Strengthening Institutional Framework for Flood Management in Bihar

Developing a Framework of Action

IGC International Growth Centre

Developing a Framework of Institutional Strengthening

Outline

Purpose of study	Flood management is central to narrative of Bihar
Structure, Methodology & Approach	Multi-disciplinary Team, Deep Engagement, Extensive Surveys, Open Consultations, Structured Analysis
Phase I – Framework for Action	Understanding the Water Resources Department inside out to sketch the institutional setup
Conducting Phase I	Scoping studies to develop structure, leadership, field-staff, community and support system surveys
Findings of Phase I	Alert engineer-driven institution lacking capacity to adopt technologies and institutionalize best practices
Phase II – Roadmap for Reform	Co-developing specific set of ideas based on findings of Phase I and outlining a roadmap for reform
Conducting of Phase II	Prioritize key areas for action, build joint teams to formulate ideas, and conduct extensive consultations
Ideas for Roadmap & Next Steps	Technology organizational and institutional aspects training & skill development, community engagement

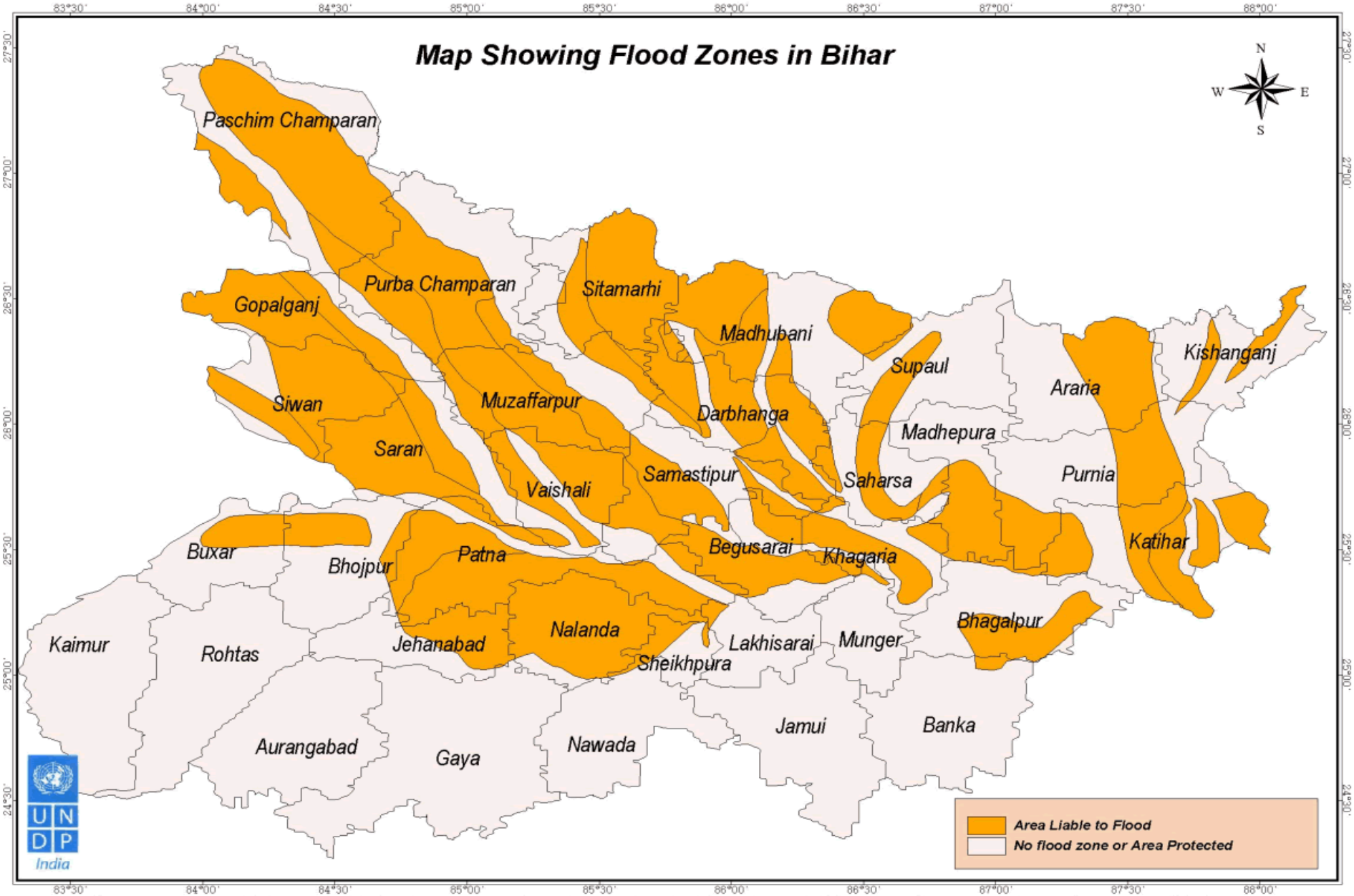
Purpose of Study

Flood Challenges of Bihar

river course change
sedimentation
human settlements
climate change
unpredictability

continuous improvements
latest technologies
resources
leadership
good fortune

- People of Bihar face recurring disaster of floods
- Flood management is a continuous cycle in Bihar
- Flood management practices need to improve every year
- Institutional strength of Water Resources Department is central to continuous improvement
- No previous study focused on analysis and strengthening of the institutional capabilities of WRD with respect to flood management
- Research on institutional aspects will enable policymakers to chart a roadmap of excellence



Disclaimer: This map was collated based on the data/information compiled by the Ministry of Urban Development and Poverty Alleviation; UNDP has not verified the accuracy of information of the Map.Source: BMTPC, India

Structure, Methodology and Approach

Multidisciplinary Team

- Ranu Sinha : Extensive Water Sector Experience at WB
- Martin Burton: Engineering Expert in Water Resources
- Ghanshyam Tiwari: Organizational Consulting Experience

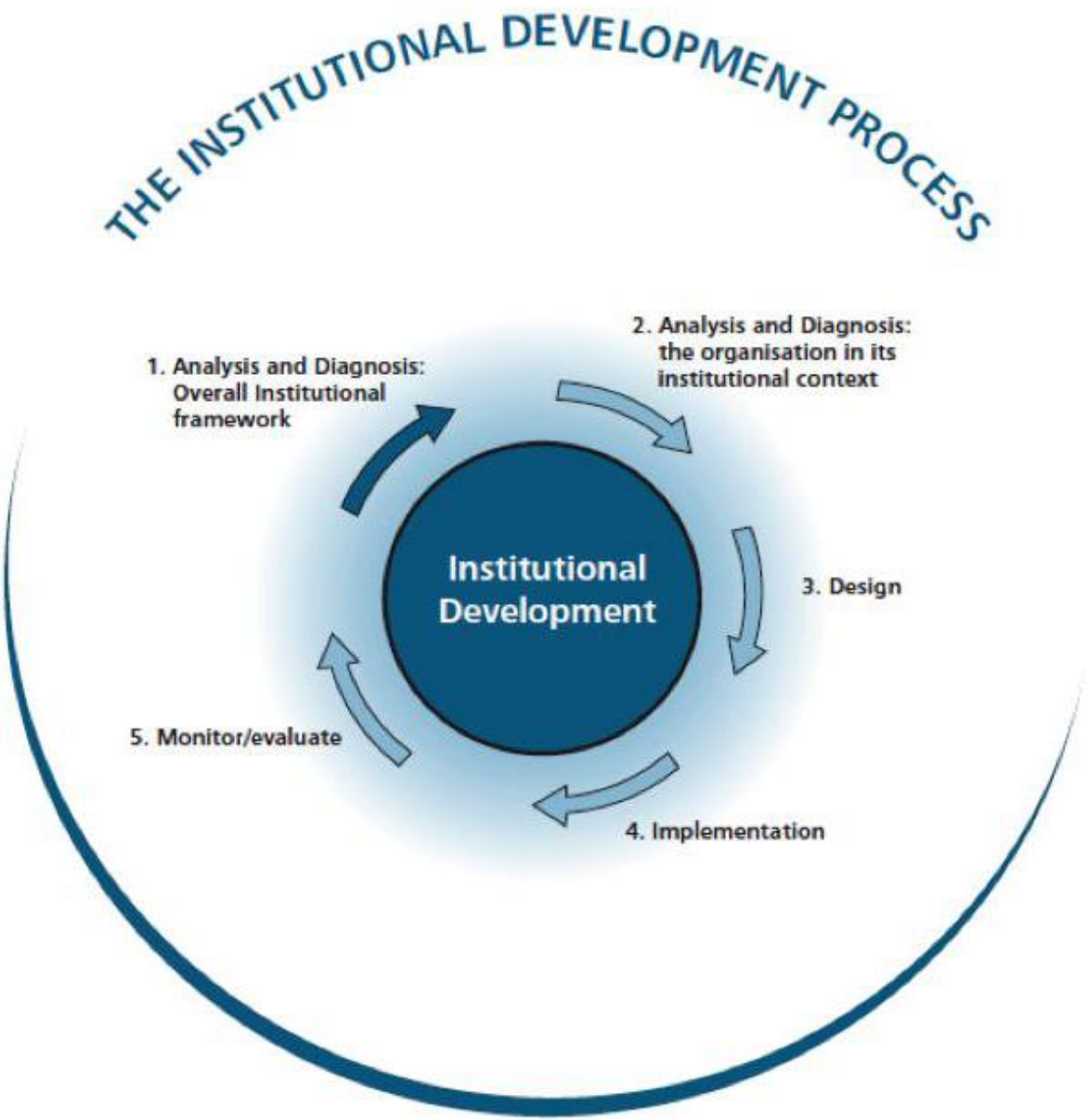
Phase I – Framework for Action

- Deep Engagement at all levels of Water Resources Department (WRD)
- Scoping visits to flood divisions and supporting institutions and focus group discussions at WRD to outline the approach
- Survey of leadership, field staff, community, supporting institutions
- Parallel study of projects and case-studies matching WRD institution
- Structuring the findings and developing framework for action

Phase II – Roadmap for Reform

- Building support in WRD to co-own the development of roadmap
- Prioritizing areas for reform
- Conceptualizing ideas and co-developing with WRD
- Engaging with experts/institutions that showcase ideas in action
- Outlining a set of specific ideas in prioritized areas and engaging WRD for a plan for implementation

Phase I – Developing a Framework for Action



1. Analysis and Diagnosis: Overall Institutional Framework

2. Analysis and Diagnosis: The Organization in its Institutional Context

Conducting Phase I – Outlining Steps

- Representative survey of key stakeholders including WRD senior leadership and field officers, community members, PRI, FGDs at village level
- Survey of officers at supporting organizations FMIS and WALMI
- Discussions at WRD and FMIS and existing research used for survey design
- Preliminary visits to Ghandak basin helped in validating the design
- Analysis of Irrigation Act, annual reports, research papers and other published materials helped in contextualizing the information
- Interaction with other agencies (DMD and SDMA) sharpened the focus
- Analysis of data and other information conducted through new as well as established frameworks for organizations

Conducting Phase I: Design of Surveys

WRD Field Survey

- Level of knowledge held about flood risk
- Quality of interactions within the WRD on flooding issues;
- Extent and timeliness of flood warnings
- Quality of embankment maintenance and management
- Quality of staff skills, training, and technical knowledge
- Map processes and quality of decision making
- Identify types of technology, hardware and software for flood management

Community Survey

- Understand the impact on flood affected households, businesses and industries in flood
- Identify level of knowledge held about flood risk
- Level and quality of interactions with the WRD on flooding issues
- Extent and timeliness of flood warnings
- Knowledge held about embankment maintenance and management

WRD Leadership Survey

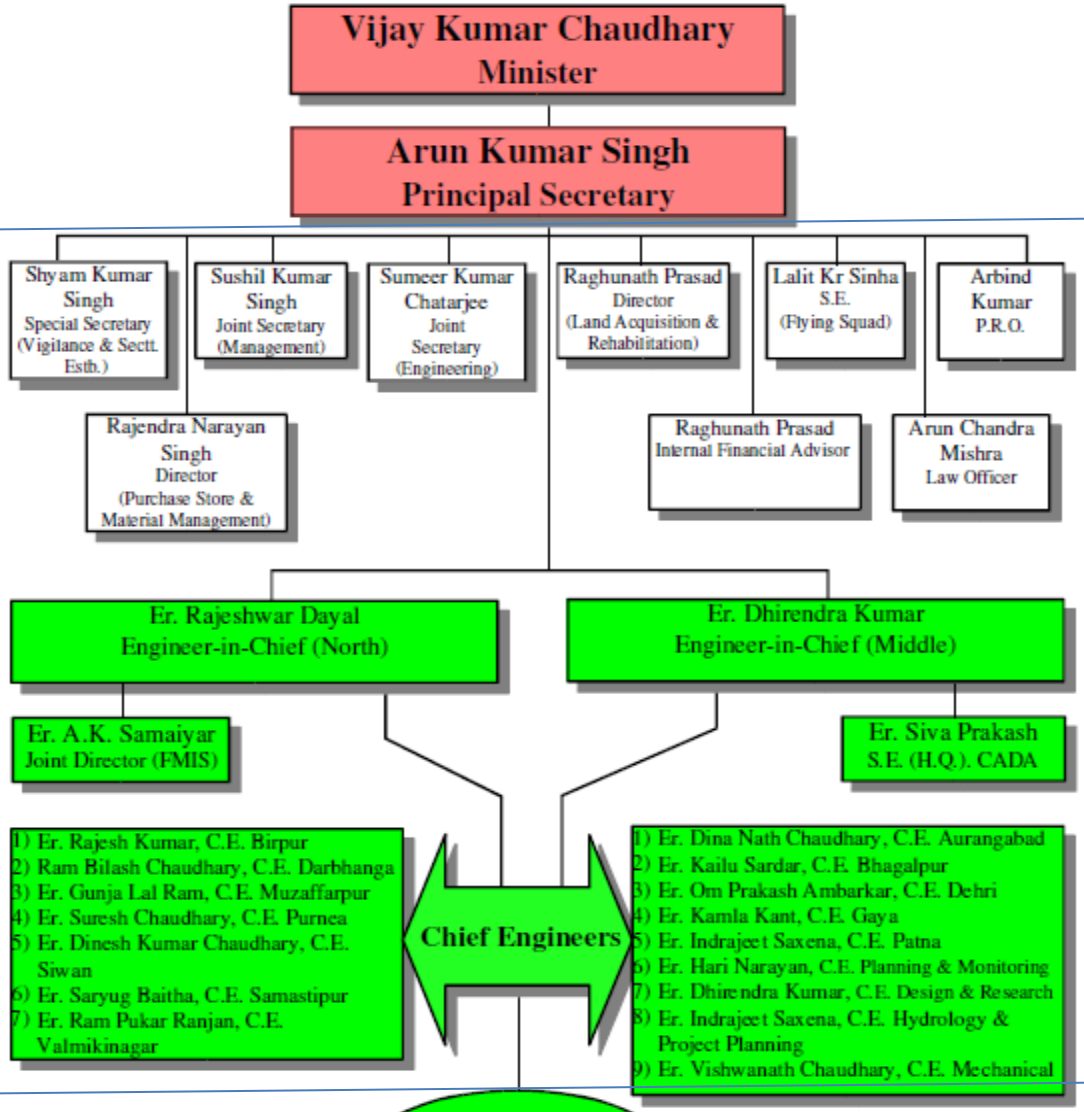
Experiences, professional growth, organizational practices, priorities, and institutional strengths and weaknesses

Supporting Organizations Survey

WALMI survey: Infrastructure, training, processes, engagement and knowledge

FMIS survey: Technology, engagement, resources, staffing and knowledge

Leadership



Field Officers

IGC Inter

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Basin Wise flood prone and protected areas

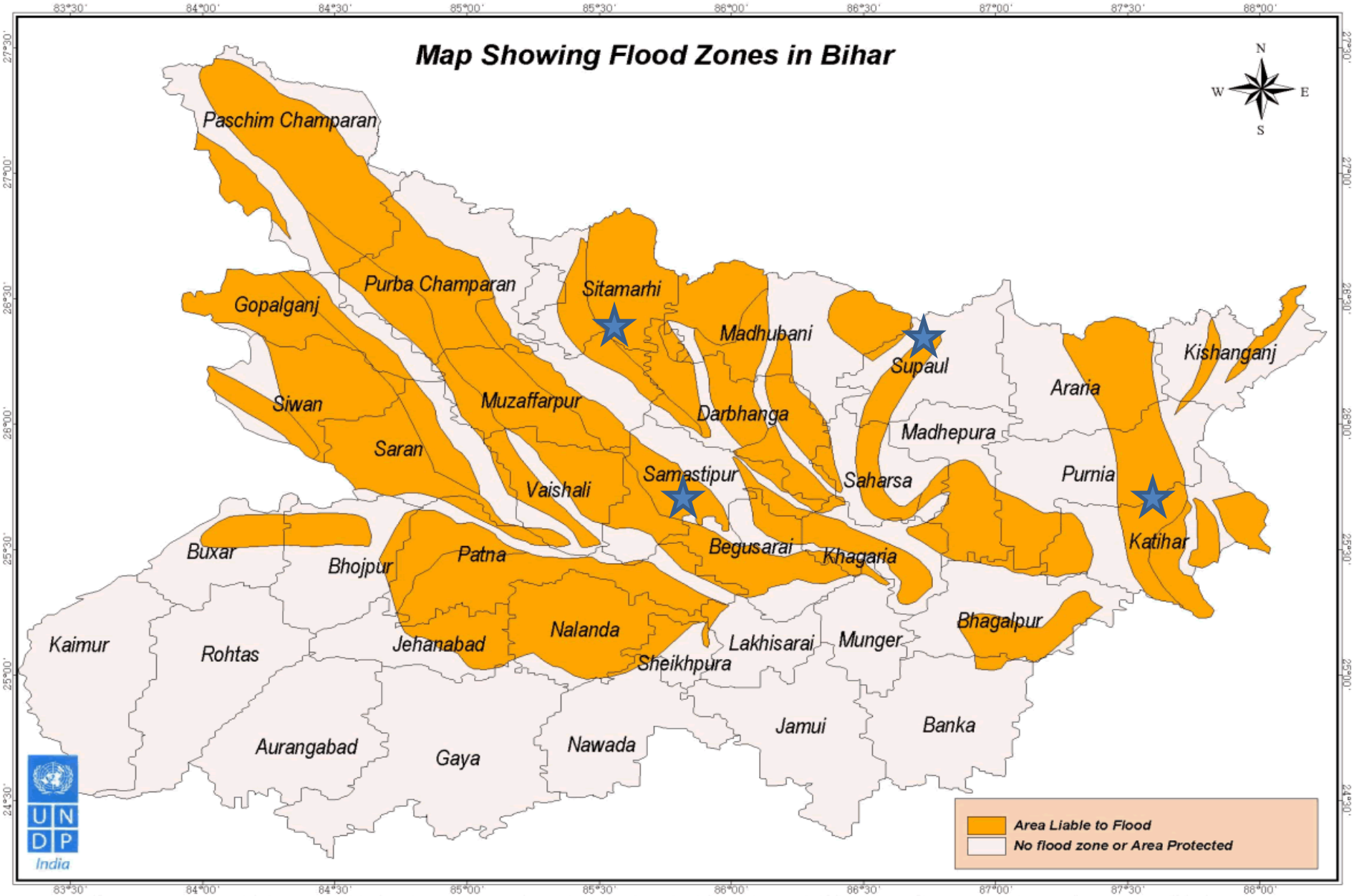
Name of the Basin	Catchment Area (Sq. Km)	Length of River in Bihar (Km)	Embankment Constructed (Km)	Flood Prone Area (Sq.Km)	Protected Area (Sq. Km)
Ganga	19322	445	596.92	12920	4300
Kosi	11410	260	387.51	10150	9300
Burhi Gandak	9601	320	704.26	8210	4010
Kiul Harohar	17225		14.00	6340	NIL
Punpun	9026	235	37.62	6130	260
Mahananda	6150	376	225.33	5150	1210
Sone	15820	202	59.54	3700	210
Bagmati	6500	394	400.79	4440	3170
Kamla Balan	4488	120	184.90	3700	2810
Gandak	4188	260	511.66	3350	3350
Ghaghra	2995	83	132.90	2530	790
Chandan	4093	118	83.18	1130	80
Badua	2215	130	NIL	1050	NIL
Lalbakeya			54.35		
Adhwara			181.50		
Bhuthi			54.70		
Total			3629.16	68800	29490

Conducting Phase I Surveys

- Three key river basins (Bagamati, Kosi, Mahananda) were selected

- Selections for field survey and community survey:
  - Divisions (2) and sub-divisions (4) were selected based on flooding history and inputs from the WRD officers in Patna
  - Field officers (EE, AE, JE) were interviewed depending on availability (22)
  - Villages (4 per basin) included outside, on and inside embankments (12)
  - Respondents in villages were mixed: caste, gender, profession etc. (145)
  - PRI members were also part of the respondents in each village
  - Focused group discussions were held in every village (12)
  - Leadership survey was sent online as well as on paper (9)

- WRD Field and Leadership survey was conducted by the study team
- Community survey was conducted by professional survey team



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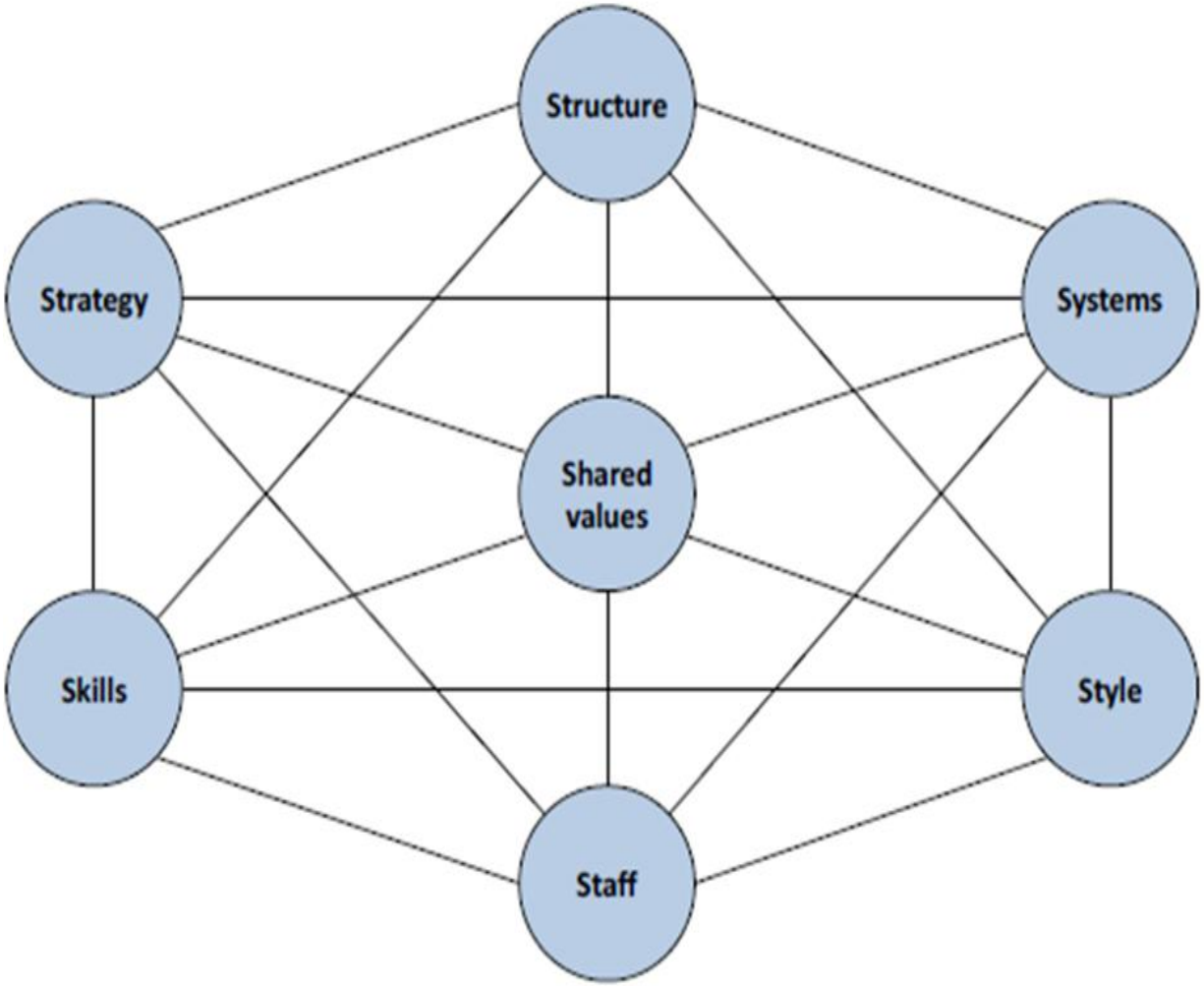
Conducting Phase I : List of Villages and Associated Households

Village	River Basin			Total
	Bagmati	Mahananda	Kosi	
Kuin	10			10
Rampur Kanth	12			12
Benipur	13			13
Janardh	12			12
Lalganj		13		13
Kath Ghar Durgapur		12		12
Lakhi Tola		12		12
Bhola Marhi		12		12
Kalyanpur			12	12
Kodhli			13	13
Lokha			12	12
Mansi Piprahi			12	12
Total	47	49	49	145

Findings of Phase I: Defining Institutional Gaps

Institutional Gaps	Definition
People Gap	Disconnects in the mission and function of organization that arise when key positions remain unoccupied or employed by staff with mismatching capabilities
Process Gap	Inefficiencies in functioning and decision-making of organization arising from the way staff engage with hierarchy largely in a top-down manner, at peer level, and with stakeholders
Technology Gap	Existing processes, practices, methods, and tools do not integrate technological systems and tools
Resources Gap	Funding shortages reduce performance of institution
Support System Gap	Inadequate setup to help the department in supplementary (non-core) functions, long-term strategic projects and capacity building
Ecosystem Gap	Lack of vision and lack of ownership of overall goals of organization by staff and stakeholders
Coordination Gap	Methods to engage with partner organizations are weak or missing

Findings of Phase I: Model of Analysis

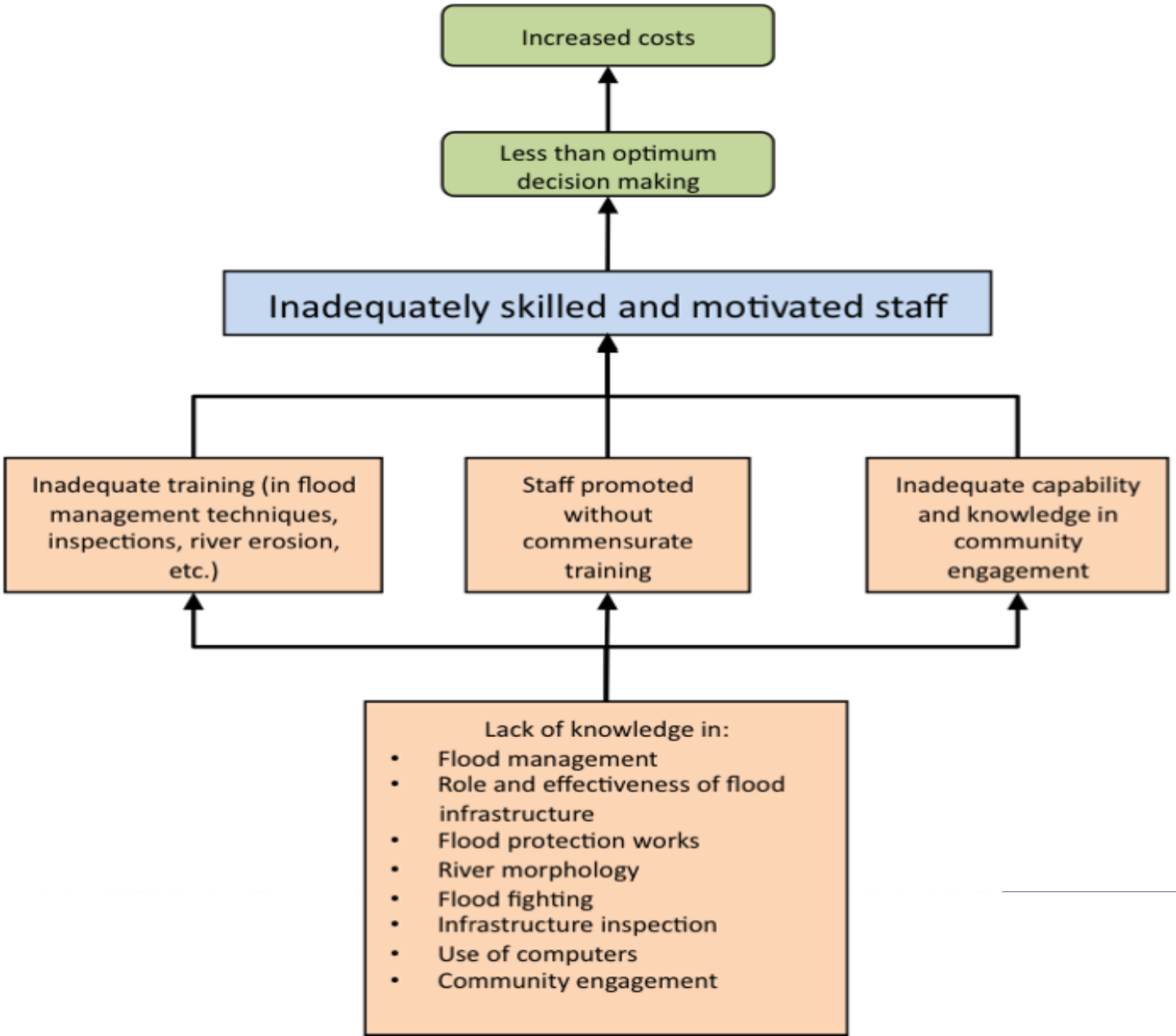


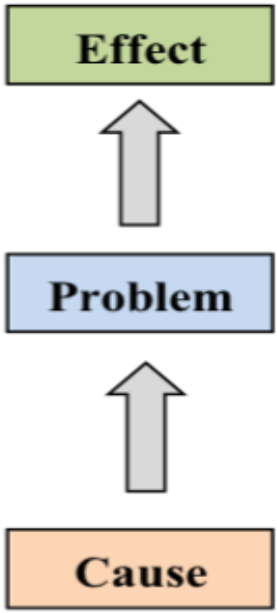
Structure: Comprises the organisation chart, job descriptions
Systems: The processes and procedures for getting the work done
Style: The way that management behaves, including showing what is important to the organisation
Staff: The people in the organisation - their capabilities, needs, strengths and weaknesses
Shared values: The culture of the organisation
Skills: The capabilities possessed by the organisation as a whole
Strategy: A coherent set of actions to further the aims and objectives of the organisation

People & Skills Gap

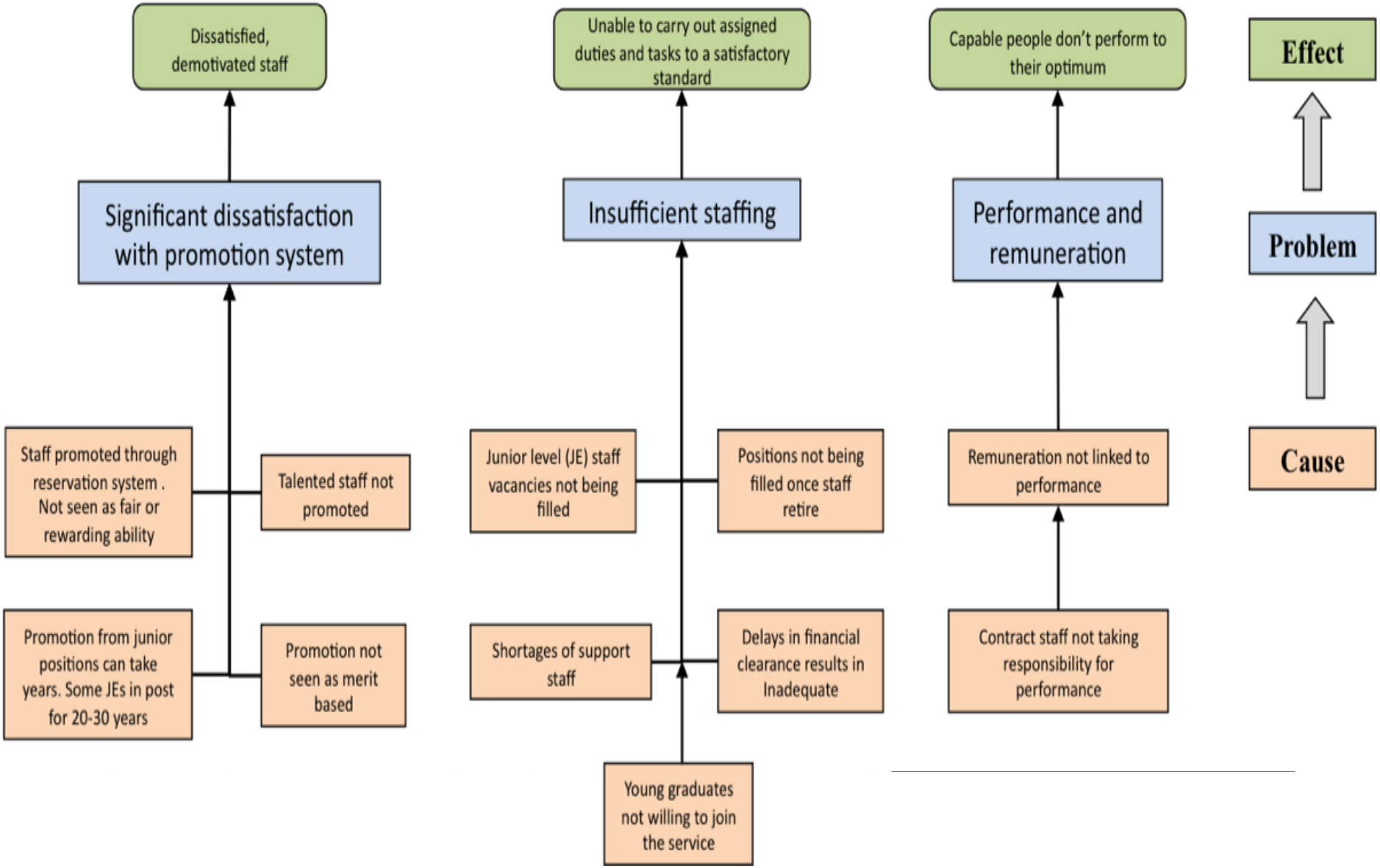
Indicators	Survey Findings
Field offices are understaffed; vacancies in all basins	• Leaders concur that there is a shortage of field staff • Department has poor dynamic and flexible staff management and little to no planning for staff shortages post-retirement • Inadequate number of staff to monitor all flood risk areas
Uniform level of technical skills **Need for more frequent technical training for all staff**	• Very few respondents understand remote sensing and GIS techniques • Evidence of high competency in river basin planning and preparation of Detailed Project Reports for water resources projects • Relatively equal technical expertise of senior level staff (EE, SE, CE) at Division level with junior level staff (JE, AE). • Few have received specialized formal training (barring seminars and introductory trainings) on flood management and associated aspects such as environment, ecology, remote sensing, flood forecasting, etc. • Little provision for training of newly transferred staff (Irrigation Division to Flood Division) • Overall desire to increase frequency & quality of flood management trainings
Unsatisfactory promotion & transfer system	• 8 out of 9 senior survey respondents think the promotion policy needs to be revised and reformulated • Promotions have weak linkage to performance & merit • Need for new time bound merit based promotion system

People & skills gaps cause suboptimal decision-making, increased costs





Staff vacancies & dysfunctional promotion system affect spirit

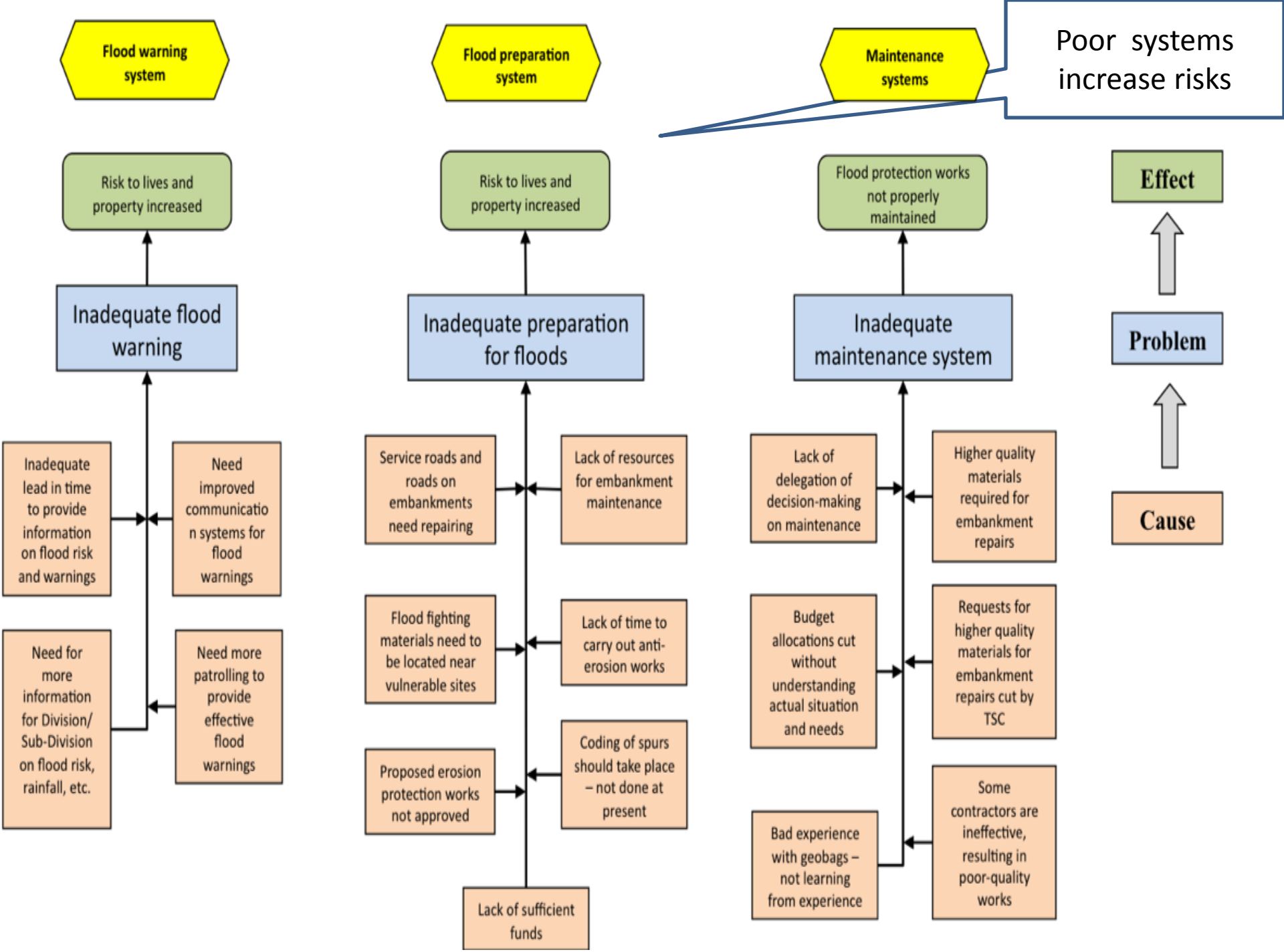


Systems & Process Gap I

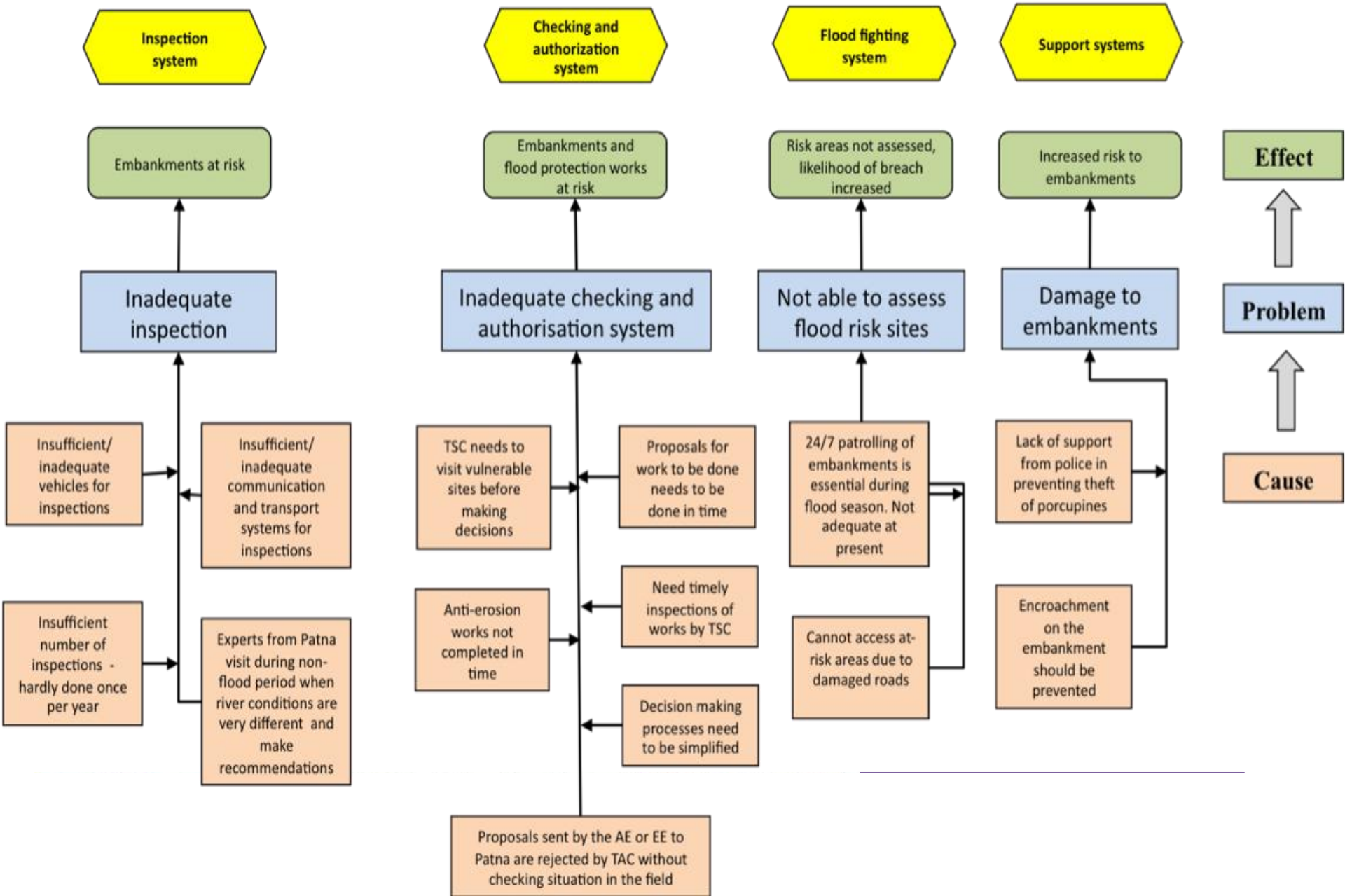
Indicators	Survey Findings
Mismatch in priorities between various levels in hierarchy	• All survey respondents claimed that primary proposals originate at the JE/AE level. However, role of JE/AE is insignificant in the technical review and decision-making process • Maintenance decisions sometimes disconnected from ground realities, little room for inputs from junior officers • Proposals rejected without adequate assessment of field situation
Top-down decision-making	• Most senior survey respondents feel JE/AE shouldn't have decision-making powers in critical maintenance, anti-erosion works • Field officers feel more of their inputs should be taken into consideration
Lack of clarity in decision-making	• Each decision involves JE/AE (making the proposal), EE, SE, CE and experts in Patna conducting the review • Experts not traveling to field to inspect sites before decisions are made on projects • Decision-making processes need to be simplified
Delays in approvals due to time spent chasing proposals through multiple nodes	• All leaders agree that even the small proposals take up to two months to be approved and sanctioned • Anti-erosion works sometimes not completed in time • Results in increased risk to flood protection infrastructure
Weak inspection & maintenance systems	• Insufficient number of inspections conducted (e.g. sometimes once a year) • Inadequate communication & transport systems for inspections

Systems & Process Gap II

Indicators	Survey Findings
Inadequate communication & flood warning systems	• Inadequate lead time to provide information on flood risk and warnings • More data to be sent to divisions and sub-divisions on flood risk, rainfall • Need for better patrolling and improved communication systems for flood warnings • Need to engage community
Lack of adequate resources	• Poor facilities and equipment for field staff (e.g. vehicles, motor boats, offices) • Higher quality materials required to carry out repair works
Training system is inadequate	• All leaders desire basic to advanced training in multiple subjects ranging from IT to Flood Management Systems • No respondents mentioned any advanced trainings taken at local institutes • National Institute of Hydrology (NIH) is only support system for advanced training, very few officers have training in this • On specific subjects related to flood management, officers demanded advanced training


Poor systems increase risks
Flood warning system
Flood preparation system
Maintenance systems
Effect
Problem
Cause
Risk to lives and property increased
Inadequate flood warning
Inadequate lead in time to provide information on flood risk and warnings
Need improved communicatio n systems for flood warnings
Need for more information for Division/ Sub-Division on flood risk, rainfall, etc.
Need more patrolling to provide effective flood warnings
Risk to lives and property increased
Inadequate preparation for floods
Service roads and roads on embankments need repairing
Lack of resources for embankment maintenance
Flood fighting materials need to be located near vulnerable sites
Lack of time to carry out anti-erosion works
Proposed erosion protection works not approved
Coding of spurs should take place – not done at present
Lack of sufficient funds
Flood protection works not properly maintained
Inadequate maintenance system
Lack of delegation of decision-making on maintenance
Higher quality materials required for embankment repairs
Budget allocations cut without understanding actual situation and needs
Requests for higher quality materials for embankment repairs cut by TSC
Bad experience with geobags – not learning from experience
Some contractors are ineffective, resulting in poor-quality works

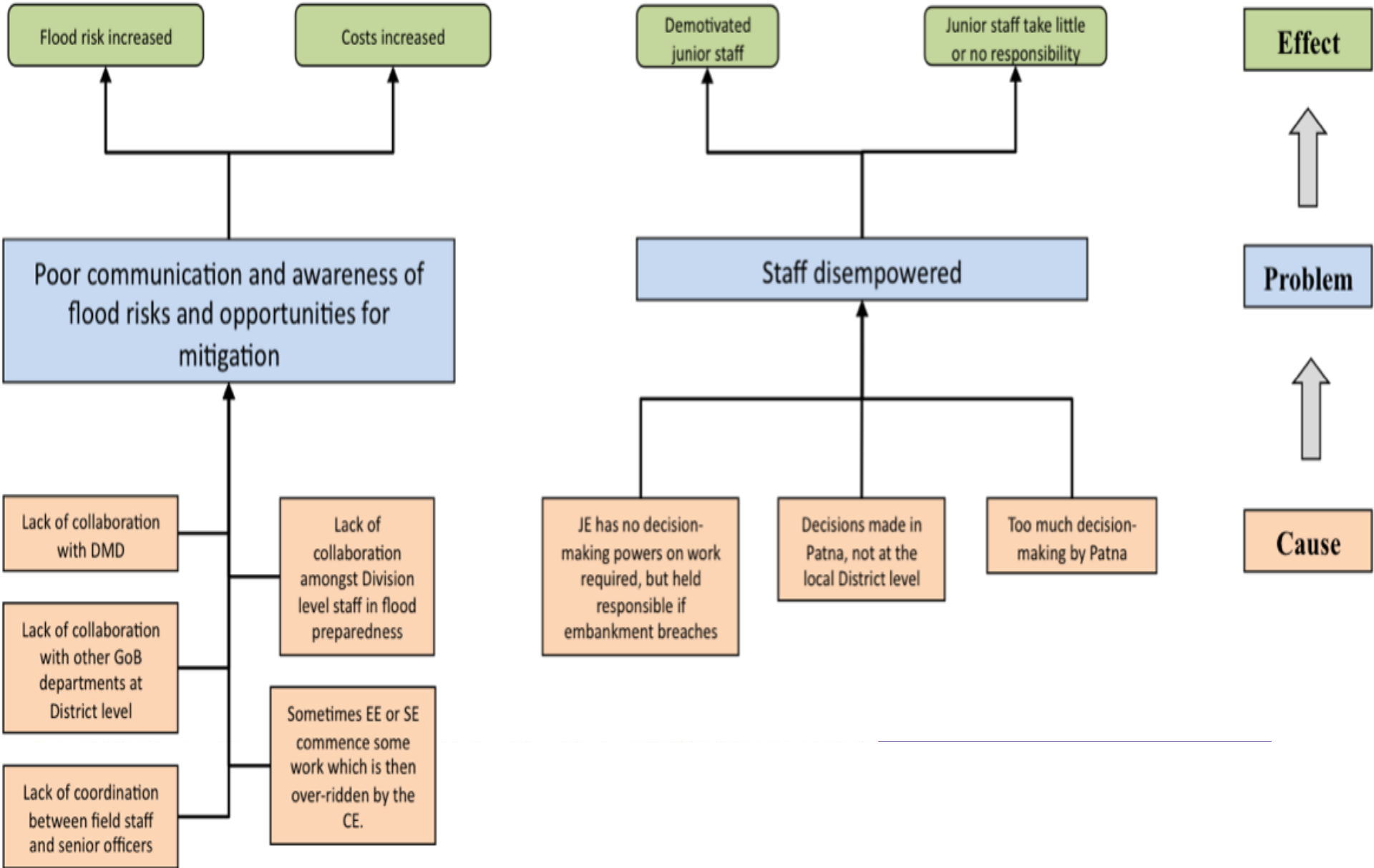
Inadequate and many-hop processes cause delay and risk WRD assets



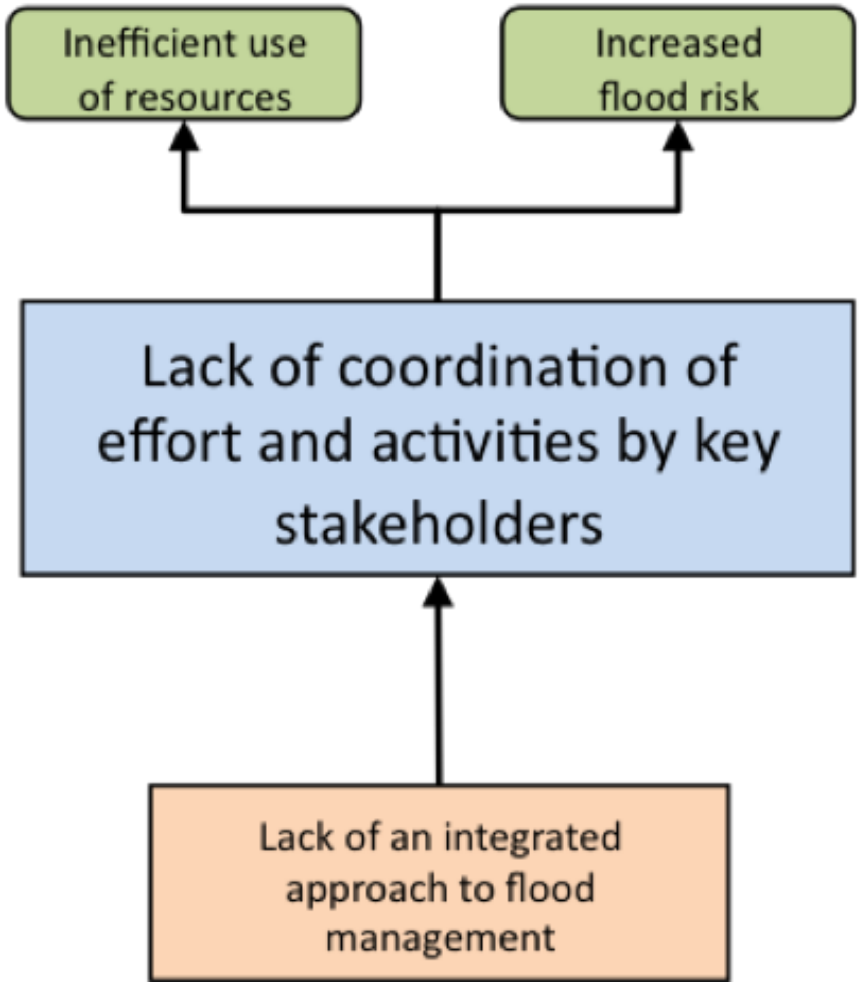
Coordination & Collaboration Gap

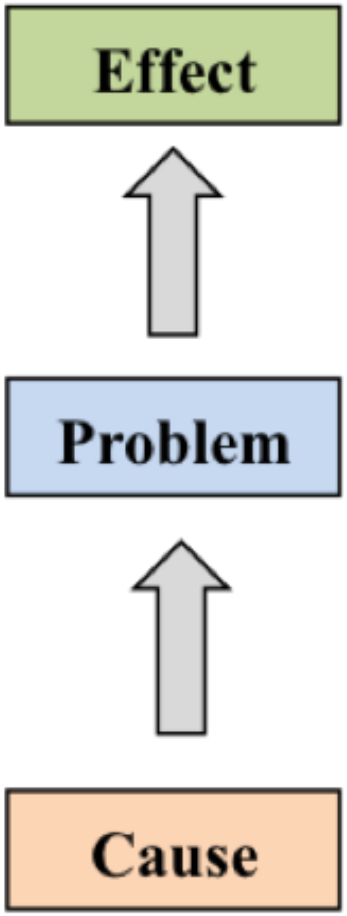
Indicators	Survey Findings
Lack of collaboration within WRD	• Decision-making too centralized on issues of inspection, maintenance, anti-erosion • More collaboration needed between JE/AE responsible for embankment and experts in Patna who have final say • Lack of collaboration among division level staff
Little to no coordination with partner agencies (e.g. WRD and DMD); Narrow focus on building and protecting flood management infrastructure	• Several senior leaders noted flood management is an integrated exercise and the coordination is lacking • Lack of clarity in roles and responsibilities within staff in the WRD and DMD – before, during, after a flood event • Better coordination required among GoB departments at district and state level
Lack of community centered approach; community stakeholders not integrated into WRD processes; WRD stakeholders are embankments NOT communities at risk	• Need for greater coordination with community during flood events, embankment patrolling & inspection • Lack of integration of community into WRD processes • Potential to engage in information sharing & flood warnings

Coordination gap, lack of empowerment of JE/AE affect accountability



Coordination gaps also create inefficiencies and risks

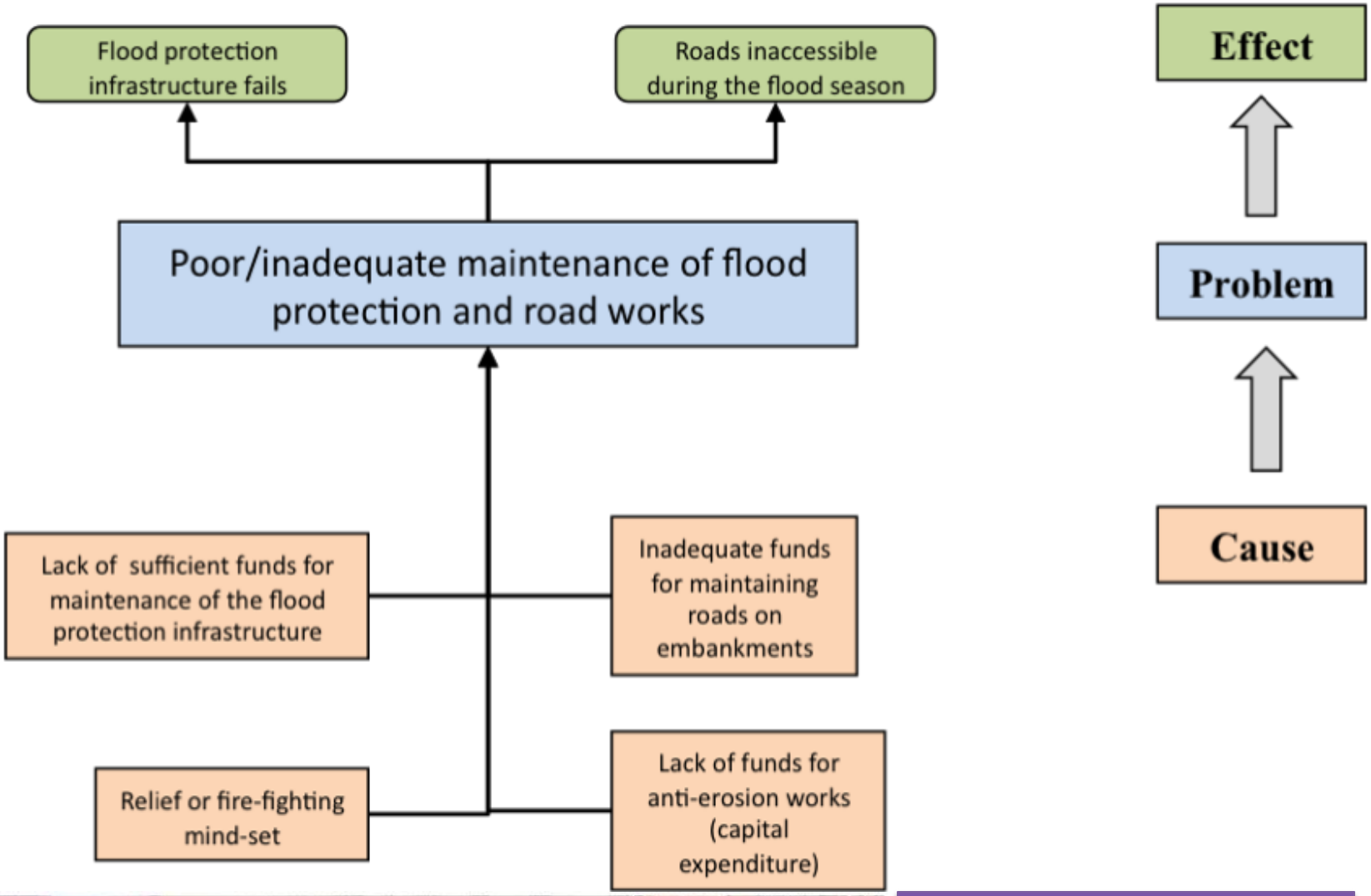




Resources & Funding Gap

Indicators	Survey Findings
Funding shortages reduce performance and quality of institution	• Discussions with senior leaders reveal a project-to- project mindset on funds • Funds are limited for upgrading office setup, facilities to field officers and field equipment
Insufficient funds for maintenance works	• Division officers felt funding insufficient to carry out maintenance works on the embankments and roads to embankments • Original budgets and cost estimates reduced ; only low cost options approved • Resulting in poor maintenance works on roads and flood infrastructure • Need to maintain or remain within 80% of original budget requests • May lead to future increase of embankment failures
Inadequate equipment and technological resources	• Lack of quality transport equipment, poor quality offices, need to increase communication devices or night vision equipment • Poor technical software and IT for communication and data collection at division levels • Poses constraints for officers to conduct inspections and reach flood sites

Resource and funding gaps create poorly operational infrastructure

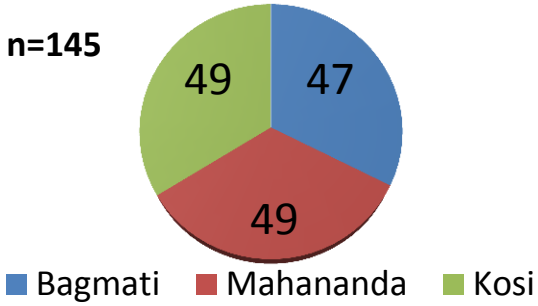


Findings of Phase I - Community Survey

- **Community Survey:**
  - 3 level of insights: aggregate level of information, interaction and engagement on floods, variations at basin level and variations based on type of village (inside / on / outside embankment)
  - Common feelings amongst community:
    - Water logging & siltation has increased
    - Maintenance of embankments slow; low levels of satisfaction
    - Lack of warning systems
    - Lack of coordinated community engagement

Total Community Survey

n=145



Focus Group Discussions (12)

- Similar experiences across basins
- Inside embankments, flood caused by sudden release of water
- Outside, watelogging remained the chief grievance and is increasing. Dalits most affected.
- Warnings not issued regarding release of water in river
- Embankments increased flooding in Mahananda and Kosi
- Dissatisfaction with maintenance
- Complaints /suggestions ignored
- Rudimentary forecasting methods
- Collaboration within is low

Flood cannot be prevented but can be managed better

Response	River Basins			Location		Total
	Bagmati	Mahananda	Kosi	Within Embankment	Outside Embankment	
Do you think floods can be prevented No.,(% yes)	19 (40.4)	16 (32.7)	16 (32.7)	26 (35.1)	25 (35.2)	51 (35.2)
Flood protection can be better ` No.,(yes)	25 (53.2)	18 (36.7)	20 (40.8)	30 (40.5)	33 (46.5)	63 (43.4)

Majority unaware of the WRD and its functioning

Which department is responsible for Flood protection No.,(% correct)	25 (53.2)	22 (44.9)	16 (32.7)	31 (41.9)	32 (45.1)	63 (43.4)
Do you know any WRD staff No.,(% yes)	3 (6.4)	9 (19.4)	10 (20.4)	10 (13.5)	12 (16.9)	22 (15.2)

Community participation in rebuilding is low

Does community collaborate during flood No.,(% yes)	25 (53.2)	19 (38.8)	14 (28.6)	33 (44.6)	25 (35.2)	58 (40.0)
Does community help in rebuilding No.,(% yes)	8 (17.0)	5 (10.2)	9 (18.4)	11 (14.9)	11 (15.5)	22 (15.2)

Findings of Phase I: WALMI Survey

- WALMI's role in flood management is both strategic and operational
- At strategic level, WALMI is responsible for developing institutional linkages for research and disseminating information within the WRD
- At operational level, WALMI is responsible for offering training to AE and JE level staff on aspects of flood management
- Today nearly a 50% shortage of staff in WALMI at all levels
- 50% shortage in the number of training staff, which has a more significant impact of the quality and quantity of trainings that WALMI can provide to WRD staff
- Training apparatus is subject to ad hoc mechanisms and frequent transfers of staff
- Does not offer any training to officers above the rank of AE
- No evidence of institutional linkages created or strengthened by WALMI
- Focus on flood management is limited to three trainings

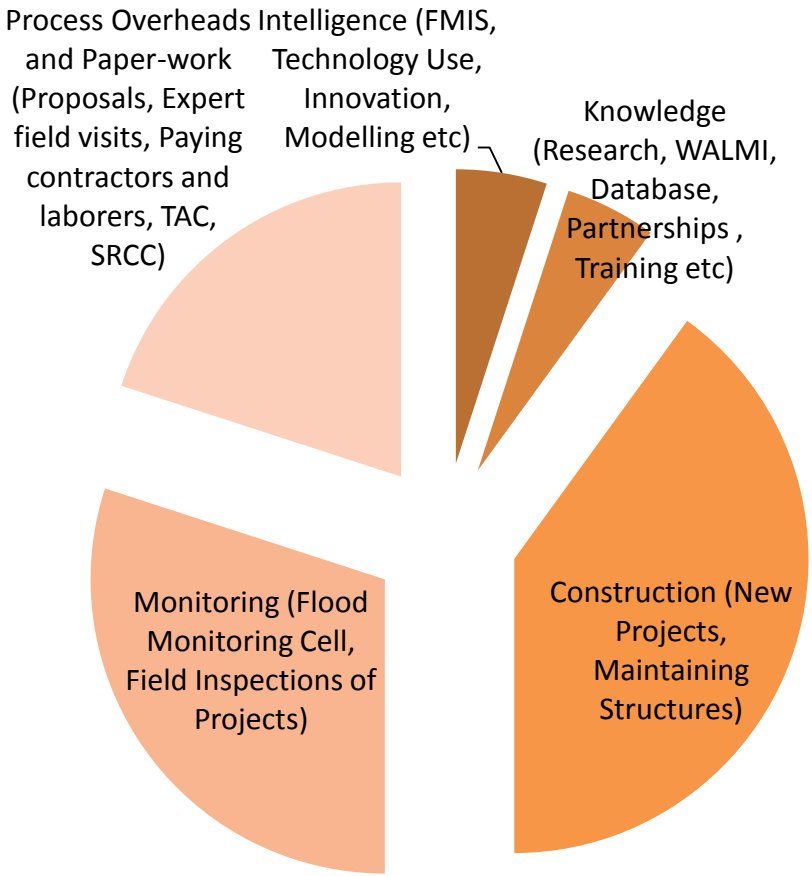
Findings of Phase I: FMIS Survey

- Aim of FMIS to generate and disseminate timely and customized information in order to support flood control and management in the flood prone areas of Bihar
- FMIS can generate satellite imagery of rivers in northern Bihar showing the movement and pathway of a flood
- Does not have the resources or capability to do real-time modeling
- No database of flood events, other than the reports provided in the annual report
- Essential for FMIS to generate database so that decision-making in Patna and in the field can be facilitated to cover high-risk areas of embankments and chart future trajectory of river movement
- Not all field offices of the WRD can take advantage of the satellite maps and data provided by the FMISC as they are not connected to the Internet; no computers.
- Need for WRD to join together the field offices with the excellent work of the FMISC in Patna so that a streamlined and integrated flood data gathering and sharing system can be put in place

Summary of Phase I Findings

Institutional Gaps	Findings
Skills	• Technical know-how of staff needs to be improved • Need for research & development unit within the WRD that focuses on training and dissemination of latest flood management techniques to WRD staff • Need to make professional human resources development and management a core objective of the WRD
Style of Leadership	• Extensive emphasis on top-down decision-making • Need for leadership to transition from construction agency to management agency; evolve to "predict and prevent". • Need to set mandate for a more professional agency • Provide strategic leadership to transform Department
Staff	• Address staff shortages and weak promotion processes • Need a specialist HRM cell, staffed with experienced HRM people • Need to identify each individual's skills and staff to match skills • Need to identify younger, capable staff and fast track promotion
Systems	• WRD systems appear to be weak; communications systems are poor • Liaison/communication with communities poor • Mobile technology and modern communication systems can offer WRD significant opportunity to address systems gaps and leap frog
Strategy	• Need to define a vision for flood management for the future; shift focus away from construction to management • Engage communities directly, integrate latest technology, improve training

WRD today focuses mainly on engineering aspects

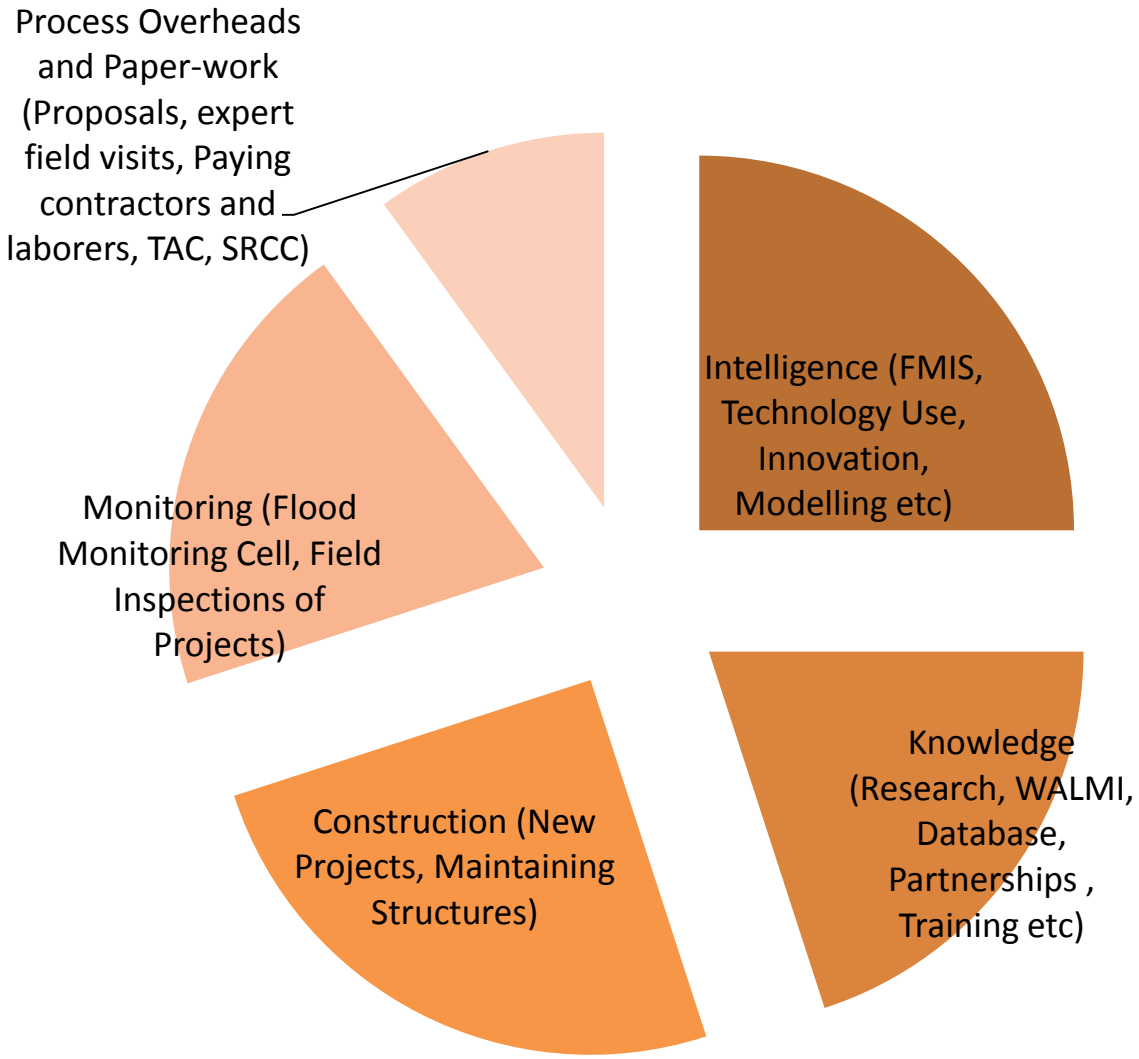


river course change
sedimentation
human settlements
climate change
unpredictability

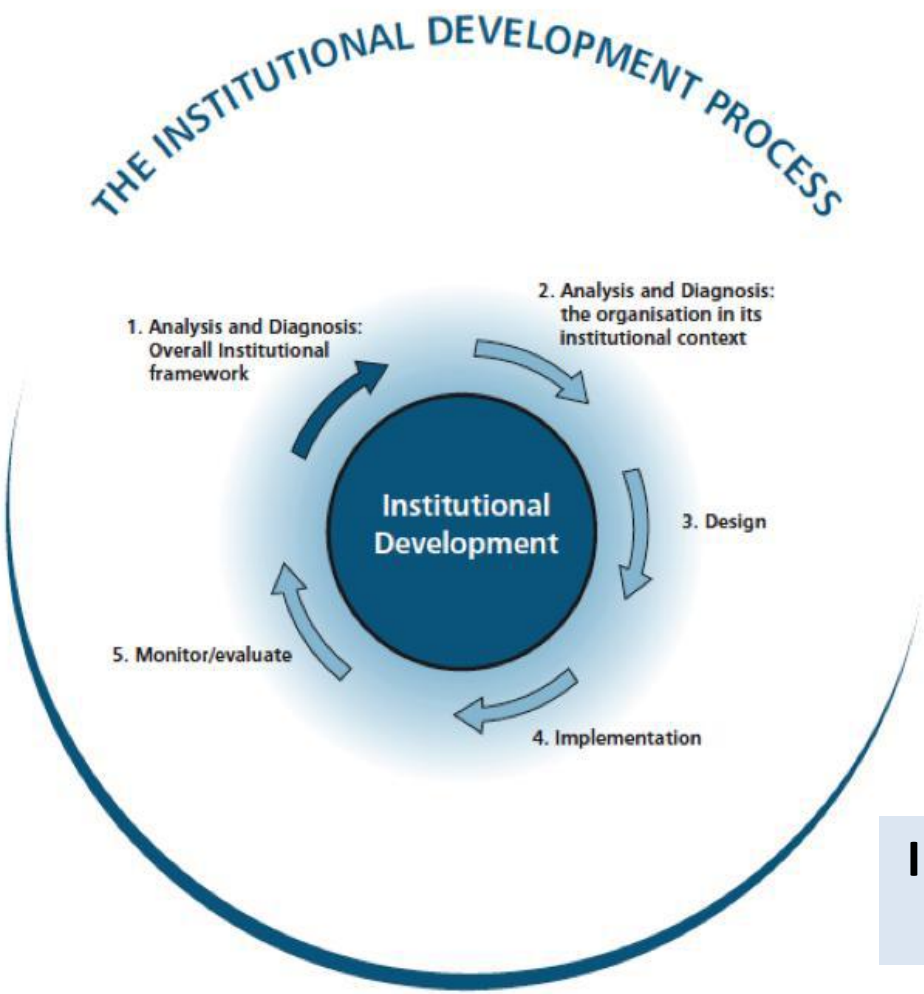
continuous improvements
latest technologies
resources
leadership
good fortune

Mismatch of activities and forces

Next Steps: Future WRD Scenario



Phase II : Developing Roadmap for Reform



Phase II Represents the "Design" stage

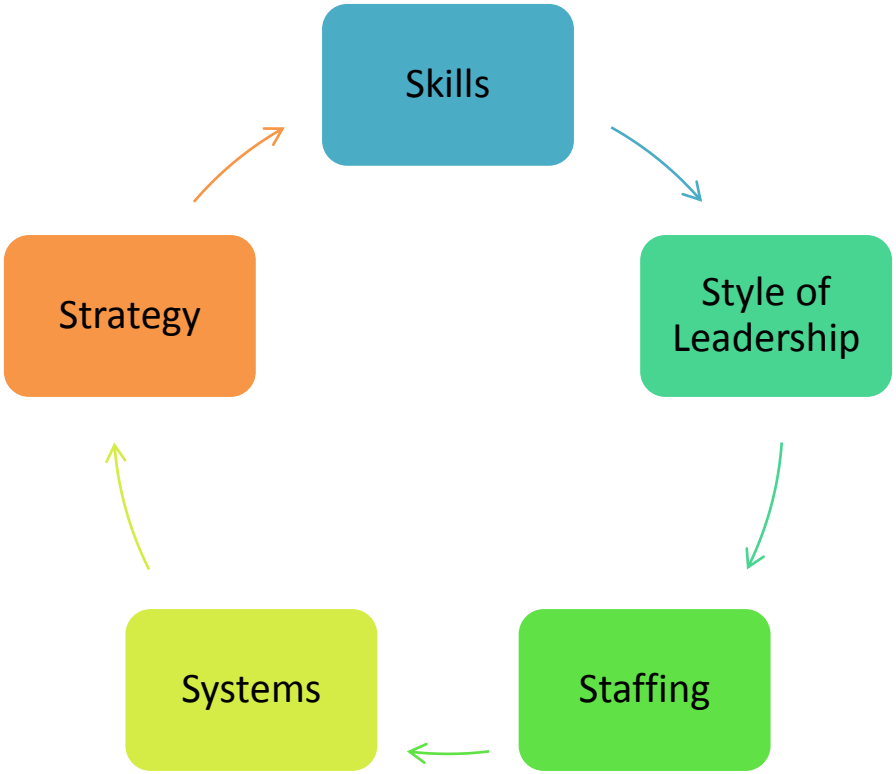
- Focus on five key challenges:
  - Skills
  - Style of Leadership
  - Staffing
  - Systems
  - Strategy
- Interaction & dialogue with WRD
- National & International consultations, best practices

Inclusive, Implementable and Sustainable Criteria for reform

Conducting Phase II : Prioritizing areas for reform

Institutional Gaps	Ideas for Roadmap
People Gap	Technology
Process Gap	
Technology Gap	Organizational and Institutional Aspects
Resources Gap	
Support Systems Gap	Skill and Training
Ecosystem Gap	Community Engagement
Coordination Gap	

Areas for Reform



Conducting Phase II : Extensive Consultations

Name of Organization	Key areas of engagement
Bangladesh Water Development Board	Functions, operations of the Flood Forecasting and Warning Centre
Center for Environmental & GIS	Understand research & knowledge development arm for flood and water resources management in Bangladesh
Institute of Water Modeling	Explore potential for development of center of excellence in the field of water modeling, computational hydraulics, and allied sciences
Indian Institute of Technology Delhi and Roorkee; Preliminary National Institute of Technology Patna	• Potential of research and training engagement in flood management • Organizational improvement required for managing floods, technology upgrades in flood management
Water Resources Planning Organization, Bangladesh	Understanding national policy framework for water management in Bangladesh

Phase II Findings: Technological Roadmap

Ideas	Solutions
Online database of basin-level flood risk	• Database of basin-specific flood risks: past flood events, their impact, occurrence, quantity and extent of damage, types of flood protection infrastructure • Risk-rating system, such as risk based color coding • Develop practice of real-time and decentralized informed decision making
Transport equipment & communication tools	• Modern, well maintained all-terrain vehicles, motor boats that can be utilized by field officers to conduct inspections • Communication equipment such as radio technology, satellite phones, night-vision equipment, internet connectivity
Flood Risk Mapping & Flood Forecasting Model	• Models for each of river basins • Coupled with detailed flood risk mapping, this becomes useful decision making tool fro WRD and Disaster Management • Scope of FMISC must be enhanced to enable this
Flood Early Warning & Dissemination Systems	• System to provide lead time of at least three days advance notice • Example of the Bangladesh Flood Forecasting and Warning Centre (FFWC) in the Bangladesh Water Development Board is an excellent case study • Set up a dedicated flood forecasting and early warning cell within the WRD
Embankment Asset Management System	• Robust electronic system to document and maintain status and history of the 2500 Km long embankment system

Phase II Findings: Organizational & Institutional Roadmap

Ideas	Solutions
Enhancing scope of Planning & Research Division	• Disseminating best practices of flood management , structural repairs and embankment maintenance across divisions • Establish benchmark of excellence and publish annual score • In-house Knowledge and Quality Center with a vision to assess progress and technological advancement of each of the divisional units of the WRD
Reconstructing Human Resource Apparatus of Organization	• Autonomous institutions for professionals specialized/multidisciplinary skilled such as hydrology, geomorphology, embankment maintenance, flood control measures, flood forecasting data collection and analysis and knowledge on state of the art technologies in flood management • For example, CEGIS and IWM in Bangladesh enjoy high levels of autonomy to recruit experts and retain
Strategic Specialization in Emerging Areas of Flood Management	• Urgent need to recruit people with multi-disciplinary education • Encourage full-time postgraduate education; well-established practice in Bangladesh where almost all senior level officers hold postgraduate degrees • Focus on specialization in flood forecasting and building of modern flood structures, among other technical specializations in flood management
Dynamic Planning Structure of WRD Staff	• Linkages with external organizations; make IIT and NIT Patna national level centers for research on flood management, remote sensing and GIS • In Bangladesh, CEGIS and IWM play an instrumental role in developing intelligence and planning for flood management; institutions can reach out to universities and researchers to work on projects in Bangladesh • IIT Roorkee has linkages with several WRDs

Phase II Findings: Skill Development & Training Roadmap

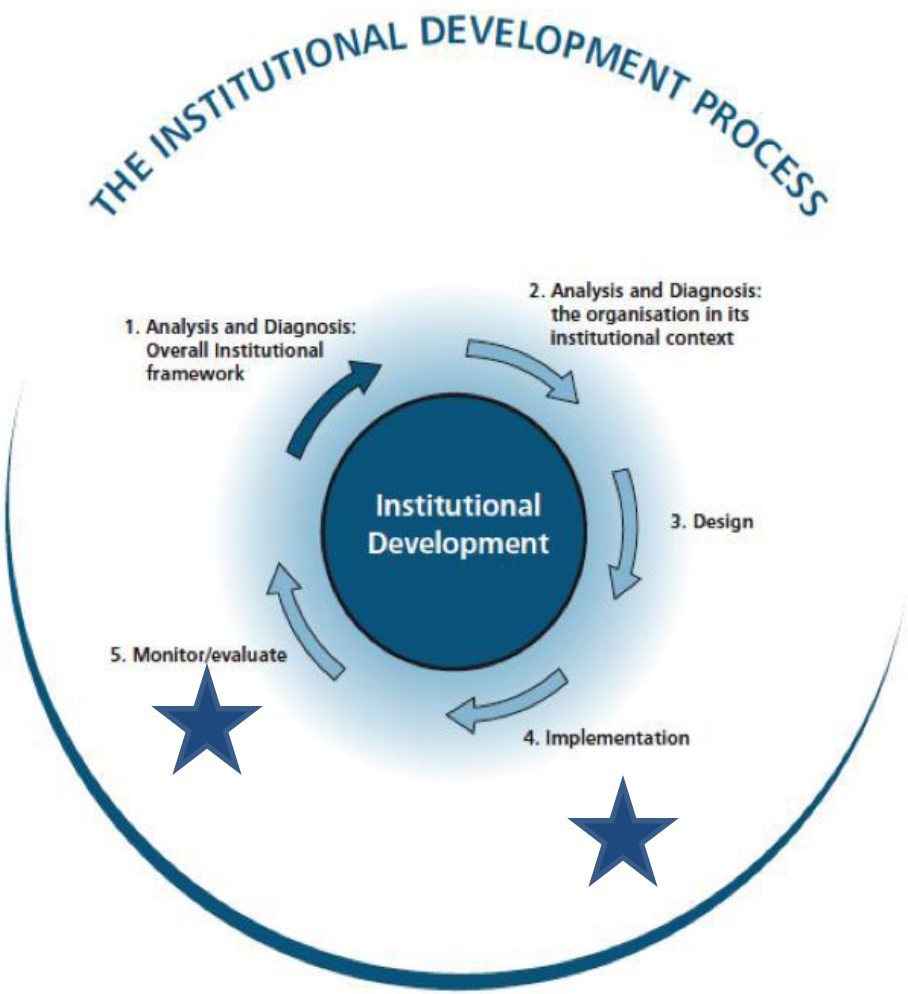
Ideas	Solutions
Developing a Culture of Skill Development	• Integrate training and skill certification requirements into promotion • Mandatory training on flood and disaster management techniques • Develop a structured policy of job rotation
Linkages with Education and Research Institutes	• Enable training, lecture and projects at different institutes and research centers
Restructuring WALMI	• Strengthen training apparatus at WALMI such that AEs and JEs placed in flood-prone river basins of Bihar are adequately skilled and trained • WALMI driven assessment for annual training needs of WRD where each employee is surveyed to assess his/her training needs • Need to develop right staffing framework for WALMI; hire core multidisciplinary team coordinating the training calendar and pool of researchers and trainers • WALMI to play leading role in integrating and disseminating international and national research and best practices on flood management
Skill Development & Training Plan	• Conduct statewide training needs assessment of WRD staff from CE to JE to establish requirements of training • Module design and curriculum development • Flood training schedule for each cadre of staff • Assess and monitor impact of training on staff

Phase II Findings: Community Engagement Roadmap

Ideas	Solutions
Raising Public Awareness	• Awareness of Risks, embankment safety and community responsibility
Basin-wise Community Flood Planning	• Basin-specific plans for flood fighting should directly engage the community • Adopt, build upon and strengthen local knowledge of communities • Relationships-capital of JE-Villagers should be tapped institutionally
Community Flood Mgmt Committees	• CFMCs flood-affected areas as an effective institutional platform for directly incorporating participation of communities • Committees can be organized to serve as community representatives, focal points or community partners for basin-level flood planning and can be activated during flood events • Participatory planning via CFMC for emergency situations can help build trust and confidence among stakeholders, enhance cooperation, facilitate information sharing and encourage regular communication • Committees can play vital role in disseminating early warning information received from WRD officials directly to other members of the community • CFMCs can run local training programs to train communities on flood protection measures
Community Flood Early Warning Systems	• WRD flood early warning systems needs to be linked with localized community flood early warning system; can disseminate crucial rainfall, inundation, river level, etc. directly to communities and villagers • Warnings can also be transmitted ~~directly to communities via~~ SMS technology or as in Bangladesh - via devices such as colored flags that warn villagers of risk levels; via CFMCs

Way Forward

- Phase I provided qualitative understanding of *some of the key challenges on the ground in some districts of Bihar*
- Phase II analysis identified four key priority areas where reforms are necessary in the short and medium-term in order to reduce vulnerability from future floods
- Not all reforms will be feasible at once; WRD to prioritize reforms
- However, it is clear that WRD has the need and opportunity to take the road for institutional vision with ideas outlined here are more.
- Reform implementation plan should incorporate the elements of change vision, change strategy, commitment, capacity and leadership, and culture



Thank You