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Predictive Modelling of the Indoor Environment to Maximise Productivity: An Analysis of Existing Premises[1]

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The Agenda

- Pre and Post Occupancy Rationale
- NABERS Protocol and Survey Details
- Building Features
- IEQ and Occupant Satisfaction Results
- Productivity Results
- Discussion

BACKGROUND

- Australian office workers spend 80% - 90% indoors.
- Market and Raters want relationship of Indoor Environment Quality (IEQ) on occupant productivity and payback cost analysis and projections.
- Pre and Post-occupancy studies now validate projections from IEQ.
- CETEC has done twenty recent pre & Post IEQ and productivity studies.
  - **NABERS Indoor Environment Protocol , productivity modelling and financial analysis .**
- Presenting a case study of a consulting engineering office-100 employees.
  - **IEQ parameters measured to NABERS draft Protocol.**
  - **Occupant satisfaction survey from Berkley University USA**

Productivity Projections

- Potential productivity projections based on design improvements in:
  - indoor comfort, pollutant, lighting, noise and occupant satisfaction improvements.
- Productivity projections based on literature eg:
  - Leijten (2002), Saylor (2002), Kats (2003), Wargocki (2006 -11), Fisk (2009) and Djukanovic (2005), Cetec SBS (1987-2012)
  - Range -2 to 13% based on IEQ and occupant survey.

Case Study

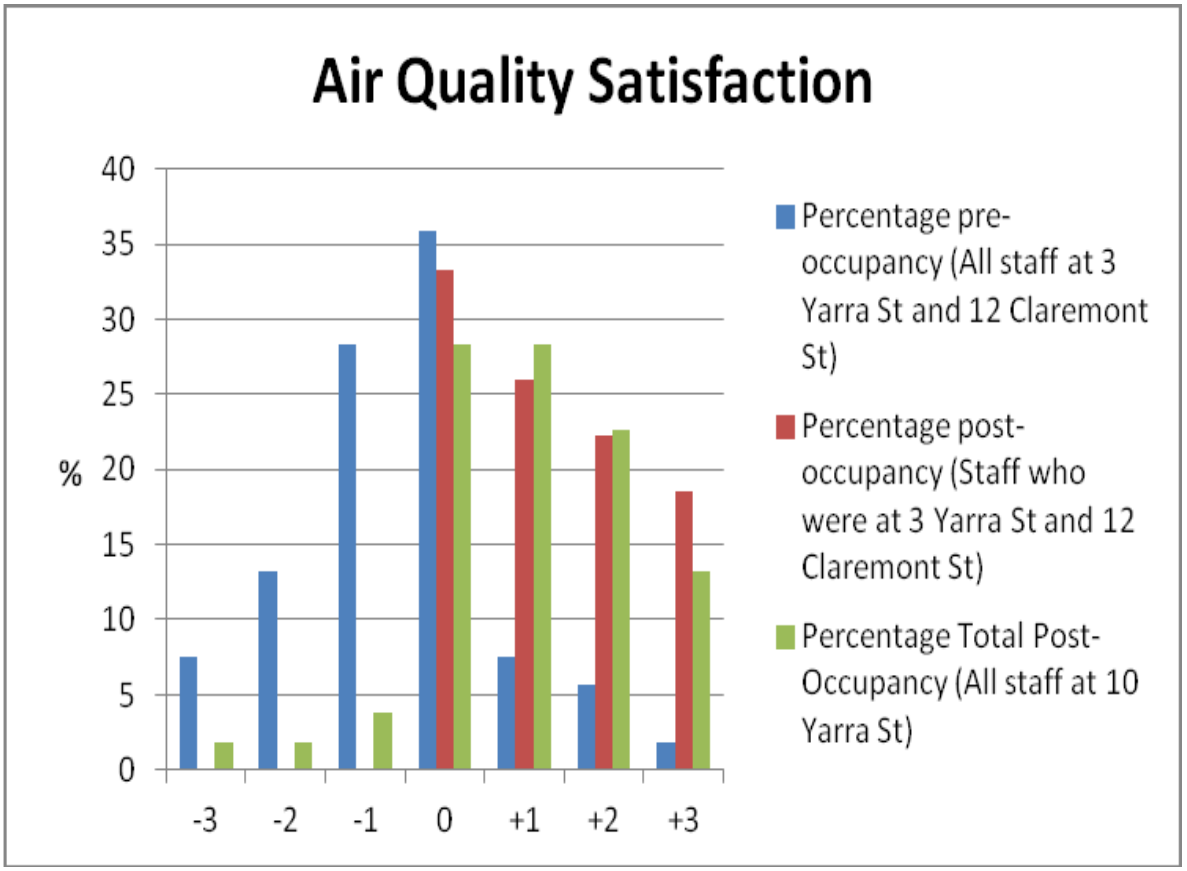
PRE & POST OCCUPANCY Indoor Environment Study Umow Lai Consulting Engineers

Methodology

- Stage 1- Measure and Project Productivity
  - Typical IEQ and survey > 50% of occupants 6 months before move
  - Productivity projection based on new building design including Indoor Environment Quality, innovation and staff changes.
- Stage 2- repeat methodology for new premises 6 months after relocation of staff
- Stage 3 - assessing corporate performance and productivity using pre and post financial analysis.

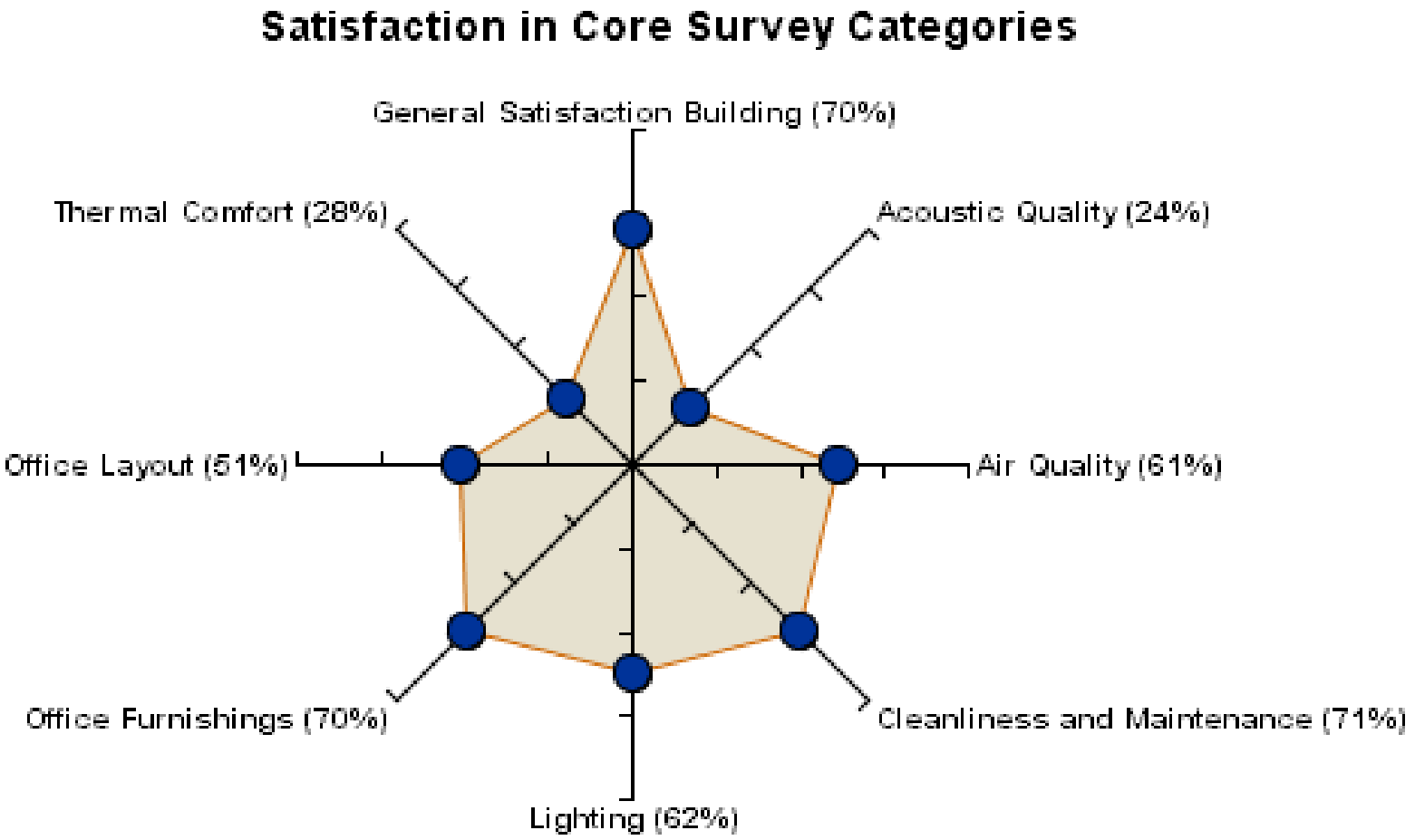
HVAC Biowalls innovation at new premises, to improve indoor air quality.

Additional studies for VOC and Microbials



Satisfaction of staff in relation to air quality for both the existing and new premises (labeled as pre and post occupancy)

Occupant Pre-Survey



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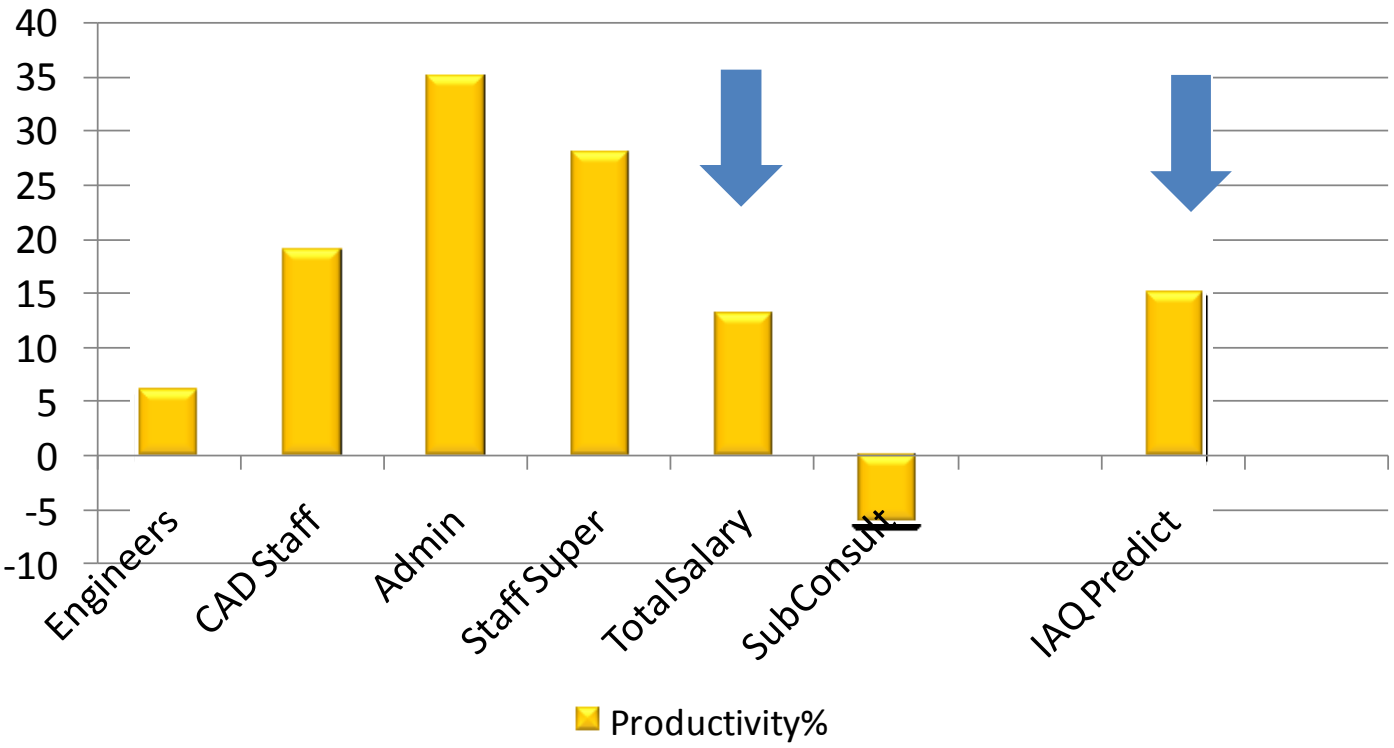

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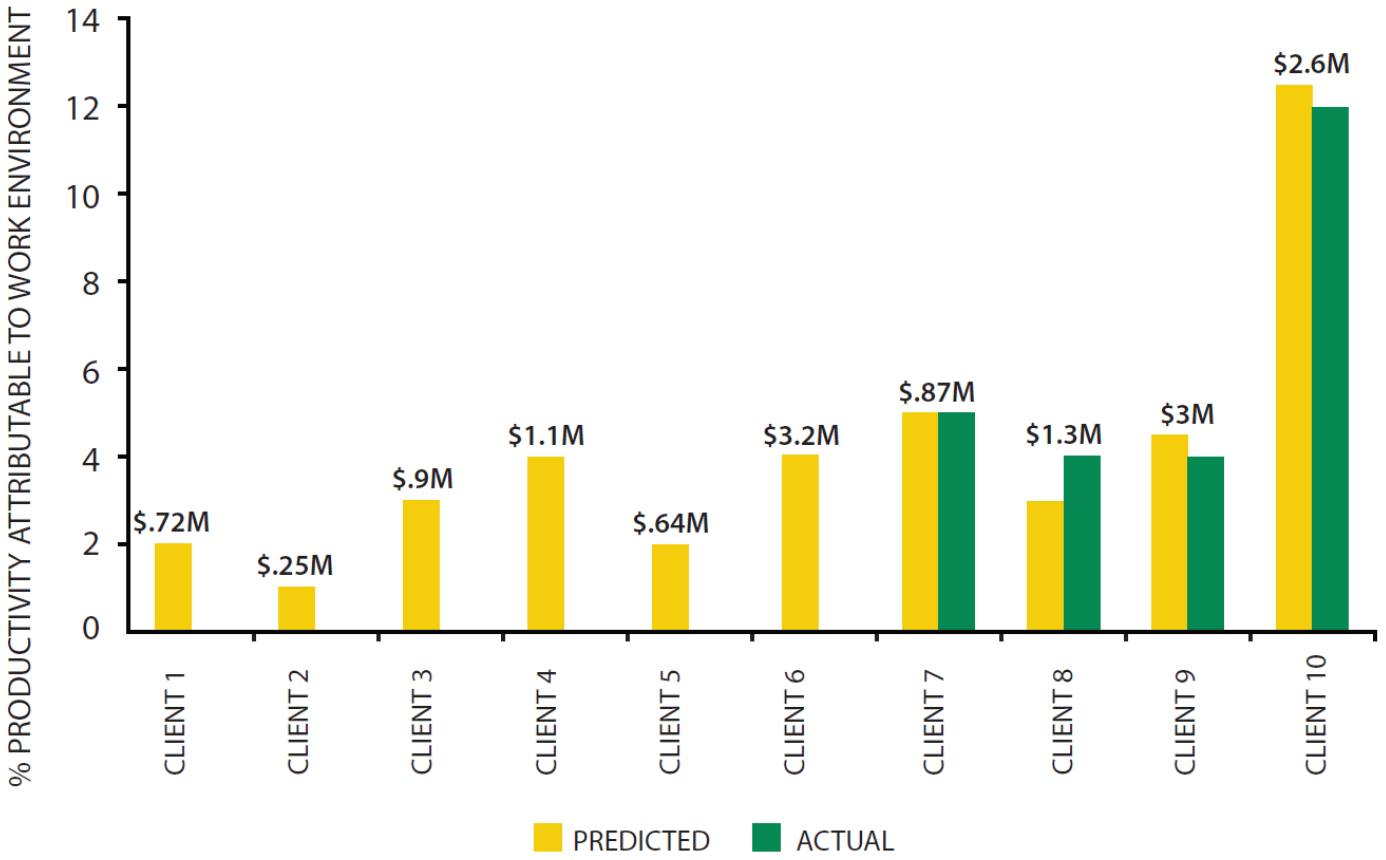
Results

- **Stage 1**-projected a 13% increase in staff productivity
- **Stage 2**- 2 year financial analysis found
  - Improved IEQ and Occupant Satisfaction in most categories
  - increase in financial productivity of 12.5%.
  - administration staff up 35%, dedicated IAQ and acoustics
  - Drafting Staff up 15%, specialised lighting, IAQ and outlook
  - Engineers (not often within the office space) up by 5%
  - External consultants down 5%

Other Cetec Productivity Assessments



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Conclusions

- Model verified by predicted 13% vs actual 12.5%.
- For the firm, the actual productivity increase of 12.5% translated to a 12 month building amortzation or $5,000 per employee per year.
- The model used still requires refinement, particular in relation to the inclusion of ongoing research relating to the impact of volatile organic compounds (VOCs) and lighting on staff performance.
- As the emergence of interest in productivity and IEQ continues to grow, building stakeholders are well placed to further exert their influence on the building and maximize its performance.
- With high cost savings based on productivity benefits (x5-x16 of energy), building stakeholders will have an indispensable tool to benchmark corporate performance and justify capital.

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