The Application of Open Building Method as a Financial Strategy in Townhome Developments

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In 2010, the housing industry faces another challenging year, as builders are dealing with a buyer's market--high inventory, low consumer confidence in real estate and a national credit crisis. Some strategies identified by builders to survive this volatile market include reducing inventory by leasing or eliminating spec homes, and reducing overhead costs. Thus, developers are faced with two interrelated challenges: improving cash flow and reducing inventory turnover time. The Open Building (OB) construction method could be an alternative to address these challenges by allowing developers to balance efficient production processes with higher levels of choice while minimizing their investment risk. This paper compares OB and traditional construction methods as a financial strategy on a townhome development, by evaluating estimated cost, projected schedule and financials. It is found that the OB approach reduces the net working capital throughout the project period, and a break-even point could be reached earlier than when using the traditional method. The benefits of adopting the OB method in a townhome construction are threefold: lower pre-sold unit requirements, lower financing costs, and lower development time.

Key Words: Open Building, Cash flow, Net Working Capital, Infill, Shell

Introduction

Multi-unit housing is growing as one favorable accommodation in addition to detached housing systems in the United States (Kendall, 1999). A typical development of townhomes requires a fairly large amount of net working capital, and because of this, traditional construction methods require that certain numbers of each building's units to be presold before construction of the entire building begins. Historically the funding requirements for the non-sold units are fairly high since the units are completely built out and then sold when the right customer walks in. But until the units are sold, the developer must carry the interim. In the current market situations of high inventory, low consumer confidence in real estate and a national credit crisis, developers are faced with two overriding needs: improved cash flow management and a reduced inventory turnover time. Traditional construction methods are no longer fit to overcome these challenges. Competitive construction techniques, such as Open Building (OB) are required. OB is an innovative construction strategy that divides the house and the construction process into two levels: shell and infill (Habraken, 1976; Kendall, 2004). The shell consists of the long-term infrastructure specific to the site including the foundations, building structure and envelope, stairs, and major mechanical, electrical and plumbing systems. The infill consists of shorter-term elements needed to make the shell habitable. The shell and infill can be designed and constructed/fabricated at different times, without disturbing each other.

The application of the OB construction method is believed to give such a competitive edge to townhome developers, as it has successfully been implemented in several parts of the world (Kendal, 1999). In addition to addressing many of the design, construction and environmental problems inherent to the traditional townhome construction practices, the OB methodology can be used in townhome development to address significant financial and business hurdles. The most important business benefits drawn from this construction technique are the minimization of the net working capital required throughout the project duration and the reduction in the pre-sold unit requirements. These merits arise from the core concept in the OB construction method, which separates the construction process into a shell and infill parts. As a result, the shell and the infill can be built, and hence financed, one after the other postponing the interior finishing of the unsold units. This paper briefly describes the overall concept of OB and its advantage as a financial strategy for townhome construction to overcome current economic problems. A model of a townhome development was used as a case study to showcase the planning phase using both types of approaches: OB and traditional construction methods. The approach of scenario-based planning was used to compare both construction methods, contrasting the estimated cost, projected schedule and financials. The long term goal of this study is to assess and measure the financial impact of OB approaches versus traditional approaches to homebuilding.

Overview of Open Building

OB is an innovative, postponement-like construction strategy that intersects product design, supply chain design and production process design (Habraken, 1976; Kendall, 2004). The benefits of OB extend beyond postponement; enabling developers to offer their homebuyers a variety of product choice, such as a variety of floor plans, features etc. more efficiently, while minimizing their risk. OB construction strategy simultaneously enables efficient work processes and a variety of products in housing (Kendall & Teicher, 2000). While optimizing efficiency of labor and process through a systematic production and assembly, this construction strategy also allows for initial customization and future changes. In the financial perspective, a benefit of OB is that the interior expenses for the shells are not incurred until after the homebuyer has entered into a purchase agreement, resulting in lower financing costs. This method also helps to secure sales because it reduces the delay time between the signing of the purchase agreement and the start of construction.

In the past 30 years, a large number of housing developments have been implemented in the Netherlands, France, Switzerland, Finland, Japan and China using the OB construction principles (Kendall, 1999). This trend is expanding as more similar projects are undertaken annually in many parts of the world including the U.S. and Canada (Kendall, 2004).

The basic principles of OB have been described by Habraken (2009) as follows:

- *The idea of distinct levels of intervention in the built environment, such as those represented by 'support' and 'infill', or by urban design and architecture.*
- *The idea that users / inhabitants may make design decisions as well.*
- *The idea that, more generally, designing is a process with multiple participants also including different kinds of professionals.*
- *The idea that the interface between technical systems allows the replacement of one system with another performing the same function. (As with different fit-out systems applied in a same base building.)*
- *The idea that built environment is in constant transformation and change must be recognized and understood.*
- *The idea that built environment is the product of an ongoing, never ending, design process in which environment transforms part by part.*

OB is a designing and building method that clearly divides a building into two distinct parts and levels of decision making: the shell and the infill or fit out. This division allows decisions by different parties, such as the preference of the dweller in the infill construction, to maximize the service of the building. The shell is the part that comprises the main frame of a building and its external elements including structural and architectural aspects of a building designed and built to meet the natural, traditional and legal conditions of the construction location. Parts of the shell such as the supporting frame, external walls and major electro-mechanical installations are expected to last throughout the lifetime of the building. The infill, also known as the “fit-out”, is the internal part put up to effectively use the space enclosed by the shell. This is the “everything behind my front door” segment of the building (Kendall, 2004). Partition walls that form rooms of different purposes and sizes constitute an important portion of the infill elements. Different internal components of the building needed for the specific life style and living standards of the dwellers of each unit are part of the infill.

Merits of Open Building

The concept of separating the whole building process into a shell and infill components offers a wide array of opportunities for the housing industry. OB allows for a better disentanglement of the complicated housing systems, while enabling successful initial customization and future adaptation of the housing for arising needs and changing demands. Flexibility and adaptability of infill systems have significant environmental implications. In addition, the OB approach brings a new business concept that could minimize the net working capital requirements of a project, which is the focus of this paper. Cash is known to be the most important resource of a construction project. More construction companies fail due to lack of liquidity for supporting their daily activities than because of inefficient management of other resources (Park et al., 2005). The ability of projects to have sufficient agility with their liquidity to finance their activities and improved cash flow management are some benefits realized from the use of OB principles during the construction period.

The flexibility of OB has a noteworthy benefit to the economy at large, beyond the design and construction period of a project. Remodeling is one of the costliest activities in construction. According to the U.S. Department of Commerce, the expense of remodeling and repair equals or exceeds the total cost of annual new construction in the industry (Bensonwood Homes, 2009). Adaptation of buildings constructed with traditional construction methods entails a tremendous amount of demolition and rework incurring huge expense to the macro economy and the sustainability of the environment. Construction, reconstruction and partial demolition of parts usually happens several times during lifespan of a building as part of the conversion or renovation process. An example of such renovation is tenant improvement applications in which landlords try to meet the housing demands of their demands. This consumes energy for the manufacturing and transportation (Jia, 2004). OB is an approach that can help to minimize such impacts through the reusability of the infill system and ease of adaptability for future uses.

The separate production and supply of infill systems to the construction site based on the choice of the customer give rise to different supply chain systems. Customization, while it gives more freedom of choice to the customer, is resource intensive (Barlow et al., 2003). Therefore, it implies more cost to the client. The five by five matrix of Figure 1 shows that there is a tradeoff between degrees of customization, associated cost, and lead time. The examples given for each category of customization, except the first one, are Japanese housing suppliers applying different types of supply chain management.

In practice, there are also some potential risks associated with the OB construction approach that must be further evaluated. Under the OB scenario some units will be completed and occupied and the remaining units need to be finished with minimal disturbance to the neighboring residents. Some of the potential risks:

1) *The affect construction will have on neighboring units:* to overcome this, the developer has to establish strict rules on working hours for contractors and subcontractor during the week and limit the availability of weekend work. In addition, all the walls connected to occupy units should be sound proofed.
2) *Keeping the trades steady with work*: The OB approach will prevent developers from losing potential homebuyers, resulting in increased sales. This is believed to create a continuous flow of work so as to keep subcontractors for different trades active. Even though the work of different trades might be required at different buildings in different points in time; the work load will be enough to keep them busy.
3) *Price increase in materials versus the time it will take to sell the shell:* if a shell is not sold immediately, there is a possibility that material prices may change. In this event, the developers will have to adjust their selling prices accordingly.

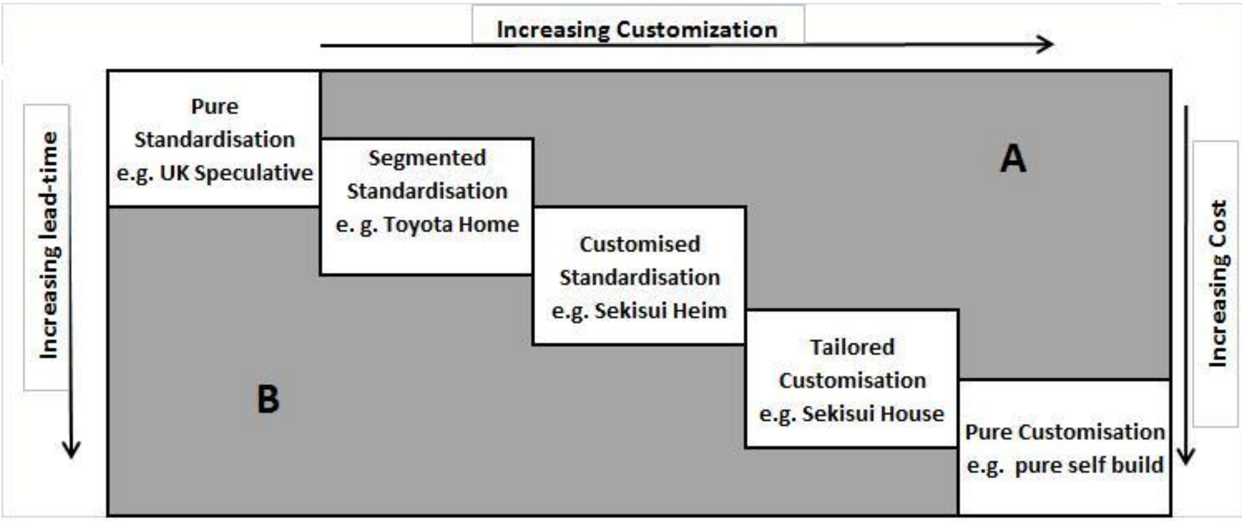

Figure1: Supply chain strategy identification matrix (Barlow et al., 2003)

Simulation of a Townhome Development

This simulation compares the financial performance of a townhome development project using OB and traditional construction methods. As part of the project planning, drawings and specifications were used to estimate cost, project schedule and financials. The purpose of this comparison was to showcase OB as a financial strategy for a successful townhome development. The project consisted of 152 units grouped into 3, 4, 5 and 6 unit complexes. The floor areas of individual units ranged from 1261 to 1800 square feet. To maximize the variety of choices, the development included 12 different floor plans. The construction was planned as a two-phase process. The first phase of the development included 11 five-plexes, 7 four-plexes, and 2 three-plexes for a total of 89 units. The second phase of the construction was planned to include 3 six-plexes, 5 five-plexes, 2 four-plexes, and 4 three-plexes for a total of 63 units.

Methodology

For the same townhouse development, two project proposals were prepared: one using OB and the other using traditional construction methods. The project proposals included: 1) Cost estimation, 2) Scheduling and 3) Financials. The RS Means 2009 Residential Detailed Costs Guide was used to estimate the construction cost, the unit prices of work items and sizes of crews required for each work type. Depending on this quantity of work and with some relevant assumptions about land acquisition and other factors pertinent to the site, the master schedule was prepared. Total duration for land development included in Phase I was estimated to be 192 days, while Phase II was determined to be 97 days. The durations for each type of building were determined (Figure 2). The financial projections included forecast of unit sales and pricing of each unit. Some of the factors considered to forecast the possible annual sales of units included: market analysis of the locality, the sales potential and history of the company with regard to townhomes developments and review of projections of economic advisors on this segment of the industry. Current and historical data were important for the computations. Based on such considerations, three possible sales scenarios were presumed: *high*, *target* and *low* sales projections which corresponded to 54, 43 and 28 units sold per year, respectively. For a more accurate profit analysis, the three possible sale outcomes were taken into account.

The comparison criterion of the two types of construction methods was based on the need to reduce the required pre-sold number of units to commence construction and minimize the net working capital. The most common practice in a townhome development is to secure a reasonable number of purchase contracts before the builder can start the construction. The commonly observed pre-sell proportion is 60-70% of the building. The OB option avoids this precondition. Instead, construction is initiated with fewer pre-sold units. This enables the customers to move into their new homes around a week earlier than the traditional approach (Figure 2).

Results

1. Cost Estimates and Scheduling

The total cost of development, as determined using the latest RSMeans unit price estimation method over the entire project period, was found to be the same for both methods of construction. The significance lies in the postponement of the interim costs in the OB scenario.

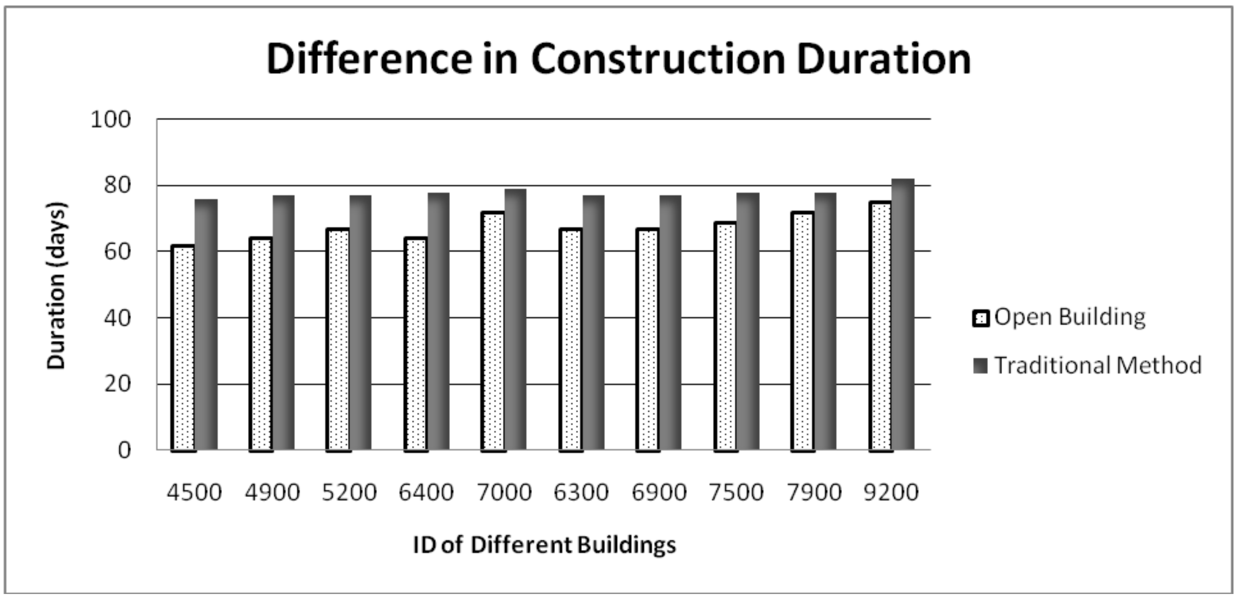

Figure 2: Construction duration of different floor plans using OB vs. the traditional construction method.

In the traditional construction method, the requirement for pre-selling of units imposed drawbacks that affected customer satisfaction negatively and challenged business success. The negative consequence of such a practice can be explained in two steps. First, customers who sign agreements to buy units had to usually wait anywhere between two to eight months before the builder could start the construction of their future home. Second, the builder was losing customers as they backed out of agreements due to the long waiting time. The following chart summarizes the comparison of construction duration for different buildings using the OB and Traditional Methods of Construction.

2. Financials: Analyses of Cash Flow, Break -Even and Return of Investment

Figure 3 shows the expected cash flow of the project taking into account both scenarios—OB and the traditional construction method. The cash flow of a 6-unit building is examined and shown below for illustration. All the other buildings, with different numbers of units, were also examined and followed similar trends in producing positive cash flow, though the differences in amount were evident due to the disparate arrangements of the 12 available layouts.

As shown on Figure 3, the traditional method scenario realizes positive cash flow only after five of the six units are sold, while the OB method realizes positive cash flow when the fourth unit is sold. It is also shown that the traditional method starts construction with the sale of at least two units, which is one of its typical trends. This showcases the central concept of minimization of the net liquidity required during the construciton phase. Up until the building is completely built out, the cost incurred in the OB method is always less than that of the traditional method. As a result of postponing the infill construction, lower net working capital is maintained throughout the project. Closer examination of the cost and revenue at different stages of the project clearly demonstrates that positive cash flow can actually be realized at an earlier time than in the usual method of construction. Comparison of the sales and costs of the different unit complexes in both types of construction approaches explicitly reveals that OB helps the investors to see a faster return of investment while keeping the net working capital lower during the process. It is also evident that the need for pre-selling units can be overridden, which in return enables the construction to start earlier by avoiding the usual waiting time and increasing the satisfaction of customers.

To explore the cash flow difference between the traditional method and the OB method, a time can be assumed when each of the 33 buildings of the project starts to produce positive cash flow. This assumption would mean that all the units have to be built and sold at fairly similar paces. This situation is not likely, especially for this project as it was carried out in two phases, but the probability of implementing a similar project in a single phase is highly likely. Therefore, such an assumption can give a glimpse of the financial comparison for the whole project. Consequently, referring to Figure 3 and similar records of each building type and examining the points where each building begins to realize positive cash flow, the difference in cash between the two methods can be calculated and the result can be multiplied by the number of each type of buildings to find the total amount for the project. In this two-phased project, there are 3, 16, 8 and 6 buildings for each of those with 6-, 5-, 4- and 3-unit types, respectively. As a result, the total amount of money the OB method renders available to the investor at the assumed time of confluence is $2,637,867.00 more than the traditional method. It should be clear that this amount is not a difference in revenue but in the required liquidity at some crucial points in the project time. This is about 10% of the overall revenue expected from the whole project, which witnesses the clear advantage of OB in the business.

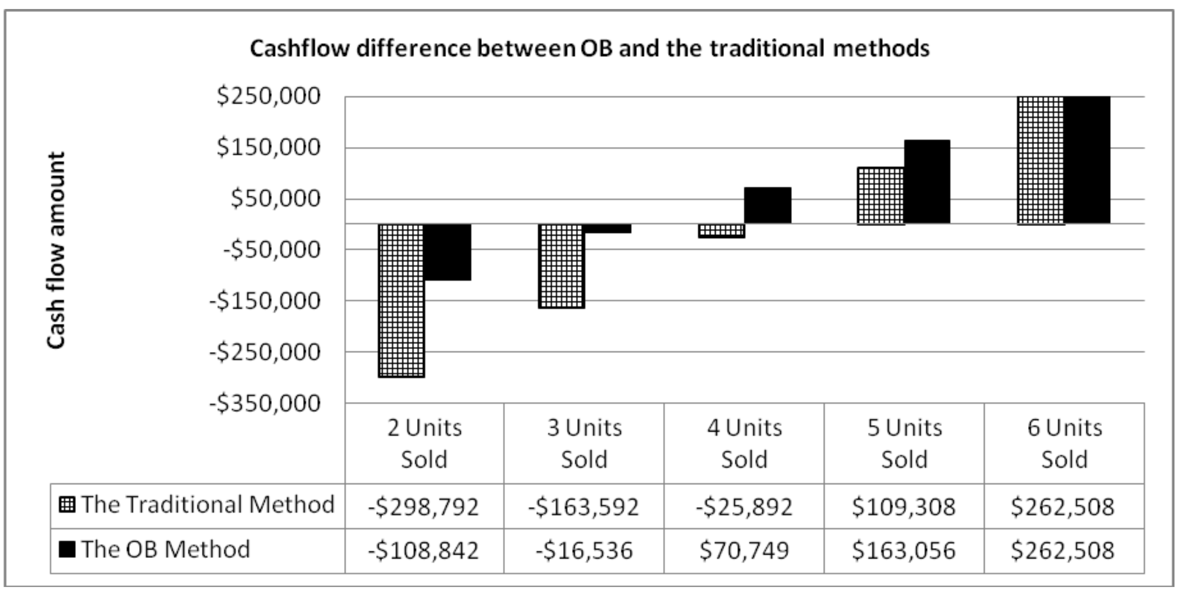

Figure 3: Cash Flow of a 6-Unit Building- OB versus Traditional Method.

The OB approach minimizes financing requirements by postponing the costs of some, if not all, units. This minimal upfront investment implies an early achievement of break-even in the cash flow of the project. As the chart on Figure 3 shows, the OB method attains the break-even level, while the traditional method is still in the negative cash flow level. The return of investment and net present value of the project for three projected sales scenarios are summarized below (Table 1).

Table 1

Return of investment and net present values for the different scenarios considered

Scenario	Net Present Value	ROI
Target (43 units/yr)	$1,286,272	11.47%
High (54 units/yr)	$1,510,470	12.93%
Low (28 Units/yr)	$415,982	7.56%

The Net Present Value (NPV) of the project was computed by discounting at a rate of 8%, and the final results in all the three scenarios showed a positive return. This helped to reach a decision about the feasibility of the project.

Discussion

Results from the comparative analysis demonstrate the potential of the OB construction approach to resolve financial constraints and increase customer satisfaction. This scheme can be effective in remedying one of the inherent and significant downsides of townhome developments--the need for a large net working capital. In the townhomes project considered in the simulation, a permanent reduction in the net working capital of about 10% of the total project cost was achieved throughout the construction period. The construction period of each building was also reduced by around 13% in the OB approach, by eliminating the need for customers to idly wait for the construction to start after signing purchase agreement. The benefits of adopting the OB construction method in a townhome development are threefold: lower pre-sold unit requirements, lower financing costs, and lower development time.

1) *Lower pre-sold requirement*: The OB method postpones the interior finishing of some units. This enables early start of construction of the shell and the few initially sold units. This approach effectively eliminates the waiting time between contract signing and commencement of construction. Consequently, less walk-away customers.
2) *Lower financing costs:* The OB method significantly reduces the net working capital as the developer does not have to incur the cost of finishing the interior of a unit until the unit is sold. In other words, it virtually eliminates inventory of completed units and its carrying costs.
3) *Reduced development time:* Two facts should be noted as far as the development time is concerned. First, in the OB method the unit will be habitable earlier than the traditional method since the latter usually waits for a significant number of units to be presold before starting construction. Second, even after commencement of construction, the OB method will take shorter time to be habitable due to reduction in work volume since the units to be included in the shell construction are fewer.

Conclusion

The OB construction method is presented in this paper as a better alternative to address common financial challenges faced by townhome developers. The advantages of the OB method are realized by dividing the construction process into two clear levels of decision making, which enables sequential financing of each segment and hence, improves cash flow and inventory turnover of the units. The results from the simulation illustrates that OB can lead to a more competitive business practice by addressing some of the pressing financial and customer related challenges in today's market. However, more studies should be conducted to evaluate and deal with the potential practicality issues of applying the OB method. Future studies focusing on the science of the infill systems as well as the possibilities of effectively combining the OB method with the traditional construction approach, are expected to maximize the benefits of the OB construction method.

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