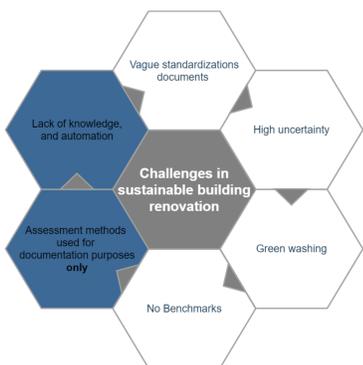


# Towards integration of LCA/LCC as a driver for Municipal decision-making in sustainable renovation of existing buildings

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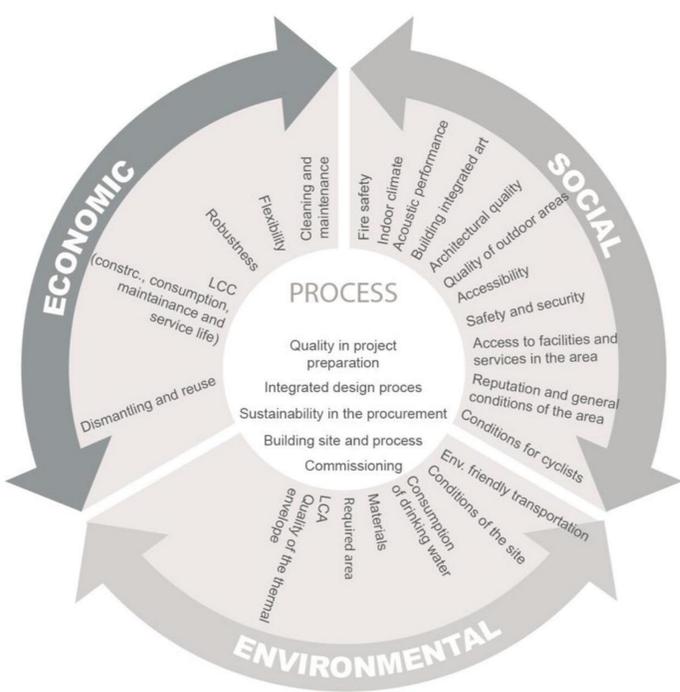
## 1 Research Aim

While sustainability assessments are well established for new construction, assessments for building renovations face unique challenges, figure below showing the main challenges found in the literature. The research work attempts to answer the following question “How Can Danish Municipalities integrate LCA/LCC for sustainable steering of public building renovation projects?”



## 2 Introduction

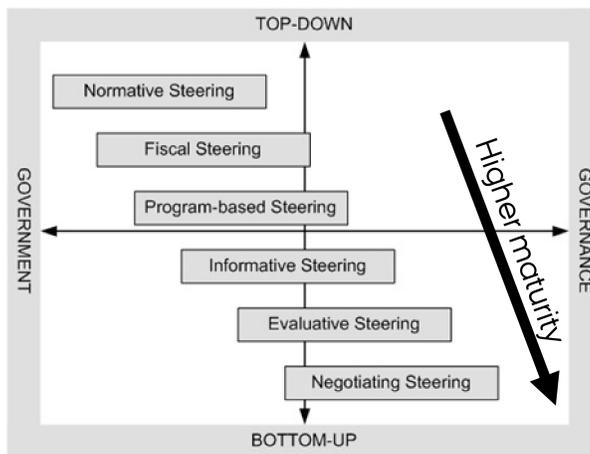
A sustainable building renovation project involves assessing the project in the three sustainability dimensions (economic, environmental, social). In this project we focus on the economic and environmental dimensions over the life cycle of the project (LCA/LCC).



Kamari et al. 2017

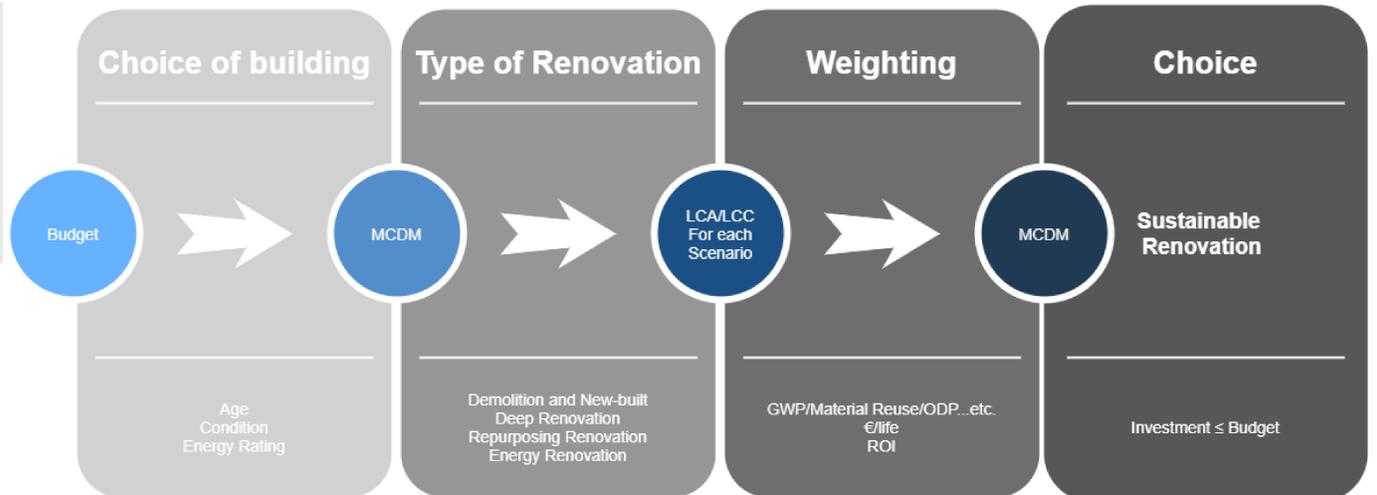
## 3 Municipality Sustainability Maturity

The way municipalities can influence the outcome of a renovation project depends on the maturity or knowledge of sustainability assessment methods by municipal stakeholders



Häkkinen et al 2016

## 4 Evaluative and Negotiating Steering

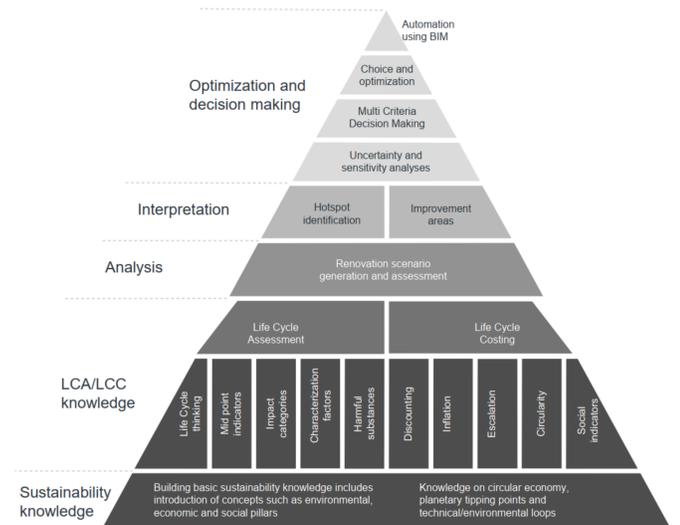


## 5 MCDM, LCA and LCC

A two step MCDM approach is needed. First to determine which building to renovate based on chosen criteria, Second to choose a renovation scenario. LCA/LCC results have different units, some metrics need to be maximized and some need to be minimized, thus a MCDM is necessary.

Indicator	Unit	±
GHG	Kg Co2 eq./m2/year	-
Land use	M2	-
Waste generation	E-Factor	-
Energy Rating	kWh/m2/year	-
LCC	€ over 50 years	-
ROI	Percentage	+
Material Reuse	Kg of material	+
Human toxicity	Kg 1.4-DB eq.	-

## 6 Integration of LCA/LCC Steps



## 7 Conclusion

General LCA/LCC knowledge is needed to fully be integrated into building renovation decision making, in addition a two step MCDM approach is optimal. First to determine which building to renovate based on chosen criteria, Second to choose a renovation scenario.

## 8 References

- Kamari, A., Corrao, R., & Kirkegaard, P. H. (2017). Sustainability focused decision-making in building renovation. *International Journal of Sustainable Built Environment*, 6(2), 330-350.
- Häkkinen, T., Rekola, M., Ala-Juusela, M., & Ruuska, A. (2016). Role of municipal steering in sustainable building and refurbishment. *Energy Procedia*, 96, 650-661.