Streamlining Systems-Based Leak Prevention in Ciudad de México through Blockchain

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Presentation Overview





• History of CDMX • Infrastructural Challenges • Stakeholder Map

• Smart Contracts

• Customer Relations

Paradox of Water Insecurity in CDMX



Cover Photo: Ted McGrath (2018); Slide Photo: *Mexico News Daily* (2017) (1) N. P. Nolan and C. Lartigue, "Evaluation of the Performance of Rainwater Harvesting Systems for Domestic Use in Tlalpan, Mexico City," Civ Eng J, vol. 3, no. 3, pp. 137–151, 2017. (2) C. Murray, "As reservoirs run low, Mexico City seeks durable fix for water woes," Reuters, 28 Dec., 2020.

Parts of Ciudad de México (CDMX) receive up to 1,484 mm of rainfall a year.

One-fifth of CDMX's 21 million residents face **persistent water** shortages.

Historical Context



Photo: Tenochtitlan, 1524 from History Today (2016)

(3) G. Ruiz, "Estimation of the Groundwater Recharge in the Aquifer of the Mexico City," Procedia Environmental Sciences, vol. 25, pp. 220–226, 2015.
(4) S. Martinez et al., "Vulnerability of Mexico City's water supply sources in the context of climate change," Journal of Water and Climate Change, vol. 6, no. 3, pp. 518–533, 2015.
(5) United Nations Department of Economic and Social Affairs, "World Urbanization Prospects: The 2018 Revision," New York, 2019.

- Tenochtitlan established on an island Lake Texcoco in the Valley of Mexico drained by Spaniards to address flooding.
- Today, water is extracted from aquifers at nearly **2x the natural recharge rate.**
- Resource availability will
 decrease by 17% by 2050, and
 population will hit 24 million by 2030.

Leak Management



- levels.

Graphic: IMTA (1987).

(8) Deltares, UNAM, Evaluación de Riesgos Naturales, Proyectos Keystone, and BARRAZA, "A Water Resilience Plan for the Heritage Zone of Xochimilco, Tlahuac and Milpa Alta," 2019. (9) M. Wattenbarger, "Fighting for Water and Life in Mexico City," Bloomberg CityLab, 05 Dec., 2018

• **Two-thirds** of CDMX's water is transported from the Cutzamala & Lerma systems located 100+ km away and through **12,000**+ km of tertiary network.

• Half the pipes were **constructed 60+ years ago** and lose 40% of water to leaks and illegal connections. CDMX spent USD \$15M addressing 12,000+ individual leaks in 2019.

 Last year, CDMX launched a USD \$550M program to rehabilitate city-wide infrastructure and reduce total water extraction by 6% (2 m3/s) from current

Asset Maintenance Stakeholders



Blockchain for Water Utilities



Image: BlockstreetHQ (2018)

(10) C. Miles, Blockchain security: What keeps your transaction data safe?

(11) K. Biswas and V. Muthukkumarasamy, "Securing smart cities using blockchain technology", Proc. IEEE 14th Int. Conf. Smart City, pp. 1392-1393, Dec. 2016



Smart Contracts for O&M



(12) SACMEX, "Programa Estratégico para Garantizar el Derecho al Agua. 2020-2024," 2020. (13) J. Shepherd, "Mexico City to fix leaks, improve distribution in bid to provide water to all," Mexico News Daily, 15 Jul., 2019. (14) A. de Coss-Corzo, Maintain and Repair: Rethinking Essential Labor through Infrastructural Work (15) S. D. Levi and A. B. Lipton, An Introduction to Smart Contracts and Their Potential and Inherent Limitations



Building Trust with Consumers



(16) J. Morales-Novelo et al., "Inequality in Access to Drinking Water and Subsidies between Low and High Income Households in Mexico City," Water, vol. 10, no. 8, p. 1023, 2018. (17) H. Eakin et al., "Expressions of collective grievance as a feedback in multi-actor adaptation to water risks in Mexico City," Reg Environ Change, vol. 20, no. 1, p. 330, 2020 (18) G. Soto Montes de Oca and I. J. Bateman, "Scope sensitivity in households' willingness to pay for maintained and improved water supplies in a developing world urban area: Investigating the influence of baseline supply quality and income distribution upon stated preferences in Mexico City," Water Resour. Res., vol. 42, no. 7, C176, 2006 (19) J. Gutierrez, "Water Scarcity and Supply Challenges in Mexico City's Informal Settlements," Penn Institute for Urban Research, Philadelphia, Penn IUR Series on Informality, 2019.

- Smart Contracts for Billing Based on Acceptable Service Delivery
- Demonstrate Transparent Ticketing Process for Service Requests

Streamlining Diligence for Investors



(20) OECD, "Making Blended Finance Work for Water and Sanitation: Unlocking Commercial Finance for SDG 6," 2019. (21) C. Kahn, "Mexico City Keeps Sinking As Its Water Supply Wastes Away," NPR, 14 Sep., 2018 (22) J. Villamil, "Mexico's ESG Bond Has Skeptics Questioning Do-Good Bona Fides," Bloomberg, 14 Dec., 2020 (23) HSBC, "Blockchain: Gateway for sustainability linked bonds," 2019.

<u>90% Cost Reduction through Blockchain (HSBC, 2019)</u>

- Instantaneous Settlement of Payments, Settlements, and Liquidation

Release Funds Based on Agreed-Upon Performance Benchmarks

Conclusion



- Numerous stakeholders involved in maintenance at all levels of asset lifecycle
- Through DLT, blockchain validates successful completion of transactions between stakeholders.
- Systems-based approach to leak prevention (proactive/reactive)