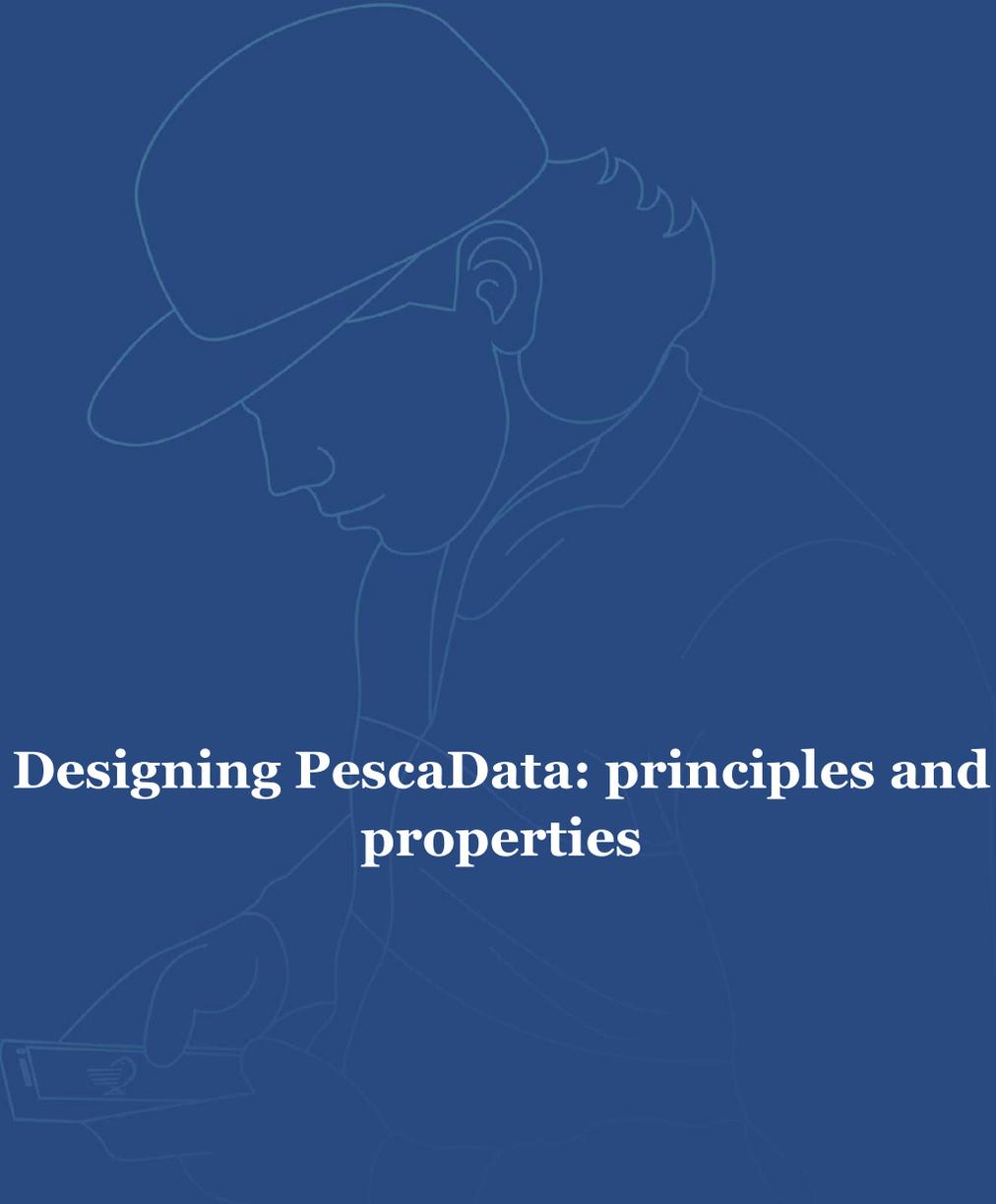




COBI

Comunidad y Biodiversidad



**Designing PescaData: principles and
properties**

Extended Summary

Technology in fisheries is being implemented at an ever more rapid pace. Electronic catch logs, smartphone applications, blockchain traceability, and artificial intelligence are just some of the many rapidly developing fields. Traceability has been identified as a key area in which technology can improve transparency and trust in the supply chain. As such, there has been a proliferation in the number of digital platforms to meet this need. In 2020, Comunidad y Biodiversidad (COBI), launched the PescaData mobile application, as part of the Innovación Azul digital ecosystem. Innovación Azul is a social enterprise that will be co-owned by fishers, fishing groups, NGOs, and other stakeholders in the ocean conservation community, facilitating collaboration, and providing a digital infrastructure for small-scale fishers in Mexico, Latin America and the Caribbean.

In this review we cover the design principles considered during the design of the Innovación Azul digital ecosystem, and specifically, the PescaData mobile application. We review two ICT for fisheries design principles, from the [Seafood Alliance for Legality and Traceability](#) (SALT), and the [Global Dialogue on Seafood Traceability](#) (GDST), and two platform design principles, the [Ten Principles of Platform Cooperatives](#) and the [Design Principles for Systems Change](#).

PescaData is not a market-driven technological solution (in contrast to most traceability technology), rather, it provides software as a service to fishing organizations, helping them digitalize their processes and breach the digital divide. However, during its design and development it has been important to consider the different types of design principles, particularly with the goal of interoperability with existing platforms and for providing holistic digital services to fishers. At present, PescaData fully considers 75% of the SALT principles (partially considering a further 16%), and 40% of the GDST key data elements (partially considering a further 14%). Most of the areas where PescaData does not consider these two design principles relate to aspects such as transshipment of fisheries products, overcoming trade barriers or exporting seafood, areas beyond PescaData's design remit. This does not exclude the future incorporation of this information but reflects the slightly differing focus of PescaData to the traditional traceability schemes.

The principles for platform cooperatives are mostly applied, with some gaps around the principles that focus on technology applications that provide direct employment, as opposed to PescaData which provides software as a service. These principles are important to consider however, particularly as PescaData is currently transitioning to a start-up company that needs to develop and fair and equitable governance structure, with future visions for an exit-to-community.

Finally, the design principles for systems change have been an integral part of PescaData's development and are considered across the platform. Some areas for improvement are noted, or are yet to be fully incorporated (e.g., the incorporation of digital ledgers such as Holochain to more effectively distribute data and control).

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Introduction

Technology in fisheries is being implemented at an ever more rapid pace. Electronic catch logs, smartphone applications, blockchain traceability, and artificial intelligence are just some of the many rapidly developing fields. Traceability has been identified as a key area in which technology can improve transparency and trust in the supply chain. As such, there has been a proliferation in the number of digital platforms to meet this need. As with any information and communication technology (ICT) initiative, there are many ways to meet the proposed goals and a burgeoning number of apps and software for traceability are being developed to meet local, specific, or general needs. This has created the need to unite and standardize visions for technology in traceability and create principles and standards for interoperability and collective action across the seafood value chain. At the same time, we are entering the era of the Web 3.0, where data sovereignty and privacy are an ever more apparent demand from users of digital platforms. Nobody likes to feel that their smartphone or computer is spying on them. Yet, at present we often design ICT for fisheries using these exact same principles, where data collected by a fisher or on a boat disappears into the cloud, never to be seen by the fisher again. Considering design principles for just system design should also be considered for ICT in fisheries.

Innovación Azul is a social enterprise that will be owned by fishers, fishing groups, NGOs, and other stakeholders in the ocean conservation community, facilitating collaboration, and providing a digital infrastructure for small-scale fishers in Latin America, and the Caribbean. Innovación Azul, and its beachhead app [PescaData](#), provide a web-based enterprise dashboard for fishing cooperatives and organisations, business operation tools for fishers, a marketplace for goods, services and ideas, and mechanisms to measure all stakeholders' contributions to international goals such as the Sustainable Development Goals (SDGs) and FAO's Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries. By 2025, we intend to reach 300,000 fishers in Mexico, and 1.2 million in Latin America and the Caribbean by 2030 - connecting them with each other, with fishing organisations, with investors, and with other key stakeholders, to work towards resilient communities and healthy oceans, together.

In this review we cover the design principles considered during the design of the Innovación Azul digital ecosystem, and specifically the PescaData mobile application. We review two ICT for fisheries design principles, from the [Seafood Alliance for Legality and Traceability](#) (SALT), and the [Global Dialogue on Seafood Traceability](#) (GDST), and two platform design principles, the [Ten Principles of Platform Cooperatives](#) (Scholz 2016) and the [Design Principles for Systems Change](#) from Armillaria (2021).



Design principles covered in this review

Seafood Alliance for Legality and Traceability (SALT)

SALT is a global community in which governments, the seafood industry and NGOs share ideas and collaborate on solutions for legal and sustainable seafood with a focus on electronic catch documentation and traceability (eCDT) and the transparent movement of seafood through the supply chain. SALT's goal is to facilitate collaboration between organizations and governments working in the seafood supply chain. The [Comprehensive Electronic Catch Documentation and Traceability \(eCDT\) Principles](#) were published in February 2021 to support social, ecological, and economic objectives in supply chains providing and synthesising best practices for designing and implementing electronic traceability programs.

Global Dialogue on Seafood Traceability (GDST)

GDST was founded in 2017 as a B2B process to establish industry-led standards for interoperable seafood traceability systems, with the goal of ensuring the legal origin of seafood products and responsible sources policies for seafood buyers. GDST has 64 members. In February 2020, GDST published their [Standards and Guidelines for Interoperable Seafood Traceability Systems – Core Normative Standards \(Version 1.0\)](#). These standards are intended to serve as voluntary industry standards governing traceability practices across the entire seafood sector.

Principles of platform cooperatives

Trebor Scholz, who coined the term “platform cooperativism” in a 2014 article which criticized the internet giants and large sharing economy platforms, calling for more democratic control of platforms that allow people to create value online. In 2016, Scholz published ten principles for platform cooperativism in the book [Platform Cooperativism: Challenging the Corporate Sharing Economy](#) (Scholz 2016.)

Design principles for systems change

[Armilaria](#), a systems design laboratory, and development partner of Innovación Azul, developed ten principles for systems change, originally published in the [concept paper](#) *From Billions to Trillions: How a transformative approach to collaboration and finance supports citizens, governments, corporations, and civil society to share the burdens and the benefits of solving wicked problems*. These ten principles, updated in 2021, are core design principles for digital ecosystems.

Innovación Azul and PescaData

Latin American small-scale fisheries are diverse, dispersed and data-poor. Small-scale fishers catch a large range of species, using small boats (usually less than 10m long) and are often grouped in cooperatives or similar types of fishing organisations. Mexico has over 300,000 small-scale fishers, and many more in the value chains. Mexico also has over 5,000 small, coastal communities, where fishing is a key part of local economies. Latin America and the Caribbean have more than 1.2 million small-scale fishers. Men are highly represented in the capture part of the fishery, but women play important roles in pre- and post-embarkation, particularly in processing and sales. Women's roles are often invisible, and a digital divide exists between both men and women and in rural communities. Fisheries management and marine conservation is ripe for disruption. Despite decades of investment, the impacts of climate change, overfishing, and pollution on ocean ecosystems and coastal communities continue to increase. Latin-American fisheries continue to be data-poor, with under-funded management and a continued battle between increased production and meeting sustainability goals.

Innovación Azul is an initiative launched by Comunidad y Biodiversidad (COBI) in 2020. Currently property of COBI, Innovación Azul is transitioning to a start-up model with platform cooperative principles, with a governance structure that allows the participation of fishers, fishing groups, and other stakeholders in the ocean conservation community, facilitating their collaboration and providing a digital infrastructure for fisheries in Latin America and the Caribbean. By taking a start-up approach to ocean conservation, Innovación Azul and its partners allow the collective development, sharing, and scaling of solutions to the ocean crisis. Tools that provide utility to fishers (such as catch logs, data visualization, fishing organization management) are included in an integrated digital ecosystem alongside modules for sales, services, and digital collaboration across a Latin American network of fishers. By incorporating distributed ledger technology user data are attributed and protected, data sharing decisions are put into the hands of the user, and any value created in the ecosystem can be returned to the users. Finally, Innovación Azul is highly modular, with API integrations allowing other platforms to easily connect, continuously increasing the utility provided to fishers.

[PescaData](#) is a smartphone app, available on [Android](#) and [iOS](#), that provides the entry point for fishers in to the Innovación Azul digital ecosystem. It contains a digital logbook, a marketplace for products, services and ideas, forums for peer-to-peer communication and mechanisms to document and co-create solutions to problems in small-scale fisheries and coastal communities. The network contains built-in data aggregators that measure the contributions that fishers and other stakeholders are making to international targets like the Sustainable Development Goals (particularly, SDG 5, 8, 13 and 14) and FAO's Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines), allowing the impacts of actions to be measured, and adaptive strategies to be proposed.

PescaData contains:

- Logbook - users can create catch logs for fishing trips, selection species and fishing information, location, bait, gear types, biometric data (size and weight) and expenses.
- Market - The marketplace lets users post offers, asks and discussion posts.
- Solutions - A solutions exchange allows users to post solutions to common problems. Connectivity to other solution exchanges is being developed.
- Species Guide - With support from [CONABIO](#), a curated species list of over 600 marine species is available

- Coop Directory - an online [directory](#) of over 5,000 fishing organisations provides an onramp to PescaData for fishing organisations and a searchable platform for buyers or other interested parties to search for fishing organisations based on species caught or sustainability goals.
- Online dashboards - [web-based dashboards](#) provide fishing organisations with a data management interface to visualise catch data, manager users and select sustainability criteria.
- Admin dashboard - an admin dashboard provides PescaData staff with admin privileges over users, fishing organisations, boats and the marketplace

PescaData and the market

PescaData is not a market-driven technological solution (in contrast to most traceability technology), rather, it provides software as a service (SaaS) to fishing organizations, helping them digitalize their processes and breach the digital divide. PescaData does, however, include a marketplace. This marketplace is designed to promote peer to peer interactions and local economies and is more geared towards helping coastal community members find goods and services (e.g., outboard motor repairs, sell fishing gear etc.) than commercialize landings.

As we now know, data are valuable, and data economies have sprung up alongside many applications of technology. We know that data collected in PescaData can be valuable, particularly if aggregated, for market research, scientific research, or other uses, particularly is PescaData reaches its goals of connected 300,000 Mexican small-scale fishers and more across Latin America. With this in mind, data aggregators are being built in to PescaData, but data sovereignty is a key principle – any data belongs to the entity that created it. This means that data markets can also be created based on information generated in PescaData. This will likely require the implementation of distributed ledgers to track micropayments across the ecosystem, and these mechanisms are currently being explored.

Applying the SALT principles and GDST Core Normative Standards to Innovación Azul

Below we review the SALT principles and GDST Core Normative Standards and their relevance to Innovación Azul and the PescaData mobile application.

Important considerations and key differences

- The need to create the SALT principles and GDST standards highlights that the electronic catch documentation and traceability (eCDT) market already has an increasing number of platforms which are competing to fill an important niche SALT and GDST have clear electronic traceability advancement goals. PescaData does not. PescaData aims to provide SaaS to fishing organizations in Latin America who are traditionally underserved by digital tools and help them move towards sustainability. This is a key difference between PescaData and the platforms that the SALT principles were created to guide, or the data elements that GDST consider to be key.
- Innovación Azul/PescaData, through API connectivity, are designed to connect fishers to services that work. For this reason, PescaData pulls species (photos and information) from the iNaturalist/Naturalista network, with further API integrations in the pipeline. Rather than replicate an eCDT system, PescaData aims to connect to existing platforms and help small-scale fishers seamlessly move catches into traceability schemes, while simultaneously improving the technological prowess and administrative capacity.
- Small-scale fisheries in Latin America are often multispecific. Traceability programs generally focus on one, or a few, species that consumers demand, particularly in export markets to high income countries. PescaData's logbooks provide fishers with the means to record everything their capture, with data sharing decision-making being placed in the hands of the fisher.
- The digital presence of small-scale fishing organizations in Latin America is low. As an example, in 2021, of over 6,000 fishing cooperatives in Mexico, less than 50 were found to have a digital presence (website/Facebook page). PescaData's public directory helps fill this niche. eCDT systems generally require a certain level of technological proficiency which may limit their implementation in some developing country markets at present.
- PescaData is a bottom-up approach that aims to grow organically in the LAC fishery sector. By providing SaaS to fishers and fishing organizations, the digital needs of many fishers can be met. Traceability systems are generally a market-driven approach that aim to meet the needs of socially responsible buyers and consumers.

Below, we review each of the SALT principles and GSDT Core Normative Standards. The colour in the final column represents the status of the application in PescaData-Innovación Azul (Green = fully considered. Yellow = partially considered. Red = Not considered or Not applicable)

The SALT principles

Initiate: Research and Engage			
Principle	Pathway step	Application in PescaData (PD)/Innovación Azul (IA)	
Be inclusive and collaborative with stakeholders	Define goals and scale of eCDT program	IA has been developed in direct collaboration with LAC fishing communities to help meet their ICT needs and modernize the sector. Fishers have provided input at every design and testing phase for PD and have been part of the development of the goals of the overall project. The support of a network of fishers (“La Red”) has been key for this coordination.	
Use data to inform decision-making	Learn from existing programs	IA builds on the unmet needs of previous ICT in fishery efforts. Data silos were common, privacy and data sovereignty not respected, and it was ICT for <i>fisheries</i> , rather than for <i>fishers</i> . By creating a holistic and just digital ecosystem that is modular by nature, ICT can reach more fishers and meet their needs.	
Use data to inform decision-making	Conduct research, assessment, or gap analyses on the existing programs and enabling environment to identify supporting regulatory frameworks, enforcement, and political will	IA is a real-world application of the https://trillions.global/ framework which describes a transformative approach to collaboration and financing that can help solve wicked problems. Alongside the Mexican Institute for the Social Economy (INAES), we have researched the legislation framework for platform and data cooperatives and conducted market studies and surveys to document the needs of the fishing sector.	
Use data to inform decision-making	Characterize the supply chain	PD is not a supply chain app, but it is designed to connect to ICT that meets this need. For this reason, PD required a characterization of LAC SSF in general as the goal is to provide SaaS to as many fishers as possible as part of the process of bringing them in to the digital ecosystem.	
Use data to inform decision-making	Assess existing exposures and risks	Risk management has been considered throughout platform development. Risks related to IUU fishing, illicit online activities, data privacy and sovereignty, and user safety have all been considered and mechanisms are being put in place to nudge towards best practices (e.g. alerts on out of season species, improved information supply to fishers for better decision-making).	
Maximize ecological, social and economic benefits	Gather economic data to prepare for cost-benefit analysis	All ICT for fisheries needs to be financially sustainable over time. IA has a business plan that includes diverse revenue schemes built including subscription fee, sponsorship, and leveraging the platform for investors. User data can be monetized with user consent, with any profit generated from data being channelled back to users to implement sustainable fisheries projects.	
Be inclusive and collaborative with stakeholders	Be inclusive in identifying stakeholders	PD welcomes all stakeholders. The current PD role out focuses on small-scale fishers in Mexico, Honduras, Colombia, and Ecuador, before full LAC expansion. However, the PD app is open for use in any scenario and does not require a complex onboarding process. Researchers, government, and CSOs are also stakeholders who can use the ecosystem.	
Be inclusive and collaborative with stakeholders	Communicate incentives/benefits to foster stakeholder participation	Clearly communicating incentives are a core part of any initiative. PD launched a digital media campaign targeting 300,000 Mexican small-scale fishers in February 2021. During 2021, this campaign reached 100,000 people per month on Facebook, the principle social network. We have also held training sessions for fishing organizations, civil society and government to inform them about the tool. As	

		expected, we've identified that incentives to use PD vary widely across the heterogenous fishery community, with some fishers needing simple catch log tools, while other are more interested in connecting with other fishers.	
Be inclusive and collaborative with stakeholders	Consult stakeholders early, repeatedly and with sensitivity to their needs	Stakeholders were consulted throughout the design process. Through workshops and consultations, fishers provided insights and feedback to the development of the technology, rollout, and implementation. Users continue to be consulted, through feedback surveys launched in PD.	
Be inclusive and collaborative with stakeholders	In consultation with stakeholders, clearly define objectives (ecological, social, and economic) of the comprehensive eCDT program	All components included in the ecosystem have been developed with fishers, during consultation phases, and feedback. Multi-year objectives have been developed to meet ecological, social and economic needs of fishers and the sustainable fishing community in LAC. A particular focus has been on data-driven decision-making for fishing organizations and equipping them for a digital transition. Including youth and women as key stakeholders in fisheries who are often excluded from decision-making processes has also been key, as these stakeholders have also often been leaders in the implementation of technology.	
Design: Infrastructure, coordination, technology & institutionalize			
Principle	Pathway step	Application in PescaData/Innovación Azul	
Address data verification needs across fisheries supply chains	Map data needs and constraints along full supply chain	PD does not address the full supply chain (to end consumer), rather components of PD address the needs of producers and fishing organizations at the beginning of the supply chain. By improving data collection at the beginning of the supply chain, supply chains are strengthened along their entire length. Many key data elements that are needed for traceability are already included in PD's catch logs (such as vessel information, permit information, fishing trip dates, species captured etc). During 2022 PD's data elements will be mapped to existing traceability measures to evaluate progress and compatibility.	
Address data verification needs across fisheries supply chains	Design eCDT program with verification needs and challenges in mind	PD does not include catch data verification protocols. Fishers are reporting to themselves and their fishing organizations, reducing the incentives to withhold or omit data at that stage of the supply chain. Integration with an eCDT would require verification steps to be developed to meet the eCDT platform needs.	
Address data verification needs across fisheries supply chains	Ensure data security and data access protocols	In PD users own their data. Decision-making over data usage is in the hand of the user. Distributed ledger technology will allow data to be tracked across networks. How this data sovereignty would be applied further down an eCDT supply chain is yet to be defined and would depend on the traceability provider. We have strong privacy policies (GDPR compliant) and have designed with data privacy principles.	
Build a lasting and scalable program	Identify potential pilot sites	PD was piloted in 19 communities and 18 fishing cooperatives during 2020. Fishers provided feedback on the app, and adjustments were made accordingly to improve UI/UX and implementation. Pilots continue, now with partner organizations across LAC who better understand local conditions.	
Maximize ecological, social and economic benefits	Design eCDT program to fit within larger fisheries management program	By using PD fishers are able to collect information about their fishery, visualize data through simple user interfaces and use the social tools to connect with other fishers to share improvements. Additionally, the web-based interfaces allow fishing organizations to share their sustainability achievements and track contributions to SDGs and FAO's SSF Guidelines. The design of the catch	

		logs was based on the registry process for Mexico's National Fisheries and Aquaculture Commission (CONAPESCA), including additional information that may be required for eco-certification schemes.	
Maximize ecological, social and economic benefits	Identify how work welfare will be monitored and supported	While not specifically linked (at present) to seafood marketing, PD's built-in surveys and indicators for the SDGs and FAO's SSF Guidelines allow fishers and organizations to measure aspects of decent work, social security and gender equality, contributing to social policies such as those in Fishery Improvement Projects.	
Maximize ecological, social and economic benefits	Implement safeguards to mitigate negative impacts of data collection to worker rights and privacy	PD/IA is GDPR compliant and has multiple security and encryption safeguards to ensure that data remain protected. Users can delete their information at any time, and retain their information, and PD has dedicated customer service support.	
Create a program that is electronic, interoperable and data secure	Seek to minimize costs	PD reduces operating costs to users by being a small download for iOS and Android, offering offline capabilities, and by providing low-cost software as a service to fishing organizations who are making the digital transition to organizational management. Beyond a smartphone, no additional equipment or technology is needed. API connectivity to other services promotes interoperability and avoids the duplication of data or processes.	
Create a program that is electronic, interoperable and data secure	Avoid creating trade barriers	PD does not create trade barriers, rather it opens opportunities for the creation of local economies (peer-to-peer offers and sales in the marketplace) and aims to be interoperable with third-party eCDT tools that serve major importers. As the ecosystem does not include point of sale, any import requirements for major markets would need to be met by the third-party eCDT supplier.	
Be inclusive and collaborative with stakeholders	Clarify roles, responsibilities and needs by stakeholder	PD is designed to be used by any stakeholder, and although different profiles will have use of different tools, no significant differences are contemplated for users of the technology. UI adaptations for operating at the international level are being considered (multiple language support, local language adjustments). By including the platforms users in the governance structure (as minority stakeholders in the start-up, and posteriorly as a full community led model once maturity is reached) users have a say in governance, the direction that the platform takes and ensuring the financial viability of the platform.	
Be inclusive and collaborative with stakeholders	As needed, formulate agreements between agencies for the sharing of information and responsibilities	Data sharing and partner agreements will be developed on a needs basis as PD looks to integrate with other systems. We are currently developing generic data-sharing agreements for third-party technology partners and working with a national network of fishers to ensure adequate language and terminology is used throughout.	
Be inclusive and collaborative with stakeholders	Ensure stakeholders from relevant supply chains formally agree to support the eCDT program	PD users will be able to decide whether to enter an eCDT program, but PD will not make decisions for end-users on how they use the platform. We will however PD support users alongside the third-party provider as they begin to use the connected platforms.	
Create a program that is electronic, interoperable and data secure	Identify eCDT technologies to fulfill data collection and analysis needs	The PD/IA team has conducted a review of existing eCDT systems that operate in our study region. Most are at pilot stages, however, we aim to design PD to be interoperable with the main players in the eCDT space. PD is currently a centralised repository with data access controls but will move to a distributed ledger in the future.	
Create a program that is electronic,	Develop eCDT programs and technologies with	PD was co-created with fishers and other key stakeholders. An iterative implementation and testing period as allowed	

interoperable and data secure	“human-centered design” approaches	us to adapt and improve our UX/UI and develop marketing messages to attract users. Human-centred design is also a system design principle that was followed.	
Create a program that is electronic, interoperable and data secure	Prioritize interoperability with existing traceability programs and data	PD/IA is designed to be interoperable with as many systems as possible. By taking an infrastructure-first approach, appropriate API can be developed more easily. A review of GDST data standards is provided below.	
Build a lasting and scalable program	Encourage the adoption of these Principles into policy	We have not yet worked to include these principles into policy.	
Build a lasting and scalable program	Estimate funding needs and responsibilities to fund the program sustainably	IA’s preliminary business model was published in 2021, including funding needs and projections until 2025. This business model, along with a financial feasibility study are being updated during 2022 for the creation of the start-up. Assuring financial sustainability of the network is key to building a long-lasting program and providing security to the ecosystem for scaling and stability.	
Use data to inform decision-making	Plan to adaptively manage the eCDT program	PD is adaptively managed. User feedback is periodically collected, and recommendations incorporated into our roadmap. Further adaptive management will occur during the exit-to-community.	
Implement: Training, uptake, scale & adaptive management			
Principle	Pathway step	Application in PescaData/Innovación Azul	
Build a lasting and scalable program	Pilots test the eCDT program	PD was piloted with 51 fishers in 19 fishing communities during 2020. Fishers deployed the technology and provided feedback. Feedback was received through online surveys, video calls and phone calls.	
Be inclusive and collaborative with stakeholders	Provide user assistance, technical support, and capacity building as needed	PD is designed to provide a smooth, user-led onboarding process, with minimal interventions from support staff. However, PD has a dedicated customer support available by email, Facebook and WhatsApp. Training to users and fishing organizations is provided and adapted to user needs.	
Maximize ecological, social and economic benefits	Monitor and evaluate the efficacy of the eCDT program by analyzing data to determine if objectives (ecological, social, and economic) are being met	PD/IA’s built-in data-aggregators measures fisher’s contributions to the SDGs and FAO’s SSF Guidelines, and general ecosystem metrics. These global indicators allow on the ground contributions to be measured and tracked over time. Mechanisms for measuring socioeconomic benefits of using PD/IA are still being developed.	
Maximize ecological, social and economic benefits	Document the costs of the eCDT program implementation and project costs of long-term operation	A business plan for PD/IA was developed in 2021 that considers the long-term economic status of the ecosystem. This plan included a subscription model that provides membership to the platform cooperative. Pitches for impact investment, and sponsorship opportunities are being prepared to scale our work.	
Maximize ecological, social and economic benefits	Assess the benefits, limitations, and challenges of the program in relation to equity and worker welfare	We are continuing to develop the tools to measure these components in PD/IA. By including surveys to measure contributions to FAO’s SSF Guidelines that are completed annually, changes over time are possible to track, with feedback being provided to the fishing organizations who complete the information. By allowing fishing organizations to track their own metrics we aim to promote self-awareness of equity challenges (e.g., the role of women and youth in the organization) and better decision making.	
Maximize ecological, social and economic benefits	Evaluate whether data is accessed timely and analyzed usefully for fisheries management	External data flows and sharing mechanisms to support fisheries management are still to be developed in PD/IA. Data interoperability with fisheries management systems is desired but our first goal is to protect data sovereignty so individual fishers and fishing organizations will be	

		responsible for pushing their information in to fishery management systems, rather than the data being pulled in.	
Use data to inform decision-making	Utilize monitoring and evaluation tools to assess eCDT program performance and identify opportunities for adaptive management	PD/IA has several metric dashboards that measure ecosystem performance (for example number of users, logs, boats etc). These indicators allow adaptive management of the ecosystem, both for the ecosystem managers and the fishing organizations that maintain profiles in PD.	
Build a lasting and scalable program	Outline scope and objective for scaling	PD/IA has a clear plan for expansion in Mexico (300,000 small-scale fishers) and LAC (1 million). We will achieve this through working with local partners (fishing organizations, CSOs, government) and digital communications and marketing.	
Build a lasting and scalable program	Identify differences between the pilot and other areas for implementation	PD/IA is no longer running a pilot. We are operational in Mexico and are adding LAC countries to the digital infrastructure. Our pilots in Mexico informed development and implementation and allowed us to assess the resources we need for scaling, UX/UI improvements and partnerships with other technology providers.	

The GDST Core Normative Standards

The GDST standards provide guidance and recommendations for the creation of traceability programs. The KDE's (key data elements) should be included in any traceability program being developed. As PescaData is not a traceability platform, some of the considerations do not directly apply, but would need to be considered if we fully integrated with a traceability technology provider.

KDE No.	KDE Name	KDE Definition	Application in PescaData	
W01	Item / SKU / UPC / GTIN	Identifier of seafood material to distinguish it within a particular facility, company, or globally.	PescaData does not generate an item code	
W02	Linking KDE	Identifier associated with physical product marking a particular instance of seafood material such as a batch/lot number, serial number, or container number.	PescaData does not create a linking KDE	
W03	Weight / Quantity	Numerically quantifiable amount of seafood with a standard Unit of Measure.	PescaData records weight and quantity of seafood caught, in metric units.	
W04	Vessel Name	Verbal moniker of a fishing vessel for identifying it visually and on vessel registries.	PescaData records vessel name	
W05	Vessel Registration	Standardized number or identifier for distinguishing vessels registered under the same flag nation.	PescaData records vessel ID (matricula in Mexico)	
W06	Unique Vessel Identification	Identifier associated with a vessel for the duration of its existence that cannot be re-used by any other vessel with a permanent physical marking on the craft.	PescaData records vessel ID (matricula) which is unique	
W07	Vessel Flag	Nation with supervision over safety, fishing operations, and catch reporting.	PescaData records the country of operation of the vessel	
W08	Vessel Trip Dates	Calendar start and end dates of a fishing vessel's voyage between the last point the fishing hold was empty and seafood is discharged. (Continued in Definitions Appendix sheet)	PescaData records vessel trip dates	
W09	Date(s) of Capture	Calendar date(s) when seafood was extracted for capture, irrespective of the fishing vessel's voyage at sea.	PescaData records vessel at sea dates, rather than catch dates. However small-scale fisheries using PescaData tend to conduct day trips	
W10	Gear Type	Equipment used to extract seafood from water for capture.	PescaData records gear type	
W11	Fishing Authorization	Unique number associated with a regulatory document, from the relevant authority, granting permission for wild-capture of seafood by a fisher or fishing vessel.	PescaData allows fishing organizations to upload permit information however it is self-reported and should be verified through a buyer's due diligence process.	
W12	Availability of Catch Coordinates	Indicator whether GPS coordinates were collected and are available	PescaData users record catch locations, but this information is not shared with the fishing organization. Each individual users can decide if they want to share this information, and this could	

			be activated if the individual requests it.	
W13	Satellite Vessel Tracking Authority	Indicator of Satellite Vessel Tracking. Authority responsible for the satellite tracking or verification.	PescaData does not record satellite tracking information but can be linked via API to third-party systems	
W14.1 W14.2 W14.3 W14.4	Catch Area (Compliance with this KDE requires completing all applicable Catch Area data fields)	Location(s) where capture of seafood occurred.	PescaData records catch area. At present geolocation data is stored locally on the device as fishers have request that this remains private. If PescaData is connected to an eCDT scheme, this could be activated.	
W15	Species	Scientific (Latin) name of the seafood.	PescaData records scientific names of species	
W16	Product Form	Commercial short-hand reference of the degree of transformation of seafood from its original living form.	PescaData does not record product form	
W17	Transshipment Location	Geographic rendezvous where seafood is discharged from a fishing vessel to a transshipment vessel.	PescaData is not designed to record transshipment. This is not a common practice in our target fisheries	
W18	Dates of Transshipment	Calendar start and end dates of a rendezvous to discharge seafood from a fishing vessel to transshipment vessel.	Does not apply	
W19	Transshipment Vessel Name	Verbal moniker of a transshipment vessel for identifying it visually and on vessel registries.	Does not apply	
W20	Transshipment Vessel Unique Vessel Identification	Identifier associated with a vessel for the duration of its existence that cannot be re-used by any other vessel with a permanent physical marking on the craft.	Does not apply	
W21	Landing Location	Where seafood was first discharged to land.	PescaData records a proxy of landing location (the fishing organization)	
W22	Dates of Landing	Calendar start and end dates when seafood is discharged to a landing location.	PescaData records landing dates	
W23	Expiry / Production date	Calendar date associated with a particular instance of a product seafood indicating the key date in its life cycle.	PescaData does not record expiry dates	
W24	Production Method	Categorization, on the spectrum of wild-capture to captive-culture, of the general seafood harvest method.	PescaData is currently designed for wild-capture fisheries	
W25	Product Origin	Country where seafood underwent the last substantial transformation.	PescaData does not record supply chain information such as product origin	
W26	Harvest Certification	Name of harvest standards body which a particular harvest seafood is subject to and the unique identifier associated with the certified entity.	PescaData allows fishing organizations to record the harvest certifications that they hold	
W27	Harvest Certification Chain of Custody	Name of chain of custody standards body which particular harvest seafood is subject to and the unique identifier associated with the certified entity.	PescaData does not include chain of custody certification information	

W28	Fishery Improvement Project	Publicly listed name of fishery improvement project which the harvest event is subject to.	PescaData allows fishing organizations to record the FIPs and eco-certifications in which they participate	
W29	Transshipment Vessel Flag	Nation with supervision over safety, transshipment operations, and catch transfer reporting.	Does not apply	
W30	Transshipment Vessel Registration	Standardized number or identifier for distinguishing vessels registered under the same flag nation.	Does not apply	
W31	Landing Authorization	Unique number associated with a regulatory document, from the relevant authority, granting permission for discharge of wild capture of seafood to land by a fisher, fishing vessel or transshipment vessel.	PescaData allows fishing organizations to register their fishing permits and associated species and boats	
W32	Public Vessel Registry Hyperlink	Website address where the public registry containing the listing of the fishing vessel.	The vessels in PescaData can be consulted in CONAPESCA's databases, however not all public databases are up to date.	
W33	Transshipment Authorization	Unique number associated with a regulatory document, from the relevant authority, granting permission for discharge of wild capture of seafood from a fishing vessel to a transshipment vessel.	Does not apply	
W34	Existence of Human Welfare Policy	Indicator of human welfare policies in place on a vessel/trip, answering the question "What kind of human welfare, labor, or anti-slavery policy was in place on this vessel/trip?"	This does not apply per fishing trip, but PescaData allows data aggregation on social elements (gender balance in fishing organizations, contributions to SDGs and FAO's SSF Guidelines, and more)	
W35	Human Welfare Policy Standards	Name of internationally recognized standards to which policy on a vessel/trip claims conformity	Does not apply	

Summary of similarities and differences between Innovación Azul and the traceability initiatives

	SALT	GDST	Innovación Azul
Geography	Global	Global, but currently has no Latin American members	Latin America and the Caribbean
Potential target market	Seafood supply chain actors and fisheries governments. Particularly for export markets in developing countries.	Supply chain technology. Particularly for export markets in developing countries	300,000 small-scale fishers in Mexico and >1.2m in LAC
Target fisheries	All fisheries	While the KDEs could be applied to all fisheries, many of the KDEs focus on industrial vessels and the international seafood trade	Small-scale fisheries and coastal communities
Impact on national and international legislation	Seeks the adoption of principles in current legislation to improve the identification and implementation of eCDT processes in the fisheries value chain	Seeks the adoption of principles in current legislation to improve the identification and registration of processes in the fisheries value chain	No current regulatory focus. The tool is focused on promoting more efficient and standardized catch records and data-driven decision-making
Social rules and regulations	Promotion of compliance with human rights laws, decent work, equity and other social benefits	KDEs include a human welfare policy standard	Data aggregators for the SDGs and FAO's SSF Guidelines create visibility around social issues in the sector

Applying the ecosystem design principles to Innovación Azul

Principles of platform cooperatives

While cooperatives have a long and storied history, platform cooperativism has recently surged in importance as an alternative to platform capitalism and a way to re-imagine the sharing economy. The sharing economy, originally a local, community affair in which neighbours or friends shared resources, was digitalized in the early 2000's by companies such as Uber and AirBnB. Through Uber you can “share” your resource (your car) and generate value. However, many tech giants have distorted this sharing economy away from social benefits, towards corporate profit. Platform cooperatives have arisen to provide similar services, but with a more equitable division of benefits. The design principles for platform cooperatives were published by Trebor Scholz (2016) and draw on the original Rochdale principles for cooperatives (1844).

While Innovación Azul is originally beginning to operate as a start-up, it will pursue a hybrid model which incorporates the applicable principles of platform cooperatives for good and participatory governance. Innovación Azul's roadmap also considers fully transitioning to (or incorporating a) data cooperative (a type of platform cooperative) as part of an exit to community once the digital infrastructure is sufficiently robust.

Principle	Application in Innovación Azul
Ownership	The PescaData technology was developed by COBI and will be transferred to a start-up (SAPI under Mexico law). SAPIs allow differential voting and ownership schemes, and fishers with sustainability commitments will be invited to join the start-up. Our vision is to work towards a full exit-to-community strategy when the ecosystem is stable.
Decent pay and income security	While PescaData is not a labour platform, it can provide income to users. Any value generated from consensual data commercialization will be returned to the users who generated the data to be spent on sustainable fishing projects, with 5% being retained by PescaData to cover administrative costs.
Transparency and data portability	Users can see all their historical data on the web dashboards and in the app. Public dashboards provide transparency information and general ecosystem metrics. All catch data generated by users can be downloaded as a CSV file on their cooperative dashboard and can also be eliminated from PescaData without involving PescaData administrators. The PescaData SAPI will also have transparent accounting, and value created from data sharing will also be available for consultation.
Appreciation and acknowledgement	PescaData is fisher-centric. This means that all achievements are community level achievements and are shared accordingly. PescaData aims to evaluate the best-practices of its users, through prizes, sustainability-orientated gamification, and peer-to-peer solution sharing.
Co-determined work	While PescaData is not a labour platform, it does provide opportunities for income generation. The models of the marketplace and data sharing have been developed with fishers through co-design workshops, field testing, and work with the national network of fishers.
A protective legal framework	PescaData has been designed within the Mexican legal framework. Mexico's cooperative law is old, but flexible, while the start-up, created as a SAPI is more modern and is a good fit with PescaData's needs. By bringing fishers in to the PescaData SAPI governance, the platform is part-owned by users and sets the foundations for an effect exit-to-community at a later date.
Portable worker protections and benefits	Does not apply. As PescaData does not employ its users it does not provide worker protections and benefits. All PescaData SAPI employees

	are provided with benefits and protections beyond those required by Mexican law.
Protection against arbitrary behaviour	PescaData has clear terms and conditions that are constantly being updated and communicated to users. We try to ensure that the language used is clear for users. Transparency will be applied for users who are warned about platform rules and community governance is expected in forums.
Rejection of excessive workplace surveillance	PescaData provides SaaS to fishing organizations and does not collect detailed data on how clients and users interact with the platform. There could be potential for malpractice at the client level and mechanisms to avoid this must be developed. A balance must be found between overly invasive data tracking and not having the data at hand to identify misuse.
The right to log off	Does not apply. Users of Innovación Azul's tools are free to use the modules at their whim. There are no usage requirements stipulated by the organization.

Design principles for systems change

The design principles for systems change were published in the report [From Billions to Trillions](#) in 2018. [The principles were updated in 2021](#). These principles speak to how global digital infrastructures should have the appropriate incentives to mobilize over \$50 trillion in capital to address the SDGs.

Design principle	Application in Innovación Azul and PescaData
<p>Thrivable <i>Solving humanity's greatest challenges is the work of generations, and requires more than status quo sustainability - it requires (re)building better. Technical, financial and legal systems must align with regenerative, living systems, and be geared towards all forms of value flows.</i></p>	<p>Innovación Azul aims to build better. By designing a digital ecosystem that is interoperable from inception, we can build a better digital ecosystem that aligns and is interoperable with other platforms that work. New concepts that use existing legislation, for example platform cooperatives, and also provide additional benefits.</p>
<p>Humanity-Centered <i>Focusing on what's best for individuals does not result in better social outcomes, as history has shown. Focusing on what's best for humanity, however, provides an opportunity to serve everyone equally, transcending cultural, organisational, and political boundaries.</i></p>	<p>Small-scale fishing is highly diverse. Innovación Azul aims to meet the needs of the majority. While some individual use cases (e.g. a specific fishery need) will need specific modifications, the overarching goal is to provide services to and connect the most number of people and users possible, irrespective of culture, location, type of fishery or socioeconomic status. Mexico has over 6,000 fishing cooperatives, we aim to provide a service to all, and many more in Latin American and the Caribbean.</p>
<p>Equitable <i>It's time that we re-engineer our economic, social, and cultural systems for justice. Equitable systems rectify historic injustices, create opportunities for all, ensure that all value created is appropriately compensated, and provide stakeholders with participatory governance.</i></p>	<p>Fisheries are a great example of a space with many actors. We have common pool resources users, managers, governments, international agencies, civil society, the private sector and academia. All these stakeholders have a role and should have a voice. Innovación Azul aims to provide the digital infrastructure to connect and potentialize these relations. Our first target is primarily the fisheries sector, before continued growth the civil society, government and academia.</p>
<p>Cooperative <i>Commitments to "collaboration" aren't enough to solve our most immediate challenges. We need to go further, faster, together. Truly cooperative systems are designed for mutual benefit, and as such must permit us to work together outside of organisational and operational siloes.</i></p>	<p>Collaboration is the name of the game at PescaData. We provide SaaS to fishing cooperatives and organizations, who are cooperative by nature. We also promote peer-to-peer solution sharing through the solutions modules. The collective wisdom of the fishing sector, united with other key stakeholders is key to bringing about widescale change and progress towards sustainability.</p>

<p>Adaptive <i>Planet-sized problems are complex adaptive systems that will not be solved in a single iteration, or by “silver bullet” solutions. We must be willing and able to respond to environmental and market feedback, and rapidly adapt and adopt new information and approaches.</i></p>	<p>We know that the PescaData app will not be perfect from the start but will need to adapt to a changing market and context. Small-scale fisheries are dynamic, are affected by both local and international changes and externalities and provide income to millions of people around the world who directly depend on the fisheries for their livelihood. This requires an agile approach to our work, adapting to local and regional needs, while retaining the humanity-centred approach.</p>
<p>Distributed <i>Distributing data means distributing power; breaking the stranglehold big tech and governments have over what is done with our information. Systems must acknowledge that equity cannot be achieved without ownership and control. Digital sovereignty is an inalienable right of all humans.</i></p>	<p>Innovación Azul and PescaData are not yet distributed. Our goal is to transition to a distributed ledger-based system in the future that runs on a distributed network. The prime candidate for this infrastructure is Holochain. It is lightweight, decentralized yet secure network that can run DApps on the scale we need.</p>
<p>Modular <i>The greatest challenges of the 21st century cannot be solved by heropreneurs. Solutions must be modular, incorporating inputs and outputs from multiple sources and stakeholders, depending on context and availability, ensuring the reliability of the system as a whole.</i></p>	<p>Innovación Azul is designed as a modular system. The PescaData mobile app is one module in this system. By connecting with other resources (e.g., CONABIO’s species lists and data) we can leverage the platforms to greater impact. This remains a challenge as connecting and sharing with multiple technological sources is not easy if the third-party systems have not been designed this way.</p>
<p>Robust <i>Much ‘tech for good’ fails in environments that lack reliable access to power, telecommunications, and modern computing equipment. Robust systems must function regardless of these constraints, and be capable of withstanding enormous stress.</i></p>	<p>PescaData is lightweight, has offline functionality and steps have been taken to minimize the size of data packages sent through the cellular networks. PescaData has been designed to handle thousands of simultaneous users and incorporates a robust and resilient data infrastructure.</p>
<p>Ubiquitous <i>Modern tool sets are imperfect combinations of web and native applications bound together by hacks and human interventions. Systems must be consistently available, and should permit interaction with any part of the system from any other part without tool-switching.</i></p>	<p>Innovación Azul combines web-apps with a mobile application, plus interoperability with other ecosystems (via API, for example with CONABIO’s Enciclovida). The platform can be accessed from any device.</p>
<p>Measureable <i>We currently value what we measure, rather than measure what we value. Systems must be designed to value outcomes over outputs, as well as all forms of value – particularly in areas lacking effective metrics – to support better sense-making, decision-making and capital flow.</i></p>	<p>Innovación Azul is the first platform in fisheries that incorporates measurable metrics that allow users to track their contributions to international targets, including the SDGs and FAO SSFG. By allowing users to track their own progress, as well as having top-down aggregated data, we can make better sense of the ocean ecosystem in Latin America and the Caribbean, making data-driven decisions and also promote measurable investments that create real impact.</p>

Conclusions

Overall, the Innovación Azul digital ecosystem, including the PescaData mobile application considers many of the design principles. Most of the principles not covered are in areas that PescaData’s technology is not designed to solve (e.g., transshipment or product export), and it is important to recognise that one platform will not solve all of our problems. However, by designing PescaData around principles of interoperability, and considering the design principles for systems change, we aim to be able to connect PescaData to other technologies that provide these services (e.g., traceability). As we move into the era of Web 3.0, interoperable technology that connects to, and allows data to flow between, different platforms will become the norm. Systems designed now, should consider these principles and those who work in the ocean technology space should work towards a more interoperable future.

Glossary

eCDT	Electronic catch documentation and traceability. eCDT systems allow collecting, sharing, and tracking of verifiable information about catches, and supply chains.
CSO	Civil Society Organization.
Electronic traceability	Electronic traceability is the digital tracking of relevant information about seafood through the supply chain.
IUU	Illegal, Unreported and Unregulated fishing
Interoperability	The ability for technological platforms and software to exchange and make use of information.
Supply chain	The fisheries supply chain is the network between fishers who catch the product, fishing organizations, buyers and final consumers.
SaaS	Software as a Service
B2B	Business to Business
COBI	Comunidad y Biodiversidad
KDE	Key Data Elements
ICT	Information and communication technology
PD/IA	PescaData/Innovación Azul. Innovación Azul is an innovative infrastructure-first approach that focuses on the development of appropriate social, legal, and capital infrastructures to leverage global, democratic, distributed technological innovations to move the small-scale fisheries sector towards collectively solving wicked problems. PescaData is the beachhead app that provides a gateway to Innovación Azul.
Data sovereignty	Makes reference to a group or individual’s right to control and maintain their own data however they see fit.
Distributed ledgers	A decentralised database that contains replicated, shared and synchronized data that has a consensus between nodes (users).
Blockchain	Blockchains are a type of distributed ledger that record consecutive transactions on an immutable database.
SDG	Sustainable Development Goals
SSF Guidelines	FAO’s Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication
Sharing economy	A socio-economic system built around the sharing of resources, more frequently used to refer to online sharing, such as sharing a car on Uber.