

Increasing the Awareness of the Benefits of Earth Observation Applications through the Space Information Infrastructure Capacity Building and Training Program (SIICaP)

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Abstract

Earth observation (EO) applications offer significant potential for addressing challenges and driving sustainable development in the Philippines. Despite the positive effect EO services can bring, its utilization encounter barriers that includes the lack of awareness of its benefits. The Philippine Space Agency (PhilSA) initiated the Space Information Infrastructure Capacity Building and Training Program (SIICaP) that aims to promote awareness of EO applications through free and inclusive online webinar platforms. This paper highlights the various webinars conducted by SIICaP showing their relevance in raising awareness of EO data, services, and programs. The analysis of evaluation results from the webinar participants further illustrates the program's reach and success. By showcasing SIICaP, this paper contributes to efforts in developing capacity building programs that aim to have the same objectives of SIICaP.

1. Introduction

The Philippines can greatly benefit from Earth Observation (EO) applications to address its various challenges and drive sustainable development in the country. EO services can bring positive effects for the public, such as improved air quality and disaster risk management (OECD, 2022). However, utilizing space technologies such as EO data faces obstacles such as lack of awareness of their benefits, constrained financial resources, and gaps in technology and skills needed to adopt these technologies (United Nations Economic and Social Council, 2020). The transition from research to the operationalization and decision-making using EO data is also a challenge (Prados et al., 2019). Space agencies and governments play an important role in raising awareness of its benefits and organizing capacity building events to foster expertise in utilizing EO data.

There are several training courses in the past and present that are concerned with the utilization of EO data. These programs emphasized the importance of distance learning, through free and online platforms, in raising awareness on the benefits of EO applications. The evaluations from the participants of these programs have shown positive impact about the use of EO data. In one instance, the NASA ARSET program showed that participants increased their knowledge of remote-sensing data products and increased their ability to access data (Prados et al., 2019). While these programs are offered worldwide, there is also a need for localized versions to better accommodate local participants in the county. In addition, a local program can offer several advantages. First, it can spotlight local initiatives that utilize EO data to address specific problems, highlighting local expertise in the field. Second, the program can foster relationships with stakeholders, helping to identify their problems on the ground and demonstrate how EO data can provide solutions. Furthermore, it has the potential to build a community of EO data users among local participants.

The Space Information Infrastructure Capacity Building and

Training Program (SIICaP) is a project of the Philippine Space Agency (PhilSA) that aims to promote awareness of space science technology and applications (SSTA) which includes EO applications among others. SIICaP is designed to be accessible for local participants in the Philippines by leveraging an online webinar platform Zoom and Microsoft Teams to facilitate widespread participation. The online engagement features emerging space technologies, services, and programs of various organizations dealing with EO applications such as PhilSA.

The paper aims to highlight SIICaP in increasing awareness of the benefits of EO applications through its webinar offerings. It seeks to assess the program's reach by analyzing participant evaluations collected following each webinar. Furthermore, the paper presents a synthesis of participant feedback and suggestions, providing insights into the efficacy of the program. By showcasing the successful reach of SIICaP, this paper aims to contribute to efforts aimed at raising awareness of the benefits of EO applications among stakeholders including government entities.

The next section will provide an overview of the diverse activities conducted by the program. The results section will show the outcomes derived from data gathered from the evaluation of participants illustrating the impact of the program across the country. The results section will also outline the feedback from participants outlining their reception and suggestions to the program. Furthermore, the results section will outline the problems faced by the program while offering strategies to overcome these issues to sustain and enhance its efforts in advancing SSTA capacity-building activities.

2. Coverage and Activities

PhilSA has embarked on a transformative mission to foster nationwide utilization of EO data through the funding of Data Analytics Technologies and Operations Services for

Space-Data (DATOS). This initiative is dedicated to the development of systems and tools aimed at efficient utilization of EO data across local regions of the Philippines. Central to DATOS is the establishment of a network of space data users and empowerment of stakeholders in harnessing the potential of EO data for environmental monitoring, natural resource assessment, disaster damage assessment, and agricultural mapping.

Within the framework of DATOS, SIICaP stands as a service, designed to capacitate stakeholders through a series of interactive webinars. These webinars primarily target local government units (LGUs), providing essential support and training in utilizing EO data. Despite its primary focus on local units, SIICaP extends its reach to the broader public sphere, including students, faculty and researchers, and other sectors because of the informative nature of its offerings and their potential to stimulate interest across these sectors.

SIICaP has organized 18 engaging webinars from April 2022 up to March 2024. The webinars are designed to highlight SSTA which includes ground receiving stations, satellite development, open-source geospatial data processing, and EO applications and services. Registration for the webinars is free and open to anyone interested in the topics offered at the event. The program featured a diverse lineup of local and international speakers who shared their expertise and insights promoting their roles in SSTA. Promotion of the webinars is orchestrated through various channels, including social media and email, to maximize reach. Figure 1 shows a photo opportunity with the speakers and participants in one SIICaP webinar. In addition to the presentations of guest speakers, participants get to interact in the quizzes offered during the webinar and win prizes. The following subsections will summarize the webinars conducted by the program showing their relevance in raising the awareness of EO applications.

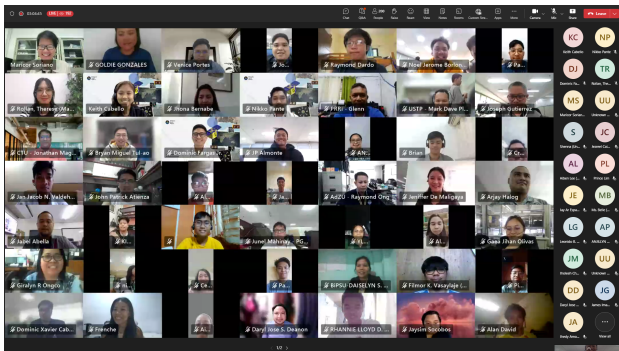


Figure 1. Photo opportunity of SIICaP organizers, speakers, and participants in Microsoft Teams.

2.1 Lakbay Kalawakan: An Introduction to Philippine Space Exploration

The “Lakbay Kalawakan: An Introduction to Philippine Space Exploration” is a three (3) part webinar series that introduced SSTA from the Filipino perspective. The first part introduced satellite technology and the history of Philippine satellites and focused on the space segment of satellite missions. The second part explains how Philippine satellites are operated from the ground, including communication, downloading of EO images from the satellites, and ground station operations. The last part demonstrates uplink and downlink communication with

Maya satellites. The webinar series highlighted the importance of developing satellites and operating them to enable EO applications in the Philippines.

2.2 Data Camp

SIICaP “Data Camp” is a five-part webinar workshop focused on geospatial data analysis using open-source software and tools. The first part introduced Python, a programming language used in multiple applications and Colab, a web tool for running Python scripts. The second part discussed geospatial vector data and GIS. The third part discussed raster data analysis and showed various EO portals, where data can be downloaded. The fourth part showed how to combine raster and vector data to produce an analysis. Finally, in the last part, participants showcased their project from what they learned from the previous activities. The workshop highlighted the importance of EO data and the use of open-source technologies to process them.

2.3 Space Data Mobilization

The “Space Data Mobilization” is a three (3) part webinar series aimed at promoting various EO applications and services. The sessions tackled three applications, disaster risk reduction and management; environmental and natural resources; and agricultural. The series highlighted the value of EO data and discussed the role of government agencies including PhilSA in aiding stakeholders using EO services. The topic discussed how PhilSA through the Disaster, Hazard, and Risk Mapping (DHaRMa) utilizes space data to map out hazard extents. One example is monitoring oil spill progression that were captured with different satellite data near the coast of Oriental Mindoro, Philippines in 2023 (Hilario et al., 2023).

2.4 Lakbay Kalawakan: Inside the Control Room, Outward into Space

The “Lakbay Kalawakan: Inside the Control Room, Outward into Space” is another three (3) part webinar series focused on the importance of space mission control and operations. The first part tackled the role of mission control operators in satellite communications. The second part highlighted mission operations for rocket launches. The last part delved into deep space missions and the crucial role of mission administrators. Participants gained insights into the groundbreaking missions of Hayabusa2 (Japan Aerospace Exploration Agency) and Rosetta (European Space Agency). The series emphasized the value of space ecosystem and roles of mission operators in the success of space object missions such as operating EO satellites and deep space exploration.

2.5 Citizen Science in Disaster Risk Reduction and Management

The “Citizen Science in Disaster Risk Reduction and Management” is a webinar about field validation of EO data using ODK, a set of tool kits used for reporting ground observation. The webinar highlighted its importance in validating disaster related EO products such as flood, landslide, and ground deformation. Participants learned how they can contribute as citizen scientists in validating the maps generated by PhilSA.

Name	Date	Number of participants from webinar platform
SIICaP Kick Off	29-Apr-22	286
Lakbay Kalawakan: An Introduction to Philippine Space Exploration Part 1	27-May-22	355
Lakbay Kalawakan: An Introduction to Philippine Space Exploration Part 2	30-Jun-22	299
Lakbay Kalawakan: An Introduction to Philippine Space Exploration Part 3	29-Jul-22	212
Data Camp: Introduction to Colab and Python	26-Aug-22	632
Data Camp: Vector Data Processing using Python	2-Sep-22	484
Data Camp: Raster Processing using Python	9-Sep-22	365
Data Camp: Using Vector and Raster Tools to Analyze Data	16-Sep-22	260
Data Camp: Show and Tell	5-Oct-22	205
Space Data Mobilization: Disaster Risk Reduction and Management Applications	1-Dec-22	221
Space Data Mobilization: Environmental and Natural Resources Applications	20-Jan-23	140
Space Data Mobilization: Agricultural Applications	17-Feb-23	150
Lakbay Kalawakan: Inside the Control Room, Outward into Space Part 1	26-May-23	234
Citizen Science in Disaster Risk Reduction and Management	28-Jul-23	287
Empowering Insights and Actions with Copernicus Data	10-Aug-23	339
Lakbay Kalawakan: Inside the Control Room, Outward into Space Part 2	11-Aug-23	246
Lakbay Kalawakan: Inside the Control Room, Outward into Space Part 3	26-Jan-24	224
Imaging Sensors	5-Apr-24	268

Table 1. Summary of participants per webinar.

Year	No. of webinars	Views from Zoom /Microsoft Teams	Participants who answered the evaluation	New participants based on evaluation	Percent increase from previous years based on evaluation
2022	10	3319	654	-	-
2023	6	1396	451	333	50.9%
2024 Q1	2	492	297	229	23.2%

Table 2. Summary of participants per webinar.

2.6 Empowering Insights and Actions with Copernicus Data

PhilSA partnered with the European Space Agency (ESA) and University of Philippines Department of Geodetic Engineering (UP-DGE) to co-organize the webinar titled "Empowering Insights and Actions with Copernicus Data". This event delved into the various applications of Copernicus EO data. Furthermore, distinguished speakers from the local and international communities showcased their research endeavors fueled by the EO data highlighting its potential.

2.7 Imaging Sensors

The "Imaging Sensors" webinar focused on the development of remote sensing systems and data processing. The webinar showed the development of a Hyperspectral camera using a pseudo satellite and a hyperspectral EO data cube, from the Commonwealth Scientific and Industrial Research Organisation (CSIRO). In addition, the webinar also highlighted local initiatives from the University of the Philippines (UP) to develop hyperspectral sensor system. The webinar showed the importance of these developments to ensure optimal EO sensors are equipped in satellites.

3. Results

SIICaP conducted a post-event survey after each webinar allowing to monitor the reach and success of the program. Participants have the option to answer the evaluation and a certificate of attendance is given in return. In addition, the number of attendances is recorded from the webinar platform. The following subsections will discuss the results from the evaluations showing the number of participants, the increase of number of new attendees, and the reach of the program by regional section, age group, and sectoral group. Furthermore, it will provide a synthesis of participants' perception towards the

project and the webinar topics, their remarks and suggestions, and problems faced by program and solutions offered by the organizing team.

3.1 Summary of Participants

Table 1 shows the summary of participants from the SIICaP webinars. The webinars are sorted in chronological order. The number is based on the count recorded by the webinar platform. The greatest number of participants is from the "Data Camp: Introduction to Colab and Python" with 632 participants.

3.2 Yearly Increase of New Participants

Table 2 shows the increase in participants per year. It is worth noting that the 2024 coverage is only the first quarter of that year. The second column shows the total number of webinars conducted in the year. SIICaP had the greatest number of views in 2022 with 3,319. The third column shows the cumulative number of attendees from the webinars corresponding with the year. The fourth column shows the number of attendees who answered the evaluation during the webinars. It is not equal to the number of participants since they are free to not answer the evaluation. In addition, in 2022, SIICaP did not conduct evaluation from the first three (3) webinars which made a poor number in the count of unique participants. The fifth column shows the number of new participants who joined only in the corresponding year. The last column shows the percentage increase of new participants. SIICaP increased its reach to new participants by approximately 50% in its second year.

3.3 SIICaP's reach by Province, Age, and Sector

SIICaP has a total of 5,207 number of views from 2022 to the first quarter of 2024. Some participants have attended multiple activities. There have been only 1,402 number of evaluation submissions and only 1,216 are unique participants.

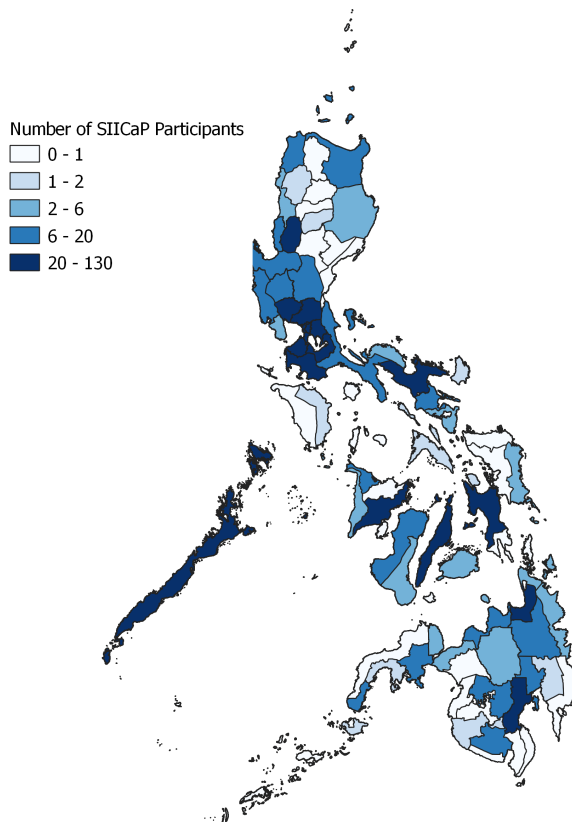


Figure 2. Map of Philippines showing the number of participants per province or districts. The legend for this map is in “equal count” or “quantile” to highlight the provinces and districts with high participation.

Figure 2 illustrates the map showing the reach of SIICaP in the Philippine provinces and districts. Based on the number of unique participants, the reach of SIICaP in terms of province, age, and sector are determined. The four (4) National Capital Region (NCR) districts have the highest number of participants with 97 from the first district, 130 from the second, 75 from third, and 88 from the fourth district of NCR. These are participants located in Metro Manila, capital of the Philippines. There are also high number of participants from the provinces next to the capital which are Rizal, Cavite, and Laguna. In the lower regions, Iloilo and Cebu have 42 and 26 participants respectively. There are multiple provinces with below 6 participants. SIICaP has reached out to 74 out of 84 provinces and districts in the Philippines. Only 36 provinces have 6 or more number of participants. Monitoring the regional reach enabled the project to ensure participants come from different parts of the country. Furthermore, it enabled active promotion in provinces with low participants by gathering contact lists and sending invites to institutions located in these provinces. These efforts enabled widespread reach of the program.

Figure 3 shows the distribution of SIICaP participants. Of 1,216 unique attendees, most of them are students with 43% which consists of students from the junior high school, senior high school, and higher education. The next highest sector is from the academe, which consists of faculty personnel in higher education and researchers in the university with 21%. Participants from national government agencies consist of 17% while the LGUs only have 7%. The private sector and non-governmental organizations consist of 9% and 2%

respectively.

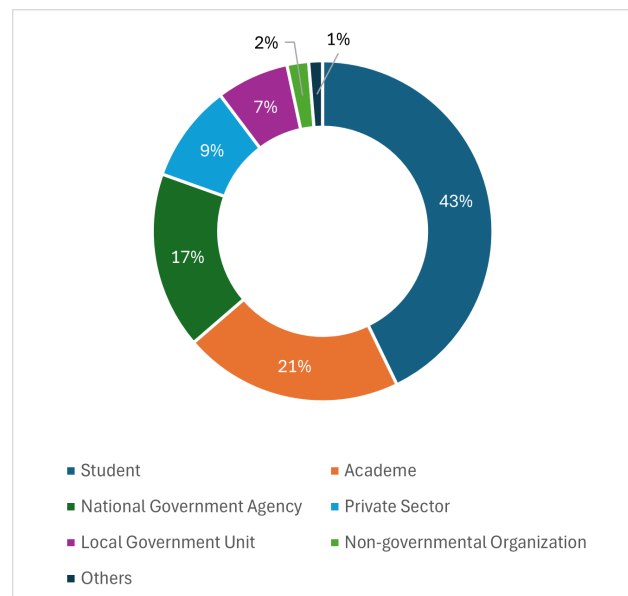


Figure 3. Distribution of participants by sector.

Figure 4 shows the distribution of participants by age. Of 1,216 participants, 37% of them are from ages 21 to 24, which also reflects the results from the sector distribution. Higher education students, i.e. college and university students, consist

mostly of this age. The second highest, with 25%, are from ages 25 to 30, which can be attributed to young professionals. The age groups 31 to 35, 36 to 40, 41 to 50, and 50 to 60 have 9%, 5%, 6% and 3% respectively.

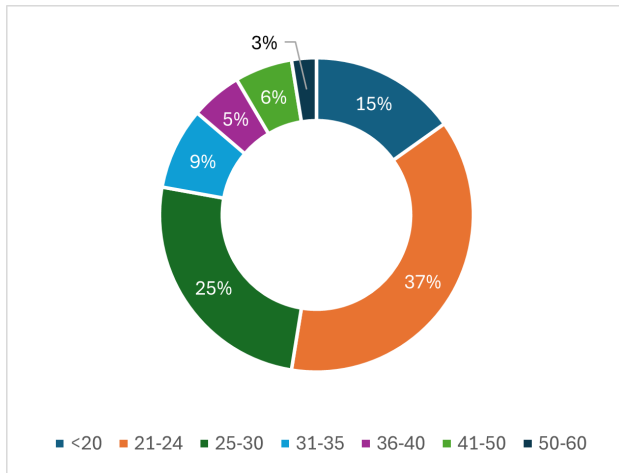


Figure 4. Distribution of participants by age.

3.4 Participants' Perception

The evaluation process solicited valuable feedback from participants with the question "Any feedback or ideas for this webinar or upcoming webinars?" The feedback prompted them to share their thoughts and ideas on the webinars attended. This feedback provided invaluable insights into the participants' perception of the webinar topics, aiding in the identification of areas of relevance and potential focus for upcoming sessions.

The "Lakbay Kalawakan: An Introduction to Philippine Space Exploration" is the first series of SIICaP that delved into the historical venture of the country into space and discussed how important is EO as learned from the country's first satellites, Diwata-1, and Diwata-2. The sessions inspired a deeper interest in space science with some participants considering it as a potential career path. Participants expressed pride in the country's advancement in space technology and dedication of Filipino space scientist towards nation building. The series was particularly impactful for educators, who appreciated the insights they learned which they could pass on to their students. They expressed interest in providing more information on remote sensing and its applications to disaster and risk assessments.

The "Data Camp" workshop had the greatest number of participants. The nature of this workshop is to introduce open-source tools like Python in geospatial data analysis including remotely sensed data. The reception of participants was overwhelmingly positive. Participants appreciated learning about the advantages and disadvantages of using various tools in programming compared to user interface software in processing data. Participants valued the exposure to different open-source technologies, open data, and online resources for learning and practicing geospatial data techniques on their own. In addition, they appreciated the free and open data philosophy as it can facilitate research and problem solving in various areas. The workshop also motivated participants to incorporate the tools into their projects and continue exploring the fundamentals of GIS and EO data processing. Many participants were introduced to new tools while for some, the

workshop served as a reinforcement of their existing knowledge on EO applications. Furthermore, they recognized the necessity of geospatial technology and EO data for addressing societal challenges. The presentation materials were well-received for being simple, effective, and accessible, especially for beginners. The workshop provided other materials as well such as Colab Notebooks and data which were noted as beneficial. The organization of the workshop was also praised as it made learning simple and fun. The interactive nature of the workshop that allowed audience participation was also seen significant by the attendees.

The third series, "Space Data Mobilization" showed various applications of EO and how are they used in the Philippines by different organizations in the government. Many participants found the webinars highly informative, gaining knowledge about types of EO data such as optical, Synthetic Aperture Radar (SAR), and various applications in disaster management, agriculture, and environmental monitoring. Students gained interest in space data and highlighted its application on disaster mitigation and assessment. The presentations were also appreciated for their use of visual aids in showing the potential of EO.

The webinar "Citizen Science in Disaster Risk Reduction and Mitigation" highlighted ODK, an open-source tool for data collection and how PhilSA uses it for validating disaster related information on the ground. This webinar showed how EO products are validated through citizen science effort. Participants considered the topic timely and relevant particularly in the context of disaster resilience which could be because of the country's experience in natural hazards. Participants expressed a desire to learn more about the tool and how it can be used in other applications.

The PhilSA co-organized with ESA and UP-DGE the "Empowering Insights and Actions with Copernicus Data" webinar to discuss different EO applications using the Copernicus data from Sentinel missions. Unfortunately, there was no feedback gathered in this session. However, participants were able to engage with questions to the speakers. Participants learned about different Sentinel products and how they are used in various areas.

The final webinar listed in this paper is the "Imaging Sensors". The webinar showed how hyperspectral sensors are developed and the development of a hyperspectral data cube. The webinar highlighted local initiatives in the field of optical sensors development. The session was described as engaging with some participants who found the topic interesting and eager for more information. Participants praised the webinar for its informative content and learned about the industry behind EO images and data analysis from payloads. Participants also appreciated the knowledgeable speakers, and the well-presented, and insightful discussions. Finally, participants appreciated one's speakers' inspirational message as they find relevance to their careers.

Overall, the webinar topics were well-received for its informative content. Participants perceived the webinars as insightful and have expressed desire for more webinars such as these offerings. Participants recognized the value of these webinars in promoting space-related activities in the country and the value of EO in bringing socio-economic change. These testimonies underscore the growing awareness of the benefits of EO technologies among individuals in the Philippines.

3.5 Participants' Remarks and Suggestions

The same feedback from participants also provided valuable remarks and suggestions. The feedback prompted them to share their ideas to further enhance the program and their gratitude. Their suggestions provided strong interest in enhancing the capacity building activity of SIICaP.

Participants expressed their gratitude for the program and acknowledged the agency for its efforts in organizing high-quality, online, and free webinars which they find instrumental for their educational and professional development.

A common request among participants was for a structured training program to acquire technical skills in EO applications. Many advocated for multi-day workshops like "Data Camp" for a more comprehensive learning experience. Additionally, there was a notable interest in expanding the range of topics to include other applications of EO data, specifically on the use and accessibility of EO products generated by PhilSA.

Participants also expressed a desire for certification and self-paced training options, allowing them to access materials at their convenience and earn certificated upon completion. Some suggested extending the duration of the webinars beyond the current two-hour format to delve deeper into topics. Moreover, they want on-site activities to supplement online learning, providing opportunities for interactive and engaging training sessions. Suggestions were also made to broaden the reach of the program by visiting local schools.

Access to presentation materials and additional resources such as reading lists, videos, and articles was deemed essential by participants to aid in their training. They also expressed a need to summarize key points from presentations for easy reference and sharing with colleagues. Furthermore, participants advocated for content-specific webinars focusing on specific EO applications, particularly in disaster-related contexts.

Overall, the participants exhibited gratitude towards the program and recognized its role in disseminating the benefits of EO technology. Their active engagement and suggestions underscored their keen interest in acquiring knowledge and skills to effectively utilize EO data. These testimonies serve as a testament to the program's impact and its potential for further growth and engagement with participants.

4. Discussions

The results of this paper highlight the significant reach and impact of the SIICaP program in raising awareness about the benefits of EO applications. The evaluation indicates a substantial number of local attendees in the Philippines, with the "Data Camp" series attracting the highest number of participants. The program has successfully engaged participants from numerous provinces, particularly drawing interest from students across various sectors. Participants feedback has been overwhelmingly positive, reflecting their appreciation for the program.

A geographic analysis of the participant data revealed that developed provinces have better access to the program. Monitoring this distribution can help enhance the program by

targeting provinces with lower participation rates. This targeted approach can assist the agency in planning future activities aimed at increasing awareness of EO benefits in underserved areas. The analysis also showed that while the program has attracted a diverse audience beyond its primary target of LGUs, it needs to focus more on engaging LGUs, who are decision-makers that can utilize EO data for local governance and planning.

The current evaluation does not assess the impact of SIICaP on participant's knowledge on their ability to access and use EO products, nor does it measure how the program supports decision-making applications. To address these gaps, future iterations of the program should include questions that evaluate these aspects, particularly when SIICaP offers hands-on training sessions.

Despite the positive feedback, participants have identified several areas for improvement. Many expressed desires for self-paced training modules and more practical experience in utilizing EO data. Incorporating this feedback can help refine the program to better meet the needs of its participants and enhance its overall effectiveness.

5. Conclusions

SIICaP has conducted 18 webinars from April 2022 to March 2024 and made significant progress in raising awareness of the benefits of EO applications in the Philippines. The engaging webinars had various topics on SSTA with a strong emphasis on EO data, analysis, services, and programs. The activities have empowered the public with the knowledge of EO applications. The total number of views in all webinars shows how SSTA technology topics are interesting and underscores the need for capacity building events like SIICaP.

The results showed a remarkable 50% increase in the number of new participants from 2022 to 2023. The program, being free and online, have reached to several provinces and districts in the Philippines. Out of 84 provinces, 74 provinces have at least 1 person who has attended a SIICaP webinar. Also, 34 provinces have at least 6 participants. The highest number of participants are from the student sector consisting of university and college students. The largest group of attendees comes from the 21 to 24 age group, which is concise with the result from the sector since students at higher levels are from this age group. The next largest age group are the young professionals, 25 to 30 years old. SIICaP have positive reviews while having consistent suggestions such as self-paced, on-site, and more technical training.

In conclusion, SIICaP has raised the awareness of the benefits of EO applications by bringing engaging and insightful webinars. It is important to continue fostering the public of the knowledge of EO application to realize its socio-economic benefits. This paper has given an overview of SIICaP, its topics, and achievements so far. By learning the insights provided in this paper, governments and space agencies can improve their capacity building efforts to improve EO utilization.

References

Hilario, P. L. A., de la Cruz, R. M., Vergara, D. C. D., Sabuito, A. J., Borlongan, N. J., Tabardillo, J. I.,

2023. MONITORING OIL SPILL PROGRESSION AND OIL SPILL VOLUME USING SATELLITE IMAGES. *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, X-1/W1-2023, 1137–1142. <https://isprs-annals.copernicus.org/articles/X-1-W1-2023/1137/2023/>.

OECD, 2022. *Earth's Orbits at Risk*.

Prados, A. I., Carleton-Hug, A., Gupta, P., Mehta, A., Blevins, B., Schmidt, C., Barbato, D. G., McCullum, A. J., Hook, E., Podest, E., Follette-Cook, M., Hudson-Odoi, S., Kinsey, T., 2019. Impact of the ARSET Program on Use of Remote-Sensing Data. *ISPRS International Journal of Geo-Information*, 8(6). <https://www.mdpi.com/2220-9964/8/6/261>.

United Nations Economic and Social Council, 2020. Exploring space technologies for sustainable development and the benefits of international research collaboration in this context.