

RESEARCH REPORT



Profile and Prospects of the Factory-Built Housing Industry in Canada

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A collage of four small images showing a pie chart, a green mountain, a blue skyscraper, and a brown house, which are then combined into a larger image showing a cityscape with a large pie chart in the sky.

CLAYTON
RESEARCH

Profile and Prospects of the Factory-Built Housing Industry in Canada

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EXECUTIVE SUMMARY

Clayton Research has been retained by Canada Mortgage and Housing Corporation (CMHC) to conduct a study of the factory-built housing sector in Canada. The focus of this study is to develop a profile of the factory-built housing sector, paying attention to evidence and possibilities for further integration between the factory-built sector and the larger Canadian homebuilding industry and with an eye on the level innovation that factory-built housing can bring to the Canadian homebuilding industry.

The residential construction sector in Canada contributes about \$80 billion to the Canadian construction sector annually. The factory-built housing sector in Canada is still quite small – production in the sector amounts to approximately \$1.2 billion. Despite its small size, the factory-built sector is an important component of the homebuilding industry. A successful factory-built housing sector has great potential to create further opportunities for the Canadian home building industry by expanding Canadian housing exports, meeting environmental challenges, and contributing to innovation in the homebuilding sector.

This report combines principal data on the size and scope of the factory-built housing industry with interviews and field visits to provide a broad examination of the factory-built housing sector in Canada. As well as examining the current state of the factory-built sector, forecasts and prospects for the future are incorporated and discussed. The outlook portion of the report includes analysis of future possibilities for technology and production methods and integration between the factory-built and on-site built sectors.

- The factory has played an important role in housing production in Canada for a large part of the past century. Prefabrication has a long history in the Canadian housing industry and has led the way for the modern factory-built housing sector.
- Factory-built housing units are segregated by several major categories including:
 - Manufactured homes;
 - Modular homes;
 - Pre-cut or pre-engineered homes;
 - Log or timber-frame homes;
 - Multi-unit residential modular homes; and

- Wood-frame non-residential units.
- Factory-built housing companies in 2004 produced some 24,440 units. Slightly more than 70 percent, or some 16,890, of these were residential units and the remaining 30 percent were non-residential product.
- Domestic consumption of factory-built residential units amounted to just under \$700 million. Exports of factory-built residential units, \$157 million, far outweighed imports of \$9 million.
- Within the single-family residential factory-built housing sector, modular homes make up the largest share, at over 40 percent of the units produced. This share has been increasing in the past decade.
- Manufactured homes are still the second most important segment but the share of this sector has been falling. Manufactured homes in land-lease communities remain an affordable form of housing and should remain relatively important.
- Pre-engineered housing systems, built in completed open or closed wood panels and erected on-site are popular and have seen nominal growth in the last decade.
- Panellized housing has struggled in the domestic market but has seen growth in foreign markets in the United States, Europe, and Asia.
- There are a wide range of distribution channels for factory-built homes in Canada, including:
 - Factory direct sales – smaller more locally-oriented firms who deal directly with customers.
 - Retailer networks – relationships between manufacturers of factory-built housing and retailers where typically the retailer takes a greater responsibility for customer service and contracts out installation of the home.
 - Builder networks – similar to retailer networks but the builders take more responsibility for the installation and on-site construction of the home. Often with builder networks, the ultimate product is co-branded between the builder and the manufacturer.
 - Community developers – developers make contracts with housing manufacturers to build homes for planned subdivisions which offer a complete house-land package to consumers.

- Integrated producer/builders – homes built in the factory are part of an integrated system with an on-site builder who completes installation of the home on-site.
 - Export channels – exports of factory-built homes take place through independent retailers or builders, as well as through subsidiaries in foreign countries.
- The factory-built housing sector is defined by both upstream and downstream inter-dependencies:
 - Important upstream relationships include millwork, truss fabrication and engineered wood products. Timely delivery is essential to these relationships.
 - Important downstream relationships include transportation and retail/builder networks. Most producers contract out trucking services and rely on a retail layer to market homes to consumers.
- Competition among factory-built producers varies in markets throughout the country. Within local markets competition among factory-built producers is important, while in markets with higher penetration competition with on-site builders is prevalent.
- Overseas international competition is still limited but initiatives such as the Super-E[®] partnership have attempted to increase exports of Canadian housing materials, including factory-built homes, to overseas foreign markets.
- The labour saving and process efficiencies that result from producing housing in a factory setting allow for the factory-built sector to drive approximately 18 percent of the costs out of the production of housing.
- The production processes involved in building factory-built homes vary from operation to operation. Producers often have very different methods for framing and sheeting floors, completing wiring and duct work, and installing drywall.
- Most factory-builders use a production line to complete their product and a few employ lean manufacturing to take further advantage of the supply efficiencies that can be drawn out of the factory.
- Technology in the factory-built sector is often not very different from that employed in on-site built homes. Some producers use increasingly sophisticated machines such as automated and computerized framing jigs, saws, and nailing bridges and overhead cranes and scaffolds.

- The most prominent materials used in the construction of factory-built housing are wood products. The use of value-added wood products varies considerably among manufacturers.
- Consumer demand for factory-built housing is typically segmented between consumers of affordable housing, principally occupying manufactured homes located in landlease communities, and higher-end custom homes primarily in rural markets.
- Prospects for demand from site-builders for factory-built homes are limited by the cost efficiencies already enjoyed by large scale builders and in several markets by insufficient production capacity.
- There are some 190 firms that supply factory-built housing in Canada. Firms are generally solvent and operating at full-capacity.
- Prospects for factory-built housing depend on (1) the drivers of traditional housing demand - population growth, household formation and demand for single-family housing units and on (2) elements that make factory-built housing unique - affordability (manufactured homes), level of customization, and niche segments such as adult lifestyle communities (modular homes).
- Population growth and household formation through to 2010 will slow moderately as the population ages and the housing cycle matures.
- Demand for single-family units is expected to moderate as a result of slowing of overall housing requirements and a continued shift out of single-family demand and toward apartments.
- Potential demand for factory-built homes also depends on the demographic characteristics of the population. The aging of the baby-boom make niche segments a potential growth area and the moving of the echo generation (those born to the baby-boom) will increase demand for affordable housing.
- Integration between factory-built producers and on-site builders may benefit both groups. For site-based homebuilders it allows for a reduction in production time and a minimization of skilled on-site labour, and for factory-builders it is a huge opportunity to increase market share.
- There are several examples of relationships between factory-built producers and on-site builders. The type of integration varies from large on-site builders who operate factory-built subsidiaries to factory-builders who control on-site building and development companies.

- Further integration between factory producers and on-site builders is limited by the rigidity of traditional business practices, and by potential capacity constraints.
- Prospects for further integration will rely strongly on potential partnerships between producers of customized modular homes and builders and developers of new subdivisions in urban and suburban communities.
- The majority of research and development (R&D) spending in Canada is carried out by the manufacturing industry. Factory-built housing producers, in their role as manufacturers, have the potential to increase innovation within in the housing industry, which has typically underinvested in R&D.
- R&D in the Canadian housing industry has typically been facilitated by larger organizations representing the industry as a whole and by government agencies.
- One of the such R&D programs to come out of partnerships between public and private in Canada is the “Value to Wood” program operated by Natural Resources Canada in cooperation with Forintek Canada. Through this program reports on process automation in the factory-built housing sector, marketing strategies for the sector, and standardized production systems have been undertaken.
- In many respects, factory-based builders in Canada are already on the vanguard of innovation within the housing industry, pioneering labour-saving techniques and technologies, advancing housing options among certain niches, like adult lifestyle living and providing viable far north housing options.
- Canadian producers of factory-built homes can also learn from the experience of the sector in the United States. Research projects focused on factory-built housing, facilitated by the Partnership for Advancing Technology in Housing (PATH), include work on the use of adhesives and sealants, air distribution systems, foundation and support systems, Lean production, and steel framing in factory-built homes.
- Factory-based builders are also on the vanguard of environmental stewardship within the housing industry, producing homes which are highly energy efficient – sometimes R-2000 – with minimal amount of construction waste.

SYNTHÈSE

La Société canadienne d'hypothèques et de logement (SCHL) a confié au cabinet Clayton Research le mandat de mener une étude du secteur de l'habitation usinée au Canada. L'étude vise à dresser le profil du secteur de l'habitation usinée tout en portant attention aux indications et aux possibilités d'une intégration plus poussée du secteur de l'habitation usinée au sein du secteur canadien de la construction résidentielle et en veillant sur le niveau d'innovation que l'habitation usinée peut apporter au secteur canadien de la construction résidentielle.

La contribution du secteur canadien de la construction résidentielle à l'égard de l'industrie canadienne de la construction s'établit à 80 milliards de dollars par année. Le secteur de l'habitation usinée au Canada a encore assez peu d'envergure, puisque sa production se chiffre à environ 1,2 milliard de dollars. Malgré sa petite taille, le secteur de l'habitation usinée est un élément important de l'industrie de la construction d'habitations. La prospérité du secteur de l'habitation usinée a de fortes chances de susciter d'autres possibilités pour l'industrie canadienne de la construction d'habitations en déployant les exportations dans le domaine de l'habitation, en relevant les défis environnementaux et en contribuant à l'innovation dans le secteur de la construction d'habitations.

Le présent rapport renseigne principalement sur la taille et l'étendue du secteur de l'habitation usinée à l'aide d'entrevues et de visites des lieux en vue de livrer un vaste examen du secteur de l'habitation usinée au Canada. Tout en étudiant la situation actuelle du secteur de l'habitation usinée, il intègre les prévisions et les perspectives d'avenir en plus d'en débattre. La section du rapport consacrée aux perspectives fournit une analyse des futures possibilités de la technologie et des méthodes de production, ainsi que de l'intégration des secteurs de l'habitation usinée et du secteur de la construction d'habitations sur le chantier.

- L'usinage a joué un rôle important dans la production d'habitations au Canada au cours d'une grande partie du siècle dernier. En effet, la préfabrication existe depuis longtemps au sein du secteur canadien de l'habitation; en fait, elle a préparé le terrain pour le secteur moderne de l'habitation usinée.

- Les maisons préfabriquées se rangent en plusieurs importantes catégories :
 - Les maisons usinées;
 - Les maisons modulaires;
 - Les maisons en kits préfabriqués;
 - Les maisons en rondins ou à ossature en gros bois d'oeuvre;
 - Les maisons modulaires collectives;
 - Les bâtiments à ossature de bois non résidentiels.
- Les entreprises d'habitations usinées en ont réalisé quelque 24 440 en 2004. De ce nombre, un peu plus de 70 %, soit quelque 16 890, étaient des habitations et le reste, 30 %, des bâtiments non résidentiels.
- Les ventes d'habitations usinées au pays ont totalisé près de 700 millions \$. Les exportations d'habitations usinées qui se sont chiffrées à 157 millions \$ ont largement dépassé les importations évaluées à 9 millions \$.
- Dans le secteur des maisons unifamiliales usinées, les maisons modulaires accaparent la plus large part, soit plus de 40 % de toutes les maisons produites. Cette proportion a connu une augmentation au cours de la dernière décennie.
- Les maisons usinées occupent toujours le deuxième rang, mais leur proportion a décliné. Les maisons usinées situées dans des collectivités aménagées sur des terrains à bail demeure une sorte d'habitation abordable et leur nombre devrait rester important.
- Les systèmes d'habitation en kits préfabriqués, en panneaux incorporés ouverts ou fermés et érigés sur les lieux, connaissent de la popularité et ont connu une croissance minime au cours de la dernière décennie.
- Le secteur des habitations en panneaux a éprouvé des difficultés au sein du marché intérieur, mais a connu une croissance à l'étranger, notamment aux États-Unis, en Europe et en Asie.
- Il existe une vaste gamme de canaux de distribution des maisons usinées au Canada :
 - Ventes en direct de l'usine : entreprises locales traitant directement avec les consommateurs.
 - Réseaux de détaillants : rapports entre les fabricants de maisons usinées et les détaillants où les détaillants

assument une plus grande responsabilité à l'égard du service à la clientèle et confient à des tiers la réalisation des maisons.

- Réseaux de constructeurs : situation semblable à celle des réseaux de détaillants, sauf que les constructeurs assument davantage de responsabilité pour la réalisation et la construction des maisons sur le chantier. Dans les réseaux de constructeurs, il arrive souvent que le produit final porte à la fois la marque du constructeur et celle du fabricant.
 - Promoteurs communautaires : les promoteurs établissent des contacts avec les fabricants d'habitations en vue d'en construire pour des lotissements qui offrent un forfait maison-terrain aux consommateurs.
 - Réseaux intégrés de producteurs-constructeurs : les maisons construites à l'usine font partie d'un système intégré qui fait appel à des constructeurs qui terminent la réalisation des maisons sur le chantier.
 - Canaux d'exportations : les exportations de maisons usinées se font par l'intermédiaire de détaillants ou de constructeurs indépendants, ainsi que de filiales établies à l'étranger.
- Le secteur de l'habitation usinée se définit par une interdépendance aussi bien en amont qu'en aval :
 - Les importants rapports en amont touchent la menuiserie, la fabrication des fermes et les produits en bois d'ingénierie. Le respect des délais de livraison est essentiel à de tels rapports.
 - Les importants rapports en aval touchent le transport et les réseaux de détaillants-constructeurs. La plupart des producteurs impartissent les services de transport par camion et ont recours à des détaillants pour vendre les maisons aux consommateurs.
 - La concurrence que se livrent les producteurs de maisons usinées varie d'un marché à l'autre au pays. Dans les marchés locaux, le concurrence entre les producteurs de maisons usinées est importante, mais dans les marchés où le taux de pénétration est plus élevé, c'est la concurrence avec les constructeurs d'habitation sur le chantier qui domine.

- La concurrence internationale outre-mer est toujours limitée, mais les initiatives comme celle de la maison Super-E[®] ont tenté d'accroître les exportations de matériaux de construction ou produits d'habitation canadiens, y compris les maisons usinées, à destination des marchés étrangers.
- L'efficacité de la main-d'œuvre et du processus qui découle de la production de maisons en usine permet au secteur de l'habitation usinée de retrancher environ 18 % du coût de la production d'habitations.
- Le processus de production des maisons usinées varie d'une activité à l'autre. Les producteurs ont bien souvent recours à des méthodes très différentes pour exécuter la charpente et poser le support de revêtement de sol des planchers, compléter l'installation des canalisations électriques et des réseaux de conduits, et mettre en œuvre les plaques de plâtre.
- La plupart des constructeurs d'habitations usinées emploient une chaîne de production pour terminer leur produit et quelques-uns ont recours à des techniques de fabrication efficaces pour tirer davantage parti du gain d'efficacité des approvisionnements qui peut être retiré de l'usine.
- La technologie au sein du secteur de l'habitation usinée n'est bien souvent pas vraiment différente de celle du secteur des maisons réalisées sur le chantier. Certains producteurs utilisent des machines de plus en plus perfectionnées, comme des modèles automatisés ou informatisés de gabarits de charpente, de scies, de plate-formes de clouage, de grues aériennes et d'échafaudages.
- Les produits en bois sont les matériaux les plus employés dans la construction d'habitations usinées. L'emploi de produits du bois à valeur ajoutée varie énormément d'un fabricant à l'autre.
- La demande des consommateurs à l'égard des habitations usinées se divise généralement entre les logements abordables, principalement des maisons usinées situées dans des collectivités aménagées sur des terrains à bail, et les maisons personnalisées haut de gamme situées en milieu rural.
- Les perspectives de la demande des constructeurs de maisons sur le chantier à l'égard des maisons usinées sont limitées par l'efficacité des coûts dont bénéficient déjà les constructeurs de grande envergure et par l'insuffisance de la capacité de production dans plusieurs marchés.

- Il existe quelque 190 entreprises qui offrent des habitations usinées au Canada. Les entreprises, généralement solvables, fonctionnent à pleine capacité.
- Les perspectives à l'égard des maisons usinées dépendent (1) des moteurs de la demande de maisons traditionnelles, en l'occurrence la croissance de la population, la formation des ménages et la demande de logements unifamiliaux et (2) des éléments qui rendent les maisons usinées uniques en leur genre, grâce à leur abordabilité, à leur niveau de personnalisation et aux créneaux d'acheteurs, telles les collectivités axées sur le mode de vie adulte (maisons modulaires).
- La croissance de la population et la formation des ménages jusqu'en 2010 ralentira modérément à mesure que la population vieillira et que le cycle des habitations arrivera à maturité.
- La demande de logements unifamiliaux devrait se modérer par suite du ralentissement des besoins généraux en matière d'habitation et de la poursuite de la tendance à abandonner les logements individuels au profit des appartements.
- La demande potentielle de maisons usinées dépend également des caractéristiques démographiques de la population. Le vieillissement des baby-boomers permet aux créneaux d'être une zone de croissance possible et les déplacements de la génération écho (issue des baby-boomers) fera augmenter la demande de logements abordables.
- L'intégration des producteurs d'habitations usinées et des constructeurs de maisons sur le chantier pourrait bénéficier aux deux groupes. Elle permettra, d'une part aux constructeurs de maisons sur le chantier de réduire le délai de production et de réduire la main-d'œuvre spécialisée sur le chantier et offrira, d'autre part aux constructeurs d'habitations usinées, une occasion en or d'accroître leur part de marché.
- Il existe plusieurs exemples de rapports entre les producteurs d'habitations usinées et les constructeurs d'habitations sur le chantier. Le type d'intégration va des constructeurs d'envergure qui régissent les filiales d'habitations usinées aux constructeurs d'habitations usinées qui régissent les entreprises de construction et d'aménagement sur le chantier.
- L'intégration plus poussée des producteurs d'habitations usinées et des constructeurs d'habitations sur le chantier est limitée par la

rigidité des pratiques d'affaires traditionnelles et par des contraintes de capacité.

- Les perspectives d'une intégration plus poussée dépendra fortement des partenariats formés par les producteurs de maisons modulaires personnalisées et par les constructeurs et les promoteurs de nouveaux lotissements dans les collectivités urbaines et suburbaines.
- Au Canada, la majorité des fonds consacrés à la recherche et au développement proviennent de l'industrie manufacturière. En effet, les producteurs d'habitations usinées, à titre de fabricants, ont la possibilité d'accroître l'innovation au sein du secteur de l'habitation, qui n'a généralement pas suffisamment investi dans la recherche et le développement.
- La recherche et le développement au sein du secteur canadien de l'habitation ont généralement été favorisés par les organismes d'envergure représentant le secteur dans l'ensemble et par les organismes gouvernementaux.
- L'un de ces programmes de recherche et de développement à découler de partenariats publics-privés au Canada est le programme *Valeur au bois* dirigé par Ressources naturelles en collaboration avec Forintek Canada. Ce programme a permis d'entreprendre des rapports traitant de l'automatisation des processus au sein du secteur de l'habitation usinée, de la commercialisation des stratégies du secteur et de systèmes de production normalisés.
- À bien des égards, les constructeurs canadiens de maisons usinées sont déjà à l'avant-garde au sein du secteur de l'habitation, expérimentant des techniques d'économies de la main-d'œuvre et des technologies, faisant progresser les options de logement parmi les créneaux, tel le mode de vie adulte, et offrant des options de logement viables pour le Grand Nord.
- Les producteurs canadiens de maisons usinées peuvent également tirer parti de l'expérience du secteur aux États-Unis. Les projets de recherche ont porté sur l'habitation usinée, étant favorisés par le partenariat destiné à faire progresser la technologie en habitation (Partnership for Advancing Technology in Housing - PATH) et comprennent des travaux sur l'utilisation d'adhésifs et de mastics d'étanchéité, les systèmes de distribution de l'air, les fondations et les systèmes d'appui, les techniques de production efficaces et le recours à l'ossature d'acier dans les maisons usinées.

- Les constructeurs de maisons usinées sont aussi à l'avant-garde de la gérance de l'environnement au sein du secteur de l'habitation, produisant des maisons hautement éconergétiques, parfois des maisons R 2000, et une quantité minimale de déchets de construction.



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1 INTRODUCTION

In the past decade nearly one in five new homes in the U.S. has been manufactured in a controlled factory environment then transported to the site. The \$17 billion U.S. factory-built home industry has evolved from its trailer-park roots, and today competes head to head with site-built homes.

Canada's approximately \$1 billion factory-based housing sector is smaller than in the U.S. (in absolute terms and relative to total new home construction), but has a long history. As the Canadian homebuilding sector continues to seek out avenues of innovation in residential construction, it is likely to make more use of factory-built housing in the years to come.

The residential construction sector in Canada contributes about \$80 billion to the Canadian economy annually¹. The vast majority of the residential new construction sector (which accounts for about 52 percent of total residential construction spending) is composed of activities of on-site builders. The factory-based sector of the homebuilding industry, however, also plays a small but important role - building homes wholly or partially in a factory setting and prefabricating major housing systems. Major groupings within the factory-based sector include:

- Manufactured homes (formerly mobile homes), which are fully-built in the factory before transportation. These homes are certified by the Canadian Standards Association as CSA-Z240, where permitted. Manufactured homes, also called "mini-homes" in Atlantic Canada, are generally one or two sections, single-storey and are highly complete (i.e., require a minimal of on-site construction). Most manufactured homes are set on surface-mount foundations. Manufactured homes can be moved again from the site to a new site, but in practice very few placed manufactured homes are ever moved. CSA-Z240 manufactured homes are always wood-framed dwellings.
- Modular homes are transported from the factory as 3-dimensional sections and installed on a full perimeter foundation. Modular homes can be any number of sections assembled into single or multi-storey homes, although the vast majority of modular homes produced in Canada are two sections. These modules are also

¹ Residential investment in 2004 measured in 2004-based dollars, less ownership transfer costs and including estimated repairs spending.

used in some cases to construct multi-family dwellings such as townhouse developments or low-rise apartment blocks. All of the producers of these homes are certified by the Canadian Standards Association as CSA-A277. Modular homes are almost always wood-frame dwellings.

- Pre-engineered varieties of factory-built housing include panellized housing (transported from the factory as 2-dimensional components and assembled on site) and pre-cut dwellings (generally log or other vacation homes). Generally pre-engineered home producers are not necessarily certified through the Canadian Standards Association. A majority of pre-engineered housing systems are wood based, but this category also includes systems which are steel and/or concrete based materials.
- Non-residential modular units. This study considers and accounts for the production and consumption in Canada of wood-frame based non-residential modular units. Although this is only a component of the sizable non-residential factory-built building sector in Canada – a majority of which are steel frame buildings – it is considered in this study as many factory-built home producers also produce wood-frame non-residential units.

This study does not consider or account for the production of “park model” units (certified by the Canadian Standards Association as CSA-Z241) or other movable structures primarily focused on the vacation or recreation market.

Traditionally in Canada, the factory-built housing sector has been focused on manufactured homes, many of which have been placed on leased land in mobile-home community developments (the homes are usually sold through retail networks). This market segment is rapidly giving way to markets defined by landowners purchasing factory-built homes, perhaps manufactured homes, but increasingly modular or pre-engineered homes, to place on their land on full perimeter foundations. This simple spectrum, however, masks the complex number of marketing and distribution relationships which exist within this sector, including landlease communities, speculative developments and other types of arrangements.

Several key trends bode well for the Canadian factory-built homes sector:

- Consumer acceptance is rising. Quality and aesthetic characteristics are now standard so factory-built homes no longer have the “house-in-a-box” image. For example, hinged trusses

allow manufacturers to produce steep roof pitches (more like site-built) while conforming to highway regulations.

- Production is turning to more modular rather than manufactured. Modular homes are “higher end,” and are usually put on full perimeter foundations – making it easier for consumers to secure traditional mortgage financing. Thus the trend toward modular reiterates the rising integration between the factory-built and site-built sectors.
- As factory-built homes market share grows, production could become increasingly cost effective due to production line, climate control, and division of labour, procurement, inventory and materials handling efficiencies. Costs may be driven down further by the introduction of large-scale labour-saving technology.
- Factory-built homes are sold as either single section (maximum width 16 feet due to highway regulation in most provinces, 28 feet in Alberta) or multi-section. A multi-section unit allows for much larger homes overall, and larger room spans within, associated with higher-end homes and toward more integration with traditional homebuilding. The proportion of sales by most manufacturers of manufactured and modular homes which are multi-section is on the rise.
- A number of non wood-based factory-built housing alternatives are emerging which are providing builders and consumers real alternatives to traditional housing concepts in Canada.
- Both in the U.S. and in Canada, the emergence of architecturally-designed modernist modular homes is bringing a certain chic to the industry and potentially raising its profile amongst the general public.

Long-term demand prospects in the U.S. for factory-built homes products remain buoyant, due to cost savings, increased acceptance and integration by developers. This is good news for Canadian factory-built home producers in two ways: first, the opportunities for future exports to the U.S. market remain strong; and second, the trends suggest that factory-built homes will likely play an increasingly important role within the Canadian homebuilding industry too.

Moreover, the factory-based sector is confident that there will be a greater acceptance of its modular product – particularly in urban areas, where penetration has historically been weaker – with the introduction of simplified objective-based building codes.

The Canadian factory-based sector is already working in conjunction with home builders and it is likely that this model will become more prevalent. Factory-built product has played a large role in several adult lifestyle communities – a growth area for homebuilding based on demographics.

By some measures, the factory-built housing sector is simply an extension of the already burgeoning factory-based housing components sector. Home builders routinely employ partially prefabricated components in their construction these days, and the range of these components is increasing. For instance, factory-assembled roof trusses are now the industry standard, with the main exception being houses with cathedral ceilings, and some areas in the north where truss penetration remains low. Similarly, floor systems and prefabricated 'stress' panels account for a progressively larger share of custom and tract new housing construction in Canada. Contractors save labour costs, and gain uniformity and quality control through a manufacturing environment with precision equipment producing a highly-engineered product – often with increased strength properties over site-built systems.

1.1 STUDY MANDATE

With this background in mind, Canada Mortgage and Housing Corporation (CMHC) selected Clayton Research to undertake a study of the factory-built housing sector in Canada, focusing on:

- Developing a profile of the factory-based sector of the homebuilding industry;
- Exploring and documenting the integration of factory-built homes and components into the Canadian housing industry; and
- Discussing the level of innovation in the Canadian housing industry.

This present study provides a broad examination of the factory-built housing sector in Canada, including estimates of its current size and scope, analysis of past and current trends, and an examination of technology and production methods along with a comprehensive forecast of the prospects of this nascent Canadian industry.

1.2 WORK PROGRAM

The work program for the fulfilment of this mandate included the following activities:

- Information collection and literature review;
- Structured interviews;
- Field visits to factories, retail centres and communities;
- Analysis; and
- Report preparation.

As well as the above activities Clayton Research liaised with the project manager at CMHC throughout the undertaking.

1.3 REPORT STRUCTURE

In addition to the introduction (Chapter One), this report contains the following:

- Chapter Two provides a **industry overview and history** of the factory-built housing sector in Canada;
- Chapter Three presents a comprehensive industry **profile**;
- Chapter Four summarizes the **technology, process and materials** used in the factory-built housing sector in Canada;
- Chapter Five estimates current **economic status** of the sector;
- Chapter Six presents a **forecast of the sector's prospects** over the next 5 years;
- Chapter Seven explores evidence of **integration between factory producers and on-site home builders**; and
- Chapter Eight review the role of **research and development** in the factory-built sector in terms of innovation with the housing industry.

1.4 THE INTERVIEW AND FIELD VISIT PROCESS

Interviews and field visits were conducted in partial fulfilment of the study mandate with various individuals and organisations in order to:

- Gain an understanding of the size, scope and key trends in the factory-built housing sector;
- Build an understanding of issues and concerns prevalent among stakeholders in the sector;

- Document use of technology and modes of production within the sector; and
- Assess market opportunities for increased use of factory-built housing within the Canadian homebuilding sector.

Interviews were conducted among a variety of industry stakeholders across Canada including:

- Factory-built housing producers;
- Retailers/distributors;
- Community owners/managers; and
- Market analysts.

Site visits were conducted in B.C., Alberta, Ontario, Quebec and New Brunswick with:

- Manufactured housing producers (both private and public companies);
- Modular housing producers;
- Engineered housing (panellized and precut) producers;
- Log and timber-frame housing producers;
- Emerging materials-based engineered housing producers, such as load-bearing steel and steel and concrete panel producers; and
- Landlease and land development communities.

Once individuals were contacted they were given a brief description of the nature of our call. As by prior arrangement, recipients were notified that the interviews were being conducted in support of a study on the profile of the factory-built housing sector and were being conducted on behalf of Canada Mortgage and Housing Corporation.

In addition to these structured interviews, conversations took place, or information was gathered, between senior staff working on this study and a number of key industry informants, including analysts at Statistics Canada, CMHC, Industry Canada, the Canadian Home Builders' Association, the Canadian Manufactured Housing Institute, the Manufactured Housing Association of Canada and other private consultants.

A complete list of industry consultations and site visits is found below.

Industry Consultations and Site Visits

Sector	Company	Location	
Community	Antrim Glen Adult Lifestyle Community	Hamilton	Ontario
Retailer	Best Buy Homes	Calgary	Alberta
Producer	Chaparral Industries Inc.	Kelowna	B.C.
Association	CHBA	Ottawa	Ontario
Association	CMHI	Ottawa	Ontario
Agency	CMHC	Moncton	New Brunswick
Agency	CMHC National Office	Ottawa	Ontario
Community	College Heights	Kelowna	B.C.
Agency	CSA	Ottawa	Ontario
Producer	Fabrication Scandinave	Carleton	Quebec
Producer	Fabrik-International	Sherbrooke	Quebec
Agency	Forintek	Quebec City	Quebec
Development	Gauvin Village	Moncton	New Brunswick
Producer	Genesis	Cambridge	Ontario
Producer	Glenwood Homes	Langdon	Alberta
Producer	Grandeur Housing Limited	Winkler	Manitoba
Producer	Guildcrest Building Corporation	Morewood	Ontario
Producer	Hillier's Trades	Happy Valley	Newfoundland
Producer	Hospitality Homes	Woodstock	New Brunswick
Producer	IHL International	Vancouver	B.C.
Agency	Industry Canada	Ottawa	Ontario
Producer	Kent Homes Limited	Bouchette	New Brunswick
Producer	Logimag Industries	Richmond	Quebec
Producer	Maple Leaf Homes Inc.	Fredericton	New Brunswick
Association	MHAC	Ottawa	Ontario
Producer	Modulex	Quebec City	Quebec
Producer	Moduline Industries, BC	Kelowna	B.C.
Producer	Normerica Post & Beam	Toronto	Ontario
Community	Pine Tree Sales and Park Ltd	Moncton	New Brunswick
Producer	Prestige Homes	Sussex	New Brunswick
Producer	Profab Homes	Quebec City	Quebec
Producer	Quality Manufactured Homes Limited	Kenilworth	Ontario
Producer	RCM Modulaire	Quebec City	Quebec
Producer	Royal Homes Limited	Wingham	Ontario
Retailer	Roymac Homes	Amhurst	New Brunswick
Producer	SRI - Winfield Division Inc.	Kelowna	B.C.
Producer	SRI Homes - Regent Home Systems	Lethbridge	Alberta
Producer	SRI Homes Inc. Shelter Homes (Evevan)	Evevan	Saskatchewan
Agency	Statistics Canada	Ottawa	Ontario
Producer	Stelumar	Cambridge	Ontario
Producer	Structurelam	Kelowna	B.C.
Community	Sunnyside Village	Spruce Grove	Alberta
Producer	Supreme Homes	Tracadie-Sheila	New Brunswick
Producer	Thistlewood	Markdale	Ontario
Producer	Viceroy Homes	Port Hope	Ontario
Producer	Winalta Shelters Inc.	Spruce Grove	Alberta

1.5 CAVEAT

The information contained in this publication represents current research available to CMHC and has been reviewed by a wide spectrum of experts in the housing industry. Readers are advised to evaluate the information, materials and techniques cautiously for themselves and to consult

appropriate professional resources to determine whether information, materials and techniques are suitable in their cases. Any photographs in this publication are for illustration purposes only and may not necessarily represent currently accepted standards.

This study relies on data from a number of sources at both the national and regional levels (see Section 3 for more detail on data sources). Estimates based on national data from Statistics Canada and other sources may be viewed confidently as providing a highly-accurate estimate of the size and scope of the factory-built industry in Canada.

Estimates are also presented in this report at a regional level. These estimates tend to be based on smaller sample sizes and more limited data from the various sources relied on in the preparation of this report. In this way the regional estimates are generally subject to a lower level of certainty. The factory-built housing industry is characterised by many private firms, and information gained from the interviews is not guaranteed to capture the opinions or expertise of the industry as a whole.

Clayton Research has endeavoured to overcome these obstacles by assessing all relevant public information available to us or attainable within the scope of the project. We have supplemented existing secondary sources with primary information obtained through the course of the project.

2 INDUSTRY OVERVIEW AND HISTORY

2.1 PRINCIPAL CHARACTERISTICS

The factory has played an important role in all housing production in Canada, certainly since the post-war period of construction rationalization. Nearly every new home in Canada includes prefabricated components from roof trusses and gypsum panels to plumbing assemblies and cabinetry. But the focus of this study is on that component of the housing-related factory sector which produces homes fully within the factory setting. Specifically on producers of manufactured or modular housing, which are nearly fully-finished in the factory. The study also investigates panellized and pre-engineered systems, which are partially finished in the factory requiring considerable assembly on site, yet for which nearly all of its components have undergone some prefabrication in a factory setting.

Most factory producers consider themselves home builders but there is a fundamental difference in the business model employed by these producers as opposed to site-built home builders.

Although the Canadian factory-built sector is not extraordinarily technologically advanced, generally producers employ more capital as a proportion of their total input costs and trade this off by using more labour saving techniques, driving down the variable cost of production relative to site-built home builders. As a result, homes produced by the factory sector have lower variable costs and higher fixed costs.

2.2 HISTORICAL DEVELOPMENT

Factory-built housing in Canada has a long history². Significant events in the history of this sector include:

- Ready-made wood-based housing was being produced in Nova Scotia as early as the 1890s. These units were being exported to the Caribbean, and also served the domestic market, in particular remote settlement areas;

² Most of the data in this section comes from Clayton Research and Scanada Consultants, *The Housing Industry: Perspective and Prospective*, Prepared for CMHC, NHA 6195. Ottawa: Government of Canada, 1989.

- In 1932 the Halliday Company began shipping factory-based housing, mostly of a panellized variety to rural and small towns. Later the Halliday Co. provided wartime housing to Toronto (see Figure 1);

Figure 1

Halliday Co. Provided Wartime Housing to Toronto



Source: Toronto Daily Star, January 11, 1945

- Throughout the War, the shortage of construction labour and the need for efficient use of limited material resources prompted both the National Housing Administration (a division of the Department of Finance) and Wartime Housing Limited (a crown corporation set up to provide worker and veteran housing – ultimately consolidated into CMHC) to encourage the use of prefabricated systems or dwellings. In many cases, builders adopted the so-called project manufacturing approach, which involved the establishment of a factory setting by a home builder to service his own projects – often on site.

This history of factory-built housing in Canada since the Second World War is interconnected with developments within the homebuilding sector itself. In a general sense, the homebuilding industry in the post-war era in Canada can be characterized by two distinct phases:

- The period from the mid-1940s through to the 1960s saw large transformations in the homebuilding industry, where the focus of products and processes was geared to reducing on-site construction time and labour and the need for skilled trades or

extensive training. The goal was to reduce costs in order to compete in the mass housing markets.

- The period since the late 1960s has seen the homebuilding industry switch focus from these broad productivity enhancements to activities and business models geared to enhancing housing performance, quality and appeal. Productivity in the home construction process, i.e., the pursuit of labour-saving and other efficiency enhancing technologies and building practices, since the 1960s, while not receding, certainly has not been pushed persistently ahead as it was in the earlier period.

Within this framework, factory-built housing has held important positions historically in each of the long phases of post war construction trends. In the pre-1970s race for productivity gains among Canadian home builders, factory-based housing played an important role in progressively introducing more and more prefabricated components to the production process, and pioneering labour-saving processes and time-saving materials. Several large producers sprang up across the country building, for the first time, traditionally-framed wood-based whole homes, ready for transport. These companies included Canadian Comstock (in Montreal), Nuway (London), West Coast Trailer (Vancouver), North American Buildings (Winnipeg), Muttarts (Edmonton), Engineered Buildings (Calgary) and Qualico (Winnipeg and Calgary).

Market shares of total single-family housing construction attributed to this sector rose steadily through this period from about 7 percent in the late 1940s to a peak of about 15 percent by the early 1970s. But the levels of factory-built housing in Canada declined from their 1970s peaks through the 1980s and 1990s in part due to the shift in consumer demand for product with a greater “lifestyle focus,” including features such as larger, more open-concept interior designs – architectural features in many cases that the factory-built sector was unable, or unwilling to deliver at the time.

A number of builders in the 1960s and 1970s dabbled in project-specific factories to design prefabricated wall panels to service their own needs. These included Campeau and Minto in Ottawa and Bramalea and Rocket Lumber in Toronto. These firms were able to increase labour productivity significantly over conventional home building.

During these years the federal government strongly supported the growth of the manufactured housing industry. For example, the Department of Regional Economic Expansion (DREE), launched in 1969, provided

funding for factories in the sector. The legacy of the DREE grants remain with us today with clusters of factory-built home producers existing in Quebec, Atlantic Canada and parts of Western Canada – areas identified by CMHC with large concentrations of DREE grants.

Ultimately, the production efficiencies pioneered by the early project-manufacturers became more infused among conventional builders (including the use of prefabricated components such as trusses, cabinets, pre-cut studs, pre-fabricated stairs, etc.), leading to a gradual exit of major producers like Campeau, Minto and Bramalea from the use of in-house factory production.

By the mid 1970s federal government programs, such as the Assisted Home Ownership Program (AHOP) introduced during the period 1973-1979, began to erode the demand for factory-built homes by providing financial assistance to middle-income homeowners of conventionally-built homes.

In many respects, the greater shifts into modular housing product from the more traditional manufactured homes, which are prevalent in the industry since the mid-1990s, is a response – albeit perhaps late in coming – to the general focus in homebuilding toward product enhancements and lifestyle marketing. A majority of factory-based producers today are modular home producers and this group generally considers itself producers of custom-built product. Modular home producers in Canada consider themselves ready and willing to produce almost any design a customer can bring to them. Moreover, through better structural materials and other technological advancements, engineered wood products in particular, these producers are able to build larger open living spaces within the modular framework better addressing customer needs.

Figure 2 illustrates interior sight lines within a two-storey modular show home built by Sussex, New Brunswick-based Prestige Homes. The large open dimensions between modules is achieved with the use of engineered wood products such as LVL beams.

Figure 2

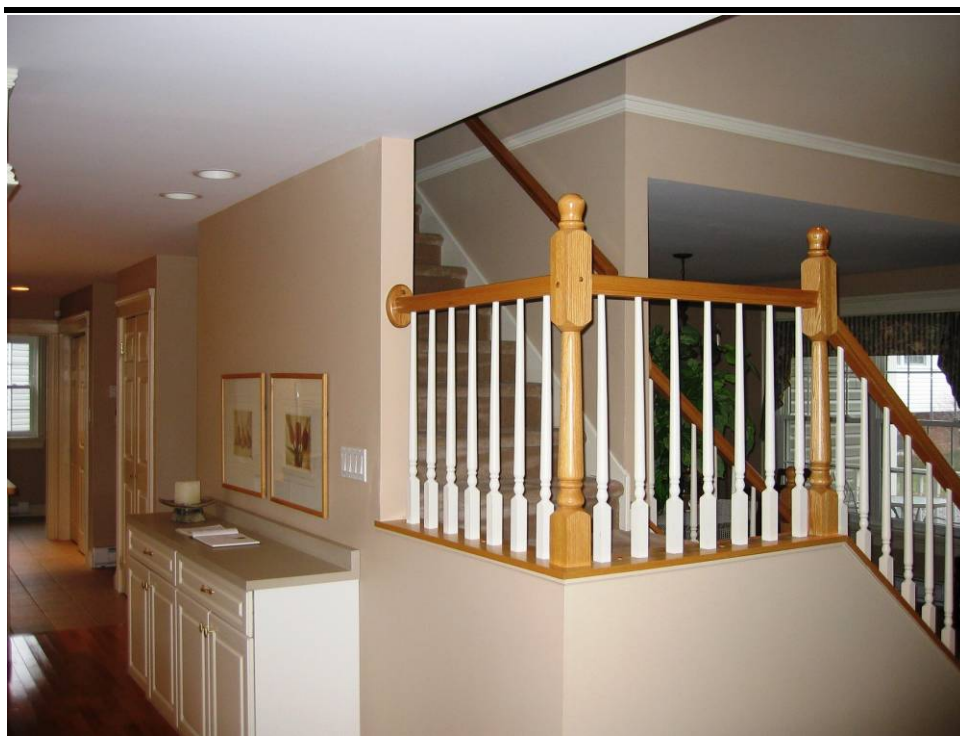


Photo by Clayton Research

The history of the factory-based housing sector helps inform its prospects. The sector has a long and varied historical interaction with the mainstream site-based homebuilding industry, and the relative prospects of the factory-based sector have risen and fallen over time depending on:

- The social or technological needs for off-site construction product (such as in times of labour shortage); and
- The ability of the factory-based sector to keep pace with consumer demands.

The remainder of this study will focus on the current state of the factory-based sector and assess the prospects for growth within this context.

3 INDUSTRY PROFILE

The last set of comprehensive data on the size and scope of the factory-built housing sector in Canada was produced for CMHC in January 1996, which was based on 1993 data³. A little over a decade has transpired since these estimates were made, so the present study presents a revised set of benchmarks for the sector.

3.1 DATA SOURCES

The present analysis is compiled by Clayton Research based on the following input:

- Data from the Statistics Canada Annual Survey of Manufacturers based on NAICS codes:
 - 321991[Manufactured (mobile) home manufacturing]; and
 - 321992 (Prefabricated wood building manufacturing).

These data are published through to 2003, but have been estimated forward to 2004 based on data from the Monthly Survey of Manufacturers (MSM). Data are only available in the MSM at a higher level of aggregation. In this case data for NAICS code 32199 (All other wood product manufacturing) and other evidence was used in the estimation;

- Data and analysis from the Statistics Canada 2001 Input-Output Model of the Canadian Economy;
- Average pricing data from the CMHC (1996) study;
- Data on changes in prices from the Statistics Canada survey of industrial product prices;
- Data on housing starts from CMHC;
- Data on international trade from Industry Canada (Strategic database); and
- Data collected on a confidential basis by the researchers during the producer interviews and field visits.

³ McGrath, T., *A Structural Profile of the Manufactured Housing Industry in Canada, United States, Japan and Germany*, Prepared for CMHC and The Canadian Manufactured Housing Association. Ottawa: Government of Canada, 1996.

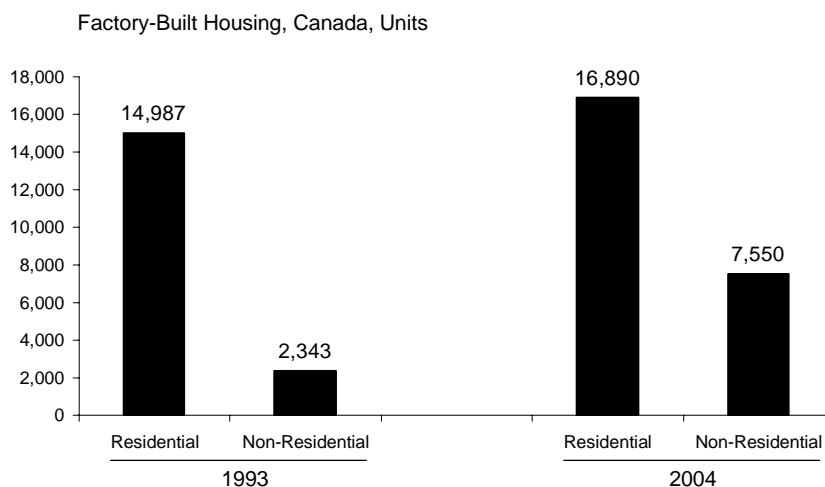
3.2 INDUSTRY SIZE AND SCOPE

3.2.1 Total Units Produced

In 2004, factory-built housing companies produced some 24,440 units – up about up some 40 percent from the 17,330 units identified in the CMHC (1996) study. About 30 percent of production by factory-built housing companies goes toward non-residential applications, including units for work camps, community centres, and other such applications⁴ (see Figure 3).

Figure 3

Factory-Built Housing, Canada, 1993 and 2004



¹ Wood-frame prefabricated non-residential units only

Source: Clayton Research based on data from CMHC (1996) and Figure 8

In terms of residential units, some 16,890 units were produced by Canadian factories in 2004, which is about 13 percent higher than in the CMHC (1996) study.

A sizable proportion of production by factory-built home producers in 2004 was non-residential product. Some 7,550 units of non-residential product

⁴ The measure of non-residential production employed here captures all applications other than housing applications (single-family or multi-family dwellings). Examples of uses of non-residential factory built units includes buildings for work camps (including bunk houses), institutions (including health care and educational facilities), recreational centres, etc. These data, however, do not capture the large industry in Canada which produces prefabricated steel buildings for commercial, industrial and agricultural purposes. The non-residential units captured in this study are wood-frame units and in many cases are produced by the same companies that produce housing units.

was produced. This segment is included in the analysis as it is by and large produced by the same companies who are producing housing units (see, for example, Figure 4, showing a module from a work-camp building under construction in the Spruce Grove, Alberta-based Winalta Inc. plant). This analysis does not include the sizable industry in Canada which produces prefabricated steel buildings for commercial, industrial and agricultural purposes.

Readers should employ caution in interpreting the changes in production levels of the industry between the 1993 and 2004. There are some differences in methodology which could affect the comparability of the two sets of data:

- The present study has included estimates of the non-wood panellized housing industry. This nascent component of the factory-built housing sector – which competes head-to-head with the wood-based panellized housing industry – was not considered in the 1996 study. That methodological change aside, there probably was little or no production of non-wood based panellized housing in 1993;
- The present analysis has determined that a sizable component of the NAICS 321992 (Prefabricated wood building manufacturing) industry's production is non-residential units. In part this is based on an analysis of the 2001 Input-Output Model of the Canadian Economy (Statistics Canada), and these findings were also confirmed in the interviews and site visits made in the process of completing this study. The 1996 study, by contrast, based its estimates entirely on a sample-based survey of members of the then Canadian Manufactured Housing Association (CMHA). The survey captured responses from a little over one-third of the industry. It is possible that that survey was insufficient in scope to capture the magnitude of non-residential production by some companies in the industry – especially those with a large non-residential focus who may not have been members of the CMHA at the time. As a test, we looked at the 1991 version of the Input-Output model and found that the proportion of the industry's production directed toward non-residential markets was some 13 percentage points higher than in 2001.

Figure 4



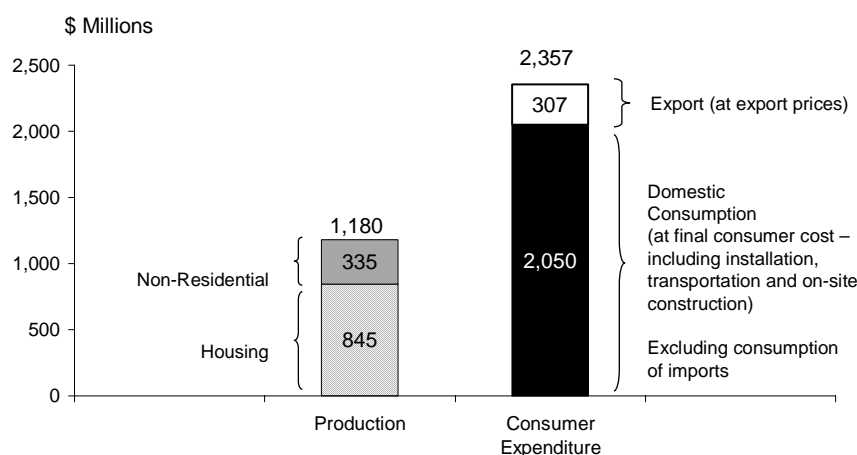
Photo by Clayton
Research

3.2.2 Production Volumes, 2004

Production of factory-built housing in Canada reached \$1.2 billion in 2004 – accounting for about 1.5 percent of the \$80 billion residential construction investment in Canada (see Figure 5).

Figure 5

Factory-Built Structures Production and Total Consumer Expenditure, Canada, 2004



Source: Clayton Research based on data from CMHC, Statistics Canada, Industry Canada, and the Survey

However, the economic value added from the sector is considerably higher. Based on the production levels of Canadian producers, the total economic product of the sector is about \$2.4 billion – which includes, for all units produced in Canada, either the direct export value or the total consumer expenditure value including such items of transportation, installation, and other construction costs.

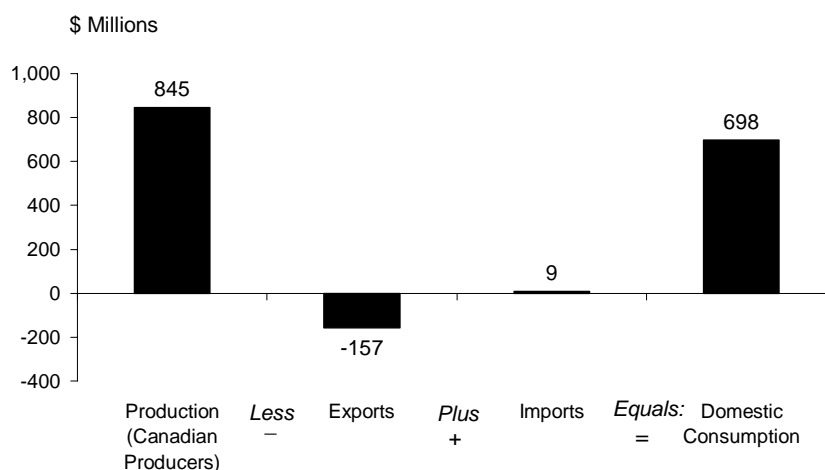
3.2.3 Domestic Consumption, 2004

Domestic consumption of factory-built residential units alone amounted to just under \$700 million (not including value added expenditure such as transportation, installation and on-site construction) – some 14,000 dwelling units. The difference between domestic production and consumption is accounted for by international trade.

Figure 6 illustrates that Canada has a large trade surplus in factory-built housing. In 2004 Canadian producers exported some \$157 million worth of factory-built homes (residential only) offset by imports of just over \$9 million. These estimates are based trade data for the entire prefabricated wood buildings manufacturing sector, with estimates of shares by major category (i.e., the categories listed in section 3.3) based on data collected in the interviews and site visits.

Figure 6

Factory-Built Housing, Components of Domestic Consumption, Residential Units, Canada, 2004



Source: Clayton Research based on data from Statistics Canada, Industry Canada

3.3 ESTIMATES OF MARKET SHARE BY CATEGORY

This section presents estimates of production of factory-built housing units segregated by major category, including:

- Manufactured homes;
- Modular homes;
- Pre-cut or pre-engineered homes;
- Log or timber-frame homes;
- Multi-unit residential modular homes; and
- Wood-frame non-residential units.

3.3.1 A note about Manufactured vs. Modular homes

Readers ought to be cautious about the differentiation between manufactured and modular homes in this report and with other information published on this industry:

- **Manufactured homes** (traditionally referred to as mobile homes) are residential units built to the CSA-Z240 MH standard (where permitted), and usually single-section units placed on a surface-mount foundation. Producers of manufactured homes must be certified by the CSA to produce CSA class 8111-01 products

defined as “Mobile Homes - Single family dwellings, manufactured at a central facility and transported on their own running gear to the dwelling site. These units have all normal facilities for connection to municipal water, sewage, electrical or gas services. CSA certification covers the complete structural, plumbing, heating and electrical services installed in the factory and is intended to obviate the necessity of further inspection by the local regulatory authorities except for site connections to services or to other modules and for site mounting features. Mobile homes may consist of one or more modules interconnected on site. Homes are built to conform to CSA Standard A277 and Z240 MH Series. Interconnection of modules where applicable, and completion of electrical, plumbing and structural systems and connection to services must be finished on site as specified in manufacturer's set-up instructions. All heating appliances must be factory installed as per Certified manufacturer's instructions.”

- **Modular homes** are three-dimensional closed-wall factory-built units, conforming to local building codes. Producers of modular homes must be certified by the CSA to produce CSA class 8131-01 products defined as “Modular/-Panelized Homes: Residential dwellings, manufactured at a central facility and transported to the dwelling site. These units, when completely assembled on site, are equipped with normal facilities for connection to municipal water, sewage, electrical or gas services. CSA certification covers the construction of the structure and any factory installed plumbing, gas and electrical services, and is intended to obviate the necessity of further inspection by the local regulatory authorities except for site connections to services or to other modules and for site mounting features. Homes are built to conform to CSA Standard A277, National Building Code of Canada and/or Provincial or Municipal Building Codes. Interconnection of modules, completion of structural systems and connection to services must be finished on site as specified in the electrical and building permits and are subject to inspection by the local authorities having jurisdiction.”

Terminology in common usage, however, differs somewhat across the country:

- In Atlantic Canada, the term “mini-home” has come to represent the homes built to the CSA-Z240 standard or other, usually single-section, factory-built homes placed on surface-mount foundations;

- In Alberta, Quebec, and other jurisdictions that do not recognize the CSA-Z240 standard, both manufactured and modular homes are labelled CSA-A277, whether placed on full perimeter or surface-mount foundations; and
- In the remainder of the country, the term manufactured home generally refers to homes built to the CSA-Z240 standard placed on surface-mount foundations, and the term modular home refers to factory-built units placed on full perimeter foundations.

The CAN/CSA-Z240 standard provides an alternative set of technical requirements for manufactured homes usually destined for placement on pads or other open or surface-mount foundation systems – generally described as surface mounts. Many of the structural and technical requirements of the CSA-Z240 standard are at lower standards than National Building Code (NBC) requirements, and strict adherence to the Z240 code can allow producers to drive costs out of their production process and potentially provide a more affordable product to consumers. Producers surveyed as part of this study have suggested that costs on a typical double-wide product (93 m²) are approximately \$4,000-\$6,000 lower conforming to the CSA-Z240 standard rather than the NBC requirements.

Many producers in Canada continue to produce CSA-Z240 standard manufactured homes, but have upgraded many of the structural and other specifications from minimum requirements in order to meet consumer demand. This evolving practice is blurring the lines between manufactured and modular housing.

As a result of varying definitions of manufactured vs. modular homes, the blurring of codes and standards which occurs in cases where minimum requirements are exceeded and the existence of jurisdictions not allowing the placement of CSA-Z240 structures, it becomes difficult, and somewhat less meaningful to segment the market into categories defined CSA-Z240 vs. CSA-A277.

3.3.2 Terminology used in this report

This study has adopted the approach employed by Statistics Canada in accounting for mobile home investment, which is to include homes sold directly to the public (directly by the manufacturer or a retail entity, but not a value added channel such as a builder or developer) as a final demand product. In practice this differentiates manufactured (mobile) homes as

those which are placed surface-mount foundations from those which are built on basements, perimeter or other full foundations.

Thus, this report will consistently use the following terminology with respect to manufactured and modular homes:

- **Manufactured home (or housing):** a factory-built home sold directly to the homeowner by the manufacturer or a retail entity, and placed on a surface-mount foundation; and
- **Modular home (or housing):** a factory-built home sold through a builder or other value added entity and placed on a full-perimeter foundation.

3.3.3 1993 Benchmark

According to the CMHC (1996) study, the factory-built housing sector produced some 17,330 units in 1993 – 13,700 of which (79 percent) were considered single-family residential units. Based on our interpretation of the data presented in that report, this benchmark implies that the notional market share of factory-built units among all new single-family homes that year was 8.5 percent (see Figure 7).

Other important benchmarks revealed in that report are:

- Manufactured homes (called mobiles in the report) accounted for 17.5 percent of all factory-built production;
- Modular homes accounted for 27 percent and other types of prefabricated homes an additional 34 percent of production;
- Commercial or industrial buildings accounted for some 13.5 percent of production; and
- The study notes that on a unit basis, the industry contracted by about 3 percent per year in the five years leading up to 1993. This decline was led by pre-cut/engineered homes, and log or timber frame homes. There was also a relatively large decline through the period in manufactured homes. Declines were offset slightly by gains in panellized production and commercial buildings.

Figure 7

Factory Built Market Size Benchmark, Canada, 1993			
CMHC (1996 Study)			
	Units	Distribution	Annual Avg. Growth 1988- 1993
		%	%
Single-family Residential Factory-built			
Manufactured Housing (Mobile)	3,033	17.5	(5.4)
Modular	4,679	27.0	(1.3)
Pre-Cut/Engineered	2,208	12.7	(9.3)
Panellized (wood based)	2,612	15.1	7.0
Log/Timber	1,166	6.7	(5.6)
Total Single-family Residential	13,698	79.0	(3.1)
Other Factory-built			
Commercial	2,343	13.5	(3.8)
Multi-family units	1,289	7.4	3.3
Grand Total	17,330	100.0	(3.1)
Domestic Consumption Analysis			
Single-family Factory-built Production	13,698		
Imports ¹	111		
Exports ¹	3,869		
Domestic Consumption	9,939		
Notional Market Share ²			
Factory-built Units	9,939	8.4	
Site-built Units	108,483	91.6	
Total Single-family Starts + Mobiles ³	118,422	100.0	

¹ Based on data from CMHC (1996) report translated to units based on value per unit data also found in the report

² Clayton Research analysis (as market share analysis in report was not consistent with definition used in this report)

³ Prior to 1999, mobiles (surface-mounted mobile units) were not included in the CMHC housing starts survey

Source: Clayton Research based on data from CMHC and CMHC (1996)

3.3.4 2004 Benchmark

An analysis has been undertaken to produce a 2004-based benchmark of market size by category. While the 1993 benchmark, above, is useful as a historical gauge, it is not directly comparable to the present undertaking, first because its results were dependent solely on survey data, and second because there are some inconsistencies in definition within that report.

Based on our analysis, Figure 8 presents an updated benchmark of production and consumption of factory-built buildings by type in Canada for the year 2004. The following observations relative to the 1993 benchmark are of note:

- The total number of factory-built single-family units, some 14,800 units, produced by Canadian factories in 2004 is up about 8 percent from the estimates made in 1993. This is in part based on our inclusion of non-wood based factory-built units in the analysis;

Figure 8

Factory-Built Market Size Benchmark, Canada, 2004

	Units	Distribution	
		Total	Single-Family
		%	%
Single-family Residential Factory-built			
Manufactured Housing	3,420	14.0	23.1
Modular Homes	6,160	25.2	41.6
Pre-Cut/Engineered	2,720	11.1	18.4
Panellized (wood based)	580	2.4	3.9
Panellized (steel or concrete)	1,500	6.1	10.1
Log/Timber	420	1.7	2.8
Total Single-family Residential	14,800	60.6	100.0
Other Factory-built			
Commercial/Industrial ¹	7,550	30.9	
Multi-family units (wood, steel or concrete)	2,090	8.6	
Grand Total	24,440	100.0	
Domestic Consumption Analysis			
Single-family Factory-built Production	14,800		
Imports	190		
Exports	2,861		
Domestic Consumption	12,129		
Notional Market Share			
Factory-built Units	12,129	7.3	
Site-built Units	153,406	92.7	
Total Single-family Starts	165,535	100.0	

¹ This category includes only wood-based commercial and industrial units which by and large are produced by firms primarily engaged in residential factory-based production. It does not include steel or concrete based pre-fabricated systems for commercial or industrial construction.

Source: Clayton Research based on data from Statistics Canada and CMHC

- About 30 percent of all factory-produced buildings are for commercial or industrial applications (bunk housing included⁵). This conclusion is somewhat stronger than in the 1993 estimate;

⁵ Although bunk houses and other camp structures may ultimately house people – usually temporarily on remote worksites, these applications are considered non-residential, as they are not residential dwellings.

- Panellized factory systems for single-family applications (including row housing) which are made from materials other than wood framing – principally light weight steel framing or steel and concrete prefabricated panels, account for some 6 percent of the sector. These units were not included in the 1993 estimate, but there likely was not a lot of production of this nature in that year; and
- Accounting for trade flows, some 11,860 factory-built single-family housing units were erected on sites in Canada in 2004 – about 7.2 percent of all single family housing starts of 165,535. This notional market share is modestly lower than in 1993.

3.3.5 Manufactured housing's share is falling

Canadian producers built some 3,420 manufactured homes that were sold to consumers and placed on surface-mount foundations. While these total production numbers are modestly higher than in the 1993 benchmark, the share of total factory-built production has fallen from 18 percent to 14 percent. The share of production among just the single-family residential type factory-built housing units, however, has remained roughly steady at about 23 percent.

There continues to be steady demand for this type of product, which is typically installed in one of Canada's roughly 1,000 manufactured housing communities.

Because manufactured homes in landlease communities offer a highly affordable form of housing, this segment will likely continue to play a relatively important role within the factory-built housing sector.

Figure 9 illustrates a single-section manufactured home with a steel chassis being installed on wooden cribs on a concrete homesite in Sunnyside Village outside of Edmonton, Alberta.

Figure 9

Photo by Clayton
Research

3.3.6 Modular home demand is growing

The number of modular homes produced in Canada in 2004 – about 6,200 in total, has risen about a third since the 1993 benchmark. The modular product, therefore, has shown the most growth of all the factory-built segments over this period. The popularity of the modular product should continue to fuel growth in this segment. Several factors support further growth in modular demand in the decade ahead:

- Modular homes account for some 42 percent of single-family factory-built production. This is up from about one-third of single-family production indicated in 1993 in the previous benchmark.
- Stronger modular home production is due primarily to lower measured output of panellized units. There is also a slightly lower share of the overall production accounted for by manufactured homes.
- Demand for modular units has been rising over the past few decades, and the rise in production represents the response by producers to this trend. Among the firms surveyed in this study, all traditional manufactured home producers also produced modular product. Among all firms certified by CSA, all firms which are certified to produce mobile homes (CSA class 8111-01) are also certified to produce modular homes (class 8131-01).

- From a production standpoint, factory-built producers can easily shift from manufactured to modular. Most of the firms surveyed in this study produce both product lines – sometimes on the same production line using mostly the same production techniques. This production flexibility provides a straightforward transition into the modular industry for existing manufactured home producers, as the demand for their product continues to migrate further toward modular product.

All in all, the factory-built housing sector is in transition across the country. There are promising demand and supply-side factors which will continue to see a boost to the sector, but the composition of that sector is likely to continue to shift toward modular product.

3.3.7 Pre-cut or pre-engineered systems remain popular

Pre-engineered housing systems, which are factory-built in completed open or closed panels then shipped to site and erected, appear to have made marginal gains in component market share over the past decade.

Traditionally domestic demand for this type of product has been focused on vacation or other second home properties. But increasingly, the producers and retailers of this product tell us that buyers are migrating from low-end units exclusively aimed at providing a seasonal vacation dwelling, to higher-end units being built by buyers often from the baby boom generation. These buyers may be building a second or vacation home with an eye to retiring exclusively to that home within a certain number of years. This trend, which is reflective of trends in cottage areas across the country, supports the idea of improved and developing markets for upper-end product from the pre-engineered sector.

From a design standpoint, pre-engineered homes have pioneered the large vaulted rooms and steep roof lines that modular home producers typically have trouble duplicating (see for example, Figure 10)

Figure 10

Photo courtesy of
Viceroy Homes



A majority of production of pre-engineered homes in Canada is produced by Viceroy Homes, a large public company with facilities in Port Hope, Ontario and the lower mainland in B.C. There are several smaller companies, primarily located in Quebec, Ontario and BC also producing product, which is aimed more at the vacation home market.

There is another public company located in Vancouver which has recently introduced a steel and concrete based pre-engineered home, and are presently licensing the technology overseas. International Hi-Tech Industries (IHI) has recently completed a 6,500 m² production facility in Delta BC and plans a second such plant in Ontario. Although the company did not have production in 2004, if it achieves its aggressive business plan over the next decade, it will be a major player in the factory-built sector, leveraging its unique technology to drive overall factory-built production up. IHI began production of a 23-storey tower in Surrey, B.C. using its pre-engineered technology in 2005 (see Figure 11).

Figure 11



Artwork courtesy
of International Hi-
Tech Industries

3.3.8 Panellized product continues to struggle

This study is considering only the production of wholly-designed panellized homes in this segment. There is a large industry in Canada that produces prefabricated panels that are wood-based, polyethylene-based, concrete-based, etc. for use as materials in residential and other construction. These include stress-skin insulated panels, concrete sandwich panels, etc. This product is not considered as part of the scope of this study.

One of the smallest components of the factory-built sector has been the panellized home component. Traditionally this sector has been composed of firms which produce open panels to be assembled on a job site. A panellized producer essentially provides a fully-framed home to a builder who then completes the mechanical, finishings, siding, roofing, etc. From a builder's perspective, panellization can speed up the time required to get a home closed in from the weather, and can make use of factory-

based efficiencies such as the division of labour, mechanical assistance, and reduction of material waste.

There are three different types of firms engaged in this industry in Canada:

- **Panellizers.** Firms that exclusively produce panellized housing. These firms typically are not certified by CSA, as their product can be entirely inspected on the building site by local authorities. These firms are engaged in marketing and selling entire panellized homes, but they also typically produce stock panels that are used in the site-built residential and non-residential sectors of the construction industry. This latter production is not included in the scope of this study.
- **Modular home builders.** A handful of manufactured or modular home producers are also producing panellized housing. Although this component is not widespread, some producers have looked at the idea of producing panellized housing as a way of getting better production out of framing equipment (jigs, bridge nailers etc.) which may otherwise be underutilized. At least two of the producers contacted for this study have a separate “panellizing” factory on site which specializes in making panels that are fed into their manufactured or modular production line process, or that can be shipped directly as a panellized home.

Figure 12



Photo courtesy of
Fabrik International
Inc.

- **Lumber retailers.** Traditionally in Canada, some lumber dealers have provided a sort of panellized home as a value-added feature

of their business. These firms continue to play a modest role in the factory-built housing sector.

There are three primary markets for panellized homes: domestic, U.S. and overseas. Of these, the domestic market remains weak, but there have been some successes among the two export markets:

- Overseas markets have provided some market opportunities for panellizers. As a partially processed manufactured good, wall panels are an ideal way to provide a value-added product for transportation to markets in Europe and Asia which are seeing rising demand for lumber-framed homes. Where transportation costs are higher, it becomes more economical to ship panels, which are a higher value-added product, rather than raw lumber. What is limiting the growth opportunities of this product overseas is that the firms involved are relatively small, and have more difficulty developing and maintaining the relationships necessary to boost these trade volumes.
- U.S. market opportunities have been growing for Canadian-produced panellized wood-based product. Successful exporters of this product tell us that many builders in the US employ business models which encourage the driving out of on-site construction costs, and that they find Canadian-produced open wood-frame panels an ideal way to do this. Single family housing starts in the US have risen dramatically from the mid 1990s, and in some areas builders are keeping pace with demand primarily through substitution of on-site activities with prefabricated components.

By contrast, the Canadian market for wood-based panels has remained relatively small and confined to a few niche areas. Generally, consumers looking for a factory-built home (because they are in a remote location, are under time constraints, or value the factory-related quality of the homes) prefer a pre-engineered system or a modular home over panellized.

In order for panellized homes to make further headway in the domestic market producers will have to develop meaningful relationships with tract builders, and at present those builders in Canada appear to be uninterested in outsourcing a major component of their own production.

Although wood-based panellized homes may likely make only limited headway in the domestic market, there is a component of this sector that has more potential to grow – prefabricated light-gauge steel panellization. At least two companies are now prefabricating pre-engineered light-

gauge steel panels in a factory setting and selling these systems to residential tract builders – KML Building Solutions of Cambridge, Ontario and Mega Building Systems of Vancouver. Producers of pre-engineered light-gauge steel panel systems have been successful in providing clear value to the residential tract builder. This system is especially well suited for low-rise multi-family residential.

Figure 13

Photo courtesy of
KML Building
Systems



Companies producing these types of panel systems in Canada probably produced in the order of 1,500 homes in 2004, which makes this segment about three times as important in the domestic market as wood-based panellized homes.

Thus, while the prospects for growth in wood-based panellized systems are limited, it is likely that steel and other alternative panel technologies will continue to capture greater share of the residential sector, elevating the overall position of factory-built housing.

3.3.9 Log and Timber-Frame Housing

Log and timber-frame housing remains a small niche industry in Canada, and is very export focused. Log home producers find most of their market in middle-market vacation home consumers, and in many cases sell directly to “do-it-yourself” (DIY) consumers. Timber-frame home producers exclusively sell to the upper-end market, which makes their potential very sensitive to conditions in the overall economy. Both log and timber-frame producers have been busy in the past few years as both the housing market and the market for second/vacation homes have been

very active, and growth in personal disposable income in Canada – especially within the upper income cohorts – has been strong. This is a segment, however, in which demand can fall very quickly when the pace of economic growth turns negative and consumers cut back significantly on their spending on vacation and second homes.

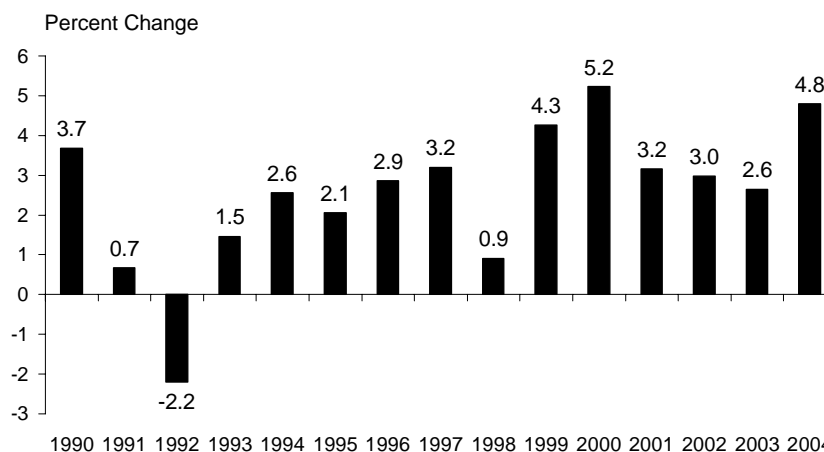
3.3.10 Other factors influencing growth: homes are getting bigger

Amongst the manufactured and modular home segments, the growth in the total number of housing units over the past decade understates the overall growth experienced by individual producers, as the value of the product, both in real dollar terms and in terms of the size of the product has generally been increasing. Consider:

- Between 1994 and 2004, for example, the price of factory-built homes rose some 37 percent (3.1 percent per year) (see Figure 14). By contrast, prices of newly constructed site-built homes (as evidenced by Statistics Canada's New Housing Price Index – excluding land) rose only 28 percent. While some of the shift in factory-built housing prices over this period may be the influence of the shifting mix (more modular sales and less manufactured home sales will drive up the average price), it is likely also the influence of factory-built homes of all types getting larger.

Figure 14

Factory-Built Housing¹ Prices, Year to Year Change, 1990-2004



¹ Wood frame

Source: Clayton Research based on data from Statistics Canada

- Multi-section production, has been growing as a share of total “manufactured housing industry” shipments by members of the Canadian Manufactured Housing Institute. In 2004, some 38 percent of the 5,500 units produced by a sample of their members were multi-section – up from 34 percent of the 5,180 units produced for Canadian markets in 2003.
- According to producers consulted for this study, a majority of the new multi-section homes are double-section, but there is a small but growing market for modular homes with 3, 4, 5, and more sections. Two-storey homes in particular, like the Kenilworth-based Quality Homes show-home illustrated in Figure 15, tend to be at least 4 sections with garage components framed on-site.

Figure 15

Photo courtesy of
Quality Homes



- Homes are also getting bigger, regardless of the number of sections. Most of the producers surveyed in this study say that the average section size for both manufactured and modular units, which is about 80 m² – but can reach as large as 150 m² in Alberta – has risen substantially over the past few decades.
- The value and value-added of manufactured and modular homes has risen substantially in the past few decades as the size of the finished homes and the quality of the materials used within has improved.

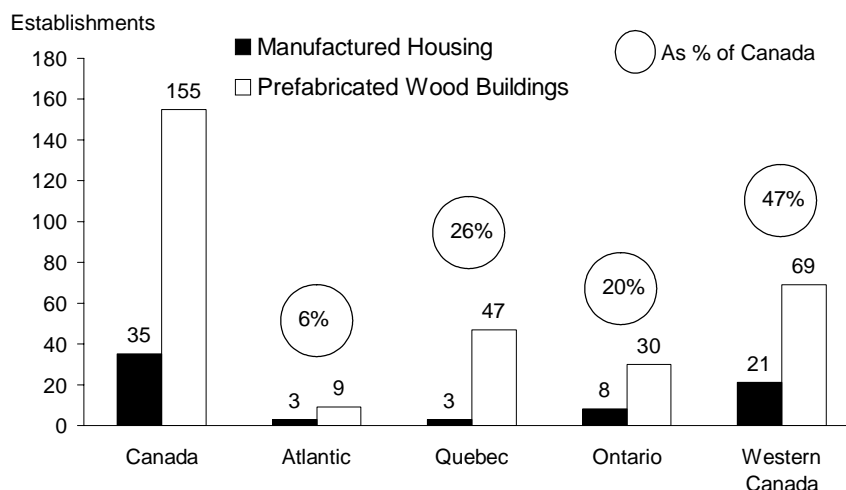
3.3.11 Regional Features

While most of the demand features reviewed above apply generally to the factory-built industry in Canada, as with most industries the Canadian factory-built sector is more a composite of various regional sectors rather than one homogeneous whole. This study has interviewed producers and visited factories and communities from coast to coast in Canada and there are important regional features that are prevalent across the country:

- The largest concentration of producers is found in **Western Canada**, which account for some 47 percent of all establishments of manufactured housing or firms engaged in the business of prefabricated wood buildings – according to the two relevant sectors in Statistics Canada Annual Survey of Manufacturing (Figure 16). There is a strong focus in Western Canada toward the manufactured home product which is sold as an end-product to consumers and erected on surface-mount foundations. In particular, the wider available widths in Alberta have ensured that the single-storey homes remain by and large the bulk of the product delivered by Western firms. There are a number of producers of factory-built homes outside of the manufactured and modular sector: including a large Viceroy plant in Vancouver (although this primarily provides homes for export), the International Hi-Tech Industries concrete panellized factory and various log and timber-frame operations. There is a relatively low degree of unionization among workers in factories located in Western Canada.

Figure 16

Number of Establishments, Annual Survey of Manufacturers, 2003



Source: Clayton Research based on data from Statistics Canada

- **Ontario**, which accounts for the largest market for new housing in Canada, has a relatively low concentration of factory builders. Statistics Canada data suggest 8 producers of manufactured housing and some 30 other prefabricated wood building producers. However there are only five companies in Ontario

certified by CSA. The market in Ontario remains firmly focused on the modular product as opposed to manufactured homes, and there is also a reasonable market for pre-engineered homes – particularly in the vacation home segment. Typically Ontario factory built housing producers are not unionized.

- The factory-built housing sector in **Quebec** accounts for some 26 percent of all establishments in Canada – and these companies appear to have a relatively large impact. There is an important level of integration between the factory-built housing sector in Quebec and the site-built sector, and this province may have one of the largest penetration rates in the country. All or most of the factories in Quebec are unionized.
- There is also a relatively large share of new housing development in **Atlantic Canada** accounted for through factory-built housing – primarily manufactured homes – or as typically described in Atlantic Canada “mini-homes”. Producers in this region only account for 6 percent of the number of establishments across the country, but most of the local producers are fairly large operations, and there is a sizable export component of homes from Atlantic Canada producers primarily to the U.S. Northeast states. About half of the factories in Atlantic Canada are unionized.

3.4 DISTRIBUTION CHANNELS

Distribution channels within the factory-built sector are evolving and at present there are several different channels, or perhaps better described as “business models” in practice. These include:

- **Factory-direct sales.** Most producers in Canada have some form of factory-direct sales (usually in the form of a factory-owned retail entity or a sales office). Some producers exclusively sell directly to the public. These tend to be smaller more locally-oriented firms. Producers who sell all or a majority of their product through a factory-direct channel say that they retain better control over the customer service relationship, are able to capture higher margins and can manage lead time delays better. Firms that do all or most of their sales through factory-direct channels can expect to spend about 7-10 percent of their gross revenues on sales and marketing related expenses.
- **Retailer networks.** Most manufactured homes, panellized homes and log/timber frame home producers sell through some sort of retail or dealer network. In some cases, these retailers are have

exclusive arrangements, where they sell for only one manufacturer, but it is more common for retailers to handle product from two or more manufacturers. The customer service relationship between the retailer and producer tends to be collaborative, but does differ from one producer to another. At least one producer we spoke with claimed to “build them, ship them and forget about them” – implying that the entire customer service obligation was then on the retailer. But other producers who used retail networks talked of an on-going collaboration on customer service throughout the retail process until the home was installed and occupied. In general, retailers will contract out the services of external firms to conduct the installation, and all on-site construction which is required. According to Statistics Canada, wholesale and retail margins combined tend to be about 30 percent on mobile homes⁶. And the installation costs are an additional 9 percent.

- **Builder networks.** A rising trend in the modular home industry is to sell homes through a ‘builder network’. In many respects, this channel is not significantly different than the retail network described above. However, builder networks may or may not have a sales site, and will always handle the installation and on-site construction in-house. Often with builder networks, the ultimate product is co-branded between the builder’s brand identity and the manufacturer’s. Figure 17 illustrates an image from the Grey Ledge Homes website clearly co-branding the builder’s brand with the producer’s brand (Prestige Homes).

Figure 17

Photo courtesy of
Grey Ledge Homes



- **Community Developers.** Another distribution model gaining in popularity are community developers. These usually independent entities develop the land in a community or sub-division then sell finished house-land product to consumers. Although customers are usually contracted prior to the selection of the factory-built home and its features, from a distribution model, the developer in these cases purchases the factory-built product from

⁶ Analysis based on data from the Input-Output Model of the Canadian Economy and National Accounts. Analysis only applies to what Statistics Canada calls “mobile homes”, i.e., those homes sold to the public and installed on surface-mount foundations.

manufacturers and uses this product as an input into their own finished house-land product. Figure 18 illustrates homes in Gauvin Village in Moncton, which was developed and sold in such a manner.

Figure 18

Gauvin Village in Moncton – an integrated factory-built home development

Photo by Clayton Research



- **Integrated producer/builders.** The idea of an integrated builder and producer is not new. As discussed in Section 2.2 the roots of factory-built housing included several project-manufacturers in and immediately after the Second World War. In addition, there remains very small-scale “ready-to-move” (RTM) builders, most commonly in Alberta and Saskatchewan, who build product in a yard, or a make-shift factory, and then move the home to the site for installation. This is a type of integrated operation (although RTM product is not counted in the estimates of industry size in this study). Further examples of integrated producer and builder relationships include Stelumar Advanced Manufacturing, a factory-built housing operation run by a large site-building company. More on this and other examples of integration between the factory and site-built sectors is discussed later in the report.
- **Export Channels.** Most Canadian producers of modular homes export at least some product to the U.S. Most of these exports are done through independent retailers or builders in the U.S. Rarely are these U.S.-based distribution networks exclusively tied to the manufacturer. Panellized producers export product to the U.S.

typically directly to builders through which they have established a relationship through a trade show or other type of channel. Some Canadian producers, such as KML Building Solutions' parent company GenisisTP Inc., own subsidiaries in the U.S. and overseas and use these to distribute within these jurisdictions.

3.5 INSTALLED EXISTING STOCK

There is very little information on the installed existing stock of factory-built homes in Canada. It is possible to estimate the number of manufactured homes (installed on surface-mount foundations), especially those installed in registered communities, through Census data and or data on manufactured home communities. But this approach would only provide a tip of the iceberg, as it would fail to properly account for 1) the many manufactured homes on surface-mount foundations on private lands, especially rural or agricultural properties, and 2) it fails to capture the size of the existing stock which is composed of modular, pre-engineered, panellized or other types of factory-built homes.

3.5.1 CMHI estimate of manufactured home communities

The Canadian Manufactured Housing Institute maintains a directory of manufactured home communities in Canada. From this list, which was last updated in 2000, the association estimates that there are some 1,100 communities across the country.

3.5.2 Transformation among communities

The face of manufactured housing communities is undergoing considerable change:

- The style and look of manufactured homes has changed considerably over the years. As a result, many of Canada's manufactured home communities contain homes that were installed at different times over the past 40 or 50 years, giving some an eclectic look.
- The jumbled organization and out-dated styling illustrated in the top left (a community in Calgary) and top right (a Kelowna-area community) in Figure 19 are giving way to the more uniform look with more modern manufactured homes, typically with asphalt shingled roofs such as in the lower left (an Edmonton-area

community) or lower right (a community in Moncton) of the illustration.

Figure 19

Old and New: a variety of community designs

Photo by Clayton Research



3.5.3 Total mobile home stock is declining

According to the Census of Canada, the number of households in Canada living in movable dwellings has been steadily declining over the past twenty years (see Figure 20).

Over the period 1981 to 2001, the number of households in this classification of dwelling declined from about 215,400 to 156,400 – an annual average decline of almost 3,000 units per year.

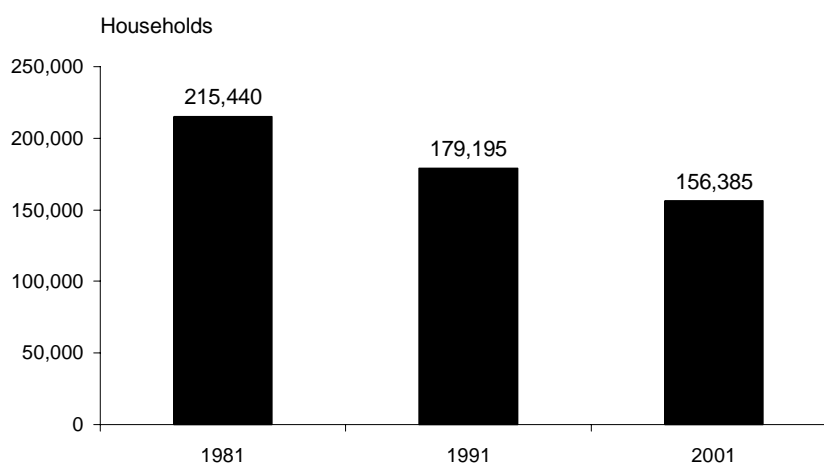
As discussed in section 3.3, production of new manufactured homes in Canada was about 3,500 units, and based on estimates from Statistics Canada on annual investment in mobile homes and the 1993 benchmark estimates from CMHC (1996) production has probably been in the 3,000-3,500 range throughout the past decade.

Thus, if the Census numbers are indicative of actual trends in manufactured homes (mobiles), then there must be close to 2 units being scrapped every year for every new unit sold and placed.

While these scrappage rates seem high, and are not reflective of comments we received talking to producers, retailers and community operators, it is a reality that manufactured home communities are transforming, from older to newer stock, and that there is considerable older stock still in existence within Canadian manufactured home communities. From an outlook perspective, therefore, there will continue to be modest demand for the manufactured home (mobile) product from replacing older, outmoded and out-styled stock.

Figure 20

Occupied Movable Dwellings, Canada 1981-2001



Source: Clayton Research based on data from Statistics Canada

It is also possible that the estimates from the Census are undercounting mobile units – particularly new styled units which may not appear to be mobiles to the enumerator. Figure 20 shows that some 156,000 households in movable dwellings were identified in 2001. Based on the CMHI estimate for manufactured home communities, this implies an average sized community of 142 units – which is somewhat lower than the typical community size of 200-250 units.

3.6 DEPENDENCE ON OTHER INDUSTRIAL SECTORS

Firms operating in the factory-built housing sector face a variety of both upstream and downstream interdependencies, but the degree of dependency on these other industrial sectors varies considerably depending on the business model employed by the particular firms.

Upstream dependent industries include:

- **Window and door producers.** Universally, the manufactured and modular home producers in Canada employ vinyl millwork for windows and doors. A select few producers offer upgrades of wood-framed, or vinyl-clad wood-framed windows. In most cases producers order windows and doors from specialized fabricators. In most cases orders are done on a job-order basis, where product is procured for a particular house once the contract is finalized. Due to the tight time lines on production, timely delivery of job-ordered materials is key, thus relationships between factory-based housing producers and providers of millwork have to be very firm. The producers have a lot at stake that the millwork products are delivered on time. Some of the producers we spoke with dealt with local millwork firms which were large enough to guarantee delivery. Many firms, however, had relationships with large millwork producers. There is only one firm in the industry, Viceroy Homes, which extrudes their own vinyl windows. In all other cases (of the firms we spoke with), millwork is obtained from external suppliers.
- **Truss fabricators.** The business models employed by factory-built housing producers in Canada with respect to truss fabrication are split between those who produce their own trusses, and those who procure from truss fabricators. Approximately 30-40 percent of producers fabricate all or some of the trusses they require on site. Most of this group produce all of the trusses they require for their own production, but in some cases, producers will fabricate trusses which are custom or complicated, and procure standard design trusses in bulk from fabricators. The remainder of factory-based housing producers procure their trusses from truss fabricators, and most of these models involved procuring on a job-ordered basis. Other than in the case of some standard sized trusses that a few producers will keep in inventory, truss procurement is almost entirely on a job-order basis. Thus, similar to the case of millwork, a solid relationship between the producer and the truss fabricator is critical, as the smooth function of the production line requires delivery of the trusses in a timely manner. Thus, there is a strong dependence of the industry on the truss fabrication industry (in the sense of requiring strong relationships), but because most producers either fabricate trusses in house, or

could easily establish such an operation, these dependencies are not as critical as in the case of millwork.

- **Cabinets.** Only a minority of Canadian factory-built housing producers manufacture their own cabinetry on site. In most cases, cabinets are procured from upstream cabinet makers, and always on a job-order basis. Generally, producers who procure cabinets from external suppliers do so in order to streamline their production process, and to avoid large inventories in finishes and other material. From a marketing perspective, producers are offering a larger number of options for cabinet style and finish to consumers, which makes production of stock cabinet doors and other components more difficult. In addition, those producers which have moved away from production of cabinets on site have done so in part due to problems with workforce management. To run a cabinet shop would require two or three specialized personnel, but often production in the plant was not high enough to keep these personnel busy in the cabinet shop alone. Thus, those producers who do make cabinets on site tend to be larger. A couple of the larger producers in Canada produce their own cabinets, including Winalta Structures in Alberta, as illustrated in Figure 21. As with procurement from truss fabricators, those producers who procure cabinets tend to do so from local suppliers. In many cases, the factory-built home producer is the cabinet maker's largest customer, and represents a bulk of their business. Thus the relationship and interdependencies between the two businesses is very strong.

Figure 21

A lamination machine and stock cabinet doors readied in the cabinet shop at the Winalta Structures plant in Edmonton

Photo by Clayton Research



- **Engineered wood products.** Another large area of upstream procurement for factory-built housing producers is engineered wood products. As reviewed elsewhere (see Section 4.3) there is a strong degree of engineered wood product use by Canadian producers of factory-built homes. Most manufactured and modular producers employ wood-I beams, OSB products and laminated beams, and procure these from large international producers such as Trus Joist Weyerhaeuser, Jagger or Huber. There are some other engineered wood products used by a selection of producers, such as Timberstrand beams and rimboards, and finger-jointed lumber. Many producers are just switching to engineered wood products, thus, the dependence on engineered wood products is just developing. It is reasonable to expect that the industry will become increasingly dependent on upstream providers of these specialized products. Conversely, as the opportunities to market these types of products to the growing factory-built housing sector become more widely recognized by producers of engineered wood products, expect to see more of these producers catering to the factory-built housing sector.
- **General building materials.** There are a wide array of traditional building materials which producers of factory-built homes procure on a regular basis. These include lumber, vinyl-gyprock, drywall,

roofing materials, paint, etc. In most cases producers have established relationships with one or more wholesalers in order to procure these materials, and the materials are acquired as inventory, or stock items. Some producers work with local building materials centres for some of these products. The relationship between the producers and suppliers of general building materials does not differ significantly from those between site builders and their suppliers. These upstream links are very traditional in most cases.

Downstream related industries include:

- **Transportation.** All factory built-housing producers, in all segments need to employ transportation to move their product from their plants to the building site. Some 80 percent of producers contract out all of their trucking services. The remainder employ an owned fleet of trucks, and sometimes also use contracted trucking services to service special needs. The trucking industry with the specialized capability to move manufactured or modular homes is highly specialized and the availability of such services is obviously higher in areas with a higher concentration of these producers. There are several trucking service options available in BC, Alberta and Saskatchewan, Quebec and New Brunswick, for example, to correspond to the relatively high concentrations of producers in these provinces. As a result, producers in these areas are less likely to rely on owned fleets of trucks. In Ontario, by contrast, producers tend to, at least partially, rely on their own fleet of trucks due to limited outsourcing opportunities locally.
- **Retail/Builder Networks.** In most cases producers of factory-built homes throughout all the different segments work with a “retail” layer of businesses that market homes to customers. In the case of panellized and engineered systems, this retail layer is generally composed of established site-builders employing the system as an input into their own building process. In the case of the manufactured and modular producers, the retail layer is either a network of retailers (often with their own showrooms) or builders who market the homes to consumers, and generally handle most of the finishing work required on the home once it arrives on site.

3.7 HOW COMPETITIVE IS THE SECTOR

There is an evolving degree of competition in the Canadian factory-built housing sector. Many producers in Canada are actively engaged in marketing and business practices aimed at increasing product sales and market share, and in many cases these practices are directly aimed at increasing competitive power in the marketplace.

There are four distinct forms of competition in the sector. Some firms are actively engaged in competing on all four fronts, and others focus on their competition on one or more of the forms.

Generally, the competitive environment in the factory-built sector is among one or more of these forms:

- **Competition among factory-built producers** within the same segment (e.g., modular homes). This competition tends to be local in nature, with producers competing with other producers of similar product located within about 500 km. Most producers consulted in this assignment that operate in relatively close proximity to producers of similar product, certainly exhibit typical competitive behaviour, including: protection of production or marketing techniques; similar pricing structures; and look-alike showroom facilities. Moreover, many of these producers report common incidences of direct competition such as offering a customer a competitive price on a model/design that the customer has already had quoted from another producer.
- Another form of competition commonly cited by factory producers is the **competition with on-site builders**. In markets with higher factory-built penetration, such as New Brunswick, this form of competition is foremost in the minds of producers. In markets with low factory-built penetration, such as Ontario, this form of competition is not so strong. The relationship between market penetration and the competitive energy between factory-built producers and on-site builders is driven by the degree to which factory producers successfully market product to a variety of different segments. In a market with high penetration, the factory producers are successfully selling products into a broad number of segments, and as a result there develops a higher degree of competition with the on-site builders who are also actively working in those segments. By contrast, in markets where the factory producers represent a relatively small share of the market, there appears to be much less of a competitive strategic approach to

the relationship between producers and on-site builders. The factory producers in these markets represent niche product (either higher-end custom homes, homes to remote locations or lifestyle communities). As is typical among a number of industries, markets for niche products tend to be less competitive with the mainstream.

Importantly, the relationship between most factory producers and on-site builders is evolving. There is more detailed analysis on this relationship elsewhere in this report. Increasingly, producers are striking alliances with certain on-site producers jointly to develop certain markets. As these business models continue to develop, expect the competitive relationships between the factory-built sector and the on-site homebuilder sector also to evolve.

- There is a low degree of competition that exists in some markets in Canada **between factory-built producers of products in different segments** – pre-engineered competing with log, panellized competing with modular, modular competing with manufactured, etc. This competition, tends to be with producers in proximity to one another within the same market. The competitive strategies engaged in this form of competition tend to be marketing focused, with producers, sometimes in conjunction with producers of same segment, providing customers and the public with information emphasising the benefits of their segment and the drawbacks of competing segments. This is a natural form of competition, as producers see that there is a certain market among customers already focused on factory-produced housing, and feel that they can gain competitive strength by drawing these customers into their segment. There is an obvious danger to this type of competition, in that producers can unwittingly scare customers away from factory building altogether, by emphasizing the shortcomings of a competitive segment. There are increasingly more crossovers between factory segments (several modular builders are also producing panellized home) and as this trend advances it is likely that the degree of inter-segment competition will wane.
- Finally, another form of competition in which the Canadian industry is engaged, is **offshore international competition**. Only a minority of Canadian producers are engaged in offshore international trade. Among these firms, those that are successful employ successful strategies against competitive producers in the U.S. and abroad.

There are instances of members of the industry working together, often with public-sector partners, to compete as a group internationally. One such example of a public-private partnership is the Super-E[®] program - an initiative of Natural Resources Canada (NRCan), CMHC and the Department of Foreign Affairs and International Trade (DFAIT). Super-E is an initiative aimed at marketing Canadian expertise in housing, particularly focused on bringing energy-efficient and low-environment impact homes built to the R2000 standard to foreign markets. The Super-E program helps Canadian companies and their export partners by providing marketing support, technical and regulatory support, and training support and is focused primarily on housing markets in the United Kingdom, Ireland, Japan, and China.

The Super-E trademark is an attempt not only to increase exports of Canadian housing materials to foreign markets but also to brand Canadian housing products as the most energy efficient and environmentally sustainable housing available, while placing stringent requirements on moisture control, and air quality. Factory-built housing producers that are focused on target export markets and are already manufacturing homes to the R2000 standard are the most suitable to join the program. One of the main Canadian companies involved in the Super-E initiative is Interhabs, a factory-built housing producer based in Halifax Nova Scotia. Interhabs UK is the British subsidiary of Interhabs and markets Interhabs homes in the United Kingdom. Interhabs is designing and constructing the first Super-E demonstration home in Scotland.

Producers we spoke with also discussed successful trade missions, including efforts organized by CMHC, CMHI, and other groups, and trade mission efforts undertaken by La Société d'habitation du Québec. Canadian associations are beginning to evolve into a facilitative role for international trade. The CMHI monitors and participates in international research, promoting its members to selected foreign markets. The Manufactured Housing Association of Canada in Ottawa sponsors a presence at trade shows in the U.S. and is actively engaged in promoting the panellized segment in particular. Regional associations are also playing an emerging role in promoting trade, often with trans-border partners. The Manufactured Housing Association of Atlantic Canada, for example, has worked with governments in Maine, and other states in order to standardize code practices.

There are very few examples of collaboration between producers in the Canadian factory-built sector, outside of the research, promotion, networking, certification, training and professional development efforts being undertaken by the regional and national associations. Collaboration on international trade initiatives have taken place from time to time, but otherwise, the competitive nature of the business, and in many cases, the vast distances between potential collaborators has kept this form of business practice to a minimum.

3.8 PUBLIC PERCEPTION

One of the keys to successful prospects in the factory-built sector in Canada is to continue to convince the public of the level of quality in factory-built homes. Public perception is vitally important, not only to help foster direct sales to consumers (or sales through small builders who tend to market the product as a factory-built home), but also as a necessary step in attracting large tract builders to the product.

In general, factory-built homes are becoming more accepted among home buyers because:

- Quality and aesthetic characteristics are now standard in these homes such as: more spacious floor plans, vaulted or tray ceilings, drywall throughout, a variety of exterior siding, walk-in closets, fireplaces, brand-name appliances, pitched roofs with shingles, larger eaves and gabled ends, and various options that are customized specifically to meet the needs of the consumer.
- In many cases, today's factory-built homes no longer have the "house-in-a-box" image they used to have, and this fact is being recognized by potential home buyers. The new look of modular factory-built homes: second storeys, cape-cod gables, and various portico treatments have all helped to make these homes indistinguishable from site-built homes. The characteristic look of "mobile homes" with bow-roofs and steel-enamel siding has disappeared from the industry. Although low-end manufactured homes can still show a somewhat boxy look, virtually all are built with steep, peaked roofs, rather than the flat or "bow" roofs of the industry 30 years ago. The increased use of multi-section placements allows a home owner to assemble dwellings with wings, setbacks and other such architectural features.

- Well installed factory-built homes are indistinguishable from “site-built” homes from a visual perspective.

The producers and retailers in the industry we spoke with also feel that public perception is turning:

- “Consumer perception of the industry: there is continuing to be more and more market acceptance from consumers, there has been a wide amount of favourable news coverage about our homes, across Canada, and especially in Ontario, and the average person is a lot more familiar with these homes, and therefore the associations with these homes are not as bad as they used to be.”
- “I think we are winning, with regards to customer perception. The thing that did it for us the most – was putting a home out front. I think the industry is improving – we are making strides to upgrade our sales people.”
- “I’ve been in business for 23 years. In my mind, years ago, it was a low-end product, but a product that young people could get into, financially it made sense – so it served its purpose well. Some people have upgraded as the product has improved. The product has had so many improvements; it has essentially gone from a low-end product, to a high-end product. And the customer base has changed, it used to be just people who could only afford it, now it’s also people who can afford anything, they are going for a top-quality product, at a reasonable price. The perception is changing – the negative perception is going away.”
- “Perception is the issue! But this is changing: most buyers are closer to this product in New Brunswick, they understand how they are made, they have relatives who work there, better understand how the product is made, etc. This helps in solving the issue, the stigma is mostly gone. I feel this has to do with the proximity of the plants to the people who buy [the manufactured homes].”

4 TECHNOLOGY, PRODUCTION PRACTICES AND MATERIALS

The factory-built housing sector is in general a very “low-tech” industry. Factories make use of division of labour and efficient production flow in order to drive costs out of production, but the industry remains relatively labour-intensive.

4.1 FACTORY TECHNOLOGIES AND PRACTICES

There is widespread consensus among factory builders that the economics of the industry deconstruct in roughly the following fashion:

- That the costs of production, including all framing and assembly to the factory gate, benefit from a number of labour-savings, process efficiencies and improved use of materials relative to building the same unit on site. In 2004, these costs according to our estimates based on Statistics Canada data were approximately \$560 per square metre;
- That retail margins, transportation costs and costs involved in the installation of factory-built housing on site (including foundation, garages and other outbuildings, etc.) typically amount to approximately 75 percent of the original manufactured product price (recall Figure 5), bringing the total installed cost of factory-built housing to some \$985 per square metre;
- Average residential construction costs per square metre in 2004 in Canada were \$1,200.
- By this measure, therefore, the factory-built housing component of the housing sector drives approximately 18 percent of the costs out of the production of housing.

The reason that construction cost per square metre for a new factory-built home are some 15 to 20 percent less than a comparable site-built home are in large part due to the efficiencies of building in a factory setting. In fact, many of the technologies and practices employed by factory builders are responsible for driving down costs and ensuring high quality performance. Factory-built homes are generally sounder and are becoming indistinguishable from site built homes as a diversity of profiles and designs hit the market.

The key to the affordability of factory-built homes is the buying power of the often large-scale factory builders, and the efficiencies of the factory

process. In general all factory-builders use these technologies and work flow issues to help drive down costs of production relative to site-built construction:

- All aspects of the construction process are controlled;
- Weather, trades delays, and other problems which can plague productivity on a construction site do not interfere with construction and cause delays;
- All technicians, craftsmen and assemblers work as a team and are professionally supervised;
- Inventory is better controlled and materials are protected from theft and weather-related damages;
- The factory setting can improve the performance of certain materials – such as the use of gas-fired heaters to assist in curing the asphalt on roofing shingles;
- The use of stations along the production line ensure that specialized labour, machinery and tools are continuously employed on specialized tasks;
- Factory-built housing producers can access bulk purchasing of construction materials, finishes and appliances;
- Factory builders are able to save time and gain efficiencies by bulk production of major components like interior wall sections; some builders have developed innovative techniques, such as foam-adhering drywall to interior stud walls (see Figure 22);

Figure 22

Large-dimension
drywall foam glued
to studs

**Photo by Clayton
Research**



- Large jigs and bridge nailers are used for the assembly of floor, wall and roof components which speed up the assembly process and avoid the sort of injuries that can occur on construction sites as workers clamber about on unfinished frames;
- Large-scale use of pneumatic tooling linked to central compressors save on time, fuel and electricity;
- The factory-model reduces the needs for interim development financing, more typical of site-built developments; and
- There are high quality-control procedures in place.

Building materials used in factory-built homes today are, in most cases, the same as those used in site-built homes (see Figure 23).

Figure 23



Photo by Clayton
Research

A number of factory-built housing plants were visited in connection with this survey and materials usage and production process were assessed.

4.1.1 Differences in Practices

There is more than one way to build a factory-built home. Some production practices differ significantly among manufacturers. Although production theory suggests that there should be one more or less efficient process, factory builders in Canada employ a variety of differing practices with more or less success. Consider these from the modular segment alone:

- **Floor framing:** Consider the need to frame and sheet a floor, while at the same time installing mechanicals such as duct work, wiring, plumbing etc. within the floor. Some producers build the floor upside down in order to build in the mechanicals and then flip the floor to begin sheeting and the rest of the construction. Others start with the floor frame already right-side up and on the production line cart, and put the under-floor mechanicals on site. Others still use either hydraulic jacks to complete work under the floor, or make use of a pit below the production facility to do so (Figure 24 illustrates such a pit – the steel in the photo, taken from underneath the homes on the line, are the production line rails).

Figure 24

View from Below – a Quebec-based factory with stations below the line to facilitate installation of servicing

Photo by Clayton Research



- **Drywall:** There are as many ways to treat drywall in the production process as there are producers. Some affix the drywall to walls in the jigs and then place the whole drywall-clad wall in place on the frame. Others assemble framed panels and then drywall the walls and ceilings within each room of the home (much as it would be in a site-built home). Others still, leave the homes without any drywall until the home is assembled on site. Some producers mud and tape the drywall on the production line (this requires leaving enough time to have the mud properly dry), others take modules out of the production line for the period that the mudding and taping is being done. Others still send the modules completely through the line then do the mudding out of the factory while the modules are sitting in the yard.
- **Production lines:** Most producers have some sort of production line where the module moves from the first station (typically the floor framing) through to the last station. Production lines are often tracks, but one producer visited as part of this study used an open floor system and had four “hoovers” under each module. These compressed air units lift the module off the shop floor and a small

team of workers easily push the module into any position necessary (Figure 25 illustrates a worker pushing a module supported by air-driven hovers under a suspended pre-finished ceiling assembly). At least one other producer didn't move the modules along a production line at all – essentially “site-built” under a roof, then moved the home out of the factory.

Figure 25



Photo by Clayton
Research

- **Inventory management:** Two of the producers visited in the course of this study have employed LEAN manufacturing. This process, adapted from Toyota, eliminates virtually all unnecessary inventories, frees up production space, uses computerized tracking of tools and materials and reorganizes the hierarchy among the workers.
- **Insulation:** Wall and ceiling insulation can be either fibreglass, or cellulous, can be either blown in or placed in as bats and with respect to the walls, can be added to the outside of a wall pre-clad with drywall or from the inside to a wall pre-clad with siding – all depending on the manufacturer.
- **Roof Truss Hinges:** The hinged truss (which is explained in greater detail in 4.3.2) is commonly used by most modular and manufactured home producers in Canada. But there are some producers who still employ roof framing, and have adapted a

plywood gusset-plate approach to the hinge application. Figure 26 illustrates such a gusset plate on a modular home in a Quebec-based factory.

Figure 26

A custom-designed
gusset truss

Photo by Clayton
Research



4.2 ADVANCED MACHINERY USE

Although production of modular and manufactured housing is essentially a low-tech production process, there are increasingly sophisticated machines being employed in some plants. In Figure 27 three technologies are illustrated:

- In the upper left is a lumber bridge employed on a framing jig. This machine automatically drops studs in place to help with the automated framing process;
- In the lower left is a laminating machine employed by a producer with a cabinet-making shop; and
- The precision computerized saw in the right panel is used in the cutting shop of a modular producer. Similar saws are also employed by timber-frame producers.

Figure 27



**Photo by Clayton
Research**

Overhead cranes, hoists and scaffolds as illustrated in Figure 28, are common in most modular and manufactured home plants.

Figure 28



**Photo by Clayton
Research**

4.2.1 Production processes relative to U.S. plants

Generally, Canadian producers surveyed in this study felt that there was a great deal of differentiation between Canadian factories and U.S. based factories. Most commonly, survey respondents felt that Canadian producers were more akin to custom home builders and that U.S. factories continue to produce identical HUD code “mobile homes” from a production line.

In reality, the industries on both sides of the border are remarkably similar. Both employ similar levels of technology, both build homes of similar quality and design, both use similar marketing and distribution channels to sell their product.

There are some differences between the two industries:

- In general, U.S. plants tend to be larger, producing on average in the order of 600-800 homes per year, whereas Canadian plants typically produce 200-400 homes per year.
- There is more homogeneity of production process techniques in the U.S. Most producers assemble the modular homes in a similar “inside out” manner. As discussed above, among Canadian producers there is more variation in terms of the production process.
- Some building techniques seem to be unique to the U.S. and not employed by Canadians. A ¼ sheets of laminated panel stock are used by some producers on interior walls between the drywall and studs. This ensures a stiffer wall, and helps avoid drywall cracking during shipping (see Figure 29). This technique is not employed by any Canadian firms surveyed in this project.

U.S. factory builders command a significantly larger share of total single-family housing production in that country, than do Canadian producers in Canada. The greater homogeneity of production among U.S. based factories and the generally larger scale of production may point to increased production efficiencies south of the border playing an important competitive role for the factory-built sector relative to the site-built sector.

For the Canadian factory-built sector to evolve and grow to capture a significantly larger share of the single-family market, it may require the adoption of some aspects of the U.S. model – including larger-scale operations – achievable through consolidations or new investment – and

increased best practices and technology transfer among Canadian producers.

Figure 29



Photo by Clayton
Research

4.3 MATERIALS USAGE

4.3.1 Wood is a dominant building material in factory-built homes

The factory-built sector is extremely wood-products focused. Trends in wood usage in this sector, are in fact diverging from the site built sector. There are a number of areas in which wood's traditional role in residential construction is being supplanted by alternative building materials such as light-weight steel studs; above-grade concrete walls and floor systems (particularly using insulated concrete forms (ICFs); and increased use of vinyl in millwork, exterior decking and other traditional wood-product applications.

In the factory-built sector, by contrast, construction practice has taken a virtual 180 degree shift over the past two or three decades from a product which resembled travel-trailers in many ways, including metal frameworks, siding and roofing, to a product which is extremely similar to traditional wood-built site-built housing including wooden wall studs (both interior and exterior) wooden rafters and trusses, wooden floor systems and wooden cabinetry.

The usage of wood products in a typical factory-built home, therefore, is on the rise, not just due to the increased shift toward wood from a production technology standpoint, but also because of the increasing size of the typical factory-built home.

4.3.2 Use of Value-Added Wood Products in Factory-Built Housing

The use of value-added wood products in factory-built housing varies considerably among manufacturers. Value added products include panel product (such as oriented strandboard – OSB); engineered product (wood I-beams, Timberstrand, floor and roof trusses); and millwork (wood windows and doors).

The greatest presence of value added wood products in manufactured housing is panel product. OSB use is extremely common, especially as roof sheeting, exterior wall sheeting (generally 7/16 – see Figure 30) and in some cases floor sheeting.

Figure 30



**Photo by Clayton
Research**

Some additional examples of OSB use found among the firms surveyed for this project include as spacers in assembled door and window headers, as a bottom plate below interior and exterior walls, etc. OSB is the preferred sheeting on roofing and exterior wall sheeting because of the quality of its strength rating. The stresses that the framing undergoes

during transportation is a particular concern in these homes – particularly the drywall homes. Producers are happy with the ability of OSB to withstand that stress. Most producers were generally happy with OSB, when asked. Complaints related to price (and extreme price fluctuations), and some cited customer resistance to the product.

Engineered roof trusses are used on virtually every manufactured home. The major innovation in this field has been the hinged truss, which allows producers to incorporate steeper pitches, but hinge the roof down for transport in order to maintain roadway guidelines (see Figure 31).

Figure 31



**Photo by Clayton
Research**

The hinged truss design was pioneered by architectural firm Steven Winter Associates working on behalf of HUD's partnerships for advanced technology in housing (PATH).

About half of the producers make use of engineered floor systems among the factory builders surveyed for this project. Engineered floor systems are less likely in manufactured homes. Among modular housing units some builders employ an open-web floor truss system (which accommodates duct work better than dimensional framing), but most frame the floor in either 2X8 or 2X10 or wood-I beam systems. Figure 32 illustrates a modular home set on a full perimeter foundation. The floor system is simply composed of 2x10 joists on a 2x10 stringer with an OSB decking visible.

Figure 32



**Photo by Clayton
Research**

Laminated timbers are used by most of the producers surveyed. The most common use of a laminated timber is as the ridge beam above the marriage wall of a multi-section home. Usually this was an LVL beam. Some producers used LVL timbers as floor stringers on modular units (Figure 33).

Figure 33



**Photo by Clayton
Research**

5 ECONOMIC CONDITIONS IN THE SECTOR

This section will explore demand and supply conditions in the sector as a backdrop for providing an assessment of sector growth potential over the next 3-5 years.

5.1 DEMAND CONDITIONS

5.1.1 Consumer demand

In terms of consumer demand, the factory-built sector faces a very steady but rising demand profile. Although it is unlikely that consumer demand will turn sharply positive over the near-term horizon, there are several factors which suggest that demand will remain positive, including:

- The industry is illustrating the benefits of factory-built housing to the public through home-shows, media exposure, show homes on major thoroughfares and other marketing techniques;
- Thus far, factory-built housing demand has come from two principal demographics 1) consumers of affordable housing, principally occupying manufactured homes located in landlease communities, and 2) higher-end custom homes primarily in rural markets. Certainly for this second category, which has been the growth segment for the sector in the past decade, demand remains very stable, and the sector should continue to benefit from improvements in real incomes in Canada and the impact that that will have on demand for housing.
- There also remains a small but vibrant component of demand for vacation homes – particularly among the pre-engineered segment. Recently there has been increasing interest among vacation home buyers for fractional ownership developments. Fractional ownership developments are conceptually similar to a time-share arrangement, but with fewer owners – typically 5-10 per structure taking title to the property. And at least one proposed fractional-ownership development in Ontario, Shelter Cover Lifestyle Community, may use factory-build modular homes from Exeter, Ontario-based Northlander Industries.
- While demand for traditional factory-built homes (manufactured, modular and wood-based panellized) is steady, the demand for innovative products from this sector appears to be very strong.

The recent success of the prefabricated light-weight steel truss systems are examples of tremendous pent-up demand in Canada for residential alternatives to homes built and delivered through the traditional channels.

5.1.2 Site-builder demand

Integration with the site-built homebuilding sector is one of the key areas of potential growth for the factory-built sector.

Tract builders (larger builders who build multiple homes in a single subdivision simultaneously) represent a large portion of the new housing production in most of Canada's major urban centres. Historically, there has been limited integration between factory-builders and tract builders, in spite of the fact that in the U.S. these types of integrated business models are more prevalent.

Producers, retailers and site-builders consulted as part of this study addressed this issue. Generally it is felt:

- While modular builders enjoy some cost savings in production through bulk buying, division of labour and other factors, so too do the very large site-builders. Thus the economics of selling prefabricated housing to site builders hasn't evolved to the point where it makes obvious financial sense for a large urban builder;
- In some markets, such as the Greater Toronto Area, producers have suggested that existing union agreements between large tract builders and major trades groups preclude the outsourcing of such a substantial portion of the homebuilding process to an off-site producer; and
- In some regions there may be insufficient production capacity for tract builders to rely on factory-built inputs during times of strong demand. The business model generally employed by tract home builders generally allows for the absorption of large changes in demand relatively easily. As demand rises, builders employ more trades and build more homes, as demand recedes, they try to downsize in such a manner to preserve their margin. This business model does not require home builders to invest significantly in capital and overhead. The factory builder, by contrast, has a much higher proportion of costs tied up in overhead, making slack period in demand costly, and also has production capacity constraints making servicing large orders problematic. Tract builders may be worried about developing

supply relationships with one or two factory-builders, as the factory-builder may not be as flexible to respond to varying demand conditions.

However, it does not mean that the traditional homebuilding sector is not interested in factory production. There are many examples of home builders adopting aspects of factory production in their business models:

- Most site-based home builders purchase prefabricated roof trusses, and prefabricated floor systems are becoming more common amongst this segment;
- One major home builder, Mattamy Homes has established its own factory and is building full factory homes for its own development; and
- Innovative value-added systems, such as the light-gauge steel system has already been adopted by several traditional home builders, so in cases where the economics clearly work in favour of the builder, builders have demonstrated a willingness to consider greater use of factory-built components or housing.

All in all, business relationships between factory-builders and tract builders are limited in the Canadian market, but the prospects of further integration in this area are possible. There is more analysis on these relationships presented in Chapter 7.

5.2 SUPPLY CONDITIONS

There are some 75 companies certified by CSA to produce modular homes in Canada. The entire factory-built sector, including panellized, pre-engineered and log/timber frame companies probably amounts to some 190 firms, using Statistics Canada's Annual Survey of Manufacturing (ASM) as a guide.

In general factory-built housing producers are solvent. Data from the ASM suggests that profitability in the five years leading up to 2003 was about 15 percent for the industry⁷. In the field visits conducted for this study, all producers visited were very busy at the time of the visit. Rarely was there an idle production line or "holes" on the line indicating slack or below-capacity production.

⁷ Net income of factory operations relative to factory revenues (i.e., analysis excludes transportation and installation activities)

Many modular producers are also investing heavily in marketing in recent years. At least half of the field visits we conducted were to plants with nearly new model homes on display. Evidence from the interviews suggest that 10 years ago it was fairly uncommon for producers to use model homes. Although this type of marketing strategy is not without its risks – due to the costly capital outlays necessary to establish these show home sites, it is likely both a positive sign of the current solvency of the sector, and a positive move from a marketing perspective. As discussed above, the ability to capture the confidence of the end consumer is a critical requirement for the success of this sector.

6 SECTOR OUTLOOK

In the past decade, the factory-built sector in Canada has experienced some modest growth, in terms of the number of homes produced, but has slipped as a share of total single-family housing construction.

This section examines the growth prospects for the sector through to 2010.

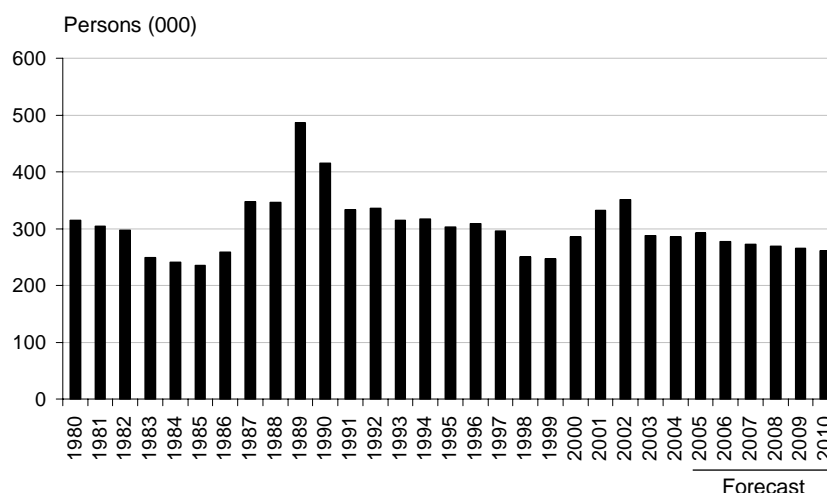
6.1 POPULATION GROWTH

Population growth and age structure are important drivers of housing demand. As a result, it is important to take a look at demographic trends from the recent past as well as over the projection period. Key highlights include:

- Population reached just over 32 million people in March 2005 according to estimates by Statistics Canada. Population growth in Canada is forecast to average about 270,000 persons per year through the 2005-2010 period. This compares with growth of 310,000 per year in the period 2000-2005 (see Figure 34).
- The **natural increase** (births minus deaths) in the population contributed growth of 102,000 persons per year in the past five years, but the trend toward this growth component is toward slower growth as the aging of the population into its higher death years continues to cause a rise in the number of deaths in Canada relative to births. The expectation is that the rate of natural increase in the population will be in the order of 81,000 persons per year through to 2010.
- Net international **migration** has become a larger proportion of total growth. Net migration to Canada has averaged 210,000 persons in the past five years. Expectations are for net migration to average 190,000 persons through to 2010 (235,000 immigrants on average and about 45,000 emigrants).
- The net result is for modestly lower rates of population growth through the forecast period relative to recent performance, as illustrated in Figure 34.

Figure 34

Change in Population, Canada 1980-2010



Source: Forecast by Clayton Research based on data from Statistics Canada

6.2 HOUSEHOLD FORMATION AND DEMAND FOR NEW HOUSING UNITS

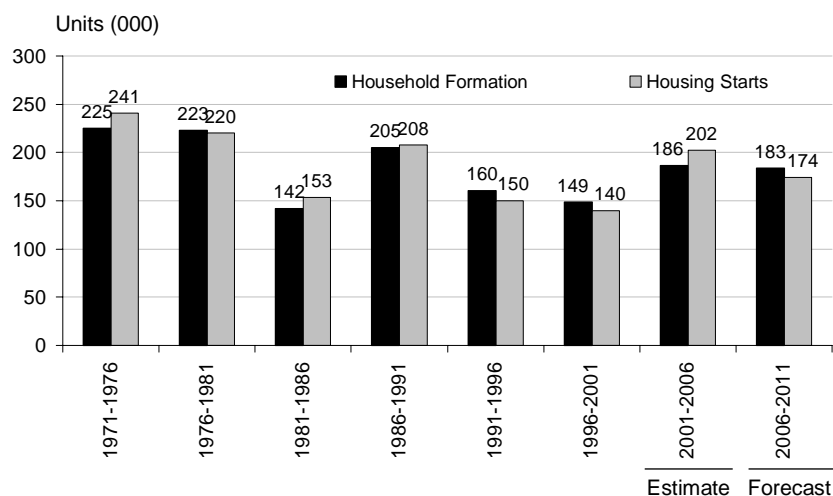
Both total household formation and housing starts steadily trended down in the decade leading up to 2001. But in the period 2001-2006, household formation is getting a boost partly to the aging of the baby-boomer population into its highest headship age groups, partly from modestly higher headship rates among groups aged 15-34 years and partly from a widespread release of pent up demand from the slower-economy 1990s years.

Housing starts will likely round out the Census period (2001-2006) at just over 200,000 units per year, modestly overshooting underlying household demand for this period of about 186,000 households (a gap absorbed by rising rental unit vacancies and a pick up in demolitions).

Over the next five-year Census period, household formation will moderate slightly, as the influence of the slower population, and the release of the pent-up demand works through the system. Housing starts, however will likely see a much sharper decline through the period as supply adjusts to the imbalance which developed in the 2001-2006 period. This imbalance principally showed up in rising rental vacancy rates.

Figure 35

Household Formation and Housing Starts, 1971-2011



Source: Forecast by Clayton Research based on data from Statistics Canada and CMHC

6.3 DEMAND FOR NEW SINGLE-FAMILY HOUSING UNITS

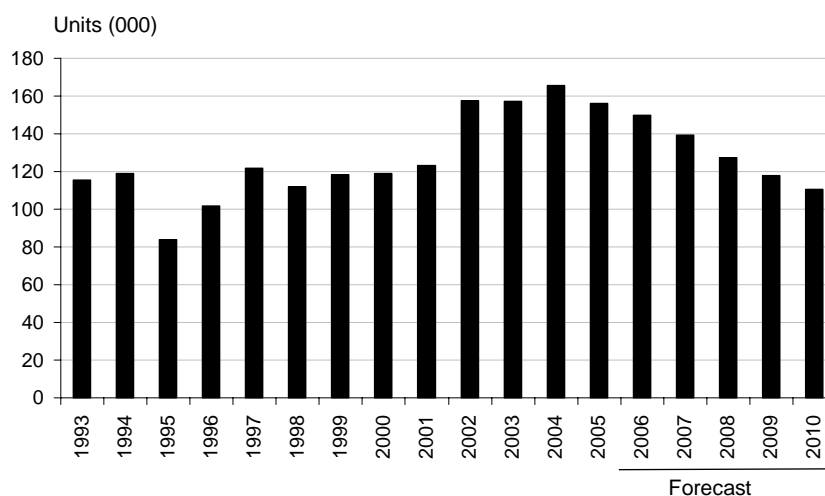
Single-family housing starts (composed of single-detached, semi-detached and row house units) reached just over 165,500 units in Canada in 2004, the highest production of this type of housing in 17 years in Canada. But in 2005, single-family starts reseeded some 5.7 percent to 156,000 units, suggesting that the peak of the current housing cycle in Canada may have occurred.

Going forward, single-family starts are expected to continue to moderate through to 2010 as a result of slowing overall new housing requirements and a continued shift in housing requirements out of single-family and toward apartments.

All told, annual average new housing requirements are likely to be about 125,000 single-family housing units through the next five years. The pattern, however, will likely be downward, with potential starts dipping to about 110,000 units by 2010.

Figure 36

Single-Family Housing Starts, Canada 1993-2010



Source: Forecast by Clayton Research based on data from CMHC

6.4 FACTORY-BUILT POTENTIAL DEMAND

6.4.1 Single-family market

The factory-built housing sector primarily contributes toward the single-family housing sector – primarily single detached units. In 2004, it is estimated that factory-produced units were employed in approximately 7.3 percent of all single-family housing starts (recall Figure 8), which represented a decline of about 1.1 percentage points off the 1993 benchmark discussed earlier in this report.

There is good reason to believe that factory-built housing may capture a slightly larger share of overall housing starts in the next five years:

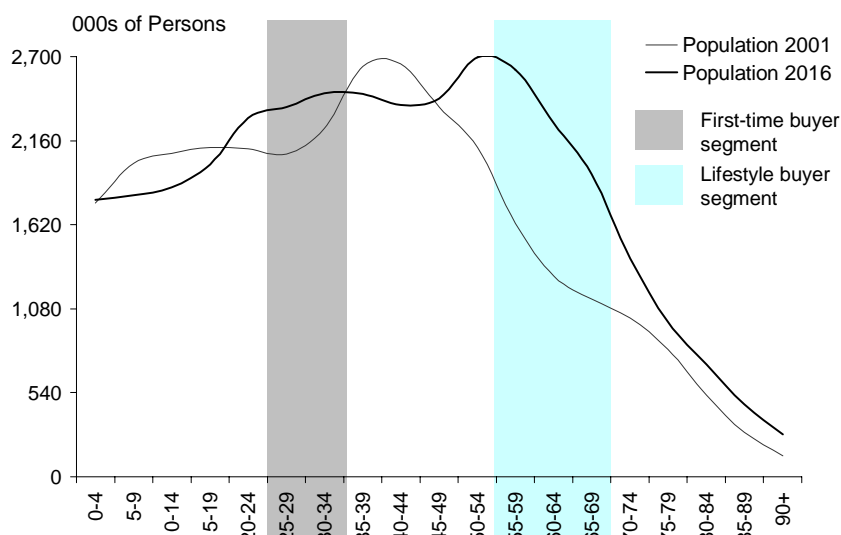
- Factory-built producers are active, solvent and have in some cases realigned their marketing and distribution efforts to appeal successfully to today's custom and rural home buyers;
- Emerging factory-built technologies, such as the light-gauge steel panellized systems are gaining strong acceptance by buyers and tract housing builders alike;
- At least one tract site builder is already integrating a factory-built component into their production process, and more builders are likely to be seen adopting this approach in the years to come;

- Manufactured home communities continue to transform, and although there is not a great deal of growth potential in this area overall, there continues to be relatively high replacement demand from the still-sizable stock of outmoded and out-styled mobile homes located in these communities; and
- One of the niche segments that factory-built housing has a relatively large share capture in is in adult lifestyle communities. This emerging segment itself is expected to capture a relatively large share of new housing requirements over the next five years, due in part to the emergence of the baby-boom cohort of the population into the lifestyle buying age groups. As a result, factory-built product, particularly modular housing, will likely benefit.
- There is another relatively important demographic segment emerging into the housing market over the next decade, and this is the group born roughly between the years 1980 and 1992 – sometimes referred to as the “baby-echo” generation, as they are generally children of the baby boomers. This group is slightly more numerous than the generation which preceded it, and as illustrated in Figure 37, this group will likely increase demand for first-time homes over the next decade. This influence will augment the need for affordable new homes, a niche that the factory-built segment is well positioned to support.
- Finally, as immigration becomes a more prominent component of overall population and household growth (recall Section 6.1), the emerging housing preferences of this group will also influence the profile of housing demand. Certainly affordability will be an important component – which will be beneficial for factory-built housing, however, previous findings by CMHC have suggested that ownership rates among recent immigrants (those in Canada fewer than 20 years) are significantly below the rest of the population⁸. Thus the emergence of the a larger component of growth tied to immigration will ultimately lead to weaker demand for new ownership housing, and a general weakening of the single-family segment.

⁸ CMHC, “2001 Census Housing Series Issue 7: Immigrant Households,” Research Highlights, Socio Demographic Series, 04-042 (2004).

Figure 37

Population by Age Group, Canada, 1986-2016



Source: Clayton Research based on data from Statistics Canada

All in all, it is reasonable over the near term to expect the share capture of single-family housing requirements serviced by factory-built housing to return to the 8-9 percent range.

On an annual average of 130,000 units, that implies requirements for factory built housing in the order of 11,000-12,000 units per year to satisfy single-family requirements. It is of note that although the share capture is expected to rise, total demand for single-family factory-built units will likely moderate from estimated domestic consumption of single-family factory built units of 12,100 units.

6.4.2 Other markets

The modest decline in demand for single-family factory-built units over the next five years, as total housing requirements in that market moderate in Canada, may be offset by other markets.

The factory-built sector delivers a modest amount of product presently to the apartment sector – about 2,000 units per year, and this is a sector that will continue to see rising demand through the forecast (also influenced by the first-time buyer segment as illustrated in Figure 37). It is likely that the factory-built sector will be able to increase its penetration into the apartment market over the next five years. The impact of the IHI system,

if the producer is able to ramp up production as scheduled, will likely make a large impact on the presence of factory-built housing in the apartment sector (recall Figure 11).

7 INTEGRATION BETWEEN FACTORY PRODUCERS AND BUILDERS

There has always been a certain amount of integration between the factory and the site builder. Even the most complete factory-built homes require a certain amount of on-site construction activity. As explored earlier in this report, in most cases all or most of this on-site construction activity is undertaken by entities that are independent from the manufacturer. In this regard, there is already a strong degree of integration between producers and the construction and home building industries. However, major factory-built components (manufactured homes, modular homes, engineered homes or fully panellized homes) remain a small minority of the mainstream home building sector both in terms of economic product and in terms of the proportion of overall housing starts in Canada.

This chapter explores in more detail the level of integration between factory-built producers and on-site builders in Canada – in particular the use of major factory-built components in mainstream home building. This chapter outlines some of the motivation for integration between the sectors, and the prospects for factory-built housing in further integration.

7.1 REASONS FOR INTEGRATION

Due to the prominence of on-site builders in the Canadian housing market, one of the most important channels for factory-built housing producers to get their product to market is through the development of relationships with site builders and developers. This relationship can prove beneficial to both builders and factory producers. For traditional home builders it allows a reduction in production time of new developments, a minimization of skilled on-site labour, less impact on neighbouring communities, and, potentially, a lower-cost higher-margin final product. For factory-builders it is an important channel for increasing market share.

For most modular houses, the level of customization available is on-par with site-built homes and completion can take place in a fraction of the time typically required for on-site construction. In bigger developments, division of labour between factory and site builders may increase efficiency by allowing the builder to focus on those components of the new home product that are absolutely necessary to do on-site, such as

building foundations, adding siding, roofing, etc., while allowing the main production of the house to take place in the factory.

7.2 EXAMPLES OF PRODUCER AND BUILDER RELATIONSHIPS

There are several examples of factory-built producers having relationships with on-site builders to produce homes in a factory setting and sell them to builders who complete them on-site. Of the factory-built housing producers interviewed the vast majority of respondents were interested in developing relationships with builders and developers. Builder networks such as those discussed in Chapter 3, where factory built homes are sold to a company who finishes the installation, are increasingly common especially in the rural market. For some factory-built producers, such as Morewood, Ontario-based Guildcrest Homes, upwards of eighty percent of their production is sold to registered builders.

Figure 38



Photo by Clayton Research

Although most factory-builders are developing these types of relationships on a small scale, and show interest in developing them further, the key to greater integration between the two industries is increased interest on behalf of traditional site-based home builders. There are several examples in recent years that this interest is developing:

- Oakville, Ontario-based Mattamy Homes – one of Ontario's largest site-built home producers – recently established Stelumar Advanced Manufacturing. Stelumar prefabricates whole homes (not modules) in its 6,700 square metre CSA-certified factory

located in Cambridge-Ontario, and transfers them via custom-designed transporters to a subdivision of their own development close by. Figure 38 shows a fully completed (excepting the masonry facing) Stelumar home being installed on a foundation within one of Mattamy's developments. Notice the custom-designed transporter in the lower-right of the illustration.

- Several Ontario-based homebuilders have adopted the whole-home panellized lightweight steel factory homes produced by KML Genesis discussed in Section 3.3.8. These include The Daniels Group, Solmar Homes, Stafford Homes, Remington Homes, Greenpark Homes, The Kaitlin Group, Urbancorp and many other very large regional builders.
- A Vancouver, B.C.-based company, Mega Building Systems markets a similar fully panellized lightweight steel housing system, typically focused on the multi-family sector and has prefabricated homes for many large home builders across Canada including Toronto's Schickedanz Bros. Limited, Vancouver's Bastion Developments, and Calgary's Statesman Corporation.
- There are other factory-built home producers that are part of larger corporate entities including traditional home builders. The Shaw Group, based in Halifax, Nova Scotia controls both Clayton Developments, one of Halifax's largest residential developers and Prestige Homes, a factory-built housing producer located in Sussex, New Brunswick.
- In a model more prevalent in the U.S., in which a factory builder will acquire or establish a home building affiliate, Spruce Grove, Alberta-based Winalta Inc. has evolved into an integrated development, site-builder and factory builder corporation. Winalta is a large factory-built producer of residential and non-residential buildings operating from its 10,000 square metre plant outside of Edmonton, Alberta and also controls three site-building and development companies: Ridgewood Homes (the group's retail arm develops manufactured home communities), Westalta Modular Homes Inc. and Carleton Homes, a custom site-built home builder and developer.
- Adult-lifestyle community developers such as Calgary, Alberta-based Parkbridge Lifestyle Communities Inc. remain an important integrated channel for manufactured homes, and, progressively for modular homes through a number of new landlease developments such as Parkbridge's Glen Antrim Estates in Hamilton, Ontario. This adult-lifestyle community embarking on its

second phase of development has a traditional suburban subdivision look and lay-out and features Guildcrest modular homes placed on full perimeter foundations.

In the U.S., where some 30 percent of single-family new housing production is accounted for by factory-built homes, there is considerably more integration between the factory-built and traditional home builder communities. Many of the models just emerging in Canada, as described above, are prevalent in the U.S. There are several companies, such as Champion Enterprises, with integrated land development, and site-building affiliates. Also even among the independent factory-builders in the U.S., most describe having established relationships with large regional or national home-builders integrating the modular product into traditional site-build developments.

It is possible that given the higher degree of sector integration in the U.S., and some of the same models emerging recently in Canada, that the Canadian industry may expect further integration in the years ahead.

7.3 LIMITATIONS TO INTEGRATION

There are a number of factors which tend to limit the amount of integration in the industry between traditional on-site home builders and factory builders:

- **Traditional business practices.** Canada's home building sector is dominated by a large number of relatively small local or regional builders. In this regard, the structure of the Canadian home building sector differs somewhat from practices in the U.S., which has a greater concentration of total new home construction accounted for by a handful of large national builders. In the case of small local home builders, there is often a greater connection between the core business identity and the notion of framing and completing homes from start to finish. To these businesses the notion of procuring largely finished homes as a business input in order to focus resources on increasing volume isn't necessarily an unattractive economic proposition, but simply goes against an ingrained idea of the firm's core business. For larger builders, there may be more of a willingness to explore alternative economic models to grow business volumes. This may explain why there is greater integration between the generally larger U.S. builders and factory-builders than in Canada. As Canada's home building industry continues to evolve and consolidate (national

home building firms are beginning to emerge with firms like Mattamy Homes and Concord Pacific Group operating in two or more provinces) we may begin to see greater U.S. style use of factory-built housing in traditional developments as a matter of course.

- **Economics.** While on average it is clear that producing factory-built homes makes economic sense: production costs are lower per square metre on a quality adjusted basis (recall Section 4.1), this relationship varies considerably from one development to another. Clearly some home builders are able, either through effective business practice, volume procurement, division of tasks, or other means, to drive significant costs out of their costs of production. In these cases, builders may well be able to achieve the sort of cost efficiencies that factory building brings to the table. In these cases, efficient niche builders may feel more inclined to stay with the site-building model and thereby capture the economic margins associated with the home construction.
- **Regulatory and structural barriers.** While factory-built housing plays a relatively large role in rural markets, there remain a number of regulatory and structural barriers to wide-spread integration into urban and suburban home building. Several factory builders surveyed in this project suggested that urban municipalities still generally impose municipal zoning conditions which in some cases make the use of factory-built housing difficult for a land developer. It was also reported that structural issues such as urban trade unions, road-access permits, and other issues all generated cost or barriers effectively eroding the economic advantage of factory-built housing in an urban setting. In 2004, urban centres of 50,000 persons or larger accounted for 89.7 percent of total housing production. Clearly for factory-built housing to integrate significantly with the traditional home building industry, it needs to gain a firmer foothold in the urban market.
- **Other prefabricated component options.** One of the difficulties faced by factory-built producers in increasing integration with on-site builders is the level to which on-site builders have already incorporated all the benefits of the factory into their production and are so big that they enjoy the same economies of scale that factory producers enjoy. Large scale urban builders already make significant use of prefabricated components such as roof trusses, cabinetry, wall and floor systems, etc. and often have the capabilities to produce them on-site in temporary indoor facilities similar to factories. Production on-site also eliminates

transportation problems and weakens the argument for integration from the perspective of the on-site builder.

- **Capacity.** Finally, home builders have a concern that factories may run out of capacity during times of strong demand. In a traditional site-build model, builders are able to relatively quickly build or release capacity as need be to meet demand, but if a builder relies on a factory-builder to provide a nearly finished product, there may be an issue of that factory being able to satisfy demand. Based on the present survey, we feel at present there is significant capacity within the factory built housing sector today; most plants only operate one, one-and-a-half, or two shifts, for example. Moreover, the industry provides relatively easy entry to new companies and producers, so we feel that the capacity fears may not be as important in the long run.

7.4 PROSPECTS FOR FURTHER INTEGRATION

The traditional relationship that has existed between factory-built home producers and building developers has most often been to provide factory-built homes to independent land owners and to lease communities in rural and smaller urban areas. As factory-built housing producers move to modular homes and away from manufactured homes, however, lease relationships are a diminishing market segment, and the rural land-owner market will always be limited in scope. The focus on potential partnerships with builders and developers has in several cases moved to producing customized modular homes to new subdivisions in urban and suburban communities. Since this is where the most growth takes place in the housing market, accessing this market will be extremely important to increasing the market share of factory-built housing.

The factors that will affect the prospects for further integration between factory and site builders are in many cases the same issues that will determine how competitive the factory-built housing industry is with site builders. That is, factors such as the size and magnitude of the gains from producing in the factory over building on-site. This will in turn be influenced by differences in the costs of inputs in the two sectors. For example, in the past century moves to the factory have taken place as a response to changes in the labour market and especially to the costs and availability of skilled labour. In an economic environment where labour costs are increasing there is a good possibility that technologies employed by factory-built housing that allow them to cut back on labour will increase

both integration with traditional builders and the market share of factory-built housing.

8 INNOVATION AND ENVIRONMENTAL STEWARDSHIP

This section supports estimates provided elsewhere in the report on the prospects for growth in the factory-built housing sector through innovations in technologies and production methods. It also explores the record of the factory-built industry promoting good environmental stewardship through the production of energy efficient homes and through advanced environmentally-friendly building practices.

Because innovations come about largely as a result of research and development (R&D) the analysis will focus on the role of R&D and innovation first within the Canadian economy in general and ultimately within the factory-built housing sector.

Included in the analysis is an investigation of some of the barriers to innovations in the on-site and factory-built housing sectors, as well as some of the prescriptive measures taken by agencies in Canada and the United States.

The section concludes with a discussion of the increasing importance of environmental concerns to the home building industry and the Canadian economy as a whole and the role that factory-built housing should have in this development, and the on-going role that the factory-built sector plays promoting good environmental stewardship.

8.1 ROLE OF RESEARCH AND DEVELOPMENT IN CANADA

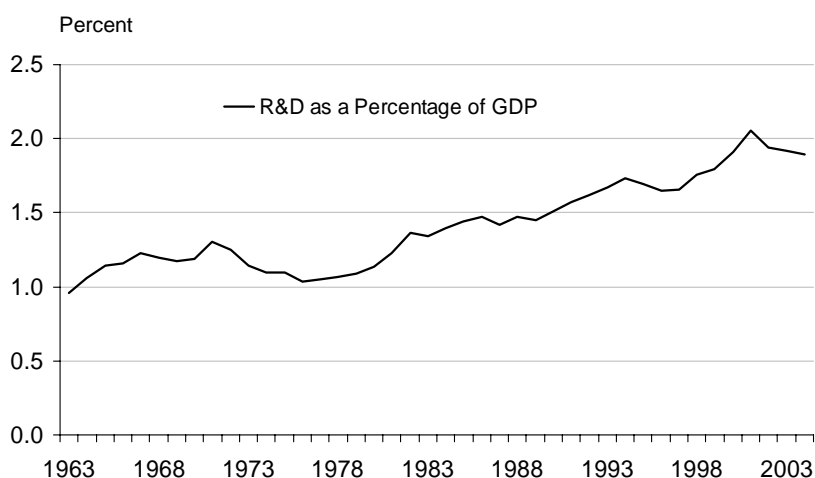
Spending on research and development as a percentage of total GDP in Canada has been trending slowly upwards through the twentieth century but has breached the 2 percent mark only once. Gross expenditures on research and development (GERD) as a percent of GDP peaked in 2002 and have since moderated. Figure 39 illustrates gross expenditures on research and development (R&D) as a percentage of GDP in Canada over the last four decades.

But this high-level observation masks considerable change among the composition of R&D investment. In the period between 1953 and 1979 R&D funding by government outweighed that by the private sector by a wide margin. Gradually, over the past forty years, however, the proportion of total R&D investment initiated by the private sector has expanded to just over 50 percent in recent years (Figure 40). Private investment in

R&D has become an increasingly important component to overall R&D investment in Canada and will likely become even more important in the future.

Figure 39

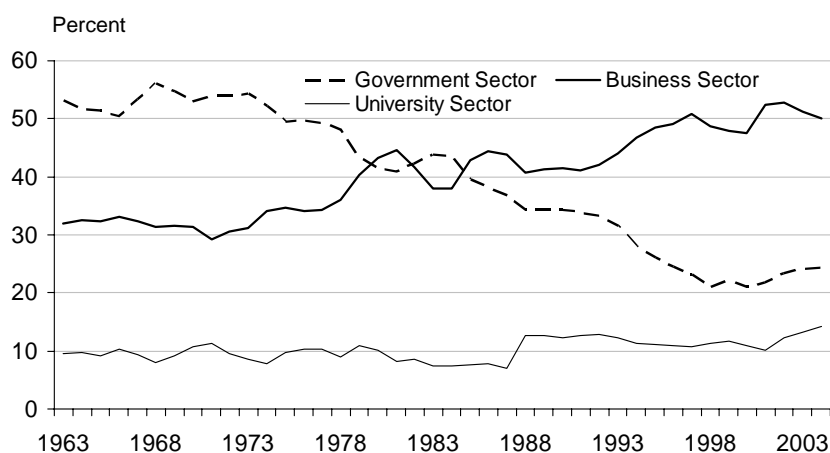
Gross Expenditure on R&D as a Percentage of GDP, 1963-2004, Canada



Source: Clayton Research based on data from Statistics Canada

Figure 40

Spending on R&D by Sector as a Percentage of Total Spending, Canada, 1974-2004, Canada



Source: Clayton Research based on data from Statistics Canada

8.2 R&D SPENDING BY CANADIAN MANUFACTURERS

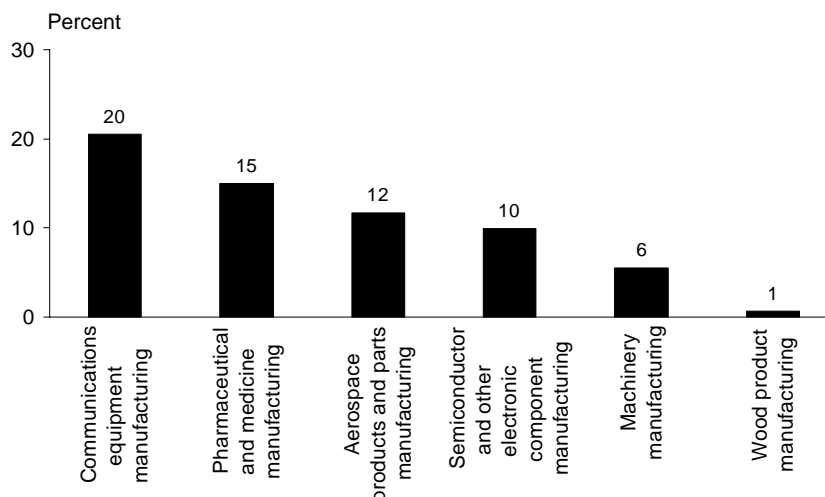
The majority of R&D spending in Canada in the private sector is carried out by the manufacturing sector. In 2004 manufacturing's share of total business expenditures on research and development was roughly 59 percent. Construction's total share on the other hand was below 1 percent. Of course, importantly, the manufacturing sector is responsible for many of the innovations that ultimately help to improve productivity in the construction sector, such as better equipment and tools, prefabricated materials and other innovations. In addition, the concept of R&D alone fails to capture an important source of innovations within the construction sector such as "learning-by-doing." Nonetheless, the vast difference is still quite striking.

Within the manufacturing sector the largest single investor in R&D is the pharmaceutical industry (see Figure 41). R&D spending by machinery manufacturers is also significant at around 6 percent. Wood products manufacturing, which includes a majority of the factory-built housing producers and an assortment of other manufactured wood products, is quite small at around 1 percent of total R&D spending within the manufacturing sector.

The level of R&D undertaken by machinery manufacturers is important because it raises the possibility for technological innovations that will positively benefit the factory-built housing industry without the industry having to invest in R&D itself. This will be especially true if the innovations are specific to production in the factory versus innovations that will also benefit on-site builders.

Figure 41

Shares of Total Spending on R&D of Selected Manufacturing Industries, 2005, Canada



Source: Clayton Research based on data from Statistics Canada

8.3 OVERVIEW OF R&D IN CANADA'S BUILDING INDUSTRY:

8.3.1 Research and Results in Historical Context

The small scale nature of the home building industry has made large scale private investment in research fairly difficult. For this reason, research has often been facilitated by larger organizations representing the industry as a whole and by various government organizations. Through the twentieth century three government agencies that have been important in facilitating research in home building in Canada are the CMHC, the National Research Council (NRC) and Natural Resources Canada (NRCan). Through the research wing of the CMHC, and the NRC's Institute for Research in Construction (IRC), information has been disseminated to builders and building manufacturers on a wide variety of new technologies and innovative processes.

One of the most important areas of research and innovation in the housing industry in the last century has been the use of prefabrication. For most of the twentieth century, fully factory-built homes were not economically feasible; transportation limitations and the high levels of production needed to realize economies of scale and organization were simply not yet present at the time. However, prefabrication was an innovation that has become prevalent. Through the 1950s and 1960s on-

site builders increasingly reduced labour costs by relying on prefabricated framing and wall panels, built cabinets, stairs and other components.

8.3.2 Recent Trends in R&D in Canada

Since 1986 the National Housing Research Committee (NHRC) has partnered government and private associations together to facilitate research in housing. The goals of the NHRC are to encourage research and minimize overlap, and to promote the application and adoption of research results. Private associations like the Canadian Home Builders' Association (CHBA) and the Canadian Manufactured Housing Institute (CMHI) are members of this committee and often partner with the government in research and development projects.

As well as partnerships with government agencies, private agencies also conduct research on their own. The CHBA produces a home building manual that is continually revised and updated with new technologies and techniques. Given their increasing importance in the later half of the twentieth century, it is likely that private organizations will become increasingly important to the development of innovations within the home building sector in the future.

8.3.3 Barriers to Innovation

Innovations in the housing industry have been slow and gradual. Beyond better tools and more efficient materials the fundamental process of homebuilding has changed little since the Second World War, when builders began "platform" framing houses.

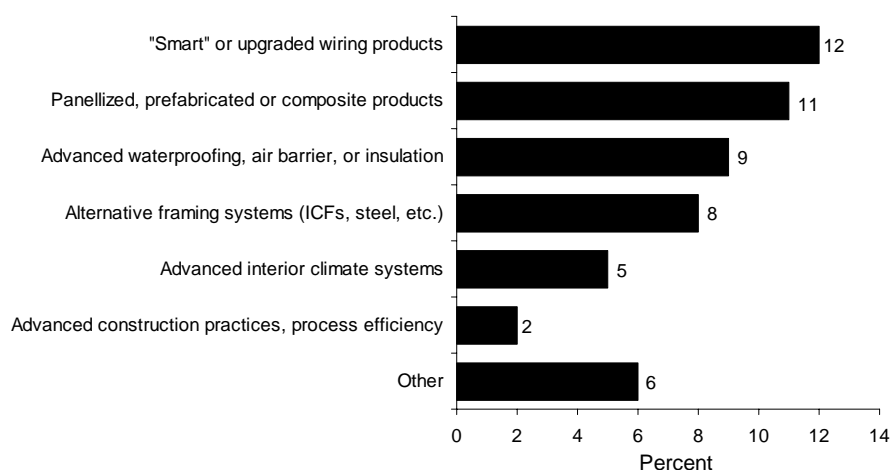
There are several reasons why this is the case. For one, building producers and manufacturers do not often have the luxury of testing their product before putting it to market. Due to this, they are often less willing to experiment with risky technologies that may not be accepted by the market place. This problem is increased by the realization that homebuyers are risk averse and often less willing to accept non-traditional products or features. These facts make "tried and true" methods and materials more appealing and innovations less likely to take root.

When innovations are adopted in the building industry they are most often innovations in building materials and less often in techniques that would improve process efficiency. Figure 42 shows results from the 2002 Pulse survey of Canadian Home Builders (conducted for CHBA by Clayton

Research). Only about 5 percent of all the write-in answers to the question revealed the adoption of advanced construction techniques aimed at process efficiency (such as computer aided design, etc.). By contrast, the majority of builders claiming the adoption of an innovation were simply using more advanced or prefabricated components, or making other functionality improvements to the home, such as smart wiring.

Figure 42

Percent of Homebuilders Adopting Innovations by Category, Canada, 2000-2002



Source: CHBA Pulse Survey, Spring/Summer 2002

This is not to say that advanced techniques will not become important, particularly to the factory-built housing industry. Recent trends towards optimal value engineering (OVE) and Lean manufacturing have the potential to further the advantage of the factory over the on-site builder and should be one of the key innovations adopted by factory-built housing operators.

8.3.4 U.S. Experience

An important player in facilitating innovation in the housing industry in the United States is the Partnership for Advancing Technology in Housing (PATH). PATH is a similar concept to the NHRC and is a public-private partnership between homebuilders, product manufacturers, insurance and financial industries, and representatives of federal agencies concerned with housing. Although it involves several government departments its

efforts are coordinated primarily by the Department of Housing and Urban Development (HUD).

PATH came about in response to the realization that the housing industry under-invests in research and development and there are substantial barriers to innovation in the homebuilding industry. Its primary goal is to dramatically improve the cost and quality of housing through the development and application of advanced technologies. To achieve this goal the agency takes part in projects aimed at advancing housing technologies, identifying and reducing barriers that impede innovation, and disseminating information to speed the development and adoption of advanced building technologies.

8.4 R&D IN FACTORY-BUILT HOUSING

8.4.1 Canadian Agencies Involved in R&D

In Canada most factory-built housing producers are represented by associations such as the Canadian Manufactured Housing Institute (CMHI), the Manufactured Housing Association of Canada (MHAC), Ontario Manufactured Housing Association, Manufactured Housing Association of British Columbia, Manufactured Housing Association of Atlantic Canada, Modular/Manufactured Housing Assoc of Alberta & Saskatchewan, Canadian Wood Council (CWC), Canadian Sheet Steel Building Institute (CSSBI), and other groups. Most of these groups are involved in some way with promoting research and development, best practice technology transfer, or other aspects of innovation promotion.

The CMHI represents the majority of modular home producers in Canada, and forges important partnerships with government organizations to conduct research in areas of interest to the factory-built housing industry. These partnerships have produced research reports on several areas, including optimal value engineering (OVE), Lean manufacturing, and market research and industry consultation reports. The CMHI also promotes innovation through the publication of its magazine, "Building Excellence," in which they report on recent technological and production trends.

Forintek Canada is another agency that conducts research in areas affecting the factory-built housing sector. Primarily concerned with research in the forestry and wood products industry, Forintek is partnered with Natural Resources Canada in conducting research on value-added

wood products through the “Value to Wood” program. The Value to Wood program’s research component is designed to address the knowledge and technology needs of Canada’s value-added wood sector.

Some reports to come out of this initiative that relate to the factory-built housing industry include:

- *Process Automation for the Canadian Prefab Homes Industry*: aimed at increasing both efficiency and market share of prefabricated home manufacturers;
- *Assessment of Large Builders Market Strategies*: aimed at understanding interactions between large builders and wood-products producers; and
- *Standardized System for the Manufacturing of Prefab Houses*: an attempt to design a standardized system for manufacturing and transportation of manufactured homes and components.

As well as conducting research, Forintek, through the Value to Wood program is also involved in technology transfer and has advisors to meet with Canadian companies and manufacturers to provide access to resource and market information and accelerate the implementation of new manufacturing processes. As an example, Forintek has developed Lean manufacturing programs for Canadian manufacturers of wood based products, and offers courses for manufacturers across the country.

8.4.2 Canadian Standards Association (CSA)

The Canadian Standards Association conducts research in order to update their codes to modern challenges. In doing this, they are often partnered with other research organizations in specific areas like factory-built housing. CSA standards are reviewed and updated on a regular basis in order to reflect new technologies and remain technically valid.

A wing of the CSA also conducts research on energy efficiency and sustainable development, and in particular to developing codes that make products more energy efficient. This is especially relevant to the factory-built housing industry, which will seek to establish itself as the leader in producing energy-efficient homes.

8.4.3 Canadian Factory-Built Housing Companies

Factory-built housing producers in Canada have much to gain by investing in R&D. The large scale nature of manufacturing makes it a

more suitable model for traditional R&D investment than on-site building. Because most producers are still relatively small scale (relative to producers in the U.S.) and in most cases face competition more from on-site builders rather than each other, research by government agencies and organizations representing the entire industry, such as the CMHI and MHAC is most common.

Nonetheless, Canadian factory-built housing producers are aware of the necessity to promote their product as being on the forefront of innovation. Some examples of innovations that have been utilized by factory-built housing producers include:

- Increasing use of automation and computer software allowing for more precise measurements and a more refined product;
- Innovations in building materials: firms seem particularly interested in materials that they can patent and market as unique to their production, this is especially true of producers of panellized housing such as Pacific Homes' "Smart Wall[®]" building system.
- Innovations in environmental design: Kent Homes and Prestige Homes, for example, have entered competitions with on-site builders to produce factory-built *EnviroHomes*.

8.4.4 Long-time Innovative Contributions from Factory-Built Housing

The fundamental business model behind factory-built housing itself remains relatively innovative, and has been contributing to innovation within the homebuilding industry at large for several decades. Recalling the roots and development of the factory-built housing sector in Canada discussed in more detail in Section 2.2, factory-builders developed a system of homebuilding with a focus on:

- Labour-saving construction techniques;
- Efficient use of materials, with a minimum of waste production;
- Shortened production times from home start to finish; and
- Bulk materials procurement.

All of these concepts, which were originally developed in the factory, have been adopted to some extent by site-based home builders, and represent the level of contribution that the sector has made to the industry in general.

Some aspects of the factory-built sector's contributions to the housing industry have been born from necessity, and have been adopted time and

again as conditions evolve. Shortages of skilled labour during the Second World War gave rise to the birth of the modern factory-built sector in Canada, and in recent years, home builders are again turning to the factory-built sector (for prefabricated components or whole homes) as the on-site sector faces increasing constraints due to chronic shortages of skilled labour.

Moreover, the factory-built sector has proven itself adept at offering product that fits particular niche demand markets much more efficiently and innovatively than the traditional home-building sector:

- For the 2003 Canadian Winter Games in the Bathurst-Campbellton area in New Brunswick, the athletes' village was constructed from 80 factory-built units provided by three different manufacturers, that were then moved and sold to individual homebuyers after the games;
- Developers of adult lifestyle communities, for which demand is growing due to demographics (discussed in Section 7), such as Parkbridge Communities and Killam Properties turn to factory-built homes due to the flexibility in community design and short build times. These communities tend to be found in more remote locations and developers have found the use of factory-built product to be more reliable than local trades.
- The factory-built sector has long been actively involved in providing arctic and far-north housing solutions for communities in extremely remote locations and short building seasons. Lessons learned in the development of these homes have helped factory-builders be in the forefront of innovative construction practices concerning durability and energy efficiency.
- Elsewhere in this report the role of factory-built housing in terms of developing Canada's export profile has been examined. This is a key area where innovation within the sector and within the home building industry at large has led to the development of a solid international reputation for high-quality well-crafted exportable homes.

The factory-built sector has not been actively involved in senior's housing – another niche area of growth over the coming decades due to the aging of the population, but this is an area where the sector could well become involved – particularly those producers involved in factory-built apartment construction.

8.4.5 Mechanization

Canadian factory-based builders have also long been involved in bringing innovation to their production through the invention and adaptation of the machinery and equipment employed in the plants. The steel and concrete panellizer IHI described in Section 3.3.8 invented and built most of the equipment used in their Delta, B.C., based plant (the plant is also built from their own panels) (Figure 43).

Figure 43

Examples of the sophisticated equipment designed and built by IHI to fabricate the company's custom steel and concrete panels

Photo by Clayton Research



8.4.6 North American Context

The integration of the North American economy makes the research done by PATH of interest to producers of factory-built homes in Canada as well as the United States. Two important partnerships that PATH has are with the Manufactured Housing Institute (MHI), and the Manufactured Housing Research Alliance (MHRA). PATH, MHI, and MHRA have produced a number of research projects aimed at promoting innovation in the factory-built housing market (see Figure 44).

Figure 44

Projects by the Manufactured Housing Research Alliance

Adhesives and Sealants
 Air Distribution Systems
 Energy Star for Manufactured Homes
 Equipment Sizing
 Foundation and Support Systems
 Fuel Switching
 Lean Production
 Roadmapping
 Steel Framing
 Single-Family Detached
 Structural Insulated Panels (SIPS)
 Ventilation Research

Source: MHRA website

Innovations developed in the United States can often be quickly put to use in Canada. The research done by PATH is available to the general public. Some of the more specific reports, such as those on specific technologies (e.g. hinged trusses, use of advanced adhesives and sealants) can be of great benefit to producers willing to adopt these technologies as well as those willing undertake some R&D on their own.

8.5 ENVIRONMENTAL BENEFITS FROM FACTORY-BUILT HOUSING

8.5.1 Advantages of Factory-Built in Producing Greener Homes

The main advantage that factory-built housing has over its on-site competitors is the ability to construct its product in a controlled environment, with protocol and systems in place to minimise the amount of waste material. This allows for more efficient assembly, avoids the effect of weather conditions on material degradation, reduces waste, and can allow for better air-leakage prevention systems.

The other advantage factory-built homes have is their ability to incorporate materials and processes that are either not available to on-site builders or that provide a particular advantage when produced in the factory setting. The use of pre-engineered products such as structural insulated panels (SIPs) for example, while available to on-site builders may be better applied to a factory setting.

8.5.2 Evidence and Criteria for Green Building in Factory-Built Housing

Factory-built housing producers have been aware of the benefits of promoting their product as the more energy efficient choice. Several

producers of factory-built homes have incorporated energy efficiency standards into their production. Some producers, such as Royal Homes and Guildcrest Homes, use Canadian government standards such as the R-2000 requirements, while others offer to build homes to Energy Star specifications.

Both R-2000 and Energy Star standards require homes to be 30 percent more energy efficient than the Model National Energy Code. Building to R-2000 standards usually involves incorporating air-tight construction with a “whole house” air exchanger or HRV (heat recovery ventilator). R-2000 standards also stipulate conditions leading to better indoor air quality (reduced use of volatile organic compounds – VOCs – and material with formaldehyde), water conservation and use of other environmental features (recycled material use in insulation, siding, wallboard, etc., energy-efficient appliances and equipment, etc.).

The use of structural insulated panels in factory-built homes or similar technologies such as the SmartWall[®] (marketed by Pacific Homes) also illustrate a move towards building materials that are potentially less costly to produce and also more energy efficient (see Figure 45).

Figure 45



**Photo courtesy of
Pacific Homes**

Over and above, participation in programs such as R-2000 and Energy Star, factory builders typically include a number of energy efficient features in their new homes. According to a 2004 report produced by

CMHI and based on industry consultation, typical new factory-built home specifications in Canada include⁹:

- Exterior walls offering R-20 performance or better;
- Roof/attic insulation levels of R-40 or higher;
- Energy efficient windows, often Low-E or Argon-filled;
- Insulated door systems;
- Tight envelope construction, yielding low air leakage rates;
- Heat recovery ventilation (HRV) systems; and
- Efficient heating equipment.

According to CMHI, factory-based builders who have introduced such energy efficiency features have done so primarily as a means to improve the marketing of the product. The study notes, however, that builders typically find energy efficiency to be a “secondary” rather than a “primary” marketing message – and that home buyers are typically interested in such features as design, layout amenities and price first and then consider the fact that a home’s construction includes upgraded energy efficiency features to be “added value”.

Factory-based builders surveyed as part of the CMHI study cited a number of challenges associated with bringing higher energy-efficient homes to the marketplace, including:

- Energy efficiency does not drive home buying decision making, only supports it;
- There is an insufficient mechanism for buyers to relate higher up-front costs associated with energy efficiency with on-going maintenance and energy cost savings down the road;
- Buyers who are able to equate costs savings with up front costs, typically use a relatively short “pay back period” in their calculation – typically some 3-5 years;
- Buyers are typically only interested in energy efficient features during periods of elevated energy costs. When energy costs subside, so does the interest in these features. This makes it difficult for builders to keep pace with the changing demand profile with respect to energy efficiency; and

⁹ CMHI, “An Energy Efficiency Action Plan for the Factory-Built Housing Industry: Consultation Report” (2004)

- To some extent, there has been growing expectations among buyers that energy efficiency measures ought to be standard in a new home, not come at a premium.

The Manufactured Housing Association of Canada (MHAC) who, in conjunction with the Canadian Housing Exporters Association (CHEA) represent a large number of the factory builders in Canada engaged in export activities, suggests that innovation in weatherproofing, energy efficiently and durability among Canadian factory-built homes has become so advanced by world standards, that Canadian homes have an excellent international reputation. The MHAC point out that many of the features required to meet the U.S. Environmental Protection Association's Energy Star for homes program are standard in Canadian factory-built homes, and as a result Canadian exporters have had a natural advantage in marketing product to consumers in the U.S. interested in homes that qualify for this program.

8.5.3 Factory-Built Housing and the Kyoto Protocol

In December 2002 Canada ratified the Kyoto Protocol on Climate Change. Canada's commitment to the Kyoto Protocol requires that over the 2008 to 2012 time period Canada reduce its greenhouse gas emissions (CO₂, CH₄, N₂O) to 6 percent below its actual emissions in 1990. Based on estimates of what emissions would be in the absence of action, this will require that emissions be reduced by roughly 45 percent. Although there is a certain amount of flexibility in how Canada meets this target, for example through the use of emissions trading and carbon sinks, the main way will be through the reduction of traditional sources of greenhouse gases

According to the Office of Energy Efficiency, housing is responsible for some 17 percent of secondary energy use in Canada and 16 per cent of greenhouse gas emissions. The majority of energy use in the residential sector (80 percent) is used for space and water heating, making developing houses that are better at keep out the cold and keeping in the warmth an important step in meeting Canada's Kyoto commitments.

The Government of Canada released the Climate Change Plan for Canada in November, 2002. The Plan provides a clear framework for the way forward while allowing for continuous adjustment based on progress. With respect to housing the Plan sets forth objectives to: provide energy efficiency retrofits to at least 20 percent of the housing stock by 2010, and to produce all new homes to R-2000 or equivalent standard by 2010 and

all new commercial/institutional buildings to a minimum of 25 percent above the Model National Energy Code by 2010.

Clearly, the Government of Canada has a long way to go to achieve these targets. R-2000 standards were introduced in the 1970s, but the additional costs involved with adherence to these standards have limited their adoption to custom homebuilding. In recent years less than 1 percent of annual single-family housing starts have been R-2000 compliant.

Since the most economical way of making energy efficient improvements in housing is during home construction, the factory-built housing sector should become increasingly important in meeting these goals.

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