Integrating operational knowledge in design of energy efficient facilities

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Agenda

• PhD project overview
• A Facilities Manager’s typology of performance gaps
• Discussion and feed-back
PhD project overview - Motivation

The performance gap
PhD project overview - Problem

Knowledge transfer from operation to design
PhD project overview – comparative study

Shared challenges:
- Complex and large projects
- Separate life stages (design, construction, operation)
- Unique projects
- Unique teams

Learning across industries
PhD project overview: Research design

- December 2016: Literature review
- Expert interviews
- Tools: GC
- Case studies: Ships, Buildings
- Validation

November 2018
Performance gaps - Re-visiting the expert interviews

"... when we talk about ‘operation’, we often talk about energy consumption... but the real ‘operation’ is about you and me! It is about the employees being well... They are the real operation cost...”

Architect, owner of architectural firm.

"... there is a functional performance too, which is something else... A ship owner spends the same amount of money on harbour fee during the life time of the ship as he did on the ship itself. He spends the same on fuel and on staff... and we still haven’t discussed maintenance...”

Ship designer, owner of ship design firm.
Performance gap: - (unscientific)Definition

• “Building performance is an attribute of a building that expresses how well that building carries out its functions… aspects are energy efficiency, thermal comfort, indoor air quality and daylighting.”

• “The page "Building performance gap" does not exist.”

• “The performance gap is a term commonly used to denote the disparity that is found between the energy use predicted... in the design stage of buildings and the energy use of those buildings in operation.”

Wikipedia
Performance gaps - Research question

RQ:
Besides the energy performance gap, **which performance gaps are experienced** in new built ships and buildings – from a FM perspective?
PhD project overview - Research detour
Performance gap - Method

10 interviews
Re-coding

3 months "Office visit"

2 workshops
Validation

3 workshops
Analysis

Results

9 types

November 2018

12 types

Literature review / Theory
A Facilities Manager’s typology of performance gaps:

1. Higher energy consumption
2. Higher operation costs
3. Higher maintenance costs
4. Operation start-up loss
5. Disappointing end-user experience
6. Disappointing FM staff experience
7. Lack of adaptability/flexibility
8. Unsatisfactory indoor climate
9. Mismatch with business case
10. Double operation or No operation
11. Parts deferred to the operation stage
12. Not meeting legal requirements

Performance gap
The fatal gaps is context specific

"Another example... when you design mirrors from floor to ceiling in a hotel... house keeping must bring a stool when cleaning ... That takes one additional minute per room... Add 800 rooms, ... hourly rate of 150 DKK, and you find out that it costs around one million DKK every year in operation."
Gaps are intertwined

“Performance gap? Yes, always... Sometimes it is a negative gap. An example: If a ship sails at a higher speed than supposed... you’ve designed too large engines. Too large engines means additional maintenance costs...”

Naval architect, owner of ship design company

“If you suddenly need five more minutes in port you need to sail two knots faster to catch up... that typically means a 20% increase of energy consumption”

Naval architect, owner of ship design company
Performance gap - Conclusion

3 things FM and designers need to understand about performance gaps:

1. Besides the energy performance gap, 11 performance gaps causing FM trouble are identified

2. The fatal gap is context specific

3. The gaps are intertwined – counter productivity can occur.