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UPC BARCELONATECH

PROCUREMENT PROCESSES IN CONSTRUCTION IN EUROPE-AN ASSESSMENT FOLLOWING PROJECT PROCUREMENT MANAGEMENT PMBOK APPROACH

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PART 1: INTRODUCTION

The construction industry represented 5,7 % of the national GDP in Spain 2020 (STATISTA, 2022), and 7,83 % in The Czech Republic in 2020 (ICEX España Exportación, 2022). It is an important economic sector in all countries, so it is important know the process that permit to perform the construction projects.

The bidding process is the regulated process by which an organization makes a need known publicly, requests offer that satisfy it, evaluates these offers and selects one of them. Usually, the countries, are regulated by a law of bidding, in order to guarantee civic transparency.

The process of bidding can be done by a public administrator or a private company. Both, have the same purpose, find the best offer, taking into account important parameters like the budget, duration of the works, the previous experience of the company etc.

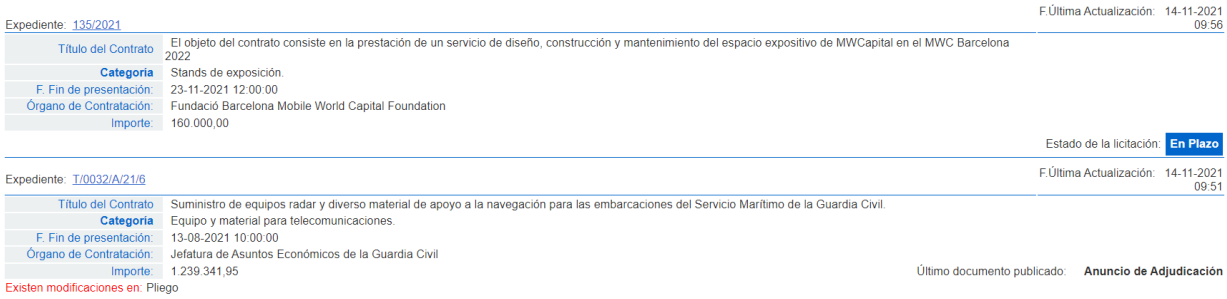
The main objective of this Master thesis is evaluating the procurement processes in construction in Spain and The Czech Republic, which are full members countries in the European Union, try to find strengths, weakness and detect potential improvements. To achieve this objective, the Project Management Body of Knowledge, issued by the Project Management Institute PMI, edition V, year 2013 will be used.

PART 2: LITERATURE REVIEW

In this part, the construction procurement law of Spain and The Czech Republic will be explained, the history, objectives and the purposes of PMBOK will also be explained.

2.1 Procurement legislation for construction tenders

In Spain, the regulator frame work of the procurement processes in public construction is "Ley 9/2017, de 8 de noviembre, de Contratos del Sector Público". It is a law that has the objective of regulate public sector contracting, in order to ensure that it complies with the principles of freedom of access to contractors, publicity and transparency of procedures, and non-discrimination and equal treatment among bidders.
BOE (Boletín Oficial del Estado) have announced public offers in Section V since 1995 and in the past .Certain announcement are also published in the EU bullet. The *Figure 1* shows an example of a public offer.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Título del Contrato	El objeto del contrato consiste en la prestación de un servicio de diseño, construcción y mantenimiento del espacio expositivo de MWCapital en el MWC Barcelona 2022
Categoria	Stands de exposición.
F. Fin de presentación:	23-11-2021 12:00:00
Órgano de Contratación:	Fundació Barcelona Mobile World Capital Foundation
Importe:	160.000,00

Estado de la licitación: En Plazo

Expediente: T/0032/A/21/6 — F.Última Actualización: 14-11-2021 09:51

Título del Contrato	Suministro de equipos radar y diverso material de apoyo a la navegación para las embarcaciones del Servicio Marítimo de la Guardia Civil.
Categoria	Equipo y material para telecomunicaciones.
F. Fin de presentación:	13-08-2021 10:00:00
Órgano de Contratación:	Jefatura de Asuntos Económicos de la Guardia Civil
Importe:	1.239.341,95

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Figure 1 Public offers Spain

In Spain, there are three types of public administration:

- Administración central/general del estado (Central State Administration)
- Administración autonómica (Regional Administration)
- Administración local (Local or Municipal Administration)

The "Administración General del Estado" are the public organizations of the kingdom of Spain. It is the instrument of the Government to develop and implement its public policies or provide services. The Government manage the Administración General del Estado.

The "Administración autonómica" is comprises all those administrative organizations that depend on the Autonomic Community and that are competent on the territory of each of these. This administration is governed by the same principles as the administración general del estado, as well as by the regulations of the comunidad to which they belong.

The "Administración local" constitute one of the territorial administrations into which the Spanish State is divided, to which the constitution recognizes and guarantees autonomy in the management of their interests. The mains administración local are the Municipality and the Province.

The legal framework governing responsible public procurement in The Czech Republic is based upon and fully corresponds to the European legislation. It is represented by Act No. 134 from the Year 2016 (Public Procurement Act). The purposes of this law are:

- The need to bring the existing rules for public procurement up to date so as to increase the efficiency of public funds; particularly, to make the participation of small and mid-sized enterprises in public procurement easier so that contracting authorities are able to improve their use of public procurement to support societal objectives.

- Using public procurement to attain intelligent, sustainable growth supporting inclusion, and to ensure efficient use of public funds,
- Use public procurement in the most strategic manner possible to support innovation via purchases of innovative products, construction work, and services; this plays a key role in improving the efficiency and quality of public services, and in addressing major societal issues.

All the public offers in The Czech Republic are announced in VVZ (MINISTERSTVO PRO MÍSTNÍ ROZVOJ CR, 2022). The *Figure 2* shows some public offers.

Všechna nová uveřejnění

Evidenční číslo formuláře	Evidenční číslo zakázky	Název zadavatele	Název zakázky	Druh	Datum uveřejnění
F2022-008592	Z2022-005946	Správa a údržba silnic Jihomoravského kraje, příspěvková organizace kraje	II/394 Tetčice průtah 1. stavba	CZ04	03.03.2022
F2022-008590	Z2022-008590	Obec Kožichovice	Obecní úřad Kožichovice	CZ03	03.03.2022
F2022-008587	Z2021-047801	Olomoucký kraj	II/449 MÚK Unčovice-Litovel, úseky A, C, okružní křižovatka	CZ04	03.03.2022
F2022-008584	Z2022-008584	Obec Tišice	Kanalizace Tišice I. etapa, 1. část	CZ02	03.03.2022
F2022-008577	Z2022-006382	Ředitelství silnic a dálnic ČR	I/17 Stradouň, úpravy komunikace	CZ04	03.03.2022

Figure 2 Public offers in The Czech Republic

Since 2000, The Czech Republic has been divided into thirteen regions and the capital city of Prague. Every region has its own elected regional assembly and a regional governor.

In The Czech Republic, there are three types of public administration (Ministry of the Interior, Department for Strategic Development and Coordination of Public Administration , 2018):

- Central State Administration
- Regional Administration
- Municipality (okresy) Administration

The “Central state administration” has a crucial role to play in the management of the public sector, consisting in the development of concepts and the creation of a general framework for the functioning of particular areas in society.

The “Regional administration” manages its property and its own revenues as defined by law. In legal relationships, it acts in its own name and bears responsibility for the resulting relationships.

The "Municipality Administration" is the lower basic of territorial self-government. A municipality may also carry the designation of a city and a township if it has the specified criteria.

The administration of Spain and The Czech Republic are similar, both have three kinds of public administration *Table 1*.

Spain	The Czech Republic
1st Central State Administration	1st Central State Administration
2nd Regional Administration	2nd Regional Administration
3rd Local or Municipal Administration	3rd Municipal Administration

Table 1 Division of Public Administration

2.2 History of PMBOK

The Project Management Institute (PMI), was founded in 1969 as a non-profit organization by James Snyder, Eric Jenett, Gordon Davis, Ned Engman and Susan Gallagher at the Georgia Institute of Technology. As an organization, it offers training and certification in project management, and it reports regularly on industry trends.

The Project Management Body of Knowledge (PMBOK), it is a guide that provide guidelines for managing projects, it also describes the project life cycle. The PMBOOK are developed through a voluntary consensus standards development process.

The PMBOK was first published in 1987 as white paper in an effort to document the project management body of knowledge. The first edition as a book format appeared in 1996, and was published by the Project Management Institute. Since the first edition of PMBOK, it has been updating and in 2021, the last edition is the 7th.

PMBOK provides and promotes a common vocabulary useful for the project management profession and is the most used standard of all projects, not only in construction. This Master thesis will be supported with the fifth edition of PMBOK (*Figure 3*).

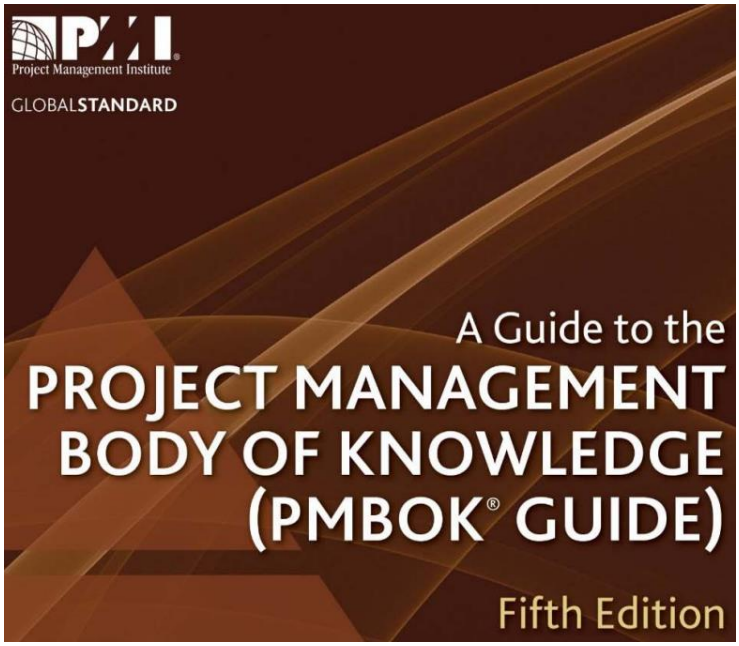


Figure 3 PMBOK fifth Edition

The *Table 2* shows a revision of all edition of PMBOK GUIDE (Chung, 2022).

Year	Title	Revision summary
1996	PMBOK Guide	Published in 1996 by the Project Management Institute (PMI), this document evolved from white paper published in 1983 called the "Ethics, Standards, and Accreditation Committee Final Report" and in 1996 was published in an effort to document the project management body of knowledge.
2000	PMBOK Guide 2000 Edition	The second edition of the PMBOK® Guide was published in 2000. It was based on the work in the PMBOK Guide 1st Edition and added new material reflecting the growth of practices.
2004	PMBOK Guide Third Edition	The third edition of the PMBOK Guide was published in 2004. After the publication of the PMBOK Guide 2nd Edition, thousands of recommendations for improvements of the PMBOK Guide were received by the PMI. The PMI formed an editorial committee to review each recommendation and tried to incorporate the suggestions into the new PMBOK Guide as appropriate.
2009	PMBOK Guide Fourth Edition	The 4th edition of the PMBOK Guide was published in 2009. This edition aimed to make contents the PMBOK Guide more consistent and accessible.
2013	PMBOK Guide Fifth Edition	The 5th edition of the PMBOK Guide was published in 2013. PMI received quite a lot of comments and recommendations to the PMBOK Guide 4th Edition and the 5th edition represents PMI's continual efforts to update and upgrade the body of knowledge for the project management profession
2017	PMBOK Guide Sixth Edition	The 6th edition of the PMBOK Guide was published in September 2017.This edition added more topics and included agile practices for the first time.
2021	PMBOK Guide Seventh Edition	The 7th edition of the PMBOK Guide was published in 2021 and it is the newest edition.

Table 2 Revision Summary PMBOOK GUIDE

PART 3: OBJECTIVES

In this part the general and specific objectives of this master thesis will be explained.

3.1 General Objectives

This Master thesis has as main objective of the evaluation of the process of procurement in construction, provide a methodology for evaluating bidding construction. To evaluate this process, the PMBOK will be use.

This methodology should not only take into account the budget, but also different criterion chooses by professionals of different field. This methodology will make possible to evaluate numerically the offers of bidders, it will be reach giving a relative weighting to each criterion.

In addition, this methodology is also intended to give the opportunity to get feedback from the bidders, to let them make better offers.

3.1 Specific Objectives

As specific objectives it is worth to mention the following:

- The roles of the most important agents will be explained in order to know the responsibilities of each one. It will deep in the mistakes that the principal agents make in construction, so that avoid those mistakes and reduce the impacts.

- Explain the important phases of bidding process, types of contracts and project life cycle to know how these phases could affect to the bidding process. Also, this thesis will analyse different methods of bidding analysis in order to know which one is better in the field of construction.

- This thesis will compare the measurement and cost estimation of bidding in The Czech Republic and in Spain. With the purpose of know the strength and weakness in each approach and try to apply the advantages to the methodology.

PART 4: AGENTS OF BIDDING

In the bidding process, the most important agents are the sponsor, contractor, the project executor and the engineer. In this part, the functions of the important agents will be explained. The *Figure 4* shows the main agents of bidding process.

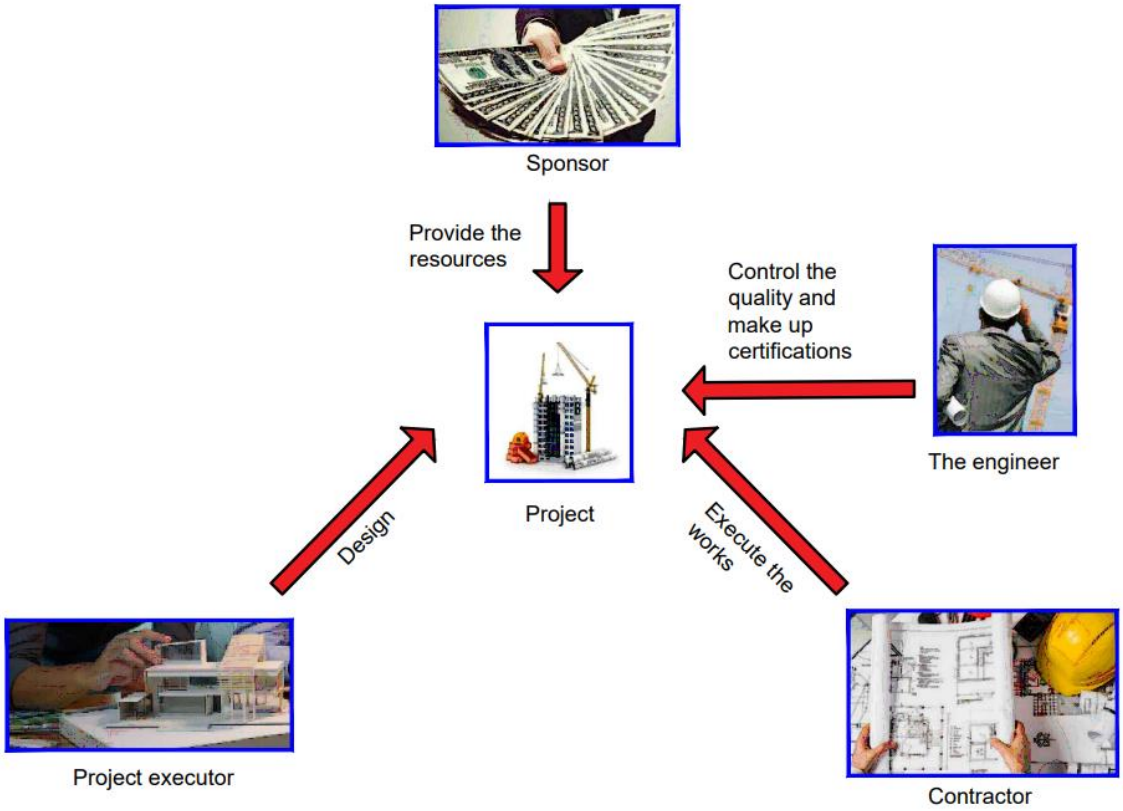


Figure 4 Agents of bidding

Part 4.1 Sponsor

The sponsor also called promotor is who provide the resources to make the project, he can be a natural o legal person.

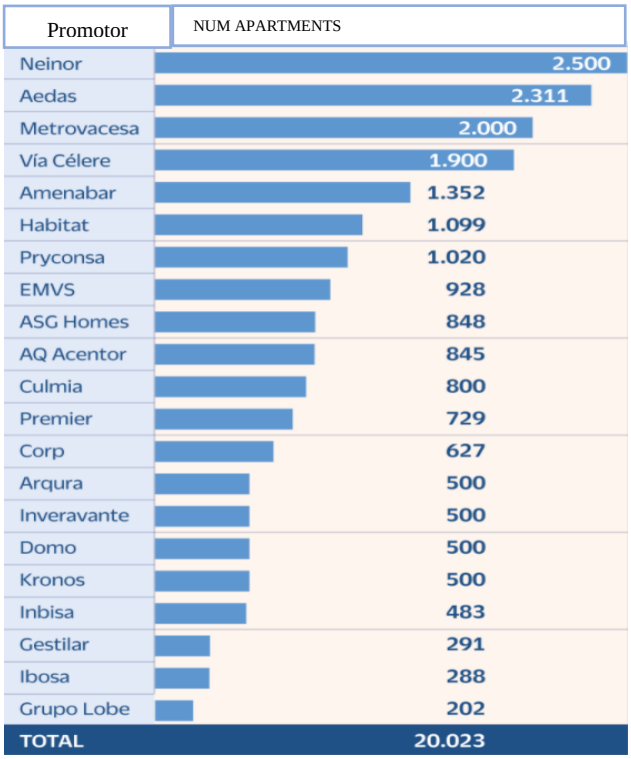
The legislation in Spain for building, design and construct is the LOE (Law of ordinance edification). The LOE defines the promotor as "any person, natural o legal person, public or private" who individual or collective, decides, promotes, programs and finances, with their own resources or those others the building for themselves or their subsequent sale, delivery or assignment to third parties under any title.

Responsibilities of the sponsor:

a. Hold the ownership over the site that empower them to build on it
b. Provide the documentation and prior the necessary information for the composition of the project, also authorize the building official subsequent modifications.
c. Manage and obtain the mandatory licenses and administrative authorizations, as well how to sign the act of reception of the building.
d. Sign the insurance provided for in article 19 of LOE
e. Deliver the buyer the documentation of the building executed, or any other document required by the competent administrations.

Part 4.1.1 Principals Sponsors

The main private sponsors in Spain (*Graphic 1*) are Neinor, Aedas, Metrovacesa, they are focus in apartments. The following graphic shows the main promotors in Spain (Cinco Días, 2022).



Graphic 1 Main private promotors in Spain

Only In Prague (Capital of The Czech Republic), 5.245 news apartments in 2018.More than half of them were constructed by the ten largest developers (*Table 3*).

Order	Developer	Number of flats sold in 2018
1	Central Group	833
2	Finep CZ	553
3	Vivus	289
4	PRAŽSKÁ SPRÁVA NEMOVITOSTÍ	253
5	Yit	218
6	Skanska	196
7	Afi Europe	174
8	Penta	157
9	Acord Invest	154
10	Avestus Real Estate	133
Total in Prague built by top ten largest developers		2960
Total in Prague		5345

Table 3 Top ten developers in Prague (Marečková)

Part 4.2 Project executor

The project executor or designer is the agent who, on behalf of the promotor and subject to the technical and urban planning regulations, lead the project.

The responsibilities of the planner are:

a) Be in possession of the academic and professional qualification of architect, technical architect, engineer or technical engineer, according to the requirements.
b) Write up the project in accordance with the regulations in force and with what has been established in the contract and deliver it, with any necessary approvals.
c) If it is necessary, he should make agreements for the promotor of partial partnerships.

Part 4.3 Contractor

The contractor also known as the seller, are external companies that enter into a contractual agreement in order carry out the project, execute the works.

The LOE defines the contractor as “the agent that assume contractually to the promotor, the agreement to execute with human and material resources, own or external, the works of the building subject to the project and the contract”.

The responsibilities of the contractor:

a. Execute the work subject to the project, the applicable legislation and the instructions of the building official and the project execution manager, in order to achieve the quality required in the project.

b. To have the professional qualification or training that enables the fulfilment of the conditions required to act as a contractor.

c. Appoint the site supervision, who will assume the technical representation of the contractor in the work. The site supervision due to his qualification or experience, must have the appropriate training according to the characteristic and complexity of the work.

d. Assign to the construction the human and material resources required by its importance.

e. Formalize the subcontracting of certain parts or installations of the construction within the limits established in the contract.

f. Sign the variation order and the acceptance certificate

g. Provide the building official with the necessary data for the preparation of the documentation of the executed construction.

h. To sign the guarantees provided in article 19 of LOE.

Part 4.4 The engineer

The LOE defines the engineer as “who directs the development of the work in technical aspects, aesthetics, urban and environmental aspects and control the quality of the work, in accordance with the project”. With the aim of ensuring its suitability for the proposed purpose.

The responsibilities of the engineer:

a) Be in possession of the academic and professional qualification of architect, technical architect, engineer or technical engineer, according to the requirements.
b) Verify the Stakeout surveying and the adequacy of the projected foundations and structure to the geotechnical characteristics of the terrain.
c) Carry out accurate tests
d) Solve contingences that happen in the building site
e) Make up the certifications of the completed works and the severance pay
f) Draw up and sign the documentation of the work carried out to deliver to the sponsor, with any necessary endorsement.

PART 5: TYPES OF CONTRACTS

In this part, the more popular contract types will be explained. It is usual to combine one or more types.

Part 5.1 Types of contracts according to the price

There are three types of contracts according to the price. In this part all of them will be explained

Part 5.1.1 Fixed-Prices Contracts

This type of contract involves a fixed price for a defined product(construction). Fixed-price contracts usually include financial incentives, if the schedule delivery date is do it on time or before.

In Spain the fixed-prices contract is redacted according to the civil code. The article 1593 of Civil Code say that "the architect or contractor who undertakes the construction of a building or other work on the basis of a plan agreed upon with the owner of the land for a flat-rate adjustment, may not ask for an increase in price even if the price of labour or materials has been increased; but he may do so when a change has been made in the plan which results in an increase in the work, provided that the owner has given his authorisation" (Comisión General de Codificación).

Part 5.1.2 Cost-reimbursable Contracts

This type of contract involves payments (cost reimbursements) to the seller for all legitimate actual costs for complete work, plus a benefit for the seller. The cost is classified in direct costs and indirect costs.

Direct costs are those that form part of the construction (labor, material, equipment etc.) and are directly related to the construction.
Indirect costs correspond to the general overhead necessary for the execution of the works (administrative costs, supervision, construction of general facilities necessary to carry out the work concepts) that are not included in the direct costs. Usually, the indirect costs are calculated as a percentage of direct costs.

Part 5.1.3 Time and Material Contracts

This contract is a hybrid of both cost-reimbursable and fixed-price contracts. The total value of the agreement and the exact quantity of the delivered are not defined by the buyer at the time of the contract award. Therefore, time and materials contracts may grow in contract value like cost-reimbursable contracts. On the other hand, time and material contracts are also similar to a fixed price contract. For instance, the promoter and the contractor establish unit rates in advance when both parties agree on the rates for specific category of resource.

Part 5.2 Types of contracts according to the delivery method

There are two project delivery methods, design-bid-build and design-build. In this part both of them will be explained.

Part 5.2.1 Design-bid-build

Design-bid-build is a traditional method, the sponsor contracts a project executor and contractor separately.

The project executor delivers the whole design document. Then the sponsor starts the bidding process.

Advantages:

- The sponsor gest the most competitive pricing
- Since design and construction roles are different. Responsibilities for project executor and contractor are clearly distinguished
- The method is sequential therefore, it is easier to follow the process
- Sponsor has more control of the design

Disadvantages:

- More changes because the contractors will only bid on what is explicitly design in the documents, so variations or mistakes in the scope will cause changes and activities that were not consider
- Construction costs are unknown until the design state is complete. If offers are more expensive, the sponsor must pay for a redesign.
- Extended timeline, since the process is linear, a delay will affect all the process.

Part 5.2.2 Design-build

Design-build is a method system in which a single entity, the design-builder, assumes responsibilities for the design and construction. The sponsor hires a design-builder instead of contracting a project executor separate from the building company.

Advantages:

- The sponsor assumes less risk with this delivery method because the design-builder assumes the responsibility of the project
- This delivery method reduces the number of changes, modifications of the project
- Faster project delivery since the construction can begin while the design is still in development

Disadvantages:

- The sponsor has less control of the design
- Not every company can put together an effective design-builder team
- Competitive bidding may be removed from the process, so the sponsor will not have the cheaper budget

PART 6: PROJECT LIFE CYCLE

A project is a temporary effort to create a unique product, service, or result. The temporary nature of projects indicates that a project has a definite beginning and end (Project Management Institute, 2013). Projects has a team, budget, schedule and expectations. This Master thesis is focus in construction projects.

A project life cycle is the series of phases that a project passes through from its initiation to its closure (Project Management Institute, 2013). The ideal phases of a project are sequential, but usually the project will have more than one phases at the same time. The combination of all these phases forms the Life cycle of the project.

6.1 Characteristics of the Project Life Cycle

Projects vary in size and complexity, but all of them have a life cycle structure. The modifications in the project will appear, but having a modification or problems in the project is not the most alarming, the most alarming is when take place this modification or problems.

All projects can be mapped to the following generic life cycle structure (*Figure 5*):

- Starting project
- Organizing and preparing
- Carrying out the work
- Closing the project

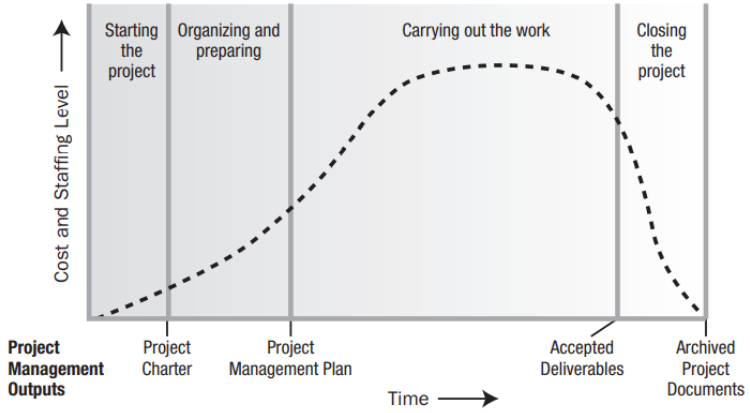


Figure 5 Typical Cost and Staffing Level Across a Generic Project Life Cycle Structure (Project Management Institute, 2013)

If we focus in the Generic Project Life Cycle, we can find some characteristics:

- Cost and staffing levels are low at the beginning of the project, peak as the work is carried out, and decrease rapidly as the project draws to a close.
- The typical cost and staffing curve may not apply to all projects. Sometimes, a project requires significant resources early in its life cycle.
- Risk and uncertainty (as illustrated in *Figure 5*) are greatest at the start of the project. These factors decrease over the life of the project as decisions are reached and as deliverables are accepted.
- The ability to influence the final characteristics of the project's product, without significantly impacting cost, is highest at the start of the project and decreases as the

project progresses towards completion (Project Management Institute, 2013). *Figure 6* shows this behaviour

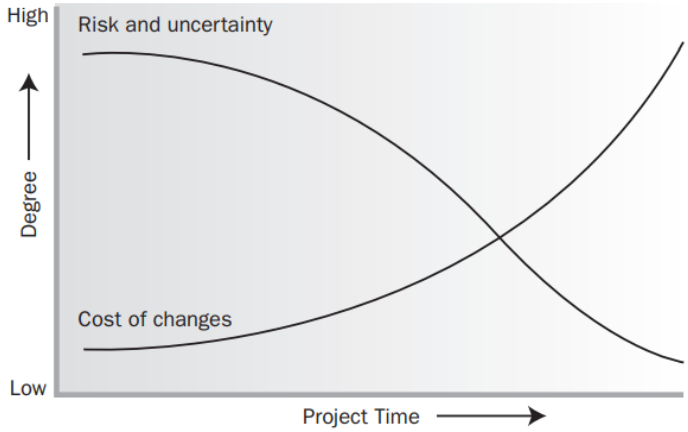


Figure 6 Impact of Variable Based on Project Time (Project Management Institute, 2013)

6.2 Project Phases

All projects may be divided in phases, the phases can be divided in sub-phases, activities. The number of phases, the resources for phases, and the degree of control applied depend on the size and the complexity.

Usually, a phase of a project end with a revision of the achieved job in order to accept the phase deliverable. This phase end represents a natural point called milestone. In a project, it is very common has different phases at the same time. The site Manager habitually carry out a revision so that he makes a decision of start a new activity of a new phase without finishing the actual activity.

6.2.1 Phase-to-Phase Relationship

There are two basic types of phase-to-phase relationship:

- Sequential relationship: The characteristic of this kind of process is that, a phase starts only when the previous phase is completed. (Project Management Institute, 2013)

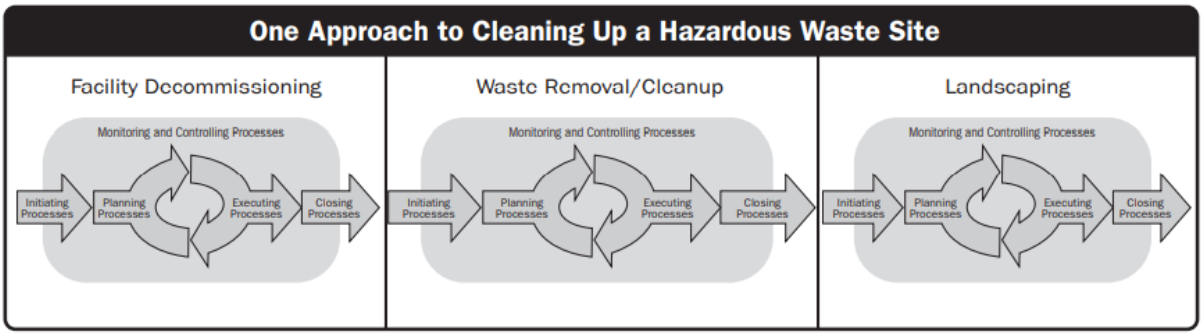


Figure 7 Example of a Three-phase Project (Project Management Institute, 2013)

- Overlapping relationship: In an overlapping relationship, a phase starts prior to completion of the previous (Project Management Institute, 2013)

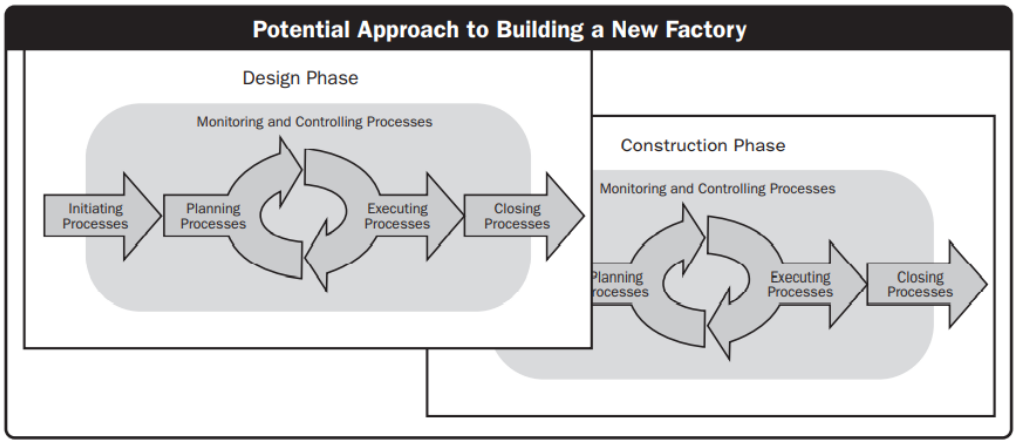


Figure 8 Example of a Project with Overlapping Phases (Project Management Institute, 2013)

In construction the most common is having Overlapping phases, so it is important planning and scheduling projects.

6.3 Timelines of Phases

It is important organize the activities, to avoid delays in a project. Usually, in the scope statement the promotor gives some penalizations for delays. It will affect to the profit of constructors. A tool to avoid these penalizations are construction timelines.

A construction timeline is what construction managers use to organize a project, dividing the project into individual tasks, activities and milestones and then attaching dates and deadlines to each.

6.3.1 Define activities

Define activities is the process of identifying and documenting the specific actions to be performed to produce the project deliverables (Project Management Institute, 2013).The deliverables are divided in components called activities.

All the activities form the activity list, that includes all schedule activities required in a project. This list must also include a description of each activity in order to guarantee that project team members will understand what they need to do to complete the activity.

6.3.2 Project Schedule

It is important make relationships between activities, the best representation of this relationships is graphical. The sequence of activities involves identifying and documenting the logical relationships between the activities in the schedule.

6.3.2.1 Gantt chart

A Gantt chart, commonly used in project management, is one of the most popular and useful ways of showing activities. Gantt chart was invented by the American mechanical engineer and management consultant, Henry Laurence Gantt in 1910s (*Figure 9*).

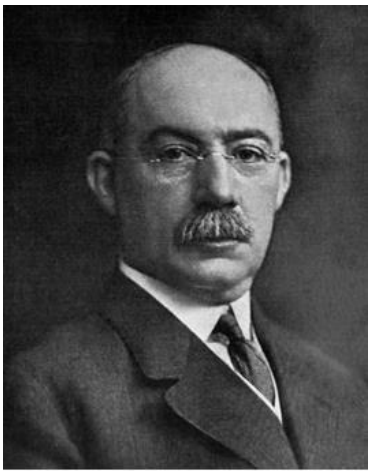


Figure 9 Henry Laurence Gantt (1861-1919)

Gantt tried to solve the problem of scheduling activities, distributing them according to a calendar, so that Gantt chart shows the duration of each activity, the start, end and the total time required for the execution of a job.

Gantt chart also allows see the progress of each activity, providing information on the percentage of each activity implemented, as well as the degree of advance or delay regarding the expected schedule.

The *Figure 10* shows the idea of Gannt chart.

Name of the activity	Duration	Week-1						Week-2							Week-3						
		Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.	Sun.	Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.	Sun.	Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.	Sun.
Activity 1	10 days																					
Activity 2	2days																					
Activity 3	10 days																					

Figure 10 Gantt chart idea

Horizontal axis: It shows a timetable or time scale defined in terms of the unit most appropriate for the work (hour, day, week, month, etc).

Vertical axis: It shows the activities that constitute the work to be executed. Each activity is assigned a horizontal line, whose length is proportional to its duration and which is measured in relation to the scaled defined on the horizontal axis.

Advantages of Gannt chart:

- The both axes can be graduated (days, week, month, etc). It is a method of great clarity and simplicity.
- It applies to very large and very small kind of construction.
- Numbers can be assigned to the activities (money, materials, volume, etc) and a distribution is obtained that allows vertical sum to calculate resource curves, certifications, expenses, collection, payment, etc.

Disadvantages of Gannt chart:

- If the Gannt chart is very detailed and/or for very long period of time, the graph will be lengthy, making it difficult to consult, handle and overview (it is very important to have it all on the same plane in order to assimilate the chart clearly).
- It is not possible to highlight the independence of some activities from others and also it is not possible to go into details.

- It simply reflects when an activity is expected to start and when it is expected to end (all activities are critical)
- Monitoring and updating means that everything has to be remake, everything has to be started again, and this is rarely done often.

PART 7: BIDDING PROCESS

The bidding process has different phases, in this part, the phases bidding process will be explained.

Part 7.1 Phases of bidding process

1. Identification of a necessity

The public administrator or a private company need solve a necessity. For example, they need a reparation in their head office.

2. Preparation of the documentation

The Public administrator/ private company prepare the contract that will be use, they make the project with all the technical specification. The objective of projects is satisfying the necessity.

3. Publication

The Public administrator/private company public the offer with the requirement and the conditions to be able to participate.

4. Presentations of offers

The contractors must present the offers within the stated time limits. They must fulfil with all the requirements.

5. Awarding a contract

The promotor must study all the offers and decide which one is better concerning with the requirements.

Part 7.2 Types of procurement procedures

In this section, the types of public procurement will be explained.

7.2.1 Open Procedure

Every bidder can present proposition, it means that this procurement is open to participation on equal terms to all bidders through advertisement of the opportunity. The Open Procedure can be used freely in any circumstances and for any type of contract.

Criteria of valuation		
Unique criteria		Multi criteria
Economical criteria		Qualitative criteria
Price	Profitability	Environmental or social aspects,quality,accessability etc

Table 4 Example of criteria valuation

7.2.2 Restricted Procedure

The Restricted Procedure is a two-stage process. The first stage is the selection of bidders, where the capacity, aptitude and experience of the bidders are evaluated.

The second stage is the submission of the offer, bidders can only present propositions, at their request and solvency, if only if they are selected by the contracting authority.

In this procedure, any negotiation of the terms of the contract with the applicants is forbidden. It is recommended in the case of particularly complex execution.
The criteria of valuation are the same as open bidding.

7.2.3 Bid with negotiation:

The administration consults several contractors and negotiates the terms of the contract with one or more of them, whom has been awarded the contract. The criteria of valuation can be the lower price with others criteria.

7.2.4 Competitive Dialogue

Competitive Dialogue allows tenderers to submit initial solutions after being successful at the selection stage. It allows the promoter to negotiate proposed solutions with bidders.

Competitive Dialogue may be beneficial where:

- Project is innovative
- The negotiation is necessary, complexity
- The promoter is unable to specify the requirements with enough accuracy. Therefore, bidders may have a major role in defining the solution

PART 8: BAD PRAXIS AND PROBLEMS

In this part, some bad praxis of the contractor and promotor will be explained as well some problems that can appear in the construction.

Part 8.1 Bad praxis of the contractors

Usually the project, take into account different aspect for evaluate the offers, one of the most important is the budget. As a result, the contractors offer budget very low, in comparison with the **estimated value of the project** (EVP), that make impossible do the project with the specification. They do that because, they hope to find new activities that were not consider, it is known as, pricing discrepancies.

Usually, all the offers, also called **bid price** (BP) of the contractor have a lower price, this reduction is called **relative decrease in the contract price** (RDP).

$$RDP\% = \left(1 - \frac{BP}{EVP}\right) * 100$$

The problem is when this "RDP", is much lower that the estimated value, it is known as **abnormally low bid price** (ALBP). When an abnormally low bid price is sent to the promotor, the promotor will discard this budget because it is impossible to do the project with the initial specification, but sometimes, promotors accept those offers.

In the *Table 5* is shown the EVP 8.959.445,39 € for a project, one building company offers a BP of 7.188.612,00 €, it is a huge reduction of the budget, this reduction is considered an ALBP, the reduction is 19.78%.

Estimated value of the project (with VAT)	8.959.445,39 €
OFFER (with VAT)	7.188.612,00 €
Relative decrease in the contract price of Building company = Abnormally low bid price	19,78%
Mean RDP	9,38%

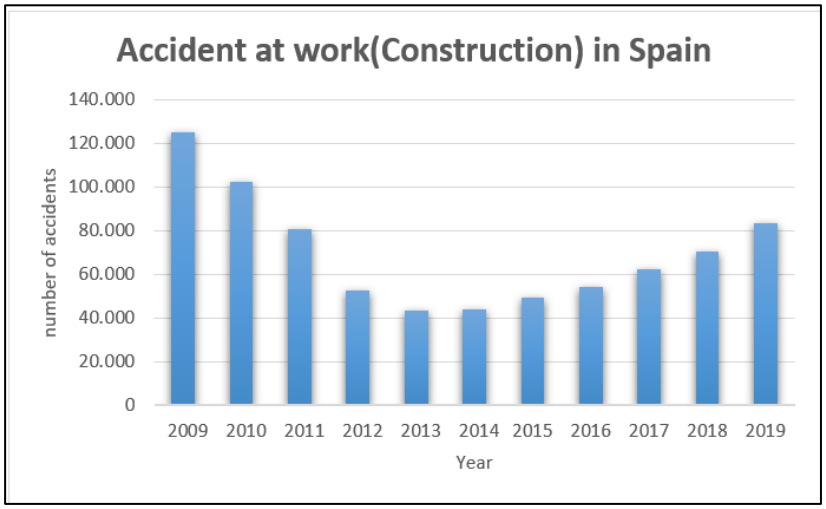
Table 5 Offer building company

It is really important sign the modifications, because sometimes when the construction starts, some materials that not were expected appear, it will generate pricing discrepancies. Usually, the promotor and the contractor talk and reach an agreement, the problem is that they do not sign the price of this new activity (*Figure 11*). When the contractor sends the receipt of this pricing discrepancy, the promotor does not want to pay.

Figure 11 Sign agreement

In many cases, subcontracting allows a higher degree of specialization. In addition, this praxis facilitates the participation of small, medium-sized companies in the sector of construction, which contributes to job creation. However, subcontracting increase the accident rate.

The *Graphic 2* (Ministerio de trabajo y economia social, 2019) shows that the accidents at work in construction decreases since 2019 to 2014, this decrease was because of the crisis in Spain (2018-2014), the sector of the construction in the crisis was critically affected. Since 2015 to 2019 the accidents at work increases, the majority of accidents in construction were because of subcontracting.



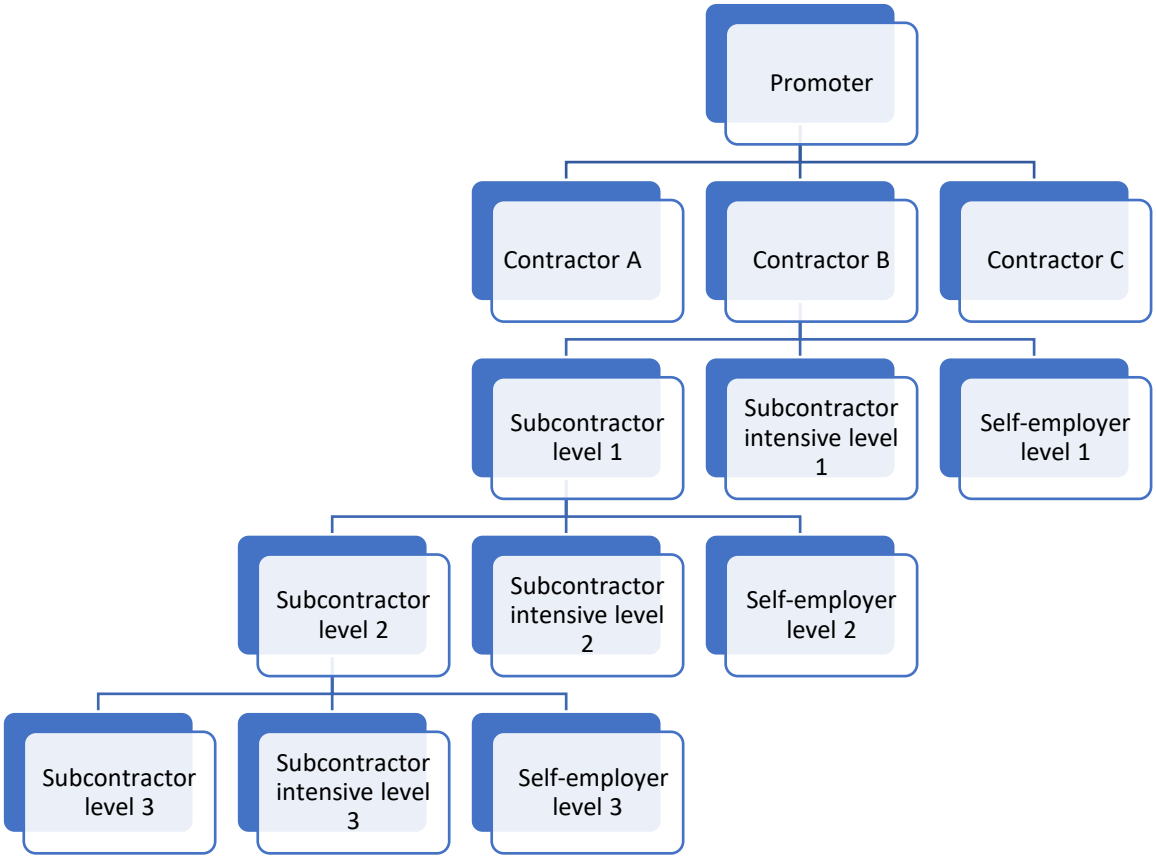
Graphic 2 Accident at work (Construction) in Spain

Another important problem of subcontracting is that the responsibility does not subcontract. It means that if the subcontracted company does mistakes in the project, the contractor will be responsible and sometimes they will spend more money solving those mistakes.

According to the *Article 1140 of Civil code of Spain*, the contractor must deal with solidarity of payment. If the subcontracted company does not pay to his workers, the contractor will pay them.

Subcontracting sometimes is a bad idea because it will give to the contractor a lot of responsibilities. Usually, the companies subcontract without evaluate the disadvantages, and this praxis will affect to the benefit of the subcontractors.

In Spain, the regulator frame work of subcontracting in the sector of construction is “Ley 32/2006, de 18 de octubre”. According to this law, the maxim level of subcontracting is level 3 (Graphic 3 maximum level of subcontracting).



Graphic 3 maximum level of subcontracting

Another problem that bidders do; they not accomplish with the transparency. A constructor with some different building companies applies for the same project. This constructor will have more possibilities to being selected for the project, also the constructor will have more power in the bidding process.

The (artículo 139.3-Ley 9/2017, de 8 de noviembre, de Contratos del Sector Público) specify that each bidder may not submit more than one offer due to the necessity of guarantee equality of conditions to all bidders, avoiding the possibility of benefit advantageous situations for any of them or the risks of manipulation of the bidding process.

The following example shows how a contractor with different building company apply for the same project (*Table 6*).

The contractor sent four offers (D, H, I, J).

Estimated value of the project			700.000,00 €
OFFERS	BID PRICE	RDP(%)	screening (RDP <=18,48%)
A	561.000,00 €	19,85714286	No
B	563.000,00 €	19,57142857	No
C	565.000,00 €	19,28571429	No
D	600.000,00 €	14,28571429	yes
E	674.000,00 €	3,714285714	yes
F	677.000,00 €	3,285714286	yes
G	681.000,00 €	2,714285714	yes
H	691.000,00 €	1,285714286	yes
I	696.000,00 €	0,571428571	yes
J	698.000,00 €	0,285714286	yes

Table 6 Example of a contractor with different building company apply for the same project

$$Mean\ RDP\ (\%) = 8{,}48\ \%$$

$$Abnormally\ RDP\ (\%) = 8{,}48 + 10 = 18{,}48\ \%$$

The contractor with four building companies eliminated the offers A, B, C because he has more weight that affected in the calculation of Abnormally Reduction Price.

What would happen if the contractor had just sent one offer (D)? (*Table 7).*

Estimated value of the project			700.000,00 €
OFFERS	BID PRICE	RDP(%)	screening (RDP <=21,81%)
A	561.000,00 €	19,8571429	yes
B	563.000,00 €	19,5714286	yes
C	565.000,00 €	19,2857143	yes
D	600.000,00 €	14,2857143	yes
E	674.000,00 €	3,71428571	yes
F	677.000,00 €	3,28571429	yes
G	681.000,00 €	2,71428571	yes

Table 7 Contractor only sends one offer

$$Mean\ RDP\ (\%) = 11{,}81\ \%$$

$$Abnormally\ RDP\ (\%) = 11{,}81 + 10 = 21{,}81\ \%$$

If the contractor had just sent one offer, the offers A, B, C would not have been eliminated.

Another common practise is also related with the offers. All bidders agree on who will be the winner. This bad praxis affects to the project because the bidders do not look for the best solution, do not make effort in the project.

When the bidders decide who will win the project, the winner will not offer low prices to the promotor, also will not find innovative solutions.

Part 8.2 Bad praxis of the promoter

Not only the contractor has fault when they are bidding, the promoter makes also mistakes. The principal problem of the bidding process is the short term that the promoter is given to the contractor. Making the impossible evaluating the project, so the contractor bids some work consignment without asking fees to companies. The short time to evaluate the project and the excess of work could make burnout to the bidders (*Figure 12)*.

Figure 12 Burnout

Another mistake related with the time; it is that promoter does not give enough time to the project executor to elaborate a detailed project. Usually, projects have mistakes, the problem is when these mistakes are so important that makes impossible for bidders evaluate correctly the project.

The *Figure 13* shows a mistake of a project executor, he did not review the plots and did not realize that the wall should be located further from the column.

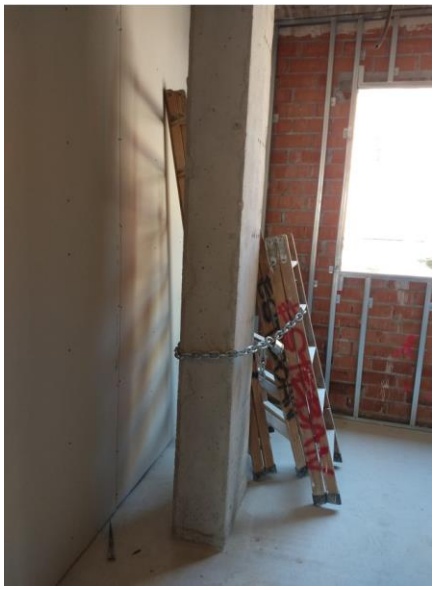


Figure 13 Mistake of project executor

It is impossible to know all the material that it will be found in the subsoil. Usually, the contractor finds materials that were not contemplated in the project and as was explained in the ***Part 6*** of this thesis, the changes at the middle of the project will increase the cost significantly. A recommendation is investing more money in the geotechnical studies. Moreover, the promoter must have availability to change the deadline of the project, because a material that was not contemplated in the project could affect to the deadline and the budget.

The most important problem of public promoter is the corruption. The corruption is one of the most structural problems that public bidding process has suffered for a long time. According to corruption perceptions index, (Transparency International, 2021).Spain and in The Czech Republic are in the queue of European countries with less corruption, Spain positions in 34 place with 64 points and in The Czech Republic positions in 49 place with 54 points (*Figure 14*). Sometimes, public administration gives the project to a bidder without taking into account the bidding process, the bidder brides the public administration.

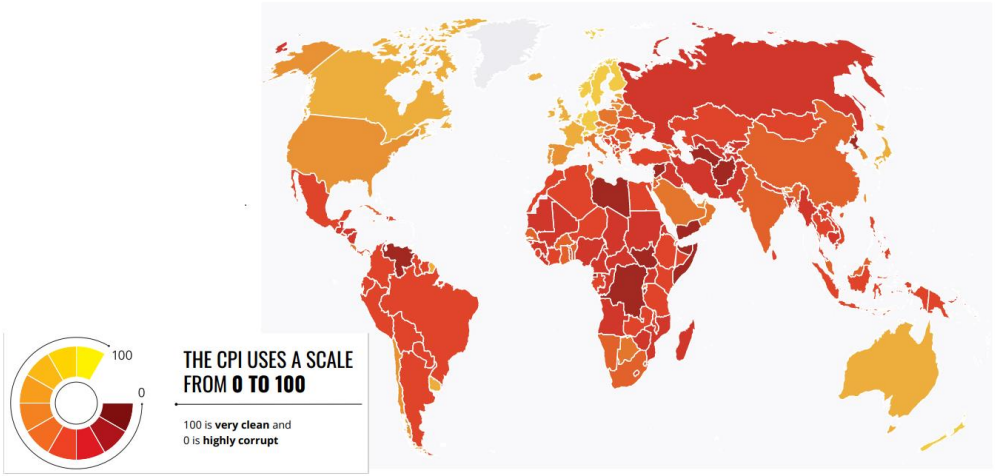


Figure 14 Map of corruption perceptions index

Part 8.3 Problems in the construction

Delays can happen for various reasons such weather, equipment failures, accidents, missing or incorrect data, archaeological remains, project mistakes and conflicts. It is not fault of the promotor, nor the constructor. Delays affect directly to the constructor, increasing the indirect costs.

A famous example of a delay in Spain is the Ave (*Figure 15*), in the railway station Sagrera (Barcelona). The project was supposed started in 2008 and finished in 2012.However, the project had stopped a few times, and to this day, it is unfinished. An important reason of this delay is that in August of 2011, when it was founded archaeological remains.

Figure 15 Construction of Ave in Sagrera (Barcelona)

PART 9: QUANTITY AND COST ESTIMATION

In this part, the process of measurement in Spain and The Czech Republic will be explained, also the most important software will be mention.

Part 9.1 Quantity in Spain

In Spain does not have a law for quantify or making the budget. Usually, the rules for the measurement are redacted in the scope statement, and the budget follow the indications of the work consignment.

The most popular software to make budget and certification in Spain are Presto (*Figure 16*) and Arquimedes (*Figure 17*). Both are commercial BIM software focus on cost and time management for building and civil engineering, both allow cost estimations to be carried out in a project.

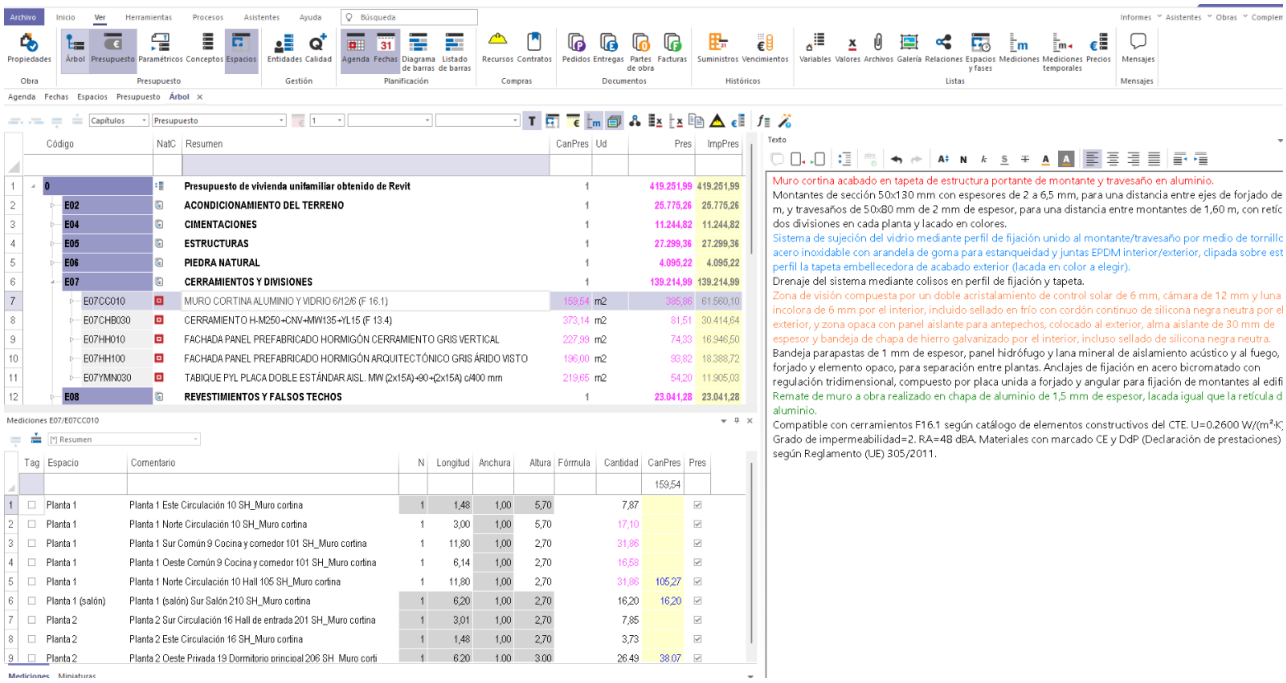


Figure 16 Presto-Interface

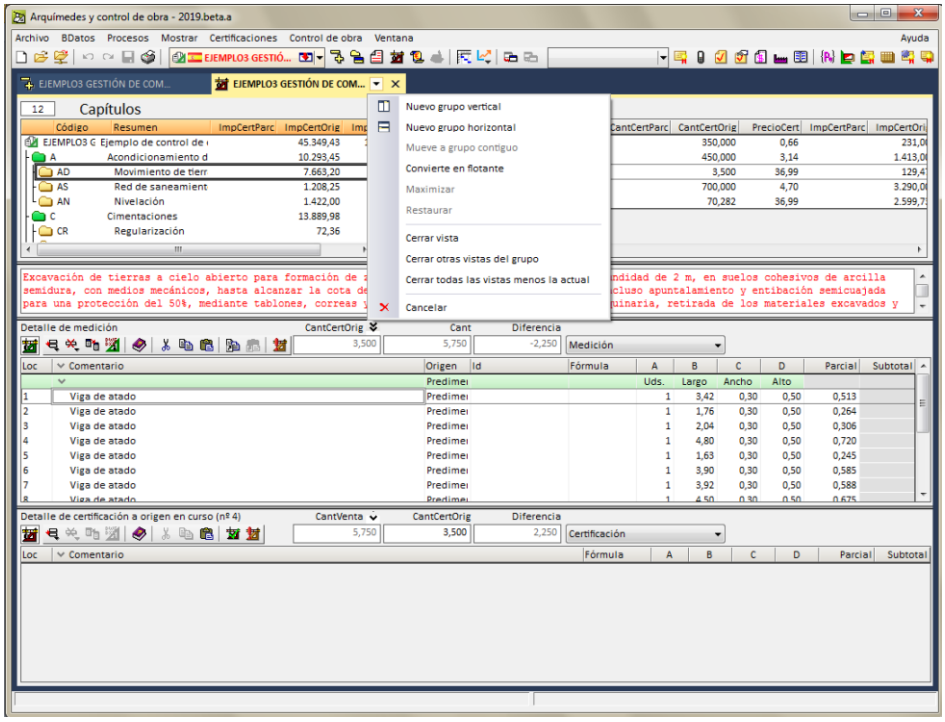


Figure 17 Arquimedes-Interface

When the contractors receive a project, they have a short term to measure and make the budget. It is impossible measure all the work consignment, so they only calculate the quantities of the most important work consignment.

Because of short time to make the budget, to save time, the contractors do not take into account the hole in the walls. Usually, if the hole is smaller than 1 m of length, the contractor will not discount this length. The *Figure 18* shows a wall of perforated brick.

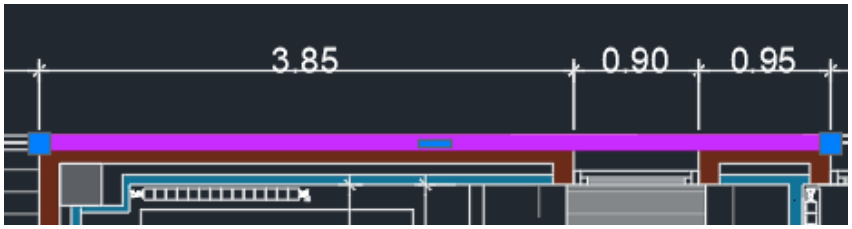


Figure 18 Holes in walls

<u>Calculation of Perforated brick:</u>

- The real length of this part of wall is: 3,85+0,95=4.8m
- The measurement of the contractor is: 3,85+0,90+0,95=5,7m

If we take into account the height of this wall of 2,85m

- The real measurement is: 4,80*2,85=13,68 m^2
- The measurement of the contractor is: 5,70*2,85=16,24 m^2
- Extra benefit for the contractor is: 16,24-13,68=2,56 m^2.

The contractor will do the budget with 16,24 m^2 but he will only use 13,68 m^2. It is necessary take into account that this is only a little part of the wall and contractor in Spain apply this criterion, with more materials.

The *Figure 19* shows a Spanish offer made with Presto. The "Código" is the code of each chapter. The code is used to distinguish parts of the project, codes should have a recognizable structure, from the overall project level to individual jobs and accounts. Each code has associated a job, this job should have an understandable name.

RESUMEN DE PRESUPUESTO

v1

ET19006 14 HABITATGES A VILASSAR DE DALT

CÓDIGO	RESUMEN	IMPORTE
01.01	MOVIMENT DE TERRES	55.872,79
01.02	FONAMENTS	111.244,56
01.03	ESTRUCTURES	235.913,23
01.04	COBERTA I IMPERMEABILITZACIONS	33.402,41
01.05	FAÇANA	129.003,77
01.06	TANCAMENTS I DIVISÒRIES	212.554,01
01.07	REVESTIMENTS I FALS SOSTRES	114.899,08
01.08	PAVIMENTS	144.898,21
01.09	FUSTERIA INTERIOR	65.025,84
01.10	FUSTERIA EXTERIOR	104.396,75
01.11	SERRALLERIA	146.501,90
01.12	MOBILIARI CUINA	89.379,15
01.13	SANITARIS I AIXETERIA	47.949,58
01.14	TRANSPORT VERTICAL	32.851,09
01.15	INSTAL·LACIONS	488.394,34
01.16	PISCINA	63.274,02
01.20	VARIS	11.946,23
01.22	CONTROL DE QUALITAT	15.162,04
01.23	SEGURETAT I SALUT	30.324,09
	TOTAL PRESUPUESTO	**2.132.993,09**

Figure 19 Spanish Offer-Summary

The *Figure 20* shows a detailed chapter of the previous budget. This Figure shows all the activities necessary to complete this chapter. The "Resumen" is a detailed description of the activities. Presto also shows the quantity of materials, unit of measurement, price and total price.

ET19006 14 HABITATGES A VILASSAR DE DALT

CÓDIGO	RESUMEN	UDS	LONGITUD	ANCHURA	ALTURA	PARCIALES	CANTIDAD	PRECIO	IMPORTE
	CAPÍTULO 01.01 MOVIMENT DE TERRES								
E22113C2	**NETEJA+ESBROSSADA TERRENY,RETRO.,+CÀRR.MEC.S/CAMIÓ** Neteja i esbrossada del terreny realitzada amb retroexcavadora i càrrega mecànica sobre camió	m2					599,81	1,26	755,76
E225R00F	**REPÀS+PICON.ESPLANADA,95%PM** Repàs i piconatge d'esplanada, amb una compactació del 95% del PM	m2					457,18	1,26	576,05
E2215422	**EXCAVACIÓ P/SOTERR.,H<=3M,TERRENY COMPACT.(SPT 20-50),PALA EXCAV.+CÀRR.DIRECTA** Excavació de terres per a buidat de soterrani, de fins a 3 m de fondària, en terreny compacte (SPT 20-50), realitzada amb pala excavadora i càrrega directa sobre camió	m3					2026,90	3,79	7.681,96
E225177F	**TERRAPLENAT+PICON.MEC.,TERRES ADEQ.,G<=25CM,95% PM** Terraplenat i piconatge mecànics amb terres adequades, en tongades de fins a 25 cm, amb una compactació del 95% del PM	m3					177,35	8,84	1.567,77
E222142A	**EXCAV.RASA/POU,H<=2M,TERRENY COMPACT.(SPT 20-50),RETRO.,+CÀRR.MEC.S/CAMIÓ** Excavació de rasa i pou de fins a 2 m de fondària, en terreny compacte (SPT 20-50), realitzada amb retroexcavadora i càrrega mecànica sobre camió	m3					378,05	25,27	9.553,37
E2241100	**REPÀS SÒL/PARET RASA/RECALÇAT H<=1,5M** Repàs de sols i parets de rases, pous i recalçats fins a 1,5 m de fondària	m2					242,30	2,53	613,02

Figure 20 Detailed Chapter-Presto

Part 9.2 Quantity in The Czech Republic

In The Czech Republic the Decree No. 169/2016 Coll must be followed, decree on determining the scope of documentation of a public contract for construction works and an inventory of construction works, supplies and services with a statement of acreage.

In The Czech Republic usually, the budgets used to make with the unified classification of structures and structural works with production character JKSO or TSKP.

9.2.1 JKSO and TSKP CLASSIFICATION

With the classification of JKSO, identifying label of structures and works with productive character contains 12 places of numeric code. The classification in the first part is five-scaled, it differentiates sections, groups, subgroups, constructional and material characteristic.

The classification on the first scale denotes the sections of structures expressed by first three places of numeric code.

Summary overview of JKSO sections (*Table 8*):

CODE	Name
SECTIONS OF STRUCTURES	
801	Civil building construction
802	Civil hall construction
803	Home builing
811	Halls for production and services
812	Buildings for production and services
813	Towers, columns,chimneys
814	Reservoirs
815	Special ground objects
817	Nuclear facility
821	Bridges
822	Roads and airports
823	Areas and ground shaping
824	Rail tracks
825	Underground objects
826	Underground objects (viewer)
827	Pipe distance and drop conduction
828	Electric conduction and overpasses
831	Hydroimprovement
832	Dams and objects on the flows
833	Tanks on the flows, flow's adjustment and ducts
SECTIONS OF STRUCTURAL WORKS	
838	Structural works at the building of technological facilities
839	Works with production character in civil engineering

Table 8 Summary overview of JKSO sections

On the second and the third scale of code is indicated the group of structures according the construction and technical similarity and function, which the structure fills in itself. Construction and technical similarity are then characterized by the name as “the building, the tower, the mast, the bridge” etc. The purpose is characterized by the names as “home building, civil building constructions, for the productive purposes” etc.

The fourth scale of classification assigns the main constructional and material characteristic of the object (*Table 9)*.

6.PLACE OF JKSO CODE	VERTICAL SUPPORTING STRUCTURE
1	Walled from bricks, tiles and blocks
2	Monolithic concrete bared
3	Monolithic concrete plane
4	Prefab from the concrete bared parts
5	Prefab from the concrete plane parts
6	Prefab form space cell
7	Metallic
8	Wooden and on the xylem substance based
9	From other materials

Table 9 Overview of constructional and material characteristic

The fifth scale assigns the kind of construction action, novelty or construction changes (Table *10)*.

7 PLACE OF JKSO CODE	KIND OF STRUCTURAL WORK
1	Building under construction
2	Re-adjustment and modernization of the object-simple
3	Re-adjustment and modernization of the object-with reparation
4	Superstructure, additional building etc. (enlargement of the object)
5	Re-adjustment and modernization of the object-with enlargement
6	Re-adjustment and modernization of the object-with enlargement and reparation
7	Vacant
8	Vacant
9	Other construction actions

Table 10 Overview of kind of construction action, novelty or construction changes

The following plots *(*Figures *21 and 22*) shows a simple house.

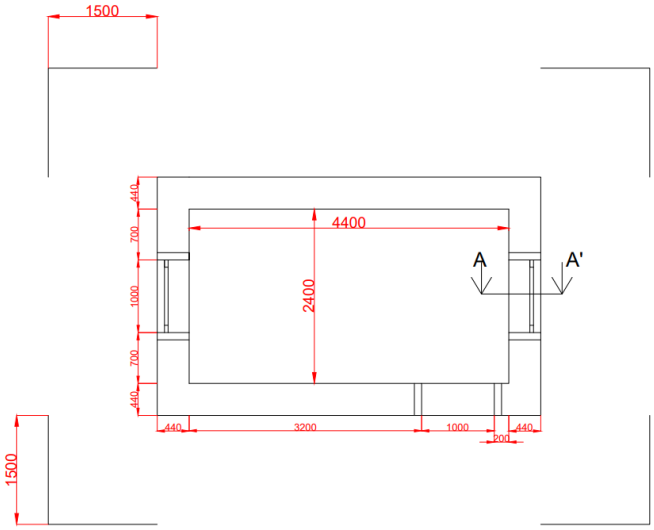


figure 21 plant-house

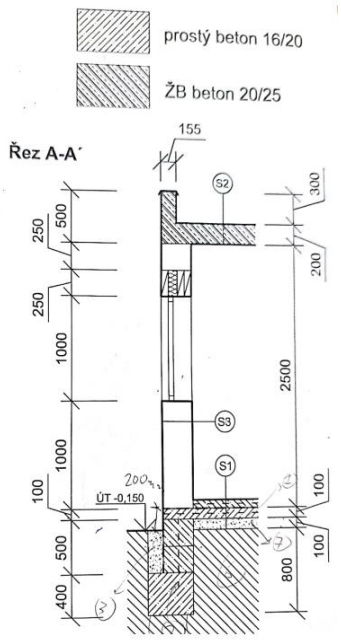


Figure 22 Section-house

In this part, a budget will be made according to the codification TSKP.
The *Table 11* shows the budget of Earthworks, Foundations, Vertical Construction and Horizontal construction in Czech crown.

Item number	Code	Description	Mesure unit	Quantity	Unit Price(CZ)	Total price
		1 EARTHWORKS				
1	12151103	Removin topsoil,thick up to 200 mm	m2	51,78	56	2.899,68
2	132251102	Excavation of grooves, up to 800 mm by machine	m2	6,5952	768	5.065,11
3	174151101	Backfill pits or around objects	m3	1,0992	143	157,19
4	162351103	Horizontal transfer of excavation over 50 to 500m	m3	6,5952	79,3	523,00
5	171201231	Ladfill fee	t	13,2	294	3.880,80
		1 EARTHWORKS TOTAL PRICE				**12.525,78**
		2 FOUNDATIONS				
6	271532212	Subsoil under foundation fraction 16 to 32 mm	m3	1,056	1820	1921,92
7	273321311	Reinforced concrete slab	m3	8,6592	3183,26	27564,485
8	273351121	Formwork-boarding	m2	8,56	503	4305,68
9	273351122	Formwork-removal	m2	8,56	128	1095,68
10	273362021	Reinforcement of foundation by KARI NETS	t	0,05217	49900	2603,283
11	274313611	Concrete foundations stribs, class. C16/20	m3	3,2976	3100	10222,56
		2 FOUNDATIONS TOTAL PRICE				**47713,608**
		3 VERTICAL CONSTRUCTION				
12	311113136	Permanent Formworkth 500mm Including concrete C16/20	m2	8,56	2630	22.512,80
13	311234111	CLAY MANSORY From Hollow Clay Blocks, thickness 440 mm	m2	37,86	2602,5	98.530,65
14	317168052	CLAY LINTEL, Hight 238 mm, Long 1250 mm	P	15	622	9.330,00
15	317998114	Thermal insulation between clay Lintels, 24 cm Height, From EPS, Thickness 90 mm	m	3,75	91,9	344,63
		3 VERTICAL CONSTRUCTION TOTAL PRICE				**130.718,08**
		4 HORIZONTAL CONSTRUCTION				
16	271532212	REINFORCED CONCRETE FLOOR SLAB , C20/25	m3	4,25	3560	15130
17	273321311	FORMWORK FOR FLOOR SLAB-ERECTION	m2	24,69	522	12888,18
18	273351121	FORMWORK FOR FLOOR SLAB-REMOVAL	m2	0,56	132	73,92
19	273351122	FALSE WORK FOR FLOOR SLAB-ERECTION	m2	0,492	195	95,94
20	273362021	FALSE WORK FOR FLOOR SLAB-REMOVAL	m2	10,56	61,3	647,328
21	274313611	REINFORCEMENT OF FLOOR SLAB WITH REINFORCING BARS	t	0,51	62900	32079
		4 HORIZONTAL CONSTRUCTION TOTAL				**60914,368**

Table 11 Budget according to codification TSKP-Part-1

The *Table 12* shows the Internal Finishes, External Finishes, Floors, Scaffold and Main Strutural Production (HSV).

$$HSV = Earthworks + Foundations + Vertical\ Construction + Horizontal\ Construction + Internal\ Finishes + External\ Finishes + Floors + Scaffold$$

Item number	Code	Description	Mesure unit	Quantity	Unit Price(CZ)	Total price
		6.1 INTERNAL FINISHES				
22	611321141	Lime-cement plaster-ceilling	m2	10,56	373	3938,88
23	612321141	Lime-cement plaster-walls	m2	33,3	458,7	15274,71
		61 INTERNAL FINISHES TOTAL				**19213,59**
		62 EXTERNAL FINISHES				
24	622321121	Lime-cement coerse-walls	m2	52,38	294	15399,72
25	6214200	Coating of OUTER Walls with fiber class mesh pressed INTO the thin-layer material	m2	52,38	237	12414,06
26	622531012	Thin-Layer plaster, grain size 1,5 mm, buter walls	m2	52,38	406	21266,28
		6.2 EXTERNAL FINISHES TOTAL				**49080,06**
		63 FLOORS				
27	63131124	Screed from concrete, class. C16/20, thickess over 80 to 120 mm	m3	1,056	4010	4234,56
28	631362021	Reinforcement of screed with weed mesh (KARI)	t	0,031	49900	1546,9
		6.3 FLOOR TOTAL				**5781,46**
		94 SCAFFOLD				
29	949101111	Auxiliary scaffold, height to 1,9 m	m2	10,56	61,6	**650,496**
		94 SCAFFOLD TOTAL				650,496
		MAIN STRUCTURAL PRODUCTION (HSV)				**326.597,44**

Table 12 Budget according to codification TSKP-Part-2

The *Table 12* shows the Damp-Proof In Insulation, Roof Covering,Joiner Worky and Painting

Item number	Code	Description	Mesure unit	Quantity	Unit Price(CZ)	Total price
		711 DAMP-PROOF IN INSULATION				
30	71111001	Damp-proofing by penetration coating,horizontal	m2	17,31	11,2	193,872
31	11163150	Asphalt penectrating varnish 1m2....0,3kg	t	5,19E-03	51800	268,9974
32	711141559	Damp-proofing by asphalt sheet	m2	17,31	109,53	1895,9643
33	62853004	Modified asphalt bands with fiber glass at th 4,0 mm 1m2 .....1,15m2	m2	19,9	164	3263,6
		711 DAMP-PROOF IN INSULATION TOTAL				5622,4337
		712 ROOF COVERING				
34	712311101	WATERPROFING FOR ROOF BY PENETRATION COATING, HORIZONTAL	m2	17,32	13,5	233,82
35	712341559	WATERPROFING FOR ROOF BY PEN.COATING V	m2	4,764	117	557,388
36	11163150	ASPHALT PENETRATION VARNISH	t	0,0071	51800	367,78
37	712811101	WATER PROF FOR ROOF BY ASPHALT SHEET, H	m2	34,64	14,9	516,136
38	712841559	WATER PR. FOR ROOF BY ASPHALT SHEET, V	m2	9,52	156	1485,12
39	62853004	Modified Asphalt Bands , Fiberglass-mat	m2	25,63	164	4203,32
40	62855001	Modified Asphalt Bands, polyste-mat	m2	25,63	181	4639,03
		712 ROOF COVERING Total				**12002,594**
		766 JOINER WORKY				
41	766621011	WINDOW INSTALLATION, HEIGHT UP TO 1,5 M, FRAME IN MASONRY	U	2	622	1244
42	61110003	WOODEN WINDOW,TRIPLE GLAZING, 1000X1000 mm	U	2	6490	12980
43	766660411	Front door Installation, In Mansory	U	1	3470	3470
44	61140500	Single-Leaf wooden door 1000x2000mm	U	1	39440	39440
		766 JOINER WORKY TOTAL				**57134**
		784 PAINTING				
45	784181101	PENETRATING COATING	m2	43,86	18	789,48
46	784221101	Rainting-white colour, roon height up to 3,8m, two coarts	m2	43,86	40,7	1785,102
		784 PAINTING TOTAL				**2574,582**

Table 13 Budget according to codification TSKP-Part-3

The *Table 14* is the recapitulation of this budget.

RECAPITULATION	TOTAL PRICE CZ
HSV	
1 EARTHWORKS	12.525,78
2 FOUNDATIONS	47713,60799
3 VERTICAL CONSTRUCTION	130.718,08
4 HORIZONTAL CONSTRUCTION	60914,368
61 INTERNAL FINISHES TOTAL	19213,59
62 EXTERNAL FINISHES	49080,06
63 FLORRS	5781,46
94 SCAFFOLD	650,496
HSV TOTAL PRICE	326.597,44
PSV	77333,6097
TOTAL	**403.931,05**

Table 14 Recapitulation

The following part shows how some activities has been calculated.

Item number:

1) $$(5{,}28 + 1{,}5 * 2) * (3{,}28 + 1{,}5 * 2) = 51{,}78\ m^2$$

2) $$(0{,}8 * 0{,}45) * (5{,}58 + 3{,}58) * 2 = 6{,}59\ m^2$$

3) $$(0{,}15 * 0{,}4)(5{,}58 + 3{,}58) * 2 = 1{,}0992\ m^3$$

4) the same as item 2)

9.2.2 Pricing system in The Czech Republic

All the material of the activities in The Czech Republic are equal to the reality, they do not round the quantities like in Spain.

The prices of the activities are standard, so there are two ways to estimate the values of the activities, with books or with software.

9.2.2.1 Pricing system with book

The book is updated every 6 months. Sometimes, with the book some activities are difficult to estimate, so it is required know the following knowledge.

At present the costing formula used in civil engineering has the following framework:

Direct costs	**PN**
Direct material	H
Direct wages	M
Direct machine costs	S
Next direct costs	OPN
Indirect costs	**NN**
Factory overhead	RV
Regular expense	RS
Total costs	
Profit	Z
Computed price	**C**

The computed price is the cost price.

The direct material (H) involves the costs for material, whose quantity is possible to calculate direct for the costing unit.

The direct wages (M) are the wages of the workers, who participate directly on the production and their efforts are possible to assign for the costing unit.

Direct machine costs (S) and the costs for mechanisms are cost for their purchase.

Next direct costs (OPN) are all kinds of the costs, that are possible to calculate directly per the costing unit and they are not involved in the previous.

Overheads (R) are the costs, that are impossible to assign per the costing unit.

Where **R = RV + RS**;

We calculate these overheads:

- **Productive (RV),** that involves all kinds of the costs arising at the production realization, but are impossible to assign per the costing unit.
  RV = (M + OPN) *s1
  Where s1 is the rate of the factory overhead assigned from the accountancy evidence of the past period.

- **Regular expense (RS),** they are the costs connected with the administration and the management of the firm. It involves all kinds of the costs including the wages and social and health insurance of the administrative workers.
  RS= (M + OPN) *s2
  Where s2 is the rate of the regular expense assigned from the accountancy evidence of the past period.

Profit (Z), is assigned from the total volume of the required profit and per the particular costing units it is divided through the additional fees or in the absolute value.

Where s3 is the rate of the profit.

$$Z = (M + OPN + RV + RS) * s3$$

To do difficult calculation the costing formula **ÚRS** is used.

The ÚRS costing formula, used since 1997 in the prices of the structural works, has the following framework:

$$C = H + M + OPN + RV + RS + Z$$

Example of calculation of cost (Tables *15 & 16*):

Item number 13 "CLAY MANSORY From Hollow Clay Blocks, thickness 440 mm"

H				
Water		m3	price (CZ)	total price (CZ)
		0,02019	52,8	1,066032
Mortar		t	price (CZ)	total price (CZ)
		0,074	3580	264,92
Clay block,440 mm		m2	price (CZ)	total price (CZ)
		1,02	1760	1795,2
H total				**2061,186032**

Table 15 Calculation of Costs with formula ÚRS Part-1

M				
M WORKER		NUM OF HOUR	price (CZ)	total price (CZ)
		1,26	165,1	208,026
M Total				**208,026**

Table 16 Calculation of Costs with formula ÚRS Part-2

OPN = M* 33,8% = 208,026*0,338 = 70,31 CZ

$S_{AGITATOR}$ = 0,1292 (sh)*10,5(CZ)=1,3566 CZ

R_V= (M+OPN+S)*vv= 106,27 CZ

R_s= (M+OPN+S)*vs= 72,71 CZ

Z = (M+OPN+S+R_V+R_S)*z= 82,557 CZ

C = 2062,5 CZ/m2 price of CLAY MANSORY From Hollow Clay Blocks, thickness 440 mm"

9.2.2.2 Pricing system with software

In The Czech Republic there are two main software to estimate the values of activities, KROS 4 and BUILDpower S (Figure 23).

KROS 4 construction software is destined for creating budgets, calculations of construction works and monitoring of construction contract. It is the only one in The Czech Republic that

contains the complete form of the ÚRS Price System and is able to work with any other database of construction work prices.

Figure 23 Software Kros 4 & BUILDPpower S

BUILDpower S is a comprehensive construction information system that provides support in the management of construction contracts. In general, it covers activities, bid evaluation, production preparation, execution and construction control. The system works interconnected on two seemingly separate lines, prices and costs. The creation of item budgets is supported by the RTS DATA price system.

The *Figure 24* show a budget made with BUILDpower S.

POLOŽKOVÝ ROZPOČET Detailed budget

Rozpočet	**9015**	**Řezáčova 58, byt č.23**	JKSO	
Objekt	Název objektu		SKP	
01	**Obecní byty**		Měrná jednotka	
Stavba	Název stavby		Počet jednotek	0
1	**oprava bytů Komín**		Náklady na m.j.	0
Projektant			Typ rozpočtu	
Zpracovatel projektu	0			
Objednatel				
Dodavatel			Zakázkové číslo	217
Rozpočtoval			Počet listů	

ROZPOČTOVÉ NÁKLADY

	Základní rozpočtové náklady		**Ostatní rozpočtové náklady**	
	HSV celkem	32 942	Ztížené výrobní podmínky	0
Z	PSV celkem	168 615	Oborová přirážka	0
R	M práce celkem	23 323	Přesun stavebních kapacit	0
N	M dodávky celkem	0	Mimostaveništní doprava	2 699
	ZRN celkem	224 880	Zařízení staveniště	1 124
			Provoz investora	0
	HZS	0	Kompletační činnost (IČD)	2 923
	ZRN+HZS	224 880	Ostatní náklady neuvedené	0
	ZRN+ost.náklady+HZS	231 626	Ostatní náklady celkem	6 746

Vypracoval	**Za zhotovitele**	**Za objednatele**
Jméno :	Jméno :	Jméno :
Datum :	Datum :	Datum :
Podpis :	Podpis:	Podpis:

Základ pro DPH	15,0	%	231 626 Kč
DPH	15,0	%	34 744 Kč
Základ pro DPH	0,0	%	0 Kč
DPH	0,0	%	0 Kč
CENA ZA OBJEKT CELKEM Total price of the project			**266 370 Kč**

Figure 24 Budget made with BUILDpower S-Summary

The *Figure 25* shows the Construction Summary.

Stavba :	1 oprava bytů Komín	Rozpočet :	002
Objekt :	01 Obecní byty	Řezáčova 58, byt č.23	

REKAPITULACE STAVEBNÍCH DÍLŮ Construction summary

Stavební díl		HSV	PSV	Dodávka	Montáž	HZS
34	Stěny a příčky	15 791	0	0	0	0
61	Upravy povrchů vnitřní	2 705	0	0	0	0
62	Úpravy povrchů vnější	2 072	0	0	0	0
729	Vnitřní vodovod ekoplastik	5 775	0	0	0	0
95	Dokončovací konstrukce na pozemních stavb	5 668	0	0	0	0
96	Bourání konstrukcí	932	0	0	0	0
713	Izolace tepelné	0	188	0	0	0
723	Vnitřní plynovod	0	393	0	0	0
725	Zařizovací předměty	0	25 988	0	0	0
730	Ústřední vytápění	0	1 500	0	0	0
7631	Konstrukce sádrokartonové	0	16 977	0	0	0
766	Konstrukce truhlářské	0	46 898	0	0	0
771	Podlahy z dlaždic a obklady	0	2 623	0	0	0
777	Podlahy ze syntetických hmot	0	29 358	0	0	0
781	Obklady keramické	0	13 361	0	0	0
783	Nátěry	0	3 470	0	0	0
784	Malby	0	26 054	0	0	0
799	Ostatní	0	1 806	0	0	0
M21	Elektromontáže	0	0	0	23 323	0
	CELKEM OBJEKT	**32 942**	**168 615**	**0**	**23 323**	**0**

VEDLEJŠÍ ROZPOČTOVÉ NÁKLADY

Název VRN	Kč	%	Základna	Kč
Ztížené výrobní podmínky	0	0,0	201 557	0
Oborová přirážka	0	0,0	201 557	0
Přesun stavebních kapacit	0	0,0	201 557	0
Mimostaveništní doprava	0	1,2	224 880	2 699
Zařízení staveniště	0	0,5	224 880	1 124
Provoz investora	0	0,0	224 880	0
Kompletační činnost (IČD)	0	1,3	224 880	2 923
Rezerva rozpočtu	0	0,0	224 880	0
CELKEM VRN				**6 746**

Figure 25 Construction Summary

The *Figure 26* shows the decomposition of the budget. It shows the chapters and the correspondent activities that form each chapter.

Položkový rozpočet Detailed budget

Stavba :	1 oprava bytů Komín	Rozpočet: 002	
Objekt :	01 Obecní byty	Řezáčova 58, byt č.23	

P.č.	Číslo položky	Název položky	MJ	množství	cena / MJ	celkem (Kč)
Díl:	**34**	**Stěny a příčky**				
1	346244351RT2	Obezdívka koupelnových van tl. 6,5 cm s použitím suché maltové směsi	m2	1,19	600,00	714,00
2	642944121RT5	Osazení ocelových zárubní dodatečně do 2,5 m2. včetně dodávky zárubně CgH 90x197x11 cm	kus	10,00	1 383,00	13 830,00
3	771111131R00	Vyplnění dilatačních spár tmelem	m	31,18	40,00	1 247,20
	Celkem za	***34 Stěny a příčky***				**15 791,20**
Díl:	**61**	**Upravy povrchů vnitřní**				
4	602015191R00	Podkladní nátěr pod tenkovrstvé omítky	m2	14,96	32,60	487,70
5	614471715R00	Vyspravení beton. konstrukcí - adhézní můstek	m2	18,10	122,50	2 217,25
	Celkem za	***61 Upravy povrchů vnitřní***				**2 704,95**
Díl:	**62**	**Úpravy povrchů vnější**				
6	601011131R00	Omítka stropů jednovrstvá Cemix 073 ručně	m2	4,24	186,50	790,76
7	602011131R00	Omítka jednovrstvá Cemix 073 ručně	m2	10,72	119,50	1 281,04
	Celkem za	***62 Úpravy povrchů vnější***				**2 071,80**
Díl:	**729**	**Vnitřní vodovod ekoplastik**				
8	722300011RA0	Vodovod, potrubí PPR - typ 3 Daplen PN 20, DN 20	m	11,00	525,00	5 775,00
	Celkem za	***729 Vnitřní vodovod ekoplastik***				**5 775,00**
Díl:	**95**	**Dokončovací konstrukce na pozemních stavbách**				
9	952901110R00	Čištění mytím vnějších ploch oken a dveří	m2	11,87	30,80	365,60
10	952901111R00	Vyčištění budov o výšce podlaží do 4 m	m2	73,44	72,20	5 302,37
	Celkem za	***95 Dokončovací konstrukce na pozemních stavbách***				**5 667,96**
Díl:	**96**	**Bourání konstrukcí**				
11	965081713RT1	Bourání dlaždic keramických tl. 1 cm, nad 1 m2 ručně dlaždice keramické	m2	2,57	49,90	128,24
12	978059511R00	Odsekání vnitřních obkladů stěn do 1 m2	m2	1,97	169,00	332,93
13	979011111R00	Svislá doprava suti a vybour. hmot za 2.NP a 1.PP	t	0,19	239,00	45,41
14	979081111R00	Odvoz suti a vybour. hmot na skládku do 1 km	t	0,19	253,00	48,07
15	979081121R00	Příplatek k odvozu za každý další 1 km	t	1,67	14,60	24,38
16	979082111R00	Vnitrostaveništní doprava suti do 10 m	t	0,19	204,00	38,76
17	979082121R00	Příplatek k vnitrost. dopravě suti za dalších 5 m	t	0,19	22,80	4,33
18	979990001R00	Poplatek za skládku stavební suti	t	0,19	500,00	95,00
19	998011032R00	Přesun hmot pro budovy z bloků výšky do 12 m	t	1,08	198,50	214,38
	Celkem za	***96 Bourání konstrukcí***				**931,51**

Figure 26 Decomposition of the budget

PART 10: SELECTION CRITERIA

In this part, the most common criteria in bidding process will be explained in order to understand the advantages and disadvantages of these criteria selection.

Part 10.1 Lowest bid price

Usually, the selection criteria are the lower offer. A promotor who selects a contractor using the low-bid method should be aware of several possible consequences (*Figure 27*). First, the promotor assumes that all firms will construct with the same specifications and quality as the project executor's design.

Figure 27 Consequences of low-bid method

The lowest bid price might not always be the most economical one for the owner because it might not always result in the lowest possible final cost after project completion. It is because, the bidders that submit unrealistically low bid price will try to apply for excessive change, in order to raise the cost of construction.

Part 10.2 Most economically advantageous tender (MEAT)

The Most Economically Advantageous Tender (MEAT) is a method of assessment that can be used as the selection procedure. This method not only take into account the lower offer of the bidders, it also gives importance to other aspects like:

- Quality
- Innovative characteristic
- Environmental characteristics
- Social characteristic
- Maintenance
- Delivery conditions

The announcement of the project, must show that the contract will use the MEAT criteria, the details of the criteria must show in the announcement.

Each of the criteria used is given a relative weighting, the weighting is done according to the importance in the project. Once the criteria and weighting has established, those must not be change. The *Figure 28* shows a diagram of MEAT.

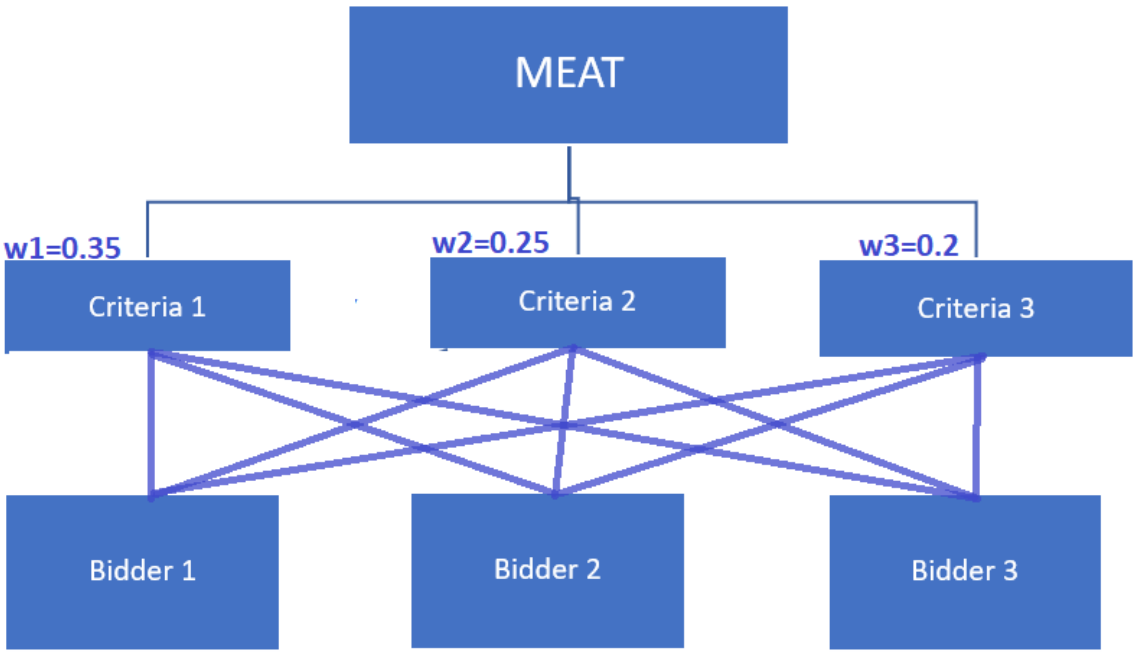


Figure 28 Meat Diagram

Part 10.3 Best Value Procurement

Best Value Procurement (BVP) is designed to increase project value by mitigating risks and increasing the transparency by underscoring the pre-award phase. (Wondimu).This method was invented by Dean kashiwagi (*Figure 29*) a professor at Arizona State University. The method not only take into account the price, also the quality, the experience of the contractors etc.

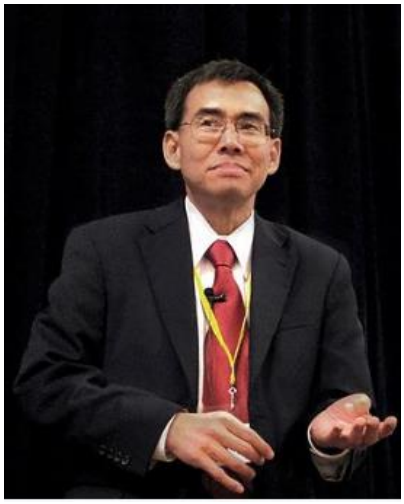


Figure 29 Dean T. Kashiwagi, speaking at a best value conference on February 9, 2009

There are four phases of the best value procurement:

Pre-Qualification Phase

This phase is a preparation for the next phase (Selection phase). The bidders can skip this phase if they want.

First, the bidders must find a **sponsor**. The sponsor is an entity that recognises the need for increasing efficiency and accountability and the overlap with BVP (Arnoud Storteboom).

Second, the promotor should contract a **BP expert**, in order to ensure the quality of the BVP and generate transparency in the procurement. Without a BP expert with experiences, the bidding process would be like the traditional criteria as lowest bid price.

Third, a core **team must be selected and educated** in all the projects because every project is different. The core team are in charge of manage the subcontractors and are also responsible for deliver agreements effectively throughout the phases.

Next, the promotor must made use of **pre-qualification**. The objective of this pre-qualification is limiting the number of bidders.

Finally, a **core document** is made. It should include the project objective, scope, indicators with weighting factors. The price is part of the weighting factors in the selection. In some cases, the projects have an open budget.

N.o	Criterion	Maximum points
1	Price	250 points
2	Experience and references	350 points
3	Personnel qualified	350 points
4	Financial capability	300 points
5	Equipment	250 points
Total points		**1500 points**

Table 17 Typical criterion

Selection Phase

The promotor and the applicants will do a **meet**. This meet is to inform and train all the candidates with the BVP methodology.

In this phase, some filters will apply to reduce the number of applicants. The filters are usually, short listening, interviews with key personnel, etc. At the end of this phase, the best applicant will be selected according to the qualification obtained with the weighting factors.

Clarification Phase

In this phase, the chosen applicant must elaborate the project and his budget in detail. During this phase, the selected applicant delivers a risk management plan (Arnoud Storteboom).This risk management plan include risks outside his control.

At the end of this phase, both part the promotor and the selected applicant will try to reach an agreement. If both parts have a deal, they can continue to the next phase (execution phase).

Execution Phase

This is the last phase; the contractor must execute the project. The contractor should give information to the promotor about the project.

Weekly reporting is an ideal tool to show the client the progress of the project as well as problems that might held up the project.

PART 11: PROPOSAL FOR BIDDING PROCESS

In this Master thesis, some selection criteria have been shown. In this part, a criterial proposal will be explained.

Part 11.1 Criteria of budget

The budget is important, but it have been shown that it must not be the only criteria. The project must reach a certain level of quality. If the budget is low, the quality will not be appropriate.

The proposal regarding to the estimated value of the project is that all the offers of the bidders should not be lower than a certain percentage (Reduction price). In the *Table 18*, you can see an example of this screening with an RDP of 5%.

Estimated value of the project			700.000,00 €
OFFERS	BID PRICE	RDP(%)	screening (RDP <=5%)
A	550.000,00 €	21,42857143	No
B	570.000,00 €	18,57142857	No
C	585.000,00 €	16,42857143	No
D	610.000,00 €	12,85714286	No
E	620.000,00 €	11,42857143	No
F	643.000,00 €	8,142857143	No
G	660.000,00 €	5,714285714	No
H	668.000,00 €	4,571428571	yes
I	673.000,00 €	3,857142857	yes
J	678.000,00 €	3,142857143	yes

Table 18 Screening with an RDP of 5%

The table shows that with these criteria a lot of offers would be eliminated, and the admissible offers do not differ so much.

With this filter we can guarantee a certain level of quality. The percentage of RDP should be applied for an expert, someone that had experience in similar projects, and this percentage should be shown with the announcement of the project.

Part 11.2 Avoiding short term to redact offers

In order to avoid the short term that the promotors give to redact an offer. It is a good idea following this process:

Promotor announce a project with the **Estimated value of the project** showing the maximum **reduction price** that will be accepted.

The bidders will send the application without the offer. They just will send how much time (working days) they need to prepare the offer.

The promotor with help of the project executor will evaluated the request of the bidders (*Table 19*) and they will decide a deadline for sending the offers. They can do a mean with the terms that the bidders send.

Bidders	Proposal term(days)
A	18
B	16
C	20
D	21
E	19
F	19
G	18
H	21
I	20
J	18

Table 19 Request of bidders

$$mean = \frac{days}{number\ of\ bidders} = \frac{18 + 16 + 20 + 21 + 19 + 19 + 19 + 18 + 21 + 20 + 18}{10}$$

$$mean = 19\ days$$

According with this example, the bidders will have 19 days to send the budget to the promotor. The *Figures 30 and 31* show a calendar of January and February respectively, these calendars show all the date and deadline of each part of the bidding process.

January 2022						
Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
					1	2
3	4	5	6	7	8	9
Announcement of the project with estimated value of the project with the maximum reduction price						
10	11	12	13	14	15	16
Application of the bidders without offer and with required time to evaluate the project						
17	18	19	20	21	22	23
Choosing deadline for budget of bidders		Time to send offer				
24	25	26	27	28	29	30
Time to send offer						
31						
Time to send offer						

Figure 30 Calendar-January

February 2022						
Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.	Sun.
	1	2	3	4	5	6
	Time to send offer					
7	8	9	10	11	12	13
Time to send offer						
14 Time to send offer	15	16	17	18	19	20
21	22	23	24	25	26	27
28						

Figure 31 Calendar February

Part 11.3 Choosing different criteria

If we do not want give too much importance to the budget, it is important take into account different criteria.

These criteria must be chosen by a group of experts in purpose of increasing diversity of aspects to be evaluated. When the list of criteria is done, each of the criteria used is given a relative weighting. This weighting also should be chosen for all the expert that participate in the elaboration of the criterion list (Table *20*).

Example of this phase:

Criteria to be evaluated

- Budget
- Environmental characteristics
- Social characteristics
- Delivery conditions

Each criterion has been chosen by one expert; all the expert will give a weight to each criterion.

Weights [1;0.8;0.6;0.4]

	Budget	Environmental characteristics	Social Characteristics	Delivery conditions
Expert A	1	0,6	0,4	0,8
Expert B	0,6	1	0,8	0,4
Expert C	1	0,8	0,6	0,4
Expert D	0,8	0,4	1	0,6

Table 20 Choosing weighting

Weight associated to each criterion:

$$\text{Budget} = \frac{1 + 0.6 + 1 + 0.8}{4} = 0.85$$

$$\text{Environmental characteristics} = \frac{0.6 + 1 + 0.8 + 0.4}{4} = 0.7$$

$$Social\ charteristics = \frac{0.4 + 0.8 + 0.6 + 1}{4} = 0.7$$

$$Delivery\ conditions = \frac{0.8 + 0.4 + 0.4 + 0.6}{4} = 0.55$$

Once each criterion has associated a weigh, this criterion must be announced with the announcement of the project.

The *Tables 21,22,23 and 24* show how to apply the different criterion.

Estimated value of the project			700.000,00 €	Weigh of budget (0,85)		
Bidders	Offer	RDP (%)	If RDP >15% ; 300 Points	If 15≥RDP≥10% ; 200 Points	If RDP<10 ; 100 Points	Points
A	561.000,00 €	19,86	X			255
B	586.000,00 €	16,29	X			255
C	614.000,00 €	12,29		X		170
D	658.000,00 €	6,00			X	85

Table 21 Criteria of budget

Weigh of Environmental characteristics (0,70)					
Bidders	Recicled materials %	If RM >15% ; 300 Points	If 15≥RM≥12% ; 200 Points	If RM <12% ; 100 Points	Points
A	10,00			X	70
B	14,00		X		140
C	17,00	X			210
D	20,00	X			210

Table 22 Criteria of Environmental characteristics

Weigh of Social characteristics (0,70)					
Bidders	Employee with disability(EWD)	If EWD >7 ; 300 Points	If 7≥EMD≥5 ; 200 Points	If EWD <5 ; 100 Points	Points
A	2,00			X	70
B	9,00	X			210
C	6,00		X		140
D	3,00			X	70

Table 23 Criteria of Social Characteristics

Weigh Delivery conditions (0,55)					
Bidders	Earlier delivery (days)	If Ed>60 ; 300 Points	If 60≥Ed≥30 ; 200 Points	If Ed <30 ; 100 Points	Points
A	20			X	55
B	50		X		110
C	35		X		110
D	80	X			165

Table 24 Criteria of Delivery conditions

The *Table 25* shows the total points in this bidding process. According to the criterion of budget, environmental, social and delivery conditions the best bidder is B.

Bidders	Points of budget	Points of Environmental characteristics	Points of Social characteristics	Points of Delivery conditions	Total points
A	255	70	70	55	450
B	255	140	210	110	715
C	170	210	140	110	630
D	85	210	70	165	530

Table 25 Total points

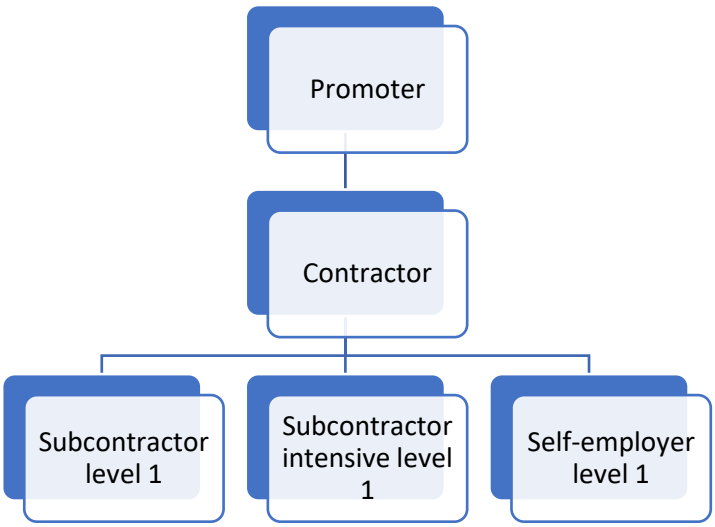
Part 11.4 Other suggestions to avoid problems

It has shown that in The Czech Republic, the contractor uses a software to evaluate the estimated value of the project. Usually, who redact a project (project executor) do not have enough knowledge to make an appropriate budget, therefore, they overprice the estimated value of the project. If the project executor uses a software like in The Czech Republic, the estimated value will be more realistic. On the other hand, the kind of measurement of Spain allows an extra benefit to the contractor, this increment is compressible so it is a good idea implement this praxis.

Pricing discrepancies always appear in projects, the promotor and the constructor should discuss a price of these new activities. Sometimes, they reach a deal but do not leave proof of this agreement in paper, they just dialogue. The contract should specify that all new deals related with new activities must be signed by the promotor and constructor. Moreover, the contractor will start to working in this pricing discrepancy only when both parts sign the deal.

The scope statement details all the elements of the project scope, requirements acceptance criteria and also penalizations for delays. The promotor should understand that sometimes delays are not fault of the constructor. When the delays cannot be avoided by the contractor, the penalties for delays should not apply. What is more, the deadline should be postpone the same number of days that the delay.

Another suggestion is decreasing the maximum level of subcontracting to just one (*Graphic 4*). In order to reduce the number of accidents.



Graphic 4 Recommended maximum level of subcontracting

Subcontracting also can affect the quality. The *Table 26* shows this idea, the contractor has to a work and the budget to do it is 100.000 €, he decides subcontracting a company to do the work for 80.000 €. This company do the same and subcontract another company for 70.000 €,

this company applies the same praxis and subcontract another company for 65.000 €. The 3rd level of subcontracting has less money to do this job, so in order to has a benefit will cut prices on the work reducing quality.

	Budget to do a work	Cost	Benefit
Contractor	100.000 €	80.000 €	20.000 €
1st Level of subcontracting	80.000 €	70.000 €	10.000 €
2nd Level of subcontracting	70.000 €	65.000 €	5.000 €
3rd Level of subcontracting	65.000 €	62.000 €	3.000 €

Table 26 Subcontracting example

Part 11.5 Summarize of the methodology

Phase 0: The promotor will contract expert of different field. The experts will decide different criteria and weighing that will be apply to the project.

Phase 1: Publication of the project with the estimated value of the project (EVP), the maximum reduction price (RP) and the different criteria with weighting.

Phase 2: Bidders will send the application without the offer. They just will send how much time they need to prepare the offer.

Phase 3: After phase 2, the promoter and the project executor will decide the deadline that the bidders will have to send the offer.

Phase 4: The bidders will send the offer and the required documentation.

Phase 5: The promoter and the project executor will calculate the score of each bidder and will give the project to the best bidder.

The *Figure 32* shows a diagram of this methodology.

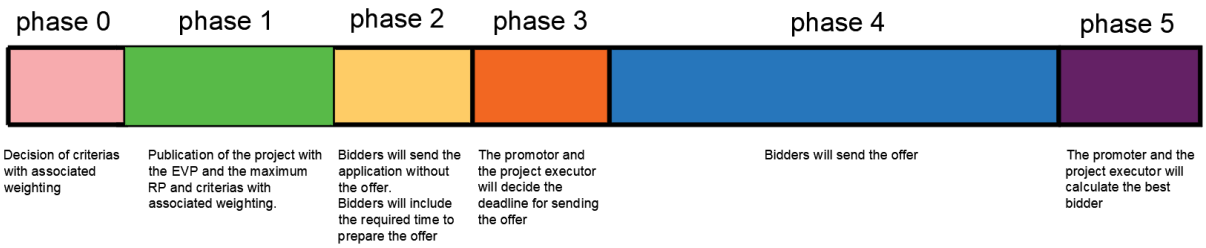


Figure 32 Diagram of methodology

PART 12: CONCLUSION

Most selection criteria of procurement processes in construction present challenges to objectify decision making in award, as it has seen in The Czech Republic and Spain. The main objective of this master thesis has been to define a methodology that allows choosing the best bidder taking into account not only the budget. This methodology achieves the best bidder being objective, it is achieved studding different criteria and consulting different experts.

The proposed methodology allows the participation of the bidders inside the deadlines of the bidding process. The bidders will send only the request to participate with a petition of time that they will need to evaluate the project. It helps to redact a better offer permitting measure more activities.

This methodology also proposes minimise the degree of subcontracting, this action will not affect the quality and the contractor will subcontract only qualified personnel. This methodology also takes into account the bad praxis of the most important agents in projects and fix those mistakes.

In Spain and in The Czech Republic usually the most important criteria of selecting bidding process are the budget, so to chance the situation is important chance the mentality and apply methodologies like the presented in this thesis.

PART 13: FUTURE RESEARCH

It is important know different work methodology, Spain and The Czech Republic are European countries but they have differences in the bidding process. Comparing both countries have giving ideas to improve the bidding process.

Spanish engineers go abroad to work, it will be interesting compare other countries and do some interviews to then that are working abroad, to know a point of view of someone that is working with a different methodology. An attractive country to study is our neighbour French or Germany that is the largest economy in Europe.

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