



# AFFORDABLE HOUSING

An  
Overview

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# Contents

- Affordable Housing: Macro Level
- Affordable Housing: Micro Level
- Affordable Housing Construction Technology: Modular Construction
- Industry Perspectives on Modular Construction

# Affordable Housing: Macro Level

- Global Overview
- Hong Kong vs. Singapore Comparison
- State of Housing Affordability in NYC and SF
- NYC Affordable Housing Tax Credits

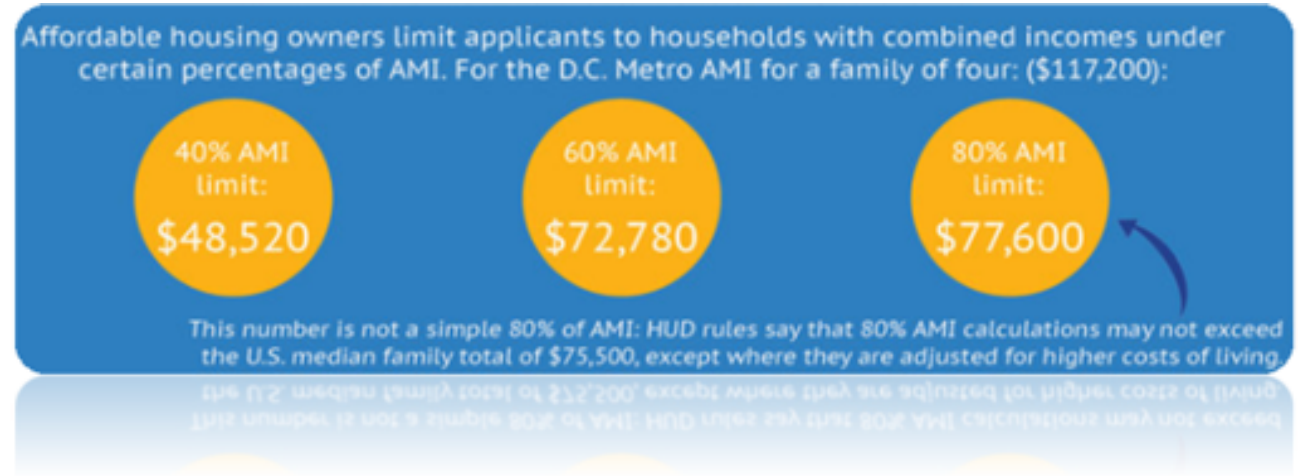
# Key Terms

## Affordable Housing



Housing is “affordable” if a family spends no more than 30% of their income to live there

## Area Median Income



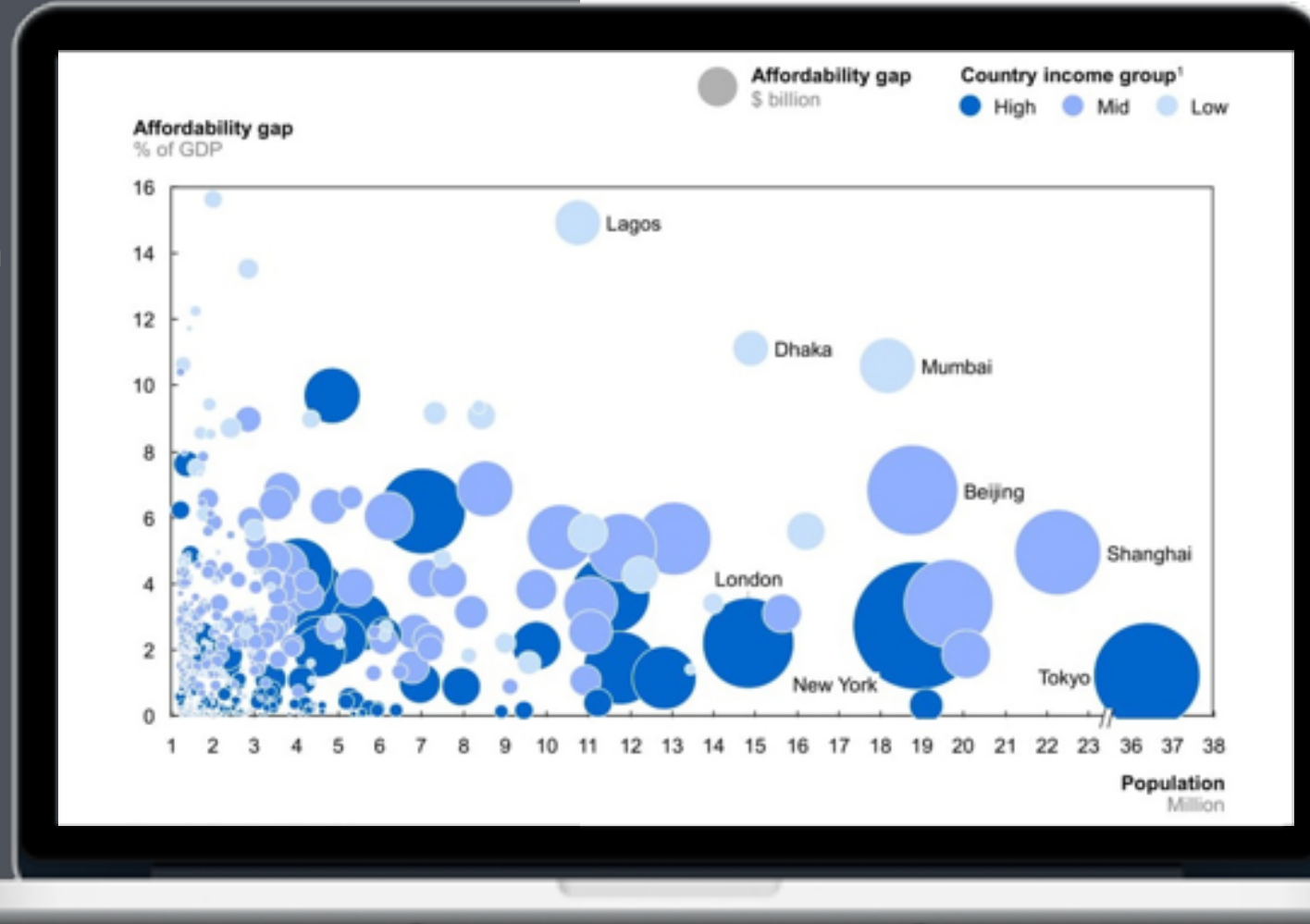
“Median” means that half of a geographic area’s household income is above that midpoint, while the other half is below that amount.



# Affordability Gap

- 2400 cities
- Population > 200,000
- Earning < 80% Area Median Income
- **Housing Gap 2025:**  
440 million households  
1.6 billion people.

- In monetary terms,
- \$650 billion affordability gap per year globally
  - \$16 trillion estimated investment.

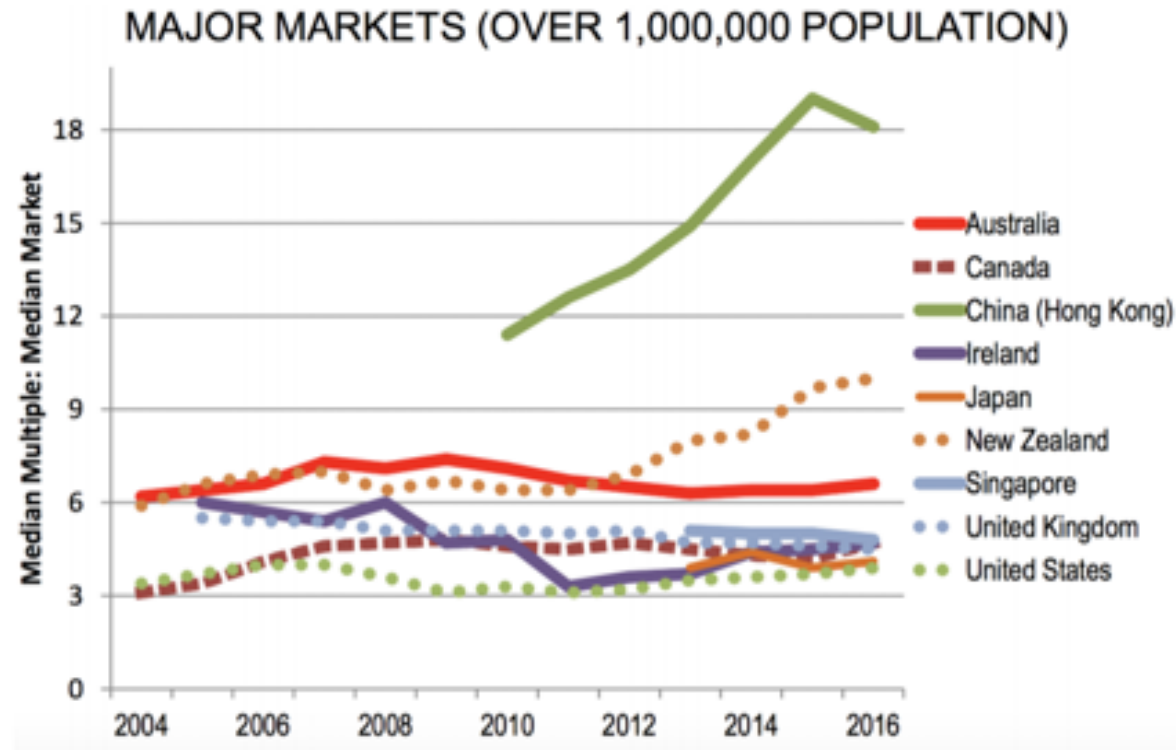


Source: World Bank; UBS Prices and Earnings Report 2012; Numbeo; CEIC; Deposits.org; Global Banking Pool; Royal Bank of Scotland; Zillow; Metroscubicos; Exame; Notaires Paris Ile de France; Jones Lang LaSalle; McKinsey Global Institute Cityscope database; US Census Bureau; national statistics offices; McKinsey Global Institute analysis

# Least Affordable Housing Markets



# Housing Affordability: 2004-16



for housing affordability in major housing markets with over 1 million population.

Figure 1: Housing Affordability in Major Housing Markets with Over 1 Million

Population (2004-2016)<sup>3</sup>



# SINGAPORE

MEDIAN PROPERTY VALUE

**\$874,372**

HOMEOWNERSHIP

**90.5%**

MEDIAN HOUSEHOLD INCOME

**\$81,908**

# HONG KONG

MEDIAN PROPERTY VALUE

**\$1.2M**

HOMEOWNERSHIP

**51.2%**

MEDIAN HOUSEHOLD INCOME

**\$42,169**

# Home Ownership Hong Kong vs Singapore

## Different Models

Hong Kong's private housing makes up 79% of market while Singapore's is at 19.9%

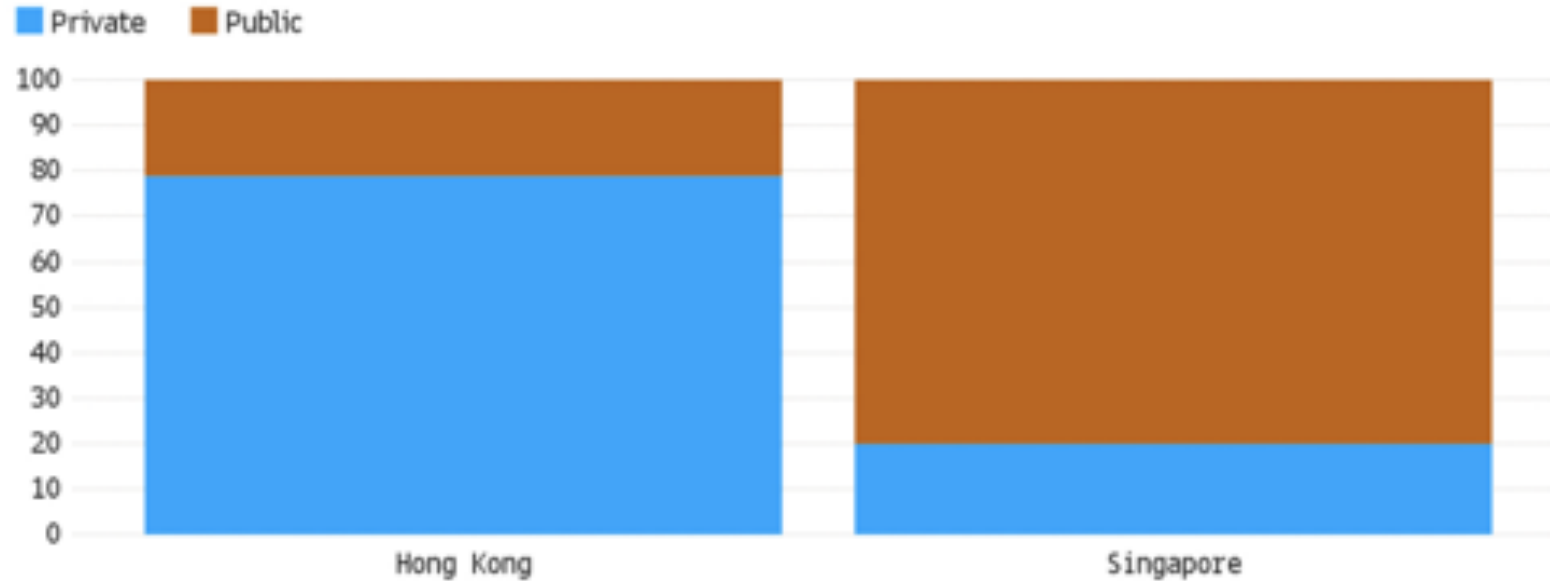


Figure 2: Different Models of Housing Markets in Hong Kong and Singapore

# Geographic, Social and Economic Proximity between Hong Kong and Singapore

- Located at the heart of the Asian continent
- Population Growth  
Hong Kong : 1%  
Singapore : 1.2%
- Fairly equal average salaries in both the cities
- Low unemployment rate
- High foreign investments with tax friendly policies

| Selected Economic and Social Indicators       |           |           |
|---|-----------|-----------|
|   | Hong Kong | Singapore |
| Real Growth in GDP (%)                        | 2.6       | 4.7       |
| Per Capita GNI (US\$)                         | 39,220    | 53,929    |
| Unemployment Rate (%)                         | 3.4       | 1.9       |
| Labor Force Participation Rate (%)            |           |           |
| Males   | 69        | 76        |
| Females                                       | 55        | 58        |
| Inflation Rate (%)                            | 4.3       | 2.4       |
| Population (million)                          | 7.2       | 5.4       |
| Life Expectancy at Birth (years)              |           |           |
| Males   | 81.1      | 80.1      |
| Females                                       | 86.7      | 84.5      |
| Infant Mortality Rate (per 1,000 live-births) | 1.8       | 2.0       |
| Total Fertility Rate (per female)             | 1.12      | 1.19      |
| Doctors Per 10,000 Population                 | 18        | 20        |
| Home Ownership (%)                            | 51.2      | 90.5      |

Department of Statistics Singapore, Singapore in Figures 2016 : [https://www.singstat.gov.sg/docs/default-source/default-documentlibrary/publications/publications\\_and\\_papers/reference/sif2016.pdf](https://www.singstat.gov.sg/docs/default-source/default-documentlibrary/publications/publications_and_papers/reference/sif2016.pdf).

Government of Hong Kong SAR, Hong Kong Fact Sheets, <https://www.gov.hk/en/about/abouthk/factsheets/>



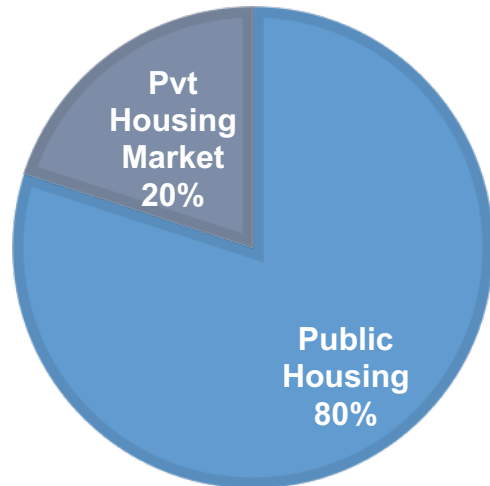
# Comparing the Two Cities Public Housing Policies

## Singapore

- Housing Development Board (HBD)
- 5% of land classified as protected.
- Sovereign controlled social security: Central Provident Fund
- \$20,000 subsidy for first time purchase
- 45% above the average median household income

### HOUSING BREAK DOWN

■ Public Housing   ■ Pvt Housing Market

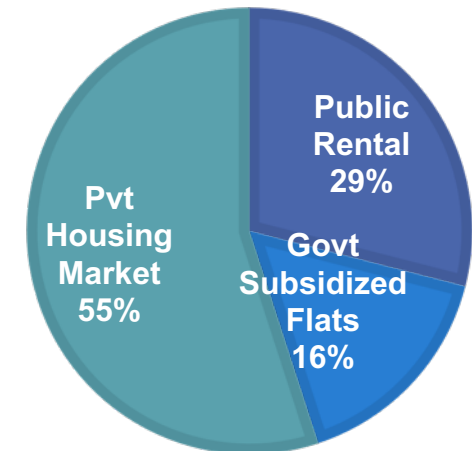


## Hong Kong

- Hong Kong Housing Authority (HKHA)
- 40% of land classified as protected
- Average subsidy of 1,700 HKD. Less than 1/5<sup>th</sup> of average income
- 14% below average household income

### HOUSING BREAK DOWN

■ Public Rental   ■ Govt Subsidized Flats  
■ Pvt Housing Market



# UNITED STATES

MEDIAN PROPERTY VALUE

**\$217,600**

HOMEOWNERSHIP

**63.9%**

MEDIAN HOUSEHOLD INCOME

**\$60,336**

# SAN FRANCISCO, CA

MEDIAN PROPERTY VALUE

**\$1.1M**

HOMEOWNERSHIP

**36.5%**

MEDIAN HOUSEHOLD INCOME

**\$110,816**

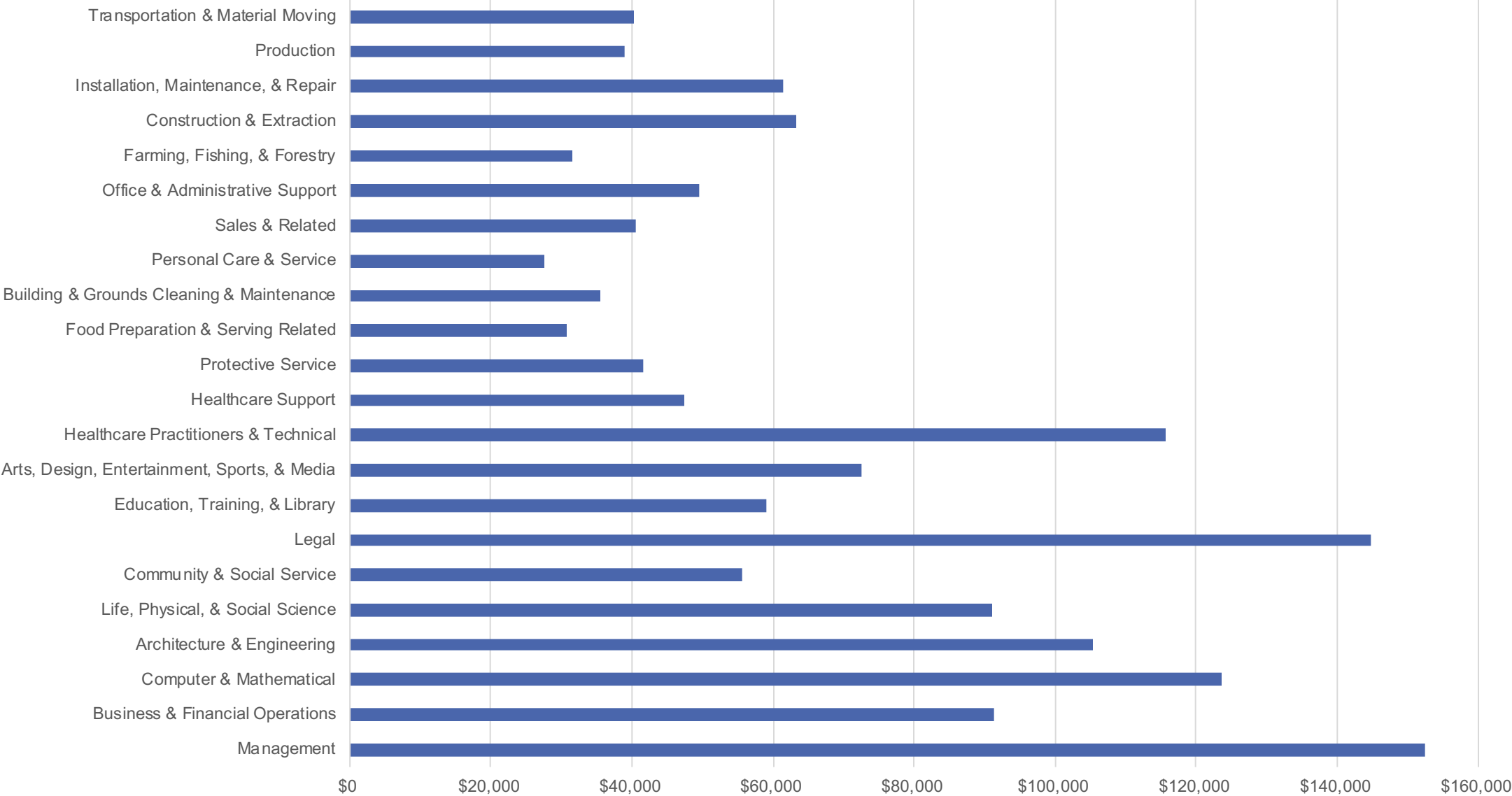
# San Francisco's Living Wage Calculator Data

| 1 ADULT                             |            |          |            | 2 ADULTS(1 WORKING) |            |          |            | 2 ADULTS(BOTH WORKING) |            |          |            |            |
|-------------------------------------|------------|----------|------------|---------------------|------------|----------|------------|------------------------|------------|----------|------------|------------|
|                                     | 0 Children | 1 Child  | 2 Children | 3 Children          | 0 Children | 1 Child  | 2 Children | 3 Children             | 0 Children | 1 Child  | 2 Children | 3 Children |
| Food                                | \$3,573    | \$5,267  | \$7,929    | \$10,517            | \$6,551    | \$8,154  | \$10,529   | \$12,820               | \$6,551    | \$8,154  | \$10,529   | \$12,820   |
| Child Care                          | \$0        | \$8,311  | \$13,997   | \$19,683            | \$0        | \$0      | \$0        | \$0                    | \$0        | \$8,311  | \$13,997   | \$19,683   |
| Medical                             | \$2,121    | \$6,965  | \$6,622    | \$6,704             | \$5,271    | \$6,622  | \$6,704    | \$6,423                | \$5,271    | \$6,622  | \$6,704    | \$6,423    |
| Housing                             | \$20,794   | \$31,815 | \$31,815   | \$42,783            | \$25,404   | \$31,815 | \$31,815   | \$42,783               | \$20,794   | \$31,815 | \$31,815   | \$42,783   |
| Transportation                      | \$4,206    | \$7,664  | \$9,011    | \$10,425            | \$7,664    | \$9,011  | \$10,425   | \$10,307               | \$7,664    | \$9,011  | \$10,425   | \$10,307   |
| Other                               | \$2,976    | \$4,951  | \$5,375    | \$6,256             | \$4,951    | \$5,375  | \$6,256    | \$6,121                | \$4,951    | \$5,375  | \$6,256    | \$6,121    |
| Required annual income after taxes  | \$33,671   | \$64,972 | \$74,749   | \$96,368            | \$49,840   | \$60,977 | \$65,729   | \$78,455               | \$45,230   | \$69,288 | \$79,726   | \$98,138   |
| Annual taxes                        | \$5,298    | \$11,505 | \$13,778   | \$18,490            | \$8,331    | \$10,599 | \$11,681   | \$14,325               | \$7,688    | \$12,508 | \$14,935   | \$18,902   |
| Required annual income before taxes | \$38,968   | \$76,476 | \$88,527   | \$114,859           | \$58,172   | \$71,576 | \$77,410   | \$92,780               | \$52,918   | \$81,795 | \$94,661   | \$117,039  |

Source: livingwage.mit.edu

A family of four with 2 adults working needs at least \$94,661/yr to afford basic living expenses

# Typical Annual Salary For Various Professions in SF





# UNITED STATES

MEDIAN PROPERTY VALUE

**\$217,600**

HOMEOWNERSHIP

**63.9%**

MEDIAN HOUSEHOLD INCOME

**\$60,336**

# NEW YORK, NY

MEDIAN PROPERTY VALUE

**\$609,500**

HOMEOWNERSHIP

**32.7%**

MEDIAN HOUSEHOLD INCOME

**\$60,879**

# New York City's Living Wage Calculator Data

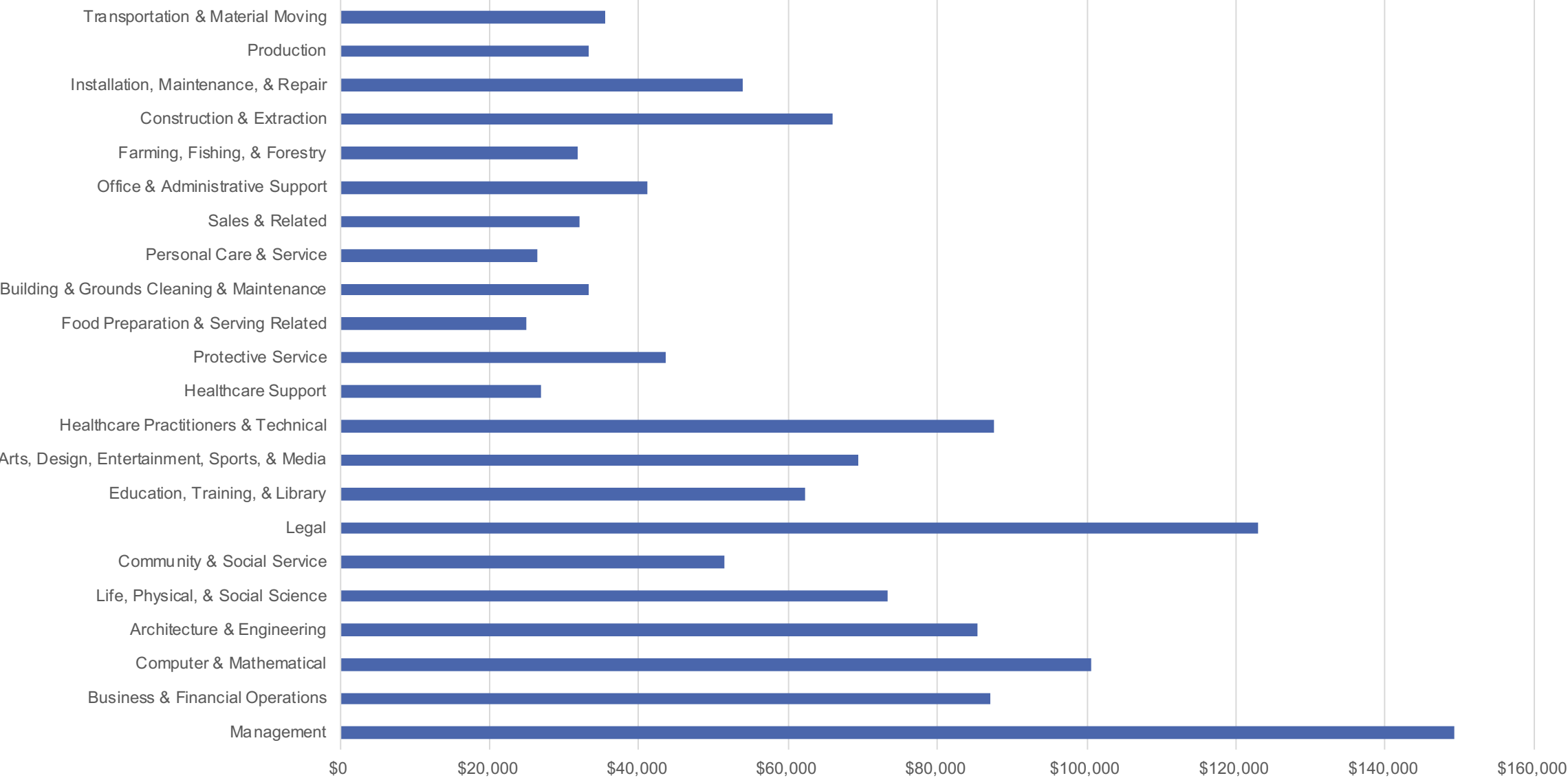
|                                     | 1 ADULT    |          |            |            | 2 ADULTS(1 WORKING) |          |            |            | 2 ADULTS(BOTH WORKING) |          |            |            |
|-------------------------------------|------------|----------|------------|------------|---------------------|----------|------------|------------|------------------------|----------|------------|------------|
|                                     | 0 Children | 1 Child  | 2 Children | 3 Children | 0 Children          | 1 Child  | 2 Children | 3 Children | 0 Children             | 1 Child  | 2 Children | 3 Children |
| Food                                | \$3,477    | \$5,124  | \$7,715    | \$10,233   | \$6,374             | \$7,933  | \$10,245   | \$12,474   | \$6,374                | \$7,933  | \$10,245   | \$12,474   |
| Child Care                          | \$0        | \$10,602 | \$23,215   | \$35,828   | \$0                 | \$0      | \$0        | \$0        | \$0                    | \$10,602 | \$23,215   | \$35,828   |
| Medical                             | \$2,338    | \$6,811  | \$6,468    | \$6,550    | \$5,469             | \$6,468  | \$6,550    | \$6,269    | \$5,469                | \$6,468  | \$6,550    | \$6,269    |
| Housing                             | \$15,449   | \$20,273 | \$20,273   | \$26,007   | \$17,033            | \$20,273 | \$20,273   | \$26,007   | \$15,449               | \$20,273 | \$20,273   | \$26,007   |
| Transportation                      | \$3,893    | \$7,094  | \$8,341    | \$9,650    | \$7,094             | \$8,341  | \$9,650    | \$9,540    | \$7,094                | \$8,341  | \$9,650    | \$9,540    |
| Other                               | \$2,785    | \$4,633  | \$5,030    | \$5,855    | \$4,633             | \$5,030  | \$5,855    | \$5,729    | \$4,633                | \$5,030  | \$5,855    | \$5,729    |
| Required annual income after taxes  | \$27,942   | \$54,537 | \$71,042   | \$94,122   | \$40,602            | \$48,045 | \$52,572   | \$60,019   | \$39,018               | \$58,647 | \$75,787   | \$95,847   |
| Annual taxes                        | \$5,267    | \$10,642 | \$14,009   | \$18,694   | \$7,827             | \$9,318  | \$10,241   | \$11,712   | \$7,606                | \$11,481 | \$14,977   | \$19,049   |
| Required annual income before taxes | \$33,209   | \$65,179 | \$85,051   | \$112,816  | \$48,430            | \$57,363 | \$62,813   | \$71,731   | \$46,624               | \$70,127 | \$90,764   | \$114,896  |

Source: [livingwage.mit.edu](http://livingwage.mit.edu)

A family of four with 2 adults working needs at least \$90,764/yr to afford basic living expenses in NYC



# Typical Annual Salary For Various Professions in NYC





Total Development Fee



Total Source of funds



NOI

0 200 400 600 800 1000 1200



In sketch, the model calculates the following:

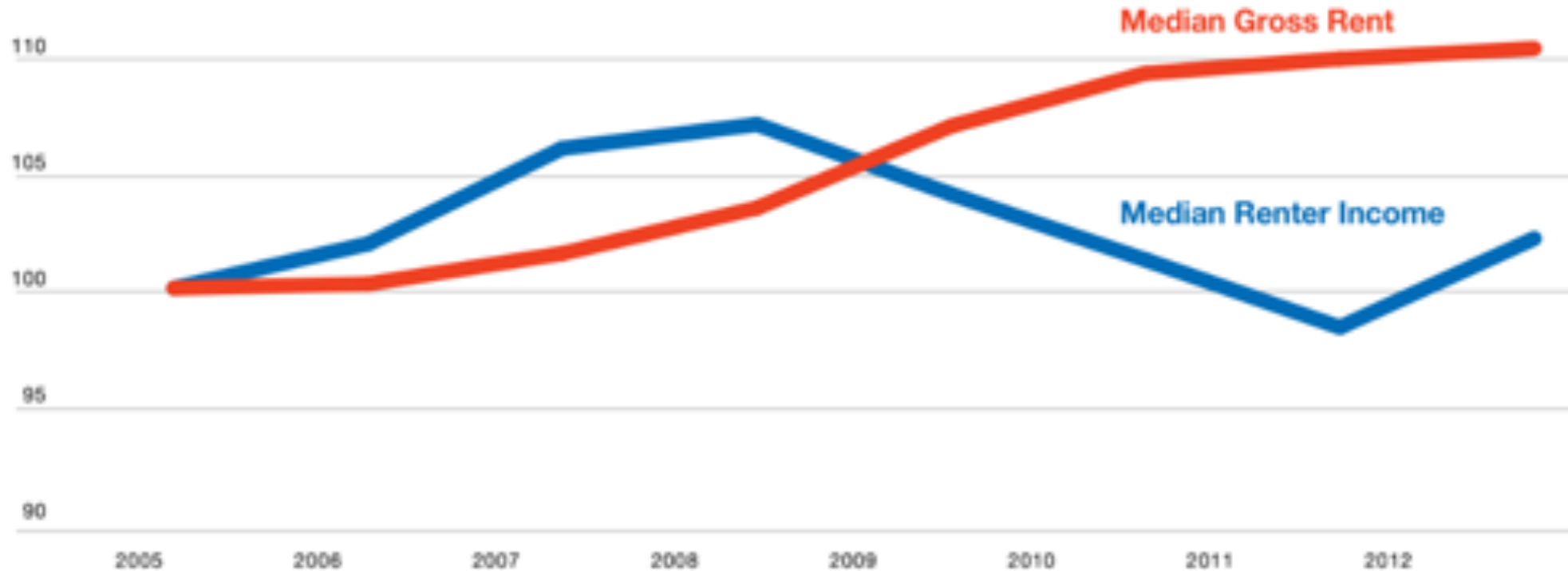
- + Property income from rents
- Expenses to operate the property
- Vacancy losses
- = Net operating income, or NOI

- + Maximum mortgage debt (calculated from NOI)
- + Tax credit equity
- + Other sources
- = Total sources of funds

- Acquisition cost
- Design and construction costs
- Financing fees
- Reserves
- Developer fee
- = Total development costs, or uses

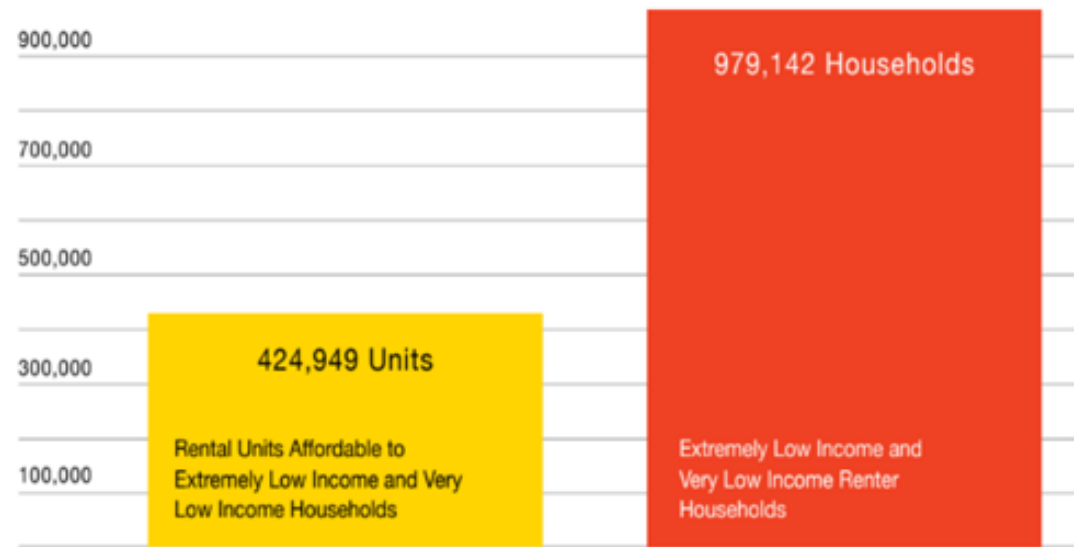
# Current Affordable Housing Crisis

Index of New York City Median Gross Rent and Renter Household Income, 2005 - 2012



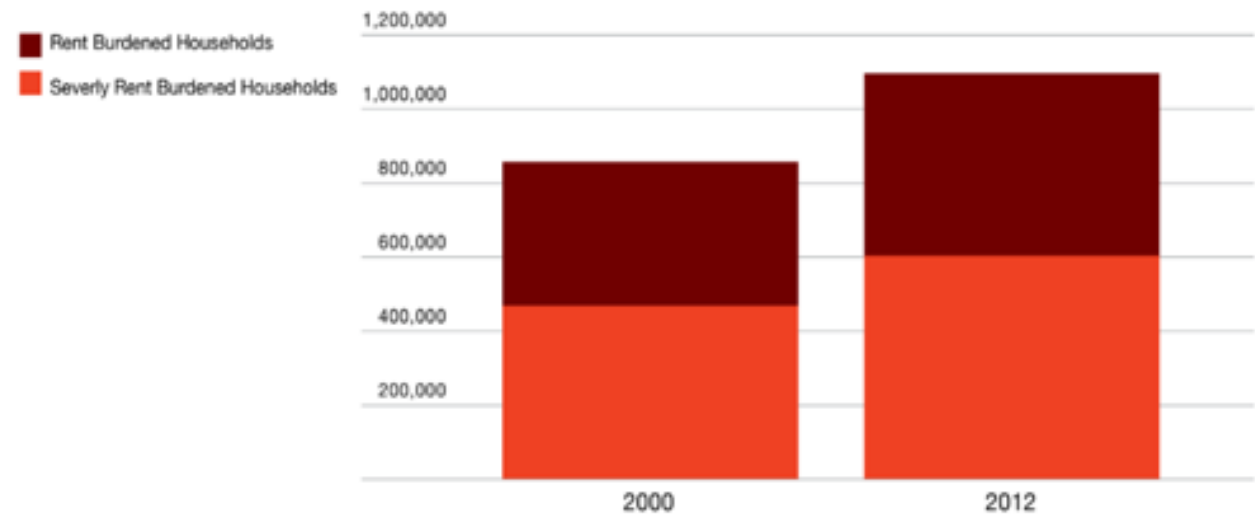
Source: Housing New York: A Five-Borough, Ten-Year Plan; [https://www1.nyc.gov/assets/housing/downloads/pdf/housing\\_plan.pdf](https://www1.nyc.gov/assets/housing/downloads/pdf/housing_plan.pdf)

# Current Affordable Housing Crisis

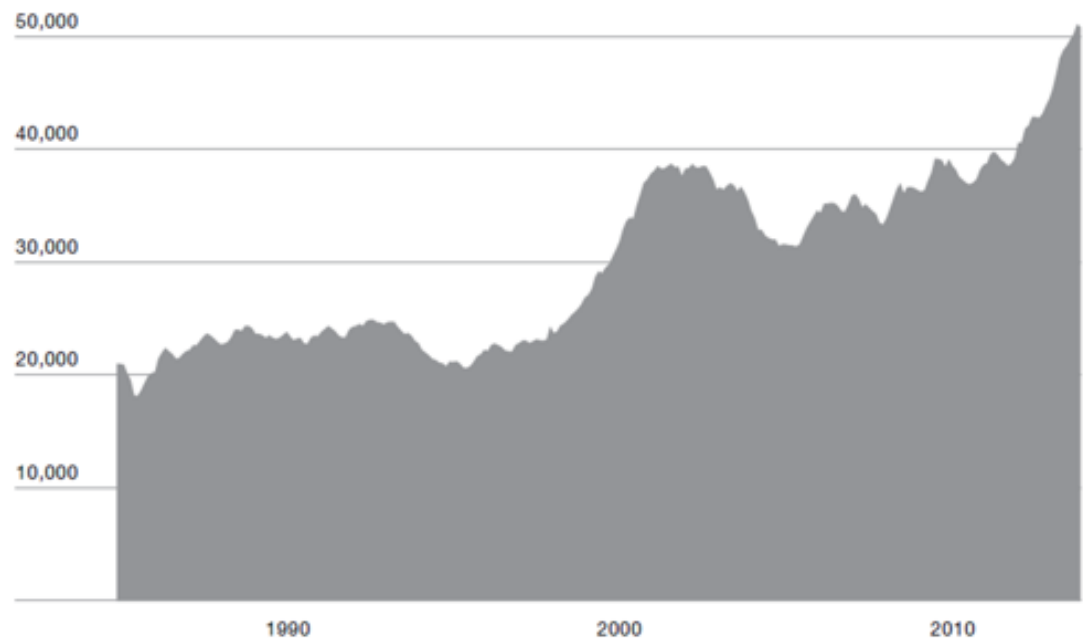


Source: Housing New York: A Five-Borough, Ten-Year Plan; [https://www1.nyc.gov/assets/housing/downloads/pdf/housing\\_plan.pdf](https://www1.nyc.gov/assets/housing/downloads/pdf/housing_plan.pdf)

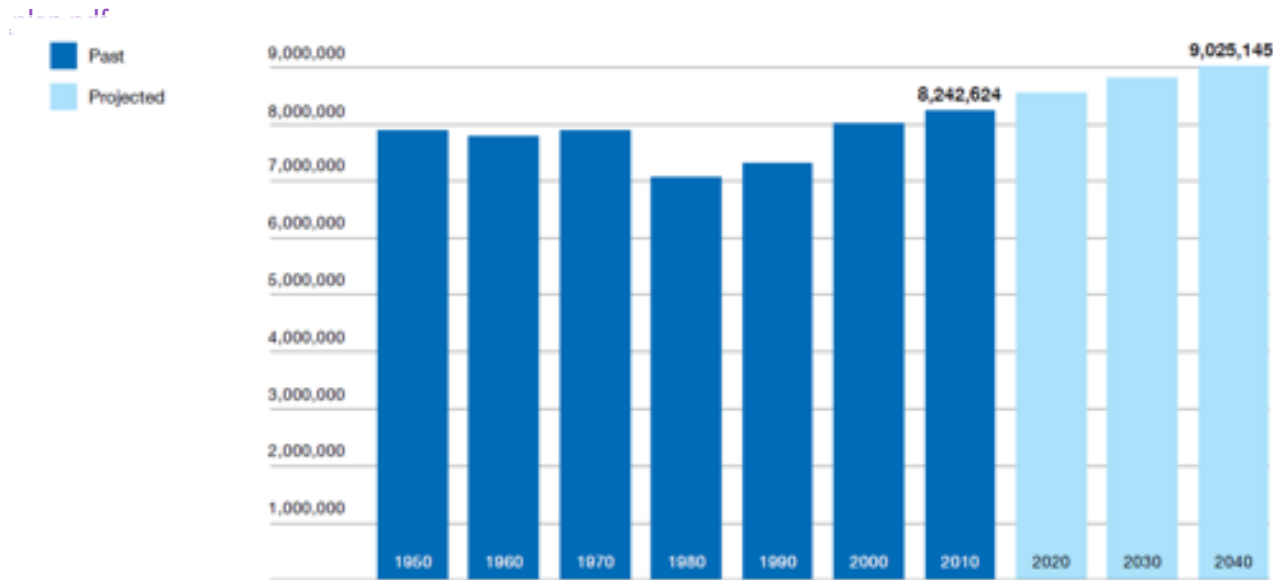
Source: Housing New York: A Five-Borough, Ten-Year Plan; [https://www1.nyc.gov/assets/housing/downloads/pdf/housing\\_plan.pdf](https://www1.nyc.gov/assets/housing/downloads/pdf/housing_plan.pdf)



# Current Affordable Housing Crisis

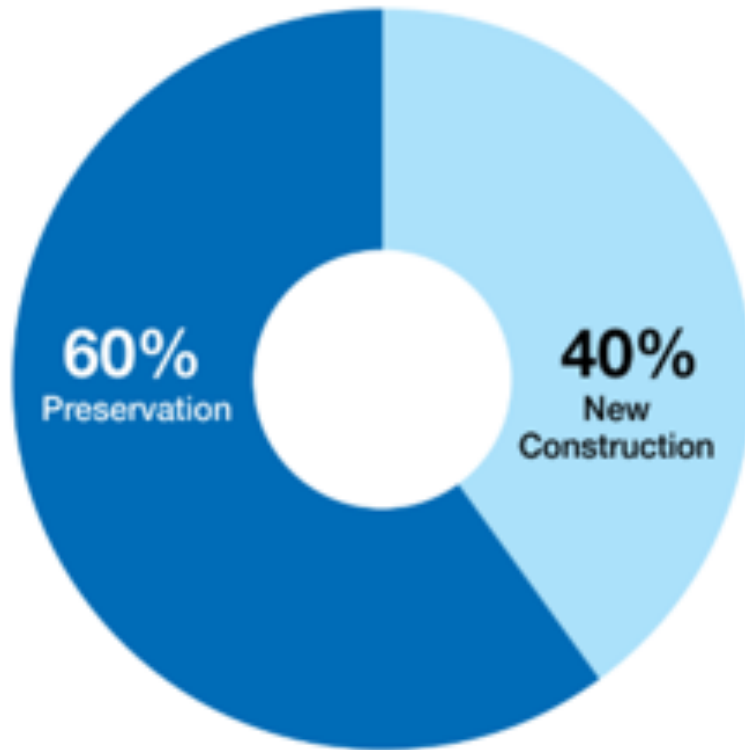


Source: Housing New York: A Five-Borough, Ten-Year Plan; [https://www1.nyc.gov/assets/housing/downloads/pdf/housing\\_plan.pdf](https://www1.nyc.gov/assets/housing/downloads/pdf/housing_plan.pdf)



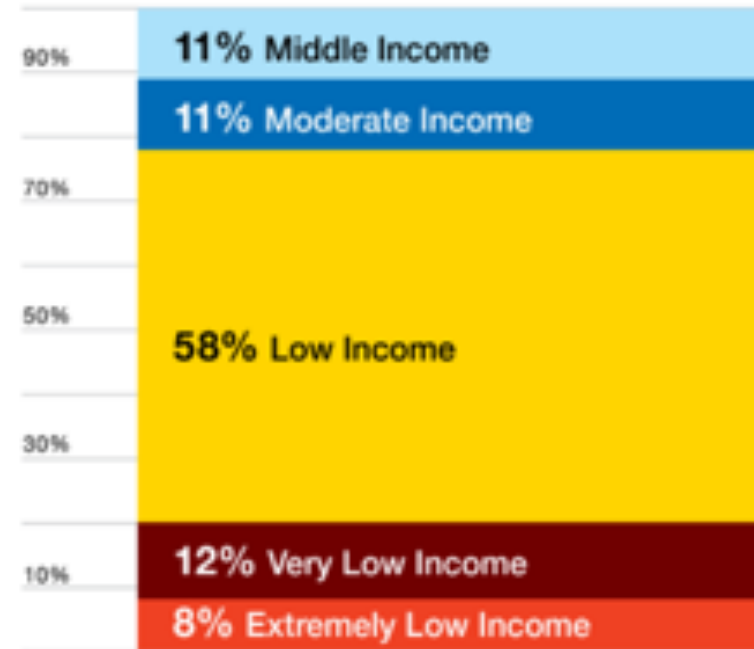
# New York, A Five-Borough Ten-Year Plan

**New Construction vs Preservation**



**Households Served**

Share of Housing Units Created or Preserved by Income Band



Source: Housing New York: A Five-Borough, Ten-Year Plan; [https://www1.nyc.gov/assets/housing/downloads/pdf/housing\\_plan.pdf](https://www1.nyc.gov/assets/housing/downloads/pdf/housing_plan.pdf)

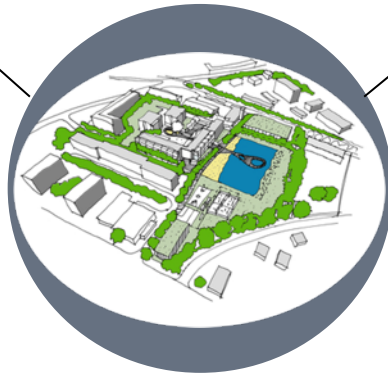


# Supply Side Value Chain

Land Acquisition  
& Securing Title



Funding Affordable  
Housing



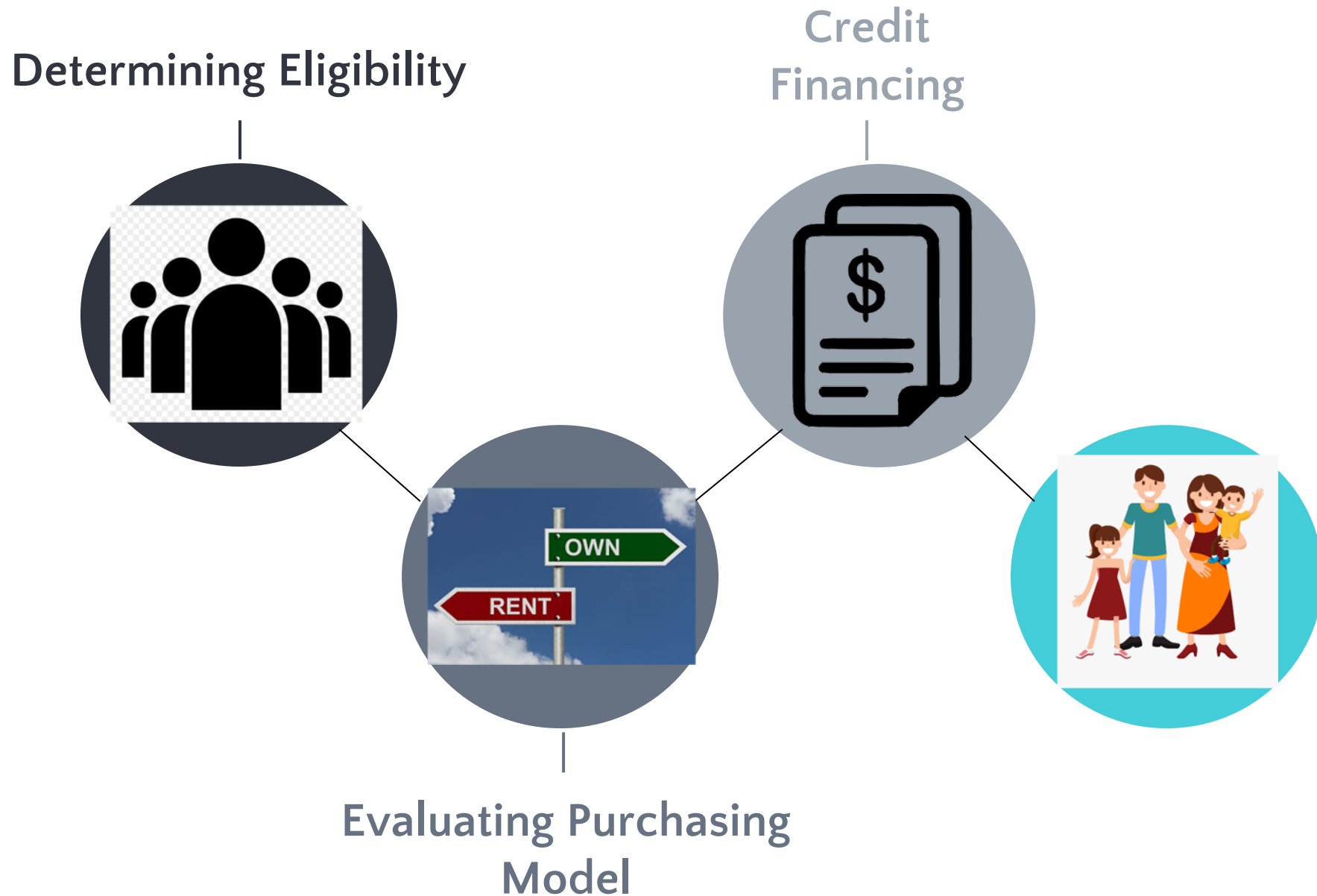
Land Use



Housing Design &  
Development Cost



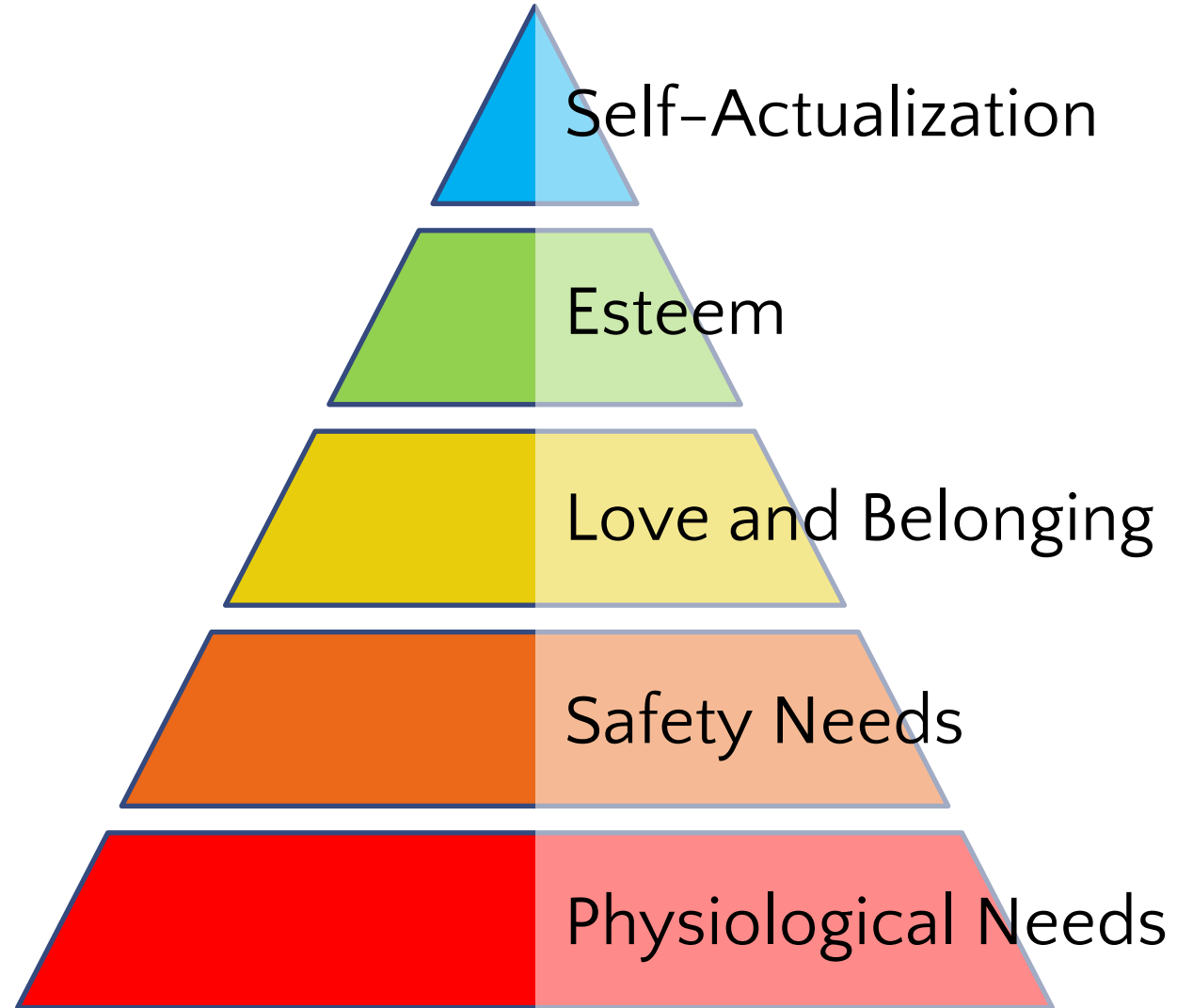
# Demand Side Value Chain



# Affordable Housing: Micro Level

- Maslow's Hierarchy of Needs
- Effects of housing on a person's well-being

# Maslow's Hierarchy of Needs



# Importance of Housing Stability on a Person's Well-Being

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Source: Project For Pride In Living

# Housing Instability & Health

## Delayed Healthcare

Budget trade-offs between health care costs and other household needs due to housing costs leads to reduced access to regular care and postponement of healthcare and medications

## Increased Anxiety

Adults who felt worried or stressed about their ability to pay their rent or mortgage were **3x** more likely to report mental distress and were almost **50%** more likely to have trouble sleeping – both of which can have long-term physical and mental health consequences.

Source: Center For Disease Control and Prevention

## Forms of Housing Instability



## Are Associated With...

### Health Risks for Children

General Poor Health  
Asthma  
Low Weight  
Developmental Delays  
Increased Lifetime Risk of Depression

### Health Risks for Adults

Reduced Access to Care  
Postponing Needed Health Care  
Postponing Needed Medications  
Mental Distress  
Difficulty Sleeping  
Incidents of Depression

Source: Enterprise Community Partners



# Housing Instability & Education



For low-income students, changing homes even **one time** in elementary school can have a negative effect on school performance, contributing to a long-lasting achievement gap.



# Affordable Housing Considerations: Transportation

Transit access can be a particularly critical issue for low-income older adults who no longer drive and rely on public transportation to reach necessary services, including medical and dental offices.

## *Transportation and Limited Job Access*



The average worker can only reach about **7%** of the jobs in their region with a one-way, **45 minute** transit commute.

And only **25%** of low- and middle-skill jobs are within a **90 minute** one-way transit commute of where low- and middle-income families live.

Source: The Brookings Institution

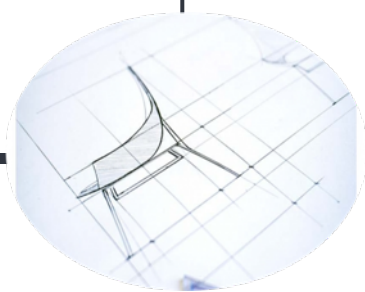
# Construction Technology: Modular Construction

- Modular Construction Overview
- Labor and Logistics Challenges
- Financing Challenges

# PHASES OF MODULAR CONSTRUCTION

## DESIGN

.CREATES THE DESCRIPTION  
OF BUILDINGS, BY DETAILED  
PLANS  
AND SPECIFICATIONS



PHASE 1

## PHASE 2

Structure  
Assembly



## MANUFACTURING & ASSEMBLY

FABRICATION AND  
ASSEMBLY OF MODULES  
IN A WAREHOUSE OR  
CASTING YARD.

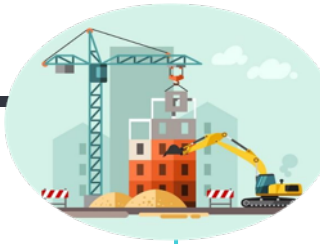
## TRANSPORTATION

ONCE THE MODULES ARE  
FABRICATED, THEY ARE READY TO  
BE TRANSPORTED TO THE SITE



PHASE 3

## PHASE 4



## INSTALLATION

. THE LAST AND FINAL  
STEP WHERE THE  
MODULES ARE ERECTED  
AND INSTALLED.



# Why Modular?



5% Reduction



5-10% Reduction



10-20% Reduction



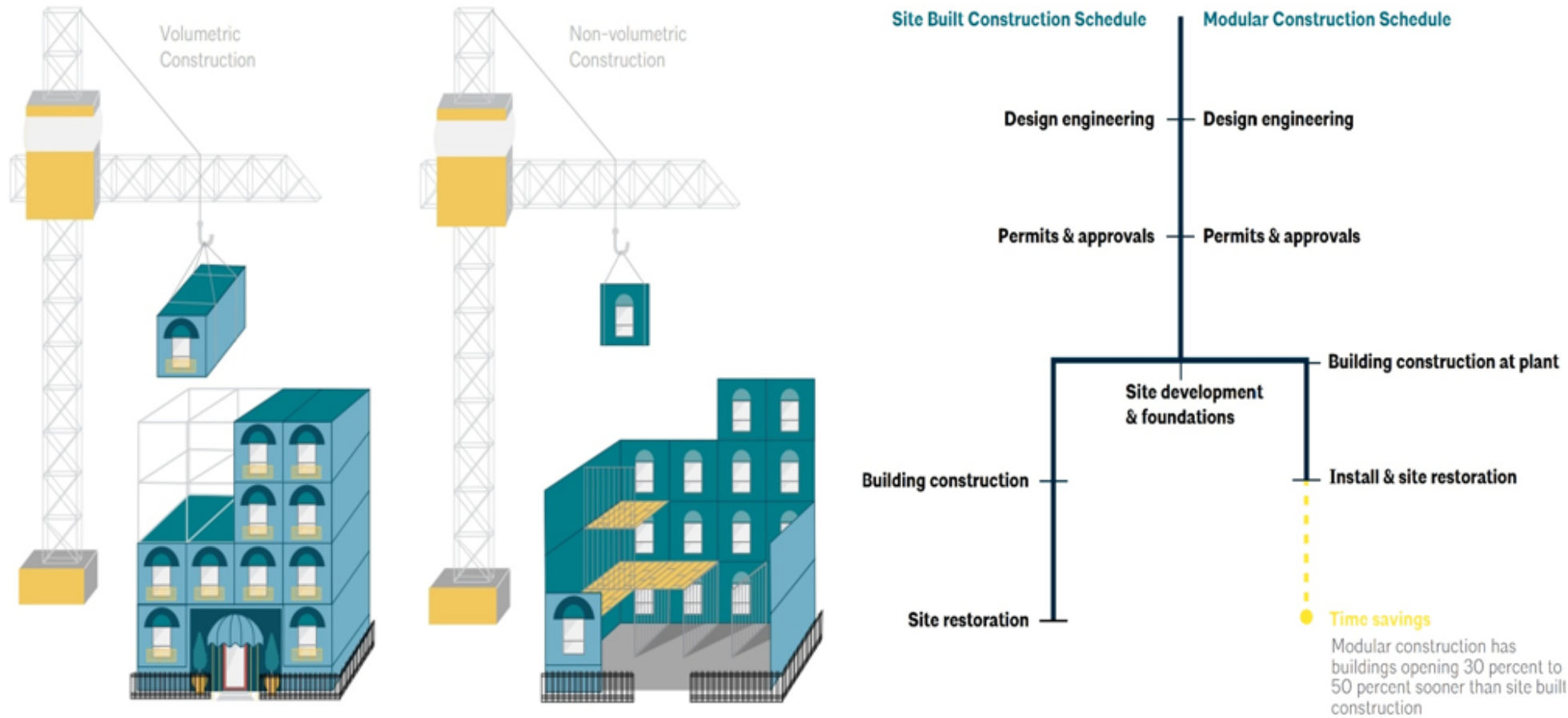
Increase in Productivity

Source: Mark Lawson, Ray Ogden, Chris Goodier; Design in Modular Construction



Benefits in Budget

# Conventional vs Modular Construction



Source: Modular Construction: From Projects to Products; McKinsey Capital Projects and Infrastructure



# MAIN CHALLENGES



**Design**

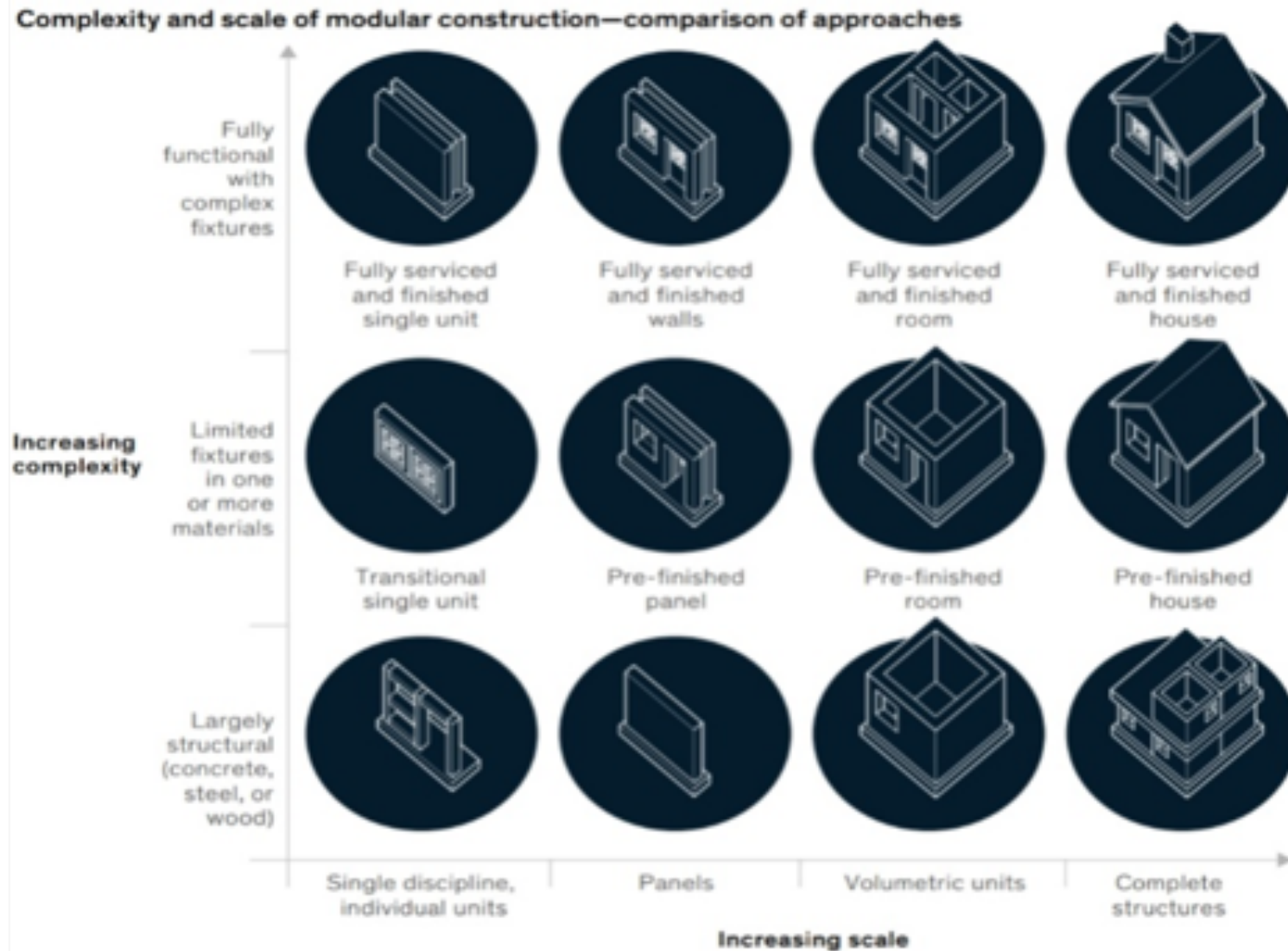


**Logistics**



**Finance**

# Impact of Increasing Complexity



Source: Case studies; interviews; McKinsey Capital Projects & Infrastructure

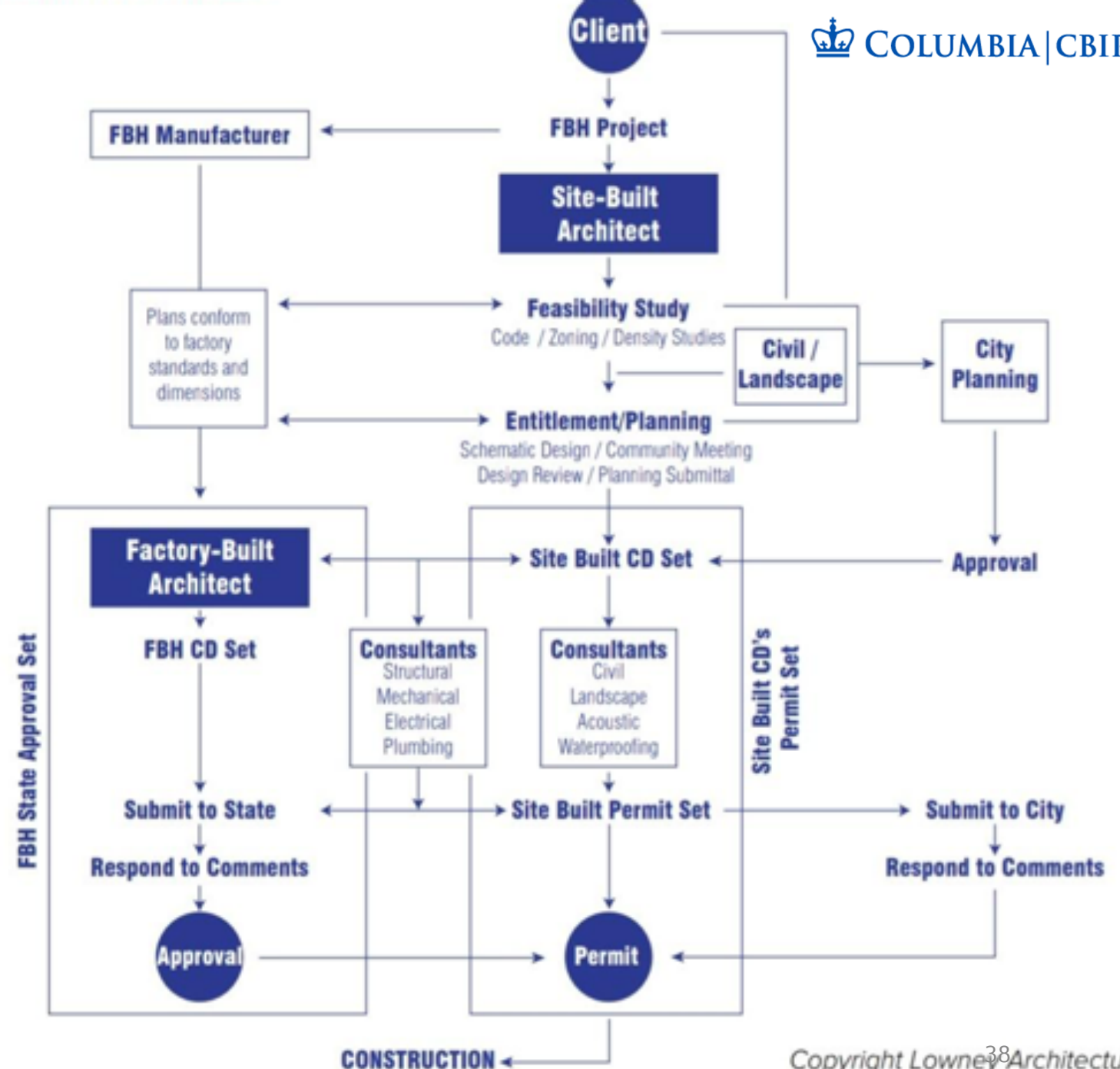
# Impact of Increasing Complexity



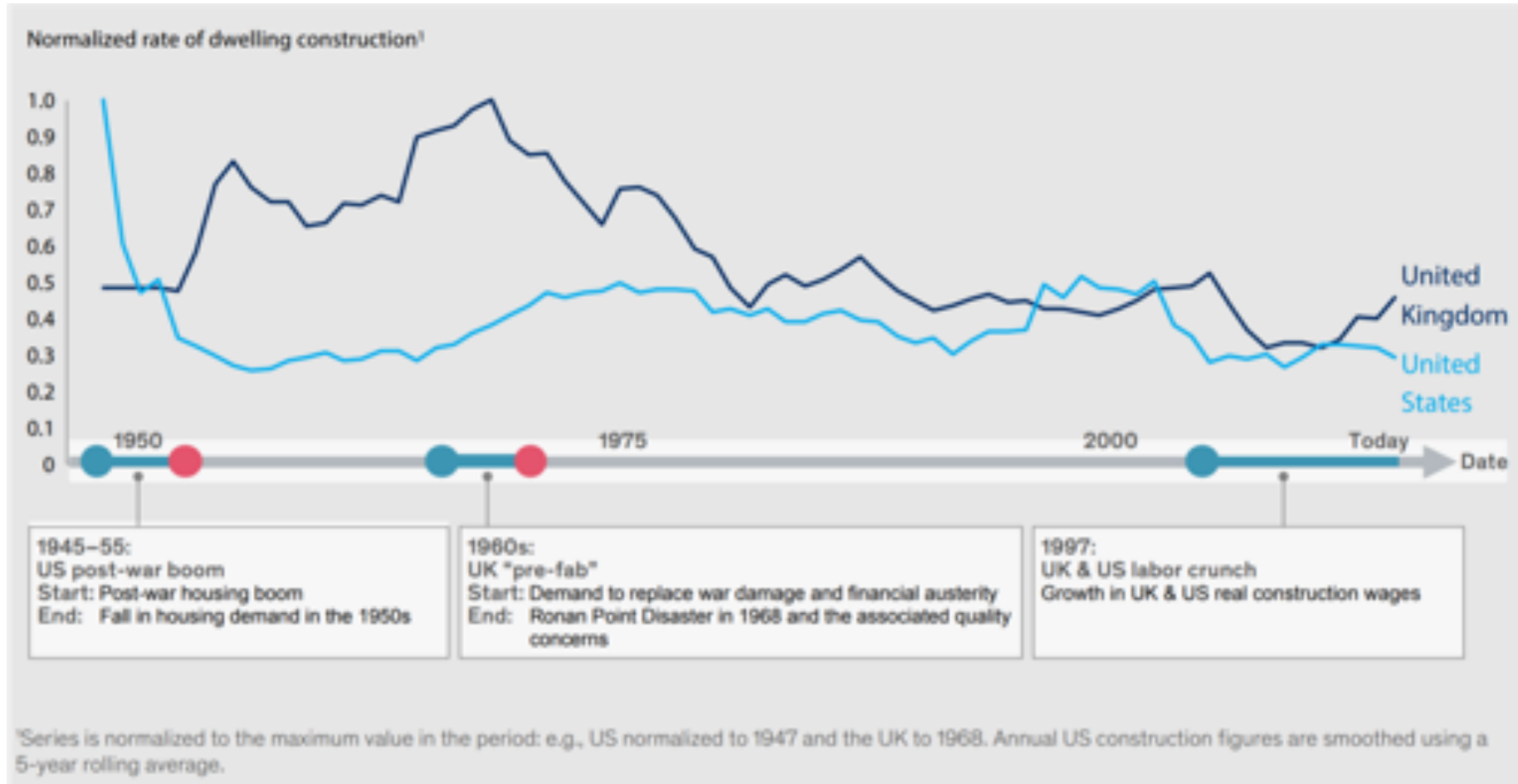
Source: Modular Construction: From Projects to Products; McKinsey Capital Projects and Infrastructure

# Modular Permitting Process

Source: WSP, Modular Construction for Multifamily Affordable Housing



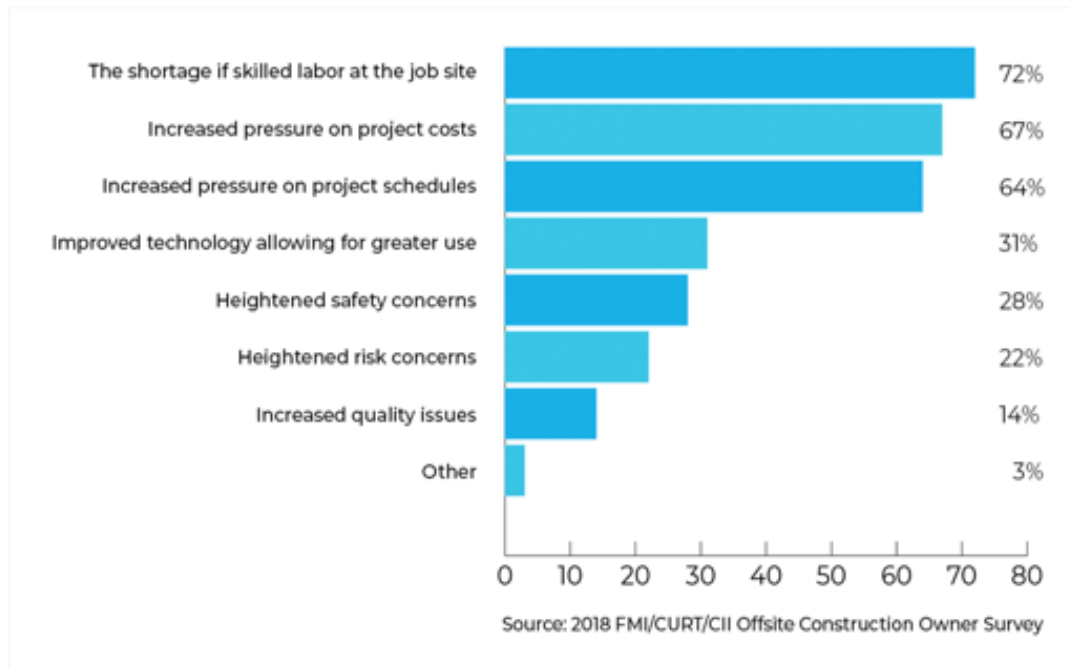
# Labor and Logistics in Modular Construction



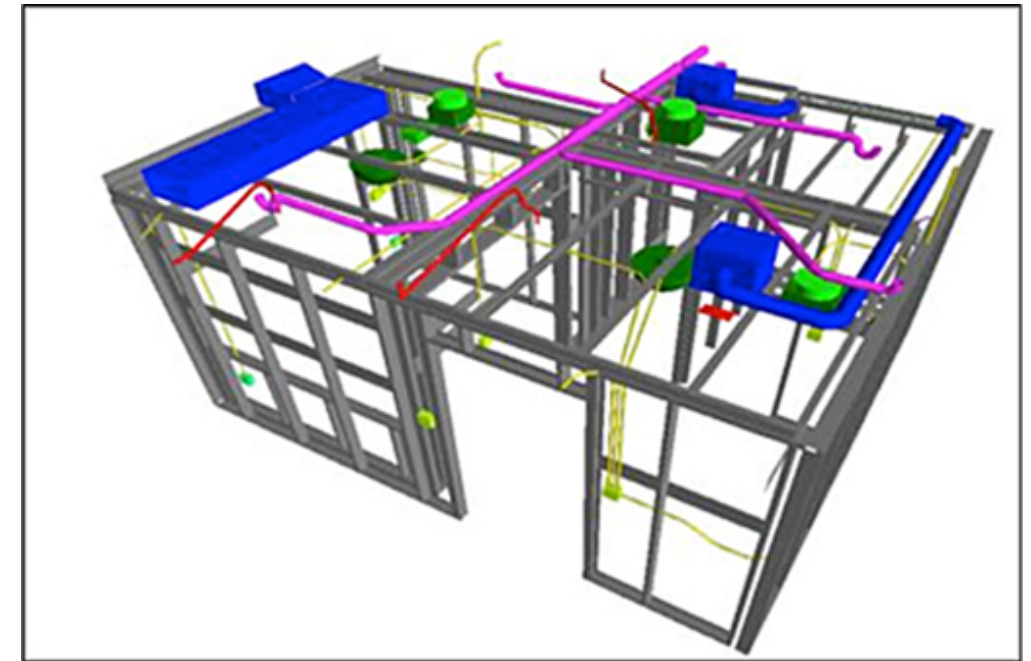
Source: Modular Construction: From Projects to Products; McKinsey Capital Projects and Infrastructure

# Labor and Logistics in Modular Construction

## Reasons why Offsite Construction Should be Implemented



Source: Offsite Construction Planning Solutions (For Modular Buildings); Wilmot Modular

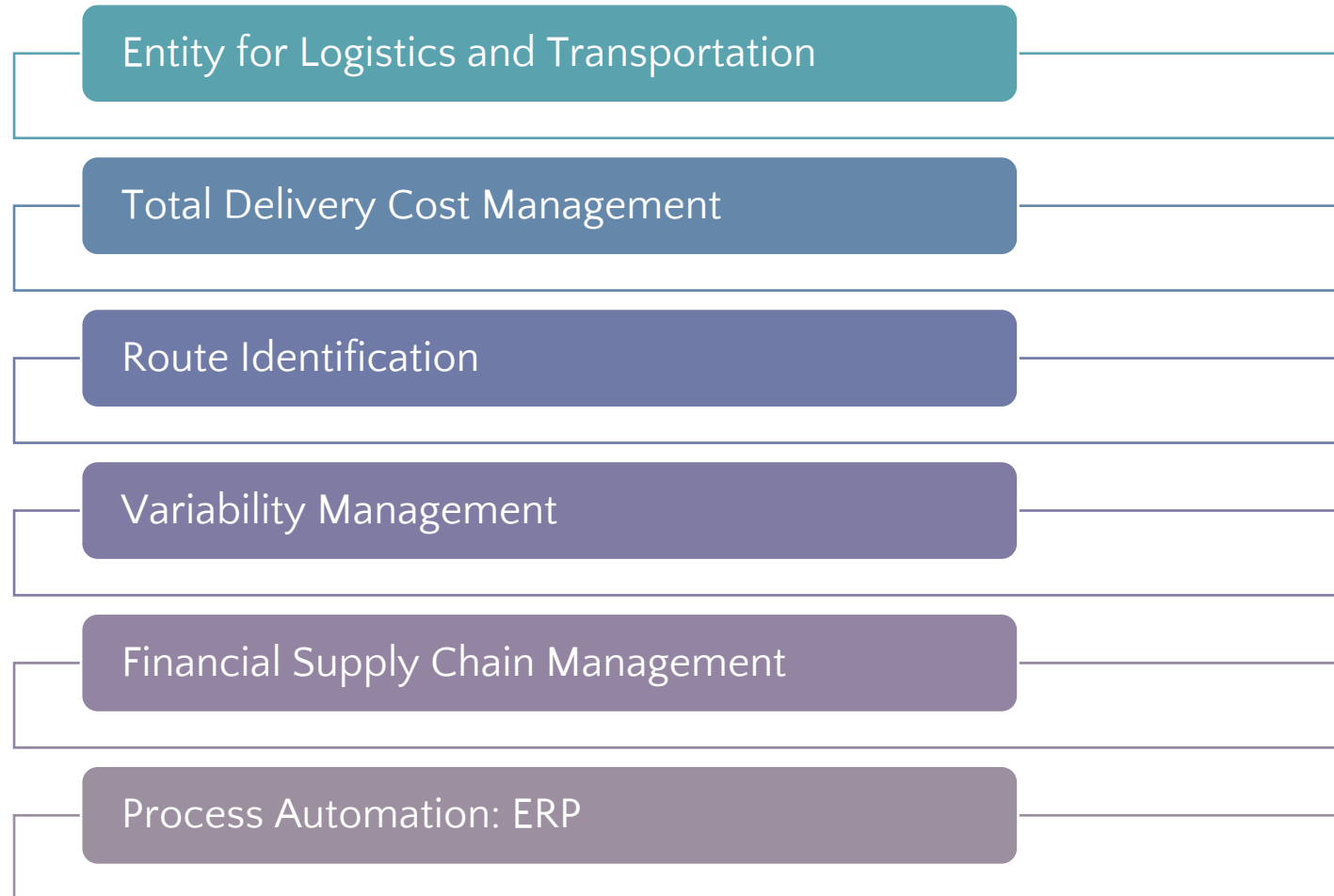


Source: Offsite Construction Planning Solutions (For Modular Buildings); Wilmot Modular



# Labor and Logistics in Modular Construction

## Project-Specific Logistics and Transportation Strategy



Source: Factors Affecting Large Scale Modular Construction Projects; (2014); Carriker et al; retrieved from: <http://ascpro0.ascweb.org/archives/cd/2014/paper/CPGT268002014.pdf>

# On-Site Installation

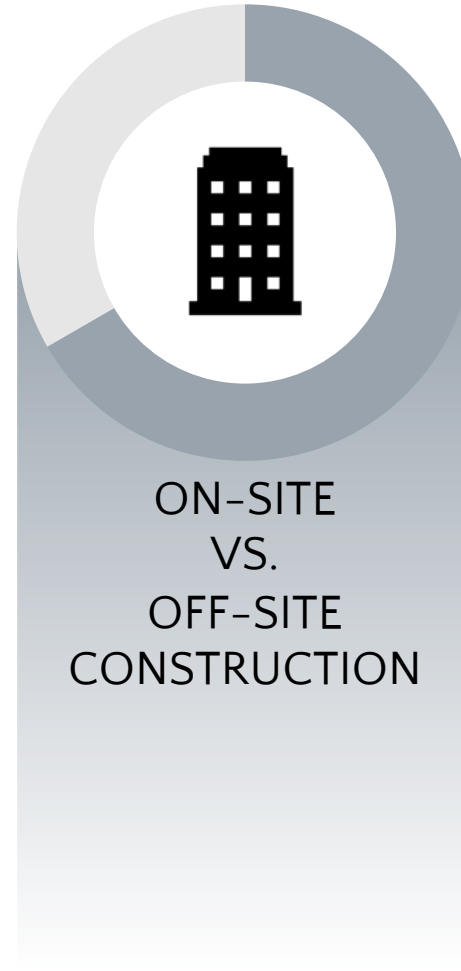
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Module installation includes matte line connections for MEP, exterior finishes and interior finishes. The crane is the most expensive part of the installation process.

Source: WSP, Modular Construction for Multifamily Affordable Housing



# FINANCIAL CONSIDERATIONS





# PRODUCTION VOLUME

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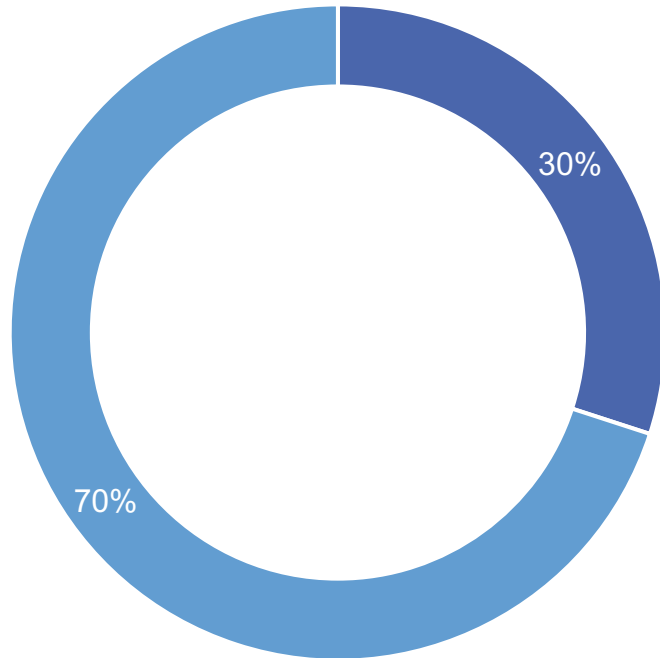
In order to diversify against the cyclical nature of the building industry, manufacturers need a range of product pipelines: student housing, hospitality, multifamily rental, multifamily owner occupied, assisted living and more.

Source: WSP, Modular Construction for Multifamily Affordable Housing



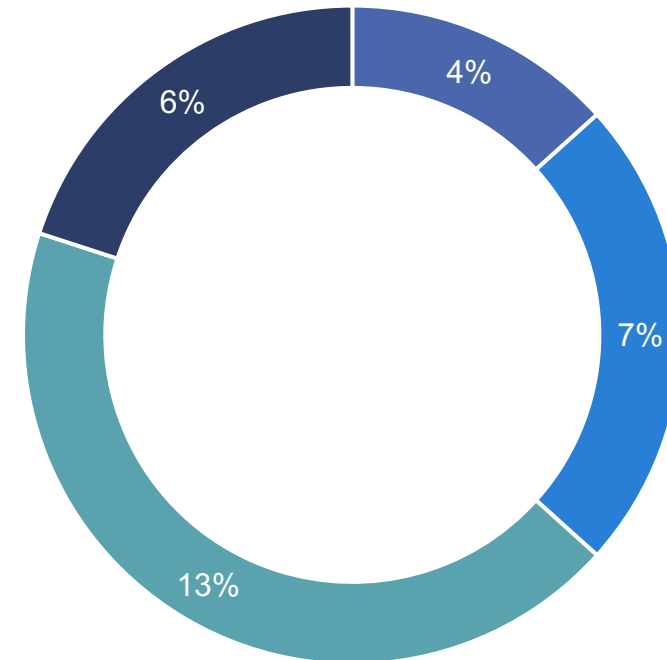
# On-site Construction vs. Off-Site Construction

Percentage of on-site work vs off-site work



■ On-Site Work ■ Off-Site Work

Percentage of on-site work



■ Foundations ■ General Services ■ Exterior Finishes ■ Interior Finishes

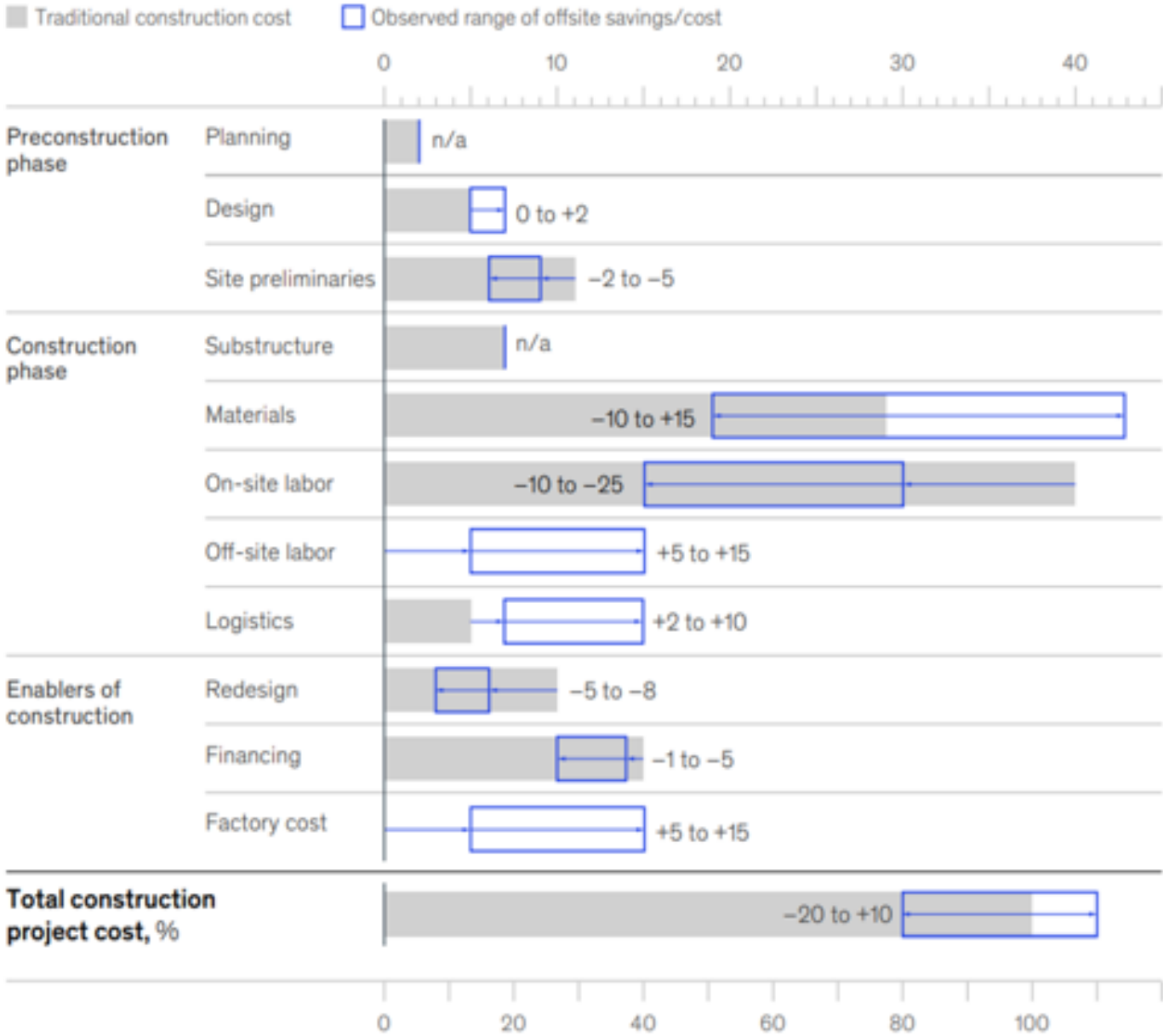
Source: Modular Construction: From Projects to Products; McKinsey Capital Projects and Infrastructure

# Savings Opportunities

There is an opportunity for 20 percent savings—but at a risk of up to 10 percent cost increases if labor savings are outweighed by logistics or materials costs.

Source: Modular Construction: From Projects to Products; McKinsey Capital Projects and Infrastructure

Traditional construction cost,<sup>1</sup> % of total, and potential offsite savings/cost, percentage point shift



<sup>1</sup>Indicative breakdown; varies by project.  
Source: US Federal Highway Administration; McKinsey Capital Projects & Infrastructure



# Financing Challenges

High initial cost of capital

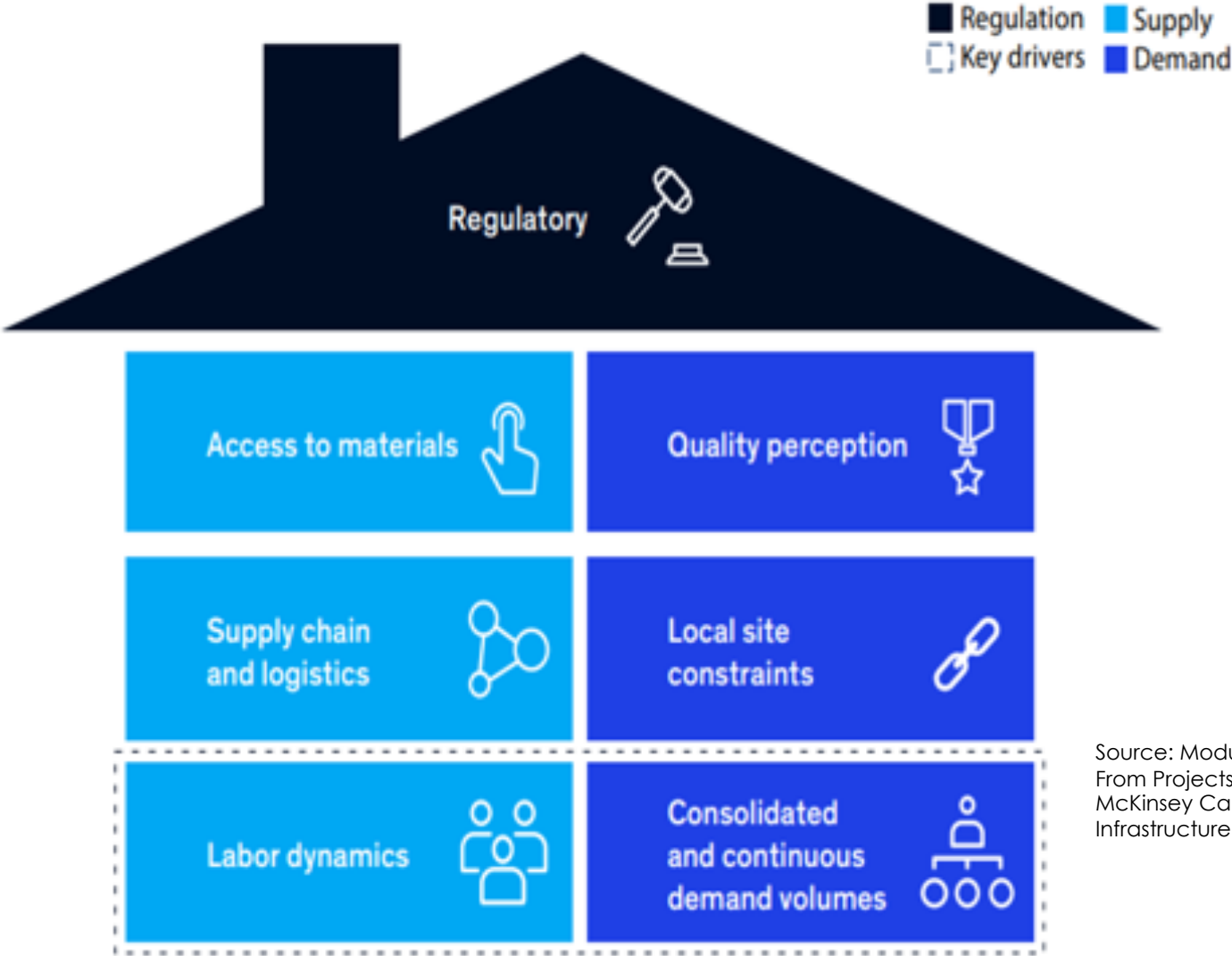
Low supply of manufacturers

Completion guarantees



Source: Velamati, Sri. Feasibility, benefits and challenges of modular construction in high rise development in the united states: a developer's perspective. Sept. 2012, [core.Ac.Uk/download/pdf/10128748.pdf](https://core.ac.uk/download/pdf/10128748.pdf).

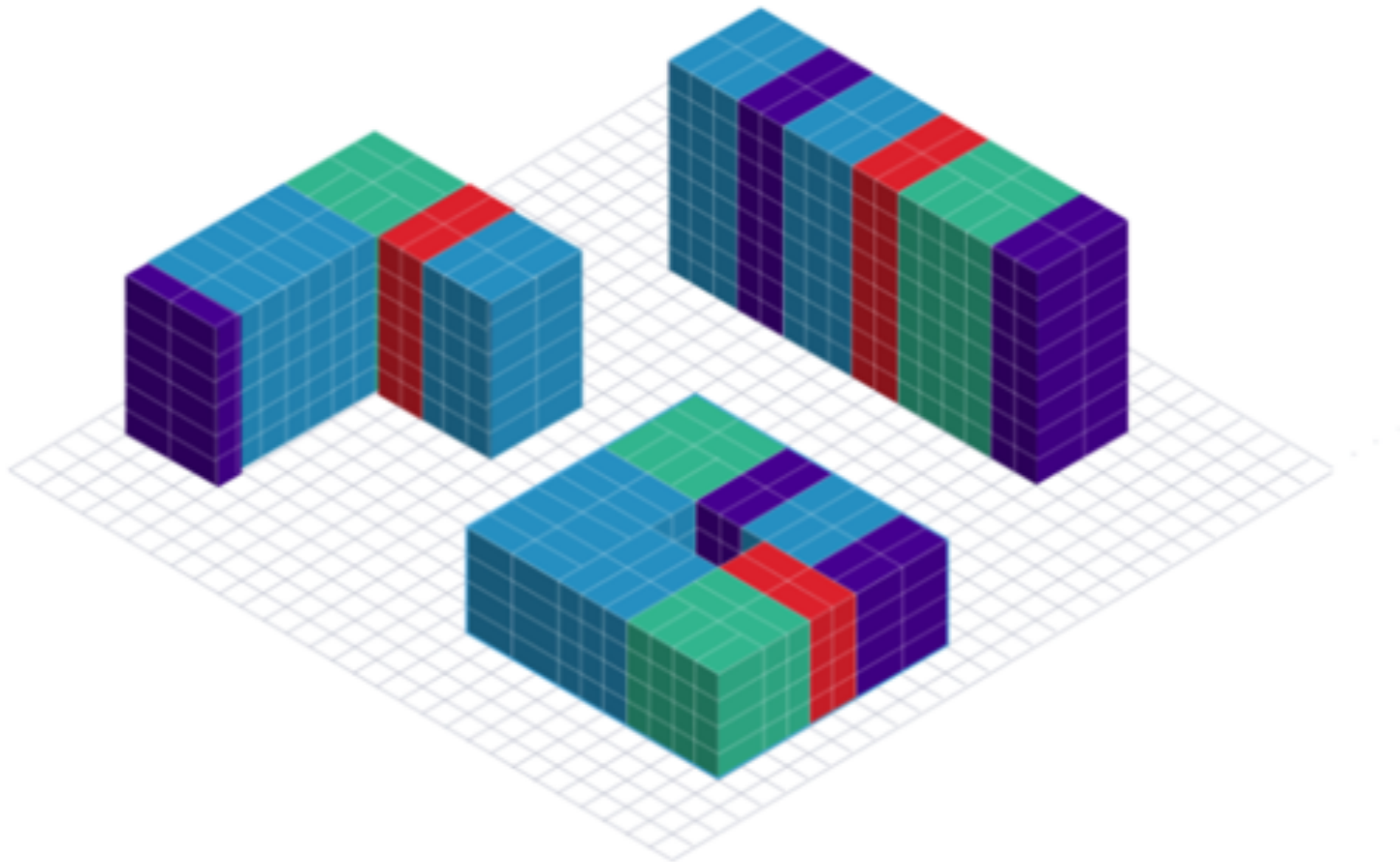
# Factors that determinate the attractiveness of a market for modular



Source: Modular Construction:  
From Projects to Products;  
McKinsey Capital Projects and  
Infrastructure

# Industry Perspectives on Modular Construction

- Manufacturer's Perspective–Full Stack Modular and Skender Construction
- Architect's Perspective–Garrison Architects
- Legal Perspective–Bob Rubin

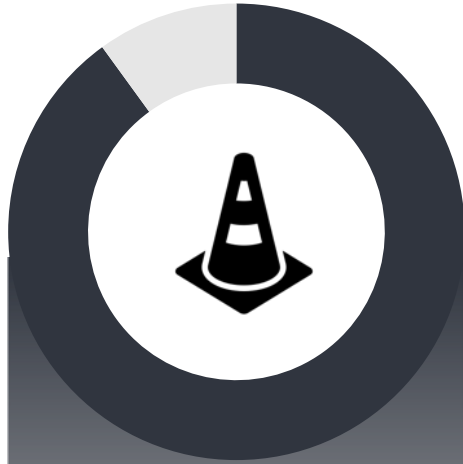


### Future Project Pipeline:

- Quarter million sqft of Affordable housing for NYC
  - 80,000 sqft in Far Rockaway
  - 160,000 sqft Fulton Street
- Student Housing
- Hotels

# Challenges Discussed

## ZONING



- Vertical Construction
- Lower Margins
- Efficiencies in material and labour

## UNION LABOUR



- More Expensive
- Labour Flexibility
- Structured for worker protection and not for efficiency

## VERTICAL INTEGRATION



- Education
- Fragmented Work
- Compartmentalization of Risks



# JIT and Lean Approach



## Assembly Line

- Workstations
- Flow of Labour and Flow of Information
- BIM Modelling



## Inventory

- Blanket Order
- Preferred Vendors
- Payment Flexibility



# JIT and Lean Approach







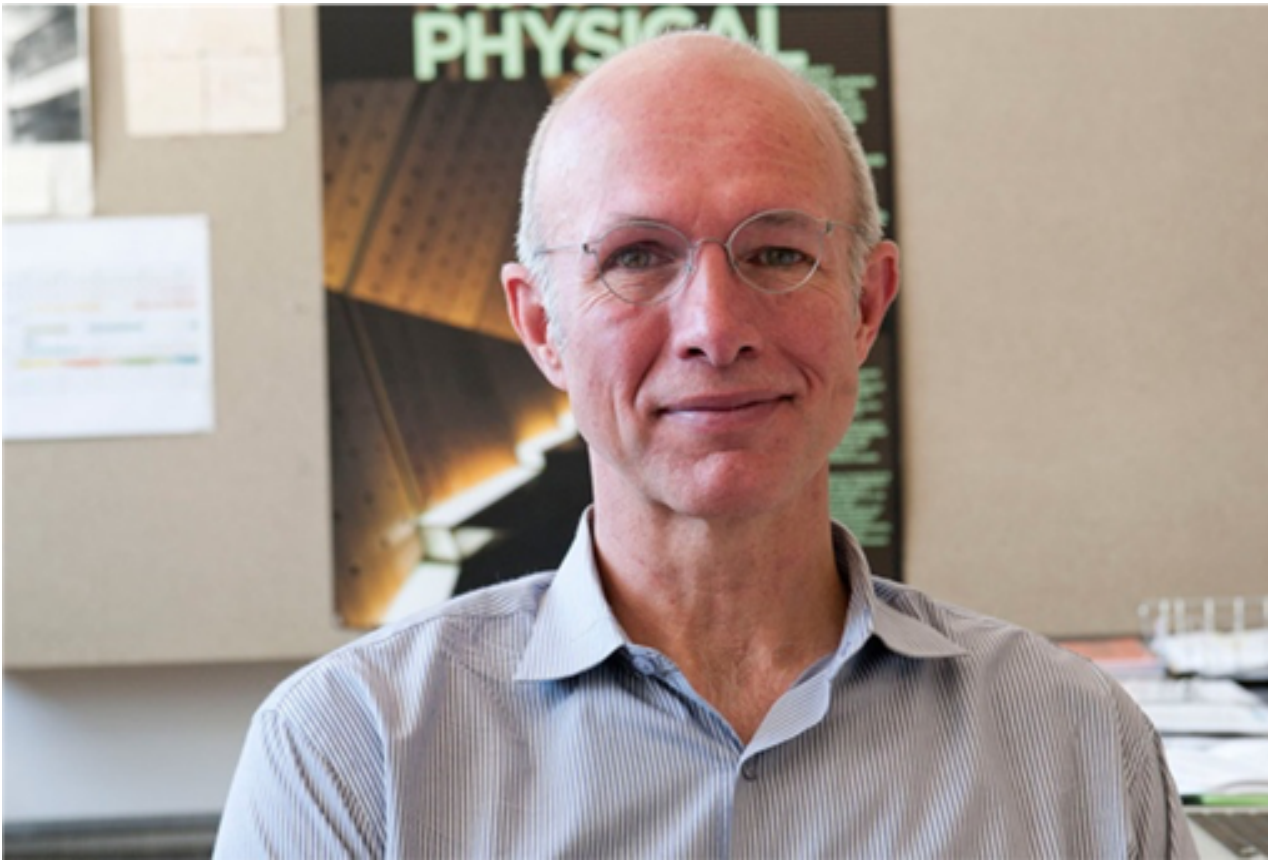
About

## Welcome to extreme integration. Skender is revolutionizing how the industry builds.

Now with groundbreaking modular capabilities, Skender is leading an industry revolution—delivering the most fully integrated offering in the business. It's cutting-edge design, manufacturing, and construction, all unified under a single process.

Experience the Skender difference

Source: [www.skender.com](http://www.skender.com)



James (Jim) Garrison

Garrison Architects

- Has focused on modular construction since the company's inception in 1991
- Design portfolio includes institutional, commercial and residential projects



# Automation and Efficiency

- Use of robots can increase productivity by 33%
  - Investment can payoff in 1 year.
- Efficient design of the modules will increase cost effectiveness of the project
- Involving Industrial Engineers well versed in the Toyota Kaizen Method can double production



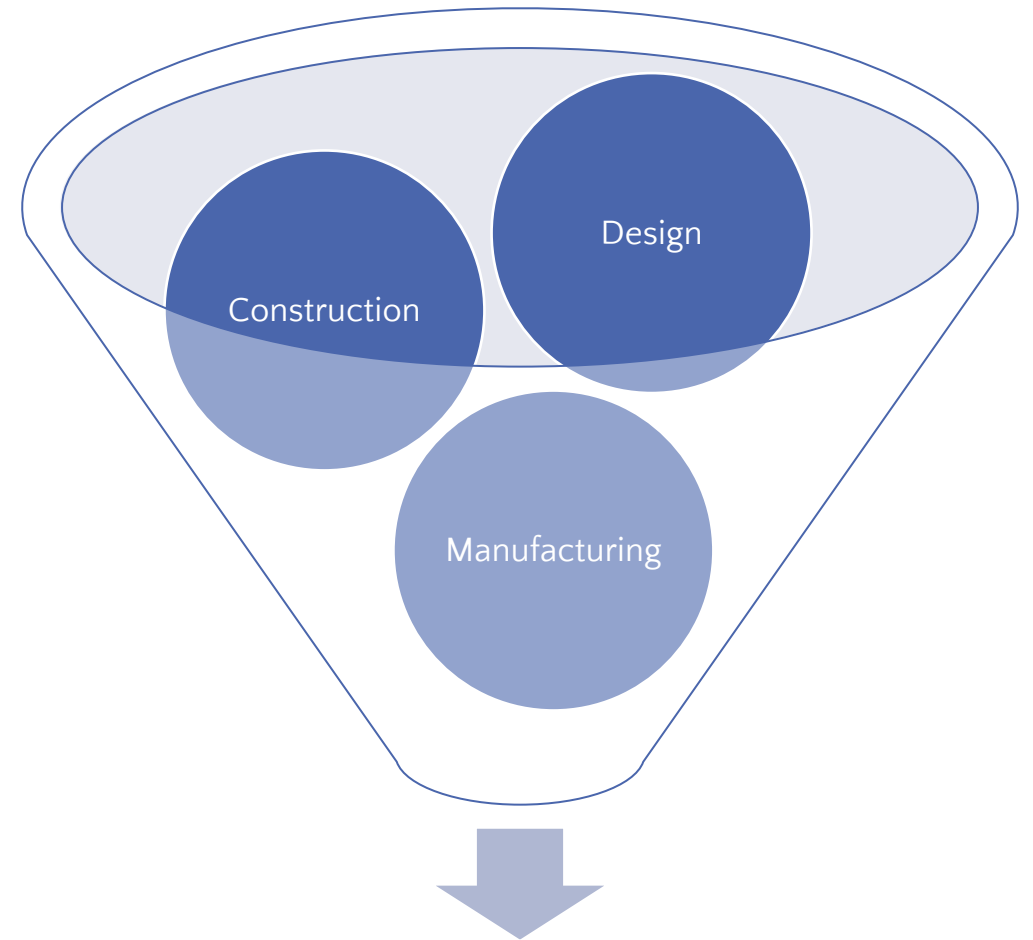
Z-Modular's Factory



Z-Modular's VectorBloc System

# The Business Side

- Integrated business models will succeed
- Having experienced designers, engineers, and CMs will increase cost effectiveness of the project
- Legacy planning is important



Modular Construction Business



BOB RUBIN

THE LEGAL SIDE



# CONTRACTUAL CHALLENGES

## ROLE



CONTRACTOR  
OR  
MANUFACTURER ?

## TRANSPORTATION



WHO BEARS THE  
RISK ?

## DELIVERY



HOW AND WHEN  
SHOULD THE PRODUCT  
BE DELIVERED ?

# Future Research

- Implementation of Automation and Robotics.
- Studying similar manufacturing approaches to implement in Modular Construction.
- Flexible Factories



THANK YOU