Innovative technologies for disaster risk reduction

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*The shaded areas of the map indicate ESCAP members and associate members.**

The Economic and Social Commission for Asia and the Pacific (ESCAP) serves as the United Nations' regional hub promoting cooperation among countries to achieve inclusive and sustainable development. The largest regional intergovernmental platform with 53 Member States and 9 associate members, ESCAP has emerged as a strong regional think-tank offering countries sound analytical products that shed insight into the evolving economic, social and environmental dynamics of the region. The Commission's strategic focus is to deliver on the 2030 Agenda for Sustainable Development, which is reinforced and deepened by promoting regional cooperation and integration to advance responses to shared vulnerabilities, connectivity, financial cooperation and market integration. ESCAP's research and analysis coupled with its policy advisory services, capacity building and technical assistance to governments aims to support countries' sustainable and inclusive development ambitions.

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Introductory Note

The Asia-Pacific region is the most disaster-prone region in the world, where 2 million people have lost their lives to disasters over the past five decades. Climate variability and extreme temperature fluctuations are posed to amplify the frequency and severity of disasters, compounding underlying vulnerabilities, such as poverty and inequality.

Technology is a vital ally in minimizing hazards and vulnerabilities. Recent technological advances have transformed data collection and decision-making in disaster management. Emerging technologies like early warning systems, drones, AI and big data enhance disaster preparedness, response, and re-covery. These technologies enable faster risk communication, improve disaster understanding, strengthen early warnings, and enhance post-crisis knowledge.

The Sendai Framework for Disaster Risk Reduction recognizes the importance of technology and calls for increased support and investment in cost-effective innovations across all disaster management phases. Effective adoption and implementation of innovative technologies would depend on enhanced knowledge, enabling policies, cooperation at different levels, and adaptation in the local context. Integration of emerging technologies with local practices and indigenous knowledge can make their applications more robust.

This issue of Asia Pacific Tech Monitor focuses on "Innovative Technologies for Disaster Risk Reduction – Successful Cases and Good Practices from Asia and the Pacific." We delve into the challenges, opportunities, and best practices for disaster risk reduction in the region. The issue explores innovative technologies, such as Japan's use of the Metaverse to enhance public disaster preparedness, India's Quantified Cities Movement (QCM) for evidence-based planning, and the Philippines' Locally Accessible Cloud System (LACS), as portable communication tools in disaster situations. Together, we aim to bolster our resilience and confront the evolving face of disaster risk in our region.

Preeti Soni
Head, APCTT

ASIA-PACIFIC

CHINA

Amendments to Trademark Law

The China National Intellectual Property Administration (CNIPA) has released amendments to China's Trademark Law for public comment.

The amendments to the Trademark Law focus in large part on improving the use of trademarks, which includes tackling issues, such as "bad faith" trademark registration, trademark squatting, and trademark hoarding. The ultimate aim of the changes is to improve the consumer experience by strengthening the legitimacy of registered trademarks and improving the business environment by stamping out anti-competitive trademark practices.

The draft amendment has slightly adjusted the scope of the types of elements that can be legally registered as a trademark. Article 4 of the draft amendment maintains the basic definition of a trademark that is in the current Trademark Law, stating that a trademark refers to "symbols that can be used to identify and distinguish the source of goods or services".

Article 14 of the new draft amendment stipulates that, unless otherwise specified, the same applicant can only register one identical trademark for the same commodity or service. It also further clarifies (in Article 21) the specific circumstances under which repeat registration is prohibited.

Specifically, a person cannot apply to register a trademark (for the same commodity or service) that is the same as one that they have previously applied for or registered, or if it has been canceled, revoked, or declared invalid within one year of the date of the registration.

Related to the regulations on repeat applications mentioned above, the new draft amendment also defines the concept of "malicious" or "bad faith" applications for

the first time and stipulates penalties for such behavior.

The new draft amendments also outline the penalties for violation of the provisions of Article 22. Under Article 67 of the draft amendments, engaging in any of the above behavior can result in a warning and a fine of up to RMB 50,000 (US$7,280). In serious cases, a fine of RMB 50,000 to RMB 250,000 (US$36,402) may be imposed. Any illegally gained income will also be confiscated.

Meanwhile, Article 83 allows for people or businesses that have been impacted by one of the "bad faith" registration behavior described above to file a lawsuit in a people's court, if the illegal behavior causes a loss. The compensation must cover at least the reasonable expenses paid by the other party to stop the bad faith application for trademark registration.

Moreover, if the illegal behavior damages national or public interest or causes major adverse effects, then the procuratorate can file a lawsuit in the people's court.

As per the current Trademark Law, a prior trademark rights holder or interested party is permitted to raise objections to a trademark registration within a given period, if they believe the registration violates certain provisions of the law. The new draft amendment shortens this objection period from three months to just two (Article 36).

In both the draft amendment and the current Trademark Law, in the event that an objection is raised within the permitted objection period, the relevant authorities are required to listen to the evidence brought forward by the complainant and the applicant and make a decision on whether or not to grant the trademark registration within 12 months of the expiration of the objection period.

In order to strengthen the "use" principle for trademarks, the new draft amendments propose three new scenarios in which the authorities have the right to revoke the registration of the trademark.

The current trademark law already outlines a few scenarios in which a trademark can be revoked, and the new draft amendment adds a few more.

The draft amendments require trademark owners to prove the need to use a certain trademark more frequently in order to maintain ownership over it.

Article 5 of the draft amendments states that if an individual or entity wants to obtain the exclusive right to use a trademark for use or promised use on its goods or services, then they must apply for trademark registration with the Intellectual Property (IP) Administration of the State Council.

The draft amendments provide more clarification on the scenarios in which a trademark holder does or does not have the right to prohibit or restrict another entity from using their trademark.

A significant change in the draft amendments is the addition of regulations on the use of trademarks for e-commerce and the internet for the first time.

Article 57 of the current trademark law lists seven actions that are considered an infringement of the exclusive rights of the trademark holder.

The draft amendments to the Trademark Law make concerted attempts to improve China's business environment and improve the strength of trademarks to make the system more trustworthy for consumers. This includes tackling anti-competitive and monopolistic practices, such as repeat registrations, trademark hoarding, and other bad-faith registration activities.

https://www.china-briefing.com

R&D Investment by companies

Companies have become the main driving force behind scientific and technological innovation in China and account for more than 70 percent of research and development investment.

Corporate spending on R&D soared to CNY1.9 trillion (USD274 billion) in 2020 from CNY30 billion (USD4.3 billion) in 1995, accounting for 77 percent of total R&D investment, according to the findings of the study published today by Innovation and Entrepreneurship in Industrial Transit at Dalian University of Technology.

Government spending on R&D has fallen to account for less than 20 percent in 2020, the report said.

Telecoms equipment giant Huawei Technologies is the biggest investor in R&D in China, with its spending second only to Google worldwide. Huawei accounts for 7 percent of all Chinese corporate investment in R&D, the report said, adding that e-commerce titan Alibaba Group Holdings and internet giant Tencent Holding ranked second and third, respectively, in China.

China's R&D spending ranked second globally in 2020, coming in at half that of the United States and twice that of Japan, which ranked third. But China's R&D intensity -- R&D expenditure as a percentage of gross domestic product -- remained middle-ranking compared with G7 countries, falling behind the US, Japan, and Germany, according to the report.

In 2020, enterprises contributed only 6.5 percent of the basic research funds in China, while the proportions in the US and Japan were 32 percent and 47 percent respectively, Sun added.

Many companies have not yet realized the importance of basic research, as they can learn about existing advanced technologies before they become leading firms, but companies like Huawei need to conduct cutting-edge research on their own, he said.

China's R&D investment reached CNY3.1 trillion last year, up 10.4 percent from a year earlier, with R&D intensity hitting 2.6 percent. Investment in basic research was CNY195.1 billion, accounting for 6.3 percent of total R&D expenditure, according to data from the Ministry of Science and Technology.

https://www.yicaiglobal.com

Deduction of R&D Expenses

China's tax authorities recently announced that the preferential policy of pre-tax super deduction of R&D expenses ("super deduction") would become a permanent policy for all eligible companies. In order to assist companies with applying for this policy, China's State Tax Administration (STA) has released a series of explainers for its implementation in 2023 in the months since the announcement.

The preferential tax policy aims to encourage companies to increase their R&D investments and support scientific and technological innovation and form part of China's wider efforts to foster sci-tech development through various support policies and tax incentives. Note that the super deduction policy is not available to companies operating in industries on the negative list.

Companies can apply the super deduction for R&D expenses as soon as September and October 2023 for the expenses incurred in the first three quarters of the year.

The pre-tax super deduction of R&D expenses is a preferential tax policy that allows certain eligible companies to double their pre-tax deduction of R&D expenses as well as pre-tax amortization of R&D expenses, depending on whether they have led to the formation of tangible or intangible assets. The aim of this is to reduce the CIT burden of companies and save companies' cash flows to encourage more investment in R&D.

https://www.china-briefing.com

R&D spending on the rise

Dalian University of Technology, a key university based in Dalian, Liaoning province, recently released a report on China's R&D spending for 2022.

China's R&D spending in 2022 exceeded 3 trillion yuan ($439 billion) for the first time, according to a report released by the Dalian University of Technology.

The report said R&D spending reached 3.08 trillion yuan, an increase of 10.4 percent over the previous year. The growth rate has exceeded 10 percent for seven consecutive years.

China's R&D spending in 2020 was 2.44 trillion yuan, the report said, ranking second in the world, behind the United States. Its R&D intensity — total national R&D outlay as a percent of GDP — was 2.4 percent, ranking fourth in the world, behind the US, Japan, and Germany.

The report added a topic, saying that basic research spending in China topped 195 billion yuan. China's basic research was more than 6 percent of the total national R&D outlay in 2019, still far behind that of major developed countries.

According to the report, the crucial task of China's R&D spending is not an increase in scale but the optimization of the structure. There are large differences in allocation across various regions.

It said that the eastern region accounted for more than 60 percent of the country's total R&D spending. The central and western regions accounted for about 15 percent, while the northeastern region accounted for 4 percent in recent years.

https://www.chinadaily.com.cn

INDIA
Plan to simplify patent laws to spur R&D

The Centre said it was mulling over making the Indian Patent Act, of 1970 more simplified and research-friendly for product-oriented results. Addressing the CII Global Science, Research, and Innovation Summit, Akhilesh Gupta, senior adviser at the Department of Science and Technology, said while India grants an average of 23,000 patents per annum, it lacks the culture of patent filing.

Gupta said the time duration for filing of patents and the same being granted is three years in India against the global average of two years.

He said the central government is looking to simplify the patent laws to encourage research, development, and innovation in the country

According to the National Education Policy (NEP) 2020, all funding agencies of research in the country will merge into a single entity -- National Research Foundation (NRF) -- with an objective to catalyze quality research in the country. It will have twin objectives of basic research and high-quality innovation.

Referring to around 0.69 percent of the budget being spent on R&D (research and development) in India, Gupta urged the private sector to pitch in with higher research allocation to match and support the government for a win-win proposition.

The senior official said the Department of Science and Technology (DST) was working in collaboration with state governments to completely re-orient and transform the R&D infrastructure of 350 state universities, which are in very poor condition.

Earlier, Parvinder Maini, scientific secretary in the office of Principal Scientific Adviser to the Government of India, urged the industry, academia, and start-ups to join hands to co-produce and co-develop world-class products and solutions as the era of working in silos is over now.

She underlined that the huge gap in the low research and development budget of India was almost due to the non-participation of the private sector to take big risks in emerging and cutting-edge technologies.

Maini said that out of 90,000 start-ups in India, only 12,000 are technology-based and about 3,000 of them are deep tech start-ups.

https://economictimes.indiatimes.com

Semiconductor manufacturing industry

India is emerging as a major player in the semiconductor manufacturing industry. On the demand side, the growth of the semiconductor industry in India is expected to be driven by the increasing semiconductor content across consumer electronics and automobiles including EVs, and also by the increasing demand for smartphones as the number of smartphones in India is

projected to reach a billion by 2026. Further, the rollout of 5G and the increasing adoption of IoT devices would accelerate the adoption of smart devices.

The Indian semiconductor industry in 2022 was US USD 27 Billion, with over 90% being imported, and therefore a significant external dependence for Indian chip consumers. This is very similar to other key markets like the USA and the EU which have high dependence on imports primarily from Taiwan and China where there is a major concentration of semiconductor manufacturing.

With supply-side concentration, the semiconductor crisis over the past two years severely disrupted the manufacturing of smartphones, personal computers, automobiles, and consumer electronics – products and segments impacting the economic well-being of individuals as well as the GDPs of nations.

With this in perspective, the Government of India announced a US USD 10 billion program for the development of the semiconductors and display manufacturing ecosystem in India covering both manufacturing and design with an objective of attracting investments in semiconductor manufacturing and design to position India as a major hub for semiconductors. The package incentivizes by providing fiscal support of 50% of project costs through a pari-pasu arrangement, thereby enabling a significantly de-risked model for semiconductor companies.

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With these, the Indian semiconductor market is expected to reach USD 55 Billion by 2026, growing a CAGR of 20% CAGR during the period 2022-2026. In addition,

the global demand for semiconductors is envisaged to grow exponentially with advancements in technology. The establishment of a strong manufacturing and design base for semiconductors with enable India to address not only the growing domestic market with a very resilient model but also support global requirements competing with the traditional supply sources on a level playing field.

While the manufacturing ecosystem for India is new and emerging, the R&D landscape is one where over the years many major semiconductor enterprises have set up large R&D bases in India to leverage the talent of India's engineers and researchers. Currently, India employs a total of 55,000 design engineers primarily involved in engineering support functions. With the Design Linked Incentive scheme, the government intends to encourage a transition into value-added research in chip designing in the country.

This is expected to generate 250,000 new jobs in the semiconductor industry across R&D, manufacturing, and other enabling sectors.

https://auto.economictimes.indiatimes.com

Scheme for circular economy in Smart Cities

The Union Cabinet has approved the City Investments to Innovate, Integrate and Sustain (CITIIS) 2.0 to promote a circular economy in 18 smart cities to be selected through a competition.

The total funding for the scheme — Rs 1,760 crore — will come from loans from French Development Agency (AFD) and Kreditanstalt für Wiederaufbau (KfW), a German development bank; and a grant of Rs 106 crore from the European Union.

The program starts this year and will run until 2027, with the support of the National Institute of Urban Affairs.

"The program envisages supporting competitively selected projects promoting circular economy with a focus on integrated waste management at the city level, climate-oriented reform actions at the state

level, and institutional strengthening and knowledge dissemination at the National level,"

The first iteration of the program, CITIIS, was launched in 2018 by the Ministry of Housing and Urban Affairs (MoHUA), AFD, the EU, and the NIUA with a total outlay of Rs 933 crore. Twelve cities out of the 100 smart cities were selected for this.

CITIIS 2.0 will include financial and technical support for 18 cities to develop projects on climate resilience, with a focus on integrated waste management. In the second component, all states and UTs will be eligible for support to set up climate centres, creating state- and city-level climate data observatories, and capacity-building for municipal staff.

According to a source in MoHUA, the projects likely to be funded through the scheme would be the collection and transportation of waste, including transfer stations; automated recovery facilities; bio-methanation plants; construction and demolition waste processing plants; and sanitary landfills.

https://indianexpress.com

Shipping Innovation and Startup Policy draft

The Ministry of Ports, Shipping and Waterways (MoPSW) issued a draft 'Sagarmala Innovation and Start-up Policy' with an aim to nurture startups and other entities to co-create the future of India's growing maritime sector.

According to an official statement, the draft 'Sagarmala Innovation and Start-up Policy' pitches for digital portal-based selection of startups to ensure a transparent process.

It also emphasized on developing a centralized repository containing all pertinent information to assist emerging entrepreneurs.

The draft policy called for creation of launch pads at ports for carrying out trials, facilitating pilot projects, establishing working space, and adopting products and solutions, the statement said.

It also noted that there is a need to provide legal and accountancy backup to startups for IP-patent filing, company registration, annual filings, and closures.

There is also a need to collaborate with national and international stakeholders for mentorship, and knowledge sharing and facilitate access to global subject matter experts, serial entrepreneurs, business leaders, and investors with the potential to get their entry and scaling in India.

This will surely promote innovation and entrepreneurship. Through this policy, MoPSW wants to enable startups to grow and prosper through innovations.

The draft policy identified several key areas for the startups to flourish, including decarbonization, optimizing processes through data, maritime education, multi-modal transportation, manufacturing, alternate/advance materials, maritime cybersecurity, smart communication, and marine electronics.

The Sagarmala program is the flagship initiative of the Ministry of Ports, Shipping and Waterways to promote port-led development in the country through harnessing India's 7,500 kilometer-long coastline, 14,500 km of potentially navigable waterways, and strategic location on key international maritime trade routes.

https://economictimes.indiatimes.com

INDONESIA
Health innovation ecosystem

The Indonesian Health Ministry is seeking to support the ecosystem of innovators in the health sector by holding the 2023 Health Innovation Day (HID).

"To support the ecosystem of innovators in the health sector, the ministry is holding a Health Innovation Day this year," Chief of the Ministry's Digital Transformation Office (DTO) Setiaji said.

According to him, the activity was a form of the Ministry of Health's efforts to transform digital health in Indonesia.

This activity was also the peak of a series of events held by the Ministry of Health as part of efforts to transform digital health in Indonesia, he added.

Earlier, the ministry held the 2023 Health Innovation Sprint Accelerator program, an incubation program for start-ups and innovators in the health sector.

In addition, it also held the Fight for Access Accelerator Program, a program to enable female start-up activists to work and innovate in the health sector, he pointed out.

"The Ministry of Health is collaborating with East Ventures and Reckitt in this program, which works as an incubation program to support the development of health technology and biotechnology," he said.

On the occasion, the Ministry of Health announced the ten winners of the 2023 Health Innovation Sprint Accelerator competition, who will receive a prize of Rp250 million each as initial investment capital.

In addition, the Ministry of Health also announced seven winners of the Fight for Access Accelerator competition, who will receive US$25 thousand each as initial investment capital.

https://en.antaranews.com

Development Of Science And Technology Parks

The Asian Development Bank (ADB) has approved a loan equivalent to $138.52 million to support a Government of Indonesia strategy to commercialize research and development (R&D) and improve start-up success at four science and technology parks (STPs) in Indonesia.

The Promoting Research and Innovation through Modern and Efficient Science and Technology Parks Project will support STPs at the public higher education institutions of Bandung Institute of Technology in Bandung, Gadjah Mada University, IPB University, and the University of Indonesia. The project will help upgrade R&D and start-up incubation facilities, provide grants to conduct applied research and incubate start-ups, and upgrade the expertise of STP

researchers and the capability of research administration staff.

"Limited technological sophistication by industries and a lack of absorptive capacity for new technology can reduce productivity and constrain economic growth," said ADB Senior Social Sector Specialist for Southeast Asia Fook Yen Chong. "With this project, Indonesian industries working with universities' STPs will gain the know-how needed to better use resources, create new products, and expand into new markets. We expect that the adoption of new technologies in Indonesia could add 0.55 percentage points to annual average gross domestic product growth over the next 2 decades, pushing Indonesia's economy into the high-income group."

The project will help the STPs focus on various disciplinary fields aligned with Indonesia's priority economic sectors such as energy (renewable energy and storage technology), transport (electric and autonomous vehicles), information and communication technology (smart technology), agro-processing and food (functional food and halal food products), and pharmacy and medicine. It will also strengthen public–private R&D collaboration; increase workforce competitiveness and productivity, particularly as new technologies are developed and adopted; and promote youth entrepreneurship and job creation.

ADB has incorporated international best practices in designing the project. It will deliver demand-driven R&D in tandem with private enterprises and communities to create a sustainable start-up ecosystem. To align research areas with national priorities and improve the R&D ecosystem, the project will create synergies with several ADB projects in Indonesia.

ADB brings substantial experience and knowledge in human capital development, R&D, and innovation from Indonesia and across the region to add value to this project. It will also explore nurturing start-up incubation through its Open Innovation Platform and ADB Ventures.

The project is in line with the government's National Medium-Term Development Plan, 2020–2024, which emphasizes human development and mastery of science and technology, and ADB's country partnership strategy, 2020–2024 with Indonesia.

https://indiaeducationdiary.in/

JAPAN
AI Copyright policy

Amid global governmental regulations, Japan has concluded already about AI copyright - it does not apply to AI training at all.

The policy grants AI unrestricted access to all data, regardless of its purpose (non-profit or commercial), the nature of the act (other than reproduction), or the source (including illegal sites). Keiko Nagaoka, the Japanese Minister of Education, Culture, Sports, Science, and Technology, reaffirmed this position during a local meeting, stating that Japan's laws do not offer protection to copyrighted materials incorporated into AI datasets.

This is perfectly in line with the Japanese government's push towards generative AI, and more specifically, building something similar to OpenAI's ChatGPT.

In recent news, Japan's privacy watchdog has issued a warning to OpenAI, cautioning them against collecting sensitive data without individuals' consent. The Personal Information Protection Commission has advised OpenAI to limit the amount of sensitive data it gathers for machine learning purposes. In their statement, they also mentioned the possibility of taking additional measures if further concerns arise.

https://analyticsindiamag.com

MALAYSIA
Personal Data Protection

The General Code of Practice of Personal Data Protection ("General CoP") introduces new legal requirements to be complied with by data users caught within its ambit. It also seeks to provide best practice

recommendations with respect to the implementation of principles under the Personal Data Protection Act 2010 and its subsidiary legislation (PDPA).

Some of the new legal requirements include providing additional mandatory information in a personal data protection notice, complying with data subjects' written request not to process their personal data for direct marketing within a reasonable time, maintaining a personal data system, and establishing a PDPA compliance framework.

The General CoP was issued by the Personal Data Protection Commissioner ("Commissioner") and became effective from 15 December 2022.

Non-compliance with the provisions of the General CoP is an offense under the PDPA, which may attract a fine not exceeding MYR 100,000 (~ USD 24,000) and/or imprisonment for a term not exceeding one year ("Penalties"). Where the offense is committed by a body corporate, its directors and other officers in the management could be personally liable.

The General CoP appears to apply to classes of data users who are not presently, subject to a specific code of practice under the PDPA. Some of the new legal requirements introduced by the General CoP are briefly discussed below.

- Additional Mandatory Information For Personal Data Protection Notices

On top of those specified in the PDPA, the General CoP requires a personal data protection notice issued by Affected Data Users to, among others, also address the following:

1. If any sensitive personal data (i.e., relating to mental/physical health, political opinions, religious beliefs, or commission of offense) will be processed

2. If the personal data of children below the age of 18 years will be processed

3. If there is any regulatory requirement to collect certain personal data

4. What practical and security measures are taken to ensure personal data and its disclosure is safe and secured

5. The name of third parties to whom personal data is disclosed and for what purpose

https://www.globalcompliancenews.com

Malaysian Government Launches Mystartup Nxt To Create Sustainable Startup Ecosystem 10, 2023

Ministry of Science, Technology, and Innovation (MOSTI) in Malaysia, through Cradle Fund Sdn. Bhd. (Cradle), has launched a series of micro-conferences, MYStartup NXT, as part of the efforts to create an inclusive, impactful, and sustainable startup ecosystem in Malaysia.

Starting with Cyberjaya, MYStartup NXT will be held across the country and proceed with Sarawak, Penang, and finally conclude in Sabah.

According to the statement, the micro-conferences aim to engage local startups across Malaysia, enabling access to the startup ecosystem support and benefits that will empower them to scale up to the next level.

It is noted that MYStartup is on a mission to create over 5,000 quality startups by 2030, and with Kuala Lumpur already being one of the top 25 emerging ecosystems globally, there is huge potential for other parts of Malaysia that must be actioned on.

MYStartup NXT is part of the government's effort to cultivate accessible innovation and support long-term startup development, in line with Malaysia MADANI's aspirations, one of which is to build an innovative and high-tech nation

According to Ahmad Kashfi Alwi, Cradle Senior Vice President of Ecosystem Development, MYStartup NXT series will enable and grow the country's startup ecosystem equally and ensure that every local startup community.

MYStartup has also introduced MYStartup Dev, a data-centric, community-driven platform exclusively designed to connect tech talents with talent development partners and upskilling programs.

MYStartup Dev will guide and teach new skills for career advancement, nurture networking with industry experts, and stay current with the latest skills and technologies, ultimately unlocking the full potential of young local tech talents in Malaysia.

Throughout the NXT tour, states and federal entities are encouraged to communicate continuously with each other to achieve the goal of cultivating and nurturing more startups throughout the country.

MYStartup Strategy is a national initiative by the MOSTI and Cradle.

It consists of several programs which aim to strengthen the startup ecosystem and community in Malaysia.

Among them are; MYStartup Roadshow, MYHackathon, MYStartup Pre-Accelerator, MYStartup Accelerator, MYStartup Internship, and MYStartup Mentorship.

The programs aim to ensure startups are thoroughly guided starting from the ideation stage, trained, supported, and opportunity to highlight their company profile to attract foreign investors.

The MYStartup Program is part of the Malaysian Startup Ecosystem Roadmap (SUPER), while Cradle as the focal point agency for the startup ecosystem which has been mandated to ensure that this strategy benefits the startup ecosystem as a whole.

This effort is also in tandem with MOSTI's target of creating 5,000 start-ups and producing five unicorn-status companies by 2025.

https://technode.global

NEPAL
Budget for Science, Technology, Innovation, and R&D

Addressing the joint session of the federal parliament, Finance Minister Mahat stated that the government will allocate 1 percent of the national budget in Science, Technology, Innovation, and Research.

This is the first time, the government has decided to allocate 1% of the total Budget in Science, Technology, Innovation, and Research and Development. The government has also allocated Rs. 1 billion for Science, Technology, Innovation and Research.

https://thehimalayantimes.com/

PAKISTAN
New AI Policy draft

The Ministry of Information Technology and Telecommunication has drafted the "National Artificial Intelligence (AI) Policy" aimed at embracing AI by appreciating human intelligence and stimulating a hybrid intelligence ecosystem for equitable, responsible, and transparent use of AI.

The policy framework envisaged providing a complete AI-enabling ecosystem in Pakistan, covering all aspects of awareness, skill development, standardization, and ethical use.

According to a State of AI Report, Pakistan ranks 117 out of 172 countries and has an index score of 34.03 in terms of AI readiness at a global scale.

The National AI Policy is crafted to focus on the equitable distribution of opportunity and its responsible use, having the defining attributes including evidence-based and target oriented, user-centric, forward-looking, objective, and overarching.

The AI policy further aims to augment AI and allied technologies through balanced demand and supply-side interventions, inducing the establishment of research & innovation centers in AI for developing, test-bedding, deploying, and scaling AI solutions.

This includes learning how to improve governance and manage the impact of AI, Responsible use of AI to generate economic gains and improve lives. In addition, AI will raise the Government's capability to deliver anticipatory and personalized services.

The draft policy noted that the main challenge for the successful implementation of

IoT Cloud-based services is the availability of data in digital form and the standardization of the data.

The Ministry stated that the need for National AI Policy is to create a broad-based awareness of the use of AI-based platforms while keeping privacy at the forefront, upskilling human capital on AI and allied technologies, guiding investment in AI research and development, ensuring ethical and responsible use of AI, and provide a framework for addressing the challenges and risks associated with the socio-economic outfit of the country.

https://propakistani.pk

PHILIPPINES

IP protection

The Philippines House of Representatives has approved on the third and final reading a bill that will strengthen the powers and functions of the Intellectual Property Office of the Philippines (IPOPHL), and amend the Intellectual Property Code (IP Code) to adapt to recent advancements in technology and further address piracy and counterfeiting.

Voting 267 against zero and one abstention, the chamber approved House Bill (HB) No. 7600 which would give IPOPHL additional powers to prevent counterfeit or pirated goods or contents.

The bill defines counterfeit and pirated goods and authorizes the IPOPHL to gather intelligence information, investigate violations of the IP Code and develop countermeasures to deter counterfeit or pirated goods or content.

If passed into law, the measure will also allow IPOPHL to visit establishments and businesses suspected to be in violation of RA 8293.

HB 7600 also adds a new Section 216-A on Preventive Action on Online Infringement which empowers the IPOPHL, after due notice and hearing, to disable access to an online location or website and prevent further access to an online location whose primary purpose or primary effect is to infringe the copyright or facilitate copyright infringement.

It would also allow copyright owners or the exclusive licensee of copyright to submit an application to the IPOPHL to order the disabling of access to any infringing online location identified in the application.

https://advanced-television.com

IP rules protect non-traditional visual trademarks

Non-traditional visual trademarks are now protected under revised rules and regulations introduced by the Intellectual Property Office of the Philippines (IPOPHIL).

The rules institutionalize the protection of non-traditional visual trademarks such as three-dimensional marks, colour marks, positional marks, motion marks, and hologram marks. IPOPHIL's director general, Rowel Barba, says such marks are now explicitly considered registrable by IPOPHIL's Bureau of Trademarks. This article outlines specific guidelines for the representation of such marks.

Aside from the protection of non-traditional trademarks, the revised rules also formally implement fully automated and paperless transactions. This means that all trademark applications and related communications must be submitted through eTMFile, IPOPHIL's online submission system. Any other communications, such as responses to office actions and subsequent requests, should likewise be submitted online through eDocFile, the IPOPHIL's electronic document filing system.

However, under exceptional circumstances, the director general may allow communications to be filed via email, personal delivery, private courier, or registered mail. Any correspondence from the Bureau of Trademarks will be sent to the applicant's email address on record. All applicants are now required to provide their email and physical addresses, as well as those of their representatives, if any. Consequently, communications are deemed filed and received on the date they are sent online, whether via email or through eTMFile or eDocFile. But if payment of fees is required, then the date of receipt is when the communication together with full payment is transmitted.

https://law.asia

THAILAND

Big firms' R&D spending rises 14%

Korean firms' spending on research and development (R&D) swelled 14 percent in 2022 from a year earlier despite sharply decreased operating income amid an economic slowdown, a market tracker said.

Combined R&D expenditures by 231 out of the country's top 500 companies came to 68.4 trillion won ($51 billion) last year, up 8.4 trillion won from a year earlier, according to CEO Score.

The tally covers businesses that have disclosed their R&D expenditures over the past three years. Financial companies were excluded.

Last year's solid increase was seen as part of their efforts to secure future growth engines, though their earnings shrank due to a global economic slowdown and falling exports.

The companies' combined operating income tumbled 25.4 percent on year to 123.7 trillion won last year, with their net income sinking 27.1 percent to 106.2 trillion won.

Of the total firms, 74.9 percent, or 173, boosted their R&D spending from a year earlier.

Chip and smartphone maker Samsung Electronics was the top R&D spender with 24.9 trillion won last year, which was up 10.3 percent from 2021 and accounted for 36.4 percent of the total.

Samsung was followed by SK hynix with 4.9 trillion won, LG Electronics with slightly over 4 trillion won and Hyundai Motor with 3.3 trillion won.

Mobile game developer Netmarble ranked first in terms of the R&D-to-sales

ratio with 32.1 percent, followed by Naver, with 22 percent and Krafton with 21.8 percent.

By industrial sector, spending by IT, electric, and electronics firms was the largest at 40.8 trillion won, trailed by automakers and auto parts manufacturers with 8.9 trillion won and service firms with 5.3 trillion won, according to the data.

https://unctad.org

Rise in startup ecosystem index

After dropping three places last year, Thailand has shown positive momentum this year rising one spot to 52nd globally, according to StartupBlink's Global Startup Ecosystem Index 2023.

StartupBlink is a global startup map and research centre offering insights into trends affecting the global startup ecosystem. Its research covers more than 1,000 cities and 100 countries, across 11 industries and dozens of sub-industries.

For three consecutive years, Thailand was ranked the 11th best ecosystem in Asia-Pacific and the fourth best in Southeast Asia, according to the report.

Bangkok represents the country's main startup ecosystem as it is the only city in the country to make the global top 100. This year, Bangkok gained 25 spots globally to rank 74th. It is also the third-best ecosystem in Southeast Asia.

There are three other Thai provinces within the top 1,000 -- Chiang Mai (ranked 591st), Phuket (640th), and Pattaya (849th).

Phuket is no longer among the top 600 cities as it fell 93 places in 2023, while Chiang Mai regained its position as the second-best startup ecosystem in Thailand, replacing Phuket.

According to StartupBlink, over the last 40 years, Thailand has leaped forward into a more economically developed country through multiple reforms and social innovations.

Mainly seen as a tourist destination, the Covid-19 pandemic caused the public sector to prioritize startup ecosystem

development as an important step in securing future economic growth.

Those efforts are not yet focused or determined enough compared to Singapore or Malaysia, but they are a good start towards ensuring the Thai ecosystem can fulfill its potential, the report says.

According to the report, the value of funding and the number of venture capital deals in Thailand in 2022 was over UScopy.25 billion, totaling 38 deals, compared to over $548 million with 41 deals in 2021, and over $437 million with 26 deals in 2020.

As in other Asian countries, Thailand would benefit from a cultural shift towards making the young population less risk-averse and more entrepreneurial.

The country has had several unicorns in previous years, such as Line Man Wongnai, Flash Express, and Ascend Money, all passing the copy billion valuation mark. Considering Thailand's robust economy, the country could produce more unicorns in the coming years, says the report.

According to Pun-Arj Chiratana, executive director of the National Innovation Agency, Thailand is Asean's second-largest economy and the friendliest business location. Since 2016, startup development has been a significant strategic policy for economic reform in Thailand.

He added that the vibrant business climate has been strengthened alongside a series of new incentives for startups. The focus is not only on Bangkok but also on other innovation districts across the country to make Thailand an attractive market for startups, innovative entrepreneurs, and investors.

https://www.bangkokpost.com

UZBEKISTAN

President Tech Award" to encourage innovation and entrepreneurship

In a move to encourage innovation and entrepreneurship, Uzbekistan has launched the President Tech Award, an annual contest that recognizes and rewards

the best startups in digital technology projects. The award is worth $1,000,000 in total, with each category winner receiving cash prizes of up to $100,000, and second and third place getting $50,000 and $30,000 respectively.

The competition will be divided into two main areas, each with its own categories. The first area will include technologies based on artificial intelligence, digital technologies in the social sphere, ICT and cybersecurity, entrepreneurship and fintech, and computer and mobile games. The second area will be a Hackathon Grand Prix, which requires teams to create a digital solution within 72 hours.

To be eligible for the award, participants must be under 30 and either Uzbekistan citizens or foreign citizens who are employees of IT Park residents. Teams formed should consist of 3-8 people for the main area and 3-5 people for the special area. Participants can only participate in one selected category for both areas. Attendance is free, and registration will be open soon.

The judging process will be handled by an independent organization with extensive international experience in startup development, ensuring transparency and fairness throughout the contest. Winners in the main categories will be determined by public voting, while the Hackathon Grand Prix winner will be selected by an independent organization.

The President Tech Award is an excellent opportunity for young entrepreneurs in Uzbekistan to showcase their talents and receive recognition for their innovative ideas. With its generous prize pool and expert judging process, the contest promises to inspire a new generation of digital innovators in the country. Uzbekistan has made great progress in its IT sphere in recent years, with the World Bank claiming that the country is going through "unprecedented economic and social transformation."

The launch of the President Tech Award in Uzbekistan feeds into the country's major IT development drive and its young and growing population, where over 60% of

the people are under 30. As one of the fastest-growing countries in Central Asia, Uzbekistan has made significant investments in its technology sector to foster innovation and entrepreneurship, such as its "one million Uzbek coders" drive. With its large and youthful population, Uzbekistan has a vast pool of tech-savvy talent that is driving the country›s digital transformation, with over 30,000 students graduating from IT-related courses at tech-dedicated universities throughout the country.

The President Tech Award provides a platform for these young entrepreneurs to showcase their skills, promote their startups, and receive recognition for their innovative ideas, ultimately contributing to the country's ongoing IT development drive. The President Tech Award aims to further attract Uzbek youth into the sphere of IT and motivate them to succeed.

https://www.intellinews.com

Technology scan
Innovative technologies for disaster risk reduction

INTERNATIONAL

AI-enabled Flood Hub

Google has announced the extension of its Flood Hub platform to scores of additional countries, providing early flood warnings to hundreds of millions of people living in some of the regions exposed to the highest levels of flood risk. App provides flood data and forecasts up to seven days in advance to regions with more than 460 million people exposed to severe flood risk.

The AI-enabled app was first debuted in India in 2018 before being expanded to cover Bangladesh, one of the countries most exposed to worsening levels of flood risk as climate impacts intensify.

Google announced it was extending the service to 80 countries, with the addition of 60 new countries across Africa, Asia-Pacific, Central and South America, and Europe, including the U.K.

The company said the platform includes some of the territories with the highest percentages of the population exposed to flood risk and experiencing more extreme weather, covering 460 million people globally.

It also confirmed the functionality on the platform has been improved, with it providing locally relevant flood data and forecasts up to seven days in advance — an increase on the previous 48-hour window for new forecasts.

Flood Hub's AI draws on diverse, publicly available data sources, such as weather forecasts and satellite imagery. The technology then combines two models: the Hydrologic Model, which forecasts the amount of water flowing in a river, and the Inundation Model, which predicts what areas are going to be affected and how deep the water will be.

https://www.greenbiz.com/

ASIA-PACIFIC

AI brings real-time weather alerts

More companies are using artificial intelligence to help shield clients in Asian countries such as Thailand and Vietnam from the fallout of weather-related disasters.

Damage from a flash flood in 2021 prompted an electronics factory at Thailand's Bangpoo industrial park to sign up for a pilot forecast service from Weathernews, a leading Japanese weather company. The service, which debuted in February, lets the factory outside Bangkok track the likelihood of sudden weather changes nearby within three hours.

The Thai Meteorological Department normally provides only daily forecasts by region. Weathernews uses AI to collect and analyze data for real-time, hyperlocal forecasts. It warns clients of potential squalls and floods, letting them put up barriers or move equipment to prevent damage.

Weathernews also works with local authorities to install its radar, expected to bring the accuracy of its forecasts in Thailand on par with those in Japan.

Several startups are also exploring weather-related opportunities in Asia. California-based Atmo signed a deal with Indonesian authorities to build an early warning system for flash floods and cyclones and is in talks with authorities in neighboring countries as well.

Tokyo-based Spectee plans to use AI for the analysis of photos and comments on social media to map out natural disasters in the Philippines. The company began a feasibility study last year and will set up a local unit once it finds a partner. Spectee, founded in 2011, offers similar services to 700 clients in Japan including companies and municipalities.

https://asia.nikkei.com/Business

AUSTRALIA

Digital Twin for mitigation of flood risk

Digital twin technology is used across many different industries. For power utilities, digital twins can now create a 3-D model of the network to optimize investments, identify and mitigate risk, and streamline operations. Endeavour Energy adopted digital twin technology from Neara. Whereas many digital twins provide a lot of detail at a small scale, or little detail at a large scale, Neara's engineering-grade model provides granular detail but on a large scale — enabling complex engineering-grade analysis automatically across the entirety of a whole network.

Leveraging the digital twin, the Neara team, in the past, implemented a floodwater simulator for Endeavour Energy using open-source government data to model the impact of rising floodwater and keep customers and workers safe. This simulation meant Endeavour Energy could more accurately isolate electricity supply ahead of areas being inundated or where floodwater brought people too close to live power lines.

Network-wide reports on flood activity were visible and editable in the utility's digital twin instance within 48 hours of the emergency commencing — when the floodwater was still rising. As the floodwater subsided, Endeavour Energy used flood mapping features to prioritize inspections to restore power to customers safely and quickly as well as understand potential

hazards before emergency crews were sent into flooded areas.

With so much time and money saved with the efficiencies introduced by the digital twin, Endeavour Energy can invest more time in strategizing for the future. The utility is committed to planning a modern grid where batteries, microgrids, and solar integrate seamlessly with the distribution network's traditional poles and wires. With its design capabilities, Neara's software and digital model are helping the utility's engineers to design and modify the infrastructure needed to allow for this integration. By first designing digitally and stress testing the 3-D model in a risk-free environment, Endeavour Energy can ensure the decisions it makes are right the first time with new construction projects.

https://www.tdworld.com

Satellite data mapping of extreme climate

To harness the full potential of using satellites, algorithms are required that can process this complex and diverse mix of big data from different satellites—en masse and quickly.

A research team has combined the best satellite precipitation data sources together with rain gauge measurements to deliver a comprehensive rainfall map of Australia.

The Precipitation Profiler-Observation Fusion and Estimation tool—known as PProFUSE—is a first-of-its-kind tool that blends data from multi-satellite global remote sensing, taking full advantage of the Bureau of Meteorology's (BoM) national rain gauge network to build our map.

The tool brings together this precipitation information to generate one unified data set that is more consistent, more accurate, and more useful than any other available data source in Australia.

PProFusE aims to optimally fuse the advantages of different data sources to come up with the best estimate of precipitation across all of Australia.

In locations that do have gauges, PPro-FusE returns a precipitation estimate that's exactly equal to the direct and trusted gauge measurements from BoM. In ungauged locations, PProFusE delivers an optimal estimate of precipitation.

https://phys.org

CHINA
5G for natural disaster management

Ericsson has signed a partnership with China Mobile Zhejiang and other partners to deploy 5G technology for public safety-focused natural disaster management in China.

In a release, the Swedish vendor said that this move follows the successful testing of a 5G mission-critical solution in ten cities across the Lishui region of China.

"Spanning early-warning analysis, natural disaster monitoring, command and dispatch, and post-disaster assessment, the solution has now been included in China's Ministry of Science and Technology's monitoring, early warning, and prevention of major natural disasters demonstration projects. As a result, the partners expect nationwide deployment to get underway in the coming weeks," Ericsson said.

"Ericsson and China Mobile provided key insights and support for the development and validation of core applications by combining respective emergency communication practices, digital twin use cases, and network slicing technologies while jointly building 5G network connectivity," the vendor added.

The solution was developed and tested in Lishui due to the region's vulnerability to large-scale natural disasters and flash floods during the wet season.

Ericsson also noted that several criteria were identified for the solution to address, including accurate disaster prediction; visible disaster occurrence; shared data silos; coordinated emergency command, and timely evacuation.

"The solution combines the coverage, high bandwidth, low latency, and reliability benefits of advanced 5G network connectivity, edge computing, digital twins, and 5G private network slicing," the European vendor said.

According to Ericsson, the solution includes:

- An integrated 5G sky-land monitoring network, which solves challenges in data integration and sharing, deployment, coverage, and construction and operational costs by ensuring rapid network deployment.
- An intelligent 5G multi-hazard early-warning model, which accelerates data processing and improves accuracy for rapid data transmission, consolidated processing, and multi-hazard identification.
- A decision-making assistant based on digital map models.
- Portable 5G sites and communication vehicles for on-site communication.
- Simulated model assessment based on remote-sensing images.

https://www.rcrwireless.com

INDIA
New drought monitoring tool

A new satellite-based drought-monitoring tool will be able to indicate the presence of drought and its level of severity, providing authorities with the maximum possible lead time to put mitigation strategies into place in India and across South Asia.

In India, the South Asia Drought Monitoring System (SADMS) was developed by the International Water Management Institute (IWMI) and the Indian Council of Agricultural Research (ICAR), the country's premier agricultural research institution.

It has been tested in India, Pakistan, Bangladesh, Sri Lanka, Nepal, Maldives, Afghanistan, and Bhutan.

The system will not just monitor the drought conditions but also incorporate this information of real-time weather

updates and open-access satellite data, and provide extension workers as well as agriculture and water resources authorities with all the information needed to forecast, monitor, and manage drought every week.

The data from the drought-monitoring system is available at the grid level and can be visualized up to the *taluk* level, Amarnath said. "We wanted the data to reach the appropriate users so that they could make informed decisions on how best to mitigate the drought risk."

"We are working closely with ICAR-Central Research Institute for Dryland Agriculture and at the taluk level, the district officials can see the value and visualize if there is a surplus or rain deficit," he explained.

If there is a deficit, ICAR, which works with Krishi Vigyan Kendras (agriculture resource centers), can take this information to them and also at the state government level and interpret what action needs to be taken, he added.

Through this, the authorities can implement district-wise contingency plans, including measures like changing the crop or switching to drought-tolerant varieties.

IWMI has been testing SADMS by validating it at the district level. The platform is already in operation in the state of Telangana. They use the system to know when to initiate their strategy for mitigating drought.

From 2017, ICAR used SADMS to implement real-time contingency measures. It helped farmers in three districts of Andhra Pradesh and Maharashtra to obtain drought-tolerant seeds, develop supplementary irrigation, and apply potassium nitrate (which helps seedlings cope better with dry conditions).

The institute will be organizing state-level workshops in India early next year to impart training on how to interpret the information at the sub-granular level by end users.

https://www.downtoearth.org.in

INDONESIA
SAS partners r-app JAKI and Flood Control System
1 September 2022

Initiative toward Smart City status using AI and IoT

Leading multinational analytics software company SAS Institute has established a partnership with the Jakarta City Government to boost the deployment of Digital Transformation initiatives such as the Digital Government Plan and the Flood Control System.

In 2019, the Jakarta Smart City developed Jakarta Kini (JAKI), a one-stop digital platform and super-app for multiple government services to help address the needs of its citizens. JAKI processes and analyzes diverse data from various reliable sources to gain a better understanding of the citizen needs and the services they require in the capital city through the application of advanced analytics, Artificial Intelligence (AI), and Machine Learning.

SAS Institute is among the main technology providers in the implementation of the Digital Transformation Plan. With its advanced analytics solutions, SAS ensures that JAKI is a reliable platform that provides accurate real-time information and data-driven insights that help improve the lives of Jakarta citizens.

For instance, through JAKI, residents can access health services like calling an ambulance or checking out the services at various public health facilities, in just a few easy steps.

In addition to healthcare, JAKI also integrates other government services such as education, health, trade, disaster, and licensing services. It is equipped with mobile-based public complaint management to incorporate systemic improvements into the platform.

SAS Institute is also fortifying its partnership with Jakarta City Government by assisting with the city's Flood Control System. By leveraging SAS Analytics for IoT, the JAKI platform predicts and monitors at-risk areas in real time to reduce potential damage or harm, and increase public awareness of disaster situations.

With these predictive capabilities and analysis, Jakarta City Government can mark when to activate water pumps, which will help accelerate disaster responses and improve preparedness for flood emergencies.

The system utilizes sensors and weather data that assess real-time situations of stream levels and predict where and when flooding may occur.

By using AI and Machine Learning, the SAS solution quickly and accurately gathers and acts upon large sets of data in real-time, thus leading to an accelerated time or speed to execute the critical actions that reduce or eliminate damage to life, property, and businesses in the city.

By using the SAS solution, the city has reduced data-gathering time from an hour to just five minutes.

In addition to quick and accurate data analysis, Jakarta's Flood Control System also delivers real-time decision-making, data management, analytical data management, and asset management.

Jakarta's Knowledge Management for Flood Control System was recognized in the IDC Smart City Asia Pacific Awards (SCAPA) 2022. It also won the 2022 WSIS Prizes in the ICT Applications: e-Science category.

Jakarta Smart City's initiatives in Digital Transformation and disaster management are supported by the SAS analytics platform, which standardizes data into a single data management system built into the super-app JAKI.

https://www.intelligentcio.com

ISRAEL
Tool to predict extreme rainfall

The Hebrew University of Jerusalem researchers have identified factors influencing the likelihood of extreme rain

events and have developed a tool that can improve the forecasting of such events.

Extreme rain events, particularly those that cause flash floods in the south and east of Israel in spring and fall are particularly difficult to forecast even a short while in advance. In April 2018, a flash flood killed 10 students from an army preparatory program who were hiking in Nahal Tzafit, a riverbed in the Judean Desert near the Dead Sea. The research led by Dr. Assaf Hochman and by doctoral student Tair Plotnik at the Institute of Earth Sciences at the Hebrew University determined the factors that impact scientists' ability to predict extreme rain events, which are linked to what is known as an "active" Red Sea Trough.

The research team used an extensive database belonging to the European Center for Medium-Range Weather Forecasts to examine all extreme rain events since 1979 and to sort them into hard-to-forecast and easy-to-forecast categories.

They found that one of the factors preventing optimal forecasting is the simultaneous entry into Israel of air masses from the south and the north, due to the significantly different characteristics of each.

A mathematical tool developed by the research team can improve forecasting even in difficult cases, so that in the near future it will be possible to predict the extremity of rain events in Israel with a high degree of accuracy, and subsequently also in other parts of the world.

This capability will enable decision-makers to prepare for such events, thus saving lives as well as significantly reducing associated damages.

https://argusenglish.in

JAPAN

AI technology to predict tsunami impacts

New research out of the RIKEN Prediction Science Laboratory has used machine learning to accurately predict tsunami impacts in less than one second.

"The main advantage of our method is the speed of predictions, which is crucial for early warning," explained Iyan Mulia, the work's lead, and a scientist at RIKEN.

"Conventional tsunami modeling provides predictions after 30 minutes, which is too late. But our model can make predictions within seconds."

To achieve this, the coast now boasts the world's largest network of sensors for monitoring the movement of the ocean floor. About 150 offshore stations make up this network and work together in order to provide early warnings of tsunamis.

To function effectively, however, the data generated by the sensors need to be converted into tsunami heights and extents along the coastline.

This normally requires solving difficult nonlinear equations, which can take about 30 minutes on a standard computer. Needless to say, this does not give people enough time to evacuate

That's why the RIKEN AI model is so crucial to saving lives. It allows people to get at least half an hour's head start from where the tsunami will strike.

The RIKEN team trained their machine-learning system using more than 3,000 computer-generated tsunami events and tested it with 480 other tsunami scenarios and three actual tsunamis.

They found that their machine-learning-based model could achieve comparable accuracy at only one percent of the computational effort of conventional approaches. Now, they claim their model could work for any time-sensitive natural disaster.

https://interestingengineering.com

TÜRKIYE

Earthquake early warning systems developed

Researchers at Dokuz Eylül University (DEÜ) have developed earthquake early warning systems that will issue alerts before a quake hits.

The Earthquake Early Warning Systems (DEUSİS), developed as a result of studies carried out at Dokuz Eylül University's Earthquake Research and Application Center (DAUM), are still in the testing phase, but «the system will issue notifications from the shifting fault before the earthquake is felt,» DAUM Director Hasan Sözbilir said. The warning will arrive 10, 15, or 20 seconds before the tremor's force reaches the surface, depending on the distance from the seismic source.

Noting that they are trying to both develop a system and create its software, Sözbilir said: "There are various instruments developed by different countries around the world, but we aim to develop a domestic system. We are using three devices that measure the movement of the earthquake together. The device that detects an earthquake under the ground gives us information with a signal, converted into a numerical parameter with software. After that, we will start the operation of the system. We will set up the system at 12 different points during the six-month trial period and the system will provide us with instant data. In other words, we will listen to the ground 24 hours a day for six months," he said.

"For example, if there is an earthquake with a magnitude of 5 and above, the system will warn us. After receiving the signal, we will cut the electricity in the subway and gas. Thus, when the earthquake shakes us, both the damage during the earthquake will be reduced and the fires that will occur after the earthquake will be prevented. We developed the mechanism and signed a protocol with the Disaster and Emergency Management Authority (AFAD) to distribute it to public institutions. The warning messages will be sent to phones as soon as the earthquake is 10 kilometers below the ground."

Right now, the system will only work in Izmir, but it can be used for any province with high seismic value, Sözbilir explained.

https://www.dailysabah.comVIET NAM

Artificial Intelligence for weather forecasting

The Vietnam Meteorological and Hydrological Administration has applied Artificial Intelligence (AI) in hydrometeorology monitoring and forecasting, making typhoon and torrential rain prediction more accurate.

The Vietnam Meteorological and Hydrological Administration (VNMHA) has built a shared digital platform for the Ministry of Natural Resources and Environment, including a data integration system based on big data, especially the AI application in identification to solve specific problems for hydrometeorological monitoring and forecasting.

The department is researching AI applications in storm forecasting, heavy rain quantification, and flood surge prediction.

Mai Van Khiem, director of the National Centre for Hydro-meteorological Forecasting, said the center used big data systems and AI in identifying upcoming tropical cyclones similar to the ones in the past to map out impact scenarios. AI has also been applied in forecasting extreme short-term rain and flash flood warnings.

The VNMHA has studied AI applications in forecasting dangerous weather conditions and disasters. In the future, a hydrometeorological virtual assistant system that can automatically provide weather information to users will be developed.

Deputy Director General Hoang Duc Cuong said the AI applications would bring significant value, save time in professional activities, and speed up automation and digitization of the hydrometeorological industry.

https://vietnamnet.vn

Application of AI in hydrometeorology

Head of the NCHMF's Weather Forecasting Department Tran Quang Nang said that the Vietnam Meteorological and Hydrological Administration has developed forecasting technology, including the application of AI to various fields such as monitoring, calculation, and forecasting technology. This application helps to improve the quality of hydro-meteorological forecasts and warnings, thus ensuring reliability and closeness to reality, contributing to reducing disaster risks, and boosting socio-economic development.

The Administration has established its Steering Committee for Digital Transformation for the 2021 – 2025 period, and at the same time implemented different research and application of artificial intelligence in specific problems, including the application of AI in storm forecasting, heavy rainfall quantification, and forecasting of water level rise caused by storms.

In the coming time, the Vietnam Meteorological and Hydrological Administration continues to invest in and develop the application of artificial intelligence in data processing, hydrometeorological forecasting and warning, build a virtual assistant system to automatically provide weather information for users, and apply virtual reality and virtual interaction in the presentation of hydro-meteorological information.

https://vietnamnet.vn

EUROPE
NORWAY
AI and big data to predict flooding

Climate change-driven disasters are only going to get worse. And while there are varying opinions on what — if anything — we can do to avert such catastrophes in the future, some companies are looking at ways to plan for this new reality, and at least go some way toward mitigating the impact of flooding.

One of these companies is 7Analytics, a Norwegian startup founded back in 2020 by a team of data scientists and geologists to reduce the risks of flooding for construction and energy infrastructure companies. With its first product, Flood-Cube, 7Analytics serves customers with AI and advanced machine learning techniques to calculate current surface water and where it's flowing today (the "runoff"), then models how that will look in the future with increased rainfall.

So, in effect, FloodCube is more about predicting *how* a flood will unfold, showing exactly where water is likely to accumulate based on various environmental factors. While it's possible to achieve this already today through combining multiple software programs and manual calculations, FloodCube brings everything together under one roof.

As with just about any AI and ML-infused software, large datasets are pivotal to 7Analytics' promise — it gathers data from openly available sources spanning digital elevation models (DEM) for terrain, satellite imaging, and climate data, then integrates these sources to make it easier for users to derive insights from. Its customers include the Municipality of Bergen, where 7Analytics is headquartered, multinational construction giant Skanska and engineering consultancy Multiconsult. And this gives a strong indication as to *who* 7Analytics is targeting, and who is most likely to care about predicting future flooding scenarios — protecting urban infrastructure is very much the name of the game here.

While its technology is mainly used by construction companies in Norway for now, 7Analytics is expanding into new areas such as energy infrastructure and is currently in talks with a handful of energy companies in the U.S. To help, 7Analytics' has partnered with StormGeo, a weather service and meteorological company that essentially tailors risk data for specific business use cases — such as disaster management in ship-routing, or energy production sites. In short, 7Analytics is helping StormGeo "enhance" its existing offering to its oil and gas customers, which includes companies in Houston, Texas.

https://techcrunch.com

PORTUGAL
A drone that douses wildfires

On a still, hot May afternoon in central Portugal, a car-sized pile of brush catches fire. As the flames leap higher, a torrent of water suddenly falls from the sky.

It's not rain, however. A large drone hovers about 15m (49ft) above, a fire-proof hose dangling from its belly. A pair of jets on either side of the hose pummel the flames with water as the drone operator controls the device from behind a fire truck, the

device's water source. In about two-and-a-half minutes, the fire is out.

The 21kg (46lb) drone, called Sap (for "ported nozzle system" in Portuguese) is one of the newest tools in the battle to beat back extreme wildfires. The drone is lightweight, easy to operate, and nimble at low altitudes. With a wingspan of 2.14m (7ft) and made primarily of carbon fiber, can swoop into places that are too dangerous or too difficult for firefighters to enter, says Carlos Viegas, a mechanical engineer who heads the University of Coimbra's Field Tech Lab and co-led the project.

The firefighting drone test occurred as a slew of wildfires continued to erupt across east and west Canada, leading to the evacuation of thousands of people. Canada is projected to see its largest area on record burned by wildfires this year. Chile was also hit with hundreds of perilous wildfires earlier this year amidst a heatwave.

While the demonstration in Lousã took only minutes, the prototype took almost four years to develop. The first hose the team tried burned up. The nozzle had to be tweaked to create pressure strong enough to effectively douse the fire. But the strong pressure burst the PVC nozzle, so the team went with heavier but more durable stainless steel instead. And after several tests, they figured out that two symmetrical jet streams, one on either side of the nozzle, were needed to keep the craft steady and balanced while it hovered up to 50m (164ft) above the flames.

Even with a bigger motor and other improvements, the drone's best use will likely still be taming early or late-stage fires, he adds – it won't replace conventional aerial firefighting equipment such as manned helicopters and "water bomber" aircraft. "For [these], the drone won't be doing anything because the fire is so out of proportion already that this won't be useful." All big fires begin as small ones, though, and researchers have found that early suppression, which this type of drone could help with, is crucial when tinderbox conditions exist.

A combination of other hi-tech tools is in the works to help keep firefighters and communities around the world safe from wildfires. Another type of drone, already in use in Oregon and several other states in the US, uses sensors and cameras that can help detect and track fires, allowing firefighters to pinpoint where to focus resources. A prototype funded by the US Department of Agriculture and led by Georgia State University researchers employs thermal cameras that can detect wind speed and direction and make predictions about where the fire will spread. Yet another project, already commercially available, uses thermal vision cameras that can be attached to headgear to help firefighters see through smoke and flames.

Some of the most important advances are in the realm of satellite technologies. Satellite data, such as temperature, humidity, vegetation, and topography, feed digital maps that allow firefighters to monitor and assess a blaze before going in.

Firefighters on the ground need to know if shifts in the wind could hasten the fire's spread or drive the blaze in a certain direction. But with the help of AI, experts are working on ways to combine satellite data on vegetation conditions and other factors with drone observations and weather data.

https://www.bbc.com

UK

Tool to assess the impact of sea-level rise

British scientists have developed a tool that can swiftly assess the impact of sea-level rises on the risks of areas flooding.

Researchers from the University of Cambridge used Hull in eastern England, one of Britain's most vulnerable cities to flooding, as a base to create the digital tool which can now be used around the world.

It will enable towns, cities, regions, and countries around the world to make better and earlier decisions to prepare for climate change.

The tool assesses the economic impact of tens of thousands of potential scenarios of rising seas and mitigation activities.

"It's vital that places like Hull make informed decisions on how best to reduce risk and increase resilience," said Mike Dobson, who works for Arup, global specialists in the sustainable environment.

"Hull is low lying — it's similar to New Orleans in many ways due to its low-lying nature on the coast — and there are 100,000 properties potentially at risk from the most extreme weather events.

Prof Spencer and his colleague Dr. Elizabeth Christie started with detailed sea-level rise prediction information from the UK Climate Projections data in 2018 to model the effects of climate change.

They then developed a framework that incorporates sea-level rise uncertainty into coastal flood-risk assessment by streamlining the process of modeling sea levels, wave overtopping, and flood spreading on land.

By the end of their research, the team had 10 million data points relating to 21,300 scenarios with 122 increments of sea-level rise and seven extreme water levels.

https://www.thenationalnews.com

NORTH AMERICA

USA

Tsunami warning system using AI

Scientists are working on a new early warning system using artificial intelligence to provide coastal residents with more lead time ahead of a potentially deadly tsunami.

According to a new study published Tuesday in the journal Physics of Fluids, an early warning system is being developed that combines "state-of-the-art acoustic technology with AI to immediately classify earthquakes and determine potential tsunami risk," the study said.

The new research used sound recordings captured by underwater microphones, called "hydrophones," to measure the

acoustic radiation produced by 200 earthquakes that happened in the Pacific and Indian Oceans.

"Our study demonstrates how to obtain fast and reliable information about the size and scale of tsunamis by monitoring acoustic-gravity waves, which travel through the water much faster than tsunami waves, enabling more time for evacuation of locations before landfall," Kadri said.

The new machine-learning model can analyze the hydrophone (underwater microphone) data within a few seconds on a standard computer.

In addition, systems that rely on deep ocean wave buoys to measure water levels often leave insufficient evacuation time.

Designed to be used alongside existing warning systems, the new system triangulates the source of the earthquake from the hydrophones, and AI algorithms classify its slip type and magnitude. It then calculates important properties like effective length and width, uplift speed, and duration, which dictate the size of the tsunami.

This new research predicting tsunami risk is part of a long-running project to enhance natural hazard warning systems across the globe, according to a statement from Cardiff University.

Their latest development is featured in user-friendly software that is set to be hosted in national tsunami warning centers later this year.

https://www.usatoday.com

Mobile system for object detection, image analysis

A team of researchers from the Department of Energy's Oak Ridge National Laboratory has created a prototype system for detecting and geolocating damaged utility poles in the aftermath of natural disasters such as hurricanes.

The system, which is detailed in the journal *Photogrammetric Engineering and Remote Sensing*, is designed to run on edge computing hardware mounted on

a quadcopter or other uncrewed aerial vehicle, allowing it to function when local infrastructure is damaged or destroyed.

The team from ORNL's Geospatial Science and Human Security Division used machine learning algorithms and onboard imaging hardware to accurately detect and assess damage to utility poles while uploading location information to a central processing hub, called the Environment for Analysis of Geo-Located Energy Information, or EAGLE-I. This information can be relayed to utility companies, first responders, or other groups supporting energy infrastructure.

The edge computing platform is one of several projects designed for incorporation into the EAGLE-I system, a multifaceted real-time situational awareness tool for the nation's energy infrastructure. EAGLE-I allows its users to monitor energy infrastructure assets, report energy outages, display potential threats to energy infrastructure, and coordinate emergency response and recovery.

While the affordable hardware does have limited image resolution and rate capture, Hughes and his team have worked hard to optimize their machine learning analysis software to ensure these limitations are manageable.

When discussing AI on the edge, Hughes is not only referring to the cutting-edge methods he and his team are using to design their image analysis tools or the UAS platform upon which they will run. He's also talking about a broader class of new AI computing projects in which AI applications are deployed in devices close to users rather than in a cloud computing facility or private data center. These so-called edge computing projects allow for improved security and efficiency, as well as increased uptime and decreased costs in many cases.

AI on the edge can be useful in a broad range of applications, and the interdisciplinary ORNL team is already considering several new research avenues enabled by their edge computing project.

The team's new edge computing system will improve damage assessment and resource allocation in disaster response and promises a new generation of remote sensing technology for improved preparedness and response to a wide range of threats to national and human security.

https://techxplore.com/news

New Global Flood Early Warning TechnologyNASA Partnership Launches Groundbreaking New Global Flood Early Warning Technology

Floods are among the most deadly and destructive disasters worldwide, and climate change has only increased their severity. To make matters worse, many smaller communities lack the tools they need to detect and respond to floods, leaving them vulnerable to the full force of their impacts.

To help protect these communities, NASA's Earth Applied Sciences Disasters program area has partnered with several leading scientific institutions to develop a new flood detection tool called «Model of Models» (MoM). This tool combines data from open-source hydrological models with Earth-observing satellite data to generate global flood risk severity updates several times a day. This is the first time that comprehensive global flood early warnings have been available at the sub-watershed level, giving communities the knowledge, they need to take early action to protect themselves.

But for this knowledge to be put into use, it must reach the hands of local decision-makers – that's where the Pacific Disaster Center (PDC) comes in. NASA partnered with the PDC to integrate MoM into their global multi-hazard alerting platform DisasterAWARE. When the MoM detects a high likelihood of flooding in a region, DisasterAWARE sends a flood early warning notification to impacted communities, letting them quickly take the steps necessary to save lives and livelihoods.

Local authorities may use this information to activate emergency response plans, order evacuations, or deploy response teams and humanitarian relief.

"This new technology covers the face of the globe, enabling us to observe flood risk and anticipate the likelihood of floods in ways never before possible," said Dr. Shanna McClain, Disasters Program Manager for NASA's Earth Science Applied Sciences Program. "The technology we've developed will be transformative, enabling early action by communities around the globe—especially small island communities and developing states that lack the necessary early warning information to protect themselves and their loved ones during flood events."

"The 'Model of Models' approach makes use of already existing technologies and combines them in unique ways that give us a powerful understanding of flood risk," said NASA's Margaret Glasscoe, Research Associate at the University of Alabama in Huntsville, who leads the project team.

"The IFRC currently integrates all of PDC's DisasterAWARE early warning and risk information into its Go Platform, which provides its 192 national societies and more than 15 million volunteers with critical emergency needs information and the tools they need to provide an adequate response.

PDC's DisasterAWARE platform serves tens of thousands of disaster management and humanitarian assistance professionals worldwide and reaches millions more through PDC's free mobile app Disaster Alert. The business community is also able to access this new flood hazard information for supply chain and continuity of operations planning through DisasterAWARE Enterprise. Through MoM and DisaterAWARE, community leaders and disaster response teams can accurately gauge flood severity through various data layers which include multi-hazard risk, exposure, vulnerability, coping capacity, and national profile assessments.

https://appliedsciences.nasa.gov

Collision-tolerant drone for search and rescue

When disasters happen, search and rescue teams use advanced technology to help them find people in need. Drones can be beneficial, but they often break when they bump into things in damaged areas.

Wenlong Zhang, a robotics expert at Arizona State University, says that's a big problem, but thankfully, that's about to change.

A team of robotics researchers from the Ira A. Fulton Schools of Engineering at Arizona State University has designed and tested a quadrotor drone with a unique feature: an inflatable frame that allows the drone to cope with collisions. Talk about designing for resilience.

The drone's frame is soft, resilient, and tunable, which means it can be adjusted to absorb and recover from unexpected taps and thumps. This makes it possible for the drone to recover from collisions that would otherwise cause rigid-frame drones to crash. Its ability to withstand knocks and jolts is a game-changer in search and rescue operations, where it's crucial to assess the damage from high up and navigate through inaccessible spaces.

Wenlong Zhang, an associate professor and robotics expert who led the research team, said that drones need to physically interact with their surroundings to accomplish a range of tasks. He added that a soft body absorbs impact forces to provide collision resilience and offers the material compliance necessary for dynamic maneuvers such as perching.

This innovation, dubbed 'Built to Bounce Back', holds the potential to transform industries that rely on the use of drones, from disaster relief to package delivery.

In addition to its practical applications, the development of this collision-tolerant drone also serves as a powerful reminder of the importance of embracing challenges and setbacks. The resilience exhibited by this drone is a prime example of how perseverance and innovative thinking can lead to remarkable advancements in technology.

With this new technology, drones can now play a vital role in assessing damage and locating survivors in disaster situations, making the work of first responders much easier and more efficient.

https://interestingengineering.com

Flood Intelligence Platform to Improve Disaster Response

Worldwide, no line of insurance has a greater coverage gap than flood insurance.

To address this problem, climate adaptation technology company Cloud to Street (C2S) aims to create a scalable parametric flood insurance policy.

C2S is already helping more than two dozen countries and several insurers, reinsurers, and corporates to close the flood gap.

"Global flooding threatens billions of people and remains the most common and costly natural peril," said Peter Lacovara, parametric insurance expert and head of commercial at C2S.

"Worsening climate change underscores the need to prioritize climate adaptation and financial solutions, to support those affected by natural disasters."

Since its founding 10 years ago, C2S has pioneered the field of satellite flood tracking. Its flood intelligence platform has enabled the United Nations and national governments to improve flood disaster response.

The company is now powering a new type of flood insurance to help flood-vulnerable communities around the world access financial support and adapt in the face of increasing climate disasters.

C2S provides precise, near-real-time intelligence on flooding and flood risk.

The ability to do this requires three main elements: satellite technology, a 35-year database of flooding worldwide, and a huge amount of computing power.

The intelligence gives governments the information necessary to better handle refugees, make more informed zoning decisions and limit construction in flood zones.

Led by senior scientists in the fields of hydrology, machine learning, and spatial analysis, C2S combines several flood data streams — including optical and radar satellites, historical flood maps, and on-the-ground intelligence — with machine learning to deliver vital and actionable information about the extent and impact of ongoing flood events.

The company aims to provide insurers and other disaster risk holders with previously inaccessible data, helping them to ensure new markets, respond to emergencies, and plan for future flood risk.

"C2S has two key technologies that are useful for the insurance business," Lacovara said. "Using our algorithms, we can look at old satellite data as far back as the 1980s and provide a footprint for any flood anywhere in the world, which allows a different look at the historical risk.

"The second piece is research into historical versus modeled outcomes for higher-frequency flooding, which is significantly more accurate than modeled output."

With so many satellites in space, C2S is able to model high-frequency flooding as it occurs. "If you look at the flooding in Pakistan in September," Lacovara said, "modeling would have been entirely impossible using any other technology than satellites."

https://riskandinsurance.com

THE METAVERSE AND REGIONAL CHALLENGES IN JAPAN

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Abstract

Disaster Risk Reduction (DRR) has become increasingly relevant to all spheres of human life. This article focuses on the application of the Metaverse in Japan to enhance disaster preparedness among people. While disaster drills have become a part of school education in Japan, challenges remain in establishing industry-academia linkage to accelerate the dissemination of knowledge and experiences with necessary disruptive technologies. The authors explain the current hurdles of the wider application of the Metaverse and examine policy directions, paying attention to remedial measures. Seeking the active participation of small and medium enterprises (SMEs) as a vital part of the DRR framework is crucial. The various factors affecting SMEs and making them vulnerable are explained. Nurturing cohorts of SMEs towards effective DRR could enhance their resilience and disaster preparedness. SME resilience will bring coherency to the national policy of disaster management.

Keywords: The Metaverse, Disaster Risk Reduction, Disaster Preparedness, SME, Resilience

Disaster Risk Reduction Beyond Digital Divide

New information and the digital era have witnessed a drastic change in data management concepts as well as information sharing, urging us to opt for a demand-driven innovation beyond the digital divide, to serve the most vulnerable with the benefits of technologies (Shaw 2020). While approximately 96% of the world's Official Development Assistance (ODA) allocated to disaster-related activities is for post-disaster recovery, only 4% is for disaster risk reduction (World Economic Forum, 2022).

This article deals with Japan's significant move towards the Metaverse application to adapt immersive learning in disaster risk reduction.

The Metaverse and Disaster Risk Reduction among the Public

Metaverse is a coined word consisting of "*meta* (transcendent)" and "*universe* (world)", expressing a three-dimensional virtual space where people are connected through avatars using AR (augmented reality) and VR (virtual reality) technology on the Internet.

Avatars, a virtual self, can communicate and move through virtual space on the Internet. The world of the Metaverse (1) enhances communications and (2) facilitates movement via the presence of the avatars. The primary usage of the Metaverse in DRR is to make it possible to experience disasters through the presence of avatars as the virtual self that represents an individual.

The application of the Metaverse creates an immersive learning process for the participants to understand the impact of disasters and survival strategies. Thus, creating an opportunity to access virtual realities amounts to enhanced disaster mitigation.

Mitigating Disaster Risks

Disaster Drills for Disaster Preparedness among the Public

In public and private spaces of Japanese society, physical disaster drills have been a vital part of compulsory education in the schooling system throughout the country. Understanding disaster risks requires knowing the space you live in. The Metaverse has enabled people to virtually experience potential risks and threats that would turn out to be detrimental to human lives. Thus, the simulation of disaster situations by the Metaverse helps us increase our chances of survival.

The Focus of The Government

The focus of the Government of Japan is to enhance Metaverse-based engagement that will define the future of Japanese society. It is anticipated that the Metaverse will further define the way of living and working better in Japan. The frequency and severity of floods and landslides have increased and the significance of countermeasures and accurate assessment of damages caused by landslide disasters has become crucial; thus, evacuation plans need to be refined (Ministry of Land, Infrastructure, Transport and Tourism 2023b).

The Earthquake Early Warning System

Since 2007 smartphones have been installed with an earthquake early-warning application in Japan, which sounds an alarm immediately before an earthquake strikes. Such an alert comes with initial small tremors before a large earthquake,

urging people to get themselves ready for evacuation. It uses seismometers and seismic intensity meters for measuring the tremors by the Japan Meteorological Agency, which has approximately 690 locations nationwide and a seismographic observation network from the National Research Institute for Earth Science and Disaster Prevention in approximately 1,000 locations nationwide. Smartphones in Japan can access a Disaster Message Board Service, and various emergency response apps of different network providers, including information-sharing apps for foreign visitors to receive emergency updates free of charge (Ministry of Foreign Affairs, 2021).

Evacuation Plans and Beyond

The Government of Japan consolidates digital infrastructure by collaborating with Architectural BIM, PLATEAU, and Real Estate ID to promote "Architecture/Urban DX" integration. By linking these data, we can calculate casualty insurance premiums, facilitate payments in the event of a disaster, and develop disaster victim ledgers in local government. This will make disaster prevention measures sophisticated (Ministry of Land, Infrastructure, Transport and Tourism, 2023b).

Project PLATEAU

Methods, Data, Technology, and Equipment

Project PLATEAU has created 3D city models. It is a web system functioning as a damaged housing visualization system. It automatically detects buildings damaged by landslides and other disasters. A smartphone application visualizes the results at the disaster site with an AR application. The damaged dwelling visualization system was developed by adding functions to Symmetry Digital Twin Cloud (SDTC).

SDTC is a GIS data integration and visualization system developed by Symmetry Dimensions Inc. based on CesiumJS. It functions as a web application that integrates and visualizes various data of a city, building a digital twin. It uploads point cloud data obtained from drones. It performs spatial analysis of point cloud data acquired by drones and 3D city models to detect buildings damaged by sediment runoff.

Project PLATEAU and Disaster Risk Reduction

Linking the basic resident register needs to be agreed upon before implementation. Overall, it was found that the detection of damaged houses by comparing point cloud data taken by drones with 3D city models could enhance effectiveness in grasping the status of damages. Minimizing casualties by natural disasters could be possible through such rapid and accurate assessment of the situation and the need for rescue operations.

Applications of the Open City Models

The open city models provided by Project PLATEAU can be seamlessly integrated with the building model precisely. It enables VR-based fire evacuation training, covering the inside and outside areas of a high-rise building in Tokyo, for example.

However, all the municipalities in Japan have not been covered yet. Since processing load in visualizing a virtual world based on Project PLATEAU requires a huge amount of data, some means of optimizing the visualization are required (Mitsuhara and Shishibori, 2022).

Social Engagement

Industrial DX aims at "Realizing the development of entire industries by utilizing a wide range of industrial knowledge and DX functions to connect industries, companies, and communities and solving social issues through the fusion of real and digital technologies" (Fujitsu Limited, 2023). Disaster mitigation and emergency rescue operation could be potential sources of business opportunities for private entities.

Practical Applications of The Metaverse

Before Disasters: Enhancing Disaster Preparedness

The application of the Metaverse carries significant meaning for reduced disaster risks if applied before disasters. There are some examples of applications for DDR related to disaster preparedness.

3D Cities: In 2020, the Ministry of Land Infrastructure, Transport and Tourism, Government of Japan, initiated a project called Project PLATEAU. It builds and utilizes 3D city models for disaster-resistant city development. As many as 48 cities all over Japan have superimposed maps indicating simulated structural inundation areas on 3D city models, allowing the public to anticipate what is to come at the time of a disaster and simulate the possible ways and means of disaster mitigation (Metaverse Souken, 2023).

Digital Twins: Tokio-Marine & Nichido Fire Insurance Co., Ltd. has utilized digital twins to predict large-scale disasters.

DX Disaster Drills and Experiential Learning: Meiji Yasuda Life has been using VR to convert disaster drills into DX. NTT has conducted participatory flood control training on the Metaverse. Tokio Marine & Nichido Fire Insurance Co., Ltd. has developed an AR app that enables disaster experience.

Evacuation Drills: The evacuation drills, such as virtual Tsunamis approaching on digital maps, allow the participants to experience pseudo-evacuation, which urges them to sprint towards a shelter in the real world. This could supplement or enhance real-world evacuation training (Mitsuhara and Shishibori 2022).

During Disasters: Structural Damage Assessment

Structural damage assessment is the first step toward recovery for a community hit by a disaster. It differentiates safe structures from unsafe ones.

A rapid scientific damage assessment carried out by a scanner drone equipped with an image processing algorithm makes it possible to compare the state of affected structures before and after the disaster. A much closer damage assessment for inter-story drift ratio and the degree of inaccuracy and uncertainty could be figured out through handheld AR. The intelligent algorithm that uses

VGGNet Convolutional Neural Network has recorded 89.39% accuracy in assessing structural damage. Swift damage assessment has been possible through a point-cloud-based algorithm and using slave drones (Khanal et al., 2022).

Post Disasters: Enhanced Possibilities of Reducing Vulnerability

The Metaverse enables the participants to digitally experience virtually created disasters. Post-disaster areas which can be visually assessed with accuracy enable an accurate assessment of the degree of damages before reaching the affected areas.

Project PLATEAU uses a web system that automatically detects buildings damaged by landslides and other disasters, also measuring the degree of the damage. The post-disaster application is on a simulation basis, tested and verified by a study team conducted by Symmetry Dimensions Inc. and Pasco Co. Ltd at Kakegawa-city of Shizuoka Prefecture from April 2022 to March 2023.

Hurdles Felt by SMEs and Recommended DRR Policy Framework

The role of SMEs in DRR needs to be increased with the necessary support from academia and local governments. The paucity of funds for disaster management, the lack of digitalization of the SMEs, and the lack of Business Continuity Planning (BCP) are the major sources of concern for SME owners. However, while the growth and sustainability of SMEs are focused on, disaster preparedness is not discussed (METI, 2022).

Industry-Academia Collaboration in DRR

By engaging educational institutions from primary schools to high schools in disaster drills, DRR education has incorporated community participation, administered by local governments, with the cooperation/participation of local industries. The role of industry in DRR has been viewed as that of a benevolent collaborator for academia, when considering big corporates. However, equal attention is not paid to SMEs.

Industry: Japan Metaverse Economic Zone

The field of the Metaverse has been constantly evolving in Japan. On 16 February 2023, an agreement on the "Japan Metaverse Economic Zone" was signed to create "an Open Metaverse Infrastructure from a Role-Playing Game Perspective (Fujitsu, 2023)" as an industrial DX initiative utilizing gaming technology.

Academia: Higher Education and DRR

Corporate investments supporting such Metaverse construction involve major players in the Japanese economy, educational institutions, as well as municipalities in Japan. One such example of a Metaverse application for disaster management is taken up by the Metaverse School of Engineering of the University of Tokyo working in collaboration with 16 business entities in Japan (Metaverse School of Engineering, 2023; Kyoiku Katei Shinbun, 2023).

Keeping SMEs in the Loop of Industry-Academia Collaborations

Through educational interactions, such as lectures, by the concerned industries, and opening internships and industry visits for the students, the promotion of basic research through industry-academia collaborations could be possible. Disaster risk reduction needs to have a wider reach. For this, the authors propose the following four points to be considered.

1) Regional, location-specific application of the Metaverse

2) Introducing the Metaverse in imparting DRR education

3) SMEs adapting the Metaverse given the Business Continuity Plan (BCP)

4) Nurturing DX human resources to serve location-specific disaster management needs

Business Continuity Plan (BCP) is a plan for companies to protect their employees and minimize disruption of business in the event of disasters such as earthquakes and heavy rains, terrorism, and epidemics of infectious diseases, and to support recovery and reconstruction in the event of a disaster. Overall, it contributes to the local economy (NHK, 2023). Society 5.0 propagates safe evacuation, prompt rescue, and optimum delivery aiming for a reduction of damage and early recovery post-disasters (Cabinet Office, 2023b).

Enhancing BCP of SMEs

In a recent survey held in Hiroshima in May 2023, 267 companies were asked to indicate their commitment to BCP. 46.8% replied that they have an intention to formulate BCP, including "Formulated BCP," "Currently formulating," and "Considering formulating" (NHK, 2023). Five years after the torrential rains hit western Japan in July 2018, such state of disaster preparedness is alarming.

Nurturing DX Human Resources

Disaster mitigation and emergency rescue operation could be potential sources of business opportunities for private entities. However, the authors would like to propose that in the current scenario where SMEs have not fully adopted BCP to enhance their disaster preparedness, it is vital to consider the process of nurturing DX human resources familiar with DRR, who could undertake internship or training sessions at SMEs where BCP is not in place. This is yet another level of industry-academia collaboration for enhancing further research and development vis-a-vis the on-site application of the Metaverse. Introducing Metaverse at higher educational institutions for imparting DRR education can be implemented outside of the campus, too. It is in this field that SMEs can be grouped into different cohorts where such trained students/professionals can be invited to establish the training modules for the existing employees and the management of an enterprise.

SMEs for DRR through BCP

As a user-friendly ready-to-use BCP format, Kariya-city of Aichi Prefecture offers its own BCP sample format on the official

website of the municipality (Kariya-city, 2021). However, such an endeavor is not always happening in all municipalities in Japan.

In disaster management, we tend to forget that people are at work too, and not always at home or in school. Also, the decision-making at the workplace often rests with the management, while infrastructural set-up, as well as assigned responsibilities, restrict the movement as well as decision-making processes of the employees. The stakeholders in the private domain, especially SMEs, have been left out of disaster management in Japan. To save precious lives, it is high time to pay attention to enable the active participation of SMEs in DRR education and BCP formulation to make the country's disaster management policy consistent and comprehensive.

Conclusion

It is noted that the accuracy of the Metaverse is appreciated, but affordability challenges are to be tackled. Predefined disasters such as a fire can be virtually experienced. Thus, the Metaverse application helps with the customization of disaster drills and prioritization of rescue operations by linking the 3D cities. Simulating the simultaneous evacuation of many people can be enhanced with the application of the Metaverse. Rapid on-site decision-making in disaster situations could be enhanced. There are three major benefits listed below.

Improved Accuracy

The more the simulations become close to real situations, the better and easier the planning against disasters. Enhanced simulations make the participants more responsive and engage in active learning. Instead of creating physical structures or not-so-real drills, the Metaverse enables the participants to experience close-to-reality situations.

Planning for Structural Safety and Safe Evacuation

Resilient cities are the key to a resilient society that can pursue the DRR principles.

Climate change and increased risks of large-scale disasters have made preparatory education more meaningful and crucial to ensure the survival of human lives. Using 3D models in virtual space such as digital twins for design simulation of cities and buildings will allow educational institutions to participate in scientific planning of disaster mitigation. It is realistic simulated evacuation experiences that lead to saving human lives. Evacuation training with decision-making experiences and trials enhance the decision-making ability to opt for a safe route as rapidly as feasible (Mitsuhara and Shishibori, 2022).

Enabling Experiential Learning

The Metaverse enables us to have an extensive virtual experience through immersive experiences that are perceived as real, and appeal to our senses. It makes us ready to face real disasters in a more calculated affordable manner. Participants' evacuation behavior, the visual impact of avatars, utterances, and associated emotions should be understood.

Enhancing Disaster Preparedness

In conclusion, the Metaverse has enabled simulations to become more accurate and cost-effective, while enabling us to anticipate what is to come. The Metaverse, by entering a pseudo-real world, can collect more personal information in comparison to conventional IT services. It could be difficult for users to correctly recognize the risks. User security features need to be provided beforehand with a full understanding of security risks in specifications and services provided through the Metaverse (Nomura Research Institute, 2022).

Priority Consent and Security Risk

Priority consent is recognized in three phases: education for disaster risk reduction before the disaster; evacuation and emergency rescue operations during and, then, post-disaster. The individuals' rights and privacy need to be protected, especially when multiple agencies could

be allowed to have access to the personal details of the residents.

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Quantified Cities Movement

A Framework For Convergent Risk-Informed Decentralised Disaster Risk Reduction

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Abstract

Rapid and uncontrolled urbanization the world over sends a clear message that cities and city governments will have to prepare themselves for managing resources, providing equitable delivery of services and ensuring safety of citizens, businesses and critical infrastructure as well as security of resources such as water, food, and livelihoods. The United Nations projects a population increase of 41% (41.86 million) between 2014 - 2030 in the 9 most populated urban agglomerations in India (World Urbanization Prospects, 2014). During the period of 2014-2050 India is expected to account for approximately 16% of the world's urban population growth (World Urbanization Prospects, 2014). City governments will fight a losing battle unless the ongoing approaches and frameworks in urban management, policy and planning are changed and/or improved. The economically weaker sections, children, the elderly, women and persons with disabilities will bear the brunt of the lack of adequacy, safety, security and equitability of service delivery and resource distribution. The situation will be further exacerbated in the event of a disaster or civil strife as well as due to long-term stresses such as climate change and environmental degradation. There is a need to formulate a sustainable, inclusive, scalable and replicable real time urban monitoring framework in order to ensure increased resilience for all settlements. All aspects of urban and rural systems, urgently need data and information ecosystems to drive sustainable and timely action. The Quantified Cities Movement is a monitoring and planning framework that improves urban and regional planning and enables settlements to be resilient by continuously providing them with near real-time information. In various contexts, we have rolled out QCM to build transparency and accountability by facilitating the participation of various stakeholders in the process of disaster risk reduction at the local level. This system enables monitoring for gaps in preparedness, response and recovery, and promotes resilience activities and increased local level understanding of urban stresses and disaster risk. This web-based platform and associated IT ecosystem is replicable and scalable across settlement hierarchies and government jurisdictions. The system enables two-way communication where all stakeholders can be alerted to situations reported on the ground.

Introduction

The current settlement planning arrangement is not structured to accommodate citizen-centric participatory resilience planning and action. There is a need for a framework which is not "top-down heavy" but rather bottom-up to inform planning and action with the insights of the citizens as well as experts. The development planning process is rarely informed by the underlying and primary risks that citizens face on a day-to-day basis. Most settlements do not possess systems that enable granular, real-time and location-based monitoring of local risks and hazards. The lack of evidence based, informed decision-making presents none or very limited opportunities to cost-effectively assess the situations of environmental/public health, disaster risk, deficit in service delivery systems, and lacunae in quality of life of the most vulnerable.

Currently, there are large vulnerable sections of population living in unplanned, unhealthy and malfunctioning cities and settlements. The absence of a reporting framework and mechanism, and lack of capacities of various stakeholders, including citizens, present a major impediment to local area preparedness and response in the case of a disaster to take anticipatory preventive and mitigation actions. In many settlements, the current management and planning arrangement is not adequately structured to accommodate or integrate issues such as efficient systems for delivery of social inputs to all sections of society, disaster risk reduction and preparedness, climate change mitigation/adaptation, environmental risk assessment and quality-of-life indicators, rights of vulnerable sections of society (CRC, CEDAW and CRPD)[1], heritage preservation and conservation as well as environmental protection and conservation.

There is a lack of a standardized system of data collection, norms and standards, reporting or feedback loops for settlement resilience planning and management in the current settlement management and planning framework. The sheer size of population and physical scale of cities present a challenge in collecting high resolution, granular, accurate, timely and relevant data for action. Indicators that must focus on hazards and resilience

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1 CRC: Convention on the Rights of the Child. CEDAW: Convention on the Elimination of All Forms of Discrimination against Women. CRPD: Convention on the Rights of Persons with Disabilities.

issues that should be integrated in the planning process are not identified or clearly defined. A wide range of quality standards and norms[2] published by various government agencies[3], at various levels, is not followed and tracked. There is a lack of scientifically collected and processed data (insight). Since scientifically collected and processed data ensures informed and objective decision making for disaster risk reduction policies and plans, most outcomes are measurable or at least tracked through an objective and participatory process. Encouraging citizen participation in the disaster risk reduction process is the most important step in ensuring healthy cities.

2 URDPFI norms, Ministry of Urban Development, Government of India (http://moud.gov.in/URDPFI).
3 Air, Water and Noise quality norms published under various acts, Maharashtra Pollution Control Board, Maharashtra State (http://mpcb.gov.in/index.php)

What is the Quantified Cities Movement (QCM)?

The 'Quantified Cities Movement' ("QCM") ecosystem comprises a mobile application accessible to citizens, an associated website for data visualization, infrastructural elements, other software and specially developed algorithms, to enable the collection and processing of data relating to inter alia quality of life indicators, sustainable development indicators, disaster management indicators and climate change indicators. The following pages provide a broad outline of the QCM ecosystem, its various elements and how the ecosystem can be used by various stakeholders.

How does QCM work?

QCM enlists volunteers to monitor their neighborhoods in cities or villages (in the case of rural settlements), for resilience planning and action. As illustrated in Figure 1, volunteers submit reports of the ground situation to the QCM dashboard that can be accessed by various government departments, elected representatives, and civil society organisations. This can be raw data or processed data in the required form of tables, graphs, reports and maps. All stakeholders can access maps, graphs and reports in order to make an informed decision for action in a given situation. In certain cases, there is potential for stakeholders to suggest and vote for solutions.

Various stakeholders deal with the data in different ways. Government agencies and departments react to grievances and emergencies, elected representatives look for solutions or propose laws that will improve the city, newspapers report the problems to a wider audience and discuss
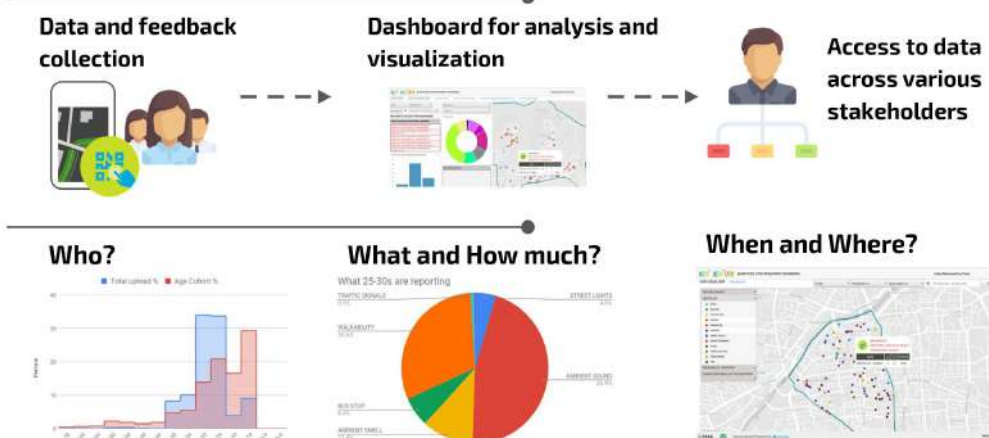
Figure 1. An overview of how QCM works
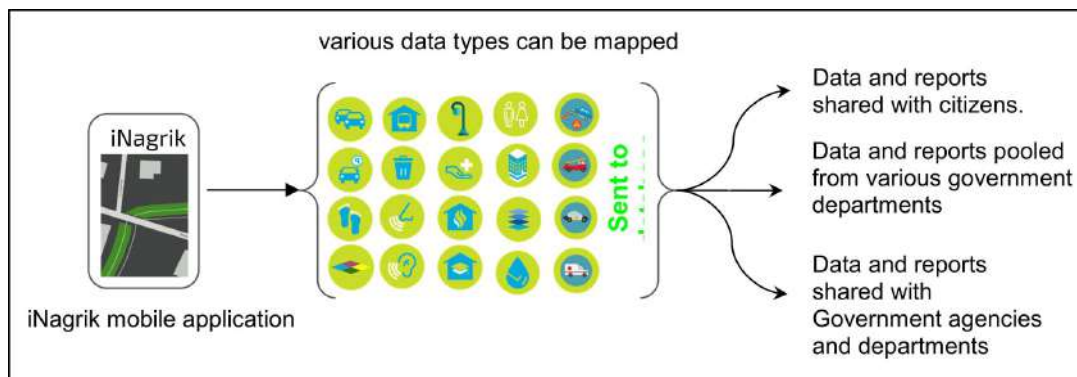
Figure 2. Data collection and scalability

the issues and citizens, volunteers and various civil society organizations report issues and suggest solutions.

With the help of the iNagrik mobile application (Figure 2), various government agencies and departments can map, monitor and manage assets, react to grievances and emergencies, and document solutions or propose new initiatives that will improve internal systems for service delivery, infrastructure management and DRR planning.

What are the elements of the QCM ecosystem that stakeholders will use?

iNagrik mobile application: iNagrik is at the heart of the QCM framework (Figure 3) and enables citizens to report, receive, and share issues and solutions.

The application enables users to upload and update data for any physical asset including but not limited to roads, buildings, social infrastructure, footpaths, and transport infrastructure. The upload is geotagged and time-stamped ensuring validation of the uploaded data. The spatio-temporal mapping enables

duty-bearers (e.g. line-departments) to visualize and track on the ground situations. iNagrik can be enabled for various languages and modified according to the

needs of line-departments/institutions and other stakeholders.

Pulse Points

Urban Pulse Points are Quick Response (QR) codes through which users can scan assets, monitor and take user feedback from amenities such as public toilets and bus stops. Figure 4 is an actual pulse point used for heritage documentation, information and feedback.

The QCM data collection infrastructure enables various stakeholders to upload a wide range of reports. In Figure 5, citizens can report for preparedness and response to enable DRR.

QCM dashboards: The dashboards are designed to provide information and analytics to departments. Features can include infrastructure listing, spatial distribution and frequency distribution of a variety of data, and the ability to query data over space and time.

The dashboards give access to analytics and trends regarding status of various types of infrastructure. Departments can

Figure 4 (Left). An urban pulse point is a QR code linked to a site of interest.
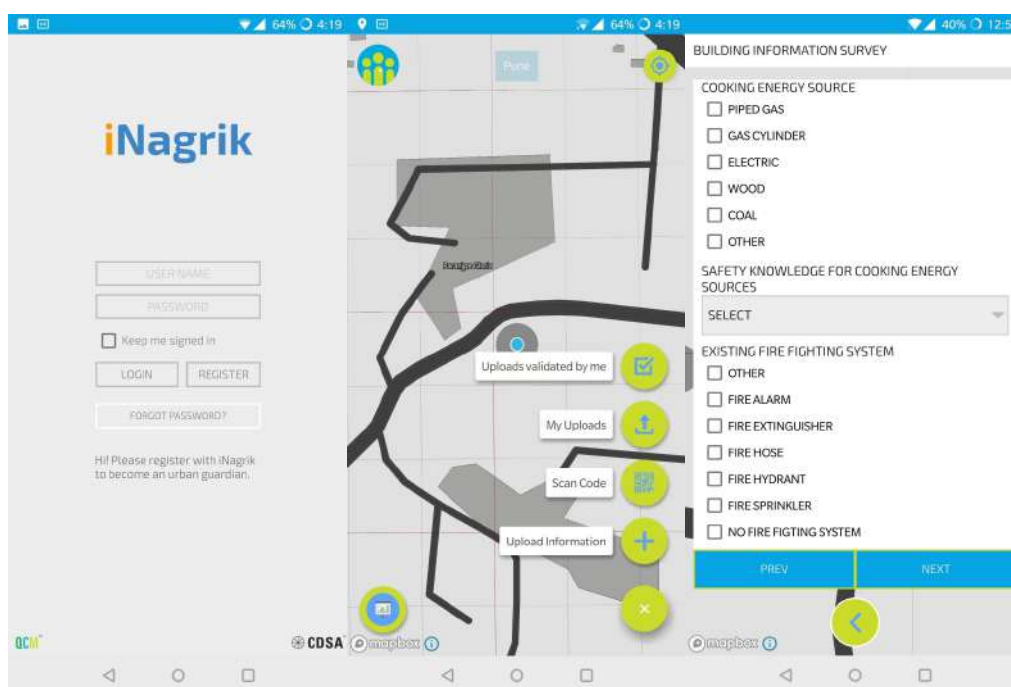
Figure 3. iNagrik mobile application
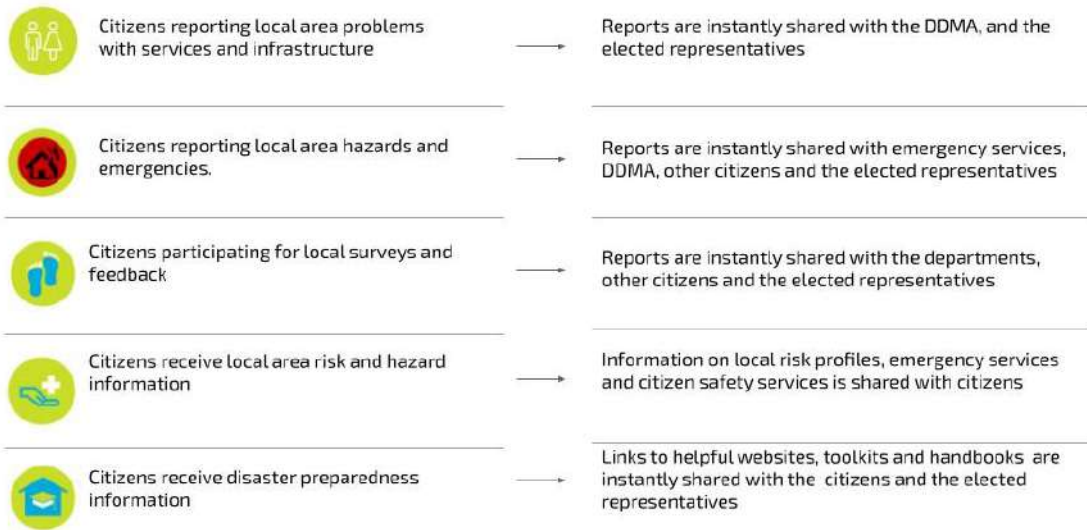
Figure 5. Types of citizen reports and two-way communication that can be enabled.
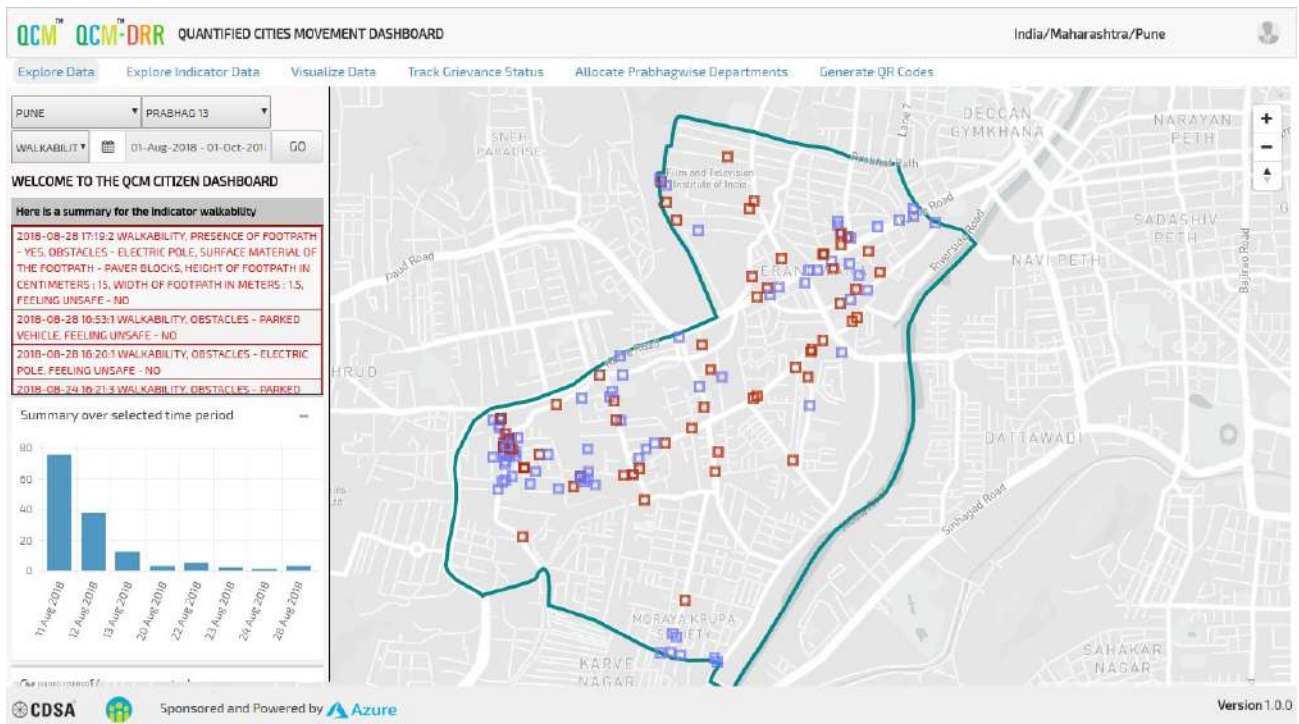
Figure 6. Map of a ward showing the clustering of various uploads regarding street issues.

track trends (Figure 6 and Figure 7), to improve service delivery and efficiently allocate resources to ensure continuity in access to services.

Dashboards have been made for various government departments to deal with grievances and emergencies (enabling Accountabilities to Affected Population) as well as monitor timely access to amenities and services. The system also enables rescue services and security services to track incident reports as shown in Figure 8.

Mapping community infrastructure: The QCM visualization interface (Figure 9) provides a three-dimensional model for administrators and planners to view priority areas for disaster risk analysis and compare data.
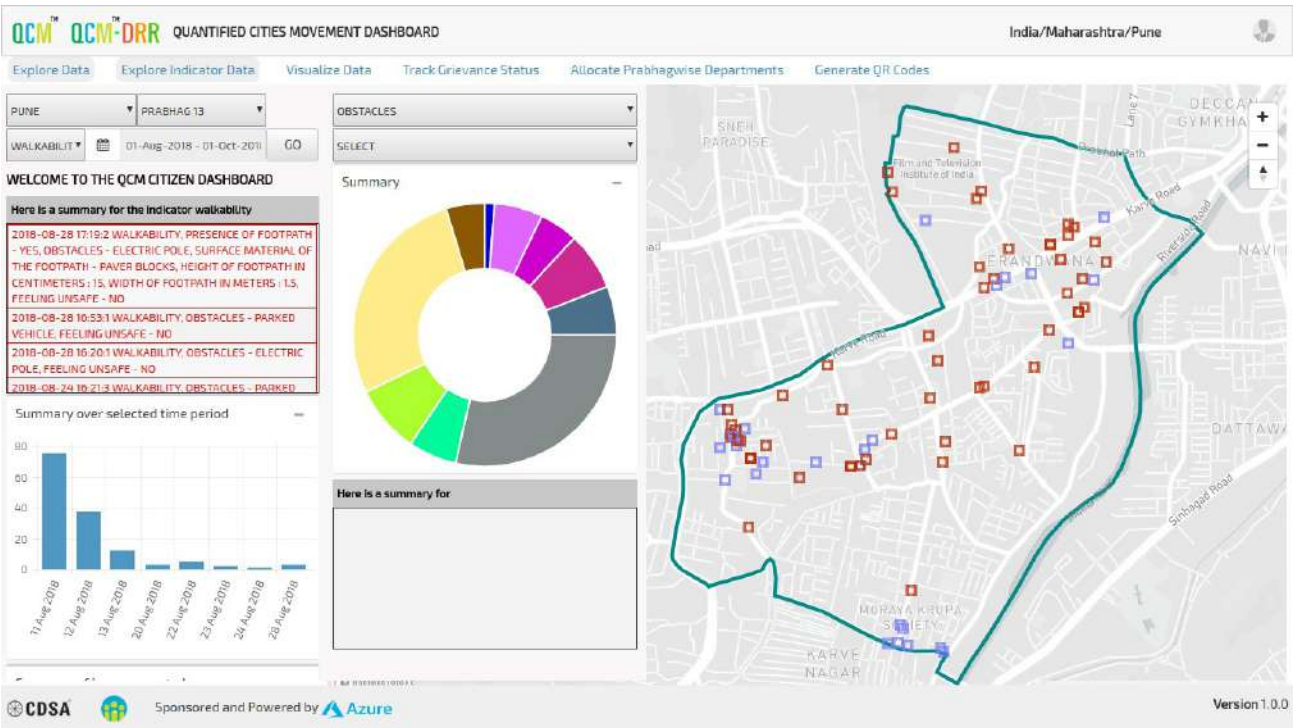
Figure 7. Map of a ward showing the clustering of street issues reported by citizens along with percentage breakdown for types of issues reported.
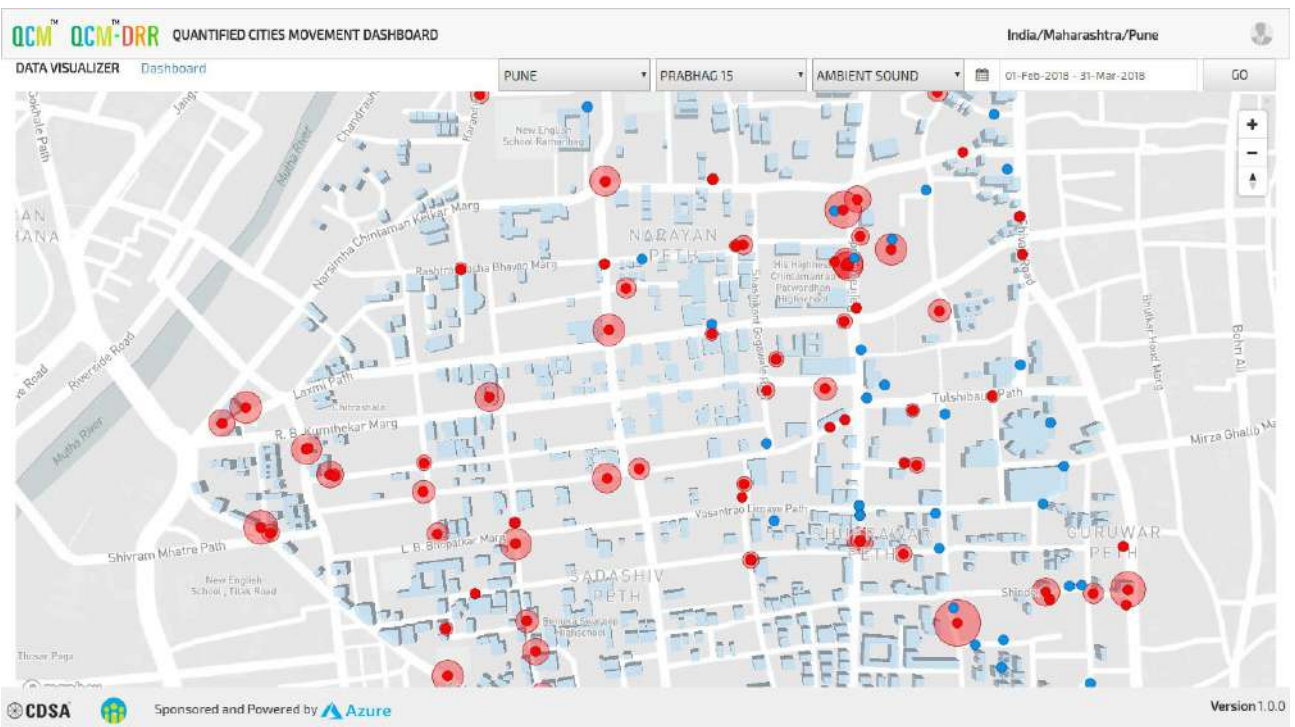
Figure 8. Map for Emergency tracking and study.

Infrastructure Location: Various types of infrastructure can be mapped through the system, based on building footprint, plot number and survey numbers. This data must be provided by the department and can establish the location of the asset. This information is important as the data for the unique location can be continuously updated and maintained.

Infrastructure area and population: Basic data regarding the infrastructure, such as built-up area, capacity, population base can be mapped (Figure 10) and fed into the ecosystem, which can be
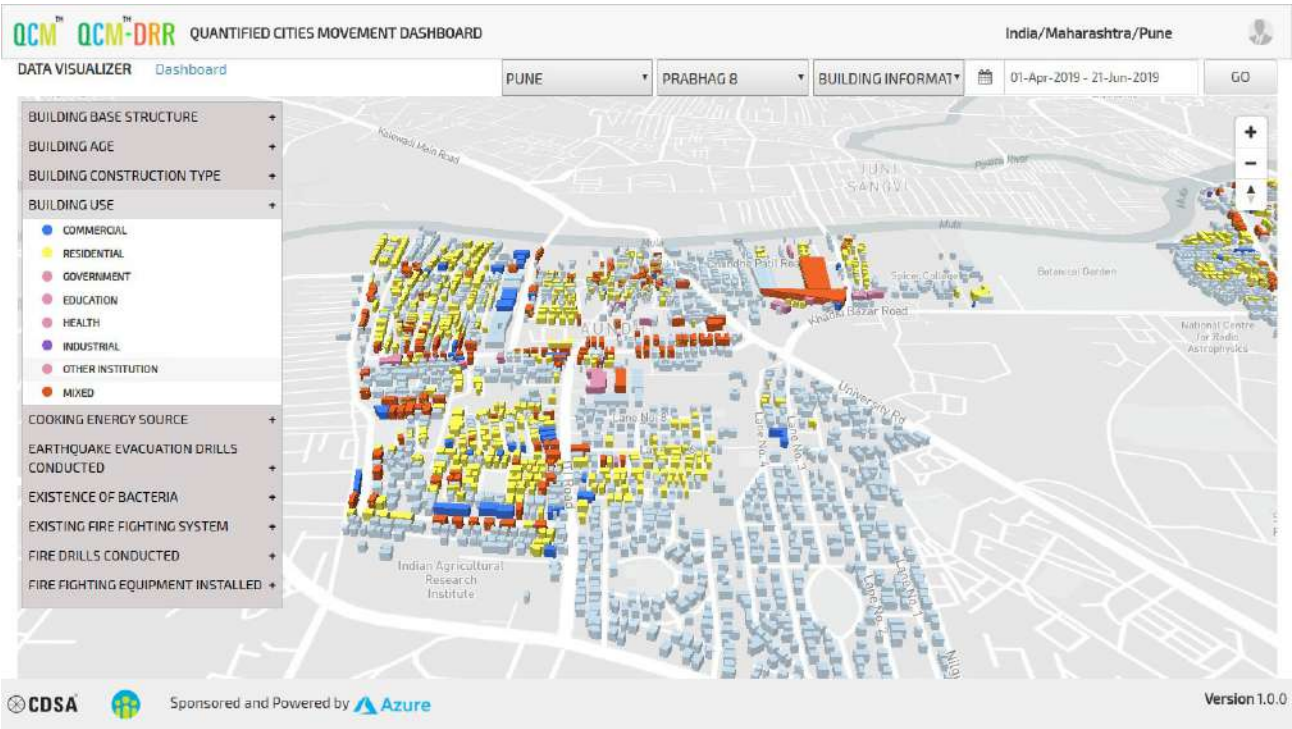
Figure 9. Mapping city land use.
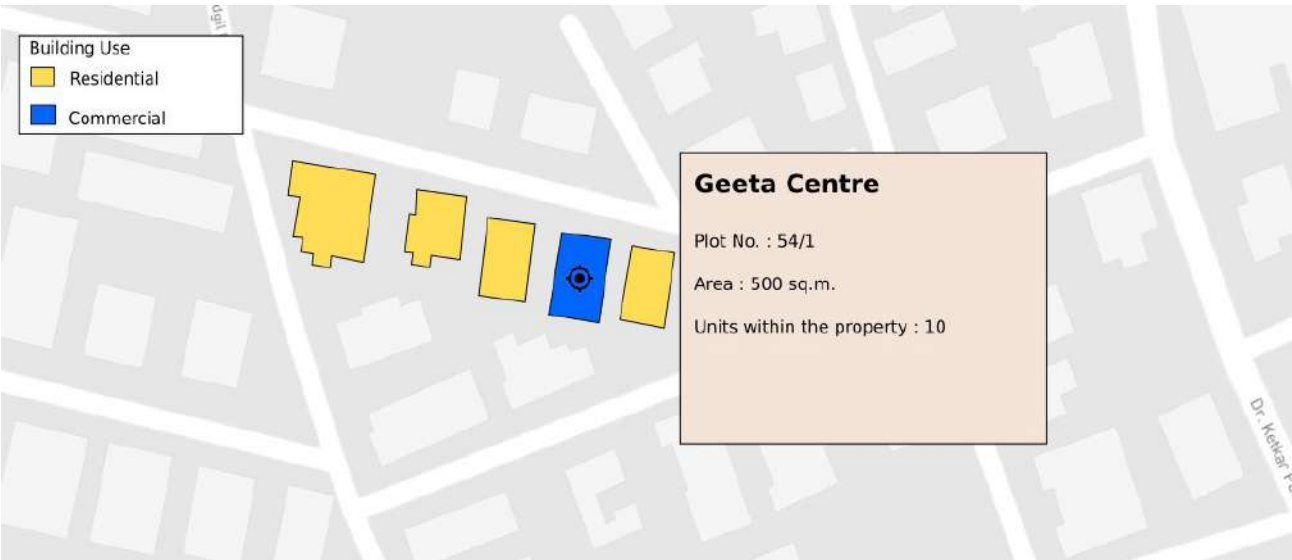
Figure 10. Mapping asset location, area and population.

accessed and used by the department. Storing such data is useful for planning and verifying infrastructure and amenity requirements for a given asset as well as enabling a quick census.

Infrastructure plot details: Important details about the infrastructure can also be updated (Figure 11). Details such as housing types, tenure type, progress of construction, property value, among other things, can be updated and mapped. Using this data, the department can measure property values, track activities linked to tenure types and status of project implementation.

Mapping preparedness: The department can decide on which type of infrastructure and amenities need to be mapped. Asset infrastructure and amenity status can be continuously updated and tracked. This enables the department to prioritize infrastructure maintenance and retrofitting. The system also enables inventorying of various elements. Various activities linked to a house, for example, can also be tracked. Figure 12 illustrates whether earthquake evacuation, firefighting and flood evacuation drills have been conducted at the location. This data is invaluable in case of a disaster as well as for disaster preparedness and resilience activities. The data can be shared with the urban local body and state authorities such as the disaster management authority of the state for improved collaboration.

Figure 13 illustrates how land use is tracked and, more importantly, how water infrastructure for a particular use is mapped through the system. Various
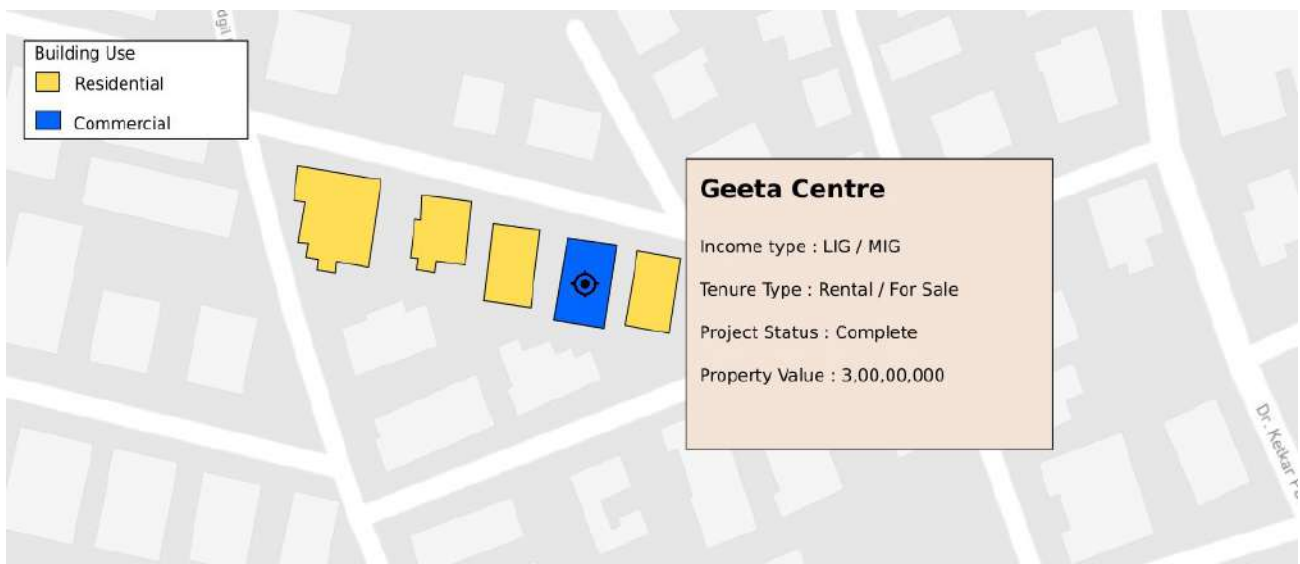
Figure 11. Mapping asset plot details and status including value.
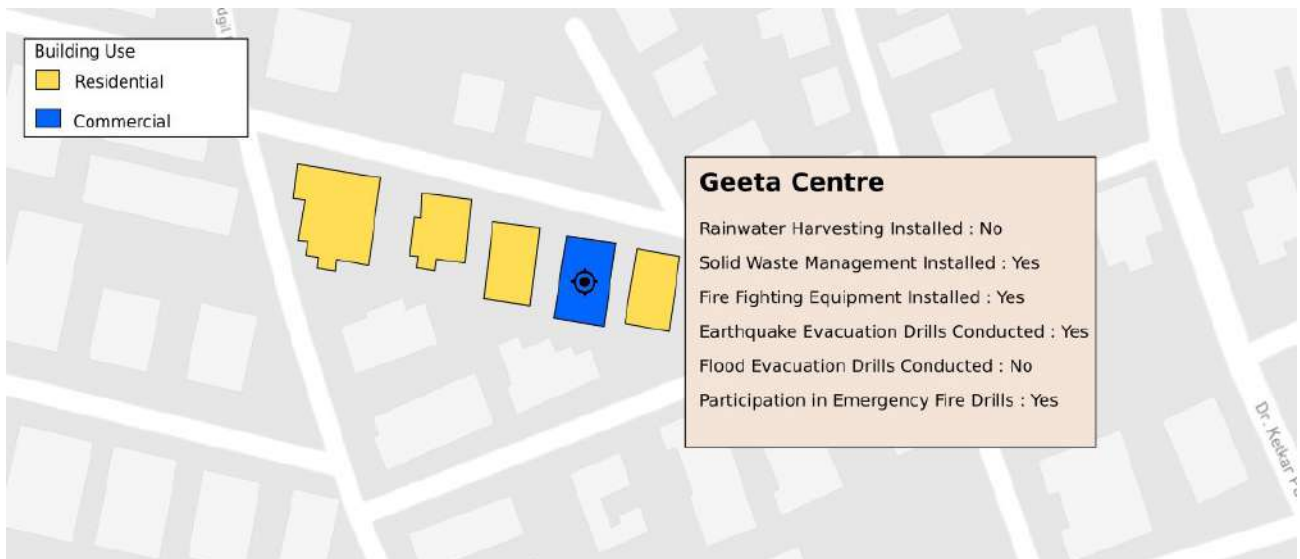
Figure 12. Mapping preparedness activities.

departments can share and cooperate to track assets. In the figure below, water sources, total water holding capacity, and availability for Geeta Centre have been mapped. This information can be shared with water supply and fire departments as well as the DRR planning department.

Sorting: Data sorting and querying is an important function that the QCM ecosystem provides. These functions enable the user to sort assets by standardized data. Any asset that has been tagged with a particular type of data can be queried

and sorted for the same. Such a system enables the department to identify gaps (Figure 14), differences across variables such as total built area, tenure, land values, density, and infrastructure.

Comparing against quality standards: By engaging citizens, scientists and surveyors in reporting neighborhood level stress and risk, QCM facilitates best practices in urban an rural policy and planning, improving participation and increasing the availability of evidence. This process empowers all citizens,

surveyors and academicians to collect data, analyze data, and map stresses identified through comparison with legislated quality standards, and also suggest solutions.

Benchmarking and comparing against baselines: Due to the potential of continuous and timely data collection, the ecosystem presents great opportunities for baseline studies and benchmarking. Stakeholders can compare the current situation to baselines and benchmarks in order to monitor marginal changes
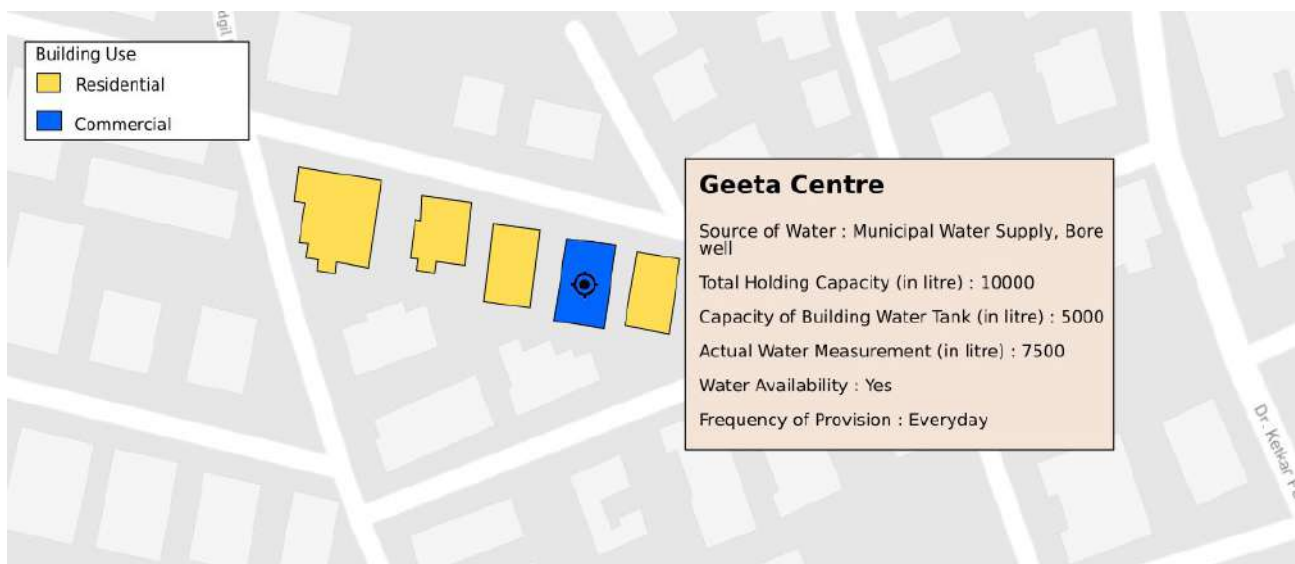
Figure 13. Mapping asset amenities such as water infrastructure and elements.

Figure 14. Sorting assets by location, area, value as well as infrastructure and elements.

for various indicators including but not limited to quality of life, climate change, disaster risk reduction and resilience.

Comparisons between wards and between cities: For standardized data-sets, stakeholders can compare various indicator levels between wards and administrative precincts or even cities.

Use Cases

Example 1.

The Alliance for Resilient Cities (ARC)

ARC is being implemented in Pune, India. It is an initiative of the Centre for Development Studies and Activities and the Pune Municipal Corporation. It is being supported and mentored by the UNICEF DRR cell in New Delhi. The Alliance enables colleges, research institutions and the local governments to carry out local area research to achieve the Sustainable Development Goals by enabling students (in photograph) to collect data using the QCM framework. The data is sent to all the alliance members for use in research and policy creation (Figure 15).

Example 2.

The Karnataka Migrant Tracking and Social Protection Framework. (KMTSPF)

KMTSPF was initiated by the Ministry of Panchayati Raj of the Government of Karnataka and supported by the UNICEF Hyderabad office in 2020 until the end of 2021. The system was implemented to track the needs of returning migrants during the COVID pandemic. The framework used a customized instance of the QCM framework to enable village officials in all the villages of Karnataka State to report migrant needs, which included health care, social protection, education, livelihoods and food security. Village officials would carry out weekly surveys to report the ground situation to the District and finally the State functionaries.

Figure 16 illustrates how the system enabled government functionaries to identify the location and breakdown of skilled workers who could find gainful employment after returning to their villages during the COVID pandemic.

Figure 17 below showed the extent and gaps in the provision of social protection that is provided by the state government to its citizens. The Arogya Karnataka Card is an important document that provides important health coverage to the holders of this card. In this case, the government of Karnataka could pinpoint the gaps in the provision of social protection and organize efforts to reach the people in need due to the availability of location and time data, which was enabled by implementing the QCM framework.

Conclusion

Internet connectivity, processing power and storage capacities have been continuously improving over the past decades.
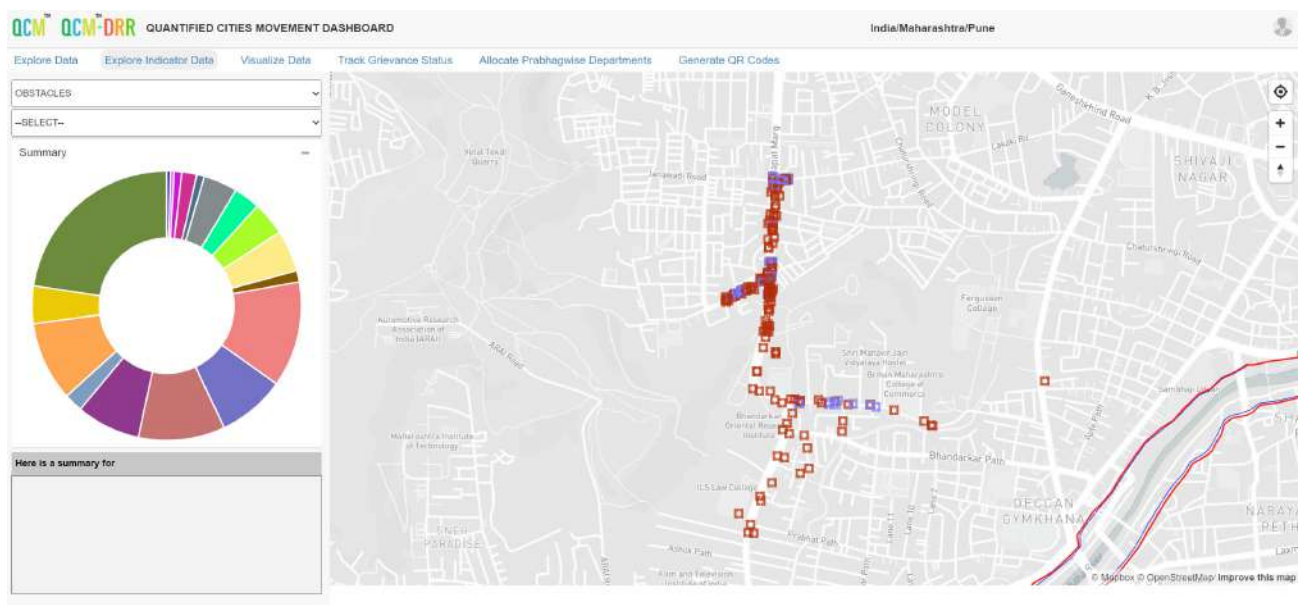
Figure 15. Student reports informing authorities whether the streets are safe for children, the elderly and persons with disabilities.
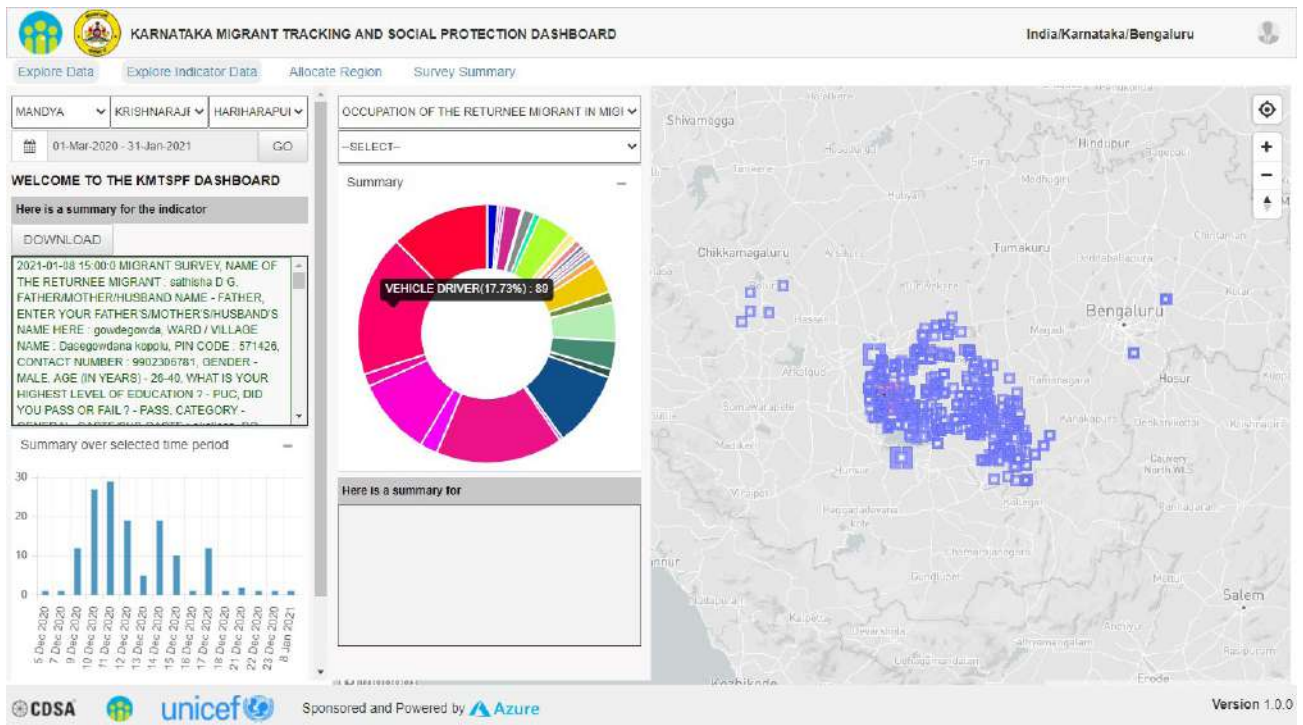
Figure 16. Reporting on skills of reporting migrants to match livelihood opportunities at the local level
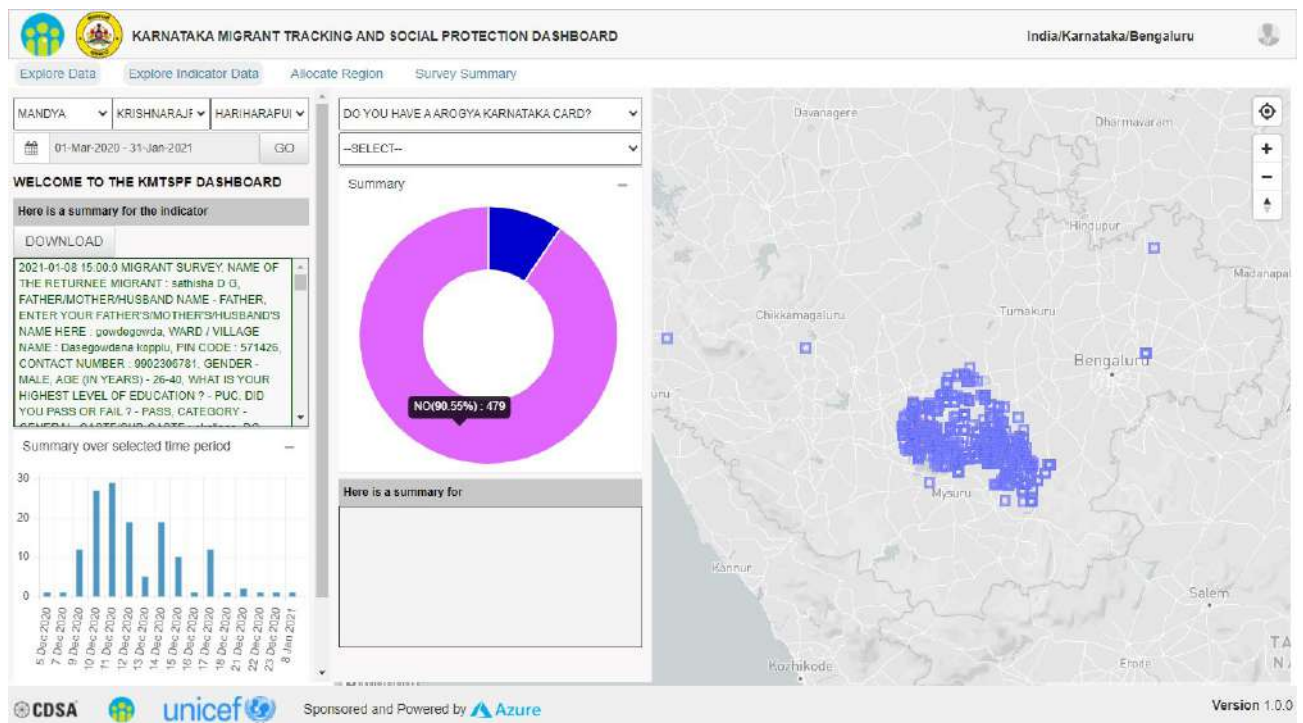

Figure 17. Reporting on skills of reporting migrants to match livelihood opportunities at the local level

Coupled with this, Internet of Things (IoT) frameworks are being installed for varied uses (refer to the Asia Pacific Tech Monitor Oct-Dec 2021 issue). The use of smartphones is expected to rise to 94% in 2030 from 68% in 2020. With this increase in adoption of communications technology at the household level, it is imperative that smartphones become enablers of disaster risk reduction. IoT devices and data can be linked to the Quantified Cities Movement (QCM) framework, presenting an opportunity for the creation of a worldwide platform for disaster risk reduction and resilience.

The system is a great framework for monitoring the achievement of Sustainable Development Goals (SDGs) as various surveys and data can be integrated and layered and interfaced in the system. With the help of youth alliances, NGOs and community-based organisations, various types of data can be collected at the grassroots level and pushed to UN organisations and local governments. This data can be compared against SDG targets to monitor and manage inputs to achieve the SDGs.

QCM readily becomes a platform for collaboration and mapping accountabilities and needs of various vulnerable groups. QCM has the capabilities of two-way communication, enabling authorities to alert selected groups about risks, various social protection programmes and livelihood opportunities.

Once such a system is installed, it ensures improvement in the speed at which data is collected, situations are monitored and local governments can respond to emergencies and make short and long-term investment plans for disaster mitigation, prevention, recovery and preparedness.

It becomes a legacy system for enabling time series analysis and a repository of time series data. The system provides an opportunity to gather granular as well as big data and, in turn, improve and enable Artificial intelligence systems for urban monitoring and management.

QCM seamlessly enables households to plug in to a social protection and disaster risk reduction system that can enable preparedness, response and recovery in the event of any disaster. The QCM framework provides an opportunity for evidence-based and risk-informed planning of settlements as well as regions. Such a system should be treated as necessary infrastructure for all settlements. By institutionalizing and deepening such a system, local and state governments enable the creation of a much needed, real-time network to protect against loss of life and property.

Locally Accessible Cloud System (LACS) as a potable communication tool in disaster situations

Toshikazu Sakano[1*], Babatunde Ojetunde[1], Jeffrey Llanto[2], Sunil Kumar Jangir[3], and Chandraprakash Sharma[3]

Abstract

With the worldwide popularization of the Internet, the Information and Communication Technology (ICT) has become indispensable not only in daily life but also in disasters like earthquakes or typhoons, to efficiently save people's lives and to mitigate and recover from the damage. On the other hand, once a large disaster occurs, the Internet and mobile communication services are often disrupted, which prevents the government and responders from starting mitigation initiatives.

To address this issue, the Advanced Telecommunications Research Institute (ATR) proposes a system called Locally Accessible Cloud System (LACS) to urgently meet the ICT demand in disaster-affected areas. LACS is designed to host multiple services for delivering, sharing, and exchanging information among local people and to fulfil the explosive demand for ICT even in the absence of mobile or broadband internet. LACS has a form of a portable case and is comprised of a small server, a Wi-Fi access point, a battery and peripheral devices. LACS conforms to ITU standard, which is the Movable and Deployable ICT Resource Unit or the MDRU.

To confirm the LACS's performance in a real disaster situation, we developed a LACS system and conducted its feasibility studies in Cebu, Philippines. LACS server was deployed at a local government facility and was connected to the Wi-Fi access point in a remote island from the facility, using fixed wireless access equipment to provide e-education and other services. We demonstrated and applied the system to the real issues in a disaster situation and during the COVID-19 pandemic, with the participation of the local government officials, teachers, students and residents. The results show that LACS is a very useful communication tool in disaster situations and also for providing various services such as e-education.

Introduction

The number of natural disasters like earthquake, typhoon, and flooding has increased in recent years. In the last couple of years, the unprecedented effect of the COVID-19 pandemic has flared worldwide and people are looking for ways to engage in social activities while avoiding the risk of the pandemic. In these disaster situations, Information and Communication Technology or ICT, including Internet-based services, play a critical role. Most people in disaster-affected areas use their mobile phones and any other communication medium to confirm the safety of their family, friends, and acquaintances. Disaster responders like local government officials, police officers, fire station workers, and medical staff use communication tools to collect and share the information necessary to do their job.

The local government regularly reports the damage and the number of victims in its area to the national government in order to get support. Besides, the local government has to deliver important information and instructions to residents to save their lives.

During many disasters, however, the telecom network and the Internet are not available or only have limited use due to the disruption of the communication infrastructure and/or the electric power outage. In the aftermath of natural disasters like earthquake, tsunami, typhoon, and flooding, network infrastructure including subscriber lines, mobile base stations, and other telecom facilities are damaged. Besides, the network sometimes stops to operate due to the electric power outage. For example, during the pandemic, people began using the Internet heavily and other network services to keep up with their life, especially in work and education. In effect, this led to congestion of traffic in the network, causing a degradation in the performance of services.

To meet the critical and explosive demand for ICT, we propose a system called Locally Accessible Cloud System (LACS), which can satisfy the ICT demand in the disaster-affected areas or any other similar situation, such as the pandemic. LACS is made up of a portable case and it comprised a small server, a Wi-Fi access point, a battery and peripheral devices. LACS is designed to host multiple services for delivering, sharing, and exchanging information among local people. The deployment of LACS in the disaster-affected areas immediately after the occurrence of a large-scale disaster fulfils the explosive demand for ICT, and bridges the communication gaps

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created by the absence of mobile and/or broadband internet connectivity.

To confirm the LACS's performance in disaster situations, we developed a LACS system and conducted a feasibility study on an island of Cebu, Philippines. In this study, the LACS was deployed at a local government facility and was connected to the Wi-Fi access point on a remote island, where access to the internet is limited, using fixed wireless access equipment. Furthermore, we tested the capacity of LACS to provide e-education and other services on the remote island. In addition, we demonstrated and applied the system to real issues during the COVID-19 pandemic, with the participation of the local government officials, teachers, students, and residents. Most participants agreed that the system was an extremely useful communication tool during disasters and for providing e-education as well.

Demand and supply gap in tele-communication sector

An enormous number of disasters has occurred worldwide in the past 40 years and their economic consequences cannot be underestimated (UNDRR, 2020). The number of disasters has increased in most disaster categories, if one compares the number of disasters in the recent 20 years (2000 through 2019) with that from 20 years ago ('80s through '90s). The impact of disasters has also worsened, which indicates that the scale of disasters has also increased in recent years.

In the telecommunication or the Information and Communication Technology (ICT) sector, disaster occurrence often affects the services seriously. Fig.1 shows a typical configuration of ICT infrastructure and its possible damage caused by disasters. Nowadays, people access the internet through mobile devices like smartphones and/or personal computers from home. These devices are connected through the access network that comprise the base station and/or optical fibers, which connect subscriber's devices and the telecom equipment in the nearest communication building. Communication buildings are mutually connected by optical fibers to form a transport network. Using this transport network, the Internet routers deployed worldwide in a distributed manner are interconnected to form the Internet. Data-centers or huge computer systems are connected to the Internet to deliver Internet-based services like social networking service, e-Commerce service, and Information retrieval service. During a disaster, the components of network access, including base stations and optical fibers, are damaged and/or stop operating due to a power outage in the disaster-affected area. Moreover, in a large-scale disaster, even communication buildings, transport networks and other building blocks sometimes get damaged. These damages disrupt the ICT services like telephone and other internet-based services.

During the massive East Japan earthquake in March 2011, 1.5 million subscriber lines of NTT East, the major telecom service operator in the disaster region, were disrupted due to the damages of access network and transport network. It took almost one and a half months to restore the damages (NTT-East., 2012). During the restoration of the ICT infrastructure post-disaster, sometimes the ability to supply ICT services degrades seriously. Once a disaster occurs, most people make telephone calls to their family, friends, and acquaintances to confirm their status and safety, which causes serious traffic congestion in the telephone network. Disaster responders like government officers, police officers, fire department workers, and medical staff, need to collect information on what occurs in the disaster area, and then closely communicate among themselves to efficiently proceed in their missions
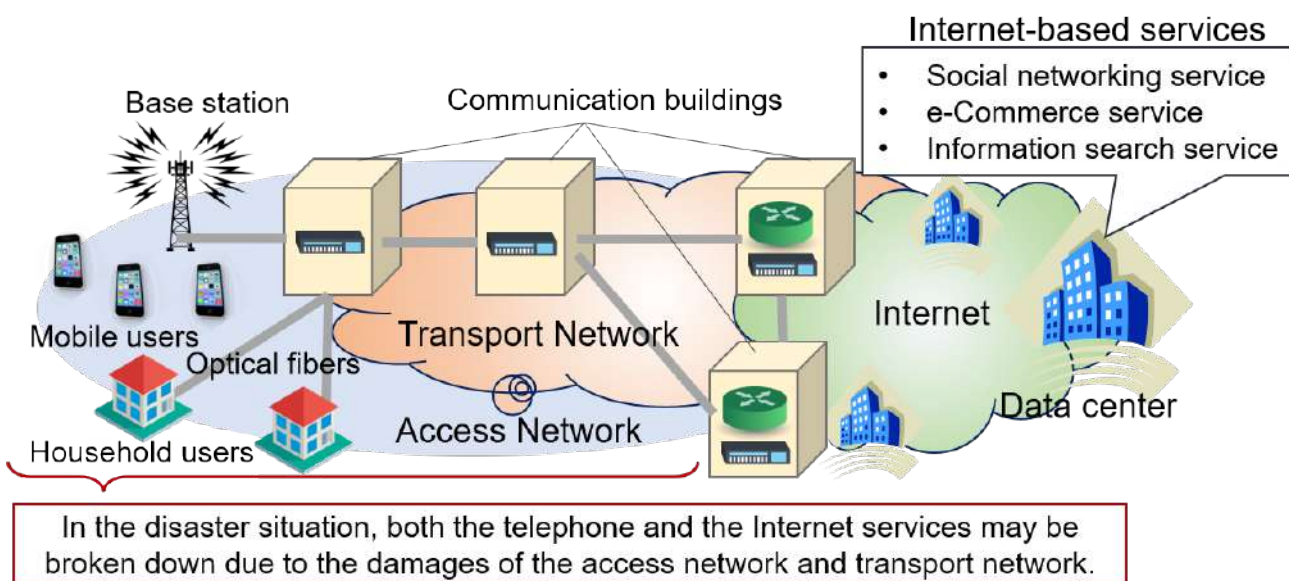

Figure 1. Possible damage in ICT infrastructure under disasters

under critical situations. Generally speaking, during the disaster, the demand for ICT services explosively increases. Filling this gap between supply and demand for ICT services during the disaster becomes one of the critical factors in saving lives and achieving early restoration from the damage.

Supply-Demand-Gap of ICT in COVID-19 pandemic

In 2019, the COVID-19 pandemic occurred worldwide, which accelerated the transition of the format of people's social activities from physical to cyber. Several countries had to enforce lockdowns and in schools and change the traditional structure of educational activities, which went from being 'in-person' to online. This called for the teachers and students to have access to the Internet. This transition caused serious issues worldwide due to the limited penetration of broadband connectivity.

According to a report of ITU, released in 2020, the year-by-year population coverage of the LTE/WiMAX mobile network, developed countries and/or urban areas worldwide was over 70%. On the other hand, developing countries and/or rural areas had low population coverage of below 70%. In the rural areas of the Least Developed Countries (LDCs), Land Locked Developing Countries (LLDCs), and Small Island Developing States (SIDS),particularly, the population coverages of a typical mobile broadband service were in the range of 20% to 40% in 2020, lagging far behind the other areas. A large demand-supply gap in ICT had appeared, especially in the education sector, in various areas of the world due to the COVID-19 pandemic.

Existing resilient ICT solutions

To countermeasure the ICT disruption in disaster situations, various solutions have been proposed and studied (Sakano et. al., 2013, Sakano et. al., 2016, ITU-T, 2016, Miranda et. al. 2016). NTT in Japan proposed a resilient ICT architecture called Movable and Deployable Resource Unit (MDRU) (Sakano et. al., 2013, Sakano et. al., 2016). MDRU is a unit that accommodates communication equipment along with a battery/generator. Once a network disruption occurs in a disaster-affected area, MDRU is carried to the area and it quickly creates an access network or local area network, delivering mainly telephone service to the local people. Users access MDRU from their daily use ICT device like a smartphone, and can make telephone calls to anyone in the local area by using their own telephone number. This MDRU architecture was standardized by International Telecommunication Union (ITU) as L.392 (ITU-T, 2016).

Similar ICT architectures to countermeasure the disasters are proposed and demonstrated (Miranda et. al., 2016, Panda et. al., 2019, Salamanca et. al., 2016, Kishorbhai et. al., 2017, Jahir et. al., 2019, and Pozza et. al., 2018). Many of them focus on restoring damaged network by temporarily replacing damaged network components. With the evolution of fifth-generation (5G) wireless network and the edge computing technology, a new concept called Network-In-a-Box (NIB) is proposed in (Pozza et. al., 2018). NIB is a concept that all the ICT components are packed in a box and the box is attached anywhere in the network to fulfil the demand for varied uses flexibly.

Locally Accessible Cloud System

To fill the ICT demand-supply gap, which became a critical issue in the disaster-affected areas, we proposed a system called Locally Accessible Cloud System (LACS) (Sakano et. al., 2019, and Teng et. al., 2020). LACS is a portable system that can temporarily form an Internet-like environment in its surrounding local area where ICT services are delivered locally. People near the LACS can access the LACS functions using their

Outlook of LACS   Devices integrated in LACS

Figure 2. Locally Accessible Cloud Sysstem (LACS)

smartphones to collect and share information, and communicate with their families and acquaintances. The basic idea in the proposal is that LACS brings the service functions of the data center to local area and then integrates them with newly deployed and/or surviving access network so that local people can access the functions directly, using popular ICT devices like smartphones.

Development of a LACS pilot product

Fig.2 gives an overview of the developed LACS pilot product, its architecture and components. LACS accommodates a small server, Wi-Fi access point, a battery, and other peripheral devices in a carry case. In the server, software for communication functions is installed. The Wi-Fi access point is to enable people in the vicinity to access LACS using Wi-Fi on their smartphone and other ICT devices. With the access point given in the pilot product, users in the area (within ten to a hundred meter line-of-sight radius) can be covered. The battery is an important building block to run the LACS for hours without electric power feed from outside.

The pilot product is able to operate about 8 hours in normal use without power feed from outside.

Fig.3 shows an example of the LACS top page. LACS offers basic ICT functions. Users can access the functions by tapping the corresponding buttons on the top page. The login/user registration allows users to create an account to access the full functionality of services deployed on LACS. The LACS software is equipped with a messaging function similar to Chat and Video communication system in social networking services, which enables us to make bi-directional communication and information exchange. In addition, the Feed is the function for broadcasting type communication. Users can use this function to upload content including text, images, video files and so on. The user registration is necessary to use the chat function and also to upload information to LACS. Only the authorized persons can upload information for delivery and anyone who has access to the LACS can access the uploaded information. During a disaster, local government officials, for example, can announce evacuation

information to the residents by uploading it to this Feed page. With these basic functions, people within the vicinity of LACS can collect, share, and communicate with other people, at least locally, even in the situation where no internet connection exists.

Table 1 shows the potential uses of LACS. The main purpose of LACS is to quickly create a local ICT environment during a disaster. Disaster response officials, from the local government, police, fire-station and hospitals, bring LACS to the site of activity and use it for communication among team members (Ojetunde et. al., 2021, and Ojetunde et. al., 2022). LACS can be deployed in an evacuation center for effective communication there. LACS can be used as a temporary local communication tool for events and training in normal situations. People in developing areas can use LACS in daily life as a tool for local communication under the restricted Internet access environment. LACS conforms to ITU standard L.392 (ITU-T, 2016) and can be classified as a kind of Network-In-a-Box solutions.

Login/User registration
Users who want to use Chat, Video communication, and want to upload contents in Feed and Pages, need to register themselves to the system

Link to Home page
Tapping this icon brings you LACS's home page.

Chat
This function offers one-to-one and group chatting service to exchange and/or share text messages, data/image/video files among users.

Video One-to-One / Group Communication
Users are able to communicate with other users using video communication.

Feed
Users can upload contents including text, image, video files to share them among people.

Pages
Users can create their own home page using a simple editing tool to announce/share information.

LACS homepage

Figure 3. Basic functions provided by LACS

User	Disaster situation	Non-disaster situation
National/Local government, Fire station, Police, Hospitals	➢ Usage in disaster response headquarters ➢ Usage in other organizations that support the activities in disasters like hospitals	➢ Drills for disaster prevention ➢ Daily use in the government work
People in disaster areas / residential areas	➢ Offer a tool for information delivery and sharing in disaster affected area with no Internet.	➢ To offload the condensed traffic at events. ➢ Daily use in residential areas as a conventional information sharing tool.
People in developing areas	Use as an instant ICT installation tool in developing areas with not-rich network infrastructure.	

Table 1. Expected use cases of LACS

Collaboration of LACS and the Internet cloud

In the case of ICT's supply-demand gap, which appears especially in the rural areas in the developing countries, installing a standalone LACS is effective in alleviating the gap but seems to be insufficient, since the information upload/sharing/exchange are performed only locally, with most of the content being handled just within the area. As stated in ITU-D, 2020, broadband mobile internet environment in developing countries and/or rural areas tend to have low population coverage. This means that in such areas, most people have smartphones or mobile devices but the connectivity to the internet is not fully updated to 4G or the latest service. Besides, the connectivity to the internet is often disrupted, probably due to the traffic congestion and unstable power feed to the base station and other network components. This network environment prevents mobile users from fully relying on the Internet for their daily activities (which included education during the COVID-19 pandemic). Therefore, it is important to extend the function of LACS to bridge the gap in such situations.

Fig.4 shows the concept of a LACS-based system to suit the ICT demand during the pandemic and in the rural areas worldwide. In a disaster-affected or rural area with limited broadband, LACS is installed to accommodate local ICT demand. Here we call it the Local-LACS (L-LACS). In L-LACS, LACS's primary functions to deliver basic communication services are installed. Application-specific software like a learning management system (LMS) for e-education is also installed. Users in the L-LACS perimeter, just like the local government officials and residents, can now access L-LACS using the Wi-Fi on their smartphones and use it as a local social networking service. Teachers and students can also access L-LACS and the LMS in it to deliver/access educational content and exchange reports between teachers and students. In addition to the L-LACS, the software package of the L-LACS is deployed in the Internet Cloud. We call it Central-LACS (C-LACS). C-LACS is a copy of L-LACS. C-LACS and L-LACS are mutually connected through the Internet. C- and L-LACSs are controlled so that they are synchronized with each other. If information is uploaded to the C-LACS, then the uploaded information is automatically copied to L-LACS whenever a connection between L- and C-LACSs is available.

The system configuration shown in Fig.4 has several features in the LACS-based system, which are applicable in the context of the COVID-19 pandemic. During the COVID-19 pandemic, the Internet connectivity was disrupted and had suffered serious performance degradation due to the access concentration of users, since most people had increased the Internet access during the lockdown. Even in such a situation, local teachers and students can use LMS by accessing it in the L-LACS locally. Besides, a local teacher can access C-LACS directly over an internet access service and then acquire educational content from a content provider on the Internet. The acquired content can be stored in the LMS in C-LACS without any delay since the connection between the content provider and C-LACS can be assumed to be broadband, which is always stable. The educational content once stored in C-LACS is then automatically copied in L-LACS when the connection between C- and L-LACSs is available. The local teacher, thus, does not have to stress about waiting for a long time to download the content to a local device using an unstable narrowband. During disasters, the same configurations of C- and L-LACSs work effectively too.

Local government officials and residents in a disaster-affected area can upload the disaster-related information like pictures of the damage or messages from evacuation centers to L-LACS. The uploaded information is then automatically copied to C-LACS when the connection between L- and C-LACS is available. The C-LACS can be accessed by anyone who has the permission and the rights to access from anywhere over the Internet. Government
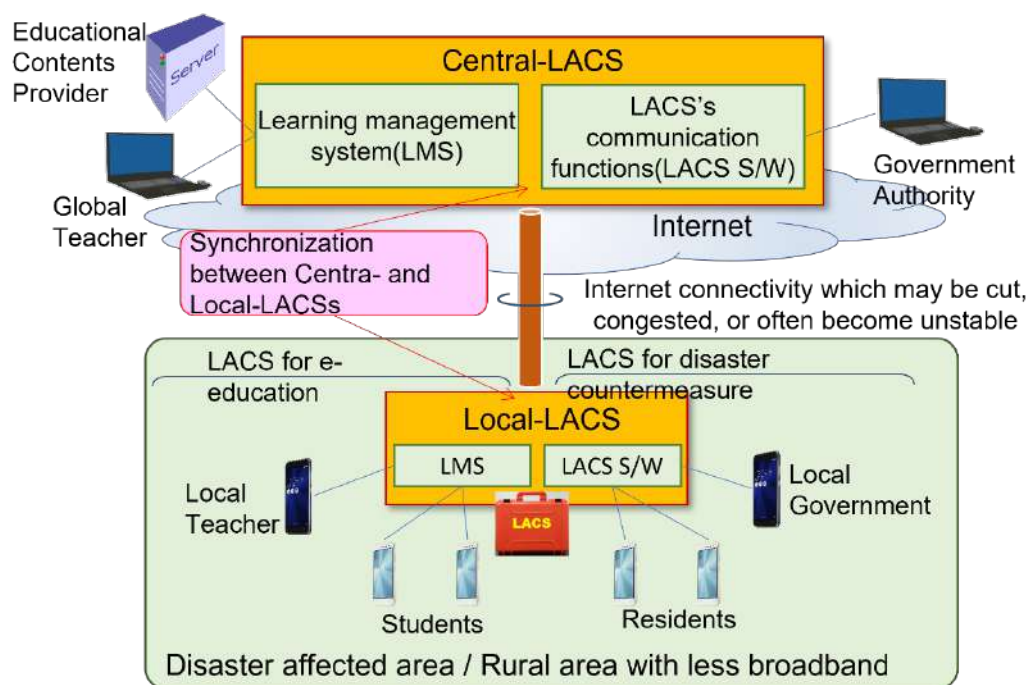
Figure 4. System concept for Central-/Local-LACSs collaboration

officials, for example, can get any information in or relate to the disaster-affected area simply by accessing C-LACS.

Feasibility studies

To confirm the feasibility of LACS, we have conducted a series of feasibility studies in Cebu, Philippines, since the completion of prototype development in 2019. Fig.5 shows the location of feasibility studies. The feasibility studies were conducted in the Municipality of Cordova near Cebu city in the Philippines. Cordova is located in the southern part of Mactan island and its population is about 60,000. It has thirteen barangays (a local administrative unit), one of which is the island barangay of Gilutongan, located on the opposite side of Hilutungan Channel.

Fig.6 explains the feasibility studies we have conducted. During its first study in 2019, the prototype LACS was demonstrated and evaluated as a stand-alone system in Cordova municipality hall. The Wi-Fi network of LACS was extended to Gilutongan Island by using Fixed Wireless Access system in 2020. In 2021, we installed C-LACS to the system with Internet connectivity and demonstrated several uses

of LACS to evaluate the functionality of the system during the pandemic. In 2022, the feasibility study focused on e-education, and was conducted in Visayas State University (VSU) located at the island of Leyte. In 2023, the feasibility study was meant for evaluating the upgraded LACS software, which had a newly accommodated video conferencing function for use in the event of a disaster or under normal circumstances. Among the feasibility studies that have happened so far (as shown in Fig. 6), the details of the feasibility study of 2021 have been reported in this article.

To confirm the fitness of LACS and the architecture shown in Fig.4 for LACS functionality, we conducted a feasibility study in Cordova and Gilutongan island in February, 2021. At the time of the study, schools were closed nationwide due to COVID-19 and educational activities had become predominantly online. So, another objective of the study was to contribute to solving the real issue on the ICT's demand/supply gap, which people were facing with the LACS-based system during the pandemic. LACS-based system was developed and deployed in Cordova for the feasibility study.

Fig.7 shows the developed system. A LACS server was set up in Cordova municipal hall as L-LACS. The server was connected to a Wi-Fi access point to form a Wi-Fi area in and around the municipal hall. The Wi-Fi area was extended to the Gilutongan Island about 6.5km away from the hall, using fixed wireless access equipment and another Wi-Fi access point that was located on the island. The LACS server was also connected to the Internet using a fiber- to- the -home (FTTH) service provided by an internet service provider. We developed C-LACS as an Internet Cloud to be the counterpart of the L-LACS in Cordova. In both C- and L-LACSs, an opensource learning management system for e-education and LACS's communication functions for disaster countermeasure were respectively installed. Using the constructed system shown in Fig.7, the feasibility study was conducted as a two-day session and activity.

Table 2 summarizes the items conducted in the feasibility study. E-education, disaster response, and platform as a service were selected as the areas of usage for the LACS- based system. In the e-education category, general instruction for the

Figure 5. Map of Gilutongan Island, Cordova, Cebu, Philippines

Figure 6. Timeline of feasibility study activities
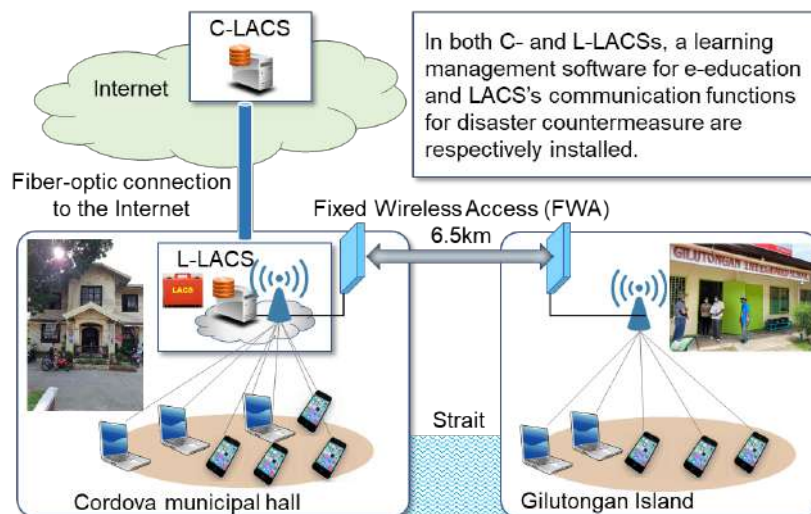
Figure 7. Developed system for the feasibility study in Cordova

Category	Study Item	Main participants
E-Education	LMS Training (General)	Local teacher/student, University professor
	LMS Training for teachers	Local teacher, University student
	LMS Training for students	Local student
	L-LACS by a local teacher	Local teacher and student
	Trial of downloading the contents to student's smartphone and work out with the contents and then upload the reports by local students.	Local student
	Trial of access to the student's report and make evaluation	Local teacher
Disaster response	Training for usage of LACS for communication	Municipal Official Stakeholders Community Residents
	Demonstration of LACS application in searching for a missing person	Municipal Official Stakeholders Community Residents
Platform as a service	Demonstration of a residents management system	Municipal Official Stakeholders Community Residents

Table 2. Feasibility study items

usage of the installed learning management system was conducted first, and then trainings for teachers and students were respectively performed. For disaster response, participants were instructed in the usage of LACS's communication functions, followed by a demonstration of the search for a missing person using LACS. In addition to the two items above, we also demonstrated an application of LACS-based system for a platform as a service. A resident management system was installed in L-LACS and was used by municipal officials for monitoring the COVID-19 status for demonstration.

Results of the feasibility study

Various potential users of LACS in disasters and pandemic, such as teachers and students of a local school, a university professor, local government officials, and community residents, participated in the feasibility study. Fig.8 shows a view of the introduction of the LACS and the feasibility study for participants.

Fig.9 shows overviews of demonstration for e-education. A student is shown accessing the LACS using her smartphone to download content from the LMS in L-LACS easily in Fig.9(a). She made a report on the content and then uploaded it to LMS over Wi-Fi. The teacher then accessed LMS in LACS and evaluated the report. Fig.9(b) shows a screen of the teacher's smartphone when she accessed LMS in LACS. The processes, which include the upload of educational content to LACS by a teacher, the acquisition of the content from LACS by a student, the submission of a report, and the access to the report for evaluation by the teacher, were successfully performed without any difficulty. The same level of performance can be achieved even with an unstable internet connection if all the processes are performed locally.

For the demonstration of LACS in the case of disaster response, participants tried to use LACS using their smartphones. They accessed LACS over Wi-Fi function of the smartphone and then used it as a trial for sharing images and exchanging messages among friends as shown in Fig.10 (a). The participants went outside of the municipal hall and took pictures of the neighboring area and uploaded the images to LACS for the demonstration of the search for a missing person using LACS. They also checked the uploaded images in the LACS from their smartphones to understand the status of the search, as shown in Fig.10(b).

Questionnaires were provided to participants for the evaluation of the LACS system for various usage. Table 3 summarizes the subjective evaluation of LACS and its

Figure 8. Introduction of the system and the feasibility study to the participants in the feasibility study.

(a) A student downloads content
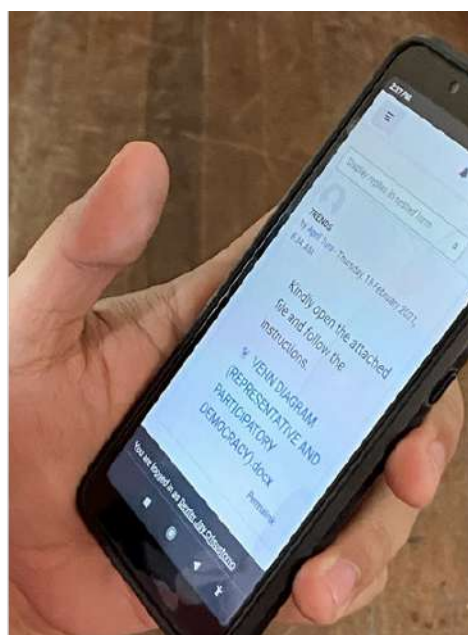
(b) Teacher can access the submitted report locally anytime

Figure 9. Overview of e-education application of LACS

Application Category	Subjective evaluation of LACS by participants (N =10)				
	Very useful	Useful	Not useful	Quite useless	No answer
e-Education	70%	30%			
Disaster response	70%	10%			20%
Resident management	80%				20%
LACS usage in disaster (overall)	80%	20%			
LACS usage in non-disaster/daily use (overall)	50%	40%			10%

Table 3. Subjective evaluation of LACS in use cases

(a) Residents try to use LACS's communication functions

(b) Residents upload the image of surrounding area to LACS to search for a missing person

Figure 10. Overview of the demonstration for disaster countermeasure

various uses by participants. Most participants evaluated LACS to be very useful or useful in each case: e-education, disaster response, and resident management. As for the usage of LACS in a disaster situation and in non-disaster/daily use, only half of the participants evaluated LACS as very useful whereas 80% of them evaluated it as very useful for usage in disaster.

Future of LACS

Despite the widespread use of the Internet in everyday life in many high-income countries, the case is quite different when compared to the situations in low- and middle-income countries. According to the data provided in the source Thomas et. al., 2020, in 71 out of 183 countries, less than half the population has access to the internet. This fact suggests that if we succeed in proving the usability of LACS, there are plenty of areas globally where LACS can contribute to achieving Sustainable Development Goals (SDGs). As part of the future development and deployment of LACS, we will focus on the improvement of LACS to provide solutions that can bridge the wide gap in the internet penetration worldwide, especially in most developing countries where access to the internet is said to be less than 25% (Thomas et. al., 2020).

Summary

In this paper, Locally Accessible Cloud System or LACS was introduced as a new and promising solution to tackle the difficulty of using telephone and Internet services during disasters. We demonstrated that in the application of LACS to the areas with unstable or intermittent Internet connectivity, a system configuration with Local-LACS, Central-LACS on the Internet, and the synchronization between the two would be useful in filling the supply-demand gap in ICT, a critical issue that surfaced during the COVID-19 pandemic. A feasibility study for the LACS was conducted in Cordova, the Philippines

for the spheres of e-education, disaster response, and platform as a service.

The results of a subjective evaluation by the participants supported the feasibility of the LACS system for the above cases. In this feasibility study, various people cooperated as participants despite the COVID-19 pandemic. According to the teachers of local schools, critical issues, such as delivering educational content to the students, collecting reports from the students, and facilitating communication between the teachers and the students, remain to be solved. We plan to keep the LACS study, especially for the area of e-education, as a long-term feasibility confirmation of the LACS system.

Acknowledgement

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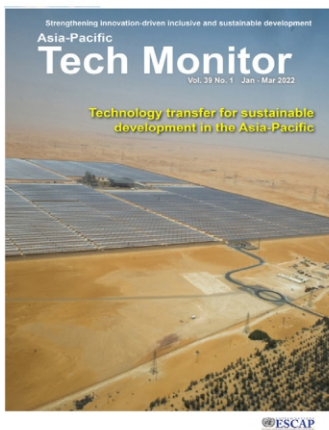https://www.aseancleanenergyweek.com/

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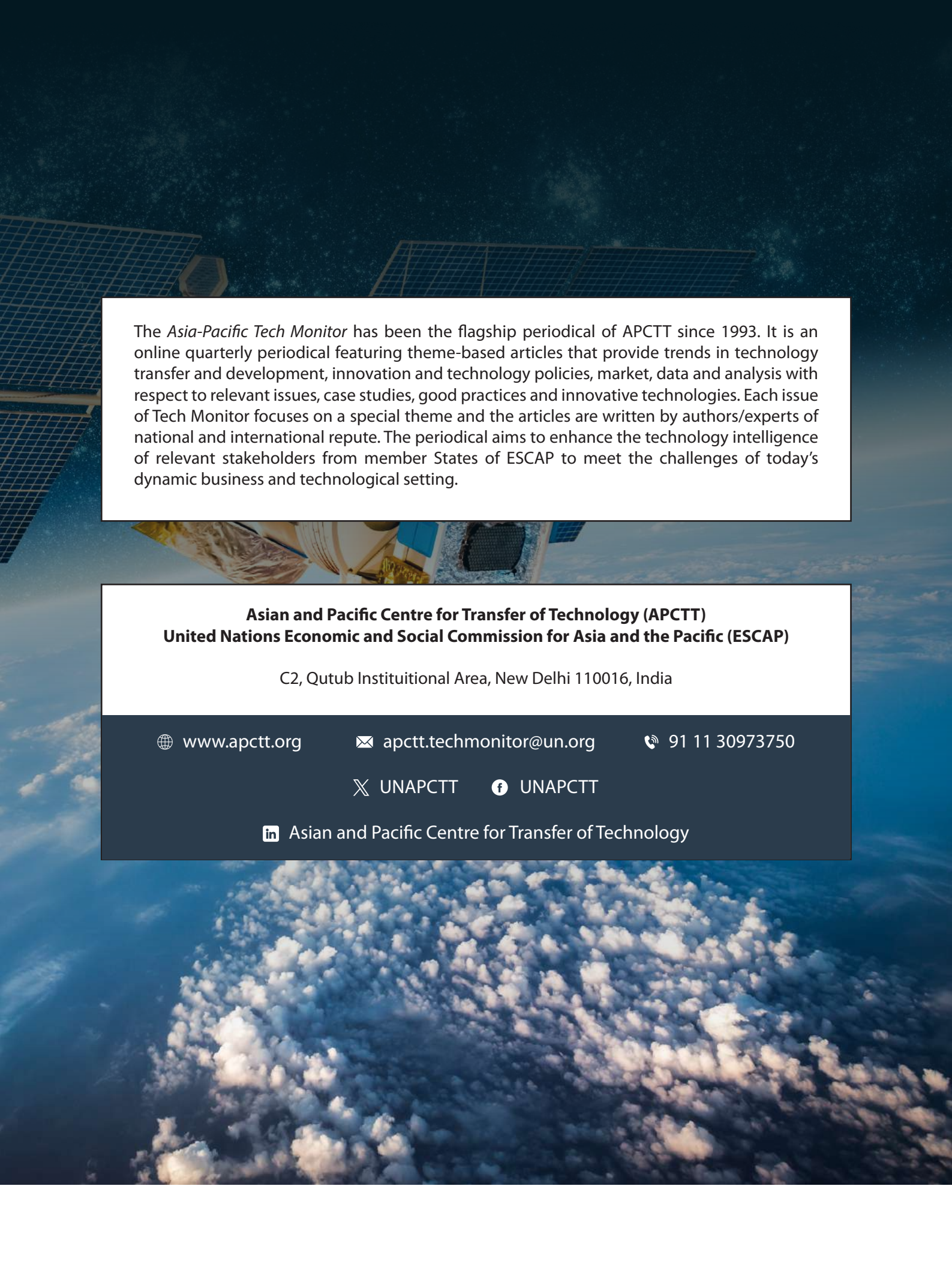Apr-Jun 2022

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