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Targeting preservation strategies for buildings at risk of demolition: A visual MCDM framework

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The risk of demolition emerges when a building no longer can maintain its original purpose (Physical-, Technological, or Legal obsolescence) or if it becomes redundant due to changes in demand (Economic-, Functional- or Social obsolescence) (Langston *et al.*, 2008). Demolition of an existing building can be prevented through circular building adaptation such as refurbishment, where repairs and upgrades are added to the deteriorating building to maintain the use and function of the building, or through adaptive reuse strategies by changing the use of obsolete buildings (Shahi *et al.*, 2020). It is essential to identify buildings at risk of demolition before they become outdated since longer periods of obsolesce can limit the possibilities for applying adaptive reuse or increase the cost and environmental saving of the transformation, and thereby resulting in demolition. This study aims to set up a method that both calculates and visualizes buildings that may be at risk of demolition. The calculation and visualization of demolition risk are divided into four parts, as illustrated in Figure 1. First, the demolition criteria are selected and formed. Then input data in an MCDM (Multi-Criteria Decision-Making) model is used to calculate the demolition risk, followed by weighting and validation. Finally, the results from the MCDM are imported into a GIS (Geographical Information System) map for generating a 2D map visualizing demolition risk on an urban scale.

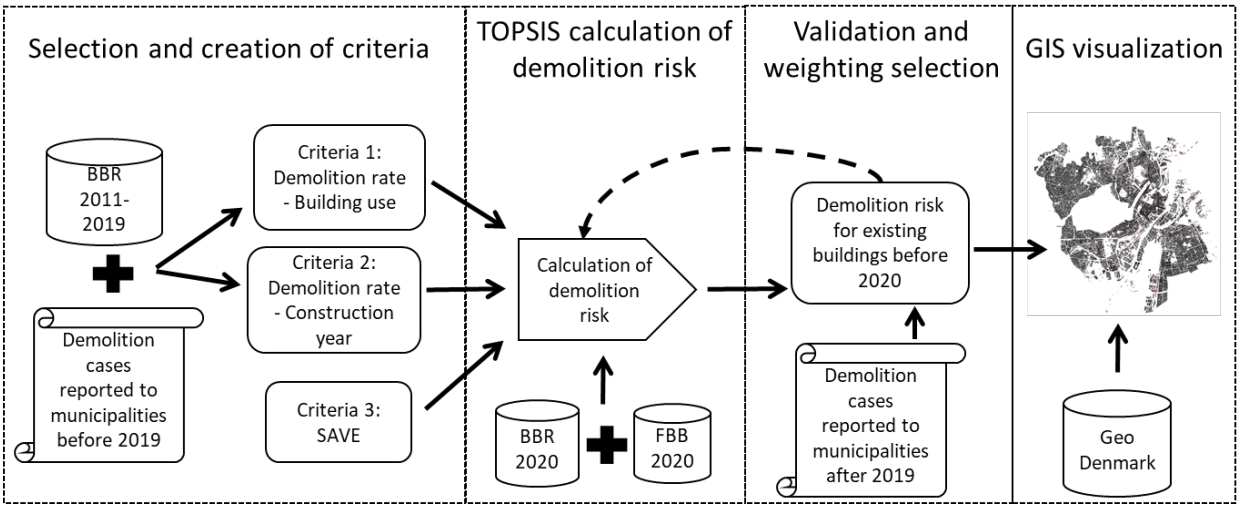

Figure 1. Steps in the framework for calculating and visualizing demolition risk on an urban scale.

The results show that with few criteria and publicly available data, it can create an overview of the distribution of demolition risk for existing buildings via a simple MCDM framework and apply it visually (See Figure 2) in urban planning and development. By using historical and publicly available data from building registers, it was possible to define and design relevant criteria based on demolition rates for building typologies and architectural values registered by Danish municipalities.

Figure 2. GIS map of the demolition risk of existing buildings in a section of Copenhagen on a graduated color scale. Dark red buildings are at high risk of demolition and therefore need assessment of opportunities to apply circular design strategies, whereas white colored buildings are at low risk of demolition.

Overall, the framework shows that there only with few criteria is an opportunity to support decisions on circular design strategies for buildings at risk of demolition. Thereby, the circular design strategies can be targeted at the existing buildings at high risk of demolition, thereby conducting thorough feasibility studies that reveal preservation potentials obtained through building adaptation or maximizing circular material utilization. The possibility of identifying potential material sources at an early stage before materials turn into construction waste can therefore be crucial for realizing the idea of 'the city as a material bank'- a central concept in the green transition and the circular economy. At the same time, building stock scanning and visualizations make it possible to create strategies for circular development at an urban scale via special policy measures, such as authorities setting stricter requirements for feasibility studies of possibilities for rebuilding and preserving buildings at risk of demolition either in connection with major architectural competitions, urban renewals or in connection with ongoing construction activity. The framework was only tested on three criteria. However, to improve the identification of buildings at risk of demolition, there is a need to implement more criteria, which should also be area-specific such that an industrial building in a densely populated area is more at risk of demolition than a building in an industrial area. Instead of only being based on the weighting, future development of the method can also be based on knock-out criteria such as listing or the appearance of harmful substances in main building parts, that will drastically affecting the potential circular design strategies.

Key words: Demolition; Building Adaptation, Circular Design Strategies, MCDM, GIS

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