BayanAI

BayanAI provides a real-time information and AI predictions of direction, risk, damage and potential impact of extreme weather events, helping Philippine communities and organizations prepare for, respond to, and recover from disasters.

Summary

PROBLEM

The Philippines' vulnerability to typhoons, fuelled by climate change, demands a shift towards proactive community-centred disaster preparedness.

The lack of real-time actionable information, leaves communities exposed, exacerbating impact and prolonging recovery.

While data is collected during emergencies, it's often inaccessible for frontline communities and organisations, hindering response and resource allocation.

PROCESS

Desk research, primary research, and interviews with residents, NGOs, and AI experts, uncovered key insights:

Disaster response involves web of stakeholders

Protocols lack transparency and coordination among these stakeholders

Vital disaster data is scattered/inaccessible, hindering efficient decision-making

A centralised data hub would dramatically improve disaster preparedness; saving lives by enabling targeted, efficient response

Based on insights we designed BayanAI.

We validated assumptions with a local NGO (viability), Filipino residents (desirability) and AI experts (feasibility).

PROPOSAL

BayanAI revolutionises disaster response using weather, geo-spatial & crowdsourced data:

Resource Gap Analysis:
Identifies needs in affected areas through damage assessments/organisational input.

Recommendation System:
Real-time insights for targeted recovery efforts, as organisations share assistance information.

Crowdsourced Data Input Interface:
Organisations/community leaders report on aid provided and areas requiring further support.

In 2023:

12.5M
Filipinos affected by extreme weather events
Source: United Nations OCHA

#1
Most at risk from natural disasters
Source: World Risk Report

€600+M
Average damage inflicted by large typhoon
Source: Statista

80%
Of filipinos own a smart phone
Source: Statista

Problem Introduction

The Philippines is deeply rooted in family and community.

Unfortunately though, the archipelagic country is extremely vulnerable to intensifying cyclones and typhoons fuelled by climate change.

Information, situational awareness and communication between stakeholders are crucial for preparing and responding to disasters.

While data is collected during emergencies, it's often inaccessible for frontline communities and organisations.

Climate Change and Disaster Impacts

Typhoons like Haiyan (2013) leave deep economic & social wounds: loss of lives, food insecurity, housing crises, compromised public health, and trauma of displacement.

While the government focuses on climate change adaptation, there's a crucial need to shift towards preventive measures that empower communities.

AI can empower communities to tackle these climate-driven challenges, building resilience and shaping their response to disasters.

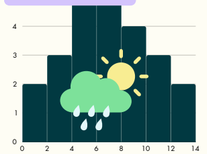
The Need for Data-Driven Solutions

Despite a wealth of data collected during emergencies, a critical gap exists – this data is not efficiently translated into actionable insights for those on the ground.

Harnessing existing data and identifying new sources would dramatically improve decision-making for organisations and communities - increasing effectiveness of preparation and targeted relief efforts - and ultimately saving lives.

DISASTER MANAGEMENT JORUNEY

Predict

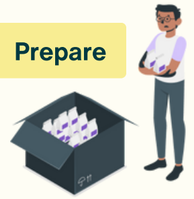


Collecting weather and environmental data

AI Opportunnity: **Improved accuracy in disaster forecasting and risk analysis.**

"#1" *Pain point*

Prepare



Developing disaster response plans and organising resources

AI Opportunnity: **Streamlined resource distribution and emergency readiness.**

"#2" *Pain point*

Respond

"#3" *Pain point*

Executing emergency plans and distributing aid

AI Opportunnity: **Enhanced coordination for aid distribution and emergency services.**

Rebuild

Conducting damage assessments and initiating reconstruction

"#4" *Pain point*

AI Opportunnity: **Prioritising and tracking reconstruction efforts effectively.**

Retrain

"#5" *Pain point*

Analysing disaster management outcomes to inform future strategies.

AI Opportunnity: **Leveraging past data to optimise disaster management strategies.**

Actor involved

- *Emergency services*
- *Residents*
- *Non-Governmental Organization*
- *International Organisations*
- *Government*
- *Private sector*
- *Local Government Unit*

Humanitarian aid providers's pain points

1 - Miscommunication and misinformation

"The government usually provides shelter areas. Finding information on the shelters is incoherent during such times."

"Misinformation is a huge issue during disasters."

2 - Unequal resource deployment

"Some places receive more resources than others because they are better-known or news coverage has been better."

3 - Over-supply/critical shortages due to lack of communication

"We lack visibility into what other organisations are delivering, leading to potential oversupply in some areas and critical shortages in others."

4 - Low situational awareness during and after disaster

"Rebuilding after a disaster is often chaotic. There is no clear picture of where damage is most severe and what rebuilding efforts are already underway."

5 - Mulitple individual organisations, with own informations systems

Using multiple different systems for the collecting and exchanging information, takes time and hinders data exchange and effective communication in real-time

*"Using **our** Handa app, we are able to balance distribution and optimize it."*

Based on desk-research & primary research via interviews with NGOs providing support for communities affected by natural disasters in Philippines.
Presented qotes are from our interviews with a Philippine NGOs and residents.

Project Process

DISCOVER: *Understand the problem and how it affects people and stakeholders*

Choosing location: The Philippines

The Philippines has world's highest risk index for natural disasters.

Research questions

- What are local impacts of climate change?
- Who is most affected, where & how?
- What organisations are involved in natural disaster response?
- What current AI solutions are deployed in disaster?

Initial problem statement

Extreme weather events are becoming more severe and frequent, affecting communities who have contributed least to climate change.

Key stakeholders

- Central government
- Local government
- Local and international NGOs
- Philippine residents

DEFINE: *Define a clear problem to be solved*

Stakeholders' needs

- Organising help & directing it to the people and places that need it;
- Good situational awareness;
- Access to a reliable information;
- Effectively exchange huge volumes of data & information with stakeholders;

Identifying pain points

- Huge economic & social impact
- Multiple agents and locations involved - over 7,000 islands.
- Disaster response (during) and relief operation (after) require coordination of multiple agents, information and resources.
- Huge volumes of data are collected but it's difficult to analyse & share in real-time with communities & organisations that need it.
- Information and situational awareness are crucial throughout, but there's unequal access to data and insights between stakeholders.

BENCHMARK: *Analysing existing solutions & AI technology to identify gaps & opportunities*

Potential applications for the AI

A) Improving Situational Awareness

AI weather forecasts:

- DeepMind's Model of Rain empowers short-term weather predictions (rainfall, timing, and locations)
- Google's GraphCast enables medium-range predictions - tracks cyclones, extreme temperatures, & atmospheric rivers associated with flood risk

Damage assessment:

- Google SKAI - machine learning and aerial imagery to identify locations of damaged buildings in a disaster region.

B) Improving Resilience & Aid Delivery

Forecast-based relief aid financing:

- Red Cross/Crescent **manually** predict extreme weather events and impacts to release funding for earlier action.
- Delphi tool (GiveDirectly & Google.org) overlays property damage data from Google SKAI & socio-economic data to identify most vulnerable communities.

IDEATE: *Define solution requirements and brainstorm ideas*

Refined problem statement

- Information and situational awareness are crucial for preparing and responding to disasters.
- Before, during and after disaster, data is collected but it's difficult to analyse and share it in real-time with the communities and organizations that need it to make informed decisions.

Identified gaps in existing solutions

Current AI technology offers fragmented solutions. Some algorithms predict disasters, while others assess damage afterward.

Although organisations such as PDRF have their own private tools, there is not one single, accessible platform. This creates a barrier for communities, humanitarian organisations, and decision-makers who need real-time, comprehensive information to prepare for and respond to disasters.

DESIGN: *Design the service, test, evaluate and validate concept assumptions*

Design challenge

To help government agencies, local communities and NGOs to have better situational awareness in order to deliver help to people and places that need it, using AI.

CO-DESIGNING

Interviews with Filipino residents

Leveraged existing Filipino connections to learn more about experiences related to natural disasters & local methods of coping.

Interview with Filipino NGOs providing natural disaster aid

Insights from The Ayala Foundation and The Philippine Disaster Resilience Foundation (PDRF) who provide support for communities hit by natural disasters, to learn about challenges they face providing disaster relief.

Validating concept with humanitarian organisations

To validate we reached out to the UNHCR Innovation Service, who support innovations mitigating impacts of the climate change in contexts of forced displacement.

Validating concept with Filipino residents and NGO

We presented our solution to Filipino residents and NGO representative we interviewed, to validate our assumptions and gather their feedback to iterate our proposal.

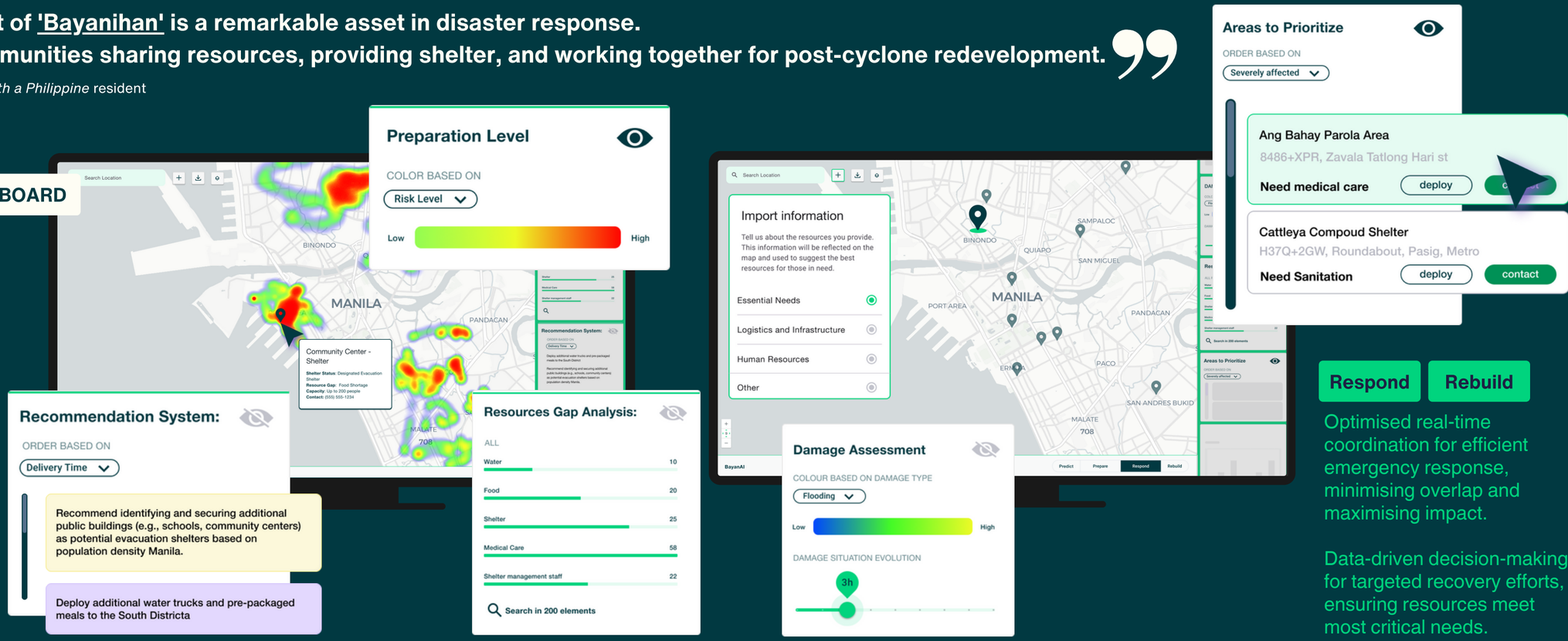
Validating technical feasibility with AI experts

We consulted AI senior experts in our network to consult technical feasibility of our proposed solution.

BayanAI

> **The Filipino spirit of 'Bayanihan' is a remarkable asset in disaster response. We observe communities sharing resources, providing shelter, and working together for post-cyclone redevelopment.**
>
> *Quote from our interview with a Philippine* resident

LOCAL AUTHORITY DASHBOARD



Prepare

Enhanced strategic planning with precise forecasts, allowing organisations to pre-position resources and personnel.

Streamlined resource allocation and training, ensuring readiness and reducing time to action.

Respond Rebuild

Optimised real-time coordination for efficient emergency response, minimising overlap and maximising impact.

Data-driven decision-making for targeted recovery efforts, ensuring resources meet most critical needs.

SOLUTION VIABILITY

Key barriers for implementation

Cost of investment
Developing BayanAI may require significant funding to develop algorithm, product and data management platform.

Trust
As an AI/data based product BayanAI will require cooperation and data exchange between multiple stakehodlers.

Implementation strategy

Before engaging other stakeholders, we will look to establish a partnership with The Ayala Foundation - local actor working in natural disaster risk management field - leveraging their relationships with local communities and institutions to iterate our proposal and build a business case.

Sources of funding

We plan to partner with one of the UN's agencies and apply for funding from the UN's Humanitarian Innovation Funds. Also we will try to secure funds from the EU, Philippine government and NGOs.

United Nations · UNHCR Innovation Service · Ayala · Manila Water Foundation

AI RISK ASSESMENT AND RISK MITIGATION PLAN

Data availability risks (in LMICs)

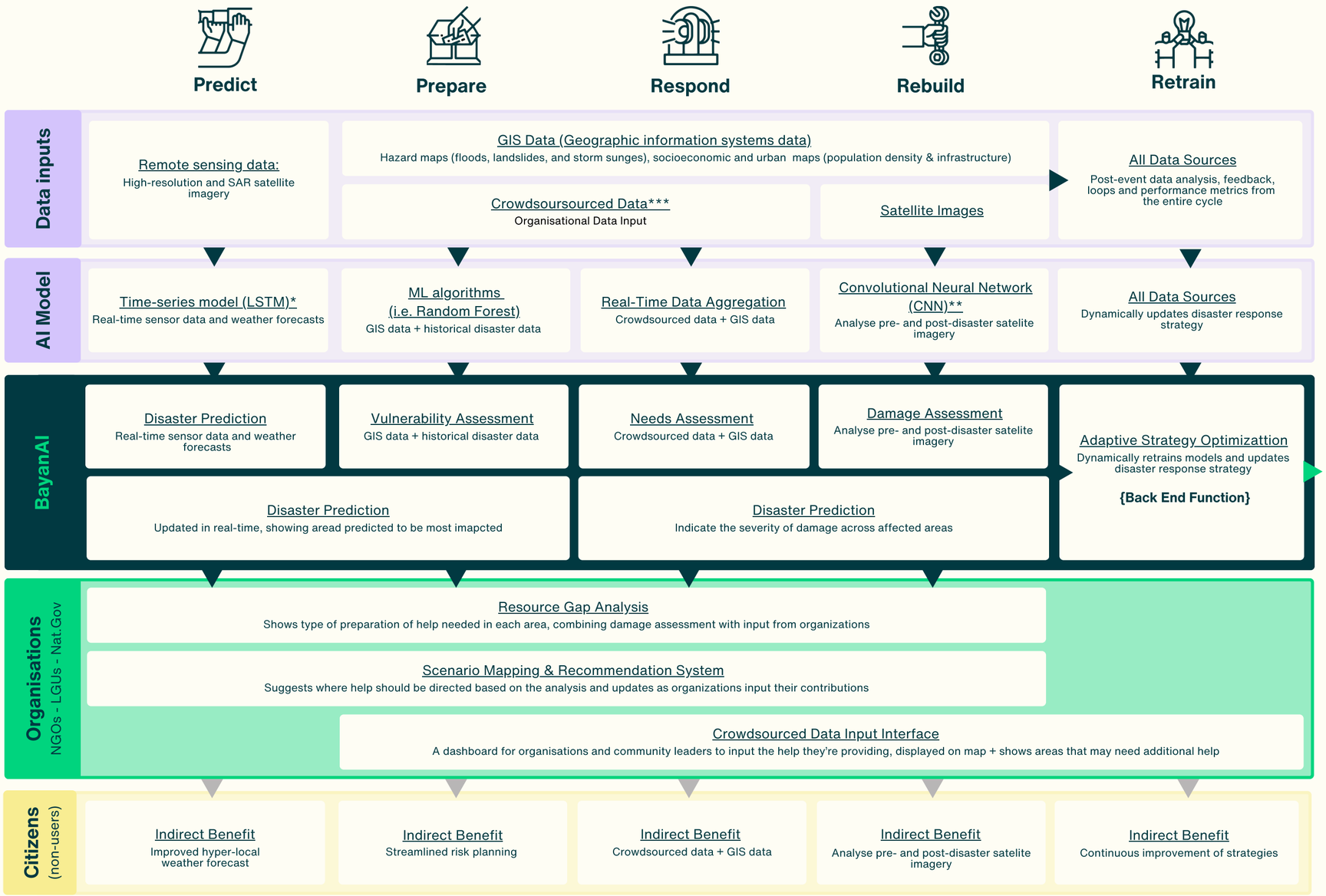
Lack of up-to-date (geospatial) data in low to middle-income countries (LMICs) compared with high-income countries (HICs) may disadvantage some areas of the Philippines and bias our algorithm.

Risk mitigation and inclusion

To ensure that our proposal is inclusive we will validate it with leading AI and disaster management experts to identify and mitigate potential biases regarding historical data, representation, measurement, data aggregation, evaluation and algorithm deployment.

Holistic Service Mapping

SERVICE BLUEPRINT



*Accurate typhoon intensity forecasting using LSTM, historical data, and a rolling forecast approach, as proposed by Yuan et al. (2021) in the *Typhoon Intensity Forecasting Based on LSTM Using the Rolling Forecast Method*.
**Rapid disaster response leveraging GIS, satellite data, and real-time CNN analysis, based on the framework proposed by Linardos et al. (2022) in *Machine Learning in Disaster Management: Recent Developments in Methods and Applications*.
***Based on "CrowdLearn", crowdsourced data management and deep learning approach, as developed by Zhang et al. (2019) in *CrowdLearn: A Crowd-AI hybrid system for deep learning-based damage assessment applications.*

SYSTEMS THINKING

Systemic solution:

BayanAI addresses climate change challenges holistically - we recognise that local environmental issues are linked to global systems.

We address the root causes - such as environmental degradation and social & economic disparities - by empowering communities to adapt to and mitigate climate change impacts.

Wider Issues:

Our tool considers the interconnectedness of social, economic, and environmental factors.

Improved disaster response not only saves lives but also helps maintain local economies and ecosystems.

Unintended Consequences:

While AI can greatly enhance disaster response, we are acutely aware of the risks of technology dependency and privacy concerns.

Our solution will ensure that AI complements human decision-making and that data use complies with ethical standards throughout.

A view to the future

Differing from top-down approaches, BayanAI fosters ownership for local leaders & tailors solutions to the unique context of each community.

In future iterations we envision providing a trusted source of truth to directly empower all Filipino citizens.