



# An assessment of sustainable housing affordability using a multiple criteria decision making method

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## ABSTRACT

Housing affordability is a complex issue that must not only be assessed in terms economic viability. In order to increase quality of life and community sustainability the environmental and social sustainability of housing must also be taken into consideration.

The paper considers the application of a methodology that can be applied to assess the affordability of different housing locations in a sustainable manner, taking into account a range of economic, environmental and social criteria. The COPRAS method of multi-criteria decision making (MCDM) is selected and applied to three residential areas as an example of how sustainable housing affordability can be assessed using a MCDM method. The outcome of the study reveals that considering a range of social and environmental criteria can greatly affect the calculation of an areas affordability, in comparison to focusing solely on financial attributes. COPRAS was found to be an effective method for the assessment and could be applied in other regions or internationally.

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## 1. Introduction

Currently affordable housing and sustainable development are major challenges facing the UK and many other countries across the globe. Sustainability and affordability concerns are now often discussed mutually and are recognised as being important to one another [1–6]; namely, affordable housing ought to be located within sustainable mixed communities and sustainable communities must provide affordable housing products. Accordingly, it is essential that affordability and sustainability issues are tackled simultaneously. However, housing affordability is frequently defined and assessed only in terms of economic viability. Other important issues, such as sustainability, housing location and quality are sometimes overlooked.

Comparing the relationship between housing expenditure and household income is the most common way to define and measure housing affordability internationally [7–9]. Such an assessment relies on a ‘rule of thumb’ which suggests that any household spending more than a certain proportion of its income on housing costs lives in unaffordable housing. This approach stems from initial studies on housing affordability, which date back to 19th century studies of the household budget, which commonly equated “one week’s pay for one month’s rent” [7, p. 471]. Housing cost to income ratios are

extensively applied to measure affordability in the UK and other European countries, the U.S., Canada, Australia, New Zealand and China [10–14]. The ratio approach appears to be ubiquitously and often indisputably adopted in international housing policies, within developed countries, to measure housing affordability. This is not surprising since it has the advantage of being easy to compute as it only relies on a few variables which are usually easily accessible. However, the housing expenditure to income ratio has been subject to criticism by several authors [7,13,14,15]. This is primarily due to its arbitrary and normative nature [7,13,14,16] and inability to account for issues such as housing quality [15].

In contrast to the conventional way of conceiving and measuring affordability, Stone [13,14] recognises that housing affordability is not separable from housing standards. Accordingly Stone [13] introduced the ‘shelter poverty’ measure which attempts to assess affordability by taking into account the adequacy of household income to cover both housing costs and other necessary non-housing costs, thus seeking to maintain an adequate standard of living. This measure therefore focuses on the residual income remaining after housing costs have been met. However, the residual approach shares some of the shortcomings of the ratio measure, such as the inability to control for housing or location quality. Bogdon and Can [15] criticised the pre existing affordability literature for focusing on house prices rather than the condition, location and neighbourhood characteristics of the housing. However, even today day the majority of tools used to assess affordability have little or no regard for housing quality,

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location and neighbourhood characteristics, i.e. what households get in return for what they spend on housing.

## 2. Research problem

The ODPM [5] admit that, previously, in a rush to build more homes to meet demand the government too often did not build communities. Jobs, shops and services, transport and green spaces are also important factors for creating thriving communities [5]. It is not enough to simply provide more homes, there must also be a strong focus on creating sustainable communities [3]. Sustainable communities are defined as “Places where people want to live and work, now and in the future” [4, p. 56]. They should be active, inclusive and safe, well run, environmentally sensitive, well designed and built, well connected, thriving, well served and fair for everyone [4].

Building housing that is not well connected to jobs, high quality services and infrastructure can and has contributed to areas experiencing low demand and abandonment. The Housing Market Renewal Initiative was prompted by the government to tackle problems of low demand and the emergence of housing abandonment in several parts of the North and the Midlands in England. In such neighbourhoods, high levels of low demand properties, population loss and high vacancy rates created decline and deprivation [17]. These areas suffer from a lack of jobs, poor public services, crime and anti-social behaviour, with streets and parks in disrepair [5]. The traditional way of conceiving and measuring affordability (the ratio of housing costs to income) may indicate that such areas are affordable, simply because they are low-cost. However, this fails to indicate anything about the quality of the housing or the environment in which the housing is situated. Accordingly, this may be a rather simplistic and unsustainable way to view affordability.

Research undertaken by the Australian Housing and Urban Research Institute (AHURI) stresses that OECD countries are increasingly recognising the need for a broad and more encompassing understanding of housing affordability, such measures would replace simple ratio measures based on housing costs and income which cannot deal with issues such as housing adequacy, location quality and access to services [18]. Nevertheless, research by the AHURI continues to focus on housing costs and incomes [19]. This research advocates the continued use of the expenditure to income ratio due to its long tradition; ease of use and to provide continuity [18]. In contrast, other research conducted in Australia advocates that housing affordability must account for ancillary costs that households may face, e.g. accessing key services, facilities and employment, and the cost of electricity, gas and water [20]. It seems that a number of authors are seeking to challenge the conventional ratio standards which are frequently used to define and assess housing affordability.

It has been suggested that the traditional way of defining and measuring housing affordability (the ability of household income to cover housing costs) may be too limited; the interaction between housing and location is thought to provide a more meaningful measure of housing affordability [21]. Furthermore, Fisher et al. [22] suggest that an important aspect of housing affordability depends on the amenities based on the particular housing location, which affects the welfare of households. Their study looks at affordability in terms of a bundle of attributes an area possesses, such as school quality, job accessibility and safety. The authors assess whether accounting for the implicit prices of such attributes influences an areas affordability measure. The authors conclude that focusing on price alone may lead to inaccurate conclusions about the affordability of an area [22].

But how is the concept of affordability perceived by low and moderate income families themselves? Seelig and Phibbs [16]

conducted qualitative analysis of housing affordability to understand how low-income renters understand residential affordability. They found that low-income families often did not choose areas that had poor amenity and location measures. Thus, while cost was an essential consideration, addressing needs or preferences for dwelling features, location or proximity to services and facilities was a priority for many low income renters, even though such choices resulted in tighter household budgets and paying more for housing [16]. The research demonstrates that an array of attributes, in addition to purely economic factors, can influence a household's perception of affordability. Specifically, quality, location and access to services and facilities appear to be important considerations directly related to a household's perception of affordability.

Clearly, improving housing affordability is not the only means by which housing can become economically viable. As well as housing costs, the aforementioned literature advocates that a wider range of criteria must be taken into consideration in order to determine true housing affordability and quality of life. Such findings have motivated the authors to conduct this particular research and develop a methodology that can be used to assess the affordability of different housing locations in a sustainable manner, taking into account a range of economic, environmental and social criteria that influence both the affordability and sustainability of housing. Given the complexity of the issue under consideration, multiple criteria decision making (MCDM) appeared to be appropriate as the basis of an assessment tool for sustainable housing affordability.

Multiple criteria decision making (MCDM), often called multi criteria decision aid (MCDA) and multi criteria analysis (MCA), is a set of methods which allow the aggregation and consideration of numerous (often conflicting) criteria in order to choose, rank, sort or describe a set of alternatives to aid a decision process [23]. MCDM is suitable for the said topic as it is able to address the numerous quantitative and qualitative criteria that affect both housing affordability and sustainability, all of which can be incorporated into one evaluation process.

There are three steps that all MCDM techniques follow [24, p. 5–6]:

1. Determine relevant criteria and alternatives;
2. Attach numerical measures to the relative importance of the criteria and to the impacts of the alternative on these criteria;
3. Process the numerical values to determine a ranking of each alternative.

Step 1 can be aided by methods which assist in structuring decision making problems. For example, Kenney's value focused thinking [25] which uses hierarchical structures to build criteria, leading from primary goals to fundamental objectives, which are further broken down to specific criteria or Strategic Options Development and Analysis (SODA) which utilises cognitive mapping [26].

In order to process the numerical values (step 3) there are various different MCDM methods available, each with their own varying characteristics. Some of the most commonly used methods include the AHP [27], TOPSIS [28], PROMETHEE [29], ELECTRE [30] and COPRAS [31]. For a survey and comparison of different MCDM methods see [32], [33] and [34], although the COPRAS method is not discussed.

Several MCDM methods have been applied in property, planning and built environment related research. For example, Ball and Srinivasan [35] proposed the AHP method to aid house selection for buyers. Bender et al. [36] used the AHP to analyse the environmental preferences of homeowners in three Swiss cities, though the ELECTRE method was mentioned as a possible alternative for environmental quality problems. Johnson [37]

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