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Indoor Air Quality Perceptions: Insights from a Cross-Sector Survey

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ABSTRACT

One of the core outcomes of the COVID-19 pandemic was a heightened awareness of the connection between indoor air quality and health. Despite this awareness, many building owners and operators still face challenges in implementing indoor air quality policies and protocols. Informed by observations and conversations with stakeholders across the real estate sector, the Center for Active Design team developed and disseminated a survey aimed at better understanding current decision-making processes, implementation challenges, and knowledge gaps in Indoor Air Quality (IAQ) management across the real estate sector. Our analysis of survey results focuses on who drives decision-making, how IAQ is prioritized in relation to energy efficiency, and the tools and technologies stakeholders use to address IAQ concerns. The survey was conducted between September and November 2023, using the Alchemer platform, and included both multiple-choice and open-ended questions to capture quantitative and qualitative data. It was distributed via Fitwel channels, including its network of ambassadors, and through the HERO Health newsletter. 185 professionals participated in the survey, representing real estate investors, developers, facility managers, engineers, and sustainability professionals. While we acknowledge the bias of the respondent group, findings revealed both missed opportunities as well as key challenges or barriers to implementing effective indoor air quality policies and protocols. While high-efficiency filtration systems such as MERV13 and HEPA filters have become more commonplace practices, lower-tech solutions like moisture control and regular housekeeping are underutilized —a missed opportunity. Two key barriers identified in the survey are the unclear stakeholder involvement in decision-making and the balance of indoor air quality and energy efficiency priorities. Further research is needed to clarify stakeholder roles and responsibilities, improve communication, and develop educational materials that address the financial benefits and return on investment of IAQ improvements to further incentivize the implementation of effective policies and protocols. Aligning IAQ standards with energy efficiency practices will also be critical for future progress.

INTRODUCTION

The COVID-19 pandemic brought an increased awareness to the importance of high quality indoor air for occupant health. What scientists and engineers had long known, that high quality indoor air supports improved occupant health and productivity, became more widely understood (Mujan, et. al., 2019). In response, terms that were once familiar only to building management or HVAC engineering teams, such as MERV13 filters and germicidal UV, became more widely understood by tenants, human resources, and sustainability teams. Yet despite the impact of the COVID-19 pandemic, a lack of consensus and leadership among decision-making has remained a key issue across indoor environmental quality management issues, from temperature to noise, but especially in relation to indoor air quality (Adan, et. al., 2007). Stakeholders involved in managing indoor air quality include architects, facility managers, sustainability consultants, engineers, builders, owners, and occupants, to name a few, all with different priorities, perspectives, and interests when it comes to the "multidisciplinary nature of health and the indoor environment" (Adan, et. al., 2007). Research indicates that while architects deem visual comfort the most essential element of indoor environmental quality for occupant satisfaction, engineers and assessors deem thermal comfort more essential (Roumi, et.al., 2023), and owners prioritize energy efficiency and cost concerns (Zuhaib, et.al., 2018). Furthermore, current building assessment models often consider each of these IEQ priorities individually rather than holistically, leading to ineffectual or suboptimal solutions (Rohde, et.al., 2020). As such, these diverse interests and stakeholders may lead to inaction or unnecessary compromise when it comes to indoor air quality management.

While not an element of IEQ, one such competing priority that has gained significant attention in the past several decades is energy efficiency. Energy consumption and usage is directly tied to human or occupant behavior, and indoor environmental quality

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While not an element of IEQ, one such competing priority that has gained significant attention in the past several decades is energy efficiency. Energy consumption and usage is directly tied to human or occupant behavior, and indoor environmental quality, particularly as it relates to thermal comfort and indoor air quality, is directly informed by energy outputs (Asadi, Mahyuddin & Shafigh, 2017). Despite how these elements are connected, there are significant challenges in managing the promotion of indoor environmental quality alongside emissions or energy use (Niza, Bueno & Broday, 2023; Ortiz, Itard & Bluyssen, 2020; Shrubsole, et.al., 2018). This has led to what some refer to as "the indoor air quality and energy efficiency dilemma", a problem that many researchers have concluded has no clear solution (Vasile, et.al., 2016; Foldvary, et.al., 2017; Asere & Blumberga, 2020). While there is also evidence that high quality indoor air and energy efficiency can exist and function in tandem, the perceived tradeoff has remained a dominant perspective (Persily & Emmerich, 2012). In light of this, the greatest challenges in coordinating effective IAQ and energy efficiency appears to be not technology or feasibility issues, but issues of management or coordination.

Within this context, our research sought to understand the diverse stakeholders and priorities, with a particular focus on energy efficiency, that contribute to decision-making around indoor air quality policies and practices. In contribution to the emerging research around the indoor air quality and energy efficiency dilemma, and in order to pinpoint the underlying causes of this challenge, the team sought to address the following research questions:

1. Who is driving decision-making around indoor air quality implementation?
2. How are indoor air quality priorities addressed in relation to energy efficiency priorities?

The study attempts to address these questions through a mixed methods survey across real estate-related professions. The authors hypothesized that decision-making is led by real estate owners, developers, and investors and that energy efficiency is viewed not only as a competing priority to indoor air quality, but also prioritized over indoor air quality. The goal of this effort is to illuminate the opportunities for improved education of key stakeholders around holistic approaches to IEQ and energy efficiency management.

MATERIALS AND METHODS

Survey Development and Dissemination

To inform the development of the survey, the authors conducted background desk research around the barriers to indoor air quality improvements and policy implementation. The team partnered with Trane Technologies to understand the challenges identified from an HVAC manufacturing and installation perspective to ensure representation in the final survey. The survey was developed and executed using advanced logic on the Alchemer survey platform. The full survey, which varied in length depending on how the respondents self-identified, was distributed electronically from September through November 2023. The survey was disseminated to all Fitwel Ambassadors as well as to the HERO Health monthly newsletter listserv; in total, the survey reached more than 2,000 individuals. While not necessarily representative of the industry as a whole, the insights gleaned provide a unique perspective from a segment of the real estate sector interested in health and well-being. In the hopes of incentivizing survey responses, participants were given the opportunity to enter their email for the chance to win a $100 Amazon gift card raffle.

Survey Design

Data from all respondents, including those respondents who did not complete the survey, were included in the data analysis, which was conducted by members of the Center for Active Design team from December 2023 - March 2024. Microsoft Excel was used to analyze the multiple choice responses, while a coded thematic analysis was used to group and analyze the open-ended questions. Basic statistical analysis methods (mean, median, maximum, minimum, sum) were employed to break down the quantitative data. Thematic codes for each question, agreed upon by the CfAD and Trane teams, were used to summarize and segment the qualitative data.

As mentioned, in order to analyze data across various stakeholder groups, respondents self-identified across a variety of identifiers, specifying their type of work, the spaces they work in, how long they've worked in their roles, and where they work. These identifiers were used to segment and analyze both the quantitative and qualitative data.

Professional identifiers:

- **Real Estate Investment Professional**. Role focuses on investing in real assets or managing ESG investing practices.
- **Real Estate Owner or Developer.** Role focuses on managing the purchase, sale, rental, or development of properties.

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- **Facility Manager or Engineer.** Role focuses on maintaining and overseeing the operations of a property or multiple properties and adhering to relevant standards.
- **Sustainability Professional.** Role focuses on implementing policies and efforts aimed at promoting sustainable practices or providing consulting services focused on sustainability.
- **Architect or Design Professional.** Role focuses on the planning and design of spaces.
- **None of the above.** Please describe.

Quantitative Data

To align with the audiences targeted in survey dissemination, the survey was designed with question logic that varied depending on the respondent's self identified profession. All respondents received ten multiple choice questions and two matrix questions, with each professional group receiving a different set of more targeted questions, as outlined in Table A below.

Profession	# of Multiple Choice Questions	# of Matrix Questions
Facility Managers and Engineers	12	1
Real Estate Owners and Developers	4	1
Real Estate Investors	2	2
Human Resources Managers	3	1
All other positions	3	1

Table A. Survey question distribution based on self-identified profession

Microsoft Excel was used to sort, review, and analyze the responses to these quantitative questions, along with basic summary statistic formulas, summing and averaging question responses, segmented by self-qualified identifiers listed above.

Qualitative Data

Similar to the quantitative questions, open-ended questions were served to respondents in varying quantities depending on how they self-identified professionally. All respondents were served four open ended questions, with additional, distinct, open ended questions served to facility managers/engineers (1), real estate owners and developers (1), real estate investors (2), and all other identifying positions (1). In order to analyze responses to open-ended questions, thematic codes were developed in advance of answer review, based on expected responses, and agreed upon by the research team. Codes, by open-ended question can be seen below:

- **Q1: What are some specific examples of how you work with and consider IAQ in your day-to-day role?**
  - **Codes:** Building Certifications; Ventilation/Filtration; VOC's + Pollutants; Building Design; Energy Efficiency; Budget; Health + Wellbeing; Building Codes/Requirements
- **Q2: In relation to your role in managing and assessing IAQ, where specifically do you feel there are gaps in your knowledge?**
  - **Codes:** Cost Analysis; Unbiased Data/Research; Technology; Retrofitting; Conflicting Sources; Energy Efficiency; Maintenance
- **Q3: In your role, what types of training/educational materials have you received or used to assist in managing IAQ?**
  - **Codes:** Building Certifications; Engineering team; ESG; ASHRAE Standards; CDC Standards; Local Government Standards; Other Standards
- **Q4: Over the past few years, what are some examples of challenges you have faced in your day-to-day role in relation to IAQ?**
  - **Codes:** Safety/Wellbeing; Owner Buy-in; Third Party Coordination; Meeting Requirements; Equipment Challenges; Occupancy; Supply Chain; Energy Efficiency

Microsoft Excel was used to sort, code, and segment responses. Each response was assigned one to three codes, as relevant, and the frequency of codes were summed and converted to percentages.

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Responses were further segmented by the self-qualified identifiers listed above.

RESULTS

Participant Data

Responses to the self-qualifying questions set the scope and parameters for the findings of this research. In total, the survey rendered 185 complete responses, and the response rate for various groups below are further explored in the limitations– explicitly, how sustainability consultants dominated our audience.While participants self-identified their profession, experience level, asset type specialty, and geographic location of work, the most significant results were rendered when segmented by profession. Response rates by profession are included below, while the rest can be found in the appendix (See Appendix A). In summary, most respondents worked primarily in commercial office spaces in North America, while experience levels ranged somewhat equally distributed from 1-3 years to 6-10 years.

Profession	Count	Percent of Total
Sustainability Consultant	108	58%
Architect or Designer	49	26%
Facility Manager or Engineer	16	9%
Real Estate Owner or Developer	4	2%
Real Estate Investor	3	2%
WRITE IN: IAQ Manufacturing	2	1%
WRITE IN: Academia	3	3%

Table B. Demographic response rates.

Quantitative Findings

The quantitative data from the multiple choice and matrix survey questions yielded significant findings both amongst the full respondent group and segmented across self-qualified professional identifiers. A complete summary of survey response data can be found in the Appendix (See Appendix B). Quantitative results with significant distributions pertaining to the research questions are summarized below in Figures A-D.

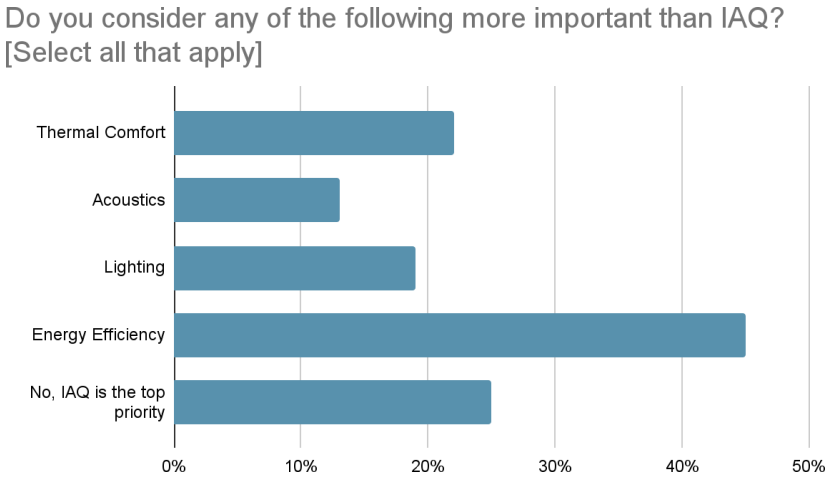

Figure A. Respondent's prioritization of other indoor environmental quality issues, and energy efficiency, against indoor air quality

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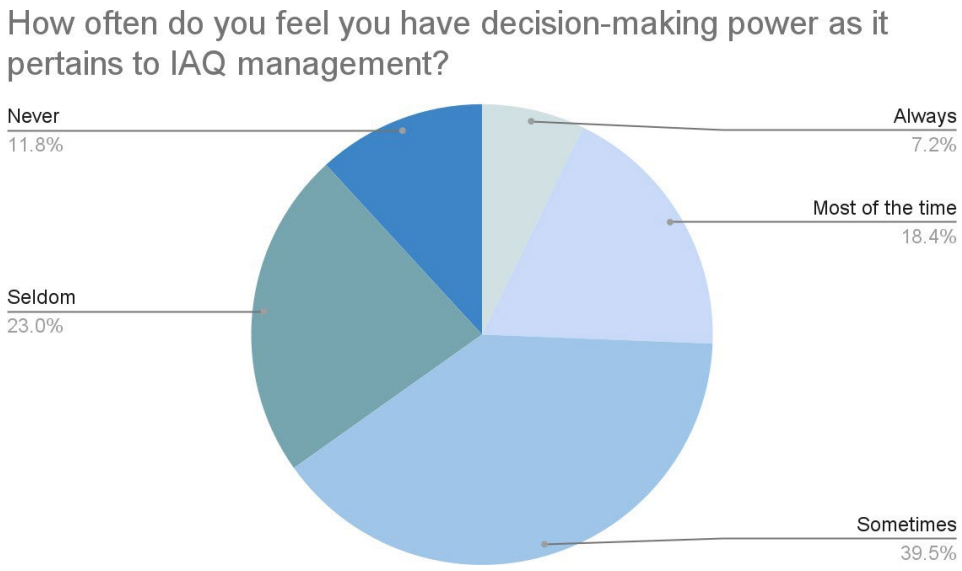

Figure B. Respondent's self-reported decision-making power in IAQ management decision-making

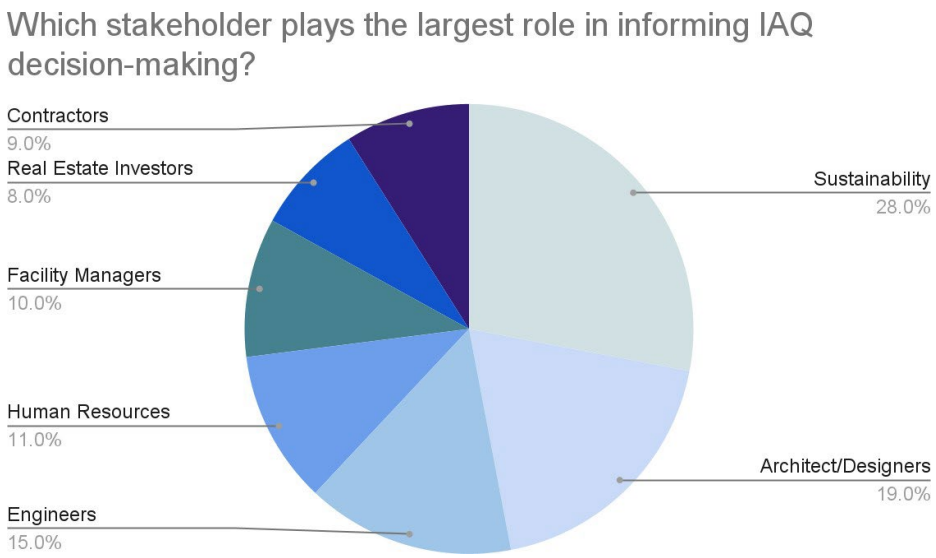

Figure C. Respondent's perception of the stakeholder that plays the largest role in informing IAQ management

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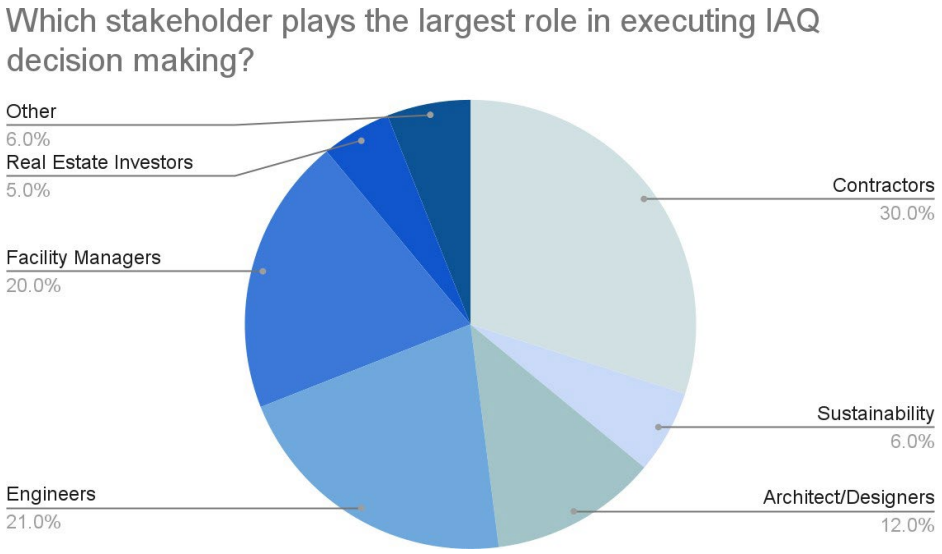

Figure D. Respondent's perception of the stakeholder that plays the largest role in executing IAQ decisions.

Quantitative findings also indicate that "Managing competing priorities" was the most difficult challenge respondents face in their current roles.

Segmenting the data by profession yielded additional quantitative results. Consistent with overall group responses, 48% of architects and designers reported prioritizing energy efficiency. Additionally, while 70% of architects and designers work with IAQ on a regular or occasional basis, just 54% of the same group, when asked to describe their understanding of IAQ management, reported having only an "acceptable" level of understanding (Very strong/Strong/Acceptable/Poor). Among facility managers and engineers, 93% of respondents indicated working with IAQ in their role, however only 43% viewed it as a top priority, and only 50% see alignment among IAQ and energy efficiency goals. Among real estate owners, developers, and investors, 100% of respondents indicated prioritizing energy efficiency over IAQ. Furthermore, while all other stakeholder groups reported real estate owners or developers being significantly involved in IAQ decision making, 100% of this group self-reported as only being sometimes involved.

Qualitative Findings

While a complete list of qualitative results can be found in the appendix (See Appendix D), many of the qualitative results reinforced the quantitative findings described above. Stakeholders reported working with indoor air quality in a variety of ways, from managing building certifications to optimizing IAQ through building design and monitoring volatile organic compounds (VOCs). Respondents also reported sourcing information about IAQ from a variety of sources, such as local guidelines, on-site engineering teams, and ASHRAE standards. The variety of directions from which respondents approach IAQ, as well as the range of sources that inform their perspectives, no doubt contribute to a scattered stakeholder management network. When asked for examples of challenges respondents have faced in their IAQ management experience, 42% of respondents reported frustration with owner buy-in, and 8% of respondents reported challenges with energy efficiency. When examined stakeholder by stakeholder, sustainability consultants overwhelmingly felt challenged by the co-management of IAQ and energy efficiency (75% of energy efficiency respondent group).

DISCUSSION

The quantitative and qualitative results support our research hypotheses, that stakeholder fragmentation in IAQ and the coordination of IAQ and energy efficiency are prominent challenges in IAQ management.

RQ1: Who is driving decision-making around indoor air quality implementation?

Both the qualitative and quantitative data indicate that there is confusion and fragmentation both among and within

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stakeholder respondent groups around indoor air quality decision-making and management. While 88% of all respondents indicated that they work with IAQ (on a regular, occasional, or daily basis), over 30% of respondents lack confidence in their IAQ understanding, only 25% of respondents believe they have meaningful decision-making power when it comes to IAQ, and quantitative data indicates that there is no strong consensus around which group is informing or executing indoor air quality
decision-making. Furthermore, with 30% of respondents indicating that IAQ management is executed by contractors, the third-party involvement in managing IAQ is higher than anticipated, potentially contributing to the fragmentation experienced. Each stakeholder group reported some level of IAQ execution by contractors, however contractors were not reported as having any involvement in approving or informing IAQ practices. This represents yet another disconnect around IAQ management.

The conflicting opinions and beliefs around IAQ management, information, and execution, supports the hypothesis that the management of indoor air quality across asset types is fragmented and requires improved communication and coordination to clarify roles, responsibilities, and decision-making pathways.

RQ2: How are indoor air quality priorities addressed in relation to energy efficiency priorities?

Similarly, quantitative and qualitative data support the notion that there is confusion and misalignment across stakeholders in the prioritization of IAQ against or with energy efficiency. Nearly half of all respondents (45%) indicated that they prioritize energy efficiency over IAQ, and that number jumps to 100% when considering the responses of real estate owners, developers, and investors. Despite these data points, when explicitly asked how they weigh IAQ against energy efficiency, 45% of respondents indicated they equally prioritize indoor air quality and energy efficiency, and see alignment in these goals. This again conflicts with the qualitative data, where energy efficiency came up as a challenge as well as an area where respondents experienced knowledge gaps. This discrepancy indicates that while there is a desire to prioritize IAQ and energy efficiency in tandem, stakeholders lack the insight or data around the strategy to do so. These findings also coincide with existing research on the challenges posed in the management of IAQ and energy efficiency, supporting the need for further research and education on how these can be prioritized in tandem.

Limitations

The survey was primarily circulated to our Fitwel audience, which skews more towards sustainability professionals, purveyors of building certification standards, and a North American-based audience, as was reflected in the respondent pool. While our findings around real estate owners, developers, and investors were compelling, this respondent pool was small. This indicates our findings are not representative of the real estate industry as a whole. Additionally, all data was self-reported, which is an important consideration in interpreting the findings.

CONCLUSION

The results and analysis from this survey reveal significant challenges in the current landscape of IAQ management. Despite a general increased awareness in the importance and value of high quality indoor air in recent years, the IAQ landscape remains fragmented in the day to day management and prioritization of IAQ. IAQ decision making involves both on-site and off-site stakeholders, as well as third party contractors. In addition, there is often lacking owner buy-in when it comes to IAQ, and communication and coordination amongst stakeholders can be difficult.

This fragmentation appears prominently in analyzing the data around perceptions of how to manage energy efficiency and indoor air quality simultaneously. While real estate owners, developers, and investors–the groups perceived to have more decision-making power in IAQ management– prioritize energy efficiency, on-site staff including facility managers and engineers more strongly consider IAQ. These beliefs, in tandem with the confusion around decision-making, support the notion that the ‘indoor air and energy efficiency dilemma’ remains prominent across the real estate industry, and functions as a call to action for improved research and communication around how these factors can be prioritized together.

Moving forward, this research has raised further questions around the frequency and chain of communication among on-site and remote real estate management stakeholders, and how conflicting priorities are considered. It also confirms the need for improved research on and education for the industry on how to effectively prioritize energy efficiency and high quality indoor air simultaneously across settings and asset types. While both IAQ and energy efficiency carry health and financial value for real estate stakeholders, there appears to be a lack of urgency and prioritization of IAQ, and a need for improved

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messaging, beyond pandemic panic, about the value high quality indoor air holds for productivity, health, and asset value.

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APPENDIX

Appendix A. Participant Self-Qualifying Identifiers, Apart from Profession

Spatial Identifiers (asset types worked in):

- Commercial Office Space
- Multi-family Residential
- Single family residential
- Commercial industrial
- Retail
- Healthcare
- Higher education
- Community (residential with surrounding commercial and public spaces)
- Hospitality
- K-12 education

Work experience identifiers:

- Less than a year
- 1-3 years
- 4-5 years
- 6-10 years
- 11-20 years
- Over 20 years

Geographical identifiers:

- North America
- South America
- Central America
- Western Europe
- Southern Europe
- Northern Europe
- Eastern Europe
- Australia and Oceania
- Northeastern Asia
- Central Asia
- Southeastern Asia
- South Asia
- North Asia
- Middle East
- North Africa
- Southern Africa
- East Africa
- West Africa

Appendix B. Response Rates of Participant Self-Qualifying Identifiers, Apart from Profession

Experience in Current Role	Count	Percent of Total
Less than a year	3	2%
1-3 years	39	21%
4-5 years	29	16%
6-10 years	34	18%

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11-20 years	51	28%
Over 20 years	29	16%

Table C. Experience response rates.

Asset Type	**Count**	**Percent of Total**
Commercial office space	116	63%
Multifamily residential	20	11%
Multiple responses	10	5%
Community	6	3%
Healthcare	6	3%
Higher education	5	3%
Retail	6	3%
Commercial Industrial	4	2%
Single family residential	4	2%

Table D. Asset type of work. Note: the following asset types were reported 1% of the time or less: Government facilities, Hospitality, K-12 facilities, Mixed use, N/A, Other

Geography	**Count**	**Percent of Total**
North America	149	81%
Northern Europe	5	3%
South America	6	3%
Southeastern Asia	6	3%
Southern Europe	6	3%
Middle East	3	2%

Table E. Geography of work. Note: the following geographies were reported 1% of the time or less: Australia & Oceana, Central & South Asia, Central America, Northeastern Asia, Southern Africa

Appendix C. Other Quantitative Results

Q1. In your current role, do you ever work with indoor environmental quality (IEQ)?		
Response	Results	Notes
Yes, I work with IEQ regularly	43%	

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Yes, I work with IEQ occasionally	27%	
Yes, I work with IEQ daily	18%	
No, I never work with IEQ	11%	These respondents, and only these respondents were given Question 5
I'm not sure	1%	
Q2. What aspects of indoor environmental quality do you consider or work with in your current role? [Select all that apply]		
Indoor Air Quality	85%	
Thermal Comfort	74%	
Acoustics	54%	
Lighting	72%	
Q3. Within your organization, how is indoor air quality (IAQ) being prioritized?		
It is the top priority	18%	
It is a high priority	52%	
It is a moderate priority	24%	
It is a low priority	5%	
It is not a priority	1%	
Q4. Do you consider any of the following more important than IAQ? [Select all that apply]		
Thermal Comfort	22%	
Acoustics	13%	
Lighting	19%	
Energy Efficiency	45%	
No, IAQ is the top priority	25%	
It depends/can't decide	5%	Write-in category
Decarbonization	2%	Write-in category
Biophilia	1%	Write-in category
Q5. In your role, how do you work with and consider IAQ? [Select all that apply]		
I am the primary decision maker on indoor air quality strategy and decide how to implement the plan/strategy	0%	

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I advise on indoor air quality concerns and offer expertise	0%	
I implement specific aspects of the indoor air quality strategy through on-site management	5%	Respondents were taken to Question 6
I manage and maintain indoor air quality technologies on-site	0%	
I work with occupants to manage questions and concerns about indoor air quality	9%	Respondents were taken to Question 6
I never work with indoor air quality in my current role	82%	Respondents' survey was terminated
I advise clients on Fitwel and WELLs indoor air quality credits	5%	Write-in category, respondents taken to Question 6
Q6. When it comes to IAQ, how do you weigh energy efficiency in your decision making?		
I consider indoor air quality and energy efficiency competing priorities, and I prioritize IAQ	11%	
I consider indoor air quality and energy efficiency competing priorities, and I prioritize energy efficiency	11%	
I consider indoor air quality and energy efficiency competing priorities, but I don't prioritize one over the other	21%	
I don't consider indoor air quality in relation to energy efficiency	8%	
I equally prioritize indoor air quality and energy efficiency, and I see alignment in these goals	45%	
This is not a concern that applies to me in my role	4%	
Q7. In your role, what are your primary influences when making decisions about IAQ? [Select all that apply]		
I look at what my peers are doing as a guidepost	15%	
I follow the most up-to-date research around IAQ	49%	
I rely on the latest guidance from international or regional authorities, such as the WHO, CDC, or the EU	33%	
I rely on the latest guidance from ASHRAE	59%	
I look to Standards such as Fitwel, WELL, and RESET	77%	
I look to ESG frameworks such as GRESB, GRI, and others	25%	
I follow the guidance/information as outlined or provided by HVAC manufacturers	21%	

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I do not make decisions around indoor air quality policies	9%	
Q8. Has your organization made any changes to your IAQ policy or management since 2020?		
Yes	50%	These respondents, and only these respondents were given Question 9
No	18%	
I'm not sure	29%	
Q9. In the development of your new IAQ policy or management plan/protocol, did you utilize any of the following standards or sources? [Select all that apply]		
CDC	41%	
World Health Organization (WHO)	26%	
EU guidelines	9%	
ASHRAE	68%	
Fitwel	66%	
LEED	64%	
WELL	53%	
BOMA	15%	
ESG Frameworks such as GRESB, GRI, and others	14%	
I'm not sure	5%	

Q10. For each of the stakeholders listed below, please indicate the role that best describes their contribution to your IAQ efforts

	Informs	Approves	Executes	Unsure	N/A
Real Estate Investor	18%	30%	8%	8%	37%
Real Estate Owners or Developers	13%	56%	14%	4%	14%
Facility Managers	22%	17%	52%	2%	6%
Engineers	31%	10%	53%	2%	4%
Human Resources	25%	12%	6%	11%	46%
Sustainability Professional	62%	17%	15%	2%	4%
Architect or Design Professional	43%	19%	29%	2%	8%

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Contractors	7%	6%	76%	4%	7%
Q11. How often do you feel that you have a sufficient understanding to effectively manage and assess IAQ?					
All of the time		16%			
Most of the time		55%			
Some of the time		22%			
Rarely		7%			
Q12. Please consider the following challenges, and rank each one based on the difficulty it poses to you in your current role.					
	Not at all difficult	**Somewhat difficult**	**Very difficult**	**The most difficult**	**N/A**
Managing IAQ technologies	19%	50%	12%	1%	18%
Implementing IAQ policies and parameters	20%	49%	14%	5%	12%
Managing competing priorities around IAQ	14%	50%	17%	9%	10%
Understanding how IAQ is measured	46%	41%	7%	2%	4%
Integrating IAQ data into risk assessments	17%	38%	18%	5%	22%
Staying up to date on IAQ standards	33%	47%	11%	4%	4%
Staying up to date on IAQ technologies	18%	56%	16%	5%	6%
Navigating supply chain issues to support IAQ needs	12%	34%	16%	6%	31%
Securing and retaining skilled staff to manage IAQ	11%	34%	18%	6%	32%
Managing individual behaviors that disrupt the HVAC system	12%	33%	21%	8%	26%
Adjusting to low occupancy rates	22%	30%	14%	5%	29%

Appendix D. Other Qualitative Results

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What are some specific examples of how you work with and consider IAQ in your day-to-day role?		
Code/Theme	Count	Percent of Total
Codes/Requirements	18	11%
Health and Wellbeing	15	9%
Building Certifications	56	34%
Ventilation/Filtration	37	23%
VOC's and Pollutants	26	16%
Design	16	10%
Energy Efficiency	9	5%
Budget	1	1%

In your role, what types of training/educational materials have you received to assist in managing IAQ?		
Code/Theme	Count	Percent of Total
Building Certification Materials	80	52%
Engineering Teams/Consulting	10	6%
ESG Materials	1	1%
ASHRAE Standards/Guidance	23	15%
CDC Standards/Guidance	4	3%
Local Government Standards/Guidance	9	6%
Other Standards	7	5%

In relation to your role in managing and assessing IAQ, where specifically do you feel there are gaps in your knowledge?		
Code/Theme	Count	Percent of Total
Unbiased Data/Research	23	55%
Cost Analysis	5	12%
IAQ Technology	6	14%
Retrofitting IAQ Management	2	5%

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Conflicting Data Sources	4	10%
Energy Efficiency	2	5%
Maintenance	1	2%

Over the past few years, what are some examples of challenges you have faced in your day-to-day role in relation to IAQ management?		
Code/Theme	Count	Percent of Total
Safety/Wellbeing	6	4%
Owner Buy-In	61	42%
Third Party Coordination	15	10%
Meeting Codes/Requirements	27	19%
Equipment Challenges	37	26%
Energy Efficiency	12	8%
Occupancy	11	8%
Supply Chain	2	1%