DEFINITION OF A METHODOLOGY FOR FOSTERING INTEGRATED COLLABORATION IN SMALL-TO-MEDIUM COMPANIES OF THE HOUSING DEVELOPMENT / CONSTRUCTION SECTOR

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Abstract
The project aims to create a methodology for managing construction projects, in a way that area, quality, information technology and legislative factors are taken into account. The methodology has been developed to facilitate both awareness and definition of the legal requirements in the area and for each company. It also aims to manage all the documents that fulfill these requirements through Microsoft Sharepoint Server Services in conjunction with Small Business Server 2003 and Terminal Server licenses, while also working along with other software such as PRESTO, CONTAPLUS and Microsoft OFFICE. As a result, the company has become better prepared to understand its role in society and the importance of INTEGRATED COLLABORATION for bringing together information that was previously dispersed within the company. In this way, it integrates different processes of a real estate enterprise, from choosing the adequate plot for its execution up to its concrete realization, including the definition of the ground plan.

Keywords: Project Management, Technology of the Information, Systems of Management, Tools of Management, Quality, Real Estate Promotion and Construction.

1. Introduction
This work aims at developing a methodology for integrating all the distinct processes involved in the construction sector. It is supposed to be a tool for helping the coordination of different professionals in each stage of the project, the management of all the knowledge produced within the company during the execution of a project and the operational and strategic communication of the guidelines and goals of each different project.

The small to medium sized company would benefit most from this methodology in the area of development and construction. Its directive body should be clearly interested in enhancing the deployment of resources in the performance of tasks, be interested in getting to know the gap between real versus planned for all the activities encompassed in the project and be interested in a type of structured information, in real time, for facilitating decision-making.

ALANTA, a small-to-medium developer and constructor in need to develop its organizational capacity through the implementation of information technology tools, has decided to invest in the creation of a methodology to guide the updating process of its managerial tools. The
managerial deficits identified by ALANTA are common to many other companies of its sector and size. Many companies which have achieved the implementation of a certified system of management, such as UNE-ISO 9001/2000 and 14001/2004 by AENOR in the case of ALANTA, still notice that they need to integrate their managerial systems. The fact that information technology might provide the tool for helping decision-making has prompted in many companies the willingness to reform their organizational structures in relation to data flow, collaboration, coordination and adaptation to an ever changing legal environment.

2. The Development / Construction Sector

The Spanish Development/Construction sector has been extensively regulated. There is, in this sense, an opportunity for keeping legislation as a guideline for designing the data flow of a company, as each company has the need to organize its internal processes in relation to the legal requirements that regulate a real estate enterprise.

Undoubtedly, the existence of a specific legislation for this sector demonstrates the importance of the real estate activity within the Spanish economy. Real estate purchase is normally an important step in the customer's life, and they, for making such a decision, usually require a great deal of warranties, state-of-art technological improvements and increasingly a self-sustainable relationship with the environment. All these factors impact upon the legislation regulating the sector and it becomes necessary for the company to adopt a strong managerial attitude as to cope with both new and old legal requirements.

Among the extensive legislation in the sector, some can illustrate what has been above said:

- Law 57/1968, regulating the anticipated amounts in construction and sale of housing units (BOE #181, July, 29th 1968).
- RD 515/1989 about the protection of consumers in relation to information access in the purchase and rent of housing.
- Ley 32/2006, October, 18th, regulates subcontracts in the Construction Sector.
- Resolution from August, 1st 2007, from the Dirección General de Trabajo, in which it is incrcribed in the record and published the IV Convenio Colectivo General del Sector de la Construcción.
- Royal Decree 105/2008, February, 1st, which regulates the production and management of debris and refuse from construction and demolition.

Among the examples, its is possible to notice that the legislation refers to the relationships of development/construction companies with its clients, workers, providers, public administration, environment and the execution of the work itself. It reinforces, therefore, all the legislation that is normally applicable to any other company in a different sector.

For better comprehending the operation of the real estate sector, with the help of the Law 38/99 – Regulation of Construction, it is possible to identify all the different agents in the construction process: the developer, the project designer, the construction site director, the execution director, institutions and labs of quality control for construction the providers and the...
customer. Through this list, it is possible to understand that the coordination of collaboration is one of the key elements for the success of construction project.

In order to develop a methodology for the implementation of an integrated collaboration platform, one has to follow the usual structures of coordination in construction projects, in accordance with market practices. Thus, it is possible to distinguish:

- Coordination centered around Optional Direction (Construction Director and Execution Director);

  In order to form the Optional Direction, the most traditional way of conducting construction projects, developers, either guided by their experience or by a preliminary viability research, hires a Project designer. This designer normally ends up as the Construction Director, normally indicating a trustful Execution Director, who jointly are the Optional Direction.

  The Optional Direction helps the Developer to formalize a construction contract with the main contractor (constructor) for effectively executing the project. The main contractor becomes responsible for the execution of the construction and for hiring all necessary subcontractors. The Optional Direction remains with the technical and economic coordination of the construction.

  Even though the Optional Direction is present in some processes in the project, even helping the developer to articulate the project and select the constructor, its participation should not be characterized by a integrated coordination, as it does not take part in all stages of the project and does not stay close to the decision-making processes.

- Coordination centered in the Main Contractor;

  In another version, the coordination of the project is through the developer, which becomes the Main Contractor, managing the effective implementation of the Execution Project and becoming responsible for contracting all the specialized subcontractors. For designing the project and forming the Optional Direction, it is usual to follow the same above mentioned procedure, but the Execution Direction is normally indicated by the Developer or becomes part of its responsibilities.

  In this arrangement, Developers are better structured for carrying out the execution of the construction. However, the coordination of the project is not yet fully integrated, as there might be a gap between the technical coordination, the projector and future Construction Director, and the coordination of the remaining areas of the project, in the hands of the Main Contractor.

- Coordination centered in the Delegated Developer;

  In the case there is a Delegated Developer, it is assumed that the entrepreneurs, generally from outside the sector, are going to take the economic responsibility and seek for support from someone who can coordinate the project in its entirety. This one would be responsible for the preliminary assessments, the contraction of a projector for designing a project, the formation of an Optional Direction, contracting several specialized subcontractors and the sale (if that is the purpose) up to the sale follow-up.

  There is a very professional relationship between proprietor and delegated developer, as the latter has to be well prepared for providing periodical information about the situation of a project. In this sense, it would be easier for the Delegated Developer to perform its tasks if the coordination better integrates all the participants that cooperate in the project and knows, in real time, the condition of each activity in the project as to report all the information as readily and accurately as possible.

The development/construction sector is extremely complex and there are many aspect which need to be further developed. In this work, it has been attempted to provide to small-to-medium companies a methodology in which they can rationalize the use of their resources.

“Selected Proceedings from the 12th International Congress on Project Engineering”. (Zaragoza, July 2008)
3. Objective

Analyse the peculiarities in the real estate sector, mostly identifying its key managerial aspects and its context.

Develop a methodology which can fit the singularities of the real estate sector, in order to offer a tool easy to implement and direct application for the directing body of a company in development and construction.

Implement the methodology in a small-to-large company in development and construction.

4. Methodology and Case Study

4.1 ALANTA

ALANTA is a small-to-medium developer and constructor which has decided to support and finance an academic research within its working environment as to qualitatively improve its organizational structure for facing new challenges in a more competitive, complex and uncertain market. Its CEO, Luis Gracia Adrián, used to say at that moment: “The real estate market is increasingly more developed, its customers increasingly more demanding, and there is no room for non-professionalized companies”. In January 2005:

- It achieved its credentials from Aenor in both UNE-ISO 9001/2000 and UNE-ISO 14001/2004;
- It prepared itself for facing an imminent crisis in the real estate market and attempted to adjust its internal organizational structure, its internal processes, its operational communications and enhance its projects in a digital culture, as to create a more competitive portfolio and maximize its resources;
- It kept all its documentation in paper-based archives, even though electronically generated through spreadsheet and word processors (Microsoft Office);
- It was not fully integrated, since all the tasks that were not necessary for the certification processes were not within the system. This situation appeared to rely on two distinct and informal systems: one for “quality” and the other for management;
- It used to communicate its values through the Management Handbook, whose hardcopies were sent to every collaborator. Besides costly and environmentally inappropriate, it required an excessive workload to keep it updated;
- It had a technological base with computers connected through a simple network without client/server protocol. The files were organized within Windows Explorer with a few rules for the creation of folders. The interpretation of users, however, resulted in a hardly controllable process, in which documents produced by a third party were not easily accessed;
- It used CONTAPLUS for accounting, PRESTO for project control and Microsoft OFFICE.

4.2. Definition of a Methodology for implementing a Platform for Integrated Collaboration

In order to face the challenge of developing and implementing a Platform of Integrated Collaboration, three main goals were set:
Check / adapt the continuously compliance with all the requirements that are imposed to
the company and the projects, by verifying the records generated in the execution of
different processes in order to avoid duplication of compliance;

Guide the collaborators of the company through a Map of Processes, which allows for
the inclusion of a new contribution, at any time, of an action within the scope of the
project and the company. On the top of it, the agents should be capable of
understanding the requirements satisfied with each record and the responsibility
originated by the generation of each record;

Shift from a fragmented management, paper-based, to an integrated management,
based on computerized tools, with the possibility of remote collaboration (as the
construction projects are geographically dispersed) in a standardized and organized
setting for facilitating the consult of documents and information of the projects and the
company;

4.3 Reduction by Adherence Layers

The reduction by adherence layers has been planned to facilitate a systematic verification if all
the records in the management system satisfy all the requirements in ALANTA, but also for
enabling an ongoing adjustment to new requirements that come to be enacted later.

Each layer of reference will mirror at least the normative guideline of reference (it is
considered to be an internal normative guideline when the requirements are created within the
company itself), the source of reference and the class of application (Construction,
Management, Environment, Development, Health and Safety, Urbanism) and any other
requirements to be observed.

Once identified the reference layer, the definition of requirements will take place in relation to
their application character (legal, those required by the legislation for the sector, and
strategic, those that the company deems necessary to be implemented according to a
strategic normative guideline); the application activity, the execution unity (construction
unities, a stage in the process, or a sub-process), the execution process, the record that
proves its compliance (the document that shows the fulfillment of a requirement); the
responsible for the requirement and the requirement client (the one who demands its
compliance).

There is ADHERENCE only when they match Registry, Responsible of requirement and
Requirement client
4.4 The Processes Map

The Processes Map ought to offer any participant the opportunity to place him or her, while developing a task, at least in relation to:

- his/her needs: which documents are necessary for developing the task;
- his/her understanding: what has been fulfilling while developing the task;
- his/her importance: which client will deploy the result of the task;

However, the Processes Map should work as a “road map” in which at any time the participant might understand all the possible ways for a project to be borne, grow and turn into a database (documental flow). It also has to allow for finding out all the criteria that the company needs to fulfill for assessing its viability (profit margins indexes and strategic necessity) and the criteria for decision-making that needs to be embodied in the project.

The previous Reduction by adherence layers facilitates drawing the Processes Map. However, for facilitating the interaction of processes and documents, given the complexity of some management systems, there should be reminded that the Processes Map might be unfolded through auxiliary documents.

The work of coordinating constructing projects is very complex as it depends on bringing together distinct areas of knowledge. It can be from technical areas, as architecture and engineering, but it may also involve salesman, administrator, accountants and computational technical support. On the top of it, the level of acquaintance and understanding of those diverse collaborators varies greatly within a project or company. Therefore, it requires an extra effort form the company for achieving a Processes Map which can coordinate all these collective contributions.

4.5 Information Technology

The definition of a software tool which can be used as a Collaboration Platform is not easy to achieve, as the selection parameters are so variegated and full of technicalities, making it not user friendly. Hence, following the methodology of Reduction by adherence layers and designing a good Processes Map enables the company to be in a better position for knowing its information flow. It makes possible to reduce the information to a minimally necessary flow and to define those who need it and when it is needed. This has helped to develop a standard for sensibly evaluating complex tools:

I. In relation to the type of solutions available in the market:

   - Classify solutions: Mix of functional tools (integration solution that encompasses tools for different branches of knowledge) or tools of single database, the so-called ERP (Enterprise Resources Planning – integration solution for distinct branches of knowledge in a single tool which defines, internally, the data flow);

   - Sub-classify the tools of single database among the so-called developed ERPs (solutions developed by technology companies from their own needs) and vertical (solutions developed for a sector from an open source standardized platform).

II. In relation to the level of compatibility between the resources of the application and the needs of the company (software):

   - Establish the processes which should be covered by the software;

   - Define the level of compatibility by determining to which extent each software fulfills the minimum processes of the company.
III. In relation to the need of resources for the implementation:
   - Define the typology of the network and the configuration of the equipment for running each of the options (hardware);
   - Define the amount of time and human resources needed for set-up, implementation and loading of historical database for getting each solution operative;
   - Define the cost of implementation.

IV. Select the most appropriated solution for the company
   - **Classifying Solutions** – assign higher scores for tools of a single database;
   - **Sub-classifying tools of a single database** – assign higher scores for the vertical and modular ones;
   - **Level of compatibility** – the higher the level of compatibility the the higher the score and discard solutions whose level the compatibility is below 70%;
   - **Resources for implementation** – higher score for the lower costs;

Results in ALANTA

ALANTA has followed the steps of the methodology in a way that:

- **Application of Reduction by Adherence Layers:**
  - It has been obtained the minimum records for complying with all the requirements of implementation in the company;
  - It has been identified about 200 records to comply with all the requirements, remaining near 75 records for construction projects, 70 records for development projects and 55 records for the management of the requirements of a project called Administration. However, the number of necessary records may change based on some characteristics of development or construction projects;
  - It has been proved easy to adequate records of the system by changing both the Layers of Reference and the requirements of application, as there were regulatory changes over the implementation period;

- **Map of Processes:** It has been noticed that, when adjusting the Map of Processes to the premises of the methodology, it has been transformed into an efficient browser for situating the collaborator in relation to the task that is going to be performed. The collaborator has all the information, in a structured way, to carry out the task, generating greater fluidity in the operational communication with the recipient of the work.

- **Information Technology:**
  - It has been defined the process of documentation management as the most important to encourage a more integrated collaboration in ALANTA;
o it has been taken into account that ALANTA already worked with PRESTO, CONTAPLUS, MS Project, as well as Microsoft Office;

o few options provided a solution with a Level of Compatibility above 70% (adopt a solution with a low Level of Compatibility means either to relinquish some features already planned or incur a higher cost for adaptation);

o the solutions were still very focused on the accounting aspects of the projects (economic and financial management) and deficient in the management of flows and documents;

o in general the applications did not encompass both the management of development and of construction, or they were very strong in one area at the expense of the other;

o some solutions for the management of development projects proposed the integration for the management of construction with the use of PRESTO;

o the need to invest in new hardware and operating systems would cost between 10,000 and € 20,000 €;

o the cost of the solutions in information technology was too broad, starting from 30,000.00 € up 240.000.00 €;

o the solutions that showed a Compatibility degree of more than 70% were above of 80,000 €;

o the time of implantation and burden of historical data for the implementation of a new solution was not less than 90 days, but it could reach up to 180 days;

4.7. Platform of Integrated Collaboration in Sharepoint Server Services

It was not possible to find tool that could adjust itself 100% to ALANTA expectations in relation to cost/quality among the 11 softwares analysed. Hence, it has adopted a strategy of introducing small changes for later facilitating the implementation of a management tool, giving time to the market for providing a more complete and less expensive management tools in the meantime. These small changes required the company to:

- Base the internal network in a client/server protocol with a powerful server and a good system of backup;
- Renew the hardware as to allow everyone to work with the same operational system;
- Enable the remote connection to ALANTA’s server through a Virtual Private Network (VPN) and Terminal Server;
- Integrate PRESTO and Contaplus, while acquiring more licenses from PRESTO;
- Develop an intranet for the document management on Sharepoint Serveices Server, which comes without charge within Microsoft Server 2003.

In order to take the results of the Reduction by adherence layers and the Map of Processes into a structure for document management, it has been necessary to:

- Create lists for Reference Layers, Application Requirements, Processes, records, Projects and Users;
- Create a list for filing all documents created or received in ALANTA in terms of the projects where a document belongs, the type of record it satisfies and the stage in which it takes place;
- Define windows for Project management, Process execution and management of each agent records;
- Set up Warnings for telling each participant of new entries, changes or elimination of documents.

In Figure 2 it is possible to see a diagram of the relationship between lists by their attributes and a suggestion for the minimally necessary attributes which should be defined for each type of list.

In Figures 3 and 4 are reproduced the computer screens generated for the project managements and execution of processes. For the project management, all the documents of each project can be observed by processes and records, as they can also be filtered by...
projects and by a tab in which the abstract of processes can be accessed. In the project execution screen, there are a number of windows for browsing the different stages of the process, including entry registers, exit registers and also the description of each stage in the process in interactive way that offers access to systems forms.

Figure 4: Screen of Process execution.

4. Conclusions

The challenge faced in this work has brought many advantages, as it has been possible to implement, besides what had been originally planned, other functions which have complemented the Integrated Management System in ALANTA. There is no doubt, though, that it has only been possible to manage the reluctance to changes with the dedicated support from the company direction throughout the process of implementation.

However, it is important to bear in mind that this methodology is a cheap alternative for small-to-medium companies aiming at digital management. The SSS has two important disadvantages in relation to ERPs, as it is not a tool with a single basis and the SSS lists are not guided in a relational way. Nowadays there are a lot of management tools, more encompassing and with lower costs of implementation, than at the time this study was conducted. It is important to keep in mind, though, that even with the increase of open source tools, also for ERPs, the lessons of this work can also be applied in these new scenarios.

In relation to the implemented tool, ALANTA has already managed two construction projects. The first is in Barbastro (Huesca), which is in its concluding stage, and the other is in Labuerda (Huesca), already concluded. It has also been deployed in two projects of development and construction, one in Arròs (Lérida), concluded, and the other in Laspuña (Huesca), under execution. It has also managed a number of preliminary analysis of construction and development/construction projects which have been turned down or under negotiation. Besides these constructing projects, ALANTA manages all its administrative documents as just another project, named Administration. All these projects have taken place concomitantly with the development of this tool.

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The experience we had up to now offers some important conclusions:

- It is increasingly imperative that companies have more than simply spreadsheets and word processors in their range of computational tools, incorporating also standardized platforms of open source. “The Sharepoint Services Server” has proved to be easy to implement and a great potential for developing business;
- It has been noticed that ALANTA has become much more flexible in adapting itself to changes in normative and market frameworks, rendering the company much more competitive. The easiness in which these adaptations took place was certainly due to the readiness of the tool for incorporating such shifts in its structure (recent legal changes, real estate crisis, new requirements for public contracts);
- In ALANTA, the management system has been capable to integrate corporate language and improved operational communication;
- Each new project in ALANTA has improved in terms of quality, as it became easier to check the flow of documents of past projects and provide readily information.

Finally, it has been possible to implement in ALANTA a tool which enables INTEGRATED COLABORATION in construction projects. This tool presents itself as an option for other organizations, as these companies in construction and real estate will always have an enhanced position if they are formally structured to follow the current legislation, to produce high quality items and to keep the balance with the environment in which they operate.

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