gallery











Note

