Unintended WSH risks arising from climate change adaptation and mitigation efforts

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Outline

- Introduction
- Methods
- Results
- Dfs Recommendations

02 Introduction

Image Credit:
Ministry of Foreign Affairs Singapore. (2018). *2018 is the Year of Climate Action in Singapore*.
Ministry of Sustainability and the Environment. (2021). *Singapore Green Plan 2030*.

Climate action and built environment

Climate change mitigation

Climate change adaptation

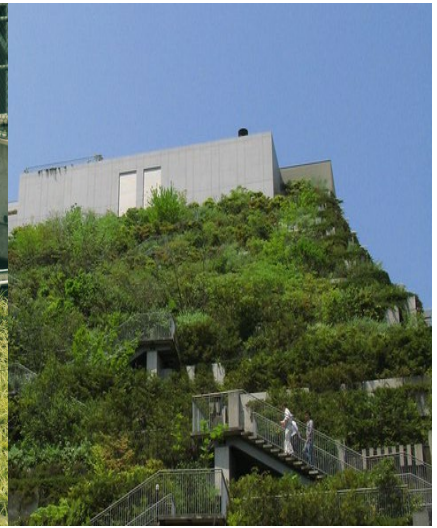

Image Credit:
Tanaka, J. (2008). *Green building*.
USAID Asia. (2018). *Big C celebrates first solar rooftop system*.

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Method

Step 1: A systematic literature review

- Known WSH risks in FM jobs
  - Screen the WSH hazards to focus on
- Known WSH risks to be induced/worsened by climate actions
- English language, journal articles, past 10 years

Step 2: Site observation

- Green building
- Green features – new loci of WSH hazards?

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Lit review results: WSH hazards in FM

- Exposure to harmful chemical or biological substances
  - Disinfectants, pesticides, pathogen et cetera.
- Hazards causing physical injuries
  - Fall from height, tool/machine use, et cetera.

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Lit review results: WSH hazards in climate actions

- Resources efficiency (recycling)
  - Exposure to pathogens, heavy metals, and industrial chemicals
- Energy transition
  - Wind & solar: fall from height, electrocution.
  - Biofuel: exposure to harmful chemical or biological substances, fire and explosion
- Mostly focusing on climate change mitigation

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Site observation

Green Features	Purpose	Additional WSH hazards introduced
Overhanging Roof	Solar shading for thermal comfort (adaptation & mitigation)	Increased working from height
Double Façade	Insulation for thermal comfort (adaptation & mitigation)	Increased working from height
Rooftop Solar Panels	To achieve net-zero energy consumption (mitigation)	-Exposure to weather, lightning; -Glaring from the solar panels; -Electrical hazard; -Increased working from height
Greenery within the building	Thermal comfort (adaptation); aesthetics	-Exposure to landscaping chemicals and soil; -Bites from animals and insects

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Site observation: additional notes

- Vertical greenery is usually more hazardous
  - Fall from height, exposure to weather elements
- More hazards detected related to adaptation
  - Current literature overlooked FM

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DfS recommendations

- Prioritise hazard elimination
  - Shift vertical greenery into sheltered floor area

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DfS recommendations

- Height access – overhanging roof, green walls
  - Design permanent structure to assist access

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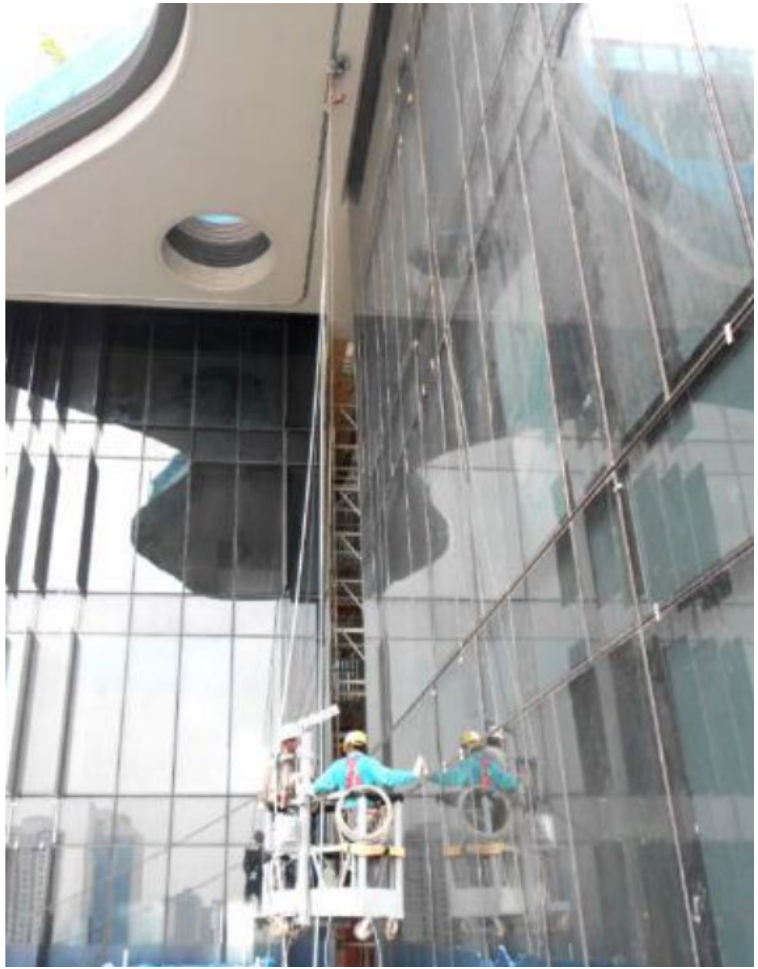

Image Credit:
Building and Construction Authority. (2017). *Facade Access Design Guide*.

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DfS recommendations

- Height access – overhanging roof, green walls
  - Design permanent structure to assist access

04 DfS recommendations

Image Credit:
Behm, M., & Poh, C. H. (2012). Safe design of skyrise greenery in Singapore. *Smart and Sustainable Built Environment*, 1(2), 186-205.

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DfS recommendations

- Height access – overhanging roof, green walls
  - Design permanent structure to assist access
- Rooftop solar, green roof
  - Multiple protective structure: parapet wall, guardrail, anchorage

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Conclusion

- Neglect of climate change adaptation hazard in the literature
- DfS recommendation – elimination is priority
- Use permanent structure to assist height access
- Weather-conscious design

Thank You!

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