|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

#

Supplementary table 2 – Barriers to mainstreaming

|  |  |
| --- | --- |
| **Barrier/challenge** | **References** |
| Ineffective/insufficient communication, coordination and collaboration between stakeholders across hierarchies and sectors | (Macchi and Ricci, 2016; Lyles et al., 2018; Mogelgaard et al., 2018; Boezeman and De Vries, 2019; Ahenkan et al., 2021; New et al., 2022; Rogers et al., 2023) |
| Lack of or inadequate data/information e.g., quantified climate change considerations | (Dalal-Clayton and Bass, 2009; Lyles et al., 2018; Mogelgaard et al., 2018; Ahenkan et al., 2021; Pieterse et al., 2021; Bleby and Foerster, 2023) |
| Lack of technical, analytical, organizational capacity to incorporate climate change data, risk assessments etc. | (Dalal-Clayton and Bass, 2009; Macchi and Ricci, 2016; Howlett and Saguin, 2018; Mogelgaard et al., 2018; Pieterse et al., 2021; García Sánchez, 2022; Bleby and Foerster, 2023; Rogers et al., 2023) |
| Not prioritizing climate change adaptation/ lacking awareness about the importance of CCA | (Dalal-Clayton and Bass, 2009; Nassef, 2012; Cuevas, 2016a; Boezeman and De Vries, 2019; Ahenkan et al., 2021) |
| Lack of stakeholder engagement | (Ahenkan et al., 2021; Rogers et al., 2023) |
| Lack of funds for mainstreaming projects | (Ahenkan et al., 2021) |
| Lacking contextualization of mainstreaming process in urban contexts | (Adams et al., 2023) |
| Conceptual under-development | (Adams et al., 2023) |
| Lacking or uneven awareness and experience with climate change impacts across government | (Dalal-Clayton and Bass, 2009; García Sánchez et al., 2018; Boezeman and De Vries, 2019; Bleby and Foerster, 2023) |
| Lack of guidance and support for mainstreaming e.g., decision-making tools, guidelines | (Bleby and Foerster, 2023) |
| Lack of resources, incl. funding, time, personnel | (Dalal-Clayton and Bass, 2009; Cuevas, 2016a, 2016b; Lyles et al., 2018; Mogelgaard et al., 2018; Boezeman and De Vries, 2019; Bleby and Foerster, 2023; Rogers et al., 2023) |
| Lack of legal incentives/regulation for mainstreaming | (Boezeman and De Vries, 2019; Pieterse et al., 2021) |
| Lack of knowledge how to move from planning to implementation, i.e., mainstreaming policies to mainstreaming action | (Cuevas, 2016a; Runhaar et al., 2018) |
| Lack of monitoring and evaluation of mainstreaming effects no indicators for success, no frameworks or processes | (Cuevas, 2016b; New et al., 2022) |
| Trade-offs | (Candel, 2021) |
| Mainstreaming vs. specialized entities | (Candel, 2021) |
| Lacking clarity about what to mainstream  | (Candel, 2021) |
| Conflict of scales, i.e., national regulation hinders coherent municipal planning | (García Sánchez, 2022) |
| Lack of political leadership and commitment | (Macchi and Ricci, 2016; Lyles et al., 2018; Mogelgaard et al., 2018; García Sánchez, 2022) |
| Political reality = messy practices on the ground | (Candel, 2021) |
| Conflicting values, beliefs, and interests | (Lyles et al., 2018; Mogelgaard et al., 2018) |
| Lacking short-term benefits | (Macchi and Ricci, 2016) |
| Unclear roles and responsibilities | (Macchi and Ricci, 2016; Mogelgaard et al., 2018; Rogers et al., 2023) |
| Power relationships, fear of losing power/influence | (Macchi and Ricci, 2016) |
| Lack of guidelines that operationalize the integration of DRR into existing dev. plans + investment for DRR | (Taylor et al., 2018) |

Adams, C., Frantzeskaki, N., and Moglia, M. (2023). Mainstreaming nature-based solutions in cities: A systematic literature review and a proposal for facilitating urban transitions. *Land Use Policy* 130, 106661. doi: 10.1016/j.landusepol.2023.106661

Ahenkan, A., Chutab, D. N., and Boon, E. K. (2021). Mainstreaming climate change adaptation into pro-poor development initiatives: evidence from local economic development programmes in Ghana. *Climate and Development* 13, 603–615. doi: 10.1080/17565529.2020.1844611

Bleby, A., and Foerster, A. (2023). A Conceptual Model for Climate Change Mainstreaming in Government. *Transnational Environmental Law* 12, 623–648. doi: 10.1017/S2047102523000158

Boezeman, D., and De Vries, T. (2019). Climate proofing social housing in the Netherlands: toward mainstreaming? *Journal of Environmental Planning and Management* 62, 1446–1464. doi: 10.1080/09640568.2018.1510768

Candel, J. J. L. (2021). The expediency of policy integration. *Policy Studies* 42, 346–361. doi: 10.1080/01442872.2019.1634191

Cuevas, S. C. (2016a). Examining the challenges in mainstreaming climate change adaptation into local land-use planning: The case of Albay, Philippines. The University of Queensland. doi: 10.14264/uql.2016.161

Cuevas, S. C. (2016b). The interconnected nature of the challenges in mainstreaming climate change adaptation: evidence from local land use planning. *Climatic Change* 136, 661–676. doi: 10.1007/s10584-016-1625-1

Dalal-Clayton, D. B., and Bass, S. (2009). *The challenges of environmental mainstreaming: experience of integrating environment into development institutions and decisions*. London: International Institute for Environment and Development.

García Sánchez, F. (2022). “Mainstreaming Adaptation into Urban Planning: Projects and Changes in Regulatory Frameworks for Resilient Cities,” in *Business and Policy Solutions to Climate Change: From Mitigation to Adaptation*, eds. T. Walker, S. Wendt, S. Goubran, and T. Schwartz (Cham: Springer International Publishing), 265–289. doi: 10.1007/978-3-030-86803-1\_12

García Sánchez, F., Solecki, W. D., and Ribalaygua Batalla, C. (2018). Climate change adaptation in Europe and the United States: A comparative approach to urban green spaces in Bilbao and New York City. *Land Use Policy* 79, 164–173. doi: 10.1016/j.landusepol.2018.08.010

Howlett, M. P., and Saguin, K. (2018). Policy Capacity for Policy Integration: Implications for the Sustainable Development Goals. *SSRN Journal*. doi: 10.2139/ssrn.3157448

Lyles, W., Berke, P., and Overstreet, K. H. (2018). Where to begin municipal climate adaptation planning? Evaluating two local choices. *Journal of Environmental Planning and Management* 61, 1994–2014. doi: 10.1080/09640568.2017.1379958

Macchi, S., and Ricci, L. (2016). “15. Climate Change Adaptation Through Urban Planning: a Proposed Approach for Dar Es Salaam, Tanzania,” in *Planning to cope with tropical and subtropical climate change*, (De Gruyter Open), 267–289. doi: 10.1515/9783110480795-016

Mogelgaard, K., Dinshaw, A., Ginoya, N., Gutiérrez, M., Preethan, P., and Waslander, J. (2018). From Planning to Action: Mainstreaming Climate Change Adaptation into Development. Washington, D.C.: World Resources Institute. Available at: https://www.wri.org/publication/climate-planning-to-action

Nassef, Y. (2012). “Mainstreaming Climate Change Adaptation into Development Planning,” in *Climate Change in Asia and the Pacific: How Can Countries Adapt?*, (B-42, Panchsheel Enclave, New Delhi 110 017 India: SAGE Publications India Pvt Ltd), 328–337. doi: 10.4135/9788132114000.n26

New, M., Reckien, R., Viner, D., Adler, C., Cheong, S.-M., Conde, C., et al. (2022). “Decision-Making Options for Managing Risk,” in *Climate Change 2022: Impacts, Adaptation and Vulnerability*, eds. H.-O. Pörtner, D. C. Roberts, M. Tignor, E. S. Poloczanska, K. Mintenbeck, A. Alegría, et al. (Cambridge, UK and New York, NY, USA: Cambridge University Press), 2539–2654. doi: 10.1017/9781009325844

Pieterse, A., Du Toit, J., and Van Niekerk, W. (2021). Climate change adaptation mainstreaming in the planning instruments of two South African local municipalities. *Development Southern Africa* 38, 493–508. doi: 10.1080/0376835X.2020.1760790

Rogers, N. J. L., Adams, V. M., and Byrne, J. A. (2023). Factors affecting the mainstreaming of climate change adaptation in municipal policy and practice: a systematic review. *Climate Policy* 23, 1327–1344. doi: 10.1080/14693062.2023.2208098

Runhaar, H., Wilk, B., Persson, Å., Uittenbroek, C., and Wamsler, C. (2018). Mainstreaming climate adaptation: taking stock about “what works” from empirical research worldwide. *Regional Environmental Change* 18, 1201–1210. doi: 10.1007/s10113-017-1259-5

Taylor, H., Reid, J., Rinschede, T., Sett, D., Fee, L., Cea, L., et al. (2018). Climate Change and National Urban Policies in Asia and the Pacific: A Regional Guide for Integrating Climate Change Concerns into urban-related Policy, Legislative, Financial and Institutional Frameworks. Nairobi, Kenya and Bangkok, Thailand: United Nations Human Settlements Programme (UN-HABITAT) and United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP).