

**COST DATABASE SYSTEM APPLIED TO REFURBISHMENT OF SOCIAL HOUSING IN
BRAZILIAN CONTEXT**

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ABSTRACT

In Brazil, low income people haven't a good way or help to preview the budget to their projects, especially concerning to build or refurbish their houses. Moved by this lack of opportunity, this paper describes briefly the work carried out to give to this public a system prepared in Internet basis which help them to calculate more precisely the necessary funds to implement this kind of investment.

Some questions emerge: How to communicate data to the Database System related to the planed build or related to the changes desired to be applied in a house existed? The Database System needs to keep cost data of new constructions and data of refurbished constructions since the costs are very different due to the different nature of the job? How to update costs of lots of items turning the system reliable?

These and other critical questions will be answered along this work and we hope that, starting from a small and specific problem we spread the possibilities of this system, reaching a level of having real helpful tools. Reaching this level, the material produced can turn a seed of more complete and helpful systems.

Computational technological support of the purposed system will be IFC, PHP and MySQL.

KEYWORDS

IFC, Building Cost, Building Budget, Building Modeling

1. INTRODUCTION

More accurate cost evaluation of financing houses is very important for low income homeowners, financial agents and construction supplier companies. With the most possible exact calculated cost, these actuating personalities on building construction can minimize their margins of uncertainty in gains and maximize their opportunities of success in the entire process. This means: if build and homeowner data are reliable and easily evaluated: (1) financial corporation will process data quickly and accurately, saving specialists time and effort (2) homeowner will have a better program of construction tasks, including quantity, and clear credit payment information (3) suppliers will work with safe buyers, will have assured ordering and, therefore, can offer better prices.

Homeowner and financial agent need to have a better anticipation of the amount of money which will be employed in the construction planned, the most near of real cost better. From the viewpoint of homeowner this forecast will help to prevent against the danger of evaluate above or under the amount really required to complete the planned construction. From the viewpoint of financial agent the advantage of a good forecast is to prevent against the necessity of deep adjustments in original credit which, if didn't made very carefully, can lead to homeowner defaults.

A computational system which interoperates with these three agents and helps in such matter is justified. A research effort was started and intended to understand all the technical implications and how to give support to actors interoperability. The first movement was the characterization of actors and data. The second movement was the characterization of relationship between actors and between actors and data. Once these steps were complete, we search for the technology that can map them in computational terms harmonically, and utilize this technology to implement the system.

2. ACTORS CHARACTERIZATION

Three are the major actors contemplated in the scene: Financing Corporation, Homeowner and Suppliers (material, equipments, services, etc.). Here a brief characterization of each one:

2.1 FINANCING CORPORATION

Currently in Brazil house finance market is growing (Folha Online, 2007) and becoming very accessible, with lots of banks offering money at diverse interest conditions. Despite this development, government bank persists the most advantageous way to get credit for the low income people.

The larger fraction of low income people legalized new realty corresponds to a small and inappropriate dwelling, purchased through financing programs based on workman compulsory social insurance contributions managed by the government. Every workman with regular work documentation must contribute. These programs can finance 100% of realty and can reach 30 years of loan term. It is common the homeowner desire to refurbish and expand their houses to adjust as better as possible to appropriate condition. This means search for new money offering and there are similar financing programs of government bank focusing these issues. In these programs the term of the construction must be until 12 months and the credit limit \$42300 USD.

The main steps in the process to get credit in Brazilian government bank are, in a simple manner (Caixa Econômica Federal, 2008):

- Determine the total budget to refurbish, expand or conclude the house.
- Collect all documentation about ownership, familiar income level, construction plans, city hall permissions, etc.
- Evaluation of previous data: budget and documentation.
- Emission of a Credit Approval Letter: documentation certifying conditions to get credit in the bank, valid for 15 days. It is possible that part of total amount stays out of the credit granted, and homeowner must be in charge of it.
- Evaluation of the realty by a bank engineering team.
- Setting up of the financed value and amortization term which will be contracted.
- Make the contract.

There are credit lines dedicated to other income range, to material acquisition only, and some specific ones. All of them have similar central technical characteristics, like homeowner budget evaluation and realty specialist verification are common.

2.2 HOMEOWNER

To be an applicant to get credit actually in Brazilian government bank, the homeowner must have, roughly, familiar monthly income of \$230 USD up to \$1800 USD and total value of building under

refurbishment of \$42300 USD. The loan term increases as homeowner income decreases reaching 120 months regularly or 360 months in fiduciary alienation case.

2.3 SUPPLIER

There are at least three kinds of supplier, but the most recurrent in construction case are the material stores. Service and equipment suppliers are more specific and can be described using almost the same characteristics used to describe material supplier.

Low income people in Brazil use to buy construction material in pieces, i.e., as the money comes, and reach a proportional amount, they go immediately to a local store to buy the next apparent useful consumables to their chaotic construction planning, in a very disordered and expensive way. Sometimes the material acquired is lost due to wrong storage conditions. With money from financing, the homeowner must plan the acquisition of consumables to extract most possible advantage of this money opportunity. The system may help to plan and to choose the better supplier in many aspects, including construction nearness.

The supplier contribution is to give to the system necessary data to evaluate the prices and conditions of payment. The system must permit the supplier to handle this information with confidentiality, security and precision.

3. DATA ORGANIZATION

The system will fundamentally deal with information. Data organization is the main effort in preparation of an efficient and useful system. Three are the key information sources: unit costs, building and homeowner. Pairs of them are useful for a particular actor, as shown in Figure 5. The combination of Homeowner and Build Information depicts the matter to be financed, necessary to Financing Agent. Build and Unit Cost information assembled make possible the calculation of total cost, very important to homeowner and which arrives at financing agent through him. To the Supplier, Homeowner and Unit Cost are two handled information to help gaining a new customer.

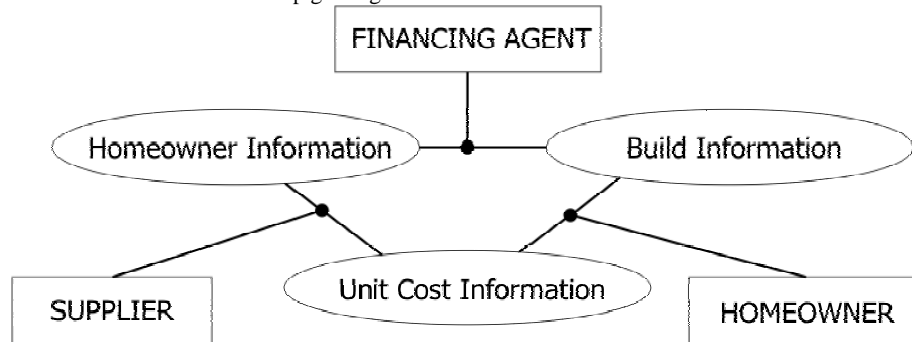


Figure 5: Information pairs useful to corresponding actors

3.1 UNIT COST INFORMATION

Supplier prices are a composition of manufacturing cost, transportations cost, government taxes, marketing cost, demand, etc. They are one component of construction cost, once associated with workforce prices and indirect costs, like new government taxes and weather adversities, the result is the construction cost. These construction costs are commonly deal as unit prices times build quantity, i. e., square meter or cubic meter can be the unit measure of material, for workforce can be one hour of work, etc. One task is composed by material, workforce and equipment application. For the calculation of unit task cost we join these three prices and an indirect cost component. This shows that unit cost is not only supplier prices, but to reach the unit cost the system must handle with supplier prices, and the right composition of material, workforce and equipment application for each kind of task.

3.2 BUILDING INFORMATION

As we are working with people without access to sophisticated ways of plan and represent the projected refurbishing, the system can give this support through a viewer and an editor of building information. This is not a simple job, but currently we have technology to develop interactive applications, running on Internet basis, linked with a very complex and complete data model managed by a robust machine and by expert people. One example of this possibility is presented in (Kehmlani, 2008).

To elect a build model for the system we search for the most adaptable model currently in use and found IFC (Howard & Bo-Christer, 2008). IFC (Industry Foundation Classes) Model is a proposition of IAI (International Alliance for Interoperability), have been endorsed by the International Standards Organization as a Publicly Available Specification (PAS) under the ISO label ISO/PAS 16739 (International Alliance for Interoperability, 2008). This model organizes information about the whole lifecycle of the building.

3.3 HOMEOWNER INFORMATION

The information about homeowner is that required by financing corporation. Supplier must require some other information, but generally with a good data form, all necessary information is captured.

4. RELATIONSHIP BETWEEN ACTORS

As financed values are smaller, interest payment are smaller also, and some taxes associated with total value. As the financed value depends on homeowner calculations of refurbishment needs, accurate in these calculations is essential and this is the central target of the system.

One financing step is engineering bank analysis. This analysis could be very easier and including unnecessary if the system had all necessary data since the early stage. If system is reliable, evaluation will be too. This reliability will be conquered by ne accuracy in calculations previously described.

Another relationship between actors causes the appearing of some questions:

a) How to communicate data to the Database System related to the planed build or related to the changes desired to be applied in a house existed?

IFC model will be the information standard way to organize and exchange building data, but the information about the build will reach your destination after handled through an editor embedded in the system's homeowner interface. The IFC model is very good but very complex too. This leads to a very good homeowner interface, simple but with complete tools to handle build information with accuracy.

In the case of refurbishment, the system needs to have information of two build models: one before and other after refurbish, to compare and extract information about what represent the changes, quantitatively and qualitatively.

b) The Database System needs to keep cost data of new constructions and data of refurbished constructions since the costs are very different due to the different nature of the job?

New construction costs have an intrinsic difficulty to obtain, but there are many companies dedicated to collect and calculate the average unit prices of a representative number of sources and sell the result as tables. Refurbish construction costs are much more difficult to obtain because they are classified information to the building companies and they do not publicize them, on the contrary these information are typically a competitive gap between companies. To surpass this wrong situation, a solution is to discover the relationship between unit prices of a new construction in unit prices of refurbished ones. This represents a big work and currently it is been made by a research group of University of São Paulo, collecting data from public and private buildings under construction. In cooperation with this group we are using the results to compose the unit cost database of refurbished buildings.

c) How to update costs of lots of items turning the system reliable?

A method to transform unit prices of new construction in prices of refurbished can be found, at least statistically, but the prices itself varies driven by market rules. To the system this represents the need of supplier (of material, services and equipments) involvement and commitment. The system can provide a way to edit, increase or delete items and prices updated periodically or at any time. The advantage to the supplier will be that they will receive directly ordering if the prices and conditions are better. The system foresees security of data access, so it guarantees loyal competitiveness between supplier companies. Not only lower prices are better, but availability, near distance of build place, conditions conceived by supplier for best customer in quantity and quality, etc. It can turn into an advantageous negotiation, prepared and calculated by the system.

5. ARCHITECTURE OF THE SYSTEM

A guide to choose the best technology to be applied in the system was that open source or freeware software has priority because we want also to show the low level investment in its implementation. In addition, popularity, good documentation, easy access and support were other criteria in that election.

IFC is an object-oriented and highly structured information building model. Building model made with IFC structure is very exchangeable and can be processed with an application capable to read the archive in IFC format.

Java is an object-oriented and Internet linked programming language. It fits very well to process IFC data. IFC viewer, editor and parser will be developed in Java.

PHP (recursive acronym of PHP: Hypertext Preprocessor) is a scripting language that is especially suited for Web development and can be embedded into HTML. PHP reveals very appropriate to make the user interface and the communication with database. It is object oriented too.

PHP works very well with MySQL database. For this reason Cost Database was mapped to MySQL and the interface with suppliers is been built to give all necessary possibilities to edit unit prices. The structure of MySQL also gives support to join information an arrangements to formulate unit costs, as presented before.

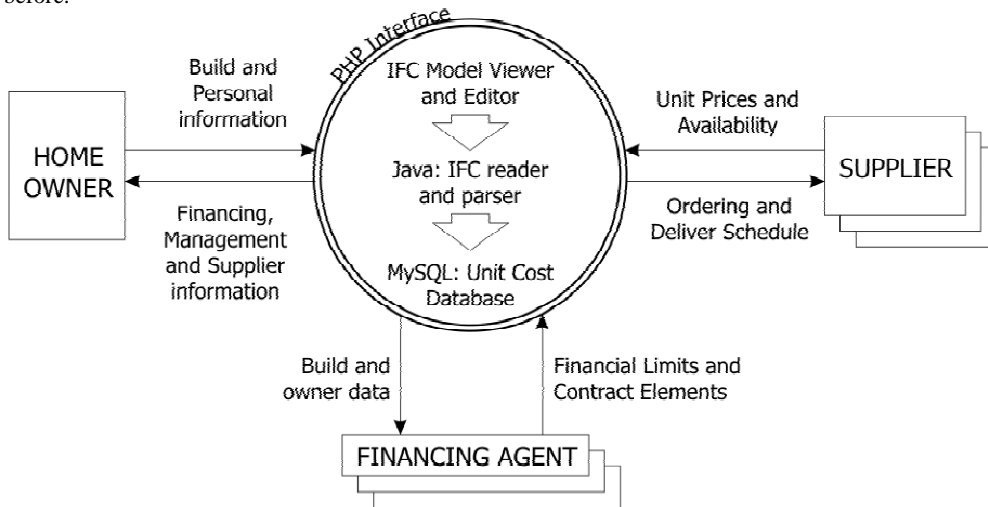
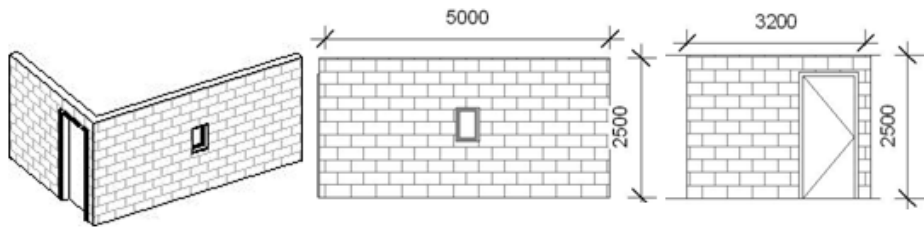


Figure 6: System architecture.

6. CONCLUSION

Until now we have experienced the use of all technological elections made and implemented some parts of the system: MySQL database of unit costs, supplier user interface and IFC parser are the most advanced ones. See the Figure 2 to visualize where each one in the system is. We have the intention to reach a prototype of the entire system to test conceptual alternatives. The complete system in a "commercial" stage must be done with further developments and for computer analysis specialists. Our work focuses in civil engineering and architecture views of the problem, mapping the problem and searching for the better solution. The next steps are concluding IFC parser and make the link with MySQL unit cost database, which seems to be the harder topic of the entire system. We believe this stage is critical and once surpassed we will reach rapidly the prototype and can experiment alternatives in final solution. We hope the continuity of this work can contribute expressively to low income people achievement of a remarkable economy of work and money. Providing a good help in refurbish their houses we think we are making a very good difference in the lives of this unfortunate people and for entire society.



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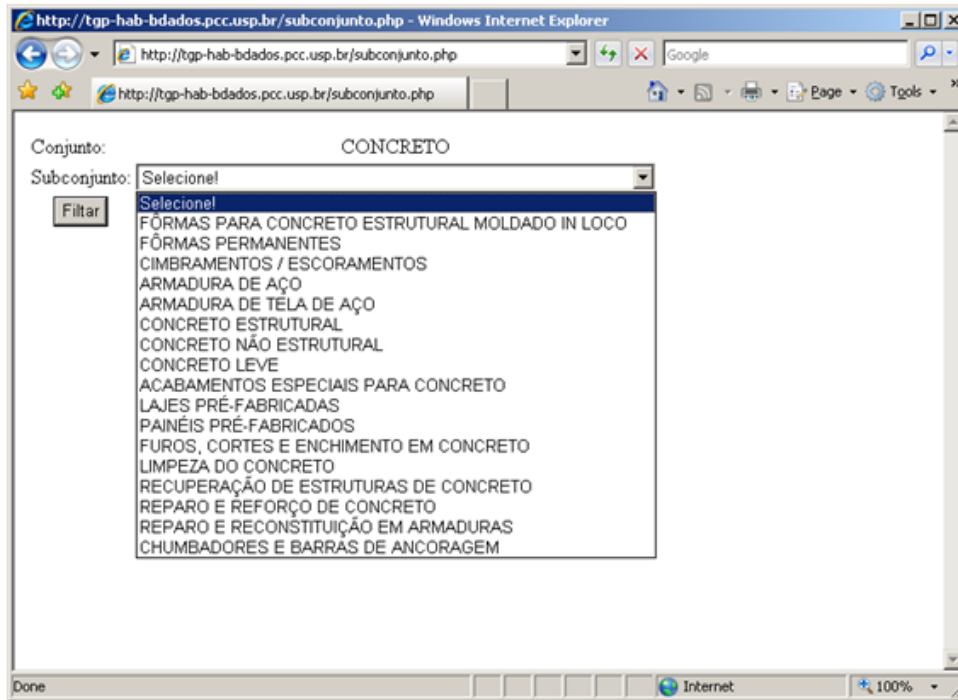


Figure 7: wall representation, IFC wall description (fragment) and supplier interface examples.

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