NDMA Pakistan

Seminar

Strengthening Infrastructure Resilience for Sustainable Development in Pakistan

7th May 2025

Strategic Intent

- Present innovative approaches to enhancing infrastructure resilience in Pakistan

- Highlight key examples of sustainable infrastructure projects

- Discuss the critical challenges faced in building resilient infrastructure in Pakistan's unique geographical and socio-economic context

- Examine the role of climate change adaptation strategies

- Explore the importance of integrating community participation and local knowledge into disaster preparedness and infrastructure development

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1. **Context**

    a. Pakistan ranks among the *top 10 countries most vulnerable to the impacts of climate change*, with unpredictable weather patterns making it prone to a wide range of natural disasters. These extreme events have *underscored the fragility of the country's infrastructure, resulting in substantial economic and human losses*. Structural deficiencies and inadequate planning have exacerbated the consequences of these disasters. Repeated floods, earthquakes and extreme climatic conditions continuously challenge the resilience of Pakistan's infrastructure, highlighting the *urgent need for more robust and adaptive solutions to safeguard the nation's development*.

    b. In light of these challenges, the National Disaster Management Authority (NDMA) of Pakistan organized the *Pakistan Expo for Disaster Risk Reduction*, inviting a diverse group of stakeholders, including representatives from the *government, NGOs, INGOs, humanitarian partners, UN agencies and academia*. The event served as a platform to *showcase contributions, foster collaborations and promote strategies aimed at enhancing Pakistan's resilience*.

    c. Leveraging this opportunity, the Infrastructure Advisory & Project Development (IA&PD) Wing of NDMA organized a *seminar to emphasize the crucial role of resilient infrastructure in mitigating the impact of potential disasters and ensuring a more sustainable and secure future* for the country.

2. **Key Outcomes**

    a. It brought together the *development organizations, humanitarian organizations, engineering departments, Industrial experts and academia experts* to discuss the following: -

        (1) *Showcasing Local and Global Innovations:* Participants shared successful infrastructure resilience projects both locally and globally, offering actionable insights and strategies tailored to Pakistan's specific needs and challenges.

        (2) *Enhanced Collaboration for Capacity Building:* Strengthened partnerships between academic institutions, government agencies, and the private sector to drive research, development and training in disaster-resilient infrastructure and

sustainable construction practices.

    (3) ***Adapting Global Best Practices to Local Contexts:*** Emphasis on customizing international standards and techniques for implementation in Pakistan's diverse infrastructure landscape, ensuring practicality and effectiveness in addressing local vulnerabilities.

    (4) ***Policy and Planning Integration:*** Concrete recommendations for incorporating resilience-focused strategies into national infrastructure policies, urban planning and development frameworks to ensure long-term sustainability.

    (5) ***Adoption of Smart and Green Technologies***: Advocacy for the integration of cutting-edge technologies such as AI-driven risk assessments, remote sensing for disaster monitoring and sustainable building materials to enhance infrastructure resilience.

    (6) ***Public-Private Sector Synergy:*** Strengthening the collaboration between government bodies, private companies and non-governmental organizations to accelerate the development and deployment of disaster-resilient and sustainable infrastructure solutions.

b.   The seminar provided *a platform to explore the challenges faced by stakeholders* in implementing resilience-building projects and outlined steps to adopt modern, disaster-resilient construction techniques across Pakistan.

c.   Promoting *increased community participation to foster a sense of ownership*, thereby ensuring the long-term sustainability and maintenance of infrastructure projects.

d.   *Highlighting the economic advantages of resilient infrastructure projects* to encourage broader community support and adoption.

e.   *Advocating for stronger enforcement and compliance* with disaster-resilient building codes, standards and urban planning regulations to ensure safer infrastructure development.

f.   *Encourage collaboration* across multiple government departments, private sectors and civil society for building resilient and sustainable infrastructure*.*

3.   **Insights from Guest Speakers**

a.   The ***seminar featured notable speakers who presented successfully implemented projects and shared their expertise***, including: -

(1) _**Dr. Usman Hassan (NUST):**_ presentation on "Infrastructure Resilience through Technology Application" provided valuable insights into the integration of Artificial Intelligence (AI) in strengthening infrastructure resilience, particularly in structural health monitoring (SHM). He highlighted the growing importance of AI and machine learning in enhancing disaster-resilient infrastructure, showcasing how AI can support short-term and long-term monitoring through data analytics and machine learning algorithms. He emphasized the role of academia, particularly NUST, in equipping future engineers and professionals with the skills needed to implement AI technologies. The presentation also covered practical case studies, such as the use of AI in monitoring structural health in historic sites like Shahzade Mosque and Diyarbakir Castle. Dr. Hassan called for the inclusion of AI-focused curricula in civil, environmental and geoinformatics engineering programs to bridge the gap between academic knowledge and industry needs. His insights underscored the importance of continuous innovation and collaboration between academia, industry and policymakers in the quest to develop resilient infrastructure capable of withstanding future disasters.

(2) _**Sarfaraz Laldin (ACTED):**_ presentation on "ACTED's DRR and Infrastructure Work in Pakistan" provided critical insights into the organization's approach to building resilient and climate-smart infrastructure in the country. His presentation highlighted the significant contributions of Acted in improving infrastructure through projects like irrigation channels, water systems, rainwater harvesting ponds and resilient housing units. The speaker emphasized the importance of integrating energy-efficient solutions, such as solar power and natural ventilation, into construction practices. He also discussed the role of community involvement and local government coordination in ensuring the sustainability and resilience of infrastructure projects. A key lesson shared was the need for a focus on indigenous practices and local materials to enhance the cultural adaptability and affordability of infrastructure. Sarfaraz Laldin also addressed the challenges faced, such as the unpredictable effects of climate change, cultural resistance to new practices and the need for more comprehensive cost-benefit analysis

to secure community buy-in. He stressed the importance of continued research and strong government ownership to overcome these challenges and ensure long-term success in disaster risk reduction efforts.

(3) *Brig. Dr. Adeel Zafar (FWO):* presentation on "Conceptual Framework for Resilient Structures with Emphasis on Innovative Strategies for Sustainable Development" provided a comprehensive overview of innovative approaches to strengthening infrastructure resilience in the face of climate-induced and seismic disasters. His insights focused on the integration of green building practices, energy-efficient technologies, and the use of smart materials like lightweight concrete and epoxy-coated rebars to enhance structural performance. Dr. Zafar emphasized the importance of local materials and indigenous solutions to address Pakistan's unique environmental challenges. He presented case studies that highlighted the effectiveness of using advanced materials, such as Steel Fiber Reinforced Concrete (SFRC) and Shape Memory Alloys (SMA), to improve the durability and seismic resistance of buildings and infrastructure. Additionally, Dr. Zafar discussed the potential of using AI tools for predictive modeling in construction, reducing the need for costly and time-consuming experimental testing. His presentation concluded with a call for stronger governance, enhanced training for skilled labor, and fostering collaboration between academia, industry, and government to create resilient infrastructure that can withstand future challenges.

(4) *Engr. Syed Jibrab Hashmi (ENCON GRUNE INGENIEURE):* highlighted the significant challenges faced by private engineering firms during construction activities in Pakistan. He addressed issues such as regulatory hurdles, limited access to funding, and the lack of skilled labor, which often hinder the efficient and timely completion of infrastructure projects. Engr. Hashmi stressed the crucial role that entrepreneurship and private companies play in enhancing the resilience of infrastructure, particularly in underdeveloped and rural areas. He emphasized that these private engineering firms are pivotal in driving public sector development, as they often undertake projects that improve access to essential services like water, roads, and housing. Engr. Hashmi advocated for promoting and supporting these firms by enhancing their skill sets, providing them with better resources,

and creating an enabling environment for innovation. His insights underscored the need for stronger collaboration between the public and private sectors to ensure that infrastructure development is not only resilient but also inclusive and sustainable for all communities, especially in rural regions.

(5) *Engr. Hafeez Abdul Rehman (NESPAK):* provided valuable insights into the design and implementation of mitigation infrastructure for vulnerable communities, specifically in flood and landslide-prone areas of Pakistan. He highlighted the critical role of rapid geotechnical, hydrological, and geohazard assessments in identifying the vulnerabilities of various sites. Hafeez emphasized the importance of integrating indigenous knowledge with scientific assessments to develop mitigation strategies that are both technically sound and economically viable. The speaker shared his approach to conducting field studies, which involved detailed data collection through rapid assessments, such as soil analysis, hydrological parameters and environmental impacts. His methodology included the use of GIS-based maps to precisely place mitigation infrastructure, ensuring that the designs adhered to international standards. Hafeez also stressed the importance of both engineering and non-engineering solutions, such as gabion flood infrastructure and tree plantation, to reduce risks and enhance the resilience of the affected areas. The presentation concluded with a comprehensive overview of the successful implementation of these strategies, offering a glimpse into how such mitigation infrastructures can significantly improve the safety and sustainability of vulnerable communities in Pakistan.

(6) *Dr. Adnan Nawaz (COMSATS):* presentation on "Burning the Future: Smog, Traditional Brick Kilns and the Hidden Cost to Infrastructure Resilience in Pakistan" highlighted the often-overlooked environmental hazard of air pollution, particularly smog and its significant impact on infrastructure resilience. He emphasized the critical role of Pakistan's traditional brick kilns in contributing to this issue, with emissions from these kilns, particularly black carbon, severely affecting air quality and accelerating infrastructure degradation. Dr. Nawaz detailed how smog impairs the performance and durability of infrastructure materials, contributing to corrosion of metals and

discoloration of concrete, which ultimately reduces the lifespan of buildings and structures. He also discussed the socio-economic consequences, including reduced labor productivity, disruptions in transport logistics and the diversion of public health resources to address the health crisis caused by poor air quality. Dr. Nawaz shared case studies, including the conversion of brick kilns in Punjab to cleaner, more efficient zig-zag technology, and stressed the need for nationwide adoption of cleaner technologies, real-time air quality monitoring and stronger integration of smog-related risks into disaster risk reduction frameworks. His insights underscored the importance of addressing air pollution not only as an environmental concern but also as a critical factor influencing the resilience of infrastructure in Pakistan.

(7) *Engr. Muhammad Irfan:* presentation on "Addressing National Infrastructure Challenges and Adopting Global Best Practices" provided critical insights into the need for tailored infrastructure solutions that align with the diverse environmental and disaster risks across different zones in Pakistan. He discussed how the country's varying topographies—ranging from high mountains to deserts and coastal regions—pose distinct challenges for infrastructure resilience. Irfan emphasized the importance of adopting construction methodologies suited to each zone's unique vulnerabilities, such as earthquake-resistant designs in high mountain areas, flood control systems in plains and innovative water and energy-efficient structures in desert regions. The speaker also highlighted global best practices, citing examples from Japan, Australia and Bangladesh, such as modular construction, green roofs, and coastal embankments, which could be adapted to Pakistan's context to strengthen infrastructure resilience. Additionally, he stressed the need for zone-specific infrastructure planning, improved land-use, building codes and disaster preparedness to address climate change and natural hazards.

4. **Way Forward:**

    a. Pakistan must continue prioritizing the strengthening of its infrastructure resilience to achieve sustainable development. The *seminar underscored the importance of enhanced collaboration among development organizations, government agencies, and industry experts*. All stakeholders should focus on:

    (1) *Encouraging continuous cooperation* between public and private sectors to implement resilience-focused policies and best practices.

    (2) Promoting the widespread *adoption of climate-resilient construction methods* across both urban and rural infrastructure projects.

    (3) Identifying and securing funding and partnership opportunities *to deploy smart and sustainable infrastructure solutions*.

    (4) *Advancing local capacity building through targeted training programs* for engineers, planners and construction professionals in disaster-resilient techniques.

  b. This *seminar represents a key milestone in Pakistan's pursuit of infrastructure resilience* and its commitment to sustainable development practices.

  c. NDMA remains steadfast in its commitment to this critical agenda, ensuring sustained collaboration with all stakeholders and driving the *vision of a resilient and sustainable Pakistan* forward.

Table 1: Participating Stakeholders of the Seminar

Ser	Organization
1.	Agency for Technical Cooperation and Development (ACTED)
2.	Alight Pakistan
3.	PDMA Punjab
4.	PDMA KP
5.	National Engineering Services Pakistan (NESPAK)
6.	Frontier Works Organization (FWO)
7.	National Highway Authority (NHA)
8.	COMSATS Islamabad
9.	National University of Sciences & Technology (NUST)
10.	National University of Technology (NUTECH)
11.	Military College of Engineering (MCE, Risalpur)
12.	Air University Islamabad
13.	National Skills University
14.	ENCON GRUNE INGENIEURE