*Proposal for Term Assignment:* **Spatial Decision Support System for Covid-19 Housing Recovery**

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**Problem Description and Primary Beneficiaries**

Housing has evolved into an area of increasing crisis over the past few decades owing to the 2008 subprime mortgage crisis and the recent blow of the Covid-19 pandemic. As much as the government is creating new avenues for investments in affordable housing, households are invariably faced with an absence of information about the resources available to enhance their housing mobility. Covid-19 has multiplied the impacts of housing segregation and the prior affordability crisis as low-income groups suffer from heavy job losses and increased rent burdens, exacerbating their risk of evictions. In lieu of the above problems, a housing spatial decision support system (Housing SDSS) for housing counselling. The SDSS will provide vulnerable households with necessary information about current housing stock and enable them with relocation options based on their priorities.

Although this project does not directly address the housing concerns faced due to Covid-19, it attempts to negotiate between the housing crisis scenarios prior to and after the pandemic, thereby consolidating a system of affordable housing that is both transparent and accessible to the affected. The project tries to mitigate a long-standing issue of housing and its affordability crisis by engaging the existing pool of resources towards creating a holistic system of housing counselling for households with severely restricted housing mobility. A secondary motivation of this project is to also create a system of housing information that is both reproducible and adaptable to structural changes over time and continues to assist vulnerable populations despite the preponderance of financial instability and housing crises in the future.

The project tries toconsider specific housing concerns of households facing eviction as a secondary impact of COVID-19 [primary clientele]. Little research is made to understand the trends of household mobility after evictions, but data from research conducted on specific population groups (such as Latino and black women) tend to suggest that they enter worse housing arrangements and struggle to recover both financially and socially. What compounds these problems is the lack of information about housing options and their accompanying trade-offs at an institutional level – there lies a general unavailability of housing counselling that is sensitive to the needs and nature of duress of low-income households. The project tries to intervene into this cycle of distress by fulfilling the current gaps in the domain of information relevant housing decision making for household groups who are either at risk or facing evictions due to Covid-19.

**Project Context and Deliverables**

Covid-19 has transformed conceptualization of the housing problem at a global scale – Housing is not just a financial asset and a mode for economic development but is now an indispensable necessity for human health. Presence or absence of adequate housing determines a household’s susceptibility to and recovery from Covid-19 . For example, most low-income households are doubling down during the pandemic, trying to accommodate family members and friends who have lost access to housing due to the economic slump. Doubling down exacerbates Covid risk because overcrowding and absence of a separate room for quarantine risks the entire household with disease contraction. Therefore, the problem of housing mobility (at a quantitative and qualitative level) is of special significance during Covid-19, adding critical value to the project proposed.

Moreover, research on the changing priorities of housing policies [from direct provision of housing to deconcentration of poverty, rent subsidization and inclusive housing], shows that mobility counselling is central to the success of housing policies (Johnson, 2005). Taking the example of the Housing Voucher Programme in Pittsburgh, Johnson demonstrates that the aspect of housing counselling for low-income household is rife with inadequacies and housing counsellors either lack the technical proficiency (knowledge of trade-offs, complete housing inventory, etc.) or are too burdened with caseload-management to render meaningful help. Therefore, it makes sense to address this domain with a decision support system equipped with a housing choice algorithm to visualize the availability of low-income housing, its spatial biases as well as enable households to harbour their cognitive abilities to make an informed housing decision on the housing unit quality and neighborhood characteristics that they desire or prioritise. The domain of in-person mobility counselling is disadvantaged by current social distancing parameters and changes in the mode of office work further advance the logic for an automated system of mobility counselling, one that is sustainable and requires minimal institutional capacity. Only rental housing is considered at this moment because it is the most effective means to enable housing mobility during the economic recession of the Covid-19 pandemic.

A decision support system for low-income housing would involve trade-offs between multiple scales and geographical hierarchies. The architecture of the SDSS will be suitable if it can accommodate a substantial threshold of low-income/housing vulnerable households. This is feasible at the census tract at the city level. Beyond the tract level, geographies are too large to visualize location choices and accommodate for heterogeneity of neighborhood and housing unit characteristics. The census tracts can be divided into neighborhoods corresponding to the at the city level, and housing units with their respective street addresses can be accommodated at the neighborhood level. Thus, there are two main scales for the operationalization of the SDSS in a city – tracts and neighborhoods. As of now, the city for the baseline SDSS is undecided and choices lie between the city of Chicago, San Francisco, and New York. These cities will be examined based upon the researcher’s familiarity with the socio-spatial characteristics (which determine feasibility of the study in 6 weeks), availability of baseline literature and overarching significance of the housing problem with respect to the city.

As of now, distinction of the city into its tracts and neighborhoods is possible through information collected from the US Census Bureau. Understanding the proportion of vulnerable population based on race, occupation, income groups [and rent burden] among other criteria can also be calculated through census information to measure the client base of the SDSS. Household location criteria can use primary survey data corroborated with secondary information from past research (for example Johnson and Sriraj et al suggest that proximity to schools is an indispensable criteria for most households looking to relocate). What is unknown remains the domain of vacant low-income units at the city, census tract and neighborhood levels. Efforts will be made to engage with existing lists of housing units from different private real-estate and government websites to create a spatial inventory of available household unit features and neighborhood characteristics to execute the SDSS. The inventorization of vacant units (for rental housing only) will engage with both the known (census data) to define the criteria for database design for housing units and neighborhood characteristics (unknown).

**Simplified Strategy for Project Implementation**

Methodology for the study is adapted from similar housing spatial decision support systems made by Johnson and Sriraj et al. (Sriraj, et al., 2006; Johnson, 2005). The baseline strategy for model building will remain consistent with the framework of secondary literature, although the identification of housing criteria and housing choice algorithm will go through subsequent revisions owing to discoveries on how the Covid-19 pandemic alters household priorities for low-income housing (in terms of dwelling unit characteristics, household size, minimum health, safety requirements, etc.). A diagrammatic explanation of the proposed study methodology is shown below.

Sources of data (such as the US Census Bureau data) will be analysed to produce tabulations for areas with the maximum number of housing clients, vacancies, and greatest concentration of vulnerable populations (low-income groups, racial minorities, etc) [input/design criteria]. Data for the SDSS is at two levels – at the input/criteria delineation level and at the output/interface level. At both the levels data is both dynamic and static. Examples of static data include – administrative information, strategies for identifying appropriate neighborhoods and evaluating households for low-income-households. Dynamic data for the same client would include a search engine for available rental units and neighborhood level spatial data.

**Chart Showing Methodology for a Simplified Housing Spatial Decision Support System**

(to be designed as part of UP 494 Term Assignment)

**Target Audience**

The Housing Spatial Decision Support System contributes to the existing literature on housing across multiple disciplines – from urban planning to real estate and policy design. Some of the avenues are discussed in the diagram below. As mentioned earlier, not much is known about the housing mobility of households facing the risk of evictions (especially during Covid-19). The literature study that informs the design framework of the SDSS tries to consolidate the concerns of such less-researched areas while adding to them critically.

This framework is valuable because it allows researchers to understand more about the trade-offs for households facing eviction and the processes involved in the selection of new residential locations for low-income groups. If successful, this project can be a step towards bringing information equity in the housing domain and inspiring the agency of low-income households to have an informed stake in their housing choices. Availability of such information in the public domain can also reveal spatial biases and enable policy makers and urban planners to intervene into predominant socio-spatially disadvantaged neighborhoods. This project can act as a database of information for further research at the academic and institutional level at an unprecedented level of granularity. Since the model will be built in R and the code available for dissemination, the framework can be reproduced in geographies beyond the case study area.

**Possible Avenues for Contributing to Existing Literature**

**Brief idea of Scope, Limitations and Assistance required**

This project was conceptualized based on research for a long-term independent study in the fall of 2020. However, the scope and time limits of the Term Assignment restrict the ability of the proposed Housing SDSS to achieve the comprehensiveness of past models. A lot of functional components identified through the literature need to be reduced and distilled to create a skeletal structure of an SDSS that is feasible for implementation with 6 weeks. It is important to keep in mind here that the SDSS will therefore not serve as a real-world replicable model for true execution at the city level, but will definitely embody the essence of one.

The process of building an SDSS requires much conceptual assistance because it will be difficult to match the available information with the conceptual model of the SDSS. At a technical level, aspects of prototype design, such as input functions for search engine design, running an algorithm for housing search and combining R analysis with a spatial database are unknown to the developer. These aspects could be explored at the cohort level to introduce new concepts for class discussions and lab sessions and enhance the real-world applicability of our UP 494 Neighborhood Analysis lessons.

# **References**

Johnson, M. P., 2005. Spatial decision support for assisted housing mobility counseling. *Decision Support Systems,* Volume 41, pp. 296-312.

Sriraj, P., Minor, M. & Thakuriah, P. V., 2006. Impact of Information on Housig Relocation using Analytical Hierarchy Process and Interactive GIS. *Applications of Advanced Technology in Transportation,* pp. 816-821.