

# ANALYSING THE ACCEPTANCE OF CUSTOMIZABLE ATTRIBUTES: A CASE STUDY OF A CONSTRUCTION COMPANY IN FORTALEZA, BRAZIL

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## ABSTRACT

Multifamily residential come in standard designs, even though each house buyer has their own social household's structure and lifestyle. Through users' demands, the housing industry is evolving to meet their changes, allowing them to modify specific items on the floor plans during planning phase. The main goal of this research is to investigate the personalization preferences in flexible housing, analysing the acceptance of the standard architectural project proposed by the contractor. This paper analyses a construction company from Fortaleza, Brazil, which builds high-rise residential buildings and offers the buyer the possibility to personalize its unit. The company's customization process is based on Lean Construction principles such as reducing rework, maintaining the continuous flow within construction sites and adding value to its clients, reducing the changes of layout during and after construction. The personalization is either mass customization or a custom-made plan, which is not designed by the contractor and needs previous approval. The research is quantitative and lists customizable accommodations to investigate the extent of acceptance or rejection of each attribute for two residential projects. There were 14 attributes analysed. Eight of them were classified as well accepted (over 80% of acceptance). Nevertheless, four were considered adaptable (within 40 and 79% of acceptance) and only two were not acceptable (less than 40% of acceptance).

## KEYWORDS

Process, variability, customization, residential projects, program of needs.

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## **INTRODUCTION**

Within the past 2 decades, the flexibility of real estate units still in the plan phase, for either finishes or spatial arrangement of enclosing constructions, the customization of projects went from a trend to a demand, making differential and competitive factor from the time of purchase and sale of the property.

"Although housing is part of a specific industry within its own production system, the global transformations influence the evolution of a residential product similarly to products from other sectors. The customization and the widest range of products offered end up being a trend that also hit the real estate industry. (BRANDÃO and HEINECK, 2007, translated by the authors)

Thus, this paper proposes to investigate customization of vertical housing units in a mid-sized construction company from Fortaleza, Brazil. The investigation is limited to quantifying the acceptances, exclusions and inclusions of modifiable attributes within the original plan.

Is there a need to customize one's housing unit, given the variety of residents' profiles in a single residential tower, or is there a particular desire of the client to be different from the others, even though the standard plan meets one's needs? The will to have both questions answered stimulates research, because the construction company of this case study claims the process of customizing an apartment to be complex, mostly considering the impacts on its planning and construction processes.

The relevance of this research may be also justified by some articles that have already been published analysing the process of customizing developed by this construction company (such as Kemmer, 2010 and Rocha, 2013), but none of them addresses the investigations of layouts chosen between by each customer. Those studies focus in detailing the process, evaluating the costs and its implications, listing any difficulties or business developments and confronting the customization as a marketing strategy and the company's management philosophy (lean construction). Thus, among the universe of the company's projects, it has been chosen for this research those projects that had considerable level of requests for design changes.

## **LITERATURE REVIEW**

Custom in general definition is to meet or exceed customer expectations by enabling the injection of subjective and personal characteristics to a service or product (Santana, Oliveira and Meira, 2007). Within the Architecture-Engineering-Construction (AEC) industry, specifically at the construction companies, one of the customization tools is providing to the customer flexibility still in the design phase.

According to Farias (2013), the need for architectural flexibility has established itself as the society has become more tolerant to practices such as divorce, homosexual marriage, home offices, and late marriage. The customization is not a result from society, but from the individual human being, that has the tendency to want to differentiate itself from the other.

Oliveira (2012) defines flexibility as the free option to redo the internal arrangement of a fixed periphery. Before him, Brandão and Heineck (1998) listed different types of

architectural flexibility, from which two stand out: 1) the offering of different plan options to be chosen from. This configures a customization, since the choice is very subjective and is made by the client himself, even though he was not the author of the plan options. 2) Providing the client with a basic plan along with the permission to change the internal spatial configuration (including the finishes), without infringing the construction rules.

Brandão and Heineck (1998) also say that the choice of the type of flexibility to be offered for housing customization is linked to the amount of private units of the project, and the gross area of each unit. Usually, projects with more units and smaller areas tend to offer Option 1, as those with larger areas and less units allow the application of Option 2.

Regardless of the customization pattern offered by a construction company, it will always be a marketing strategy, which can generate, in addition to customer satisfaction, an advertising channel and increasing of future sales by recommendation (Oliveira, 2007).

Regarding lean construction, the customization is related directly to the process of value generation. It considers the individual's perceptions referring to the satisfaction of its individual desires (Piller, 2003). With the same intensity that customization directs the sales, if it is not well planned, it can compromise quality, cost and deadline for delivering the product. The success of the process involves skilled labour, rigorous constructive control, and company standards and general rules.

## **RESEARCH METHOD**

The research is quantitative, and it was developed with the tabulation of data generated after studies of different plan's layouts. All database was provided by the construction company. This study's universe corresponds to 50% of the customized units at a partial or full level (each tower) from two residential projects which must meet the criteria listed below:

- Have similarity in the private area of the standard unit, thus the program of needs is similar;
- Be located within the same region and have the same market focus (Upper Class and Upper-Middle Class), to ensure common interests;
- Have been designed by different architects, so that different parties may be analysed concerning a similar program of needs;
- Have been recently built, to ensure non-obsolete findings;
- Have finished the customization process, to allow a complete analysis.

Two residential projects have met these requirements, and were named Building A and Building B here.

## **CASE STUDY DESCRIPTION**

The buildings chosen for the case study have 8% difference between their private floor area, a similar number of units per floor and per tower, different architects and are recent enough to have their results applied to other projects. Table 1 brings both buildings features and characteristics.

Table 1. Building A and B features and characteristics

Criteria	Building A	Building B
Number of buildings	1	2
Apartments per building	42	44
Apartments' floor area	206m <sup>2</sup>	226m <sup>2</sup>
Architect	A	B
Focus	Upper Class	Upper Class
Month / Year of completion	May/2014	December/2014
Month / Year of conclusion of customizations	May/2013	December/2013
Percentage of simple customizations	5%	16%
Percentage of partial and full customization	50%	26%

In addition, Buildings A and B are located in adjacent neighborhoods, Meireles and Aldeota (respectively), both wealthy neighborhoods. The map on Figure 2 illustrates the location of both buildings, the distance between them is about 2km, and Table 2 shows the plans of the standard units of both buildings and the architectural program of each unit.



Figure 2. Map of Fortaleza (left) and Aerial photo of neighbourhoods Meireles and Aldeota (right).

Table 2. Standard units' plans

Building A	Building B
Plans	
<p><b>L-shaped Living room with restroom</b></p> <p><b>3 suites (master suite with bathtub)</b></p> <p><b>Home office and Linen Closet</b></p> <p><b>Gourmet balcony (barbecue area + countertop)</b></p> <p><b>L-shaped Kitchen</b></p> <p><b>Service area</b></p> <p><b>Maid's room</b></p>	<p><b>L-shaped Living room and restroom</b></p> <p><b>3 suites (master suite with closet and bathtub)</b></p> <p><b>Home office and Linen Closet</b></p> <p><b>Gourmet balcony (barbecue area + countertop)</b></p> <p><b>Kitchen and pantry</b></p> <p><b>Service area</b></p> <p><b>Maid's room</b></p>

## THE CONSTRUCTION COMPANY

Founded in 1977 in Fortaleza, Brazil, the construction company of this case study focuses specifically on Upper Class and Upper-Middle Class. It has built more than 700.000m<sup>2</sup>, distributed in several residential projects.

Since 2004, the company has been using many lean tools and practices such as *kanbans*, *andon*, *poka-yokes*, supermarket concepts in the warehouses, transparency tools, production in small batches, new solutions formatted as A3 tool, standardized work and many others.

## THE COMPANY'S CUSTOMIZATION PROCESS

At the construction company there is a technical team exclusively dedicated to manage the customization process, which is responsible for registering the customer's decisions and analyse the customer's needs, as for finding project limitations and constructive constraints.

The process begins before the completion of the structure of the building's first floor, when a book that gathers information about the customization options and all technical

information related to the apartment's project is sent to each customer. This book contains: a) a cover letter that limits the project's modifications and its finishes, and sets the deadlines for customers' choices to be made; b) the project set (plans and elevations) of the standard unit and its facilities systems (structural, electrical, hydraulic, and air conditioning); c) the memorial of material with the finishes previously specified and several illustrative images. At this stage, it is also placed on the construction site a showroom with all the finishing materials specified for the standard unit that helps to keep transparency of the process and to accelerate the customers' decision-making (Kemmer et al., 2010).

Through this material, the customer may choose between two different paths. The first is to select one of the layouts pre-configured by the construction company for the standard unit. The second path is the option to customize the interior layout according to his need (Figure 1).

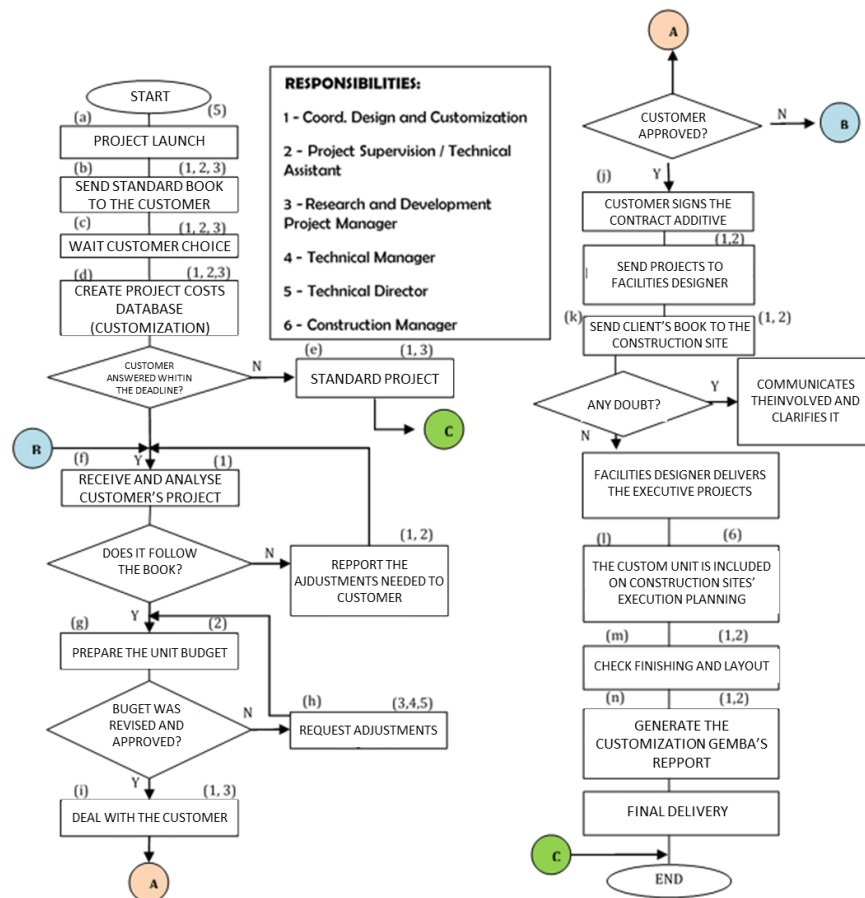


Figure 1. Company's Flowchart for Customer Customization.

By choosing the first path, the choice does not generate extra costs and the customer is entitled to choose one of the floor finish options within the default settings. By choosing the second path, the customer has to hire his own architect and other designers to prepare the set of projects containing the modifications requested. Once the customer has all projects (architectural, electrical, hydraulic, etc.) he must send it to the construction

company within a deadline to be revised and executed, according to the standard previously determined.

The second option involves additional cost to the customer, the customization process is longer and more complex, as it can be seen in Figure 1. The customer choices must be evaluated concerning technical constraints and they affect the construction directly.

The construction company ranks the free customization (with few constraints) into three types: simple, partial or total. The simple customization, the modification involves layout or finishing specifications without changing the installations systems. The partial customization reaches changes in the layout and materials' specifications, but still does not change its facilities. When the intervention reaches three attributes: layout, finishes and building installations, it is classified as total customization.

## RESULTS

Given the tabulated data from the customers' requests, this research aimed to identify the rooms that were added, deleted and maintained in the standard plan offered by the construction company for each project.

### ACCEPTANCES

The rooms (or spatial arrangements) most frequently maintained by customers were: Maid's Room (100%), Closet (100%), Service Area (100%), Bathroom (100%), Gourmet Balcony (barbecue area) (95%), Kitchen (80%), Guest Bathroom (80%) and Linen Closet (80%).

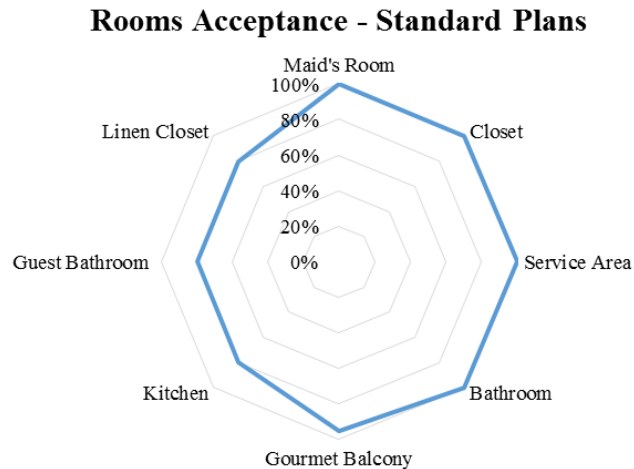


Figure 3. Percentage of acceptances of each room

The Maid's Room is a suite accessible for the housekeepers through the Service Area. Although currently the majority of Brazilian families hire a daily cleaner (employee who does not sleep in t), the result of this research indicated that the Upper Class still hires housekeepers and prefers to provide them with an individual room.

Regarding the Closet, the study showed that in all suites the residents usually have a space reserved for wardrobes. This space is usually near the bathroom door and is always wider in the Master Suite.



Within the analysed plans, 100% of the customers did not change the spatial arrangement of the Service Area, a room with functional linear sequence of laundry features (tank, scrubber and washing machine). The same occurred with the Bathroom, where the spatial usual sequence (countertop, toilet and shower) was maintained. The Master Suite's Bathroom and the Guest Bathroom were not accounted for this percentage.

The standard plan for both projects A and B brings the differentiate in a barbecue area in the balcony, the Gourmet Balcony. This spatial arrangement had 95% acceptance.

The spatial arrangement of the Kitchen was accepted by 80% of the customers. The standard plan offers a square-shaped kitchen, with stove, countertop and refrigerator arranged as a triangle, facilitating movement. Those who modified the kitchen did it tending to the functional arrangement where there is an island for the stove (20%).

The analysis of acceptance of the Guest Restroom brings the company the opportunity to verify its real need, as it was on the standard plan of Building A, but not in Building B. The results showed that it is a room required by Upper Class, as it was accepted in 80% of cases in Building A and was included in 70% of the projects in Building B.

Finally, the Linen Closet was maintained at 80% of the cases, but not necessarily as or the same size offered by the builder. Its location is in 100% of cases a dead space between two walls or pillars in the corridor of the apartment suites.

## **MODIFICATIONS, EXCLUSIONS AND ADDITIONS**

Regarding the Living Room, the default L-shaped format was accepted by 70% of the clients. The other 30% included the expansion of this space, making it rectangular or square-shaped by removing one suite.

The research has shown that the amount of Suites (03) established by the standard plan was maintained at 45% of the cases, 20% of the layouts have reduced this number and 35% have increased it. This was the room that had more balanced results between maintained and modified (45% x 55%).

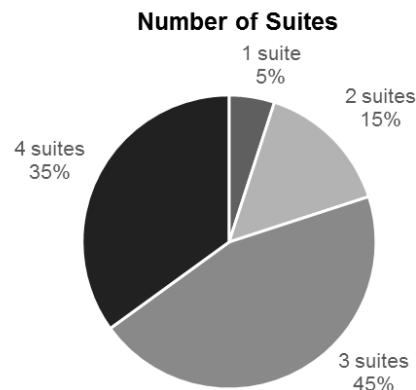


Figure 4. Number of Suites in the sample

Regarding the Pantry, the results were biased. Pantry is a room that guards groceries and / or other kitchen utensils. As the Building A's standard plan had no pantry, no changes on the kitchen's layout in this regard were observed. In the case of Building B, whose standard plant included the pantry, 70% of customers chose to keep it. This suggests that the pantry



is necessary for the Upper Class customer, but when it is not offered in the standard plan, the resident solves his need with loose furniture or custom-made cabinets.

The survey found that both Home Office and Reversible Bathroom have lower acceptance, both were maintained only in 30% of the analyzed plans. Also in relation to exclusions, the bathtub was removed in 45% of the Master Suites analyzed. This last room had its other functions (toilet, shower and countertop with 02 sinks) maintained 100%.

Finally, it was observed that about 5% of costumers added an Intimate Living Room on the final layout of apartment.

## CONCLUSIONS

The investigation made on layout's customizations in the projects of this construction company, showed that the standard plans offered by the builder are within the standards demanded by the market. However, being an architectural design research, up to the first drive usage year, on furniture phase, evaluates the satisfaction of the resident with the default layout.

In this research, the comparison of data has taken into account that room or spatial arrangements well accepted are those which had percentage of 80% or greater. Those that had percentage equal or lower than 40% were determined as not acceptable. Customizable attributes that had their maintenance in the range of 41% to 79% were considered as adaptable. Figure 5 summarizes the following results.

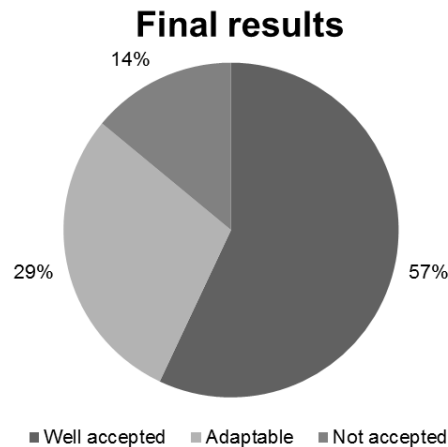


Figure 5. Summary of Results

Of the 14 attributes analysed, eight were classified as well accepted, four as adaptable and two were classified as not accepted. Almost 60% of the attributes were well accepted by customers and less than 15% were not well received. Thus, this article is an input to the developing the program of needs of plans for apartments of residential buildings that are similar to the studied profile, considering the following suggestions:

No longer include the Home Office and Reversible Bathrooms on standard layout;

Place the bathtub offered to master suite's bathroom as a customization option and not by default;

Allocate the Living Room, Suites and Pantry in a nuclear position on the plan, without any connection with structural functions, because they are rooms likely to be changed;

Keep the arrangement of Bathrooms with sink, toilet and shower;

Keep the items that had percentage of acceptance equal or greater than 80% (Service Area, Bathroom, Closet, Maid's Room, Gourmet Balcony, Square Kitchen, Restroom and Linen Closet).

Even though the construction company found assertiveness of the program of need, the customization should not be disqualified as a company's process. There are strong incidence of layout's changes by the residents, even with small flexibility in the standard program proposed. It was concluded that the customization is much more a personal desire of the owner, than a technical matter of adjusting the standard plan with outdated program of needs. Thus, although it is non-profitable and not technically necessary, customization is justified by the market character, sales and customer satisfaction.

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