

# The Karman Project

Consultation & Contribution to the UNOOSA-IAF  
'30th Workshop on Space Technology for  
Socio-Economic Benefits'



Space-for-  
Empowerment

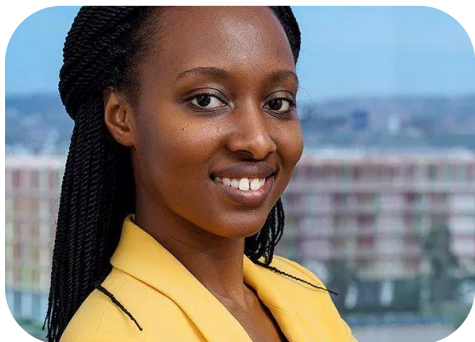
1.

**Best practices in capacity building (public and private sector enablers) for education** collated from leaders of non-space-faring and emerging nations across four continents and 11 nations.

2.

**Understanding of the key enabling role of international partnerships and cooperation** in capacity building, highlighting levers, enablers and frameworks of reference for future modeling.

# About Us



The Karman Project coordinates global leaders across the private and public space ecosystems to **build common understandings**, and increase **cooperative efforts for a peaceful and sustainable future** for space and Earth. Our foundation actively works with **over 200 selected leaders** across 60 nations worldwide.



astronauts  
agency directors  
corporate leaders  
entrepreneurs  
investors  
artists  
researchers



**Joseph Abakunda**

Chief Strategy Officer  
Rwanda Space Agency



**Siti Nur Aazzah Abdul Aziz**

Deputy CEO  
Network Integrity Assurance  
Technologies



**Lynette Tan**

Chief Executive  
Singapore Space & Technology



**Andres Mora Vargas**

Robotics Engineer  
NASA Ames



**Clarisse Iribagiza**

CEO, Hehe &  
Co-Founder, DeepTechAfrica



**Rogel Mari Sese**

Chair, Aerospace Engineering  
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Co-Founder  
Piston Labs



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**Davis Cook**

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Research Institute for Innovation,  
Sustainability and ZASpace



**Raycho Raychev**

CEO  
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**Sahba El-Shawa**

Founder  
Jordan Space Research Initiative



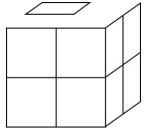
**Kevin Ramirez**

Space/Earth Observation Manager  
Climate-KIC



# Key Pillars to Enable Skilled Workforce

## Academia

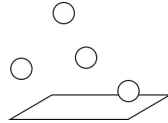


Workforce Promotion

International Knowledge  
Transfer

Research & Development  
Models

## Industry

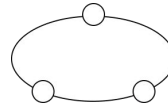


Existing Industry Strengths

Existing Supply Chains

Industry-led Ecosystem  
Development

## Government

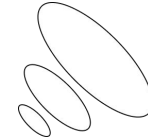


Baseline Studies

Coordinating &  
Implementing Bodies

Focused Strategies &  
Roadmaps

## General Public



Awareness Building

Perception Shift &  
Burning Platforms

Support of Constituents  
> Government

\*Comprehensive recommendations available in Appendix

# Satellites as First Project

Should we all be launching satellites?

## Common Understandings & Experiences

- Satellite missions can be highly effective catalysts in kickstarting space ecosystems. Case Studies #1, 2 & 3 showcase successful examples from Guatemala (academia-led), Rwanda (government-led) and Bulgaria (industry-led).
- Results include:
  - ◆ Accelerated technology and knowledge transfer facilitated by international partners
  - ◆ Establishment of national space agency, dedicated laboratories, educational programs and first customer base
  - ◆ Increased public awareness

## Alternative Models to Build First Ecosystem

- Leverage existing industry expertise (e.g. Australia's expertise in robotics, automation and mining)
- Encourage private sector involvement across the value chain and re-frame "space" stakeholders (e.g. South Africa's procurement of products and services from non-space companies)
- Focus on downstream applications for:
  - ◆ Commercial purposes (e.g. Republic of Singapore, Brunei Darussalam)
  - ◆ Socio-economic needs (e.g. Rwanda, Philippines)
- Note: Long-term sustainability; partnered efforts

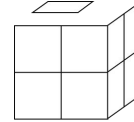
# Promote STEAM, Not (Just) Space

Trend #2

## Casting a wider workforce net

### Common Understandings & Experiences

- Prioritize the development of a robust STEAM (science, technology, engineering, arts and mathematics) workforce (e.g. mining, agriculture, medicine), which can feed talent, knowledge and innovations into the space industry
- Leveraging existing industry knowledge for spin-in/spin-off potentials; attracting new space players (e.g. Australia, Costa Rica)
- Reach beyond universities, additionally engaging with high-schools and tertiary institutions to encourage early adoption and practical skill-sets
- Embedding space **into** society



Credit: Anel Kenjeeva, Universidad de Costa Rica; Aazzah Aziz; EnduroSat

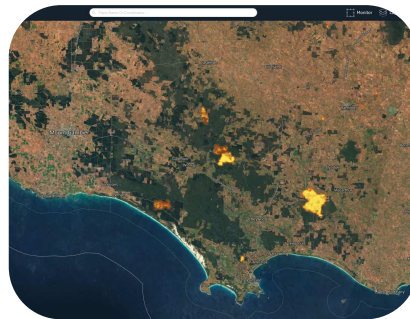
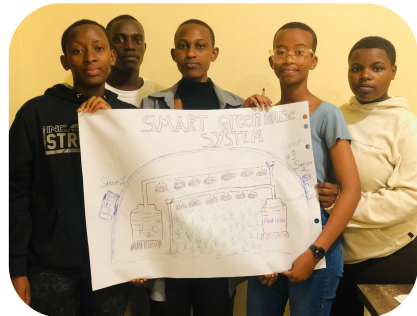
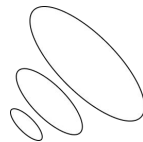
# Find Your “Burning Platform”

Trend #3

## Ensuring buy-in across the four pillars

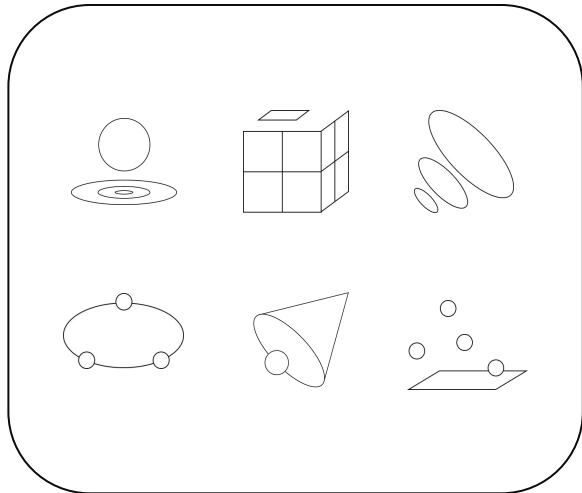
### Common Understandings & Experiences

- Best way to build an ecosystem and attract your workforce is by addressing genuine need or “burning platform” that emphasises urgent need for space activities
- Demonstrate: **why space, why now?**
- Think local, but leverage international use cases to demonstrate acceleration with space
- Leverage four pillars to ensure sustainability, interest and support
- Examples: Food supply (Rwanda); Bushfires (Australia); Connectivity (Philippines); Healthcare; Disaster Management



Credit: OroraTech; Clarisse Iribagiza; Ateneo de Davao University's ACCESS Mindanao

# Building on the Shoulders of One Another



- Different ecosystems and contexts experience common challenges and solutions
- Ecosystem approach is key to building capacity in a sustainable manner; all four pillars (Academia; Industry; Government; General Public) interrelate
- International cooperation vastly accelerates:
  - ◆ Knowledge and technology transfer
  - ◆ Human resources and talent
  - ◆ Credibility of local capacities
  - ◆ Financial resources and funding diversification
  - ◆ Identification of common needs and opportunities
- Appendix of Presentation:
  - ◆ 20 Key Recommendations across 4 Pillars
  - ◆ 6 Case Studies
  - ◆ Further Readings and Resources





# Contact

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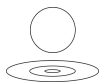
[www.karmanproject.org](http://www.karmanproject.org)



# Appendix

Process, Case Studies &  
Key Recommendations

# Our Process



## Consultation

21 August - 1 September 2023

1:1 Consultation Series  
Group Workshop



## Presentation

29 September - 1 October 2023

UNOOSA-IAF Workshop  
Baku, Azerbaijan



## Whitepaper

Capturing input and  
recommendations; identifying  
opportunities for  
support/cooperation

# Regions Represented

## Asia-Pacific

Rogel Mari Sese, Philippines  
Siti Nur Aazzah Abdul Aziz, Brunei  
Dharshun Sridharan, Australia  
Lynette Tan, Singapore  
Sahba El-Shawa, Jordan

## Eastern Europe

Raycho Raychev, Bulgaria

## Africa

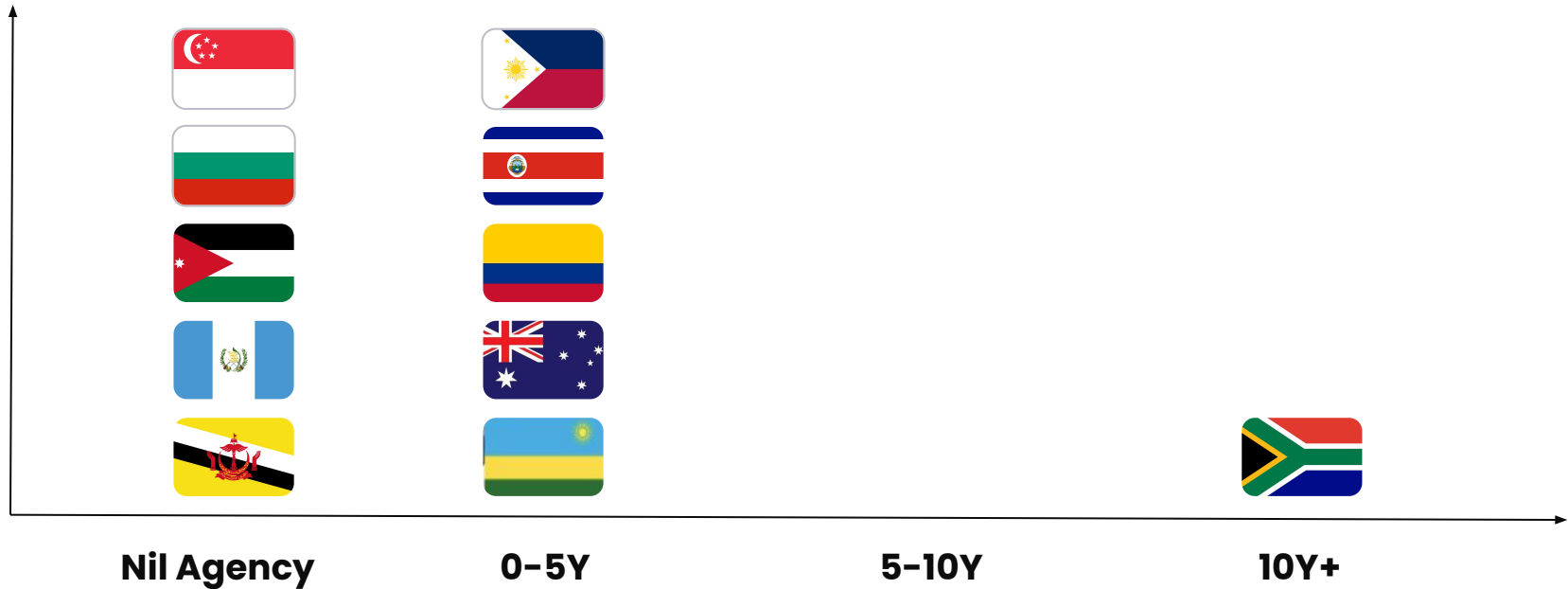
Joseph Abakunda, Rwanda  
Clarisse Iribagiza, Rwanda  
Davis Cook, South Africa

## Latin America & Caribbean

Kevin Ramirez, Colombia  
Andres Mora Vargas, Costa Rica  
Luis Zea, Guatemala

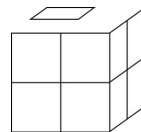


# National Program Maturity



# Academia

## For the Institutional Leaders



### Key Recommendations

Promote **STEM workforce** rather than pure space workforce

- Prioritize the development of a STEM workforce (e.g. mining, agriculture, medicine), which can feed talent, knowledge and innovations into the space industry.
- Reach beyond universities, additionally engaging with high-schools and tertiary institutions to encourage early adoption and practical skill-sets.

Form international partnerships for **knowledge transfer**

- Partner with universities in more developed space nations to develop local capacity in the short-medium term. Identify your value proposition to attract international support/talent to your region.
- Provide funding for local students to gain education in established programs abroad; create academic positions for international experts in local institutions.

## Foster innovative Research & Development to serve industry

- Encourage academia to integrate with the market by promoting projects with long-term impacts and connections to industry needs.
- This will ensure longevity for projects/collaborations and create demand within industry for the relevant skilled workforce.

## Leverage open-sourcing and nationals abroad to accelerate research

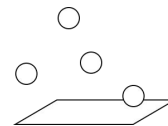
- Find the balance between Intellectual Property ('IP') and open-sourcing critical elements (e.g. space systems design): open-sourcing = acceleration.
- Leverage nationals you have abroad in already developed space nations to deliver access to projects, samples and opportunities (e.g. Guatemala).

## Consider innovative models of education and workforce creation

- Build strong STEM communities locally via networking, education and ecosystem meetups.
- Build local programs (e.g. Bulgaria's *Space Challenges Program*) with the support of international partners to create skilled workforce.

# Industry

## For the Ecosystem Builders



### Key Recommendations

Leverage existing industries and expertise as your foundation

- Leverage existing industry capabilities, such as robotics, mining, medicine and agriculture, and find talent in areas where the country already excels.
- Take advantage of familiar territory to de-risk, demonstrate spin-off capabilities and develop reputation for industry excellence.

Encourage private sector involvement across the value chain

- Encourage the private sector to develop and manufacture downstream products and services that can be procured, expanding their reach globally and supporting local economic growth.
- Re-frame industry mindset around what a 'space company' is and can be.



## Partner with industry accelerators to bring in knowledge

- E.g. Airbus' #Africa4Future Accelerator Program (Participant: Clarisse Iribagiza with HeHe) focused upon local needs (remote sensing for precision agriculture and infrastructure development).
- Bypassing traditional education systems to inject international knowledge directly into industry.

## Consider industry-led missions to stimulate education and inspiration

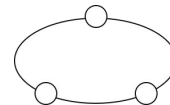
- Industry and private actors can stimulate an entire space economy by leading technology and innovation advancements with private funding.
- Attach these missions to educational projects, outcomes and institutions for multiplier effect.

## Leverage industry successes to attract government attention

- In a pro-business economic context, early and consistent commercial successes can encourage the government to consider the space economy, even in the absence of an agency.
- This can lead to further investment into education and commercial risk-sharing, e.g. through Public-Private Partnerships.

# Government

## For the Policymakers



### Key Recommendations

Conduct a **baseline study** to provide a **benchmark** for future

- Assess the current educational opportunities, assets, infrastructure, human resources, capabilities and policies related to space in the country. *“A Patchwork of Fragmented Activities”* – Rogel Mari Sese.
- Analyse international programs/policies to eliminate unsustainable programs and leapfrog development stages.

Establish a **coordinating body** and **enabling regulatory environment**

- Instead of a full-fledged space program, consider prioritising the development of enabling policies and regulations that immediately support academia and industry - and ensure ministries can appropriately administer with speed. Coordinating body is ideal.
- Involve various government agencies and sectors that can benefit from space technology and applications in the crafting of space policies and programs. Stakeholder consultation is key for buy-in.

## Establish a focused strategy and roadmap to guide the ecosystem

- Develop focused roadmaps/strategies for building capacity, avoiding over-diversification. Prioritise specific areas of expertise and consider specialising early to attract opportunities, skills and workforce.
- Align with local socio-economic needs, addressing economic inclusion and transformation to increase local ownership and participation.

## Fund education and academia-industry partnerships

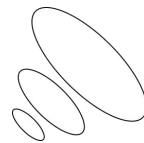
- Government can provide a significant role through funding and specialised training/capacity building programs when they don't yet exist in local universities.
- Consider allocating certain spend on space-related solutions that marry academia and industry, e.g. a clear pipeline for R&D grants to turn into commercial contracts and employment.

## Design a government-led national project utilising the Triple Helix Approach

- Develop a national project (e.g. nation's first satellite) to address specific sector (e.g. agriculture and food supply) using the Triple Helix Approach in designing this mission (Government x Industry x Academia)
- Partner with an advanced space faring nation or company to facilitate launch, or a fellow emerging space nation to co-sponsor launch (sovereignty ≠ long term space sustainability).

# General Public

For all of us



## Key Recommendations

Promote **general awareness** beyond astronautics

Establish a **“burning platform”** to engage constituents

- Space is not just about space exploration. Educate the public about the benefits of space technology for economic growth and social development.
  - Engage with diversified communication avenues - newspapers, social media, etc.
  - Tap into human emotion and capture imagination.
- 
- Establish a compelling reason or “burning platform” that emphasizes the urgent need for space activities.
  - Communicate the importance of space endeavors to the public to garner support and interest.
  - Emphasize the tangible benefits of space technology, such as improved healthcare, food supply and disaster management to garner public support.
  - **Remember:** governments represent their constituents.

## Institutional and governmental buy-in to overcome skepticism

- Demonstrate relevance of space technologies to trusted ecosystem players.
- Gain buy-in from various sectors, including academia, banking, social sciences, and government by demonstrating the practical value of space technology and applications.

## Inspire through achievements (and pop culture)

- Share inspiring stories of space achievements to capture public interest and support, even if not primarily driven by scientific purposes.
- Don't underestimate human emotions and the national pride that can stem from a successful space mission.
- People love puns; adults are just as important as youth.

## Foster two-way communication between space sector and public

- Foster two-way communication between the government, industry, and the general public to create a shared understanding of the value and benefits of space.
- Make space accessible via competitions, townhalls and connection with relevant industries.

# Quetzal-1 CubeSat Launch

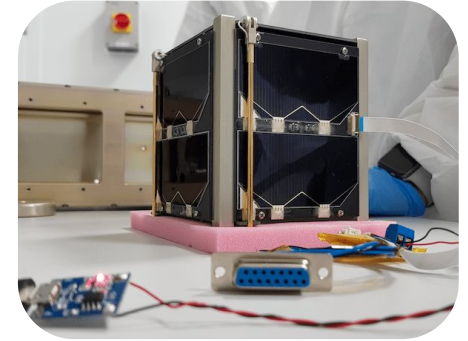


Case Study 1

- CubeSat started as academic project > University contributed time of 2 x Professors time plus \$220.00 in materials.
- Perceived as “sci-fi” or scam, and only support gathered was \$5,000.00 from an insurance company with ESG interest.
- Wrote proposals for partnership with UNOOSA and JAXA KiboCUBE programme > awarded.
- International partnership ‘verified’ the project’s legitimacy, enabling local backing.

## Results (Read more [here](#))

- Successful flight in 2020 after six years in development.
- Flight was the #1 story in Guatemala.
- 4 peer reviewed journals on it, plus a book with their story on the challenges with the motivation to change mentality that people in Guatemala can indeed do “high tech”.
- All modules developed in-house and then open-sourced for new projects.
- Development of Aerospace Laboratory at Universidad del Valle de Guatemala.



“DIY”

INTERNATIONAL PARTNERSHIPS = CREDIBILITY

MISSIONS AS INSPIRATION

Credit: Universidad del Valle de Guatemala; Ivan Castro

# RWASAT-1 Launch



Case Study 2

- In 2019, RWASAT-1, was launched from the Tanegashima Space Center by the Japanese Aerospace and Exploration Agency (JAXA), and deployed from the ISS.
- The project was initiated and funded by the Government of Rwanda.
- A team of three Rwandans Engineers with support of engineers from the University of Tokyo developed the RWASAT-1 CubeSat.

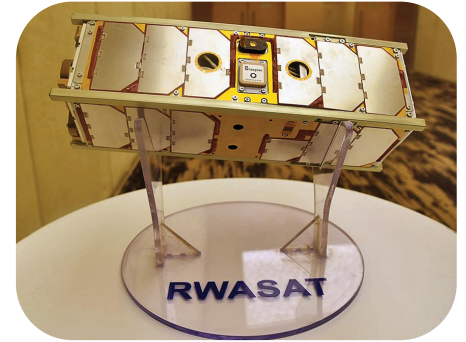
## Results

- After the deployment of RWASAT-1 into orbit, relevant stakeholders from the Rwandan Ministry of Agriculture received data via a remote ground station in Kigali.
- The mission aimed to enable informed decisions in the prediction of crop yields as well as soil moisture monitoring.
- The establishment of Rwanda Space Agency followed in 2020.

ADDRESSING LOCAL NEEDS

INTERNATIONAL PARTNERSHIPS

TRIPLE HELIX



Credit: Rwandan Ministry of ICT & Innovation; ADF

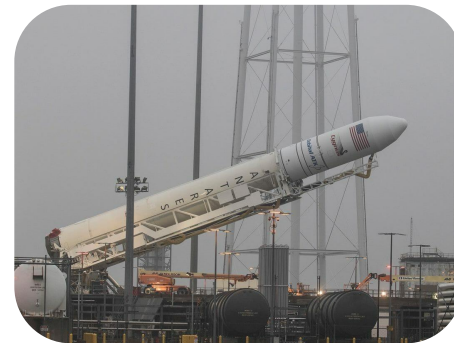
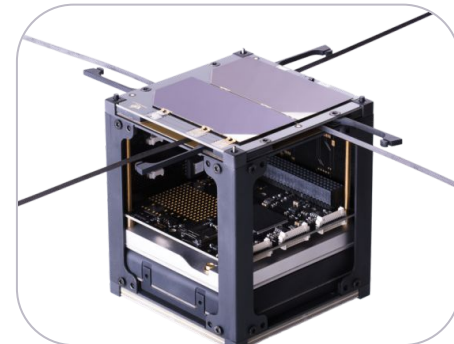
# EnduroSat One Launch

Case Study 3

- The Space Challenges program and EnduroSat successfully developed the first Bulgarian CubeSat mission, with the main purpose to provide practically-oriented education on the topic of satellite communications for the first time in Bulgaria.

## Results (Read more [here](#))

- Successfully launched from the ISS in 2018. EnduroSat One succeeded in its mission and was recognised internationally.
- The cadets of Space Challenges (EnduroSat's space educational program) communicated with the satellite and downlinked telemetry.
- The first beacon signal was "Ode to Joy" by Friedrich Schiller, which helped the mission to go viral on social media.
- Enabled development of best practices in correct registration and launch preparation processes for future educational and Radio-Amateur CubeSat programs on local (Bulgarian) level.



INDUSTRY-LED ECOSYSTEM & EDUCATION

MISSIONS AS INSPIRATION

Credit: EnduroSat



# Space Challenges

## Case Study 4

### Space Challenges Program

- Space Challenges was born with the idea that space education should be fundamentally free and relevant to current space industry trends.
- It has enabled the development of local space talents utilising industry education and international partnerships. Welcomed leading experts from ESA, NASA, MIT, Berkeley University, IBM, Rolls-Royce, UK Space Agency, Airbus, SpaceX, Stanford, etc.
- 30% of all EnduroSat employees originate from the Space Challenges Program.
- Currently working on redefining higher education by making it 90+% **practice-oriented** and by mixing education and hard work on real space programs with placements.

INDUSTRY-LED EDUCATION

INTERNATIONAL PARTNERSHIPS



Credit: EnduroSat

# 7,218 Postcards to Space



## Case Study 5

- As part of her Karman Project Commitment, Aazzah Aziz aimed to collect 4,000 postcards from the youth of Brunei and send them to space with the partnership of Club for the Future. They successfully collected 7,218 postcards containing art, dreams and stories.
- *“When we did our 4000 postcards to space project, many organisations supported us: the national TV broadcaster, sporting and martial arts associations, primary and secondary schools, shopping malls, etc. We could see that space truly is an interesting topic for many people and 99% of the time, kids get the most excited and parents also enjoyed the fun. There are no age limits when it comes to space.”*
- However, we need to **raise the awareness among the adult demographic** as it is this demographic that should have more updated and relevant information about space technology and its benefits.
- Awareness and support from a broader audience will feed directly back into governmental investment.



INSPIRE YOUTH, BUT ELEVATE BEYOND

INTERNATIONAL PARTNERSHIPS

Credit: Aazzah Aziz

# ACCESS Mindanao



## Case Study 6

- Ateneo de Davao University (AdDU), in partnership with other academic institutions, government agencies, and private institutions (note: Triple-Helix Model), launched AdDU Community Connectivity Empowered by Satellite Service for Mindanao (ACCESS Mindanao) to provide alternative solutions using satellite technology to **address the problem of online connectivity**, democratize access to the Internet, and improve the quality of life for people in Mindanao.
- The program established a network of **schools, hospitals, businesses, and communities** that are linked to the Internet through satellites to provide connectivity to **remote and isolated** communities throughout the BARMM and Mindanao.
- Three-phase implementation:
  - ◆ Phase 1: Local pilot project
  - ◆ Phase 2: Expanding the satellite connectivity in Minanao
  - ◆ Phase 3: Utilise learnings for National Telecommunications Satellite
- As a component of the project, an information and education campaign is also being conducted to raise awareness in the target communities.
- Read more [here](#).

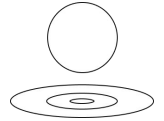
BURNING PLATFORM

TRIPLE-HELIX MODEL



Credit: Ateneo de Davao University

# Key Community Resources



Sese, R.M. (2022) 'Chapter 4, The Philippine Space Program: A Modern Take on Establishing a National Space Program', in *ASEAN Space Programs: History and way forward*. S.I.: SPRINGER, pp. 57–77.

Sridharan, D. & Silva, N. (2022). Global Space Strategy - Uniting Towards a Common Objective. IAC-22,E3,IP,6,x68243.

Sridharan, D. (2023). *Learning from Australia's Space Sector Rebirth: Constructive Insights for the Robotics Ecosystem*. S.I.: ARAA – Australian Robotics and Automation Association.

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