

**LEAN DESIGN MANAGEMENT APPLIED TO CONCRETE
STRUCTURES FOR RETAINING AQUEOUS LIQUIDS
A REDESIGN PROCESS MODEL TO PORTUGUESE DESIGN COMPANIES**

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ABSTRACT

This paper refers to the need of reengineering the design process in Portugal. It's a paper that derives from a research project (course of advanced study and research for the degree of PhD, in the University of Salford) to redesign the process management of Portuguese construction design companies.

Nowadays, the companies present design projects with poor construction details, long cycle times and low profits. We don't see long-time partnerships, which could generate synergies and would allow a knowledge management approach.

The research project intends to create, initially, a more generalist model, which may be applied to design projects in general, and a more specific one, to the design of reinforced concrete liquid retaining structures.

1. INTRODUCTION

This paper refers to the reengineering of the Process, now used in Portugal by the design companies, in particular in the design of reinforced concrete liquid retaining structures (e.g. sewer treatment plants).

At the end of the seventies, the international credit lines to investments in the environmental area were begun in Portugal. By the eighties, the legislation was reformulated by the transposition of the European to the Portuguese Law.

With the Portuguese Law 74/90, all the industries producing pollutant residues, were forced to construct sewer treatment plants. Industrials had a new obligation and not a new wish. As a consequence, the clients always choose the lowest price project design, since this infrastructures are considered as an additional cost to the production activity.

The Portuguese government together with EC, have created a subsidy line for this kind of plants, that would cover a large part of the costs with the construction. However, the design of the sewer plant is an initial cost, required to be candidate to the subsidy...

2. PRESENT PROCESS IN PORTUGAL

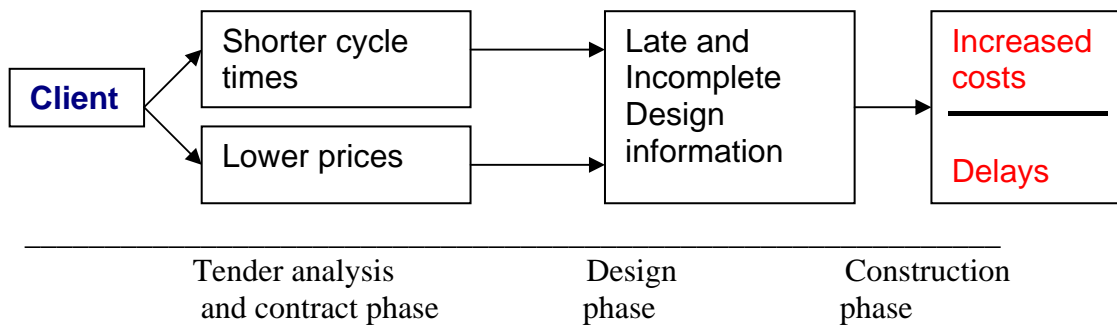
The Portuguese construction market has changed, but the global design process has not. It's the same linear process as fifty years ago:



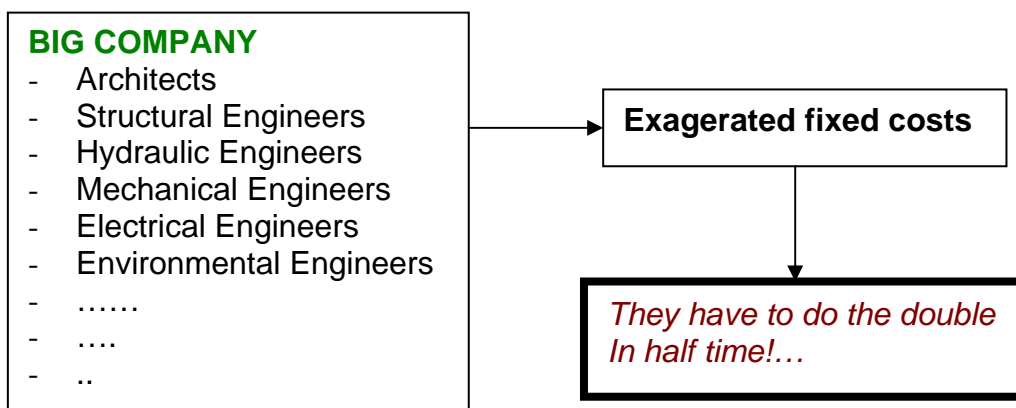
Effectively, a process may be defined as a sequence of steps performed to obtain a certain objective. A process is composed by people, tools and procedures together. Design processes are what people do, using procedures, methods, knowledge and equipment, to produce a good that is of value to the client and profits to the company. However, the process shall be iterative, in order that it will be permanently controlled and optimised.

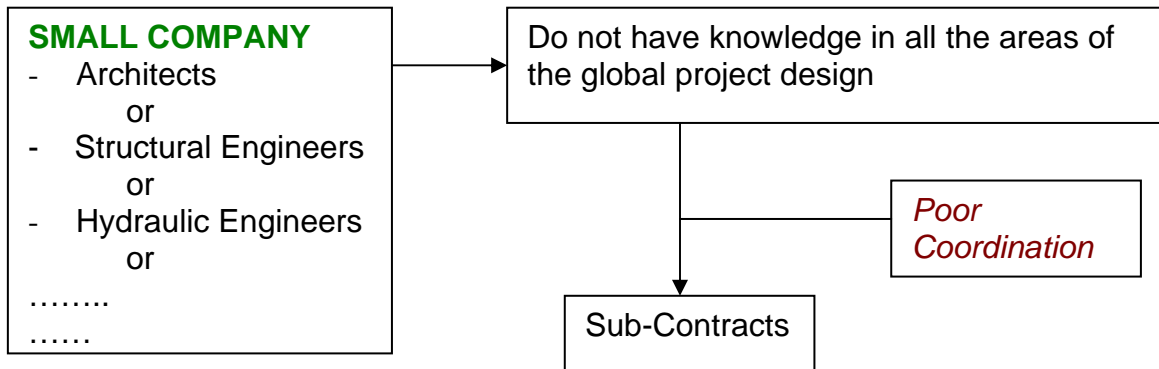
Today, there are computers, software, internet,..., The tools and equipment are not the same as fifty years ago... People have different knowledge... Why the same process?

Clients are increasingly pressing for shorter cycle times and lower prices. That points to late and incomplete design information, which will increase costs and delay in the construction phase.

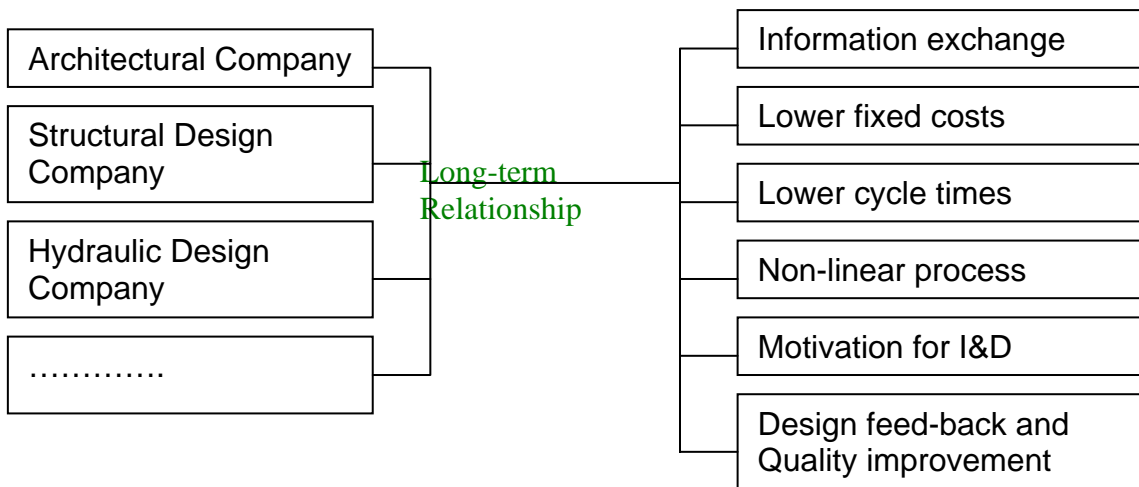


At the present time, there are two main kinds of design teams in Portugal: big companies, which englobe all the designers specialists, with the correspondent costs, and small companies, which sub-contract some of the engineering specialities involved in the global design. In the first case, the companies have exaggerated fixed costs and, so, “they have to do the double in half time”... In the second case, there is not an interrelationship that allows to produce a good and complete design project.





Due to the lower prices and cycle times of contracts, the small firms tend to impose the same to their sub-contracted companies. There is no long-term partnership, which would give to the companies the means to identify weaknesses and strengthen the process pro-actively, in a collaborative way.



3. PROBLEMS IDENTIFICATION IN DESIGN

The main problems in the design of concrete structures for retaining aqueous liquids, in Portugal, are:

- No specific standard
- Inadequacies in technical knowledge of designers (no specialisation)
- Disloyal concurrence
- No long-term relationship between specialists and/or companies
- Poor briefing and communication
- Out-of-sequence design process
- “Anarchic” process

In these special kind of projects, there should be considered special problems, that are not significant for the major constructions. That is the case of concrete impermeability, of concrete shrinkage, or concrete cracking, for example. The inexistence of a standard is a “permission” to forget some of the special properties these structures need. On the other hand, in Portugal, it is difficult to find bibliography related to the structural design of reinforced concrete liquid retaining structures. To make the problem bigger, there is not a great concern, by the clients, with this type of problems because they will only be detected some years later. The sewer plants, for the industrials, in general, are considered a way to keep working... It’s a legal obligation.

It is time to begin thinking of sustainable design and construction projects!...It’s time to change mentalities and processes!...

With the introduction of accessible software and hardware in the market, the knowledge was a little bit neglected, to emphasise the “need of knowing how to introduce data in the computer...” We see, in some cases, of chartered engineers “putting a pig in the machine and getting sausages in the other end..”, which could be good if they would had the anterior enough experience to analyse the results.. The problem increases when they practise prices lower than an half of the right price, practised by the competent design teams. This distorts the market and decreases quality.

As referred before, clients are pressing for lower costs and cycle times. The specialised companies, that do not cover all design areas, tend to try to obtain the lowest prices to their sub-contracts. This may seem more economic at the time, but will certainly not increase speed and promote I&D, neither generate long time benefits.

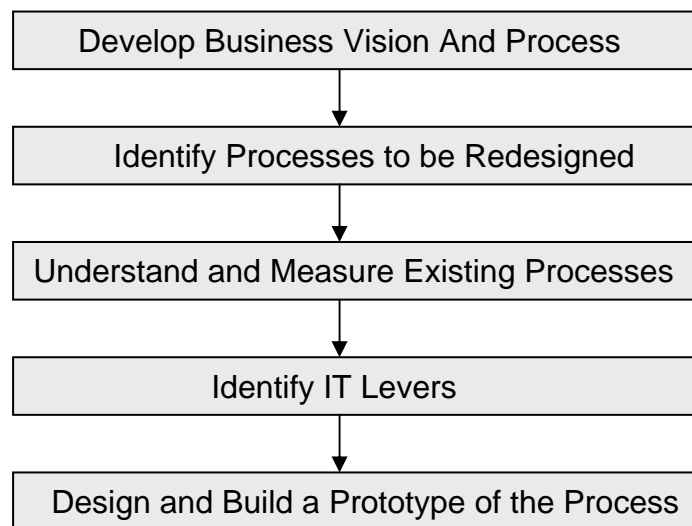
Looking at the present situation of global design projects of this kind, we can conclude that the process, in Portugal, is an “anarchic” process.

4. THE CHANGE TO LEAN DESIGN

The question is: “what and how to do to create a process that will produce an output that is value to the customer,..., doing more with less” (Michael Hammer et al, 1995), with the premiss “quality should be free...” (James Womack et al, 1990), never forgetting that we are in the “sustainability era – the XXI century”.

Thomas Davenport and James Short (1990), divided the process reengineering in five steps:

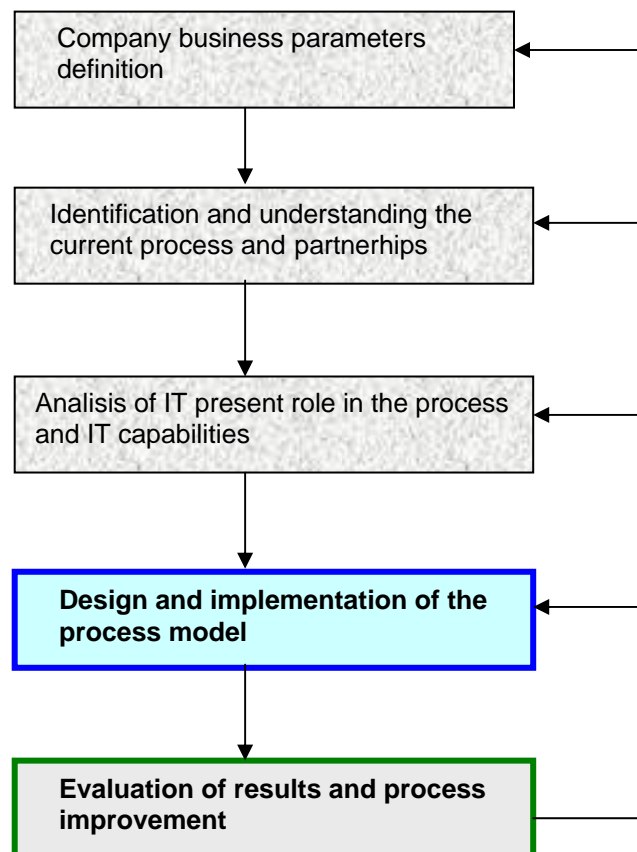
Five steps in Process Redesign



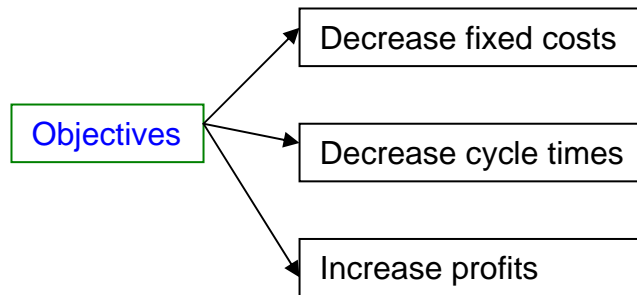
These will be the base to create a proposal of a process redesign model to improve construction design in general, and in this special case in particular. The difference will only be in the technical parameters and activities scheduling, which will be different in this kind of projects.

5. REDESIGN PROCESS MODEL PROPOSAL

Considering the five steps of process redesign proposed by Davenport and Short, and trying to apply that theory to the global design of reinforced concrete structures for retaining aqueous liquids, the model is divided in five stages:

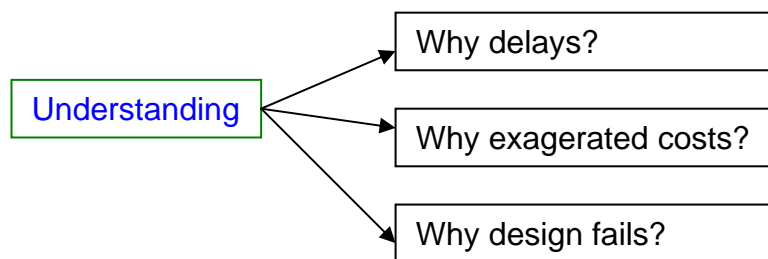


In the first stage, the company must define the cost origin, determine the present break-even point, the profits ratio,The company business diagnosis must be done. Based on this data collection, the objectives shall be defined.



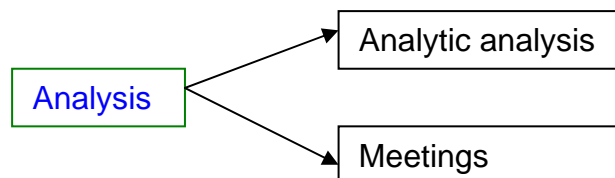
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The second stage will allow to understand the present process. The way the company have been working until then will be analysed. Hierarchies, teams composition, technical development, partnerships, etc. will be studied and defined. On the other hand, the design fails and delays must de evaluated and its causes determined.



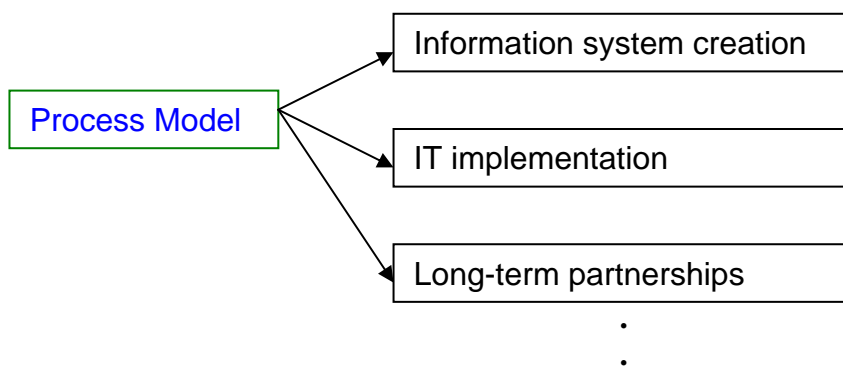
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Stage three is a data analysis and reflection phase. Managers and technical personal will participate in meetings. The past sub-contracted companies will be called to participate. It's time to ask everybody to participate in process redesign. The way to establish each design tasks sequence must be thought of.



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According to the conclusions of previous stages, a process model will be designed. It will include the IT levers to be used, internal and external communication system definition, design teams organisation,... Continuous professional valorisation and I&D will be encouraged, long-term relationships shall be established and this will provoke synergies. The model will be implemented.



After the redesigned process implementation, begins the continuous process improvement (stage 5). A design project feed-back must be obtained from each project, and analysed. The fails will be found and the process readjusted. It will be a permanent stage.

6. CONCLUSIONS

Portuguese construction design process needs reengineering. The model proposal presented in this paper is an initial model, which intends to change radically the existing process in Portuguese construction design. However, this model is just the first try to produce an appropriate model to Portuguese reality. Benefits of its implementation must be evaluated, it must be a mutable model, it must be improved. In a future, phase international benchmarking will be used, as well as a case study methodology. Enquiries and direct participation will be considered. Results will be analysed and process continuously improved...

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