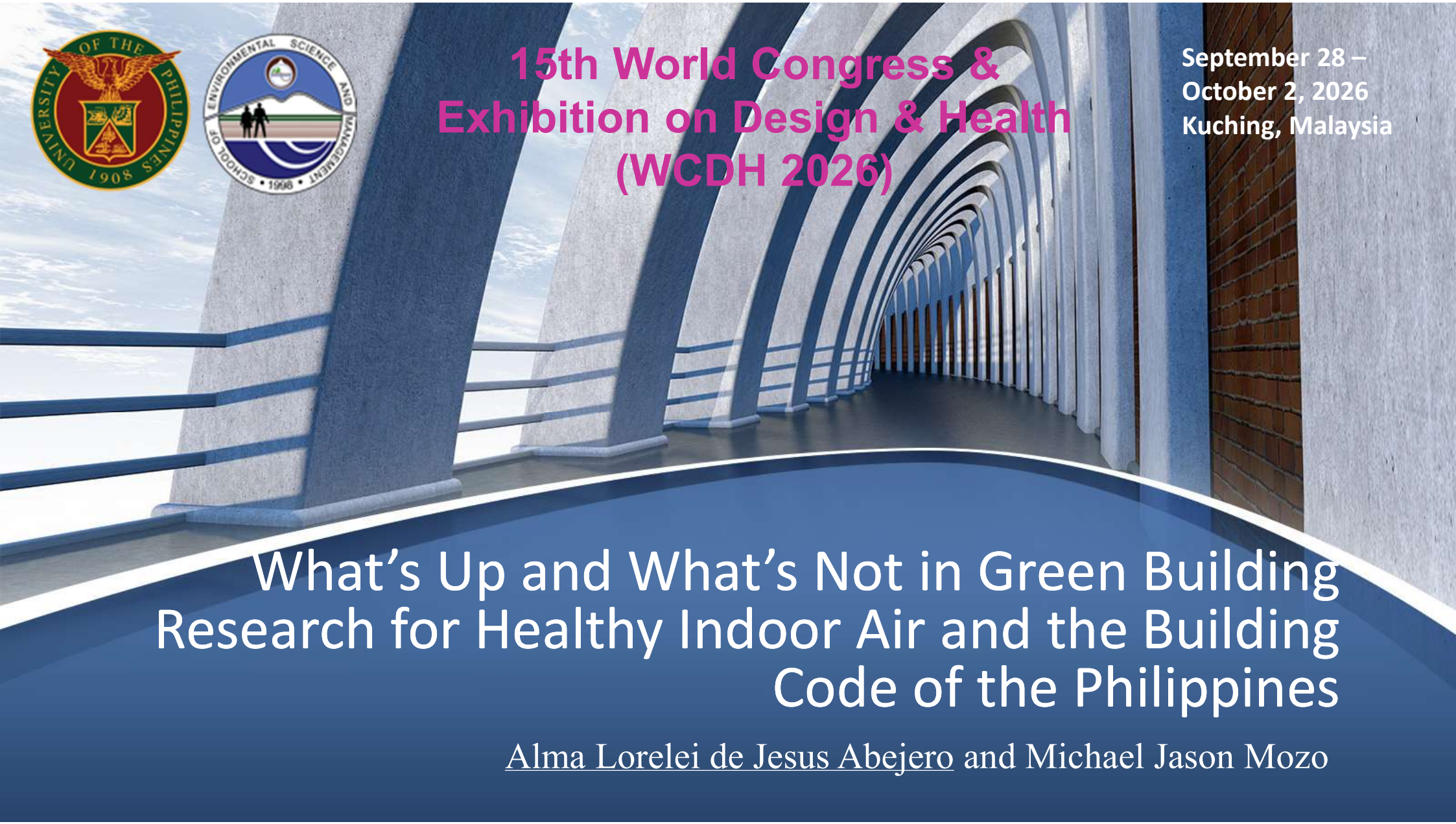


15th World Congress & Exhibition on Design & Health (WCDH 2026)

September 28 – October 2, 2026
Kuching, Malaysia

What's Up and What's Not in Green Building Research for Healthy Indoor Air and the Building Code of the Philippines

Alma Lorelei de Jesus Abejero and Michael Jason Mozo

OUTLINE

- Green Building and Indoor Air
- Philippine’s Building Code
- Methodology
- Findings
- Conclusion



By Gemini

INTRODUCTION

The Edge, Amsterdam:

The World's Greenest and Smartest Office Building



- https://architalks.org

Maximum Energy Efficiency

- passive solar system that harnessed nature for maximum efficiency
- smart system for lighting, ventilation, cooling/heating

Water Management Innovations

- rainwater harvesting system
- low-flow fixtures with greywater recycling

IAQ

Eco-friendly Materials

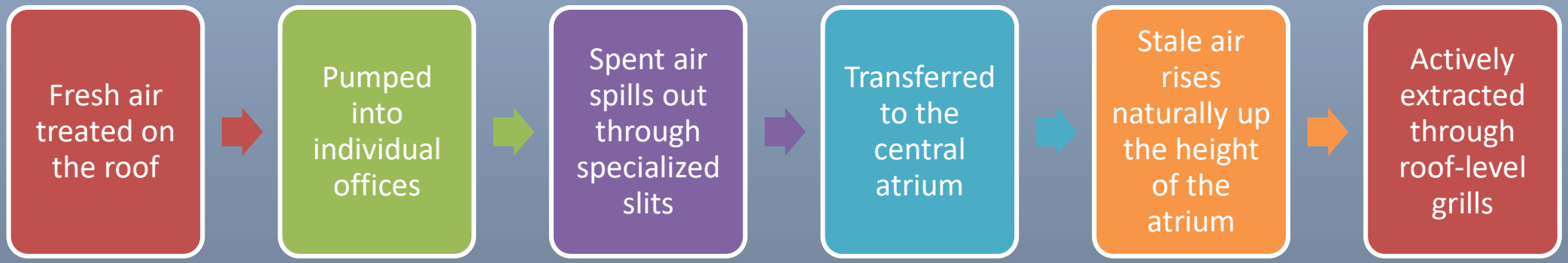
- Non-toxic finishes
- Green walls and plant installations

AIR HANDLING SYSTEM

The building is located along the busy A10 motorway

- Utilizes advanced **ePM1 air filters** to capture particulate matter down to 1µm
- Delivers **precise air volumes** tailored to space types
- Operates with **frequency regulators** linked to building sensors, adjusting air volume dynamically based on **real-time occupancy and carbon dioxide (CO_2) levels**

Air Flow Path



RATING: 98.36% (BREEAM-NL)

IAQ - for basic hygiene, for good ventilation to avoid disease transmission and for thermal comfort

National Building Code of the Philippines (1972)

- Building and safety standard
- Complimentary Laws - Fire Code of the Philippines, National Structural Code of the Philippines
- Air Space Requirement and artificial ventilation

Complimentary Law

Philippine Green Building Code (2015)

- sets mandatory minimum green standards for building permits
- Minimum Fresh Air Rates, Designated Smoking Area and Use of non-Toxic building materials

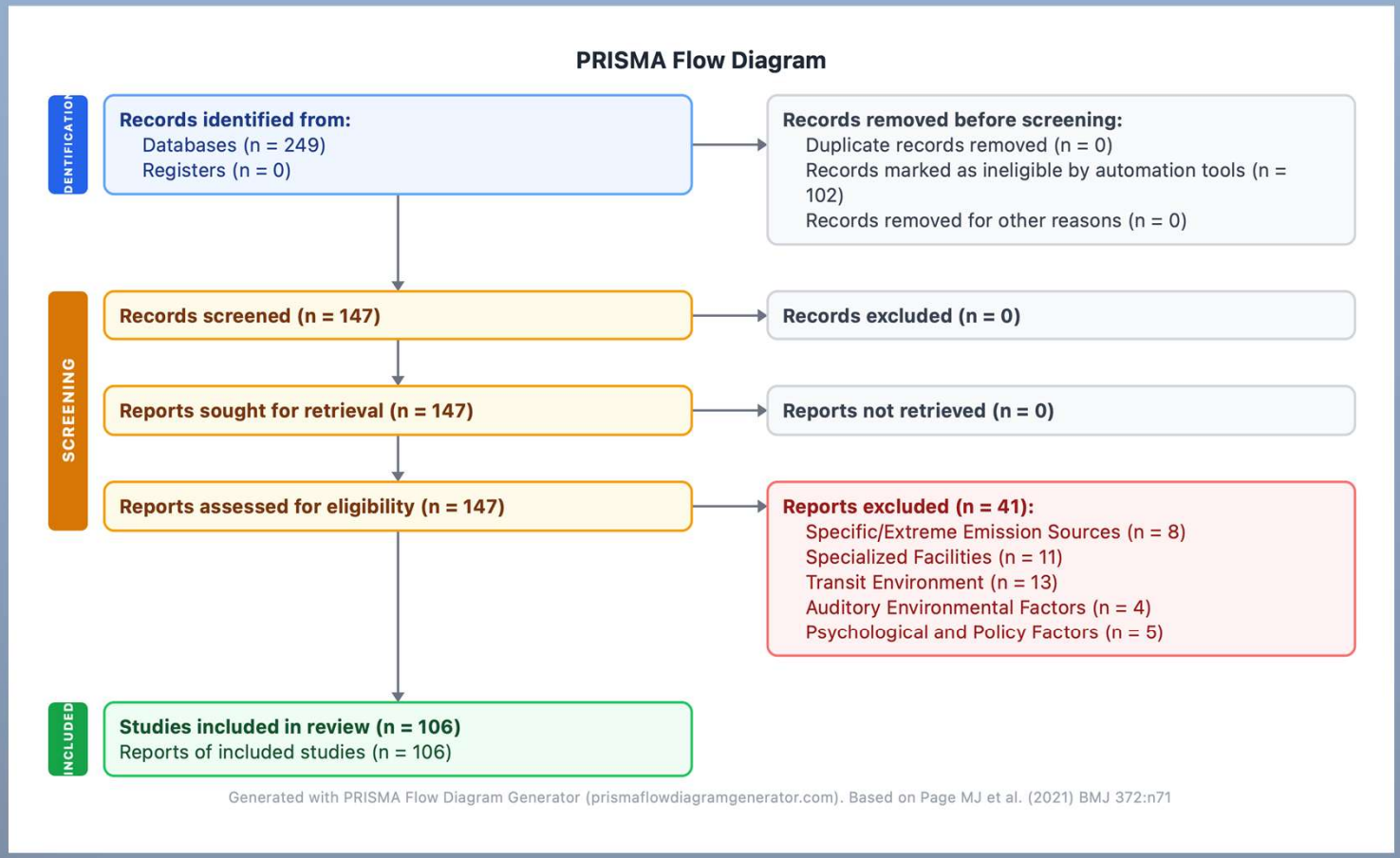
BERDE (Building Eco-Responsive Design Excellence) → **LEED**

METHODOLOGY

"indoor air quality" AND "building design" AND "public health"

1. **Search Strategy and Information Sources**

- journal articles in **English**
- published from **2016 – 2026**
- within the **Environmental Science** and **Engineering Subject Areas**



Data Extraction and Categorization

Focus of the Study

- Ventilation and/or Filtration Systems
- Building Design/Layout
- Building Materials
- Monitoring
- Factors
- Assessment/Optimization/Monitoring Tool

Type of Indoor Area

- Office/Work Space
- Residential Building
- School
- Community Facility

IAQ Parameter

- temperature and relative humidity
- CO_2
- Pollutants

Gap Analysis



National Building Code of the Philippines



Philippine Green Building Code



BERDE Rating

VERSUS

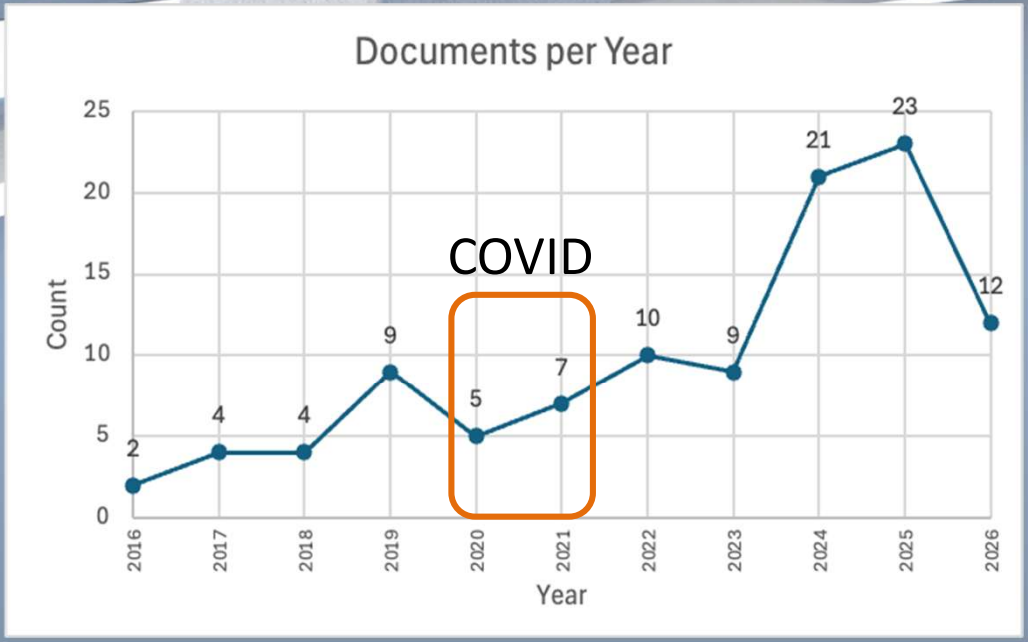
INDOOR AIR QUALITY

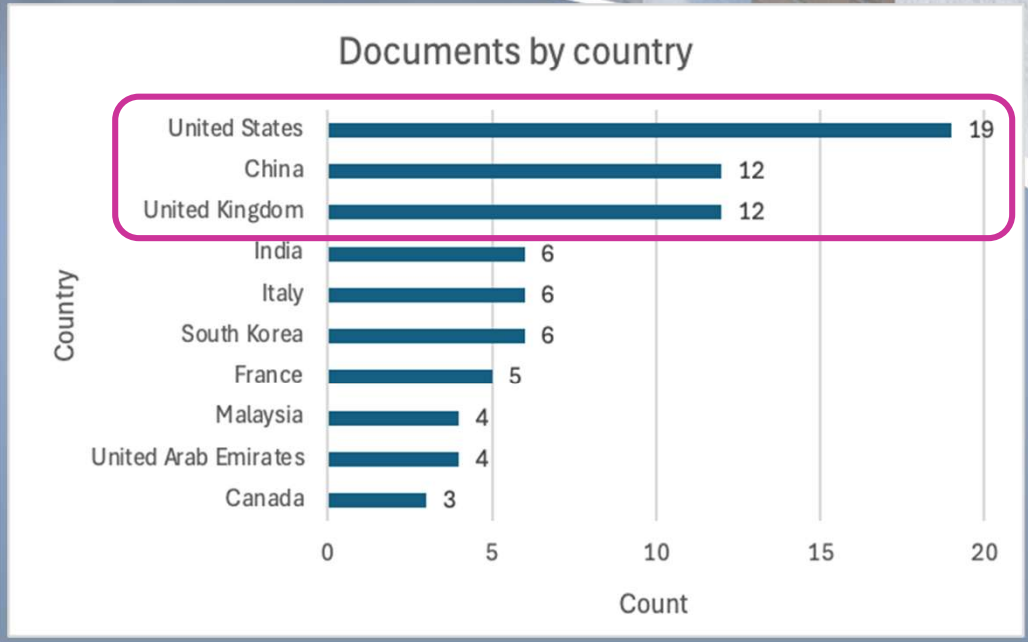
- World Health Organization Indoor Air Quality Guidelines

AND

- LEED Rating System for Green Buildings

Bibliometric Analysis

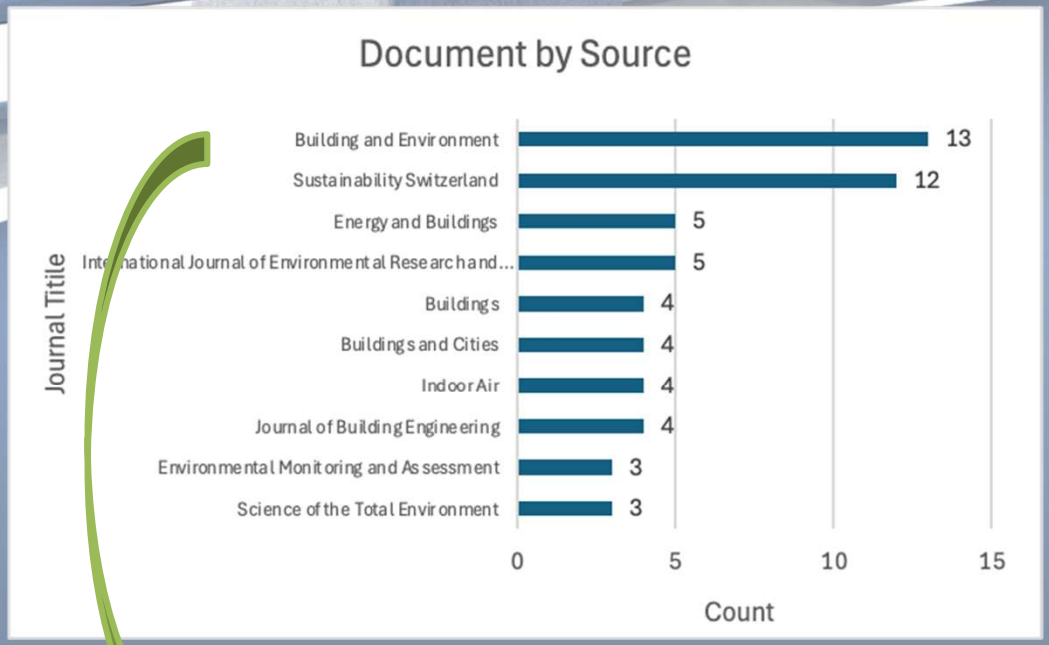


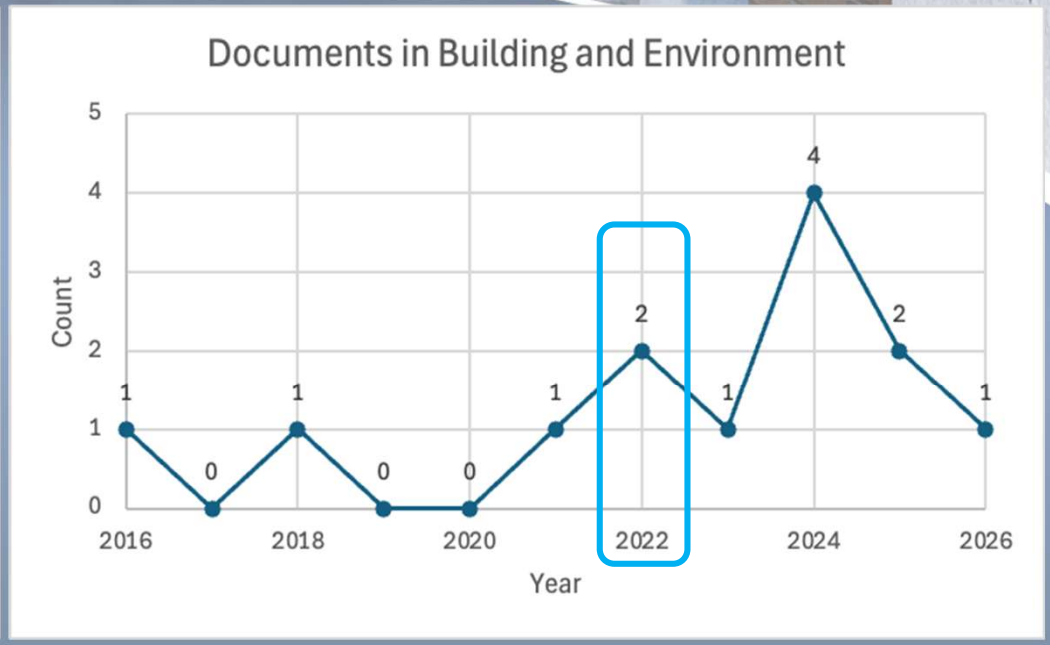


2022 marked a greater interest in indoor air with notable studies in relation to infectious diseases after the COVID-19 global pandemic

- health risk awareness,
- severe ambient air pollution and
- high indoor chemical emissions

Bibliometric Analysis



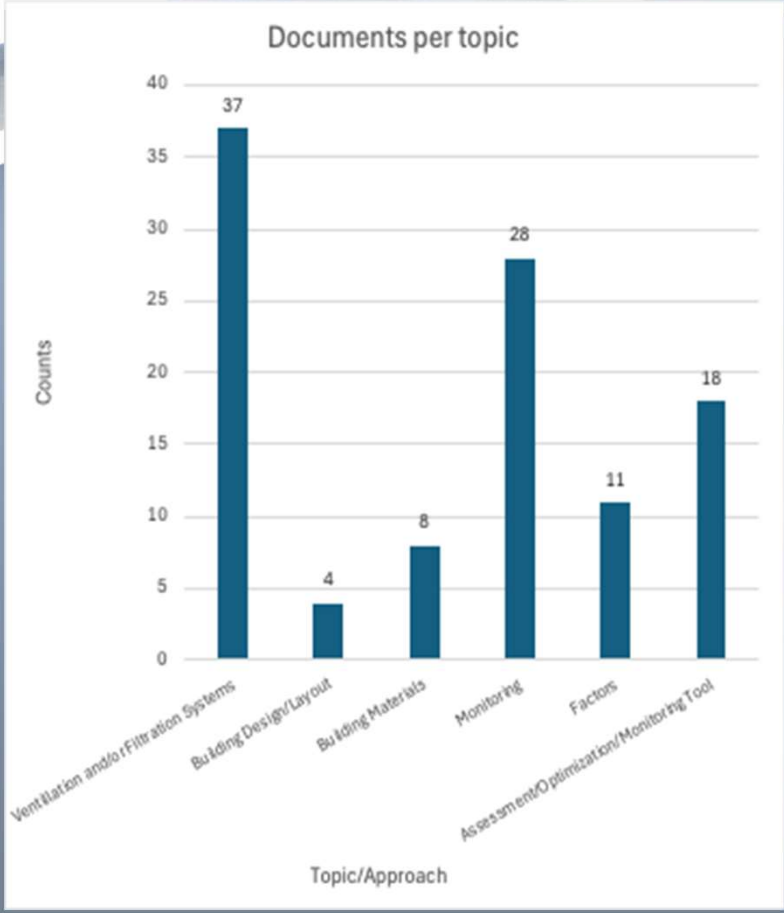


Building and Environment - research papers, comprehensive review articles, editorials, and short communications related to **building science, urban physics, and human interaction with the indoor and outdoor built environment**

Literature Summary

SIX GENERAL APPROACHES

of improving the building performance in terms of indoor air quality control and management



1 Ventilation and/or Filtration Systems (n = 37)

include airflow, air exchanges, air pollution reduction, and improvement of the currently available materials and systems including utilization of the natural environment.

2 Monitoring (n = 28)

Include identification and quantification of pollutants, their spatial and temporal variability and analysis of human exposure and risk

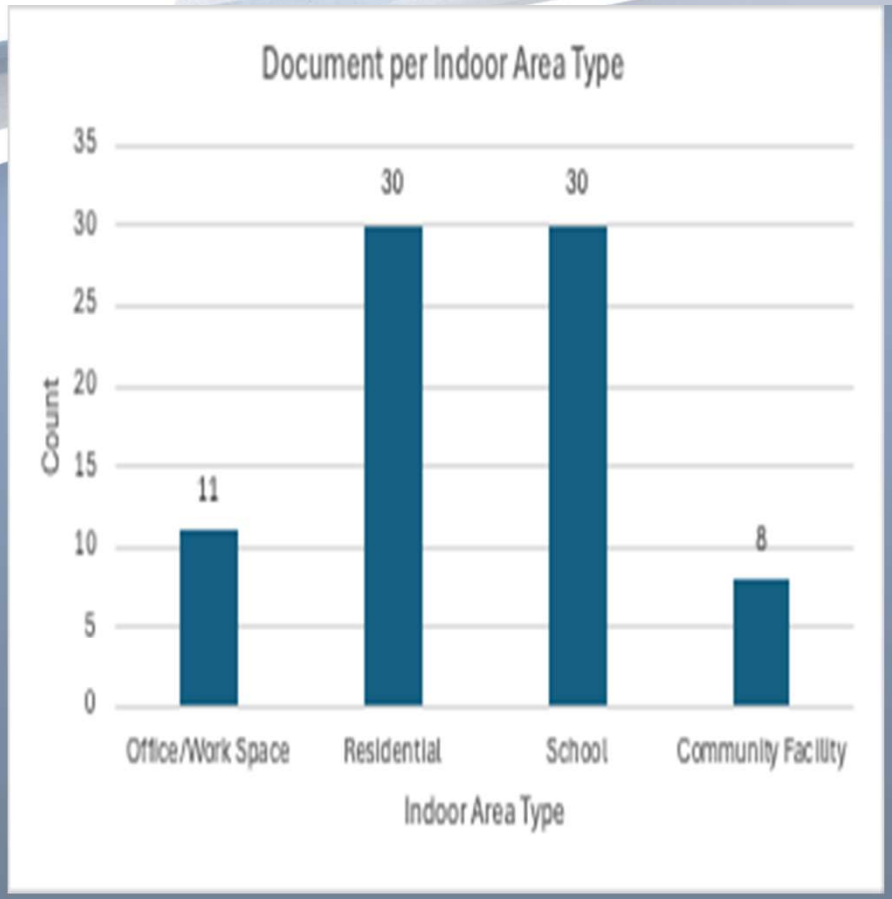
3 Assessment/Optimization/Monitoring Tool (n = 18)

Include development of instruments and/or software programs used to analyze and/or optimize building performance

Literature Summary

FOUR COMMON TYPES OF INDOOR AREA

considered by the literature



Residential Building and School

n = 30

- **prioritize – homes and schools**
  - **distinct risk profiles,**
  - **occupant vulnerabilities, and**
  - **direct impacts on human wellness**

Literature Summary

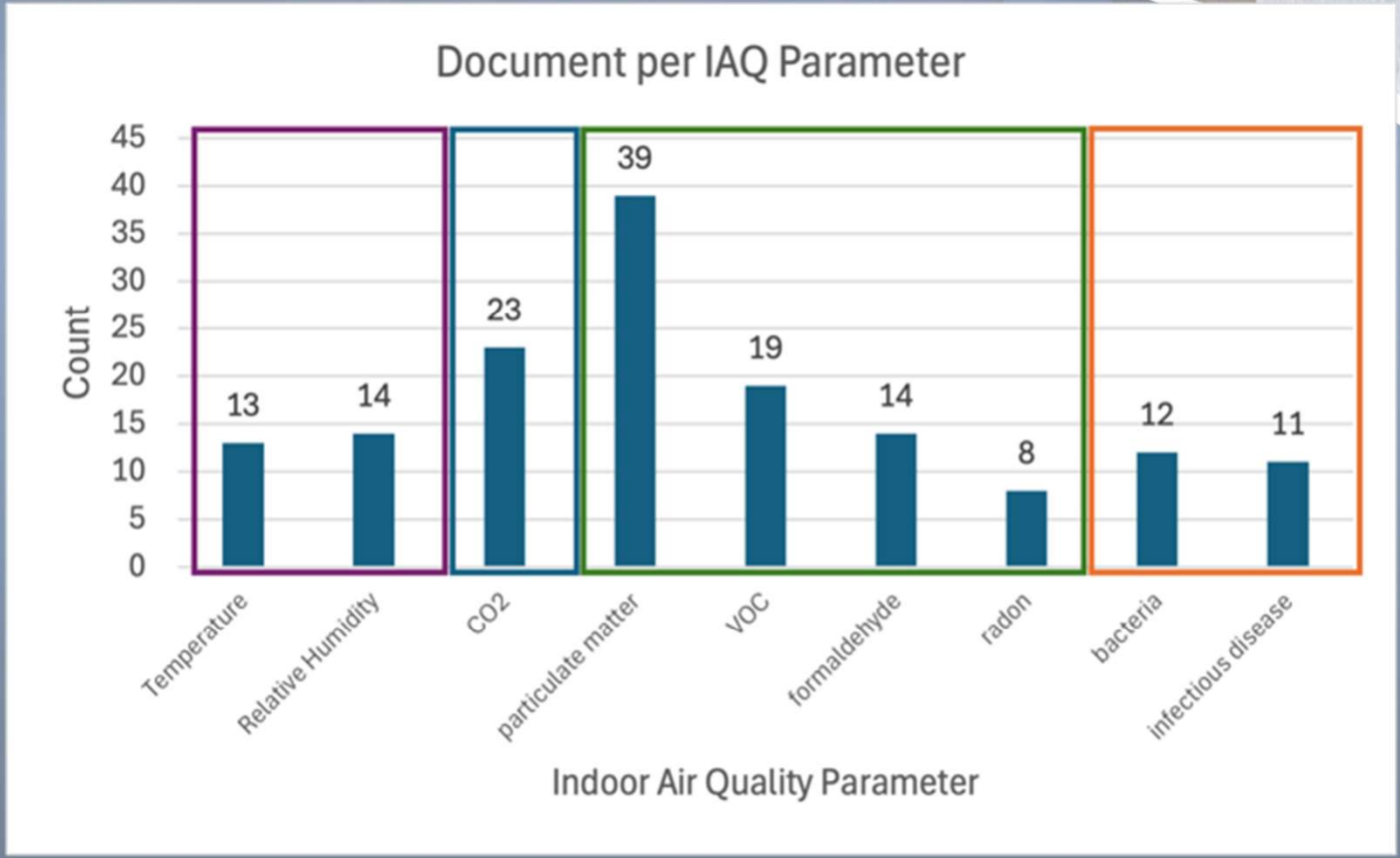
INDOOR AIR QUALITY PARAMETERS

analyzed in the final selections

Physical
- Temperature
- Relative Humidity

Chemical
- CO_2
- Particulate matter
- VOC
- Formaldehyde
- Radon

Biological
- Bacteria
- Infectious disease



Literature Summary

INDOOR AIR QUALITY PARAMETERS

analyzed in the final selections

World Health Organization Indoor Air Quality Guidelines

- benzene
- CO
- formaldehyde
- naphthalene
- NO_2
- PAH (especially benzo[a]pyrene)
- radon
- trichloroethylene and tetrachloroethylene

- only 1 study assessed benzene
- no study was conducted on naphthalene, PAH and tri & tetra chloroethylene

GREEN BUILDING CODE OF THE PHILIPPINES

Plus the BERDE Rating System

INDOOR ENVIRONMENTAL QUALITY SECTION

- ventilation rate per occupancy category

SUSTAINABLE MATERIALS SECTION

- non-toxic materials with VOCs emission threshold

NO SECTION IN THE CODE IS ABOUT AIR FILTRATION SYSTEM NOR POLLUTANT MONITORING SYSTEM.

ISO 16890 series – classifying and evaluating efficiency of general ventilation air filters on PM sizes

LEED vs BERDE
Building Assessment and Rating System

Features	LEED Rating System	BERDE Rating System
Objectives	To promote the well-being of construction workers and building occupants by minimizing environmental quality problems associated with construction and renovation	To assess, measure, monitor and certify the performance of projects above and beyond existing national and local building and environmental laws, regulations and mandatory standards.
HVAC system	Minimum efficiency reporting value Equivalent filtration media class of ePM In-room air-cleaning systems	Natural and Mechanical Ventilation allowed with compliant specifications Provide sensors to monitor indoor air quality
Source control	Keep sources of contaminants out of the building and have a plan to eliminate any that are introduced.	No smoking Minimize the entry of pollutants through the building envelope and entrances Use indoor materials with low VOC content based on a generally accepted standard for VOC limits.
AIR QUALITY TESTING AND MONITORING	Preoccupancy Air Testing (1–2 points) After construction ends and before occupancy, but under ventilation conditions typical for occupancy, conduct baseline IAQ testing Test for the individual VOCs listed in Table 3 using an allowed test method and demonstrate that the contaminants do not exceed the concentration limits	Conduct an assessment on the existing indoor air quality Measure: PM ($PM_{2.5}$ and PM_{10}), O_3, CO_2, CO, NO_2, radon, formaldehyde, and total VOCs. Establish and Implement a program to improve indoor air quality



SUMMARY

Bibliometric analysis

- there were increasing trends in publishing this topic in the 10year period with the highest contributions from United States, China, and United Kingdom.
- most of the articles focused on ventilation and filtration systems followed by IAQ monitoring.
- among the IAQ parameters, temperature and relative humidity were always discussed followed by CO_2, PM, and VOCs

Building Code Analysis

- only specified ventilation rates, sustainable materials and VOCs emission thresholds, compensated for by particular provisions in the BERDE Rating System V5.0

ALIGNED WITH THE RECENT TRENDS IN IAQ RESEARCHES EXCEPT FOR THE USE OF INDOOR PLANTS AS IAQ NATURAL FILTRATION SYSTEM



Thank You!