Renewable energy technologies for small-scale tuna fishery

In Indonesia, traditional handline fishers lose about 60% of the value of large yellowfin tuna harvested due to inefficient supply chains, lack of infrastructure, poor harvest handling practices, and other inadequate systems that compromise fish quality. To address this, Yayasan IPNLF Indonesia partnered with solar cooling experts in GIZ and Indonesia, private tuna industry partners, and a local community in a remote area of Indonesia to implement an off-grid, solar-powered ice maker and cold chain, and improve the tuna supply chain.

By deploying off-the-grid, solar-powered ice-making machines, the project aims to produce high-quality yellowfin tuna for high-value markets while also training fishers to improve handling practices, cold chain protocols, and asset management - ultimately enhancing livelihoods in a climate-friendly manner.

Innovative and transformational

This innovation is helping small-scale artisanal fishers in a remote coastal region in Indonesia to compete in the global seafood market by providing them with better cold chain and fish handling techniques, which can boost local economies as well as the Indonesian GDP.

The solar-powered ice maker can effectively reduce fish waste, and plastic waste generated during ice transportation. Replicating this innovation in other remote fishing communities, particularly in developing and underdeveloped nations, can provide significant economic benefits to small-scale fishers by securing livelihoods and alleviating poverty while promoting environmental protection.

Sustainability beyond OIC

Yayasan IPNLF is developing a business model to showcase the potential for investment in solar-powered ice-making systems as a self-sustaining enterprise. This model will help generate efficiencies and value in the fishery and offer better market access.

The ownership of the solar ice maker will be transferred to a private sector partner or the local fishery cooperative if they agree to manage and maintain the facility for at least five years, for the benefit of the community. Technical support from GIZ will assist fishery stakeholders in operating and maintaining the solar ice maker. Additionally, Yayasan IPNLF has been working closely with the Indonesian government to obtain institutional support in the long run. The global IPNLF team is also actively promoting the concept and progress of the project at international forums to attract investors, partners, and potential adopters.

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Key achievements so far

⇒ Conducted multiple fisher training sessions regarding fish handling improvements at sea and on land.
⇒ Finalized the design of the Solar Ice Maker system and selected the proper site for installation. Established an agreement with the site owner to operate and maintain the Solar system after full installation.
⇒ Improved machine design for easier housing of two 20-feet containers (previously, a building was required).
⇒ Installed eight pelagic data system devices to help track vessel activity.
⇒ Conducted cold chain and vessel quality assessment of handline tuna fishers in the remote community and developed an improvement action plan (implementation began in November 2023).
⇒ Solar ice maker construction is near completion, and control panel (final component) programming is underway.
⇒ Presented the innovation project at three international events for possible replication and scaling up in new locations.

Building Equity and Livelihood Resilience by Applying Renewable Energies in Indonesian Small-Scale Tuna Fisheries

WWF-Peru

July 2022 – June 2024

OIC financing $250,000
Peru’s fisheries sector is vital to its economy and its second-highest foreign currency generator after mining. However, Peru’s fisheries system is faced with regulatory problems — most fishing vessels are “informal” and fall under the illegal, unreported, and unregulated (IUU) fishing category due to the lack of documentation and registration. To address this issue, WWF-Peru developed TrazApp, a traceability system that allows users to follow the fish’s route in the different stages of the production chain. It collects, stores, shares, and visualizes pertinent data in real-time, providing a range of benefits, including improved illegal fishing detection; modernized data management supporting informed decision-making; and transparent fisheries management.

With the OIC’s support, the project is making TrazApp interoperable with private and government systems, such as digitizing and standardizing the administrative procedures and improving management data, as well as onboarding electronic monitoring technologies; and training end-users including fishermen and government officials how to use the upgraded TrazApp to increase transparency in the fisheries sector.

TrazApp is empowering fishing communities in Peru, including artisanal fishers, and providing access to greater economic independence, and making their role in the supply chain more visible.

**Key achievements so far**

- **Helped 48 fishing vessel owners obtain Single Taxpayer Registry (RUC),** allowing them to generate invoices and access markets.
- The San José Fishers Cooperative used TrazApp to collaborate and transact directly with the Oceano Seafood processing plant on 80 occasions. This transaction was initiated by WWF-Peru and resulted in over 80,000 kilograms of jumbo squid being sold by artisanal fishers directly to the plant, generating sales of over US$75,000.
- **Using TrazApp, thirteen vessels** by nine vessel owners marketed 714 tons of fish products.
- TrazApp is now connected to the IMARPE database, providing fishers with up-to-date prices for commercial marine species at each port.
- TrazApp is now the official system for issuing fishing permits in Peru, enforced by DICAPI, increasing transparency in the sector.
- A presentation to a Peruvian importer in Japan, led to a new TrazApp pilot agreement to track the fish products’ journey from capture to import.

**Sustainability beyond OIC**

WWF-Peru is establishing TrazApp as a national standard by gaining recognition and support from national fishing authorities and key players in the Peruvian seafood production chain. Its growing demand presents it as a promising fully tested traceability and financial technology platform.

WWF-Peru aims to develop TrazApp into a sustainable business model and will seek funding for strategic initiatives like expanding its user base, offering it as a software-as-a-service (SAAS) and business-to-business (B2B) service provider package, and launching it in other countries. WWF-Peru is investigating the feasibility of providing access to TrazApp through various membership levels and personalized services such as technology customization, training, and integration with national government systems.

**Ending IUU in Peruvian small-scale fisheries through traceability technology**

**WWF-Peru**

**July 2022 – May 2024**

**OIC financing** $190,000

**Realized additional co-financing** $148,393.54

**Anticipated additional co-financing** $190,181.38
This innovation offers a holistic and revolutionary approach to addressing the increasing environmental and economic challenges on the exploitation of the Caribbean spiny lobster, the region’s most economically significant fishery, with Bahamian exports generating US$90M annually. This innovation has three components. First is developing a novel genetic tool based on population genomic data for Caribbean spiny lobster, enabling improved, science-based management of this economically and ecologically important fishery. Second is the transfer the latest grow-out aquaculture technology and management, co-design small-scale grow-out operations for spiny lobster with fishers. This innovation will be accessible, community-led, and appropriate to Bahamian and the wider Caribbean context. Finally, by engaging with fishing communities and government policymakers, there will be increased awareness of the conservation challenges for this fishery, the science, and aquaculture-based solutions to protect it, and the economic benefit it provides. The project will also evaluate the feasibility of establishing a National Caribbean spiny lobster nursery in The Bahamas, drawing on the well-established model by the National Lobster Hatchery in Cornwall, UK.

Innovative and transformational

The University of Exeter’s innovative approach to enhancing the sustainability of Caribbean spiny lobster exploitation is empowering local communities and fishers to become agents of change. By taking a multidisciplinary approach jointly with local partners and developing groundbreaking tools, knowledge, and policy considerations, they are ensuring the effective management of Caribbean spiny lobster populations across the region. This project has the potential to boost small-scale fishers in the Bahamas and the wider Caribbean access to new markets and broader promotional opportunities.

Key achievements so far

⇒ Collected and performed quality control of 839 Caribbean spiny lobster samples, representing 29 sites across 15 nations and including samples of 4 closely related panulirid species.
⇒ Sequenced 384 of the best quality range-wide samples, to generate a unique dataset with approximately 5 million reads per sample.
⇒ Completed two knowledge exchange activities in the Bahamas with local fishers, where the University of Exeter and partners co-designed grow-out practices and operations with the fishers.
⇒ Deployed 15 novel grow-out cages across 2 sites on Eleuthera island to assess cage fouling dynamics and ability to support lobster growth.
⇒ Established land-based grow-out trials, with 55 pueruli and juvenile Caribbean spiny lobster.
⇒ Conducted three stakeholder engagement activities: two focus groups targeted at school-age children (11 to 14), with 26 children participating, learning about the importance of spiny lobster, and the possibilities of aquaculture; a focus group with eight community members of Tarpum Bay (Rotary Club); and interviews with 15 fishers from across the Island of Eleuthera to learn their views on sustainable fisheries, spiny lobster and aquaculture.

Sustainability beyond OIC

At this stage, the University of Exeter has already engaged with other funders, philanthropic organizations, and charities to fund other aspects of this project (e.g. development of a collector-building trade on the island, establishment of a small nursery and scheme to support fisher collection of juveniles). The University of Exeter has also been approached by representatives from other governments in the region (Jamaica, Bermuda) who are keen to explore whether the approach is transferable. They will continue to pursue these opportunities to ensure wider adoption of the innovations both locally and regionally in the long term.
Accurate data and assessments are cornerstones of well-managed fisheries, but only about 17-25% of stocks globally are assessed for stock status.

The Sustainable Fisheries Partnership Foundation (SFP) uses advanced digital technology for global fishery identifiers to improve catch reporting, helping managers identify where IUU fishing is happening and the scale of the problem. This will also help both managers and small-scale fisheries, where a lack of fisher registration is an impediment to effective management.

SFP will test the IDs in two different supply chains representing a small-scale fishery in the Philippines; and an industrial fishery in South Africa.

These pilots will allow SFP to develop a business plan on deploying the world’s first public database of unique fisheries IDs to the rest of the global seafood industry and its stakeholders using existing and new technologies.

Universal Fishery IDs

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Innovative and transformational

This will be the world’s first global standard and fishery identifier database. It will be hosted by the UN FAO, giving it credibility and accessibility. The seafood industry and its stakeholders will have a new and better way to share data and information about fisheries that are commercially traded. The application of these IDs can transform food identification systems for wild fisheries, reduce the potential for mislabeling, improve governments’ ability to track exports and imports, and simplify seafood data collection and traceability for seafood businesses across the supply chain. The project unlocks inefficiencies in how the seafood industry operates by changing its behavior toward identifying fisheries and sharing information. SFP will also train producers, particularly small-scale fishers to enhance their understanding of end-market requirements and pricing using the Universal Fishery IDs, and help them make informed business decision.

Key achievements so far

- Compiled a database of stock and fishery management areas of over 1,200 areas globally and validated over 1,500 unique fishery ID codes that will soon be made publicly available.
- Partnered with the Philippines Bureau of Fisheries and Aquatic Resources (BFAR) as well as Chicken of the Sea (a US importer), and Wholechain (traceability provider) to pilot the fisheries IDs in the Philippines.
- Trained over 30 women and 20 men on the application and benefits of the IDs.
- Launched the fishery IDs with over 200 people in the Philippines, including fishers and their families, facility workers, local and national government representatives, USAID representatives.
- Tested the fishery IDs through its supply chain with Chicken of the Sea, Wholechain, Phil Union (a Philippines exporter), Publix (a US retailer).
- Ongoing second pilot project using a South Africa yellowfin tuna and swordfish supply chain with Cape Fish (a South Africa exporter), Envisible (a US distributor), Giant Eagle (a US retailer), Wholechain. The South Africa government has also expressed interest.

Sustainability beyond OIC

SFP secured FAO’s commitment to sustain the IT infrastructure for fishery IDs that hosts the GSRF and fishery ID indefinitely. SFP will maintain the standard for IDs and promote their usage. The business plan will outline expansion strategy, revenue generation, and budget for partnering with investors and funders.

SFP plans to roll out the IDs to its strong network of seafood companies, fishers/fisheries, and service providers. The fishery IDs will also be embedded in free and publicly available tools, such as SFP’s FishSource.org, and Ocean Disclosure Project (ODP). As the innovation scales up throughout the seafood industry, sustainably managed fisheries in small island developing states (SIDS) and developing countries have more opportunities to market their products internationally.
Space Data against IUUF

The Surrey Space Centre at the University of Surrey, and the Mauritian Research and Innovation Council are designing, developing, and validating a nearly real-time satellite-based application able to detect illegal, Unreported and Unregulated Fishing (IUUF) activities in the Mauritius Exclusive Economic Zone (EEZ), with characteristics of automation and high scalability to the rest of the world. The ocean innovation, NEREUS project, uses satellite data from Synthetic Aperture Radar (SAR) and self-reporting data like the Automatic Identification System (AIS). One of the offline products of this innovative tool, is a heat map product that identifies areas where ships frequently do not report over some period. The tool will provide a real-time component that triggers satellite tip-and-cue actions following an anomaly detected in the AIS data.

Innovative and transformational

The innovation provides a ground-breaking, nearly real-time, and automated space-based maritime surveillance solution for illegal fishing, with powerful remote sensing imagery to detect “dark” ships potentially partaking in illegal fishing activities. Once the innovation is adopted nationally in Mauritius, it can provide an accurate understanding of the economic losses caused by exploiting marine resources, and avoid a potential loss of, in the worst-case scenario estimates, US$10M per year. NEREUS can aid authorities in facilitating economic recovery measures and sustainable fisheries policies. It can help replenish tuna stocks and positively impact the ocean environment. The entire tool can be transferable to other EEZs and Marine Protected Areas (MPAs), even globally. Scaling it up to the entire Indian Ocean can have a minimum 25x multiplier effect.

Key achievements so far

- Acquired about 250 spaceborne radar datasets from the UK NovaSAR mission over the Mauritius Exclusive Economic Zone, the largest light-and weather-independent spaceborne collection ever acquired over Mauritius.
- Trained more than 50 delegates on Synthetic Aperture Radar as part of the capacity building component. Participants measured an overall knowledge improvement, in some areas, exceeded 35 percent gain.
- Conducted an in-person stakeholder workshop in Mauritius with 60 attendees from different organizations, the local community, and two ministers from the Mauritian government to raise greater awareness among stakeholders and enable the end-users to share their expectations and requirements to learning and using a tool such as NEREUS.
- Promoted Nereus and its innovativeness, and the problem of IUU fishing online and in five in-person international events in four continents, reaching more than 1000 people.
- Produced and delivered 15 (out of 22) outputs that together contribute to the project’s four outcomes on quantifying the extent of IUU in Mauritius, assessing its economic impact, supporting local authorities and the ocean biodiversity preservation.

Sustainability beyond OIC

The innovation is designed to encourage Mauritius authorities to adopt the NEREUS tool, which has been developed according to their needs as end-users. The innovation’s algorithms are being transferred onto a monitoring platform (Skylight), which is already in use by the Mauritius authorities.

In the long term, the innovation will replicate the technology in other countries that face similar IUUF threats. The evidence produced for Mauritius and the contacts made during the first project workshop with the wider region of the Indian Ocean can enable the transfer. Additionally, the project also aims to transform the tool so that it can contribute to the Blue Economy more broadly. The NEREUS team has already conceived concepts for parametric insurance products based on satellite evidence and is actively exploring for additional funding options.
Key achievements so far

⇒ Published the Guidelines for Implementing Value Rescue in Small-Scale Fisheries Manual in English.

⇒ Fifteen (15) cooperatives have tripled the amount of harvested sustainably produced seafood destined for preferential markets since the project started, from 20,000 kilos to 60,000 kilos. Fishers’ earnings increased by 7% to 56%, depending on the species.

⇒ The cooperatives have increased the value of their harvests by processing them locally, guaranteeing quality, safety, and digital traceability through SmartFish’s software partner, Plenumsoft Marina. SmartFish installed Iluméxico’s solar technology into their processing facilities to mitigate the effects of power outages and decrease their reliance on the traditional power grid.

⇒ SmartFish is working with Bitácora Social, a group of anthropologists, to identify opportunities to understand local norms better and foster more equitable inclusion and visibility of women in the value chain.

⇒ Registered four new Fisheries Improvement Projects (FIP) on FisheryProgress.org, demonstrating compliance with the widely recognized certification standards of the Marine Stewardship Council.

⇒ SmartFish continuously works with partners to replicate the VRM in up to 50 cooperatives.

Sustainability beyond OIC

The VRM services are designed to be entirely self-sustainable and do not require philanthropic support. SmartFish’s business advisors assist the cooperatives in comprehending and documenting their production costs so that they can accurately determine the actual cost of implementing best practices and pass these costs on to the buyer. Throughout the collaboration’s appropriation phase, the fishers, cooperative leadership team, and plant personnel continue to adopt self-sustaining best practices without external financial assistance. The cooperatives’ access to premium markets and their relationship with the buyer are designed to ensure compliance with environmental sustainability standards, and the seafood product handling and processing traceability system and best practices are used. SmartFish secured philanthropic funding from foundations in the United States and Mexico for three years (2024-2026) to implement the VRM with fisher cooperatives in the Baja California Peninsula and other regions of Mexico.

Value Rescue of Small-Scale Fisheries in Mexico

SmartFish Rescate de Valor, AC
July 2022 – June 2024

OIC financing $240,000
Realized additional co-financing $247,363
Anticipated additional co-financing $3,382,409
Behaviors of Distant Water Fishing Fleets

The innovation addresses a fundamental data gap on distant water fishing (DWF) fleets to help inform sustainable fisheries policies in five developing economies - Senegal, Ghana, Peru, Ecuador, and the Philippines. These countries are some of the most vulnerable fisheries in the world where the impacts of unsustainable fishing affect people’s income, employment, and food security the hardest.

The project is aiming to: a) visualizing, defining, and investigating the scale, form, and behavior of the international and national DWF fleets operating within the Exclusive Economic Zones (EEZs) and surrounding waters of each country; b) studying and comparing IUU fishing and unsustainable behavior of the DWF fleets in these EEZs to identify patterns and commonalities, as well as concrete vessels (including the companies behind them); and c) estimating the economic losses derived from this activity to build a business case for policy and enforcement reform.

Innovative and transformational

ODI is developing a much-needed replicable blueprint and a robust new database to help assess the extent of DWF in the EEZs and support effective policymaking and planning to tackle illegal, unreported, and unregulated (IUU) fishing. This scientific research combines social and data sciences using big data analytic techniques, machine learning (ML) and ensemble algorithms, and GIS that will enable users to understand the social practices, regulations, and implications of DWF. The outcomes of this innovation will support policymakers and other stakeholders in the five countries with evidence and analysis of fishing activities, to help them interpret and use the data to form a business case for policy and enforcement reform. Outcomes will include an open-access data repository to enable interested parties to replicate and scale up this type of data analysis. By filling data gaps and producing fundamental analysis on DWF in EEZs, the project will strengthen the regulatory environments in which these practices happen and the enforcement efforts to stop IUU fishing and unsustainable fishing practices.

Key achievements so far

- **Set up a relational database of vessels** flagged to the five countries in the study and the foreign fleets that operated in their waters, allowing researchers to interrogate the database interactively.
- **Developed and tested deep-learning models** to identify full-blown fishing maneuvers tailored for distinct fishing maneuvers that proficiently gauges the likelihood that a given set of automatic identification system (AIS) points.
- **Deployed Geographic Information System (GIS) technology** to map and visualize where vessels are and how they move that helps researchers identify suspicious behavior, alert the regional focal points, and investigate further.
- **Identified most of the main types of fishing per national fishing fleet** in the database.
- **Identified the main foreign fishing fleets operating in each EEZ and their main types of fishing.**

Sustainability beyond OIC

The methodologies used in the innovation are replicable and scalable to explore other challenges related to sustainable fishing. All resources – including the open-access data repository – will be made freely available on ODI’s website, which is maintained and updated regularly. Key resources will also be shared with a range of relevant stakeholders, including governments and policymakers, as well as other stakeholders with an influence on DWF, via webinar training, targeted emails, social media, and media outreach to ensure the results are incorporated into ongoing work and to ensure the longevity of the project in coming years.

Illegal, unreported, and unregulated (IUU) fishing and unsustainable behaviour of Distant Water Fishing Fleets

ODI

July 2022 – May 2024

OIC financing $249,536.87
Iluminar el Mar

Fisheries bycatch is a major concern in Ecuador’s marine resources, where several species, including those that may be endangered, are accidentally caught in fishing equipment. The artisanal fishing industry is particularly at risk of incurring costs associated with fishing bycatch, as larger species, such as sea turtles, can damage fishing gear and reduce catch per boat effort. Non-certifiable fish catches also receive lower market prices. Therefore, there is an urgent need for effective and scalable solutions that can help lessen bycatch while supporting livelihoods in artisanal fishing communities.

The innovation is testing the effectiveness of Bycatch Reduction Technologies (BRT) in the nearshore gillnet fishery in Jaramijo, Ecuador to substantially reduce turtle and other megafauna bycatch without affecting fishers’ catch. The project is supported by a sustainable business model that provides participating fishing crews additional access to export and domestic markets. This initiative aims to ensure that artisanal fishers can sustain their livelihoods in the long term by helping maintain fish stocks and reducing impacts on endangered species in the Pacific Ocean.

NOTE: In May 2023, SafetyNet Technology Limited, the primary contracted innovator, asked to withdraw from the project implementation due to the company’s financial risks. Their project partners, Mare Nostrum and the Leatherback Project offered to take over the responsibility as the project lead and to continue the project implementation as stated in the original contract with the remaining project budget. After several consultations with the UNDP’s Procurement and Legal Team, and the deliberations of the OIC regarding Mare Nostrum’s technical and financial capacities, the contract with SafetyNet Technology was terminated. A new contract was signed with Mare Nostrum to carry on with the ocean innovation.

Innovative and transformational

Iluminar el Mar is conducting scientific research on the effectiveness of led light bycatch reduction technologies while evaluating the socio-economic viability of that technology and developing an adequate business plan for implementation. The OIC innovator began the six-month trial for two bycatch reduction technologies (BRT) for the first time in Ecuador - light deterrents and electromagnetic devices with full participation of the local stakeholders from various sectors. The results of the scientific experiments with innovative applications of the BRTs will contribute to the development of a practical model for light’s application as a marine turtle bycatch-reduction tool.

The ultimate goal is to reduce fishing’s impacts on marine biodiversity and make fishing practices more sustainable while generating new opportunities for small-scale artisanal fisheries to access higher-quality markets. This project aims to actively support the recovery nearshore gillnet fishery in Ecuador and help Ecuadorian authorities develop policies supporting market access through fisheries management models based on the conservation of marine species and responsible fishing. The team aspires for Ecuador to become the first country in the world to adopt bycatch reduction technology and spark hope for the restoration and protection of our ocean.

Key achievements so far

⇒ Organized a team of government allies, biologists, fishermen, onboard observers, and legal advisors working to execute this project.
⇒ Led two fishermen workshops to educate the fishing community about Project Iluminar el Mar.
⇒ Conducted a socioeconomic evaluation of the effects of fisheries bycatch on the artisanal gillnet fishing community, which can be published in a scientific journal.
⇒ Trained onboard observers in the data collection needed to execute the trials.
⇒ Launched the fisheries trials in collaboration with fishing cooperatives and support from the government agencies.

Sustainability beyond OIC

The innovative business model to implement BRTs into small-scale fisheries will be rolled out incrementally, starting with the ports with the highest bycatch rates. Implementation in a percentage of each fleet could take place per year until the target number of vessels is outfitted. Monitoring of BRT use by fishers will take place through yearly renewal of fishing licenses. A human-centered design study will be conducted to address questions about implementation, maintenance, and funding. The preliminary results of this innovation will be used to explore additional funding for other project in Ecuador as well as in other countries in the region such as Panama and Colombia.
In the Maldives, women play a crucial role in turning fish into income, but they face challenges like delayed payments, unreliable buyers, and a lack of financial resources. International Pole and Line Foundation (IPNLF) Maldives is introducing a transformative solution connecting women fisherfolk in the Maldives to a digital market platform.

The platform enables women fisherfolk to manage their production and sales data, receive direct payments, conduct online financial transactions, build credit histories, and access financial tools. This innovation empowers women in the fishing industry by granting them control over marketing and branding, enhancing the value of their fish products, ensuring transparency and traceability in the fisheries chain, and providing consumers with detailed product information.

**Key achievements so far**

- Conducted a baseline survey and published the baseline and technical feasibility report capturing data and information to understand women's fish processing activities better and address challenges.
- Trained 50 women in business, digital and financial literacy, as well as food hygiene and safety for fish processing.
- Conducted three consultations with women and project stakeholders on developing an e-commerce platform.
- Developed two iterations of the e-commerce platform, eDhumashi—one for customers and another for suppliers; a corporate website; and an admin portal, all available in English and Dhivehi with a unique branding image.
- Continuously testing, fixing bugs, and polishing the e-commerce platform in preparation for the full launch of eDhumashi platform.
- Assisted six women in formally registering their new business and in signing them up and their products to eDhumashi.
- Developed communication and marketing strategies and implementation plan to promote the platform and the women fisherfolk's products.

**Sustainability beyond OIC**

IPNLF Maldives is driven by a vision of empowering women in the fisheries sector. To achieve this, they are expanding eDhumashi and encouraging more women from diverse regions to sign up and sell on the platform for free. The organization is working towards creating a sustainable business model that involves private entities, transaction fees, and international retailers/investors who share their passion for empowering women. IPNLF Maldives is committed to promoting eDhumashi through innovative marketing strategies and partnerships with global organizations.