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Using Economies of Scale to Produce Starter Homes

A MARKET-BASED APPROACH TO INCREASING THE SUPPLY OF ENTRY-LEVEL, SINGLE-FAMILY HOUSING IN STATES WITH LARGE RURAL POPULATIONS

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DISCLAIMER

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Cover Photo Source: Fading West Development, Buena Vista, Colorado

Table of Contents

4 OVERVIEW

6 BARRIERS AND POTENTIAL SOLUTIONS FOR IMPROVING ENTRY-LEVEL HOUSING SUPPLY AND AFFORDABILITY

- 6 1.1 Barriers to producing starter homes
 - 8 1.2 Off-site construction as a piece of the solution
 - 14 1.3 Case study: Olmsted County, Minnesota
 - 14 1.4 Case study: Benton County, Arkansas
 - 15 1.5 Potential cost savings from modular construction techniques
 - 16 1.6 Challenges to modular construction, or: why isn't modular already working?
-

20 PROPOSED APPROACHES TO FACILITATING THE USE OF OFF-SITE CONSTRUCTION TO PRODUCE AFFORDABLE, ENTRY-LEVEL HOMES

- 22 2.1 Proposed concept, option 1: Bulk/advance purchases
 - 25 2.2 Proposed concept, option 2: Creating a new factory
 - 28 2.3 Challenges to Implementing these concepts
 - 30 2.4 Initial steps
-

34 APPENDIX A: INTERVIEWS

35 APPENDIX B

Case Study: Olmsted County, Minnesota

38 APPENDIX C

Case study: Benton County, Arkansas

41 ENDNOTES

Overview

Too little entry-level housing is being produced in most markets across the country.¹

In many places, homeownership is all but out of reach for many working-class and even middle-income families. Large-lot zoning and other regulatory barriers, increases in land and construction costs that are outpacing inflation, and rising interest rates all create barriers to building starter homes. From 2019 to 2021 alone, the price of existing single-family homes rose 30%.

Many places around the country face the additional challenge of not being well-served by production builders, who rely on economies of scale to produce lower-cost homes. It is often difficult in these areas, which include rural communities and small towns and cities, to generate the economies of scale needed to produce entry-level homes. As a result, moderate-income households often lack quality housing options that fit their budget and needs.

Over the past several months, in partnership with BPC's J. Ronald Terwilliger Center for Housing Policy, Abt Associates has worked to develop a concept for addressing the challenge of producing entry-level single-family homes in these markets.

The basic concept is to use off-site construction techniques, such as modular or panelized construction, to generate the economies of scale needed to produce lower-cost entry-level homes. The finished homes look (and indeed are) very similar to stick-built homes—they have just been developed in panels or modules in a factory before being assembled on the site. These homes cost more than manufactured housing but less than traditional stick-built housing, filling an important missing niche in the housing market.^a

The concept is designed to meet the housing needs of moderate-income households that are not currently being well-served by the private market. Although modular construction could also be useful for reducing the costs of producing subsidized affordable housing, this paper focuses on the use of public-private partnerships that harness modular housing technology to create affordable, unsubsidized homes.

This paper describes the proposed concept and outlines how state governments, philanthropic leaders, and others could work together to capitalize on off-site construction techniques to lower housing costs while generating steady well-paying jobs, reducing the carbon footprint of the homes produced, and

^a Homes produced in this manner are different from manufactured housing, in which entire homes are built off-site and governed by a special federal building code.

increasing local resilience to climate-related disasters. It was developed based on a literature review and interviews with experts and stakeholders (listed in Appendix A). The concept was revised based on input solicited at a roundtable hosted by BPC.

The paper is divided into two sections. **Part 1** describes challenges to housing production, particularly in rural communities and small cities and towns, identifies the market failures or challenges to be addressed through our concept, and discusses the potential for off-site construction to help solve these market failures and increase the supply of entry-level single-family housing. **Part 2** proposes several approaches to piloting the use of off-site construction techniques as a solution. It lays out proposed tasks and a timetable for implementing a pilot project, involving a cross-section of stakeholders willing to take up the challenge presented.

1. Barriers and Potential Solutions for Improving Entry-Level Housing Supply and Affordability

The shortage of starter homes in most places in the United States did not arise overnight. In previous generations, entry-level homes were abundant. As late as 1980, 40% of new homes built were starter homes (defined as homes of 1,400 square feet or less). By 2021, this share had fallen to 7%.² A range of market and political forces have created the housing crunch we are now facing, and a concerted effort on the part of many stakeholders employing a range of solutions will be needed to house the nation's households adequately and affordably. This section describes some of these forces, focusing on rural communities and small cities and towns, and then highlights potential solutions to the barriers to producing entry-level housing at affordable prices.

1.1 BARRIERS TO PRODUCING STARTER HOMES

Rural areas of the United States in general have seen steep declines in construction over the past decades: The most recent U.S. Census data show that from 1999 to 2008, an average of 221,000 new single-family homes were built in non-metro areas annually; this fell to an average of 68,000 single-family homes per year in the period from 2009 to 2017. (The Census' Survey of Construction stopped reporting data specifically for non-metro areas after 2017.)

Several market conditions lead high-volume production builders of single-family homes to serve some markets and ignore others. Underserved markets are not a single market type; they vary in demographics, income levels, access to employment and amenities, weather patterns, and geographic characteristics. Some of the barriers that discourage production builders from supplying entry-level housing are common across these markets; others affect some types of markets more than others.

Barriers to housing production common across rural areas and smaller markets.

Several market conditions that pose barriers to producing entry-level housing are common across many rural areas and small towns and cities, regardless of the type of housing market. One key challenge is that the *low levels of demand*

for housing as compared to larger housing markets mean there are *fewer opportunities for builders to achieve the economies of scale needed to produce homes at a lower cost*. Smaller-scale development patterns reduce incentives for private investment in housing production; as a result, these markets are typically served—if they are served at all—primarily by local, custom builders with little ability to expand capacity to meet increases in demand.

They are typically not served by production builders, which focus on markets where it is possible to build large numbers of homes and take advantage of economies of scale. Production builders build on spec (i.e., without necessarily lining up a buyer before building), typically using a small number of repeatable designs and on a large scale in major subdivisions. In comparison, other single-family home builders use custom designs and build one house at a time on the homeowner's land. A single-family home in a nonmetropolitan area is more than three times as likely to be a custom home than one built in a metropolitan area.³ Unsurprisingly, production builders are more than three times as productive as traditional single-family home builders (defined as the annual real value added per employee).⁴ Homes built one at a time using custom designs will necessarily cost more to produce than the homes built by production builders, which is one reason why it is difficult to find entry-level homes at affordable prices in many rural areas and small cities.

Costs of construction in rural areas and smaller cities can also be driven up by a *lack of skilled labor* and *relatively remote locations*, which can mean that the costs of transporting materials are higher, and construction workers would have to travel long distances to get to construction sites. Many of these markets *lack physical infrastructure*, which impede the production of homes at scale. In addition, there are often *fewer financing options* in rural areas and small towns and cities than in larger metro areas.

Barriers to housing production in rural areas with weak housing demand.

Some markets not well served by production builders face additional barriers to increasing housing supply. In rural areas with a flat or declining population and employment opportunities, *incomes are typically lower* than those in urban areas. Although land is often less expensive, other costs of producing housing are typically higher (such as labor and transportation costs for materials), meaning that typical incomes are not sufficient to cover the costs of newly constructed homes. *Home values are often lower and slower growing* than those in urban areas, further reducing incentives for investment in housing. While many residents of these markets own their homes, and in fact there may be vacant housing units, the *quality of the housing is often substandard*. These markets' primary housing need is for approaches to rehabilitate existing housing or replace aging manufactured homes with newer models that are of higher quality and more energy efficient.

Barriers to housing production in high-opportunity small markets and rural areas.

At the opposite end of the spectrum are rural areas and smaller housing markets with amenity and recreation-driven in-migration. These areas are characterized by recreation opportunities and/or the presence of institutional employers such as hospitals or colleges. In some cases, the demand for housing is also driven by proximity to urban areas. These areas are characterized by income inequality and often well served by high-end builders, who produce custom second homes, vacation properties, and homes for higher-income full-time residents, but suffer from a severe lack of housing affordable to those in the lower and middle ranges of the income spectrum. In many of these markets, there is demand for entry-level homeownership units that sell or rent at an affordable level. Because of a shortage of such homes, many people employed in these markets, especially in the service industry, endure long commutes to areas with more affordable homes.

This is the market type that is most likely to benefit from the concept that we are proposing. Park City, Utah; Buena Vista, Colorado; Olmsted County, Minnesota; Benton County, Arkansas; and Martinsville, Virginia are all examples. (Profiles of Olmstead and Benton counties are provided below.)

1.2 OFF-SITE CONSTRUCTION AS A PIECE OF THE SOLUTION

Off-site construction techniques help to solve one of the key barriers to housing production in some rural areas and small cities and towns by offering opportunities for economies of scale to reduce the cost of construction. Off-site construction is not a panacea; it is one strategy that has the potential to improve housing affordability in some markets. This section describes off-site construction, the features of off-site construction that could be used to improve affordability of entry-level single-family homes, and the types of markets where this approach could have an appreciable impact on housing supply and affordability.

OFF-SITE CONSTRUCTION IS NOT A PANACEA; IT IS ONE STRATEGY THAT HAS THE POTENTIAL TO IMPROVE HOUSING AFFORDABILITY IN SOME MARKETS.

What is off-site construction?

Off-site construction is a broad term that includes a range of construction approaches. The key characteristic of off-site construction is that much of the planning, design, and manufacture of building elements is done at a location other than the final installation location to support efficient construction of a permanent structure. Off-site construction includes different techniques such as:

- Prefabricated (or panelized) construction, in which construction components (panels) are fabricated at a factory and then connected on-site to complete the assembly process;
- Modular construction (also called volumetric modular construction), which involves building 3-D units that can be connected with additional units on-site to create buildings of varying sizes; and/or
- Self-contained rooms such as bathrooms and kitchens.

All of these approaches require high levels of precision, coordination, and quality control to avoid problems with on-site installation and assembly, which often improves the quality of construction.⁵

*The discussion below focuses on **single-family modular construction, a term we use to mean the manufacture of complete modules, one or more of which can be assembled to construct a single-family home.** Later in the paper we discuss the alternative of panelized construction, which is not as cost-effective as modular because it requires more on-site work but requires less in the way of upfront investment.*

Although the two are often confused, *modular construction is not manufactured housing.* A manufactured home is a type of home defined by its adherence to the 1976 HUD code and use of a steel chassis with axles and wheels attached. A significant share of manufactured home loans are chattel rather than real estate loans;⁶ they can be placed on land that is either rented or owned; and they are not always set on a permanent foundation. Manufactured homes are designed to be able to be moved from a rented lot to another location, although this is not common.

In contrast, modular is a construction *process*, not a type of house. Installation on the site typically takes less than a week; once installed, homes built using modular techniques can be essentially indistinguishable from site-built homes. They are built to the same local, county, and state building codes as site-built homes, but are built indoors in a factory setting. Like site-built homes, ownership of a home built using modular construction techniques is not separable from the land on which it is installed. Modular homes are set on a permanent foundation of a basement or crawlspace.

Approaches to modular construction range widely in terms of capital intensity. Some modular factories are essentially stick-built construction under a roof; correspondingly, it requires essentially the same labor. Other modular factories are more capital intensive, using a production approach that more closely resembles manufacturing than stick-built construction. Workers are stationed along an assembly line performing specialized, routine tasks. These factories rely more heavily on automation. They require a larger up-front investment of capital, but less labor overall and less skilled labor in particular.

Although this concept paper focuses on modular construction, manufactured housing is an essential component of the housing stock. When titled as real estate rather than chattel, it provides an affordable option for homeownership for many households. Manufactured housing suffers unfairly from a stigma of poor quality that has not been a reality for almost 50 years and is only very slowly fading.

Economies of scale in modular construction.

Modular construction offers the potential to achieve economies of scale and otherwise reduce the cost of construction in several different ways. First, the manufacturing approach to construction supports an integrated planning and supply chain optimization strategy, which means that *construction materials can be purchased in bulk* to reduce costs. Second, *materials can also be used more efficiently*—some reviews have estimated that modular construction reduces by 40% the amount of wasted construction materials relative to stick-built homes. Third, and perhaps most importantly, *labor can be used more efficiently*. There is no drive time between sites and no daily tool setup and teardown. The manufacturing approach also means that labor can be specialized, which reduces the training time needed for employees to be fully productive.

Off-site construction provides other benefits as well, some of which can also contribute to reducing costs. Importantly for some regions of the country, *modular construction sharply reduces weather-related delays*. In many parts of the country, foundations can only be poured in 6 to 8 months of the year; with the sequential process of site-built housing, this means that above-grade level work cannot commence until the foundations are complete. With off-site construction techniques, construction of the modules or panels can commence during colder months and be ready for setting at the site as soon as the site and foundation work is complete.

Other benefits of modular and other off-site construction methods.

Off-site construction may also *help to solve a construction labor shortage that is nearing crisis levels*. After the housing market crash of 2009, construction dropped precipitously, and many workers left the industry permanently. Since then, there has been a chronic construction labor shortage. Current workers are aging, and not enough new workers are being attracted to the field, meaning

that there is no solution in sight for the construction labor shortage. It is not surprising that the construction industry has difficulty attracting new workers: in many contexts, it is a hazardous job with job sites—and therefore commuting requirements over a wide radius—that can change frequently. Construction work is often seasonal in nature, and non-union jobs sometimes offer few benefits. It is sufficiently physically strenuous that many women and older workers may not be able to perform some job requirements, limiting the applicant pool.

In addition to a labor shortage, the construction industry is also experiencing a crisis in productivity. Construction in the U.S. is now less productive today than it was in 1995, with one or more consequences: squeezing profit margins, flattening workers' wages, and increasing prices for consumers. In comparison, since 1945 productivity in manufacturing, agriculture, and retail has grown by up to 1500% through automation and adoption of digital technologies and other approaches to improve efficiency.⁷

Modular construction can help address both the construction labor shortage and increase productivity by *creating higher-quality, safer jobs* than site-built construction. With construction able to proceed regardless of weather, modular manufacturers can offer year-round construction jobs at a single location in a controlled environment. The factory setting and “Lego brick” approach to construction mean that work is performed at a lower risk to workers than site-built construction (for example, because it is closer to the ground), and can be less physically demanding, which helps to expand the potential labor pool. For example, Rise Modular, a modular manufacturer in Minnesota, reports that much of its labor force is new to the construction industry. *Automated processes also reduce the need for skilled labor*, which is in especially short supply.

Another source of efficiency comes from the parallel processes used in off-site construction, compared with the serial process used in site-built construction, in which only one thing can happen at a time. In off-site construction, work that must be performed on-site (for example, laying the foundation) can occur simultaneously with building construction. Some manufacturers estimate that modular construction projects can be completed 30 to 50% faster than a similar site-built project.⁸ The *shortened construction schedule* also offers potential for cost savings through means such as lower property holding costs (insurance, property taxes, interest payments on loans), and a shorter period over which construction costs can increase (essential during periods of high inflation).

While the cost benefits of modular construction are important, it is important not to oversell them. The costs of constructing a unit represent only one component of the costs associated with a home purchase, which also include costs for land, infrastructure and fees. So the final cost savings to the consumer will not be as large as the cost savings associated with the construction of the unit alone. In many rural areas and in some small cities, however, there are virtually no new single-family homes being built at all outside of high-end

homes aimed at the wealthiest homebuyers. Because modular housing can aggregate demand across a region to take advantage of economies of scale, it can get housing built in places where it just is not being built, meeting a critical need for entry-level housing supply.

Modular construction also has a generally *smaller greenhouse gas footprint* compared with site-built homes. Homes built in panels or modules in a factory use precision measurements and reuse excess materials in other projects, so materials can be used more efficiently and are less likely to be wasted. In addition, materials are delivered to and housed at a secure centralized location before construction begins, and construction workers are not required to spend time and fuel driving to job sites in potentially far-flung locations.

Finally, especially if prioritized by the modular builder or their funders, modular buildings can be *higher quality than site-built construction and better able to withstand natural disasters*. Because they are constructed to be transported, they typically use more fasteners than site-built homes, which can improve their durability during weather events such as windstorms. For example, the Federal Emergency Management Administration (FEMA) concluded in its review that wood-framed modular and masonry buildings performed well relative to other single-family types during Hurricane Andrew in 1992. They reported that there was relatively little structural damage in modular housing developments. A builder or funder that wished to prioritize disaster resistance could adopt a building design that incorporated a high degree of resilience to the most common types of disasters in their area.

Markets where single-family modular construction could have an appreciable impact on housing supply and affordability.

As noted above, modular construction is not a panacea. It is one strategy that can help improve affordability and increase housing supply in some types of housing markets. Most local communities need to employ a full range of strategies to address housing challenges (many of which are described on the LocalHousingSolutions.org website that Abt Associated developed in partnership with the NYU Furman Center); modular construction is one such strategy that can play an important role in many communities. Rental subsidies, downpayment assistance programs, manufactured housing, zoning that allows relatively high-density housing development, and many other strategies are also essential.

Our concept of using modular construction to produce lower-cost housing is geared toward markets with these features:

- **There is strong demand for housing, which is in short supply.**

Modular construction can be effective in markets where jobs that pay a living wage are widely available—places where the demand for housing is high but there is little housing affordable to people with moderate or middle incomes. In these markets, workers are often forced to make long commutes because they cannot afford housing where they work. By contrast, in housing markets with weak demand, there may be plenty of housing units, but the housing available is poor quality and/or in need of significant rehabilitation. In these markets, renovation strategies are more likely to be effective.

- **There is no housing for “missing middle” buyers.**

In many markets, there is some housing such as manufactured homes and apartment buildings for renters and some lower-income households, plus custom homes for high-income households and those with second homes, but little or no middle-income housing affordable to entry-level homebuyers.

- **Production builders are not operating.**

While modular construction can compete against production builders in many markets, the need for modular construction as a vehicle for achieving economies of scale is less acute in markets that are already well served by production builders. Like modular factories, production builders have opportunities to purchase materials in bulk and use materials and labor more efficiently than custom builders.

- **There are opportunities to achieve economies of scale across the region.**

Modular has the most potential for cost savings when units are produced at scale. For single-family production for rural areas, this scale can mean relatively small numbers of units in scattered sites using a standardized design and constructed in batches. The region to be served by a modular factory will need to be capable of absorbing about 200 units per year, which is the scale that may be needed to justify the investment in a new modular factory.^b A factory could serve a small city and its surrounding counties or even an entire state or multi-state region.

In addition, the following market features may make modular even more attractive.

- **Weather limits construction schedules or creates significant delays.**

Modular construction has a significant advantage over site-built constructions in markets where many aspects of site-built construction can only be performed when the risk of severe weather is low, which in some places is only 6-8 months of the year.

^b Note that the annual capacity of many modular manufacturers is about 200 homes.

- **Construction labor is scarce or very expensive.**

In many areas, there simply is not the development capacity to produce more homes than what is currently being produced. Workers may be in short supply and able to command a very high price that is not compatible with the production of lower-cost homes. With its off-site approach, modular factories can cultivate a steady workforce paid fair wages that can compensate for worker shortages in disparate parts of the region.

Modular construction has already been demonstrated to be effective in places around the country such as Buena Vista, Colorado. Other examples of markets where modular construction could be considered as a strategy for increasing both housing affordability and housing supply include Olmsted County, Minnesota, and Benton County, Arkansas—two markets that we reviewed in preparing this concept paper. Summaries of the case studies are below; more detailed case studies are in Appendix B and C.

1.3 CASE STUDY: OLMSTED COUNTY, MINNESOTA

Olmsted County is a 655-square-mile region that includes a mix of rural and urban areas. About three-quarters of the county's population lives in the city of Rochester, which has a population of about 121,000⁹ and is roughly 85 miles southeast of the Twin Cities. The county's economy is dominated by the Mayo Clinic and other healthcare-related employers, which are drivers of the county's recent population growth and low unemployment rate.

According to local housing experts we interviewed, Olmsted County faces several challenges in increasing the inventory of entry-level homes. First, *the area has few developers*; those working in the county primarily develop housing at higher price points affordable to the county's physicians and other healthcare employees. Relatedly, *the county lacks production builders*, so housing development is unable to take advantage of economies of scale that can bring down the cost of the home. Third, *labor shortages in the construction industry* are a chronic problem for rural areas in Minnesota, including Olmsted County, so projects tend to cost more, and timelines are longer in these parts of the state. Finally, *developing the infrastructure necessary* for accommodating new housing is another important barrier in more rural parts of the county.

1.4 CASE STUDY: BENTON COUNTY, ARKANSAS

Benton County covers 884 square miles in Northwest Arkansas. Its largest city, Rogers, has about 68,000 residents and is about 110 miles away from Tulsa, Oklahoma, the closest large city. The county has a total population of 284,000. Other sizeable cities include Bentonville, the county seat and home

of Walmart’s headquarters, and Springdale, which is primarily in neighboring Washington County. The county has seen rapid population growth over the last 20 years of about 85%. In addition to Walmart, major employers include JB Hunt Transportation Services, Mercy Health System of Northwest Arkansas, and Tyson Chicken.¹⁰

Local policymakers and philanthropists we interviewed reported that due to its rapid growth, Benton County has struggled to meet the demand for housing for moderate- and middle-income households. The existing supply is geared to either very low-income or high-income households. Current housing production is falling far short of the number of units needed to meet demand, especially for households earning less than \$78,000 annually.¹¹ Although there are a handful of production builders in Benton County, they find it challenging to build middle-market housing because of community opposition and additional land use approvals for higher-density development. Among the challenges to building in Benton County are the high cost of land, lack of developer capacity for delivering a diverse range of housing types and price points, and sales prices for “entry-level” housing units that are not financially feasible given local incomes. Local experts worry that the lack of entry-level housing will lead to burdensome commutes for lower- and middle-income households.

1.5 POTENTIAL COST SAVINGS FROM MODULAR CONSTRUCTION TECHNIQUES

Estimates of cost savings from modular construction vary widely, ranging from 5 to 40%. One reason for the variation is that not all modular housing factories are operated to ensure maximum and consistent cost savings.

MANY MODULAR MANUFACTURERS ARE ESSENTIALLY CUSTOM BUILDERS ... THEY LACK ABILITY TO ACHIEVE ECONOMIES OF SCALE AND REDUCE COSTS.

ACHIEVING SAVINGS FROM MODULAR CONSTRUCTION REQUIRES PRODUCING MODULES AT SCALE, USING HIGHLY REPEATABLE MODULE DESIGNS.

Many modular manufacturers are essentially custom builders, in that homes are made-to-order. Like other custom builders, they lack ability to achieve economies of scale and cost savings. The website Modular Homeowners estimates that a custom modular home can save a buyer 10 to 20%. In comparison, Fading West Development, a modular manufacturer and developer that uses standardized designs and produces modules at

scale, reports that their homes are 25 to 50% more affordable than site-built through a combination of lower construction costs and lower land costs with high-density development. Rise Modular reports savings of 5 to 10% on its commercial off-site construction, with a total savings of 20% when factoring in time savings.¹² A Turner Center study focused on multifamily housing found that off-site construction in California can save up to 20% on the cost of a three to four-story wood frame multifamily apartment building.¹³

Although the experience of these and other organizations demonstrates that there is potential for appreciable savings, in reality, achieving savings from modular construction requires producing modules at high volume, using highly repeatable module designs, and generating a predictable pace of construction that allows the factory and workers to be fully and consistently utilized.

1.6 CHALLENGES TO MODULAR CONSTRUCTION, OR: WHY ISN'T MODULAR ALREADY WORKING?

With construction efficiencies and shorter timeframes contributing to potentially significant savings, why hasn't modular construction already revolutionized the construction industry and made a greater contribution to addressing the high cost of housing? Although its share is growing, modular currently represents only about 4% of new construction starts in the United States.

Modular construction does play a major role in several countries, including Japan, where panelized and volumetric modules account for about 20% of the million-odd new single-family and multifamily homes built annually. In Sweden, over 80% of the country's housing units are built using off-site construction, primarily using panelized construction. Off-site manufacturers there emphasize sustainable, energy-efficient building to respond to consumer demand and in anticipation of future stricter government building requirements.¹⁴ In Singapore, the government has responded to construction labor shortages by requiring that bathrooms be constructed as modules.

In the United States, construction materials costs that are outpacing inflation and labor shortages nearing crisis levels are motivating new interest in modular construction. Modular manufacturers like Fading West (see call-out box), Rise Modular, Factory OS, Dynamic Homes, indieDwell, and Autovol are demonstrating that a variety of modular construction business strategies and approaches can succeed.

One potential barrier to the expanded use of modular construction is that the U.S. has seen the high-profile 2021 bankruptcy of Kattera, a technology-driven, off-site construction company that launched in 2015 and eventually raised more than \$2 billion from investors. This experience may have increased the perception of risk of the industry. However, Kattera's failures do not appear

to have been related to its use of modular construction techniques. The company, funded by private equity investors with expectations for high returns, reportedly expanded rapidly by acquiring companies with little regard to culture or integration.

Regardless, there are real risks and other barriers associated with modular construction that are preventing faster, more widespread adoption of modular construction techniques. Some of these challenges include:

Risk of adding manufacturing capacity.

Construction is a cyclical industry, meaning that demand for construction is closely related to the strength of the economy. An economic downturn can mean sharp declines in demand for newly constructed housing and a financial contraction in the industry. Modular construction is capital intensive relative to site-built construction, so expanding capacity to meet uncertain demand carries a higher degree of risk than a similar expansion by a production or custom builder. Manufacturers we interviewed reported that difficulty managing this risk prevents them from expanding their capacity.

Many modular factories use a “construction under a roof” approach to building rather than a lean manufacturing approach.

Many developers report experimenting with modular construction techniques, only to fail to achieve cost savings relative to on-site construction. A small number of single-family homes constructed by a modular manufacturer that offers made-to-order units, effectively operating as a custom builder rather than a lean manufacturer, is unlikely to see cost savings.

The learning curve for modular construction is long.

Stakeholders and others interviewed report that developers experienced in site-built housing often find their first modular construction project to be challenging. Some developers report not saving time or money with their first modular project because of their inexperience; with a completed project under their belts, they expect future projects to save both time and money.

It can be a challenge to find contractors with experience installing modules on-site.

Contractors with experience installing modules are often in short supply. Lacking a portfolio of past projects upon which to estimate costs, contractors without specific experience in modular installation often overestimate costs and provide high bids for installation work, adding unnecessary expense to the housing.

CrossMod is a newly coined designation for manufactured homes that incorporate features such as pitched roofs and carports designed to make them look like stick-built homes and are installed on a permanent foundation. Fannie Mae and Freddie Mac both have products designed to facilitate the financing of these homes.

An education and technical assistance pilot sponsored by the Virginia housing finance agency, Virginia Housing, succeeded in generating support among the community and leadership of Danville for CrossMod homes. The City of Danville ultimately created an overlay district to accommodate the homes, which would otherwise have been prohibited by local zoning.

<https://www.virginiahousing.com/innovation>

It can be a challenge working with local officials to understand the appropriate scope for on-site inspections.

Some states have developed state-level approaches to modular inspections to streamline the inspections process and accommodate the modular construction approach. Minnesota, Rhode Island, and North Carolina all use a third-party pre-inspection of modular components prior to installation. In many other states and localities, there is a patchwork of regulatory approaches to inspecting housing modules. The inspection process can be further complicated when the factory is located in a different jurisdiction from the construction site, and the two locations have different codes and regulations.¹⁵ Lack of clarity in the appropriate scope for local, on-site inspection can lead to delays and replication of work.

Confusion about what is modular construction can lead community residents to assume it is manufactured housing, which carries stigma and an (unjustified) reputation for poor-quality construction.

Many stakeholders we spoke with reported that local policymakers, leaders, and community residents often oppose modular construction, confusing it with manufactured housing and/or assuming it will be poor quality.

Lack of experience with financing modular construction can limit options for construction loans.

Construction financing designed for site-built housing is not well suited for modular construction because of differences in process and timing. Lenders

may also view site-built construction financing as less risky than modular construction, because they can take ownership of a partially completed home if the borrower fails to repay the loan.

Although there are challenges to using modular construction techniques, the approach has demonstrated success in increasing housing supply and improving affordability around the world and in pockets of the United States. It is important to understand these barriers to clarify what will need to be addressed to take advantage of the potential of modular construction to substantially reduce the costs of construction. As discussed below, we believe a public-private partnership could help overcome these barriers and realize modular's potential for producing affordable entry-level homes.

2. Proposed Approaches to Facilitating the Use of Off-site Construction to Produce Affordable, Entry-Level Homes

The remainder of this paper proposes alternative, market-based approaches to address barriers to off-site construction to facilitate its use to increase housing supply and improve affordability, especially in markets underserved by production builders including rural areas and small cities and towns. These approaches focus on two primary goals: achieving economies of scale to reduce costs and reducing the risk of creating or expanding capacity for off-site manufacturers. A number of states are already taking innovative approaches to incentivize modular construction (see text boxes below on Colorado’s Innovative Housing Incentive Program and Virginia Housing’s Innovative Demonstrations Program), suggesting that states may be an important force in driving these efforts.

Continuing the convention of the prior section, we focus here particularly on modular construction, but similar approaches could be used to facilitate use of panelized construction for this purpose. Given recent innovations in manufactured housing, sponsors could also consider partnering with a builder of CrossMod manufactured homes (see box).¹⁶

The State of Colorado is encouraging modular manufacturing in order to increase housing supply, create jobs in the state, and reduce the cost of affordable housing through its **Innovative Housing Incentive Program** (IHIP). IHIP was passed by the Colorado General Assembly in March of 2022 and provides a total of \$40 million in state funding. Funds will be used to provide three incentives for innovative housing manufacturers:

- Working capital grants of up to 20% of operating expenditures
- Incentives on completed homes of between \$1,000 and \$4,500 per unit. Affordable, sustainable, resilient units receive higher incentive amounts
- Low-interest loans to start a factory

<https://oedit.colorado.gov/innovative-housing-incentive-program>

Achieving economies of scale.

The single most significant barrier to achieving the maximum potential cost savings from modular construction techniques is the lack of a sufficiently large production run. A production run of about 50 homes constructed in one “batch” is estimated to be large enough to produce economies of scale and thus appreciable cost savings. Few small cities or towns in rural areas could absorb this many units within a short period of time. Alternatively, a fully utilized modular manufacturer that operates using lean manufacturing processes with standardized unit design can produce economies of scale in smaller batches.

Note that standardized unit design does not necessarily imply a cookie-cutter appearance. Modules can be stacked in a variety of ways to produce different home configurations that range from the most affordable 1,500-square-foot house to a trade-up unit for a growing family of 3,000 square feet. The “skins” of homes—the materials, colors, and designs used in siding—can also vary, as can rooflines and other design elements. For example, Fading West Development offers only three floor plans and six bolt-on additions; this produces over *500 different combinations of houses*. The variation in design elements and exterior materials adds even more to the diversity of homes in each subdivision.

Reducing the risk of creating or expanding capacity.

Modular manufacturers we interviewed said the cyclical nature of the construction industry and the capital intensity of modular construction techniques make opening a new factory risky. Modular manufacturing does not easily expand and contract: steady demand is needed to justify the investment in manufacturing capacity and hiring of the construction workers needed to operate the production line. A guarantee of a baseline number of orders would significantly reduce the risk of expanding capacity; one manufacturer estimated that reliable orders of about 200 homes per year using standardized designs could serve as the backbone of a new factory; another estimated that reliable medium- or long-term orders of as few as 50 to 100 homes per year could provide the runway needed for a modular manufacturer to expand its capacity.

This section describes two different ways to structure a public-private partnership that would facilitate the production of affordable entry-level homes through off-site construction. The first is for one or more sponsors—potentially Housing Finance Agencies (HFAs), tribal governments, or other government agencies, institutional employers, or other organizations—to form a partnership with a modular manufacturer and guarantee bulk/advance purchases of a minimum number of homes per year for several years. The second is to organize a cooperative to create a new modular factory to serve a region with chronic housing undersupply and little or no existing modular construction capacity.

There are challenges that will need to be addressed to implement each of these ideas that we discuss below. We also recognize that both of these ideas are big “lifts” and not every region will be prepared to jump in headfirst. For

organizations that are interested in the concept but not ready to commit to one of the first two ideas, we describe some more limited pilots that could help lay the groundwork for expansion of modular construction techniques for entry-level single-family housing.

2.1 PROPOSED CONCEPT, OPTION 1: BULK/ADVANCE PURCHASES

To achieve the economies of scale needed for significant cost savings from modular construction, the first concept proposes that one or more sponsors would enter into an agreement with a modular manufacturer to produce a minimum number of homes per year (for example, 100 homes or 200 homes) for several years for an agreed-upon price. This could be a single organization, or, to aggregate sufficient demand, is more likely to be a consortium of organizations, such as HFAs, tribal or other government agencies, school districts, quasi-government organizations, institutional employers, and others. We envision the sponsor or sponsors working with a manufacturer who uses a volumetric construction approach, but other approaches could also be effective, such as panelized construction and/or components of units (e.g., bathroom pods).

Implementation of this concept would include these key features:

- A partnership with an existing manufacturer that operates using lean manufacturing processes, who would commit to deliver a minimum number of units to the sponsor(s).
- Agreement to purchase a minimum number of units from the partner manufacturer each year at an agreed-upon price (or price formula).
- Agreement between the sponsor(s) and the manufacturer on a basic set of standardized designs for modules/panels/portions of units.
- The region served should be characterized by relatively uniform requirements for housing quality standards related to weather such as needs for wind resistance, seismic conditions, and snow loads.
- The region served should include sufficient demand for housing to adequately absorb all of the units and could include small cities as well as rural areas.

This approach would address several of the barriers described above that currently prevent wider adoption of off-site construction techniques to produce affordable entry-level homes.

Risk of adding manufacturing capacity.

Existing modular manufacturers typically do not have financial capacity to add 100 or more homes per year to their production schedules. The advance commitment from the sponsor(s) to purchase units significantly reduces the risk of expanding capacity, for example by opening a new plant, to the

manufacturing partner. The manufacturer can then expand production to meet the demand for the additional homes. Three modular manufacturers interviewed in developing this concept confirmed that an advance purchase commitment significantly reduces their risk and improves their ability to expand capacity.

Challenges to achieving consistent workflow.

Another advantage of a pre-buy arrangement is that it enables the manufacturer to scale their staff and factory to generate a consistent production of units that keeps the staff fully occupied, without the starts and stops that lead to inefficiencies.

Other challenges to realizing cost savings.

As noted above, maximum cost savings will require a limited number of designs, which can be addressed by pre-specifying the designs during the negotiation process. If the sponsor(s) partners with a modular manufacturer that operates for maximum efficiency and cost savings using a limited set of floor plans, such as Fading West, this will likely already be part of their business model. In addition, by negotiating a pre-buy agreement for a price or formula, this approach solves another problem, which is how to ensure that the cost savings achieved through the more efficient production process translates into a lower price from the manufacturer. Without this type of arrangement, nothing prevents the modular manufacturer from selling the homes for as much as the market will bear.

Size and cost.

Drawing on interviews with modular manufacturers, we roughly estimate the cost of homes constructed to range from about \$90-\$130 per square foot. At an average of 1,000 to 1,500 square feet per home, the cost of each home pre-installation would be from \$90,000 to \$195,000. At 200 homes per year, the sponsor(s) would guarantee approximately \$18 to \$39 million in orders to the manufacturer each year. Alternatively, if the agreement with the manufacturer were for 100 homes per year, this would be approximately \$9 to \$19.5 million. Annual orders could be made up of about 5-10 orders from various sponsors of about 20 homes each. Greater efficiencies—and therefore costs savings—might be achieved with larger projects.

One example of a potential process for implementing this idea, through either a single sponsor or a consortium is summarized briefly below. This process covers a four-year period, but timeframes could vary depending on the region's readiness for a modular manufacturer, including whether state-level agencies are supportive of the effort.

- **2.1.1 Year 1: Laying the groundwork**
 - Convene a working group
 - Develop prototype modular plans
 - Provide grants to facilitate working group efforts
 - Aggregate demand across a state/region
 - Build state government support for pilot
 - Work through implementation challenges
 - Identify a construction financing partner
- **2.1.2 Year 2: Launching the pilot**
 - Launch pilot
 - Provide patient capital to modular manufacturers, developers, and others
- **2.1.3 Year 2-4: Operating the project**
 - Provide guarantee to modular manufacturer of orders of 200 homes per year for several years
 - Provide support to consortium members
 - Provide education and technical assistance to increase community acceptance of modular homes
 - Monitor and evaluate the process throughout

Reducing costs in home construction is an important step toward improving affordability, but represents only about 35-40% of the total installed cost of a home.^c

The sponsor(s) must also consider other aspects of development costs to identify ways to improve affordability. These could include high-density development and working with local governments willing to facilitate the land entitlement and permitting process.

^c This share will vary depending on the price of land. In an area with less expensive land, the cost of construction will make up a larger share of the total.

2.2 PROPOSED CONCEPT, OPTION 2: CREATING A NEW FACTORY

Many developers we spoke with for this project reported interest in using modular construction techniques but said that existing factories lacked the capacity to meet their needs. As an alternative to entering into a pre-buy arrangement with a modular manufacturer with an existing factory, government agencies, foundations, developers and other stakeholders could form a public-private partnership by making equity or equity-like investments to build a new factory. As an example, the Virginia housing finance agency, Virginia Housing, made an equity investment as part of its partnership with the new factory indieDwell, which will open in Newport News, VA in 2023.

This option is most likely to be viable if it does not compete with an existing manufacturer. This could be achieved by locating in an area with sufficient demand but entirely lacking in any modular manufacturer, such as Northwest Arkansas, or by targeting a different market segment from existing manufacturers, such as entry-level homes.

FADING WEST DEVELOPMENT

Fading West Development is an integrated manufacturer, developer, and installer of modular homes that is currently focused on developing subdivisions of modular homes in rural areas in Colorado. The company builds about 200 units (“boxes”) per year, designed to be affordable to middle-income homebuyers.

Fading West improves affordability using at least three strategies: modular construction, economies of scale, and high-density development. The company reports that their homes, to date installed in a subdivision with 10 homes per acre, are 25-50% less expensive than site-built homes.

They report that their boxes cost about \$130 per square foot, and factory costs represent about 38% of total costs of an installed home. The remaining 62% is site costs (30%), infrastructure (12%), entitled land (12%), financing (4%), and developer fees (4%).

The mission-driven company further improves affordability by including both market-rate and below-market homes in its subdivisions. Below-market homes are available through partnerships with nonprofits.

Fading West Development has one completed subdivision, in Buena Vista, Colorado, and is in the process of working with the town of Breckenridge, Colorado, to create a second. Breckenridge is a tourist location with high-end vacation and second homes and very little housing for local restaurant and ski resort employees.

One model for the company would be to essentially franchise the Fading West Development model (see call-out box). As with the first concept, there could be a single sponsor or a cooperative in which multiple partners work together to aggregate demand to support at-scale production. Sponsors could include HFAs, tribal and other government/quasi-government units, developers, major employers, school districts, universities, hospitals, and others. For example, an HFA could work with a nonprofit to set up a factory that could supply lower-cost homes to the HFA's partners. Or a large employer or government agency could make an equity investment in a modular manufacturer to produce entry-level for-sale housing for corporate employees.

The sponsor or sponsors would work with the manufacturer to select the location of the factory and have input into the construction approach—modular, panelized, or some other technique—and other aspects of the business model. For example, the business model could be vertically integrated, and include a developer to create entire modular developments, allowing cost savings to include not only lower-cost construction techniques, but also housing at relatively high densities to reduce the costs of land and infrastructure.¹⁷

Alternatively, the homes could be supplied to a range of partner developers who find locations for the homes and agree to sell them at an affordable price.

This approach would help address the same market failures as the consortium in Option 1 that currently prevent wider adoption of off-site construction techniques to produce affordable entry-level homes. These include the risk of adding manufacturing capacity and challenges to coordinating across projects to aggregate demand and increase scale.

Perhaps most importantly, this approach would address barriers to access to capital for modular manufacturers. It can be hard for modular manufacturers to raise capital from private equity investors; this challenge would be compounded by a project that seeks to produce homes at the lowest cost, rather than the highest price that the market would bear. Manufacturers we interviewed estimated that a new modular manufacturing facility would cost a minimum of \$20 million to build (the Fading West factory was approximately \$25-\$27 million including start-up costs).¹⁸

The degree of risk in a modular manufacturing venture and rates of return vary widely, depending on a variety of factors including:

- A relationship with one or more organizations with dependable demand for homes
- Types of modules produced (custom vs. standardized)
- Affordability of modules produced
- Local cost and availability of labor
- Quality of factory management

INNOVATIVE DEMONSTRATIONS PROGRAM

Through its Innovative Demonstrations Program, Virginia Housing partners with nonprofits, manufacturers, and local jurisdictions to increase housing supply in rural areas. Successes achieved through these partnerships offer lessons for efforts elsewhere to increase production of entry-level homes.

Virginia Housing uses both grant funding and a Low-Income Housing Tax Credit Innovation Round designed to encourage innovative approaches to housing production, including modular housing construction.

Virginia Housing's REACH *Virginia* (Resources Enabling Affordable Community Housing in Virginia) program provides up to \$500,000 in grant funding to affordable housing providers that use innovative approaches to construction; projects have used next-generation manufactured housing (for single-family homes in Danville, VA); modular construction (for single-family homes in Martinsville, VA and senior apartments in Fishersville, VA) but also 3D printing and other approaches. The program is funded with a portion of Virginia Housing's net revenues.

Virginia Housing also recruited a steel modular housing manufacturer to the state, providing both a REACH *Virginia* grant and an equity investment. The new factory in Newport News, VA will open in 2023. It will be the first East Coast factory for indieDwell, a Public Benefit Corporation headquartered in Boise, ID. Other partners include Newport News Redevelopment and Housing Authority and the City of Newport News. IndieDwell will also receive benefits from the Virginia Enterprise Zone Program. The factory is expected to build at least 300 new units each year and employ 220 people when fully operational.

Potential steps involved in a pilot for this idea include roughly the following schedule and tasks. The process described covers five years, but timeframes could vary depending on how long it takes to lay the groundwork and the extent to which state agencies are supportive of the pilot. Note that this pilot could be substantially shortened for a partnership with an existing manufacturer that is opening a new factory in a new part of the country, such as indieDwell's new facility in Newport News, VA (see box).

2.2.1 Year 1: Laying the groundwork

- Convene a working group of interested cooperative members and other stakeholders
- Develop a business plan for the factory, including:
 - Location
 - Construction technique(s)
 - Suppliers
 - Business strategy (e.g., degree of vertical integration and automation)
 - Financing plan
- Provide grants to facilitate working group efforts
- Identify a CDFI or other financing partner for construction financing
- Build state government support for pilot
- Work through implementation challenges

2.2.2 Year 2: Raise capital, build the factory

- Raise patient capital for the factory
- Build and staff the factory

2.2.3 Year 3-5: Operating the factory

- Operate factory, including management activities; government and investor relations; and business development
- Provide patient capital to modular manufacturers, developers, and others
- Provide support to cooperative members' development efforts
- Provide education and technical assistance to increase community acceptance of modular homes
- Monitor and evaluate the process throughout

2.3 CHALLENGES TO IMPLEMENTING THESE CONCEPTS

There are a number of challenges that will need to be addressed in order to take these ideas from concept to a workable realistic solution for entry-level homes. We identify several of those challenges here:

1. **Who will sponsor the project?** One or more sponsors will need to assume responsibility for either entering into a pre-buy arrangement or for establishing a new factory. As we note above, this effort can be led by a single organization that is willing to assume the overall risk for the project or through a consortium or collaborative or organizations that share similar

goals. A partnership has the advantage of sharing the risks involved, and potentially can bring in members that can help address some of the other challenges identified below, but adds complexity as the collaborators will need to reach agreement on key issues.

If a collaborative model is used, it may be worth examining some pre-existing collaborative models, including the Housing Partnership Network, Stewards of Affordable Housing for the Future and Strength Matters, to determine what lessons could be learned from these collaborations about how to align the individual visions of different organizations to work together toward a common goal.

2. **Who will design the homes?** Modular construction does not easily allow for changes to the home at the installation site, so upfront design decisions are very important. Boxes must be precisely designed in advance to easily fit together during on-site installation.
3. **How will the project be financed?** If the project is well designed and executed, it should generate sufficient revenue through the sale of the homes to fully cover the costs of producing them. Because there is a gap between when the factory must be established and materials ordered and when the revenue will come in from the sale of the homes, some sort of financing will be needed to get the operation off the ground.
4. **How will sites be identified and entitled?** The homes will need to be put somewhere, obviously, which will require land and appropriate infrastructure. One or more organizations will need to assume responsibility for finding sites, obtaining the approval needed to site the homes there, and ensuring the sites are well served by utilities like water and wastewater. Depending on how this is arranged, some financing may be needed for these operations as well, as land will need to be purchased and infrastructure built, before revenue from homes sales comes in.
5. **How will buyers be found and qualified?** This could be handled by the same organizations that find and entitle the land or by different organizations. For example, developer-partners could be enlisted to find and prepare the sites and nonprofit housing organizations could market and sell the homes, potentially to income-qualified buyers.
6. **Who will install the homes?** While the homes will be built in modules or panels, they will need to be installed on site. One option may be to ask the installers of manufactured homes to adapt to also install modular or panelized homes.
7. **How will building inspections work?** Since these homes are covered by local building codes and not by the HUD Code that applies to manufactured housing, it will be important to identify best practices in working with local officials to facilitate inspections/approvals. The program sponsor(s) could also work to promote state-level regulatory frameworks for modular.

8. **Will the homes be accepted?** Because the homes are built in factories, rather than onsite, there is the potential for stigma that could impede acceptance. There will likely be a need for a marketing program to educate community residents and local officials about the facts of modular construction and its advantage over site-built construction.
9. **How can the learning curve be shortened?** Organizations that are new to modular construction will find likely there is a fair amount to learn to implement the process efficiently. They will want to tap into the community of developers working to solve similar challenges and learning resources and technical assistance (for example, via ModX).

INTEGRATING MANUFACTURED HOUSING

Another question to consider in working through the implementation challenges is whether to integrate manufactured housing into the model. For example, if the delivery model ends up focusing on developing larger subdivisions, there could be value in including some manufactured homes along with the modular homes in the subdivision to widen the mix of incomes served.

2.4 INITIAL STEPS

Sponsors that are potentially interested in implementing one of these concepts will likely want to set up a working group to talk through the various options and challenges and develop a game plan for implementation. We recognize, however, that not all organizations will be ready to take on such a big project.

Short of organizing bulk/advance module purchases or creating a public-private partnership to build a new modular construction factory, there are a number of steps that sponsors or communities could take to build momentum for possibly adopting one of these approaches in the future or otherwise facilitating the entry into the marketplace of a manufacturer of modular homes, homes built through panelized construction or CrossMod manufactured homes.

People we interviewed highlighted several barriers to modular construction techniques that a pilot could help address. These include stigma and confusion among policymakers and community members about the difference between manufactured housing and modular construction; a long learning curve for developers new to modular construction that has reduced the potential for cost savings; limited financing options for both homes being constructed using modular techniques and for funding factory construction or expansion; and a need for reform in policy and practices in some parts of the country relating to transportation and inspection.

Increasing the overall housing supply through off-site and manufactured housing construction. While this concept paper focuses on public-private partnerships to facilitate off-site production of entry-level single-family homes, this is not the only approach worth considering. Even without a mission-driven owner or partner, the development of a modular or manufactured housing factory could lower housing costs by increasing the overall supply of homes and compensating for the lack of development capacity in many rural areas and small cities. There may well be approaches short of the more comprehensive partnership discussed here that could help facilitate these private (or mostly private) operations.

This series of pilots and resources for industry participants would help to address these barriers and lay the groundwork for a public-private partnership to produce entry-level homes.

Assess regional readiness.

One useful, first step would be for a potential sponsor (or sponsors) to assess the readiness of the region for a public-private partnership to introduce or expand modular construction techniques. The assessment could examine the likely demand for these homes, where the homes are most likely to be installed (and whether there are already production builders in those areas), what partners might be available and interested in working on the project, the degree of support from policymakers and other stakeholders, the degree to which local zoning and building codes facilitate modular construction techniques, state transportation regulations and inspection standards, and local acceptance of modular construction techniques. The assessment could also evaluate whether a partnership with an existing manufacturer is feasible, or whether a new factory is needed to create the needed production capacity. The results of the assessment should be used to identify next steps for laying the groundwork for a public-private partnership.

Undertake a single bulk purchase of modular homes.

To fully understand the process of modular construction and its challenges and benefits, there is no substitute for undertaking a modular housing project. For example, a program sponsor could make a single bulk purchase of 20 to 30 modular homes from an existing manufacturer. In addition to creating much-needed housing units, the order would allow the sponsor and its partners to work through the challenges of financing and delivering the homes.

Undertake a more modest public-private partnership.

A sponsor or sponsors interested in moving forward with a public-private partnership, but not ready to commit to a project of the size we outline, may be able to assess the proof of concept of a public-private partnership by committing to a smaller project, such as annual purchases of 25 to 50 homes or creating a factory designed for panelized construction techniques. While these approaches would not necessarily achieve the same level of cost savings as full-blown modular construction, they could allow sponsors to test whether they have the capacity to finance and deliver the homes, and see the benefits of providing steady year-round jobs, before committing to a larger project.

Panelized construction involves completing less work in the factory. More of the work is done on-site, which reduces opportunities for efficiencies and cost savings but also reduces the capital needed to build and operate a factory. This kind of smaller-scale operation would involve lower stakes for the sponsor(s) in developing the capacity to distribute housing units, assemble sites for housing development, and use year-round construction. Once the sponsor(s) develops greater capacity, the factory could be expanded via additional shifts of workers, additional investment in automation, and/or a shift to modular construction techniques.

Develop a community of practice to support the organizations delivering modular homes.

There is inevitably a learning curve with modular construction. Regions that decide to implement a public-private partnership may find it useful to establish a community of practice or other similar support mechanism to help the organizations working to find and entitle land and deliver modular homes learn from each other's experience. This approach could also be used to support developers who are starting to experiment with modular construction in regions that are not pursuing a public-private partnership.

Policy and regulatory reform.

Some regions may have barriers to modular construction in the form of transportation regulations, inspection standards, land use policy, building codes, and other policies and regulations. A sponsor(s) could work with state and local officials and other local stakeholders to implement policy and regulatory best practices to lay the groundwork for a public/private partnership or to support modular construction more broadly.

Pilot marketing/education project.

A sponsor(s) could work with an existing modular manufacturer to craft a marketing campaign to educate residents of a region about what is modular and measure favorability of modular construction techniques before and after the campaign. A similar project was undertaken by Next Step Network, which is dedicated to supporting factory-built homes as a viable, sustainable

homeownership solution, and NeighborWorks America. They have partnered to create educational materials to help local communities and nonprofit organizations understand the importance of manufactured housing and more inclusive zoning.

The pilot could also draw on the approach taken in the EPA “This is Smart Growth” marketing campaign. The marketing and education could include a series of case studies of single-family modular developments. These would be designed to provide education about the look and feel of modular construction techniques and their impact on communities. Ultimately, the marketing would be intended to improve receptivity to entry-level modular homes among policymakers, local leaders, and community residents. Sponsors that choose to focus on CrossMod homes, or to integrate CrossMod homes into a menu of product offerings, could similarly focus on the benefits of these homes.

Lessons learned.

Education could also include case studies that focus on lessons learned in the process of developing modular entry-level housing projects. Case studies would provide insights to the sponsor(s) as well as various other stakeholders including developers, policymakers, local officials, community members, and others.

Identify sources of patient capital.

It will be important to cultivate relationships with impact investors to identify those interested in creating a fund to provide a public-private partnership with patient capital at low rates. This capital would be used to reduce the financial risk to the manufacturing partner of expanding capacity to produce entry-level homes. The funds would need to be flexible and help to provide support to the manufacturing partner during housing market downturns. The funds could also be used to provide upfront capital to developer partners to assemble land for modular housing developments and pay for orders of modules prior to sale to individual homeowners.

New Markets Tax Credits.

New Market Tax Credits could be a potential source of financing for a new modular construction factory created by a public-private partnership. The feasibility of this approach could be explored with the goal of ultimately creating a recommended financing structure/capital stack for a new factory.

Construction financing pilot

The sponsor(s) could work with a local CDFI/other financial institution and impact investors to create construction financing and other loan products designed specifically to accommodate the features of entry-level homes constructed using modular techniques in the region.

Appendix A: Interviews

Ivan Rupnik

ModX/Northeastern University

Eric Schaefer

Fading West Development

Gerald Hunter

Idaho Housing and Finance Association

Kathryn Almberg

The Housing Company (Idaho)

Caleb Roope

Autovol

Warren Hanson

Greater Minnesota Housing Fund

Jesse Arentson and Jesse Schott

Southwest Minnesota Housing Partnership

Tom Tomaszewski

Annex Group

Chrystal Kornegay

MassHousing

Jim King

Fahe

Seth Appleton

MISMO/Mortgage Bankers Association

Paul Okeson

Dynamic Homes

Adam Schiff and Ben Ellgin

Office of Sen. Tina Smith

Eileen Fitzgerald

Wells Fargo

Nathan Anonick

Office of Sen. John Boozman

Christian Lawrence

Rise Modular

Nick Guertin

Coalfield Development

Meredith Bergstrom

Walton Family Foundation

JoMarie Morris

Coalition for Rochester Area Housing

Jae Jang

Office of Rep. French Hill

Appendix B

CASE STUDY: OLMSTED COUNTY, MINNESOTA

Olmsted County is a 655 square mile region that includes a mix of rural and urban areas. About three-quarters of the county's population lives in the city of Rochester, which has a population of about 121,000¹⁹ and is roughly 85 miles southeast of the Twin Cities. The next biggest city is Stewartville, which has roughly 6,100 people, illustrating the size differential between Rochester and the rest of the county's cities and towns. The county's economy is dominated by the Mayo Clinic and other healthcare-related employers, which are drivers of the county's recent population growth and low unemployment rate.

From 2000 to 2020, Olmsted County's population grew about four times faster than the rest of the state, at a rate of 31% compared with about 8% for Minnesota. There has been some housing production in Olmsted County, but it has not kept pace with the rate of population growth. In 2020, the county issued 429 housing permits, 417 of which were for single-family homes. According to Zillow estimates, in July 2022, the county's typical home value²⁰ was about \$325,000.

Local housing experts described some of the housing gaps and challenges in rural areas in Minnesota generally and Olmsted County specifically. They also identified some solutions being explored. The following is a brief summary of these issues:

Increasing the inventory of entry-level homes is a significant challenge.

JoMarie Morris, strategy and operations consultant for the Coalition for Rochester Area Housing ("The Coalition"), reported that one of the county's biggest struggles is increasing the inventory of homes in the range of about \$250,000-\$300,000. She noted that the area lacks developers, and the ones that are attracted there are mostly building luxury multifamily projects in Rochester. Many developers cater to price points affordable only to the county's physicians and other healthcare employees.

The county lacks production builders that can achieve economies of scale.

New housing in the county has primarily been built by smaller, local builders and contractors from the Twin Cities metro area. According to the 2020

Comprehensive Housing Needs Analysis prepared for Olmstead County by Maxfield Research & Consulting, because Olmsted County lacks volume builders, housing development is unable to take advantage of larger economies of scale that can bring down the retail cost of the home.²¹

Housing affordability in Olmsted County is suffering for other reasons as well.

Housing costs in Olmsted County are expected to continue to rise due to increasing land costs. Morris said Rochester and its surrounding communities have very few buildable lots available (e.g., with connections to existing infrastructure). Few opportunities in the county remain to renovate or rebuild existing distressed housing—most have already been rehabilitated—increasing the price for newly platted lots. Other factors may also impact housing supply and affordability, including increasing regulations and entitlement fees, labor shortages, and a lack of infrastructure. Minnesota generally has more land use regulation than other Midwest states.

Warren Hanson, president and CEO of the Greater Minnesota Housing Fund, reported that labor shortages in the construction industry are a chronic problem for rural areas in Minnesota, including Olmsted County, so projects tend to cost more, and timelines are longer in these parts of the state.

Morris also said that in more rural parts of the county, developing the infrastructure necessary for accommodating new housing is one of the biggest barriers. Hanson reinforced this point, noting that housing infrastructure costs have increased, and they are hard to finance.

Housing needs are expected to far outpace the rate of new housing supply.

Olmsted County's 2020 Comprehensive Housing Needs Analysis projects that between 2020 and 2030, the county would need to create a total of around 18,100 housing units: 7,700 for-sale housing units, 5,000 rental units, and 5,400 senior units to keep up with demand. This is nearly double the number of units permitted between 2009 and 2019, which include 3,910 units of single-family housing and 5,438 units of multifamily housing.

Attempts to incentivize new construction of modest homes are struggling.

The county has early strategies in place to help address single-family housing gaps and challenges, like the Growing Affordable Inclusive Neighborhoods (GAIN) program that provides up to \$10,000 in down payment assistance for building homes for households earning less than 80% of the area median income. Due to rising construction costs, the GAIN program has been slow to start, so the county is looking to enhance the program and find additional ways to incentivize the construction of modest homes. The county is considering raising the GAIN

program's income limit to 100 or 120% AMI and increasing the maximum sales price beyond the current limit of \$300,000, since it is difficult at present to find newly constructed homes that sell below this level. Additionally, the Rochester area Community Land Trust, First Homes, a subsidiary of the Rochester Area Foundation, provides subsidies that have funded the development of projects providing additional housing units in the county.

Modular construction as a potential solution.

Some experts advocate for the use of modular construction techniques to address high construction costs in Olmsted County. Rise Modular, a modular construction factory to the west of Olmsted County, recently began producing multifamily housing. Maxfield Research, the county's consultant for the 2020 Comprehensive Housing Needs Analysis, wrote that there is, "... Great opportunity in the modular construction sector that can be utilized in Olmsted County and southeastern Minnesota, providing a win-win scenario to the local modular builders and consumers through cost savings."²² Morris agrees that there could be opportunities for modular construction builders to achieve economies of scale in the county.

Manufactured housing's role.

Manufactured housing also has a role to play in addressing Olmsted County's housing challenges. Morris said one manufactured home community in Olmsted County became a cooperative, which can help residents achieve greater residential stability; it has been very successful with only four vacant lots left. However, she has seen the price of manufactured homes going up.

Appendix C

CASE STUDY: BENTON COUNTY, ARKANSAS

Benton County covers 884 square miles in Northwest Arkansas. The county has a total population of 284,000 with a median household income of about \$72,000. Its largest city, Rogers, has about 68,000 residents and is about 120 miles from Tulsa, Oklahoma. Other sizeable cities include Bentonville, the county seat and home of Walmart's headquarters, and Springdale, which is primarily in neighboring Washington County. From 2000 to 2020, Benton County's population grew by about 85%, substantially faster than the rest of the state, which grew by about 13%.

Unemployment in the state and county have both decreased since 2010. According to the Bureau of Labor Statistics, the county's 2020 unemployment rate was 4.5%, lower than Arkansas' 6.1%. In addition to Walmart, major employers in Benton County include JB Hunt Transportation Services, Mercy Health System of Northwest Arkansas, Tyson Chicken, and Walmart.²³

According to recent Zillow estimates, in July 2022, the county's typical home value²⁴ is \$335,280.

Local housing gaps and challenges.

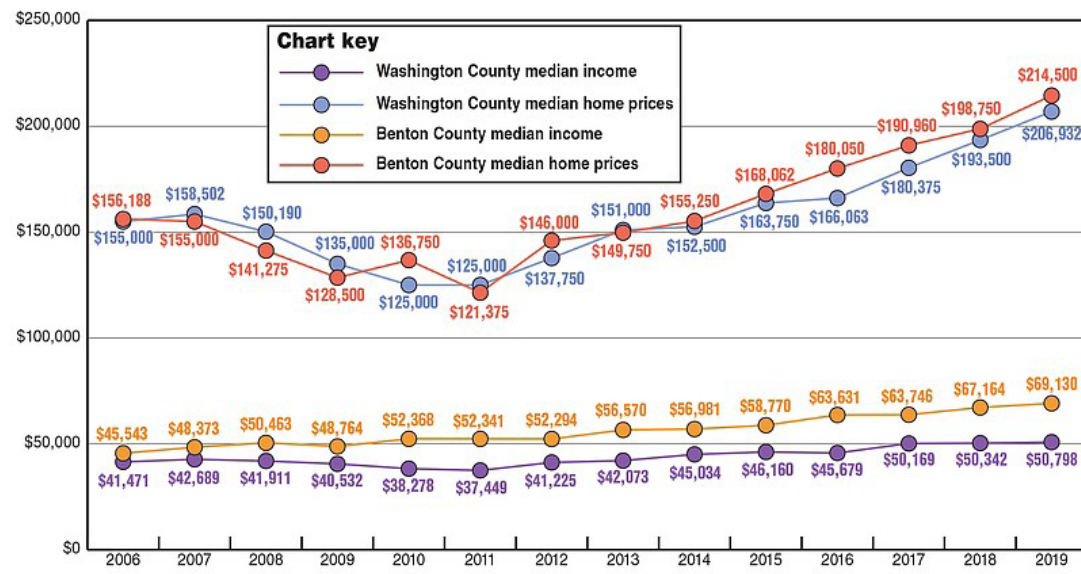
Local housing experts, policymakers, and philanthropists described some of the opportunities and barriers to meeting housing demands in Northwest Arkansas and Benton County. They also identified some solutions being explored.

Nathan Anonick, legislative counsel for Senator Boozman said over 80% of Arkansas' counties are experiencing population loss, while the northwestern part of the state is seeing the opposite due to private sector investment in the area from companies like Walmart and Tyson. Due to supply chain issues, rising home prices, and rate increases, Anonick said Benton County has struggled to meet demand for middle-market housing; the existing supply is either for very low-income or high-income households. He said, "People are flooding into Northwest Arkansas, but the biggest issue that we hear about is on the supply side."

According to the Northwest Arkansas Council, the region needs to add 2,900 housing units a year, and half of those units need to serve households making less than \$78,000 to meet demand. Current production would need to more than double to meet this demand: only 1,400 units were built annually from 2010-2016.²⁵

The Northwest Arkansas Housing Policy Landscape Assessment by a team led by Smart Growth America and funded by the Walton Family Foundation found, “There is insufficient production capacity and experience—as well as a lack of incentives—among local developers to provide the number of units and range of housing options needed to meet the projected demand.” In addition, limits on density prevent the efficient use of land and infrastructure to produce an ample supply of homes. As a result, as shown in the chart below, housing costs are rising faster than incomes.

Housing Prices Outpace Incomes. The increase in housing prices in Benton and Washington has outpaced the growth in wages, making it difficult for people to become home owners. Below are the median home price and median incomes from 2006-2019. The years 2006-2011 are full-year figures, and 2012-2019 average first- and second-half figures.



Source: Center for Business and Economic Research at University of Arkansas and NWA Democrat-Gazette/CHRIS SWINDLE

Meredith Bergstrom, program officer for the Walton Family Foundation’s [Home Region Program](#), said lack of capacity and funding among local partners is significant a barrier to rural housing programs and development in Northwest Arkansas. Both she and the Smart Growth America team reported that local policies in Northwest Arkansas pose barriers to developing diverse housing options. Homes built in Northwest Arkansas are primarily 3-bedroom, single-family homes; many developers report that it is more expensive to build “missing middle” homes and denser development because of additional land-use approvals and community opposition.²⁶

Bergstrom said labor shortages have become a bigger issue over the past couple of years since the COVID-19 pandemic. This problem is particularly acute in Bentonville because of several major developments, including a new Walmart home office. The project will be opening in phases through 2025.

To address the region's housing supply issues, the Walton Family Foundation is exploring various strategies, like supporting the overall capacity of [Partners for Better Housing](#), which has a shared equity program, called the Pay-It-Forward Fund, and the Northwest Arkansas Council's Workforce Housing Center, which is guiding a regional approach to addressing housing supply issues. The Walton Family Foundation has also discussed strategies with local nonprofits from a regional housing fund to land banking.

The Walton Family Foundation supports preserving and developing homeownership and rental opportunities in the region. Bergstrom says the Walton Family Foundation and its partners are working to encourage missing middle housing and infill housing near transit.

Potential for off-site construction to address local issues.

When asked, Anonick said modular housing could be a solution in Benton County and its surrounding areas that are also growing. He said there is more development in these areas, but the supply of middle-market housing is not materializing in Benton County, affecting its neighboring counties. Anonick said the biggest issue is that Northwest Arkansas cannot get construction materials in quickly enough; it is more expensive, affecting the housing supply in the area. Bergstrom also mentioned this as a barrier to developing housing in the area.

No modular or panelized construction manufacturers currently operate in Northwest Arkansas, but Bergstrom said there is interest because of the high costs of housing.

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