Flood Exposure and Decision-Support Platform (FEDS)

Case Study Note



Disruptive Technologies for Public Asset Governance (DT4PAG)

Supporting Digital Transformation Solutions in Viet Nam

June 2024

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Federal Department of Economic Affairs,
Education and Research EAER
State Secretariat for Economic Affairs SECO

Disruptive Technologies
for Public Asset Governance

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

Abstract

This Case Study Note describes how Ho Chi Minh City's Flood Exposure and Decision-Support Platform (FEDS) was developed and adopted. FEDS is an example of a simple, yet powerful digital tool that addresses Public Asset Governance (PAG) problems in Viet Nam. It is the first such tool developed under the Disruptive Technologies for Public Asset Governance (DT4PAG) program, supported by the World Bank and Switzerland's State Secretariat for Economic Affairs (SECO). FEDS provides a valuable platform for the government, and eventually, citizens, to report flood incidence in a way that supports improved decision-making on flood management, as well as investments in flood mitigation.

This note shows how cost-effective, easy-to-use digital solutions can contribute to increased government effectiveness and quality of service delivery. The note provides an overview of platform objectives, the challenges encountered, the solutions applied, and some critical success factors and lessons learned in the Viet Nam context. As these tools are replicated and scaled across Viet Nam as part of government- and donor partner-led digital transformation reforms, it is hoped that this Note and others to follow will provide valuable information for similar projects across Viet Nam and beyond.

Acknowledgments

This case study is made possible with support provided through the World Bank DT4PAG program and SECO. The implementation team comprises Huong Thi Lan Tran (Senior Public Sector Specialist, Task Team Leader), IIdrim Valley (Public Sector Specialist, Co-Task Team Leader), Kai Kaiser (Senior Governance Specialist, former Co-Task Team Leader), Anh Thi Thuc Nguyen, Hieu Danh Luu, Phuong Thanh Do, Consultants. The note was prepared with assistance from Deanna Audrey and Steven Furst. Administrative support was provided by Hoa Thi Thanh Nguyen.

The team would like to thank the peer-reviewers Andrew Blackman (Senior Economist, EEADR), Marc S. Forni (Lead Disaster Risk Management Specialist, SEAU2), and Son Duy Nguyen (Senior Operations Officer, EACVF) for their input and advice.

The note was undertaken under the guidance of Alma Kanani (Practice Manager, Governance, EEAG1).

Table of Contents

Executive Summary ***1***

1. Introduction ***3***

2. Minimizing Impact from Flood Events ***4***

3. A Digital Platform for Flood Reporting and Data Management ***6***

4. How FEDS Works ***8***

Mobile Application for Field Staff and Managers 8

Web Application for Flood Managers and Leaders 10

5. Value Delivered Thus Far ***11***

People 13

Process 13

Technology 14

6. Building on Success ***14***

7. Critical Factors for Digital Transformation ***15***

People 15

Process 16

Technology 17

List of Tables and Figures

Table 1: Feedback from FEDS users/stakeholders _____ 12
Table 2: Summary of Guidance Notes for Digital Transformation in Viet Nam _____ 188

Figure 1 - FEDS Project Focus *5*
Figure 2 - FEDS Development Timeline ..... ***Error! Bookmark not defined.***
Figure 3 - FEDS Operational Model ..... ***Error! Bookmark not defined.***
Figure 4 - FEDS Mobile Apps for (1) flood field officers and (2) citizens – Android/iOS *9*
Figure 5 - FEDS Web application with Flood Monitoring Dashboard *11*
Figure 6 - FEDS Impact ..... ***Error! Bookmark not defined.***

Box 1: Roles in Flood Reporting and Information Management _____ 5

Acronyms

Abbreviation	Definition
ADB	Asian Development Bank
API	Application programming interface
DGA	Digital Government Academy
DOC	Department of Construction
DOIC	Department of Information & Communications
DPC	District People Committee
DT4PAG	Disruptive Technologies for Public Asset Governance
FEDS	Flood Exposure and Decision-Support Platform
FUV	Fulbright University of Vietnam
GFD	Green Field Consulting Co. Ltd
HCMC	Ho Chi Minh City
HIMC	Ho Chi Minh City Infrastructure Management Center
MIC	Ministry of Information and Communications
PAG	Public Asset Governance
PPT	People-Process-Technology
SECO	Swiss State Secretariat for Economic Affairs
SHTP	Saigon Hi-Tech Park
SHTP Labs	Saigon Hi-Tech Park Research Laboratories
SSO	Single sign-on
UDC	Urban Drainage Company

Executive Summary

Imagine a bustling Southeast Asian city of over 9 million inhabitants. Every rainy season, it suffers from deadlocked traffic, damaged infrastructure and major disruptions to lives and businesses as repeated flood events virtually paralyze substantial portions of the city. Now imagine a set of under-resourced and over-burdened city infrastructure management agencies, struggling to anticipate, manage and mitigate these events and their impacts. This is the situation faced every year by the Ho Chi Minh City Department of Construction (HCMC DOC) and Ho Chi Minh City Infrastructure Management Center (HIMC), and their district-level counterparts. Adding to the challenge is a mostly paper-based data collection and reporting process. This results in a fragmented, unstructured data set that defies effective aggregation and analysis to support decision-making.

Effective flood management and mitigation is a daunting task, and a number of key factors are beyond these agencies' control. What is well within their control, however, are critical elements like timely and consistent reporting, solution-focused data analysis, and evidence-based decision-making. The Flood Exposure and Decision-Support Platform (FEDS) has been developed and implemented to provide those capabilities. It was designed in close cooperation with the HIMC and DOC as the government bodies responsible for daily flood management along the city's main road network. Specifically, the platform:

- Facilitates timely reporting and geo-tagging of flood incidents to help the city respond more promptly and effectively to flood events;
- Provides a flood dashboard and maps for HCMC flood management authorities and citizens; and
- Supports more strategic prioritization of maintenance and new investments in flood-defensive infrastructure, to reduce adverse impacts.

The FEDS platform was developed and implemented over an 18-month period with the full support and close collaboration of the HIMC, DOC, and Department of Information and Communications (DOIC) leadership. A user-driven, iterative approach was used, involving extensive consultations between the World Bank, the solutions provider, HCMC and district flood management authorities, and citizen representatives. Six primary 'data layers' were standardized and integrated. These encompassed critical elements such as the locations of flood hotspots, cameras, flood- and rainfall-measuring stations, tide stations, and maps of flood-management infrastructure. The platform includes specialized mobile and web applications for data collection and reporting by field staff, leaders, and managers, with a citizen version in the pipeline.

The WebGIS application runs in the office environment through a web browser. It features a comprehensive dashboard that provides HCMC leadership and managers with crucial flood data. This includes:

- A flood status table showing details of all recorded flood segments;
- A summary table that breaks down flood data by administrative units, covering seven key parameters: total flood segments, average flood depth, length, width, area, duration, and drainage time; and
- Time series graphs that depict trends over days, months, or years for these parameters.

As of November 2023, the FEDS platform had over 850 users and generated more than 1,450 flood reports. City flood management personnel have recognized its effectiveness in improving response times and decision-making quality.

Even in the early stages, FEDS is already contributing to meeting some of the overall asset management and resilience objectives of the Disruptive Technologies for Public Asset Governance (DT4PAG) project across its three pillars of 'people, process, technology' (PPT):

- People, by building skills for using the FEDS platform;
- Process, by supporting flood-management authorities to identify a specific public asset governance (PAG)-related problem, and obtaining buy-in to facilitate government ownership, adoption, and data sharing (evidenced by a new 'operational regulation' and data-sharing protocols); and
- Technology, by developing a digital application that offers enhanced flood-management analytics for better decision-making.

FEDS represents a simple but powerful solution that is replicable and scalable across Viet Nam and the broader region. What makes the FEDS effective is how it syncs not only into the broader engagement on complex flood risk management in HCMC, but also to the whole of city digital innovation efforts. Going forward, the application will be enhanced with advanced analytics and decision-support features, along with enriched feedback functions. This will deepen and broaden the platform's business value and its applicability to other settings.

The FEDS implementation experience provides some key lessons across the PPT pillars for the DT4PAG program and similar initiatives seeking to support digital transformation in Viet Nam:

People lessons:

- Ensure the project is aligned with broader government capacity-building activities;
- Develop a communication plan early and create key supporting knowledge products;
- Maintain a level of focus and effort based on both project resources and absorptive capacity;
- Ensure digital data analysis and management skills are prioritized by the client to maximize the value of available data; and
- Present technical information and design tools for use and consumption by audiences with different levels of technical capacity.

Process lessons:

- In the Southeast Asian context, institutionalization through operational regulation is essential;
- Anticipate challenges to accessing and sharing data, an absence of data standards, and gaps in existing data sets, and plan accordingly;
- Ensure adequate resources to conduct the required sector- and process-specific analysis;
- Identify the right problem and align incentives; and
- Allow adequate time for capacity- and relationship-building to gain client commitment and ownership.

Technology lessons:

- Ensure all relevant stakeholders are aware of the cost and effort required to support system development, operation, and maintenance; and

- Leverage any existing applications and information from government, stakeholders, and other development partner projects.

1. Introduction

The Flood Exposure and Decision-Support (FEDS) platform is the first digital tool developed under the Disruptive Technologies for Public Asset Governance (DT4PAG) program, with support from the World Bank and Swiss State Secretariat for Economic Affairs (SECO). The DT4PAG implementation team consists of two World Bank staff (co-task team leaders) and six local consultants, working with leading international data and IT advisors from Singapore and the USA. Specialist local IT companies are also contracted as needed to develop and implement the digital tools.

The FEDS platform aims to improve flood reporting and management in Ho Chi Minh City (HCMC). The HCMC Department of Information and Communication (DOIC), Department of Construction (DOC), and the HCMC Infrastructure Management Center (HIMC) identified it as a priority project, as it aligns with their digital transformation vision and program. The DOC and HIMC have a clear vision for building an integrated information system for HCMC infrastructure management across all areas of their mandate, namely flood management, urban lighting, city greenery, and drainage management.[1]

The FEDS was developed in close cooperation with HIMC and DOC as the HCMC government bodies responsible for daily flood management along the main city road network. The HIMC and DOC coordinate and collaborate with the District Peoples Committees, district and commune-level flood management agencies, and service providers. Their functions include:

- Monitoring hydro-meteorological observations and flood situations across the city;
- Managing contractors to operate flood-control infrastructure (for example, sluice gates and pumping stations);
- Deploying staff and machinery, such as mobile pumps, to local hotspots during flooding, including removing litter from water-collection infrastructure, marking dangerous areas and assisting in traffic coordination; and
- Reporting on flood-related issues and providing advice to city leaders on city flood-management strategy and intervention planning.

This note has been developed following the FEDS adoption by the DOC and HIMC and its deployment in 21 districts and the Thủ Đức City district of HCMC. The DT4PAG program is currently supporting the agencies to scale the use of FEDS and to incorporate its outputs into broader flood-management decision-making in the city. This note also documents the ongoing reform journey in HCMC as a reference for other tools being developed under this project and beyond. It describes the context, approaches and solutions deployed, with particular reference to the three DT4PAG pillars of 'people, process, and technology' (PPT). In this context, the note assesses the results that have been achieved or are envisaged and articulates lessons to be considered in similar efforts.

[1] A total number of four missions were conducted in HCMC, which identified flood management as the priority objective, with later efforts planned on construction and public housing management.

2. Minimizing Impact from Flood Events

Ho Chi Minh City is a sprawling metropolis with over nine million inhabitants. Its geography is defined by the confluence and low-lying delta areas of the Đồng Nai, Sài Gòn, Soài Rạp, and Nhà Bè rivers. Every rainy season, a combination of tides, upstream runoff, and heavy rainfall – now more frequent and severe due to the changing climate – create urban flooding events. The city's aging and clogged drainage infrastructure cannot keep pace with urban development and increasingly frequent extreme events. These events disrupt businesses and lives and wreak havoc on transport, drainage, power, and other public infrastructure.[2] City flood-management agencies have limited resources and struggle to minimize and mitigate that disruption and damage. Armed in the past with only rudimentary flood-data capture, analysis, and reporting tools, these agencies faced constant challenges in making decisions on the appropriate allocation of resources, materials, and manpower. The FEDS platform is designed to provide the agencies with a capability for effective data capture, aggregation, analysis, and reporting, intended to support asset management decision-making and give authorities a leg-up on an increasingly difficult task.

Extreme climate events are increasingly frequent and inevitable. This emphasizes an urgent need for improved urban planning, enhanced asset identification and management, and timely coordination and communication between citizens and government. Digital tools are well suited to contribute to these objectives in the face of significant challenges experienced by HCMC, and other urban governments in Viet Nam, and beyond.

In the absence of an integrated digital platform, flood-event reporting and data analysis are hindered by unstructured data in disparate paper, Excel, and Word formats. Typically, when a flood occurs, HIMC and District People Committee (DPC) flood managers receive field reports by phone or send text messages with photos using Zalo[3] working groups. The flood locations are not georeferenced, but described as street addresses or local landmarks that are well known only among local field officials. The absence of georeferencing precludes the development of maps for effective citizen communication or flood management. That the data is unstructured also makes it difficult to access and analyze for timely response and rapid mitigation deployment. It is also difficult to extract, summarize and archive, both for official reporting and in the development of long-term flood-management strategies. Figure 1 illustrates the overall flood-defensive public infrastructure management process and highlights the upstream challenges which are the focus of the FEDS project.

[2] Source: The ADB HCMC Adaptation to Climate Change, Summary Report, 2010 ranked HCMC among the top 10 cities in the world most likely to be severely affected by climate change. This is based on several factors, including the city being barely above sea level; a large and growing population; urban development patterns decreasing infiltration and causing localized flooding; and extreme climate and hydrodynamics forecasted to intensify towards 2050.

[3] Zalo is in common use across Viet Nam and allows for instant messaging with attachments.

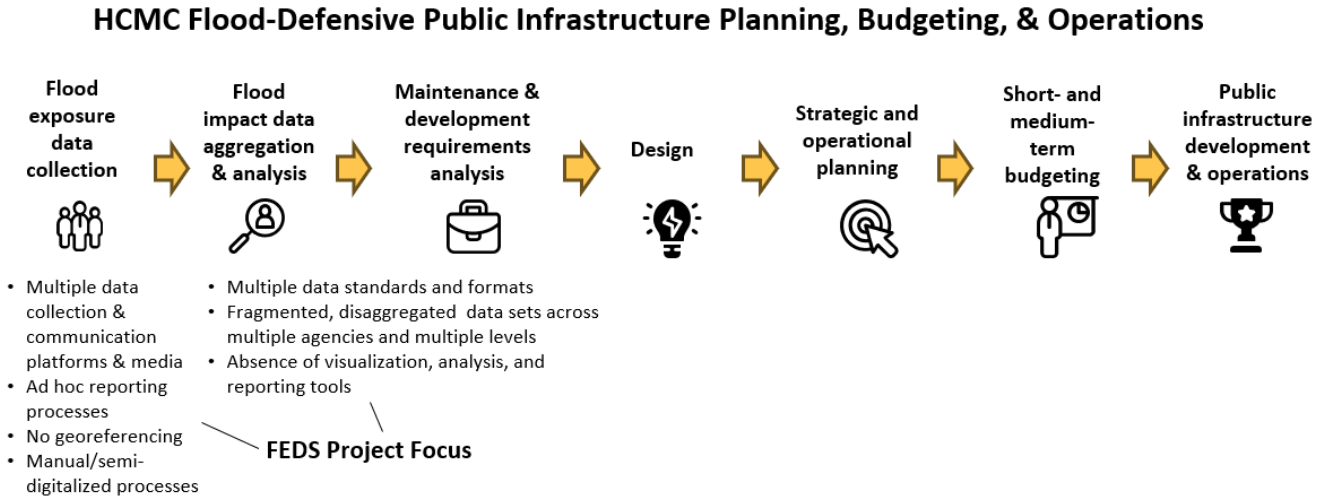


Figure 1 - FEDS Project Focus

Agency coordination on flood management is further inhibited by fragmented responsibilities across various management levels (city, district and commune). Flood management responsibilities are divided between HIMC and the district authorities. HIMC and its contractor, HCMC Urban Drainage Company (UDC), are responsible for managing flooding along the city's primary road network. Along smaller roads at the district level, the flood-management mandate is assigned to the Division of Infrastructure and Urban Management under the DPCs. Commune officers oversee flood response in the communes (Box 1). The absence of real-time information that is easily accessible to flood managers at all levels profoundly hampers their ability to act and coordinate their activities. A common digital platform would fill that gap.

Box 1: Roles in Flood Reporting and Information Management

City leaders (District People Committee leaders at the city and district levels, and DOC) – lead digital transformation and the adoption of digital tools for flood management and mitigation.

Flood managers – review flood reports and update flood information (HIMC, district, commune, UDC).

Field officers – create flood reports (UDC, commune level).

Public/citizens – consult current flood extent and report flood events.

Administrators – system administration, user administration.

The FEDS platform emerged as a solution to these flood-management challenges. Its primary goal is to bolster long-term flood-management strategies and enhance the decision-making process for investments. FEDS achieves this by offering tools for real-time flood reporting and rapid response, coupled with the systematic storage of structured, georeferenced flood data. The platform is also intended to serve as a channel for HCMC to both report and access verified flood information. Its specific objectives are to:

- Facilitate timely reporting and geo-tagging of flood incidents to help the city respond more promptly and effectively to flood events;
- Provide a flood dashboard and map visualization for HCMC flood-management authorities and citizens; and
- Support more strategic prioritization of maintaining existing, and investing in new flood-defensive infrastructure, to reduce the adverse impacts of flooding.

Implementing FEDS is expected to significantly reduce the impact of floods on people's lives and businesses, as well as on public and private assets. This would be achieved through faster response times and improved analysis for effective flood-defense infrastructure management. This platform will help improve the integrated flood risk management information system (FRMIS) that the city is planning to put in place. Specifically, the FEDS provides real time situation awareness, which can better identify infrastructure deficits where drainage and water diversions may not be functioning properly, which helps both in response and for operations and management of the overall FRM infrastructure system. The synchronization between this real time platform and the less agile FRMIS could be replicated in the other large city engagements, including in Can Tho and in Da Nang, based on the experience in HCMC.

Province	Use case	Objectives
HCMC	FEDS	A platform to facilitate timely reporting and geo-tagging of flood incidents to help the city respond more promptly and effectively to flood situations and reduce adverse flood impacts through the strategic prioritization of maintenance and new investments in flood-defensive infrastructure.

3. A Digital Platform for Flood Reporting and Data Management

The urgency and magnitude of the need to minimize the impact of flooding made the FEDS a top priority for digital tool development under DT4PAG. Consultations with the DOIC, DOC, and HIMC resulted in a firm commitment to its development and deployment. Leadership from the key agencies agreed to provide support and resources for the effort. Importantly, they also agreed to facilitate access to, and the integration of the relevant data under their control.

A results-oriented and flexible digital solutions provider was needed to develop and implement the platform. The DT4PAG team engaged a firm called Green Field Consulting Co. Ltd (GFD).[4] GFD's key tasks included designing, iterative development, and deploying the system; providing warranty service and technical support for six months from the time the system is handed over and officially put into use; and facilitating copyright of the source code, which remains jointly owned by the World Bank and HIMC/DOC.

[4] GFD is a research-based company that provides a range of services, including natural resource management, GIS, and remote sensing in Viet Nam.

To ensure that the FEDS meets the needs of the various user and stakeholder groups, it was essential to accurately identify the functional and technical requirements. A user-driven, iterative approach was used in the design of the platform. This involved extensive consultations between the World Bank, GFD, HCMC and district flood-management authorities, as well as citizen representatives. Figure 2 provides an overview of the key activities in relation to the development and rollout of the FEDS.

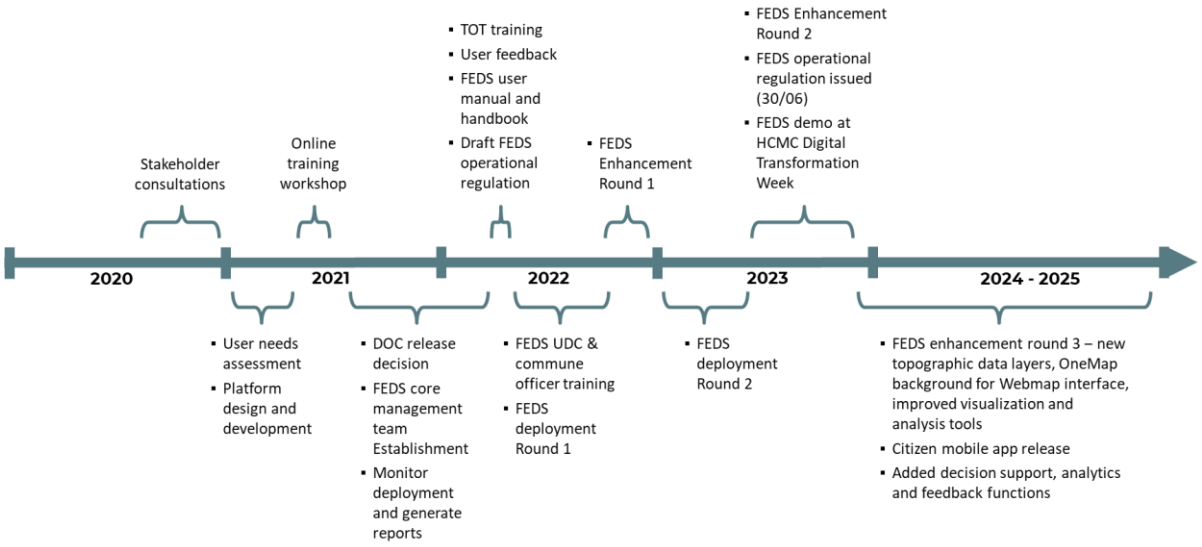


Figure 2 - FEDS Development Timeline

The development approach prioritized cost-effectiveness and user-friendliness, catering to both government officials and citizens. Key to this approach was designing a system that could systematically collect flood report data, integrating it with HCMC's central data warehouse, and making it accessible via application programming interfaces (APIs).[5]

The data and its management are central to the system's success. To ensure accuracy and relevance, base-map data had to be updated with additional information and datasets and then migrated to the servers of the DOIC. This process demanded close collaboration between DT4PAG, HIMC, and DOIC. It also involved securing formal authority for implementing the FEDS. Before integration, six primary 'data layers' –predominantly in formats like Excel and AutoCAD – needed to be standardized. These layers encompass critical elements such as the locations of flood hotspots, cameras, flood, and rainfall measuring stations, tide stations, maps of flood-management infrastructure, and reporting templates. Standardizing these data layers ensured a comprehensive and effective approach to mapping and managing flood risks in HCMC.

After integrating the necessary base-map data and datasets, the FEDS was developed and then deployed. The platform includes specialized mobile and web applications for field staff, leaders, and managers, with a module for citizens in the pipeline. Following the early development phase, training

[5] API is a set of definitions and protocols to build and integrate application software. It is essentially a software intermediary that allows two applications to talk to each other.

sessions were conducted across Thủ Đức City and all 21 districts of HCMC to ensure effective utilization.

Currently, FEDS is actively used in 11 districts for reporting flood events, with plans for a full rollout across all districts and Thủ Đức City by July 2024. This expansion is expected to significantly enhance the city's capacity to manage and respond to flood risks, thereby improving safety and infrastructure resilience.

4. How FEDS Works

The mobile app is used for data collection and reporting by field staff and, eventually, citizens. The WebGIS application is provided to leaders and flood managers for the office environment via a web browser. It is envisioned that citizens will be able to use the mobile application to view and report inundation. **Error! Reference source not found.** shows how FEDS works.

Mobile Application for Field Staff and Managers

When flooding occurs, field staff collect flood data via the HCMC Flood Report mobile app (eventually citizens will be able to do the same through the same app). The app allows for (a) data collection, and (b) flood status observation. Data can be collected in two ways: either by updating parameters of frequently flooded segments, or by collecting new flood data – including capturing images. The platform also defines key concepts to assist field officers in reporting on flooding, including locational aspects such as flooding point, section, and area; flooding sources, such as tidal, river or rain; and flood characteristics, such as depth, areas, and time. New flood data can be collected as a flood point or a flood segment. Flood segment data is collected as a line, from the beginning of the segment to the end. For flood-status observation, users can view flood data in the app. This includes both baseline data (from flood-management infrastructure and flood hotspots) and external data (from cameras and rainfall, tide, and flood-measuring stations). This data is limited to the boundaries of HCMC. Currently under development, citizens will also be able to use the mobile app to view inundation information. Data entered on the mobile app is then available on the web application for use by the managers and leaders, and by the officers when they return to their workplaces.

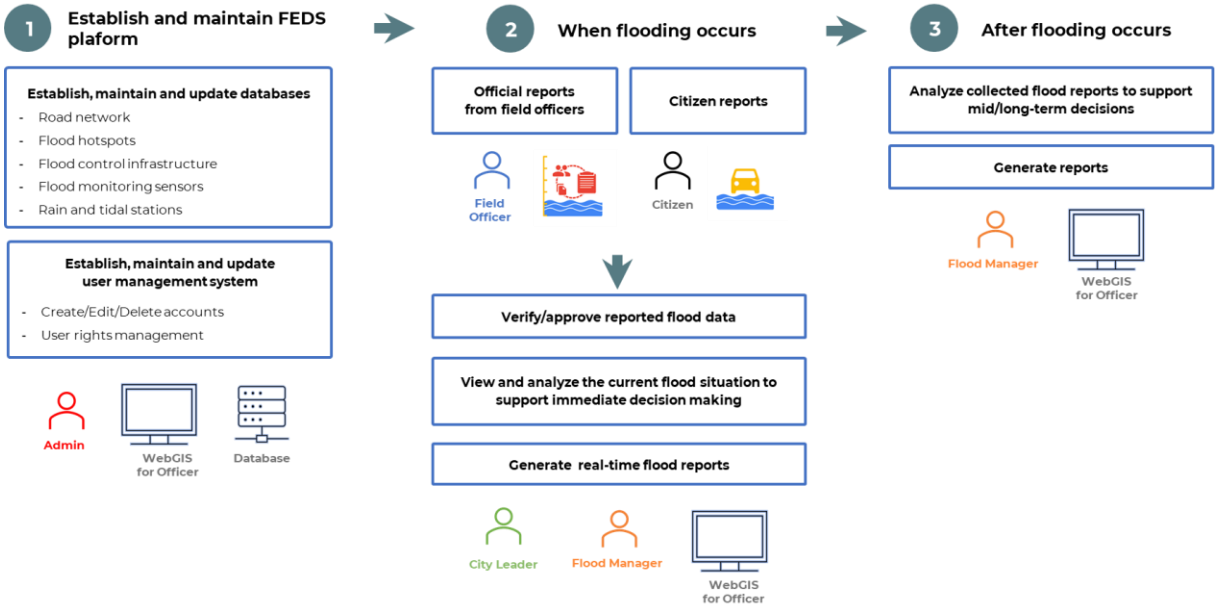


Figure 3 - FEDS Operational Model

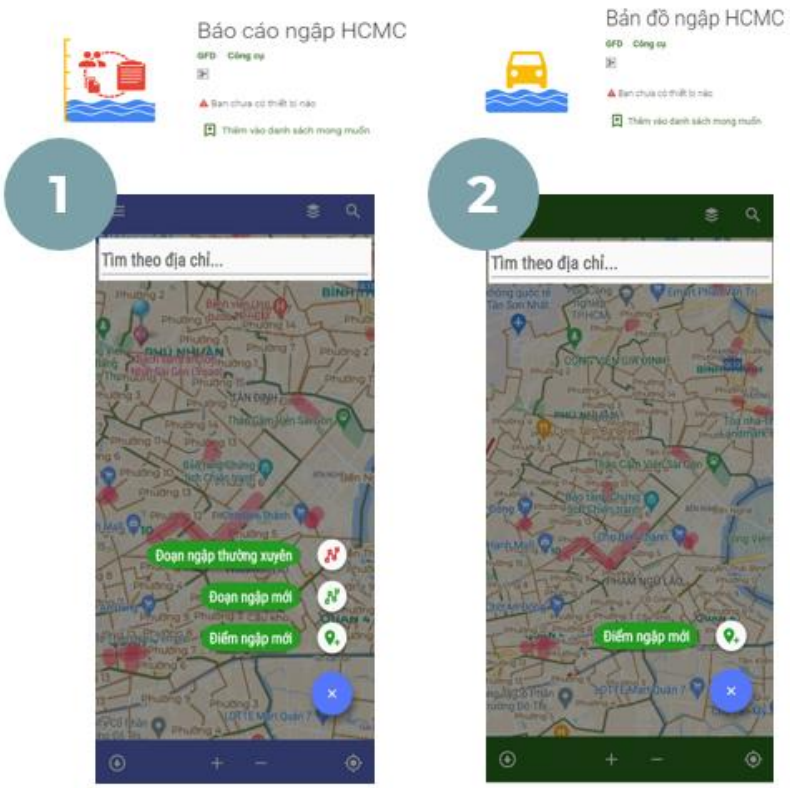


Figure 4 - FEDS Mobile Apps for (1) flood field officers and (2) citizens – Android/iOS

Web Application for Flood Managers and Leaders

Data collected via mobile apps is seamlessly synchronized with the WebGIS application,[6] a vital tool for HCMC leaders and managers. This integration allows for the efficient verification and approval of flood data, enabling quick and informed decision-making. The application's capabilities extend to generating rapid reports and providing a comprehensive view of flood conditions in real-time.

Managers have the advantage of accessing data for in-depth analysis at any time, thus facilitating more informed flood-management decisions. This includes automated dashboards and consolidated reports that aggregate critical flood information, such as the total number of flooded sections, breakdown by administrative units or streets, and the average depth, length, and area of inundation. These dashboards categorize floods by severity and offer interactive map layers. Users can easily navigate between layers, zoom in for detailed views, or search for specific locations – enhancing their ability to respond effectively to varying flood situations.

The web application features a comprehensive dashboard that provides HCMC managers and decision-makers with crucial flood data. This includes:

- A flood status table, showing details of all recorded flood segments;
- A summary table that breaks down flood data by administrative units (roads, wards/communes, districts, and basins). It covers seven key parameters: total flood segments, average flood depth, length, width, area, duration, and drainage time; and
- Time series graphs that depict trends over days, months, or years for these parameters.

The reporting tool is dynamic, allowing field reports and photos to be transmitted in real-time from mobile devices, adhering to standardized flood data formats. Hydro-meteorological data can also be submitted via the web interface.

The application includes various functions and features for data and user management and reporting. Managers from the UDC and at the district/district, ward/commune levels also have added responsibilities and rights in the system, including approving inundation data collected by field officers.

[6] https://thongtinthoatnuoc.tphcm.gov.vn/

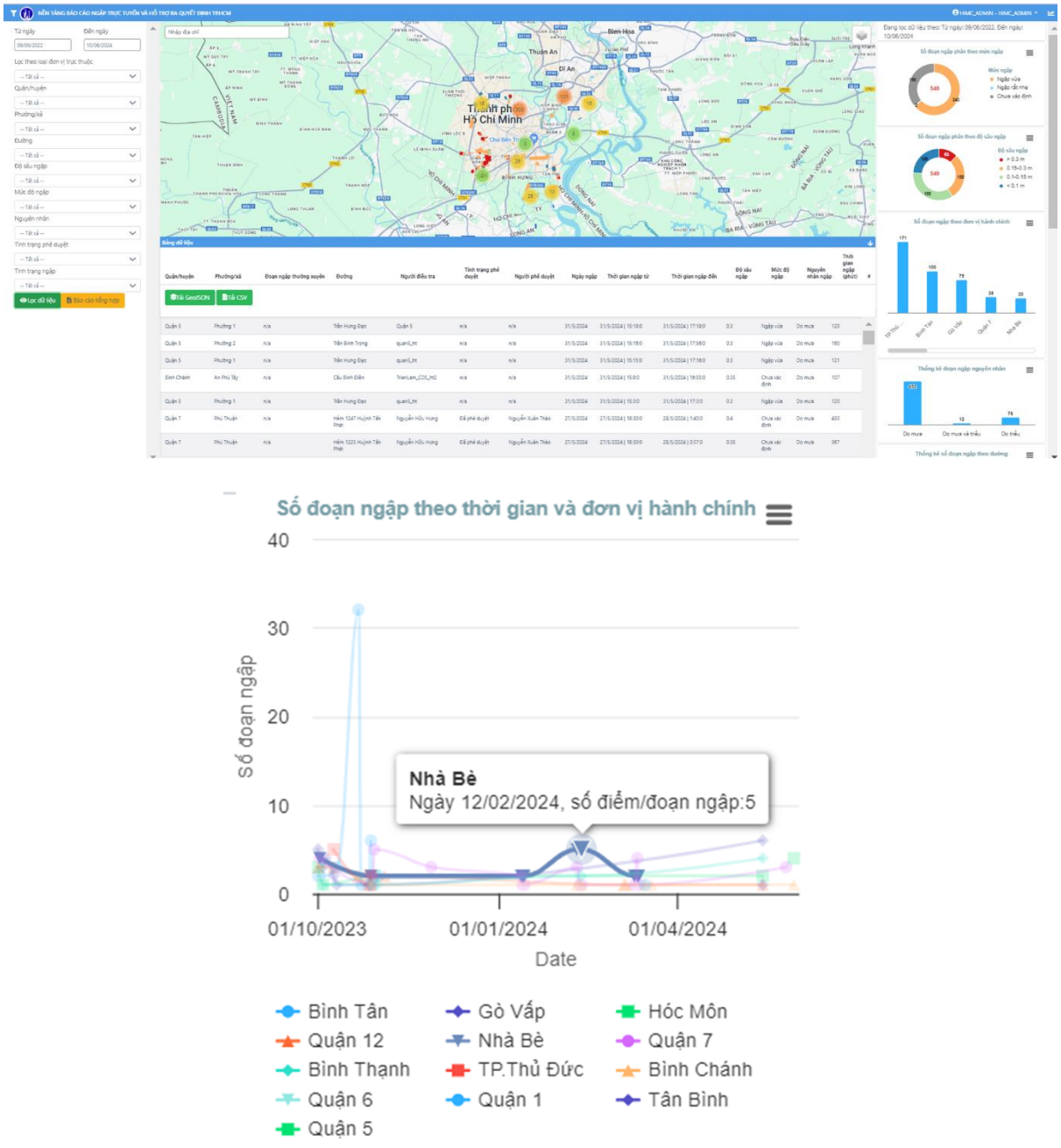


Figure 5 - FEDS Web application with Flood Monitoring Dashboard

5. Value Delivered Thus Far

Longer-term performance metrics are currently being defined, but even in these early stages of adoption, the FEDS has already demonstrated promising results – as outlined below. This includes positive feedback provided from FEDS users and stakeholders (

Table).

The FEDS has also contributed to meeting some of the overall asset management and resilience objectives of government and of the DT4PAG program, including contributing to the management of

climate change impacts. Specifically, FEDS has progressed DT4PAG's objectives across the three PPT pillars:

- People – by building skills for using the FEDS platform;
- Process – by supporting flood-management authorities to identify a specific public asset governance (PAG)-related problem, and getting buy-in to facilitate government ownership, adoption, and data sharing. The near-real-time collection, aggregation, georeferencing, and presentation of the FEDS data through mapping and analytical tools, substantially increases the timeliness and utility of flood exposure data for infrastructure maintenance and development requirements analysis and decision-making. Figure 6 below illustrates the areas in the process in which FEDS will have the greatest impact. Impact that will be magnified as the system is scaled.
- Technology – by developing a digital application that offers enhanced flood-management analytics for better decision-making. The FEDS platform provides a simple but powerful solution to end users that is replicable and scalable across Viet Nam and the broader region.

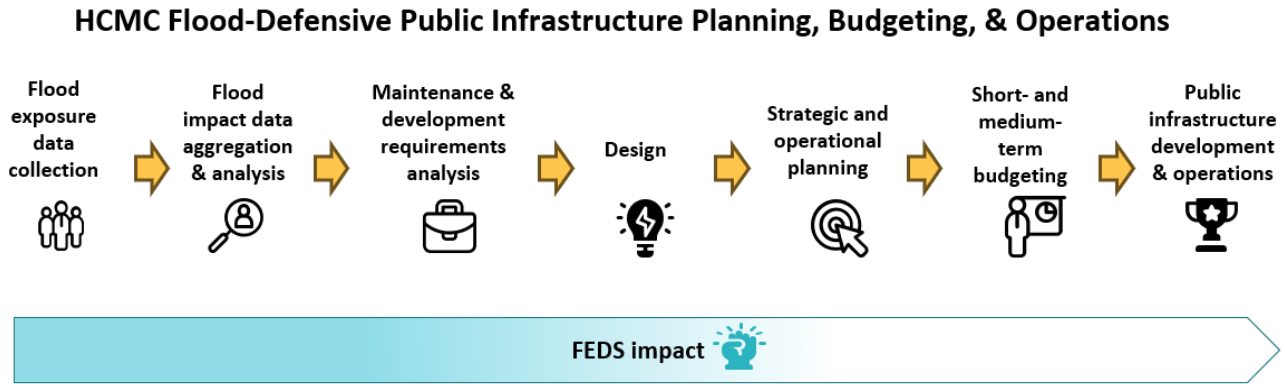


Figure 66 - FEDS Impact

Table 1: Feedback from FEDS users/stakeholders

Module	Feedback
Flood reporting	– "Convenient, easy to operate, and easy to use. Easy to update information and to update new flood points." – "Easy to manage, store flood data, no need to record separately." – "The database of anti-flood infrastructure is quite complete." – "Convenient for summarizing reports." – "Provides precise location of flood points to help build a plan." – "Helps to report the exact location of the flood to monitor and provide a treatment plan."
Web application	– "Easy to use, convenient report aggregation, friendly interface." – "As an information channel to know the flood situation, retrieve data, report quickly and conveniently, store long-term data, assess and analyze in detail

	the situation and extent of flooding; provide quick flood information, report to leaders for timely handling plan to reduce flooding fastest." – "Provides a general view of the current status and extent of flooding in the city to assess and make decisions for the future." – "Provides a lot of instant information, can export branch reports, especially the past information." – "Manage the flood situation, quickly update the flood situation, extract to serve the work of finding solutions for flood protection." – "No need to install, no need for a computer with strong configuration. Access anytime, anywhere through a browser. Just need Internet access." – "Synchronize data with relevant agencies in flood management in a timely manner." – "Quickly update flood data, reduce paper reporting procedures, save time." – "Visual charts, maps, track information, synthesize data, assess the level of flooding." – "The feature of filtering data on demand is very good."

More specific examples of how FEDS has contributed to the DT4PAG objectives across the PPT pillars are provided below.

People

The FEDS platform has enhanced flood management and reporting in HCMC. As of November 2023, it had over 850 users and generated more than 1,450 flood reports. Its effectiveness is recognized by city flood-management personnel for improving response times and decision-making quality.

Extensive training has played a crucial role in the platform's success. Eighteen training workshops, both online and offline, have been conducted for 766 participants from various departments, including DOC, HIMC, UDC, Thủ Đức City, and all 21 districts. Participant feedback highlights FEDS's effectiveness for flood reporting and management. The 'train-the-trainer' approach ensures sustainability and capacity building among local flood management authorities, extending their reach to officers across 132 communes in 10 districts. Training materials include manuals, handbooks, and videos for the mobile applications 'Báo cáo ngập HCMC' and 'Bản đồ ngập HCMC'. The videos can be viewed via the links below, and training materials accessed via the links provided in the section titled 'References for More Information'.

English

Vietnamese

Process

City officials are taking ownership of the platform through a formal deployment decision and a recent 'operational regulation'. During the project inception phase in 2021, a deployment decision from the HCMC DOC marked a formal agreement for FEDS. An operational regulation was then issued

in June 2023 to reflect the city's commitment to integrating the platform into government systems.[7] This was a critical step toward ensuring the full rollout and sustainability of the platform. In the Viet Nam context, an 'operational regulation' is a technical document that assigns stakeholder roles, tasks, and responsibilities. After the project prepared the first draft, it was reviewed, revised, and formalized by the HIMC and DOC.

FEDS data-sharing protocols were agreed, contributing to improved interoperability among government agencies. The protocols include an official city dispatch that enables the use of the city's topographical base map, the sharing of the road network and administrative boundaries, as well as the digital elevation model. Flood data generated by the FEDS is planned for integration with the HCMC OneMap, which is currently being developed for wider integration across sectors and among citizens.

Technology

The FEDS platform is fully operational on the city infrastructure and is available as a mobile app on both Android and iOS, supported by WebGIS technology. The demonstration platform was provided as open-source code, which the HCMC authorities could then deploy in their stack to promote sustainability and foster ownership. The platform provides tailor-made solutions for the HCMC flood-management authorities' mandate and practice standards, based on the latest proven digital technologies.

During HCMC Digital Transformation Week, the FEDS platform was showcased at the two-day exhibition on October 16-17, 2023, themed 'Mining Digital Data for Successful Transformation'. Organized by DOC, HIMC, and the World Bank, the FEDS booth attracted widespread interest, underscoring its relevance in digital transformation.

6. Building on Success

The FEDS has been highlighted as one of the city's successful non-structural flood defensive measures in 2023. The platform is currently already running on the city's infrastructure and managed by the HIMC/DOC. Next steps agreed with the DOC and the HCMC Digital Transformation Center include the integration of FEDS data and dashboards into the city's OneMap and OneApp, currently in development. The planned FEDS app version for citizens will also be integrated into the OneApp. The team will continue providing support to the city on this integration.

Plans are in place to enhance the FEDS application with advanced analytics and decision-support features, along with enriched feedback functions. DT4PAG will continue to support the further development and improvement of the system. This may include integrating flood data with other data registers, as this would allow for a more comprehensive assessment of assets exposed to climate change impacts in financial terms. The added functionality will deepen the platform's business value to accelerate adoption across the remaining HCMC districts, and potentially to other flood-prone areas

[7] FEDS deployment decision: Official dispatch No. 9073/SXD-HTKT dated 24/09/2021, stating that the DOC agreed on the domain of FEDS. FEDS operational regulation: Guideline for FEDS management and operation QD9681_HD-SXD-HTKT 30/06/2023, FEDS regulation outlining the required tasks, roles, and responsibilities for FEDS stakeholders.

in Viet Nam and beyond. Additional next steps will involve integration with the city's OneApp and support for the launch of the FEDS mobile application for citizens.

Performance indicators for FEDS will be established and incorporated into an ongoing monitoring and evaluation (M&E) function. The metrics will focus on user feedback – a crucial element for promptly identifying and resolving issues, as well as incorporating improvements and feasible innovations. A structured process will be implemented for responding to this feedback, ensuring issues are not only addressed but also communicated back to users. This will contribute to building trust in and support for the system.

To facilitate capacity building in digital transformation, a Digital Governance Academy (DGA) is being established at the Fulbright University of Vietnam (FUV) in HCMC. The academy is intended to become a hub for digital transformation training and establish a community of practice. In 2023, a comprehensive two-year work plan was developed by the World Bank task team and FUV. This sets the stage for digital transformation capacity building in the public sector in a way that is sustained, and context-driven. The development of curricula and competency frameworks aligned with international standards and tailored to Viet Nam's digital landscape is currently underway. The program will focus on training local government leaders and officials, with use cases supported by DT4PAG.

7. Recommendations: Critical Factors for Digital Transformation

The challenges faced and lessons learned from designing and implementing the FEDS platform offer clear guidance for the DT4PAG project, and any similar initiatives seeking to implement digital tools and support digital transformation in Viet Nam and globally. What makes the FEDS effective is how it syncs into the broader engagement on flood risk management in HCMC, which is a complex issue that involves a half dozen departments and requires a differentiated approach. The main risk these types of tools and platforms face is that, while they are cool technical solutions, they very often lack full institutional support by government officials that have responsibility for flood risk management investments and flood response activities. Yet, the FEDS has been institutionalized in the whole-of-city digital innovation efforts as a clear successful demonstration what digital innovations in flood management mean. The recommendations to be drawn from this cuts across all three of the PPT pillars.

People

Ensure the project is aligned with broader government capacity-building activities. The FEDS platform is part of a city-wide digital transformation vision and program being rolled out by the DOIC. It is an example of and is closely aligned with ongoing efforts to deploy new technologies (mobile, geospatial, IoT, etc.) to address city leadership and agency priorities. At an even broader level, DT4PAG is establishing the Digital Governance Academy (DGA) in coordination with the Ministry of Information and Communications (MIC). Opportunities will be sought to elevate DGA training programs, the delivery of courses, and early success stories to MIC management. The DGA will address both technical as well as leadership gaps to support digital transformation.

Develop a communication plan early in the project and create key supporting knowledge products. Sharing innovations and promoting the value of digital tools will raise awareness, lead to synergies, and increase the likelihood of support and adoption. Examples of successful approaches and solutions, and critical success factors should be shared frequently and widely through a variety of channels and products. This note is one such product.

Maintain a manageable level of focus and effort based on both project resources and absorptive capacity. Developing and implementing digital tools for government is an intensive activity for both the project team and the subject agency staff. It can also involve substantial change. Efforts should be appropriately timed and sequenced to allow for adequate focus and optimal adoption, and to respond to lessons learned.

Ensure digital data analysis and management skills are prioritized by the client to maximize the value of available data. The ability to build databases, and then analyze and manage the data, is a critical skill component for digital transformation. While the project can inject those skills temporarily, client agencies must put a priority on building those capabilities, whether by developing them internally or establishing long-term service partnerships.

Present technical information and design tools for use and consumption by audiences with varying levels of technical capacity. Communication tools and products and the system user interface should be designed to reach all levels of audiences to promote and facilitate awareness, understanding, and ultimately the successful adoption of new technologies.

Process

In the Southeast Asian context, institutionalization through operational regulation is essential. The project plan should allocate significant time and resources to this step. The enforcement of the operation regulation legislation needs to be ensured so the process and its adoption are made legal and mandatory. To facilitate the adoption of the tool, all levels of leadership and management need to have a clear understanding of the system and the efforts needed for the platform's successful deployment. While the FEDS was being used with a verbal commitment to its adoption, it was not fully institutionalized until an operational regulation was issued. Prior to the regulation, there was continued reluctance on the part of some staff to fully embrace changes. This contributed to delays, and additional attention and resources were required to sustain the effort until buy-in was mandated on paper through the approved government directive.

Anticipate data access and sharing challenges, an absence of data standards, and existing data gaps, and plan accordingly. The sharing of data between different government bodies is often constrained by existing policies and legislation. When building the integrated data sets for the FEDS base map and applications, a lack of data-sharing protocols proved to be a significant impediment. The project had to wait for the Digital Elevation Map 2020 to be shared, which required approval from the Department of Natural Resources and Environment. Data sets from flood sensors and associated cameras deployed by the Saigon Hi-Tech Park Research Laboratories (SHTP Labs) were needed. Discussion about integrating these data sets was initiated from project inception, and took considerable time as an official regulation had to be approved.

Ensure adequate resources to conduct in-depth sector and process-specific analysis. Substantial effort is required to identify and design process reforms and system functionality, and then to identify appropriate regulatory changes and entry points. Sectoral expertise within the World Bank should be leveraged where appropriate. Any ongoing or existing business process reviews in the sector in which the digital tool is being developed should be identified and built on.

Identify the right problem and align incentives. In practical terms, it's not always evident from the beginning whether regulatory buy-in will be supported by the government. This makes it important to invest time in identifying the right problem that allows for the alignment of good incentives for experimentation and iteration. Incentives need to be considered early in the project, including ensuring the delivery of early successes in use-case performance.

Build in adequate lead times for capacity- and relationship-building to gain client commitment and ownership by the leadership and technical managers, particularly to effect legislative and regulatory changes.

Technology

Ensure all relevant stakeholders are aware of the cost and effort required to support system development, operation, and maintenance. Deploying even basic digital tools involves various cost factors, some that appear obvious and others that may initially be obscured. For instance, operating costs are straightforward. Software licensing and maintenance fees can be calculated based on projected users or transactions, and hosting and data center charges are also clear. A little less obvious is ensuring adequate technical capacity to deploy the application/platform. Is there sufficient computing power and memory? Are network connectivity and bandwidth sufficient? In the FEDS case, the Zalo-based method of flood reporting required minimal connectivity.[8] Even more obscure is additional investment in equipment or capabilities in other agencies or systems. For FEDS, additional investments by SHTP were required for additional flood sensors. Lastly, time and investment could be required to fill skills gaps.

Leverage existing applications and information from government, stakeholders, and other development partner projects. In digital tool development, a review of existing platforms, their status, and the quality of accompanying data assets is required to avoid duplication and wasted resources. The FEDS was integrated into HCMC applications architecture through the 'single sign-on' (SSO) principle.[9] It was also agreed that DOIC servers would host the FEDS. Leveraging existing capabilities can save time and create synergies. Integrating into existing systems also promotes government ownership and achieves cost efficiencies in platform maintenance and operations.

[8] The DOIC provided a server that was strong enough and scalable to accommodate high traffic in the future. The specific requirements of the server needed to be sent to all key stakeholders early in the process to determine if additional investments, upgrades or clean-ups were necessary, as part of adopting the FEDS digital tool.

[9] The SSO principle is an authentication method that enables users to securely authenticate with multiple applications and websites by using just one set of credentials.

Table 2: Summary of Guidance Notes for Digital Transformation in Viet Nam

People

- Ensure the project is aligned with broader government capacity-building activities;
- Develop a communication plan early in the project and create key supporting knowledge products;
- Maintain a manageable level of focus and effort based on both project resources and absorptive capacity;
- Ensure digital data analysis and management skills are prioritized by the client to maximize the value of available data; and
- Present technical information and design tools for use and consumption by audiences with varying levels of technical capacity.

Process

- In the Southeast Asian context, institutionalization through operational regulation is essential;
- Anticipate challenges to accessing and sharing data, the absence of data standards, and gaps in existing data sets, and plan accordingly;
- Ensure adequate resources to conduct the required in-depth sector and process-specific analysis;
- Identify the right problem and align incentives; and
- Build adequate lead times for capacity- and relationship-building to gain client commitment and ownership.

Technology

- Ensure all relevant stakeholders are aware of the cost and effort required to support system development, operation, and maintenance; and
- Leverage any existing applications and information from government, stakeholders, and other development partner projects.

References for more information

Links to FEDS tools

Mobile app for officers: Báo cáo ngập HCMC (Flood reporting HCMC)

- iOS: https://apps.apple.com/vn/app/b%C3%A1o-c%C3%A1o-ng%E1%BA%ADp-hcmc/id1568670330?l=vi
- Android: https://play.google.com/store/apps/details?id=com.hcmc.android.manage

Mobile app for the public: Bản đồ ngập HCMC (Flood map HCMC)

- Phiên bản iOS: https://apps.apple.com/vn/app/b%E1%BA%A3n-%C4%91%E1%BB%93-ng%E1%BA%ADp-hcmc/id1568779743?l=vi
- Phiên bản Android: https://play.google.com/store/apps/details?id=com.hcmc.android.community

WebGIS for managers and the public:

- WebGIS for managers: https://flood.gfdapp.net/
- WebGIS for the public: in progress.