Employing Back Casting Principles for The Formation Of Long Term Built Asset Management Strategies

A Theoretical Approach

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Structure

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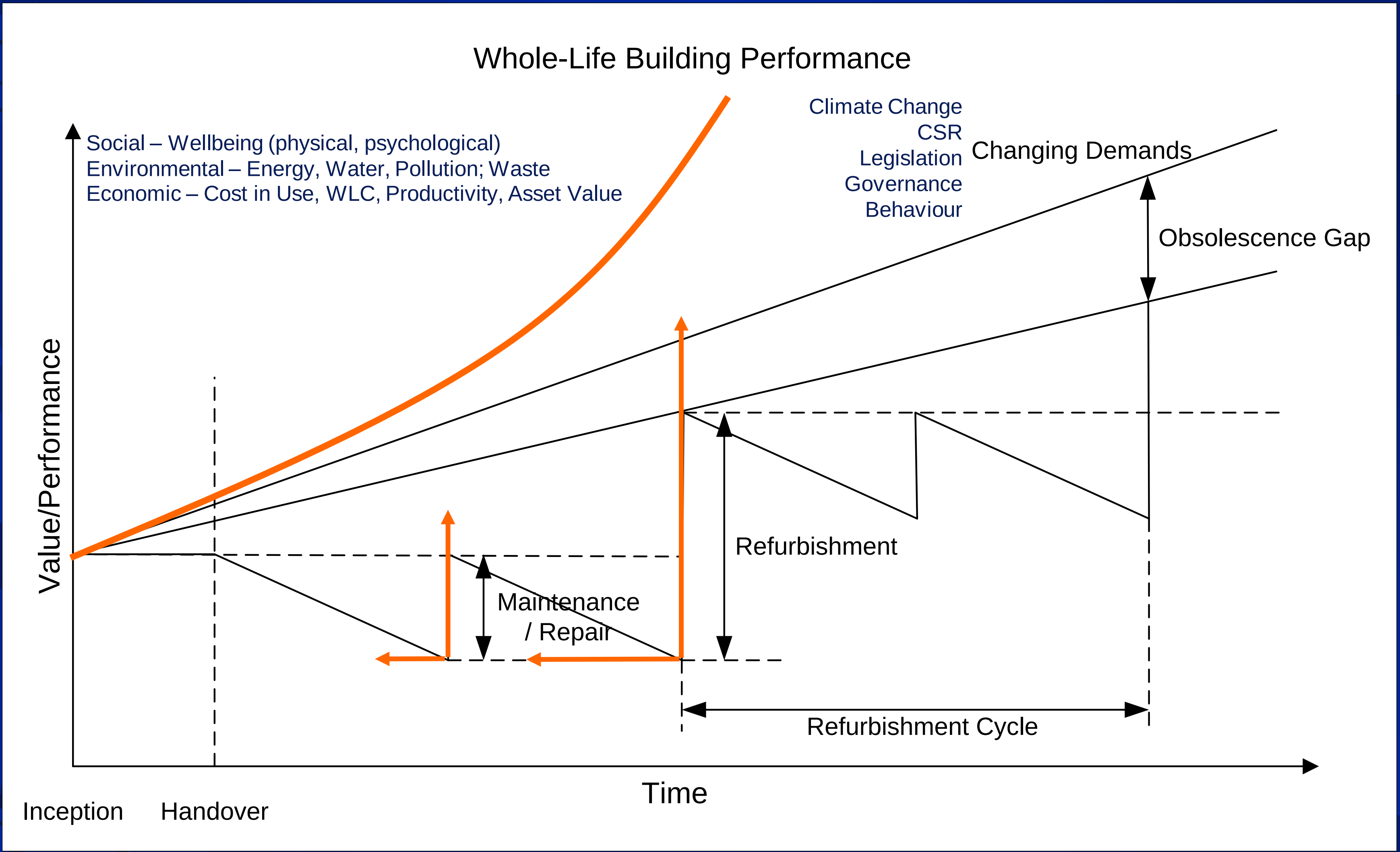
  - Building Life Cycle
  - Climate Change
  - Adaptation and Mitigation
- Back Casting
  - The General Theory
  - Application to the Building Life Cycle
- Case Study Building
  - Research Methodology - Action Research Approach
  - Results
- Practical Implications
  - Applying Back Casting to Built Asset Management
- Conclusions

The Problem

- Facilities Managers are responsible (amongst other things) for managing built assets over their life cycle.
  - Day to day operations
  - Routine and planned maintenance
  - Refurbishment
  - Disposal
- All of which have to be exercised against the value that the built assets provide in support of core business.
- However, value is not a constant but changes over time to reflect business and society needs and expectations.
- How should Facilities Managers exercise their responsibilities against a changing agenda?

The Building Life Cycle



Maintenance & Refurbishment

- Traditionally, Facilities Managers have used a form of condition survey to establish the value/performance of the components of a building and compared this against thresholds to predict the time interval until the component needs to be maintained (returned to its original condition) or replaced with a newer version of the component (upgraded).
- The time interval is smoothed to account for financial constraints.
- In this process Facilities Manager's are employing a forecasting methodology to plan the future building life cycle.

Maintenance & Refurbishment

- But, we know that forecast planning rarely delivers what is expected and more often than not forecast models miss their intended end point.
- In built asset management this results in:
  - Maintenance backlogs;
  - High cost refurbishments ;
  - Increased obsolescence.
- We also know that those solutions whose ‘added value’ are most difficult to quantify tend to loose out in a forecasting model where ‘safe’ solutions are preferred to ‘untested’ innovations.
- This is particularly true for adaptation and mitigation to climate change.

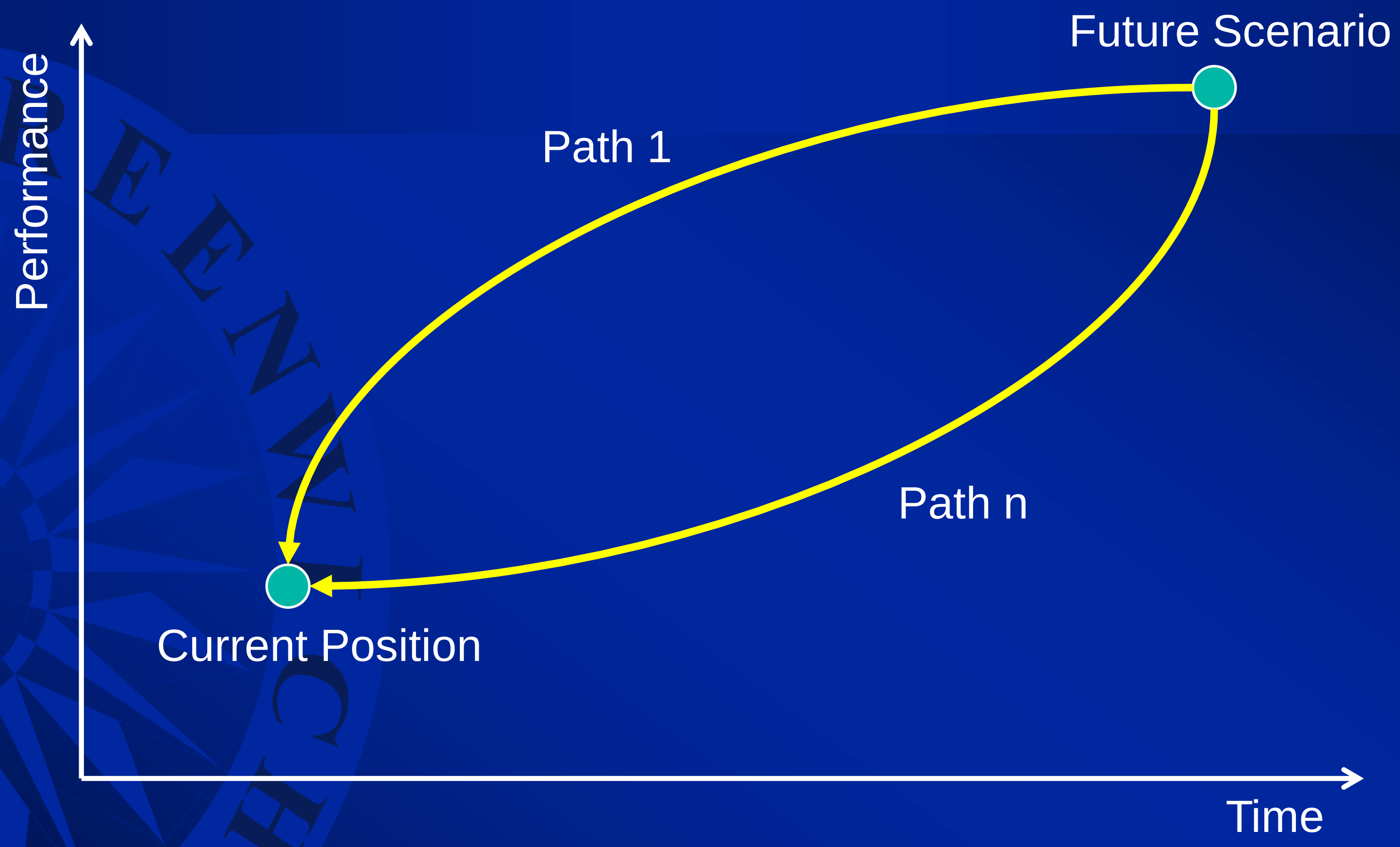
Research Questions

- So, how should Facilities Managers integrate adaptation and mitigation to climate change into built asset management plans?
- How can the uncertainty around climate projections be accommodated in built asset management plans?
- How can long term climate adaptation and mitigation interventions be prioritised alongside other interventions that offer an immediate benefit?
- Can back casting provide an alternative approach to built asset management planning that could better support adaptation and mitigation to climate change?

Back Casting

- Robinson (1982, 1990) defined Back casting as a normative method in which a desired long-term end-point is set and then used as the reference point to 'look back' to the current day position to identify the various stages at which actions are required to achieve a successful journey from the current day position to the preferred future position.
- Back casting has been used in sustainability and energy futures studies to engage a wide range of stakeholders in the development of futures scenarios
- Futures scenarios are used to set the endpoint in back casting studies.

Back Casting



Future Studies

- Future studies have been used for policy planning; in depicting economic and market trends; and for setting organisational strategies.
- Chatterjee and Gordon (2006) identified a ‘futures’ spectrum and described a range of approaches to deal with uncertainty and ambiguity at one end of the spectrum (e.g. behavioural simulations, scenario planning and modelling etc.) and certainty at the other end of the spectrum (e.g. forecasting, exploration etc.).
- Banister and Stead (2004) and Miola (2008) mapped the different types of future scenario to different types of futures.

Future Studies

Future Studies	Questions	Scenario
Probable	What is likely to happen	Precautionary /Predictive scenarios
Possible	What might happen	Explorative/ Projective scenario
Preferable	What we would prefer to happen	Visionary/Normative Prospective scenario

- ‘Probable’ and ‘Possible’ future studies are described as forecasting approaches which use predictive and exploratory scenarios based on quantitative data generated from surveys, past and current trend monitoring and explanatory modelling to develop views of the future.

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- **'Preferable' future studies are described as back casting approaches which use visionary and prospective scenarios based on a mix of quantitative and qualitative data generated through workshops, focus groups and Delphi techniques to develop views of the future**

Back Casting

- Finally, Dreborg (1996) concluded that back casting was most applicable to situations where:
  - The problem being addressed is complex and a change in the existing trend is required;
  - Time frames are long and deliberate choice (interventions) need to be made;
  - Dominant trends are part of problem; and
  - The problem scope is wide and externalities are crucial

Back Casting

- The authors would argue that these criteria map well to the problems of integrating adaptation and mitigation into future built asset management decision making models, where:
  - Climate change scenarios are complex and riven with uncertainty;
  - Facilities and built asset management time scales are long, typically 30-60 years;
  - Short-term thinking tends to dominate over long-term objectives;
  - Potential solutions involve multiple stakeholders and external agencies.
- So, theoretically back casting should be applicable to built asset management planning.

Research Methodology

- The subject of the research project was a £75m new educational building.
- As part of the initial design the client requested their Facilities Management department to work with the design team to undertake a review of the potential impact that climate change could have on the building and develop a long term facilities and built asset management strategy to ensure that the building continued to perform at an acceptable level over a 60 year period.
- Researchers from the University of Greenwich were part of the project team.

Stockwell St Building

Action Research

- The action research team comprised representatives from the Architects; Building Services Engineers; Structural Engineers; Quantity Surveyors; the Client (represented by the Facilities Management Department); and members of the Sustainable Built Environment Research Group at the University of Greenwich.
- Action Research team met formally on 4 occasions (one day workshops), with individual team members working on specific aspects of the project between meetings.
- The Action Research project lasted 15 months.

Workshop 1/2

- The first workshop established:
  - The focus for the project;
  - Developed a set of questions for the partners to investigate;
  - Agreed procedures for data gathering/analysis; and
  - Outlined a set of deliverables for the second meeting, which was mainly concerned with an assessment of the antecedent climate threats and the identification of future climate change risks.
- At the second workshop the action research team received a climate change risk report that identified current and expected risks aligned to the predicted first and second refit of the building (2020 and 2040) and design life (2080).

Workshop 2

- The risk reports were generated using the UKCP09 (median prediction emissions scenarios) to produce likely weather scenarios and associated building impacts on:
  - Internal Comfort & Building Façade;
  - External Comfort;
  - Structural Stability;
  - Infrastructure;
  - Water Supply;
  - Drainage & Flooding;
  - Landscaping; and
  - the Construction Process.
- Thermal performance and pluvial flooding were identified as critical scenarios.

Post Workshop 2

- **Once the weather data had been presented, the facilities management members of the action research team developed performance specifications, in terms of operational expectations of the building for 2020, 2040 and 2080, and the design members analysed how their design solutions would perform against each specification.**
- **In particular 4 questions were considered:**
  - **Would rooms overheat in the future?**
  - **What will be the impact on the annual energy loads?**
  - **Can the chiller specification cope with the increased load?**
  - **How will solar gain change in the future?**

Workshop 3

- The third Workshop examined the design implications of the questions outlined above.
- The performance specifications provided the 'operational targets' (end-points) from which costed adaptation solutions were 'back-cast' to ensure that the building would meet its targets over its life-cycle.
- This process identified twenty five adaptation measures which were tagged as ‘do now’, ‘2020’, 2040’ or ‘2080’.
- Each adaptation was evaluated against the following principles:
  - Measures that required structural alteration were recommended to be undertaken immediately irrespective of their actual required implementation date.

Workshop 3/4

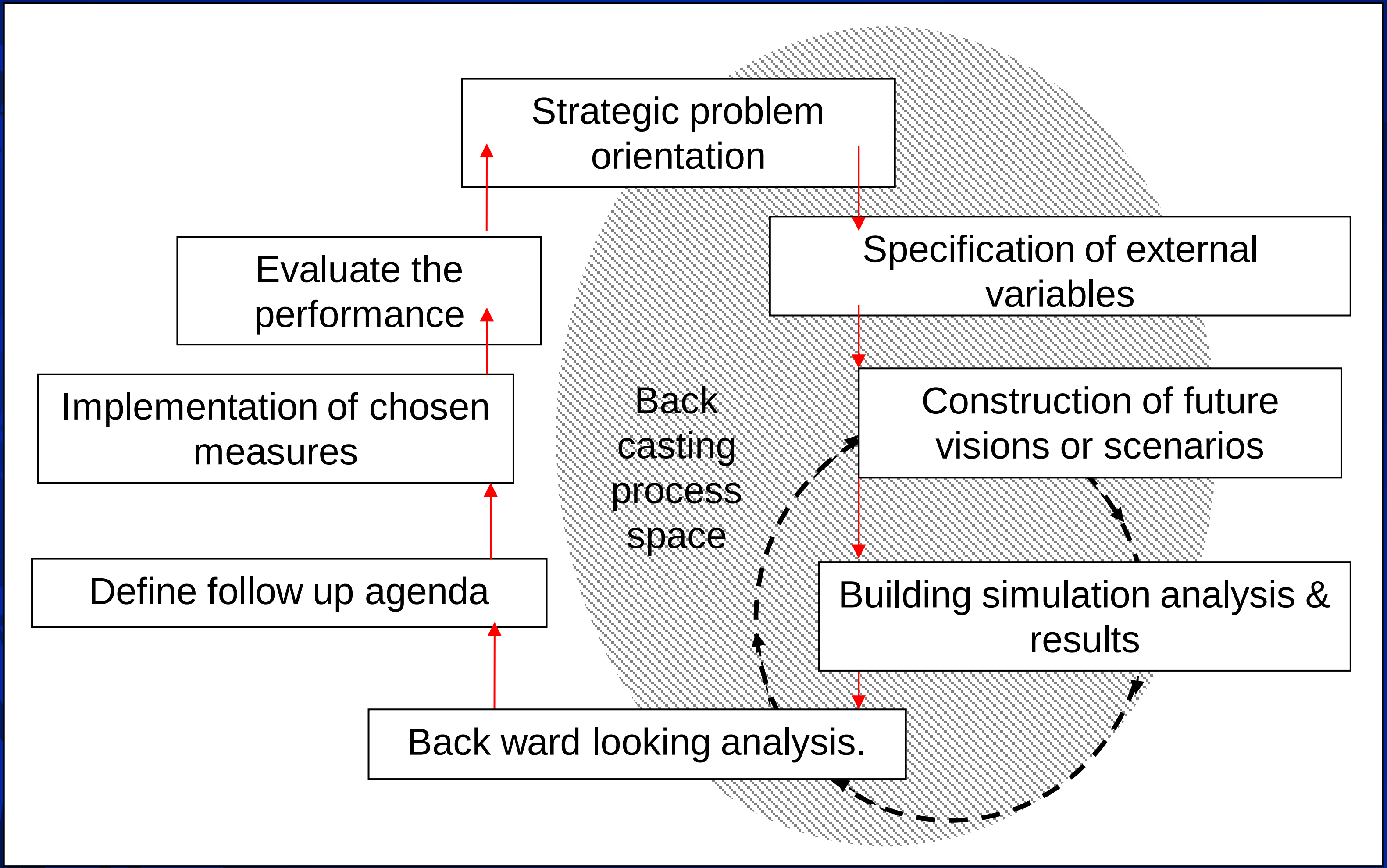
- Measures that required changes to system or component capacity were only to be implemented when required but consequential structural and space planning issues were implemented as above.
- Each measure was considered in terms of its impact on the current design and modifications introduced to facilitate a future retrofit.
- Those measures that were identified, but for which the UKCP09 weather data provided no firm direction, were assessed on their merits. This particularly applied to the risk of flooding where preparation was undertaken even though the likelihood of future events was uncertain.

- At workshop 4 all the adaptation options were considered and 25 were adopted and integrated into the future built asset management plan.

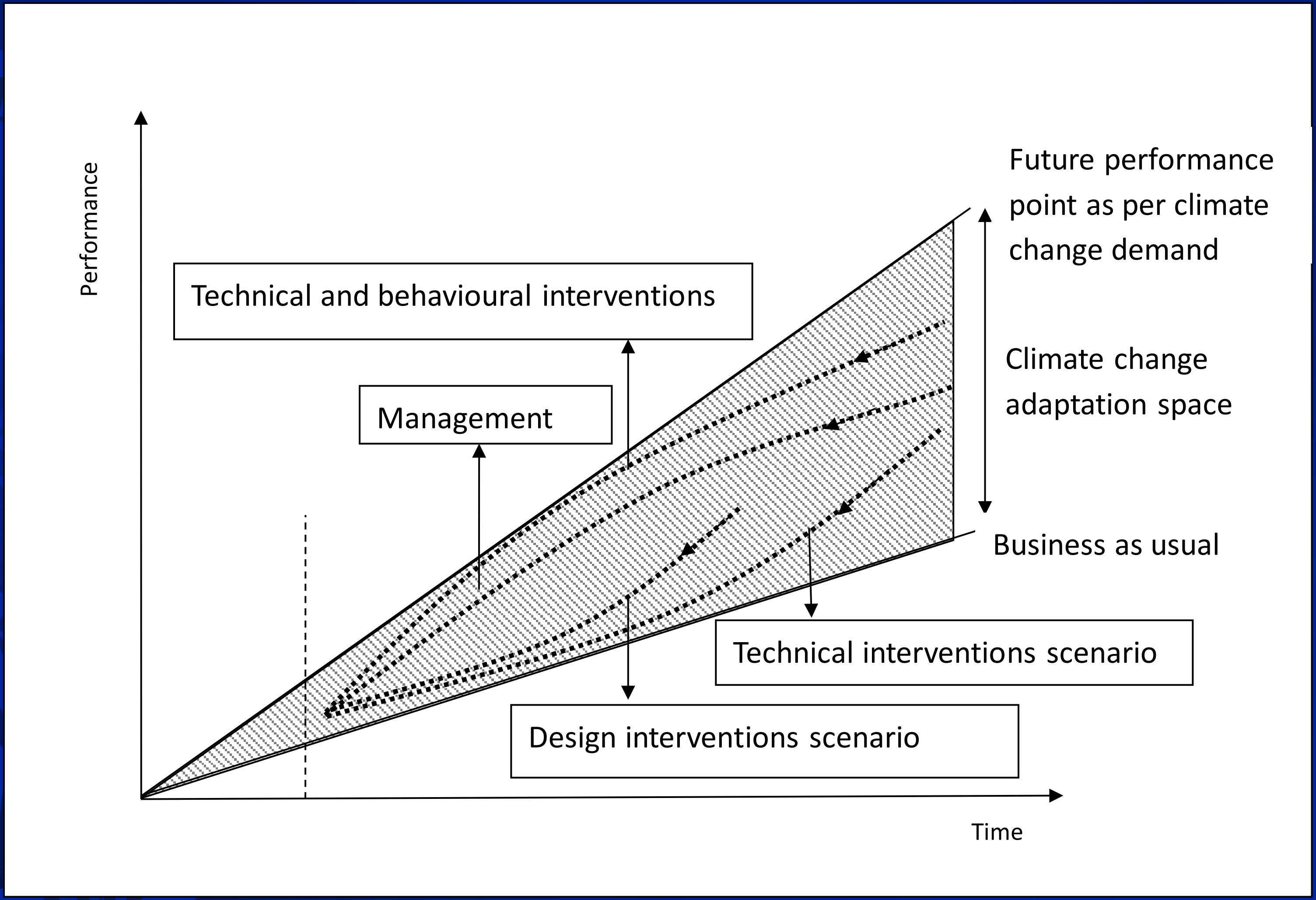
Practical Implications

- A 6 stage approach to using back casting for built asset management planning was developed.
  1. Set future performance scenarios;
  2. Specify future performance criteria and metrics;
  3. Develop alternative paths that could be taken to reach the end-point;
     1. Scenario1 – Business as normal path
     2. Scenario 2 – Management path
     3. Scenario 3 – Design path
     4. Scenario 4 – Technical path
     5. Scenario 5 Management/Technical path
  4. Identify points (time) along each path that each invention would need to be actioned;
  5. Implement interventions;
  6. Evaluate performance.

Back Casting Model



Scenario Paths



Conclusion

- This analysis confirmed the applicability of the back casting as an alternative to forecasting to develop future visions against which facilities and built asset management adaptations could be evaluated.
- This said, the adaptation solutions developed through the project tended to be biased towards technical retrofit solutions, which most likely reflected the balance of the action research team and the lack of an accepted approach for quantifying the cost benefit of management strategies for climate change adaptation.
- This latter point will need to be addressed if the back casting approach to built asset climate change is to be more widely adopted.

Thank You.

Questions?