

Data-Driven Reform to Address Public Housing Problems

New York City Housing Authority (NYCHA) Reform Plan



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Executive Summary

The purpose of this plan is to analyze the condition of the New York City Housing Authority (NYCHA) and propose an operational plan to reform NYCHA by using data-driven methods. NYCHA is the largest public housing organization in the U.S. and one of the most important factors in New York City's housing market and living conditions. This reform plan aims to make NYCHA more efficient and effective in its housing services to make New York City's public housing conditions better.

New York City Housing Authority (NYCHA) has Two Great Challenges

There are two major problems that NYCHA face. The first one is that NYCHA has poor housing conditions for its residents. Another challenge is the lack of public housing supply for all New Yorkers in need, which creates a huge imbalance in the public housing market of New York City.

The Data-Driven Reform Consists of Three Different Strategies

The data-driven solution for NYCHA can enhance its service quality of public housing and solve the public housing shortage to improve the overall housing condition of New York City by three following strategies:

1. Implement machine learning methods to deliver better public housing services.
2. Introduce big data analysis and accounting techniques to build public housing neighborhoods with a reasonable budget.
3. Experiment with the Singapore Style of governmental restrictions on public housing for trading based on digital regulation.

Additional Efforts are Required to Implement the Reform Plan

Supplementary preparations for data-driven reform such as data processing, staff training, and equity assurance are indicated to understand how to implement the plan. Partnership opportunities are also mentioned to explain how can other institutions help to benefit the stakeholders in the data-driven reform.

The Data-Driven Reform benefits NYCHA in the Long Run

The initial cost for the reform can be high due to the resources that are needed to collect and the high housing supply goal that NYCHA should accomplish, but data-driven methods can improve NYCHA's efficiency and effectiveness in the long run, which can save billions of dollars each year to succeed in the future.

Introduction

New York has been one of the largest and most cosmopolitan cities in the world that draws immigrants to live and settle. The metropolitan area population is 18,867,000 in 2022 and is estimated to continue growing to 20,817,000 in 2037, according to U.N. projections (MacroTrends). The large population brings problems that are difficult to solve, especially in housing. The Case-Shiller Home Price Index of New York City has increased 35.3% in only two years (YCharts). The renters in New York City need to earn \$110,000 per year to pay for the median asking rent, while they only make \$50,000 per year in the median. Half of them spend 30% of their income on rent in NYC, and one-third of households even spend over 50% (Milstein, J.). Unfortunately, housing shortage and inflation have long been familiar and unsolved for New Yorkers.

Among all New Yorkers, low-income people are in the worst condition under the influence of New York City's skyrocketing housing prices. The figure below shows the proportion of low-income and moderate-income households with gross rent of at least 30% or 50% of their monthly pre-tax income. According to Harvard International Socioeconomics Laboratory, roughly 45% of low-income New Yorkers are paying more than 50% of their pre-tax income for their rent, while around 30% of them cost 30% or more of their earnings on housing. Low-income New Yorkers are under the heavy economic burden of housing even with public housing.

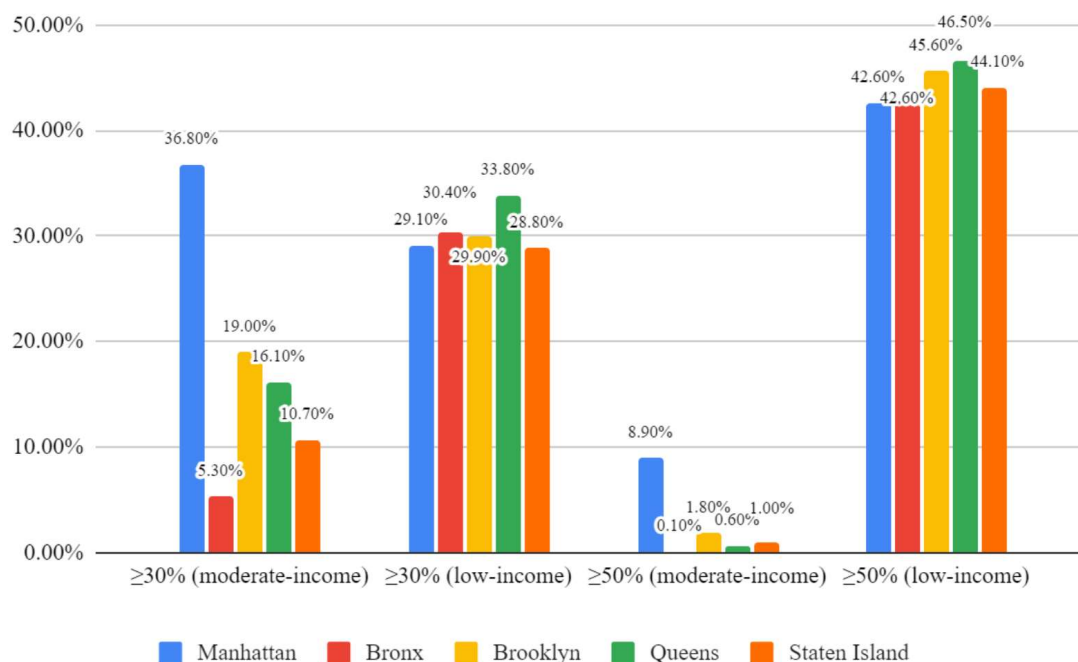


Figure 1: Proportion of low-income and moderate-income households with gross rent of at least 30% or 50% of their monthly pre-tax income.

So, what is going on with New York City's Public Housing Market? Why New York

City Housing Authority, the biggest public housing agency in America, failed to make the housing of the city abundant, affordable, and equitable to all New Yorkers?

Background

New York City Housing Authority (NYCHA) had been supporting low-income New Yorkers with public housing since 1934. However, NYCHA gradually became more and more rigid and obsolete, even unable to meet people's basic demands for the quantity and quality of public housing.

Challenge I: Existing Housing Services in Poor Condition

According to the *2021 New York City Housing and Vacancy Survey*, figure 2 below shows that public housing in New York City has the highest rates in both the 1-2 and 3 or above maintenance deficiencies categories. A more serious problem is that the rate of 3 or above maintenance deficiencies in public housing (43%) is 3 times more than the average rate of New York City Housing (14%). Bad public housing conditions would be extremely harmful to the residents and inevitably discourage New Yorkers to live in NYC Public Housing. According to *Housing Our Neighbors: A Blueprint for Housing and Homelessness*, health issues like asthma and chronic absences are caused by the poor housing quality of NYCHA commonly. Bad housing conditions do not only affect New Yorkers' health but also disrupt the demands of actual needs for public housing. NYCHA would intend to supply fewer houses due to the lack of demand. According to *NYCHA Fact Sheets*, there are 564,301 New Yorkers served by NYCHA's public housing in 2019, while only 535,686 people live in public housing in 2022. However, the number of the homeless and the average people's burden of housing is still increasing. The quality of housing service at NYCHA needs to improve to the average quality rate of New York City to show the actual demands for public housing.

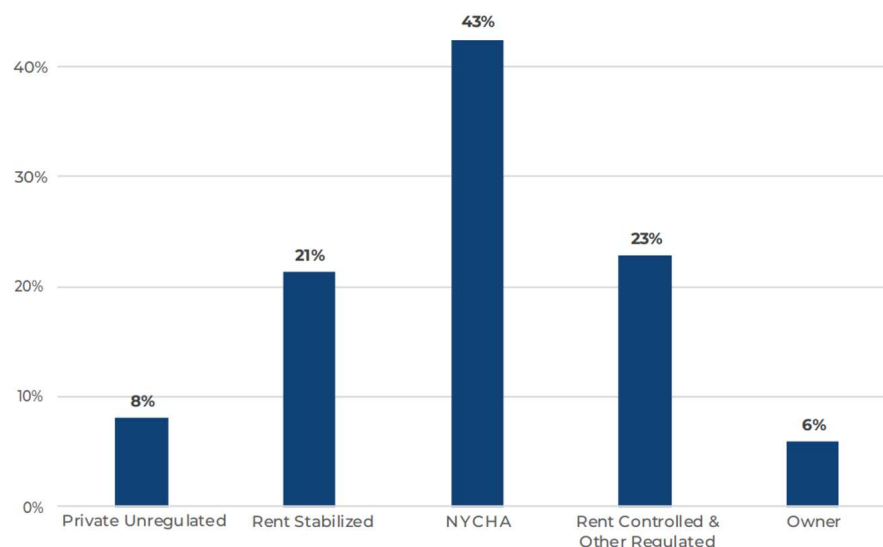


Figure 2: Prevalence of Three or More Maintenance Deficiencies by Housing Type of New York City.

Challenge II: Much More Public Housing Supplies are Required

Improving public housing service quality is not the only challenge. The problem of insufficient public housing is also a significant reason why overall New York City has soaring housing prices and a great housing supply shortage. According to figure 3 below, only 31,500 extremely low-income dwellings can be assisted, while over ten times people need housing (Stein, S). The very low-income households, which need public housing, are three times more than the supply of the NYC government. NYCHA does not provide enough houses for people who are actually in need of public housing.

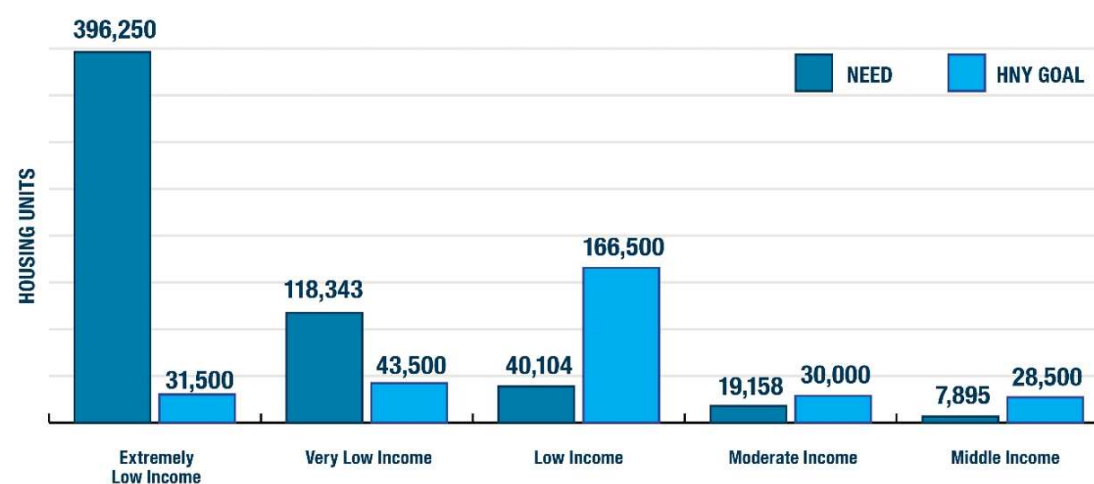


Figure 3: New York City's Actual Housing Need VS. NYC Housing Authority's Supply of Housing for Housing New York 2.0 (HNY).

In 2022, the monthly housing inventory declined by 6.1% and the average home selling price rose by 13.1% (Nysar). The overall housing market of New York City continues to deteriorate. Even though the private sector and the overall economic situation have some effects on the housing market, NYCHA's lack of public housing supply is one of the main reasons why New Yorkers are suffering for housing.

Proposed Strategies

New York City Housing Authority (NYCHA) can implement several reforms by using data-driven methods to improve the service quality of NYCHA to all New Yorkers in need and address the housing shortage of NYCHA, which can significantly reduce the overall housing problem in New York City.

NYCHA should implement machine learning methods to build better public housing neighborhoods.

Housing Our Neighbors mentioned improving the service quality of NYCHA. Machine learning methods can optimize the usage of public staff and resources to improve public housing services. Figure 4 below shows how machine learning can help NYCHA to utilize the information such as condition of public housing units, demographics of public housing residents, social condition in the neighborhood, and other factors to get satisfying outcome such as optimal staff management, lower deficiency rates, and faster reactions to feedbacks by designing specific algorithms for NYCHA and using clustering, classification, and regression methods.

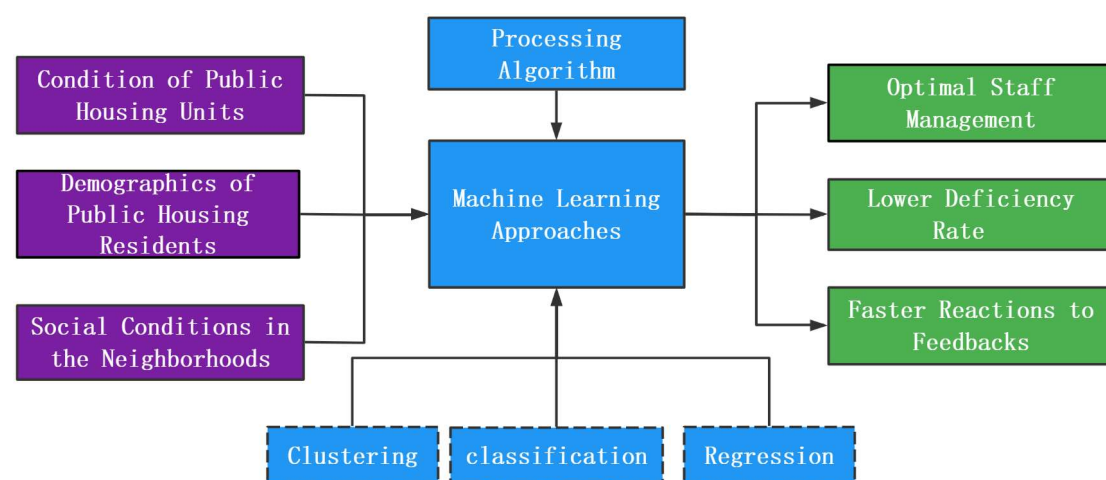


Figure 4: Machine Learning processes for New York City Housing Authority (NYCHA).

For example, maintenance teams of NYCHA can be more effective by knowing ahead of what aspects can cause a higher probability of damage in steam, water, electricity supply, and so on. The efficiency of NYCHA can greatly increase, while the cost of NYCHA will be gradually reduced, which can help to solve the problem of the \$40 billion capital repair deficit of NYCHA (City Limits).

Introducing big data analysis and accounting techniques to figure out the actual number of people in need and the reasonable budget for Housing Our Neighbors and NYCHA.

Current New York City Mayor, Eric Adams does not plan to set a numerical goal of building new houses for New Yorkers (City Limits). That decision is problematic. There is no way to regulate and assess the performance of the government without a numerical goal. Even if the plan has a specific goal, the officers still need to explain how the goal can ease the problems of housing to prove the government is doing a successful job.

In addition, in Eric Adams's vision, *Housing Our Neighbors* plans to build the neighborhood model, as figure 5 shows below, which is forming close communities that are easier to manage and lower the miscellaneous cost. Compared to the old model of NYCHA called Regional Asset Managers (RAM), which has houses in several different boroughs but under a single management portfolio, the neighborhood model can be more efficient to address residents' needs and promote helpful programs such as employment sessions for everyone in the certain community.

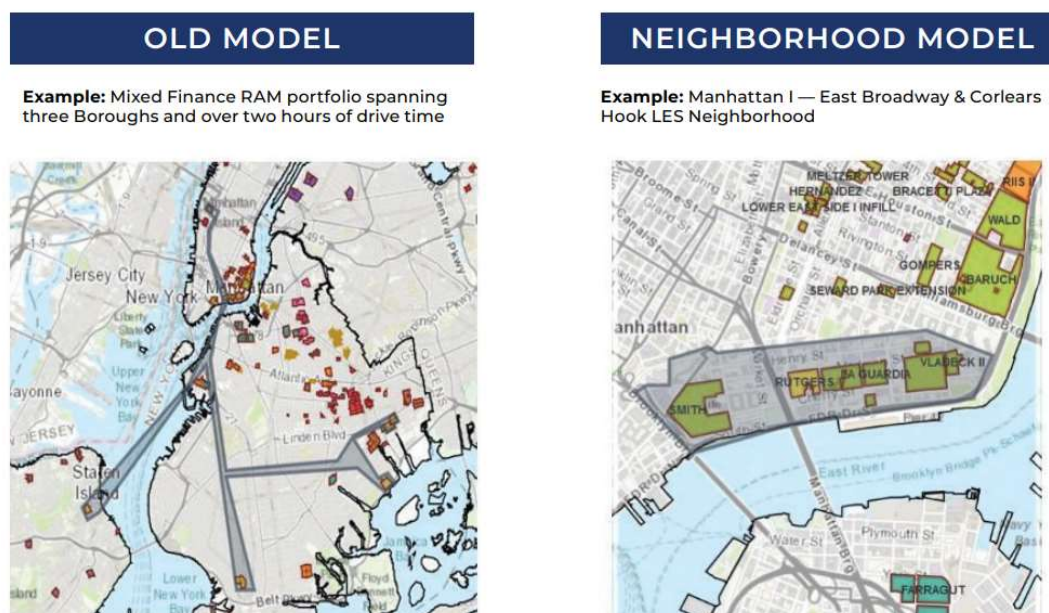


Figure 5: The Old Model of NYCHA public housing VS. The Neighborhood Model by Eric Adams, Current New York City Mayor.

Therefore, big data analysis and accounting must be used in this circumstance. Firstly, NYCHA should use data statistics to know how many people need public housing right now and in future years. Big data analysis can help NYCHA to select specific regions that have larger areas, lower building costs, and easier access to other resources. Then a reasonable goal of how many homeless people should be settled each year can be planned to gradually lower the shortage of housing.

Moreover, NYCHA can make a detailed budget plan based on the goal of the housing number with big data analysis and accounting, so the plan can be reasonable and feasible to solve the problems.

Singapore Style: NYCHA should implement governmental restrictions on newly built housing for trading based on digital regulation.

Those newly built housing should serve the purpose of balancing the demand and the supply of housing. However, if the buildings can be traded, people would have the incentives to capitalize on the houses. Those welfare houses would be harder to access for the poor because they do not have the money or the ability to buy or rent the house. Singapore-style housing ensured that the poor do not need to worry about living space, but also cannot profit from welfare.

Figure 6 below indicates the homeownership rate & the percentage of the resident population living in Housing and Development Board (HDB) flats in Singapore. Since 1990, over 80% of Singaporeans live in public flats while around 90% of Singaporeans own a home. The strong correlation between these two facts demonstrates that Singapore has been maintaining a good job of providing people homes with public housing.

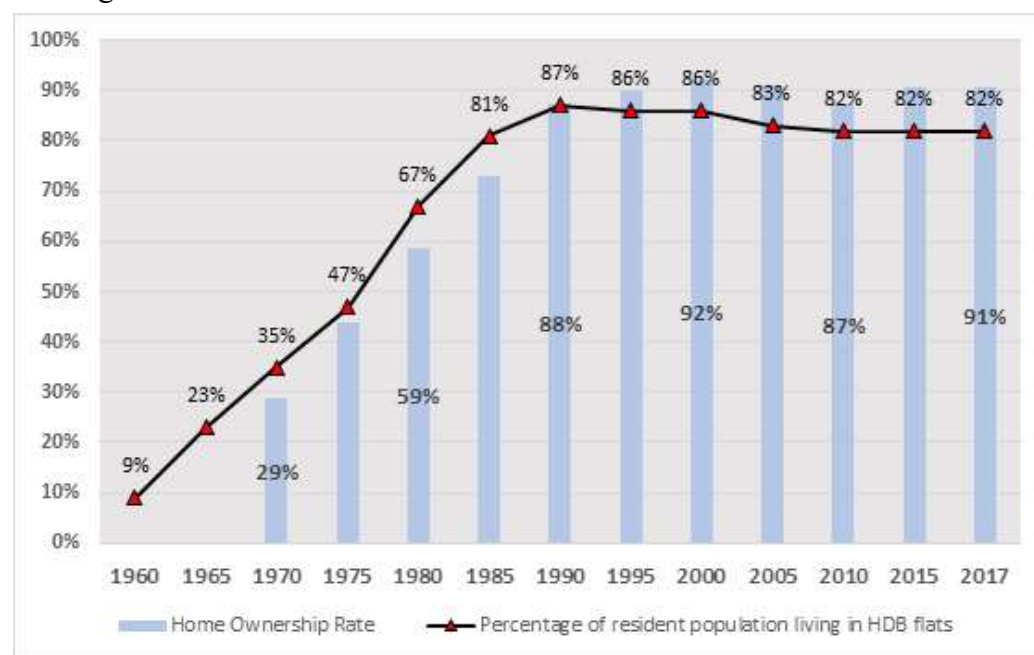


Figure 6: The Home Ownership Rate & The Percentage of Resident Population living in Housing and Development Board (HDB) Flats of Singapore.

NYCHA, as part of the government, has the advantage to apply digital regulation in every public house by policy and lawmaking. Everyone who lives in the public home offered by NYCHA will be digitally managed by NYCHA's network. For example, the government can check the households' transactions and whether the right person lives in the house. Compensations for expenses of privacy will be made by lowering the price or rent of the public houses. Frauds will be greatly reduced by the transparency of financial regulations. People who actually need homes can access the resources more easily.

SWOT Analysis: How Data-Driven Methods benefit NYCHA and Public Housing in the Long Run.

Data-Driven Methods for NYCHA	
Strengths	Weaknesses
<p>Make Data-driven Decisions: Decisions such as improving public housing pipes, choosing ideal community locations, would be based on comprehensive and systematic data analysis.</p> <p>Create Unbiased Opportunities for All New Yorkers in Need: NYCHA will identify those low-income people and use rational data analysis tools to help those people who are most in need of public housing.</p>	<p>Higher Investment and Lack of Funding: Current funding is not enough to support all low-income New Yorkers to receive public housing or financing to support themselves. Therefore, an increase of funding is needed from donors, government fundings, and stakeholders. But the process would be hard and requires effort.</p>
Opportunities	Threats
<p>Cost Saving in the Long Run: More money would be saved based on gradually grown information and algorithms, lowering down the \$40 billion capital repair deficit of NYCHA.</p> <p>Potential Public Housing Model in the U.S.: Solving the public housing of NYC can be a great example of government reform.</p>	<p>Without Governmental Support: If the government does not provide enough funding and information disclosure, there is no way that the program can produce a satisfying result.</p>

Overall, the data-driven reform can make NYCHA serve more New Yorkers for public housing with better service quality, and change the deficit situation and public image of NYCHA. Initial reformation cost, which is the main and only weakness of the data-driven reform, is reasonable and beneficial in the long run. The plan explains why the initial cost is negligible considering the sustainable gain from the data-driven innovation.

Implementation Details

New York City Housing Authority (NYCHA) still needs to put additional efforts into data-driven reform to ensure the strategies can produce an outstanding result. The implementation details below can both fulfill the prerequisites of the reform and improve NYCHA's overall performance in public housing services.

Key Staff Training for Better Data Capacity and Maintenance of NYCHA

Current NYCHA does not have sufficient and useful datasets specifically for machine learning algorithms. Therefore, more specific categories of NYCHA building and resident information need to be collected to predict which housing units are most in need of repairs or upgrades, and to identify neighborhoods where additional social services may be needed to support residents of NYCHA. In order to accomplish that, staff training and additional monitoring devices are needed to collect valid datasets.

The specific datasets that NYCHA should maintain are listed below:

- NYCHA staff should use survey forms and application information to record the dataset of demographics of public housing residents, including information on income, employment, and household size;
- NYCHA should implement sensors for household temperature, and monitors for water, electricity, and gas. Both digital and paper feedback forms should also be provided for residents to keep track of the condition of individual public housing units, including information on maintenance needs, repairs, and upgrades;
- All existing case management should also be recorded by the staff of NYCHA to review and improve the future services for public housing residents;
- NYCHA can also build strong connections and partnerships with other departments of the NYC government to get the most updated information on economic and social conditions in the neighborhoods where public housing is located, including information on crime rates, public health outcomes, and access to education and transportation.

In addition, NYCHA, as a government institution, should always have timely data transparency for suggestions and improvements from both inside and outside of the agency. The validity of the data published also needs to be guaranteed in order to receive useful advice and analysis. NYCHA should aim for both data transparency and validity to ensure that the residents can receive decent quality services.

Equity Ensurance among Applicants of Public Housing

When New Yorkers are applying for public housing, they need to answer questions such as age, gender, and race. This would create a potential bias and inequity based on their personal background. Therefore, all unnecessary information should not be collected to create an equal and diverse NYCHA community. However, the income level and the personal net asset value of each applicant need to be assessed because only the personal financial condition would demonstrate the urgency and necessity of their need for public housing.

Partnerships Enhancement

Existing Partners

- The Food Bank NYC, Community Service Society, NYC Health, and NYC Small Business Services, etc. These partnerships can be helpful for low-income residents to receive proper food, health, social, and employment support from the NYCHA community, which can be a chance for them to get out of poverty and pursue their American dreams. NYCHA needs to play a role as the representative of the NYCHA residents rather than intermediaries who profit from both sides. Enforcing the interests of the residents should be the goal of the partnerships.
- JPMorgan Chase & Co., The Rockefeller Foundation, and Citi. These financial institutions can support NYCHA residents financially. However, most New Yorkers who need financial help cannot receive support. Financial access for those New Yorkers in extremely low-income families should be granted in a larger amount to address the housing problems for them. It is a problem that only New York City government institutions such as NYCHA can address rather than disadvantaged groups such as low-income New Yorkers.



Proposed Partners

- New York University, Center of Urban Science + Progress and Stern Business School. Although NYCHA has many partners in business and public needs areas, there is a lack of research and consulting teams to figure out its own problems. NYU CUSP can help NYCHA to process, analyze data and propose suggestions to improve NYCHA's service quality and efficiency based on machine learning and big data analysis, while Stern Business School can optimize the cost of the reforms and improvements based on NYCHA data and CUSP analysis results. In this way, NYCHA can make better reforms that can address the public housing problems.



Conclusion

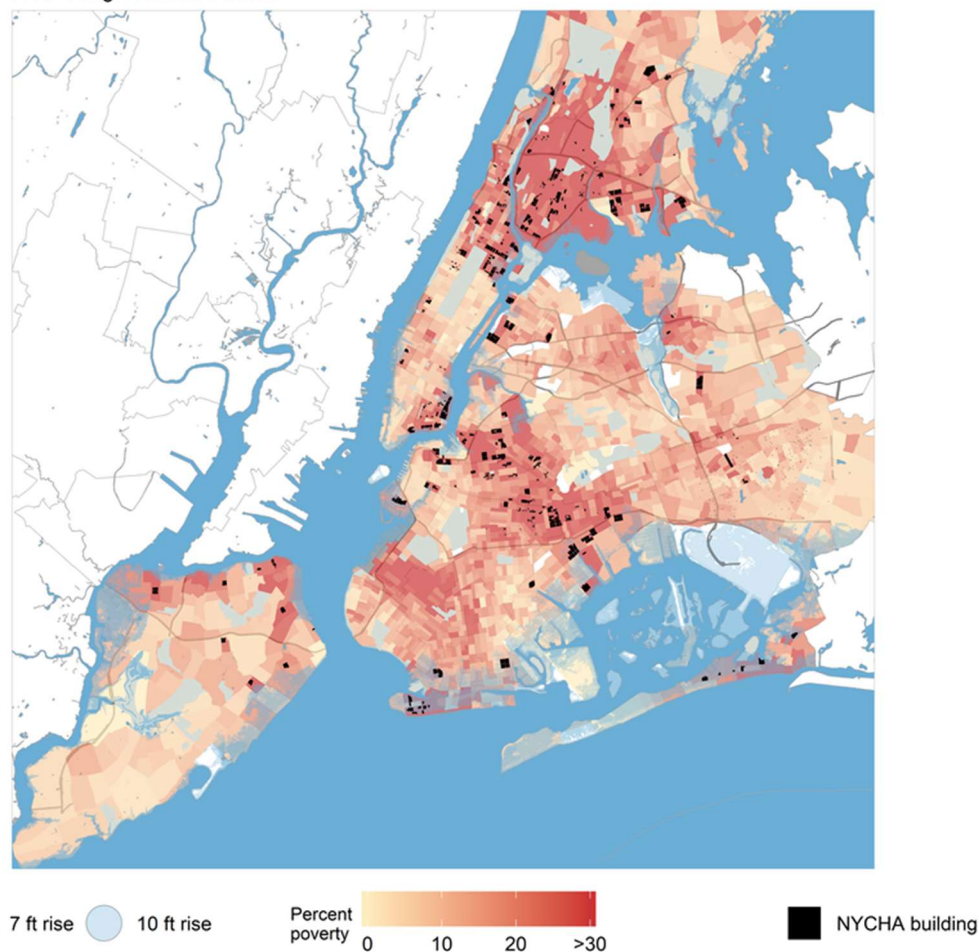
Even though New York City faces a great housing crisis and NYCHA is not in a fully functional condition to provide public housing, there are still methods to fix the current problems. Based on data-driven methods, NYCHA reforms can be successful in the long run and help more and more New Yorkers who need public housing support in an effective and efficient manner.

This reform could become an important legacy for both the current New York City mayor Eric Adams and the Interim Chief Executive Officer of NYCHA, Lisa Bova-Hiatt. Solving the public housing problems in New York City is not only a success for all New Yorkers, but also set a standard for big cities all around the world to show how technologies can make a huge difference in urban development.

Appendix

Appendix 1: Citywide NYCHA building and Poverty Rate of Each District in NYC

NYC Congressional Districts



Appendix 2: Number of Maintenance Deficiencies by Borough, Year Built, and Building Size in New York City

	Occupied Housing Units									
	No Maintenance Deficiencies			1-2 Maintenance Deficiencies			3+ Maintenance Deficiencies			Total
	Estimate	MOE	%	Estimate	MOE	%	Estimate	MOE	%	
Borough										
Bronx	212,200	± 18,180	41%	164,800	± 14,580	32%	140,700	± 14,390	27%	517,500
Brooklyn	589,600	± 23,840	59%	292,200	± 19,390	29%	117,500	± 11,410	12%	999,200
Manhattan	377,500	± 19,970	56%	202,700	± 13,850	30%	88,510	± 9,344	13%	668,800
Queens	473,700	± 22,480	59%	252,300	± 18,100	31%	76,730	± 10,390	10%	802,800
Staten Island	120,500	± 11,080	71%	41,660	± 7,062	25%	6,562**	± 2,482**	4%**	168,700
Year Built										
Before 1947	935,900	± 36,500	53%	569,900	± 25,910	32%	273,000	± 20,940	15%	1,779,000
1947-1973	482,200	± 25,360	56%	253,500	± 18,220	30%	119,900	± 10,520	14%	855,600
1974-1999	163,500	± 14,760	68%	58,930	± 9,325	24%	19,120	± 5,072	8%	241,500
2000 or later	192,000	± 16,670	68%	71,360	± 8,906	25%	17,850	± 4,511	6%	281,200
Building Size										
1-2 Units	568,500	± 28,850	65%	248,200	± 20,190	29%	52,640	± 8,498	6%	869,300
3-5 Units	217,500	± 17,630	59%	119,200	± 15,620	32%	32,440	± 9,415	9%	369,200
6-19 Units	188,700	± 16,240	51%	119,500	± 11,920	32%	62,030	± 10,130	17%	370,300
20-49 Units	216,300	± 19,840	44%	157,000	± 14,160	32%	122,200	± 12,420	25%	495,500
50-99 Units	218,600	± 17,150	49%	148,000	± 13,370	33%	83,570	± 9,413	19%	450,100
100+ Units	364,000	± 21,910	60%	161,600	± 14,130	27%	77,040	± 8,044	13%	602,700
Citywide	1,773,000	± 42,210	56%	953,600	± 31,930	30%	429,900	± 23,590	14%	3,157,000

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