The impact of occupational health and safety regulations on prevention through design in construction projects: Perspectives from Spain and the United Kingdom[1].

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ABSTRACT

BACKGROUND: Since the mid-1990s, Prevention through Design (PtD) has become increasingly prevalent in the built environment. The acceptance of PtD has largely been due to the removal or reduction of risks during the execution phase of construction projects. European States have had the added impetus of national legislation.

OBJECTIVE: This paper analyzes the influence of European Union Directive 92/57/EEC on occupational safety and health injury prevention in the project design phase.

METHODS: Qualitative methods comprised individual semi-structured interviews and focus groups with a panel of experts. Sixty individuals from construction and related professions (architects, engineers, constructors, developers, and other construction experts) answered 17 key questions to establish national perceptions of the effectiveness of Directive 92/57/EEC in Spain and the United Kingdom (UK).

RESULTS: The implementation of PtD in the project design phase in the UK is clearer since the regulations explicitly state the obligations of project designers as well as those of the coordinator. Interviews with Spanish experts show that, in Spain, the prevention culture is less frequently implemented.

CONCLUSIONS: The most significant differences of the European Directive and national regulations which influence PtD are linked to the Health and Safety Coordinator, and Health and Safety documents.

KEYWORDS: Prevention through Design (PtD), Directive 92/57/EEC, Occupational Safety and Health, Construction

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1. INTRODUCTION

The construction sector is one of the driving forces of the economy in the European Union. In fact, as the largest industrial employer, it provides work for almost 44 million workers whose jobs are either directly or indirectly related to construction [1]. Moreover, construction workers are more exposed to biological, chemical, and ergonomic risk factors, as well as to noise and temperature hazards, than workers in other industries. In fact, approximately 45% of construction workers claim that their work detrimentally affects their health. The *European Agency for Safety and Health at Work* estimates injuries and illnesses in the construction sector have a high cost for individuals, employers, and governments [2].

In response to the rising number of workplace accidents in the construction sector, the European Parliament and the Council of the European Union published Council Directive 92/57/EEC [3], on the implementation of minimum safety and health requirements at temporary or mobile construction sites. Generally speaking, statistics show that Directive 92/57/EEC has had a positive effect on construction health and safety performance in most European countries [4]. Nevertheless, there have also been other factors and initiatives in EU member states during the period since the implementation of the Directive. This makes it difficult, if not impossible, to establish a direct connection between accidents and the regulations [5,6].

On the other hand, regarding the actual causes of workplace accidents, various studies claim that a high percentage of construction accidents could have been avoided, mitigated, or even prevented if wiser decisions had been made in the design phase and during preconstruction planning [7-13]. As a result, Prevention through Design (PtD) can be regarded as an effective way of improving occupational health and safety levels at construction sites.

The first phase of this study analyzed the impact of Directive 92/57/ECC on the workplace accident rate in European Union member States and investigated how the directive was implemented in each country [4]. The second phase, covered by this paper, analyzed the impact of the EU directive on PtD. Based on the results obtained in the first phase of the research, this study focused on the situation in Spain and the United Kingdom (UK), to understand its influence on the design stage of construction projects. For this purpose, a series of focus groups or panels of experts were used to evaluate the perception of different stakeholders (e.g. project designers, work inspectors, contractors) of the effectiveness of PtD in the project design phase.

2. METHODOLOGY

To establish the impact of Directive 92/57/ECC on PtD, it was first necessary to select the countries to be studied. The characteristics of the construction sector were then analyzed in each member state as well as the transposition of the directive in its national laws with a specific focus on the design phase. The choice of Spain and the UK was based on the results of the first phase of this research [4] since the structure of the construction sector in the two countries, the accident incidence rates as well as their respective transpositions of the EU directive differed significantly. The UK has one of the lowest incidence rates in the EU15 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom - EU states prior to the accession of ten candidate countries on 1 May 2004) and Spain one of the highest [4].

The methodology in this second phase of the research project was mainly qualitative. The tools or evaluation instruments used belong to the set of techniques provided by the European Commission and the Europe Aid Cooperation Office [14]. The methodology was selected, based on *frames of interpretation* which identifies nine procedural categories (ethnomethodology, conversational analysis, ethnography, phenomenology, hermeneutics, phenomenography, grounded theory, symbolic interaction and interpretative interaction) [15]. The two categories selected were conversational analysis and phenomenology. Authors like Montero, Kirwan, Skriver and Rasmussen [16-20], highlight the socio-technical nature of Health and Safety and apply methodology used in social sciences research frequently.

Following the guidelines of Cisneros-Puebla *el al.* [21], this research was based on the data collected within these frames of interpretation from experts, who were interviewed individually and/or in focus groups (i.e.

architects, engineers, constructors, developers, and other construction experts). The interviews took place in in Spain and UK in order to identify the repercussions and impact that health and safety regulations have had in both countries in relation to PtD. Other research studies on occupational health and safety in the construction sector have also used this same methodology [13, 22-25].

All the interviews were recorded and subsequently transcribed for their analysis by means of open coding and selective coding. The purpose of open coding is to express data in the form of concepts. Accordingly, the texts were segmented in paragraphs. The expressions were classified in meaning units, which were tagged and assigned concepts or communication codes [26]. The codes were annotated with the names of concepts retrieved from publications on PtD (constructed codes) or taken from the interviewees (*in vivo* codes). Finally, since the objective of this comparative research was to highlight the influence of PtD legislation on the reduction of workplace accidents in the construction sector in Spain and the UK, corrected thematic coding after Strauss (1984) [27] was used. The final result was a coded report, in other words, an inventory of the concepts derived from the information obtained from the interviews and focus groups.

Individual interviews and focus groups both require a list of questions given to respondents. In this study, the interviews comprised 17 questions organized into six groups:

A. Background and experience with PtD (Prevention through Design)

B. Organization and industry impacts (how PtD has changed the ways that construction activities are performed)

C. Barriers to and enablers for implementing PtD

D. Specific impacts and innovation of PtD

E. Perspectives of PtD (people's views/attitudes)

F. Future implementation of PtD

Group A covered the past and present experience in PtD of the interviewees. The questions in Group B were formulated to detect how PtD has affected the way that the interviewees perform their work. Since in some cases, this concept was not a part of the professional practice of many of the interviewees, it was also necessary to ask them why they did not use it (Group C). Certain questions on the current situation of PtD (Group D) were included to identify the innovations that have had an impact on the prevention of accidents and work-related illnesses. Groups E and F collect the opinions of the interviewees on the impact of PtD, its importance, and its future.

With regards to the subjects for the interviews and the focus groups, the professionals were those that had played a strategic role in the implementation of the occupational health and safety regulations either in Spain or the UK. Their profiles were in accordance with the following categories:

- Presidents of professional associations
- Architects, engineers, building contractors, and specialists in occupational health and safety
- Leading members of government departments or associations: Ministry of Labor, National Institute of Occupational Safety and Health, etc.

Table 1 shows the total number of subjects that provided information, whether in individual interviews or in focus groups. Once the data had been collected in the UK and Spain, the information was structured in a SWOT matrix (Strengths, Weaknesses, Opportunities, Threats) [28, 29] to establish perceptions of the obligatory and practical application of the requirements regarding PtD in both countries. These matrices are one of the decision-making tools that give the best results in the analysis of strategies.

Table 1. Interviews performed in Spain and the UK

	SPAIN	UK
Instituto Nacional de Seguridad e Higiene en el Trabajo /Institute for Occupational Safety and Health (IOSH)	1	1
SEOPAN/Construction Industry Council (CIC)	1	1
Civil engineers	4	2
Architects	4	3
Occupational safety experts in different companies	15	20
Colegio Oficial de Aparejadores y Arquitectos Técnicos/President of the Association of Planning Supervisors	1	1
Service Inspector	1	1
Building constructors	2	2
TOTAL NUMBER OF PARTICIPANTS	29	31

3. THE CONSTRUCTION SECTOR IN SPAIN AND THE UK: STATE OF PtD IN THE SPANISH AND ENGLISH TRANSPOSITIONS OF DIRECTIVE 92/57/ECC

This section describes the construction sector in Spain and the UK, and highlights the most relevant aspects of each for purposes of comparison. This makes it possible to study workplace accidents as well as the way in which each country has transposed Directive 92/57/ECC in its national legislation with special emphasis on the concept of PtD.

3.1 ECONOMIC IMPACT AND WORK ACCIDENT RATE

In 2011, the European Construction Industry Federation (FIEC) [1] reported that Spain and the UK were third and fourth in production, employment, and enterprises in the EU27 construction sector. However, according to Eurostat [30], the production volume (building construction and civil engineering) in the construction sector in Spain has progressively declined since 2006 (when it was 176.67[2]) to a value of 76.52 in 2012, In fact, in 2010, the reduction from the previous year was as much as 20.7%. In contrast, the evolution of the production volume in the UK has been less erratic. Its value in 2007 (106.90) only fell to 93.50 in 2012.

Furthermore, the work accident rates in each country vary considerably. In the EU in 2010, construction accidents accounted for 14% of the total number of non-fatal workplace accidents and 27% of the fatal accidents [30]. When the construction sector is compared with other European production sectors, the results show that it is the most significant source of work accidents. Despite the fact that the laws in Spain and the UK are based on the same EU directive for health and safety at construction sites, the most recent Eurostat data (2010) [30] show that there is a considerable difference in the incidence rate (per 100,000 persons employed) of fatal accidents in both countries (2.36 in the UK and 7.99 in Spain in 2010) and also in the number of non-fatal accidents (Standardized incidence rate of accidents at work with more than three days absence) (1341.51 in UK and 6828.75 in Spain in 2010).

[2] Production in construction is compiled as a "fixed base year Laspeyres type volume-index". The current base year is 2010 (Index 2010 = 100).

3.2 HEALTH AND SAFETY REGULATIONS

Directive 92/57/EEC set 31 December 1993 as the deadline for its transposition into the national legislation of all member states. Both Spain and the UK transposed the directive after this date, and spent the years afterwards revising and modifying it. The UK finished the transposition in 1994 and called the new law *Construction (Design and Management) Regulations 1994*. In 1996, the law was modified and published as *Construction (Health, Safety and Welfare) Regulations 1996*. Eleven years later in 2007, new modifications were included and the new law was enacted as *Construction (Design and Management) Regulations 2007* [31]. The UK's Health and Safety Executive (HSE) completed its evaluation of CDM 2007 in May 2011. Further consideration of future work on the Regulations and Approved Code of Practice (ACoP) was delayed following the announcement of the Löfstedt Review of Health and Safety Legislation [32] and the subsequent Red Tape Challenge initiative. The Health and Safety Executive HSE Board has agreed that work to simplify and rationalize the CDM 2007 Regulatory package should now be undertaken. This is to be based on a 'copy-out' of the Temporary or Mobile Construction Sites Directive (TMCSD) [33]. The current intention is to transfer the responsibilities of the CDM Coordinator (Design Phase) to a Principal Designer in the same way that the UK combined the directive role of the execution phase coordinator into the Principal Contractor.

In Spain, the transposition took place in 1997 in Royal Decree 1627/1997. This law established minimum occupational health and safety regulations in construction works. Since then, the law has been modified on two occasions by the following regulations: Royal Decree 1109/2007 that regulates subcontracting in the construction sector the Royal Decree 337/2010 and Royal Decree 39/1997.

The transpositions and subsequent modifications of Directive 92/57/EEC in Spain and the UK reflect significant differences in their structure [4,34,35]. For example, in Spain two health and safety documents are required, one in the pre-construction project and other in the project construction stage, but in the UK only one document is used in both stages (Figure 1). Table 2 compares these two transpositions and highlights the duties and tasks to be performed in the project design phase of the construction work.

It can be observed how the UK CDM legislation includes the word Design in its name. Furthermore, the obligations of project designers include the consideration of hazards and risks during the execution and/or maintenance phase. This includes making provisions for accident prevention at the time of the project design and to provide information regarding other risks that would not be readily understood by a competent contractor.

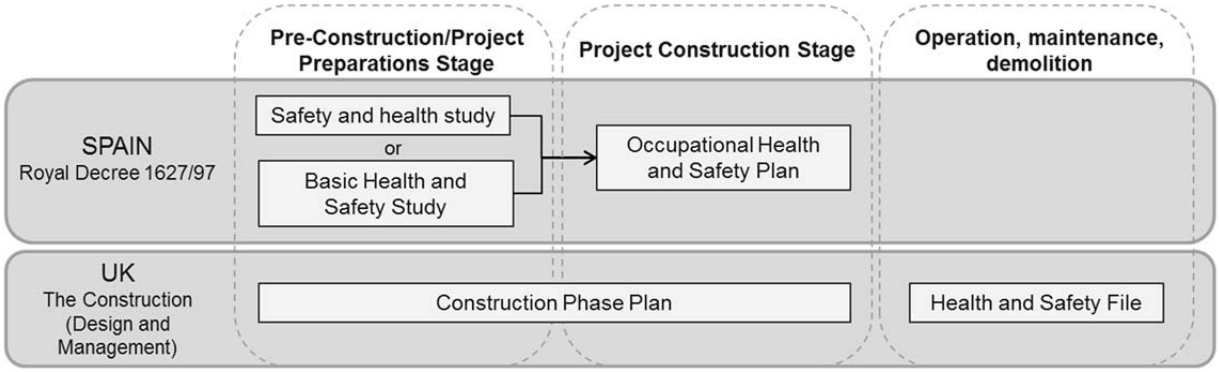

Figure 1. Comparison of Documents in Spanish and British legislation

Table 2. Differences between the health and safety regulations for the construction sector in Spain and the UK.

	SPAIN Royal Decree 1627/97	UK The Construction (Design and Management) Regulations 2007
Work safety documents	**Health and Safety Study** in construction projects of certain types[3] and generally speaking, for all large building projects or for those that could be especially hazardous. This study should be part of the project execution plan or the project design. It should be in consonance with the nature of the project and include preventive measures for the risks inherent in the construction work. **Basic Health and Safety Study** (for other types of construction project): It only includes an identification of occupational hazards and prevention measures. **Occupational Health and Safety Plan**: as an application of the Health and Safety Study or the Basic Health and Safety Study, each contractor must elaborate an Occupational Health and Safety Plan, which analyzes, studies, develops, and complements the previsions in the Health and Safety Study or the Basic Study, depending on the execution plan of the building project.	**Construction Phase Plan**: document that lists the health and safety measures, construction work regulations, and any other special measures that must be applied in the construction work. **Health and Safety File:** in *notifiable* construction projects[4], this document should contain the information necessary to guarantee the safe implementation of the construction work, including its clean-up, maintenance, modification, renovation, and possible demolition. This information warns of risks and helps in making decisions concerning work safety.
Obligations of project designers	To address the general principles of accident prevention in health and safety anticipated in the conception, study, and design of the construction project and especially in everything related to the following: • Decisions regarding construction, technical, and organizational matters in order to devise a work plan or make decisions regarding any phase of the project which is being carried out simultaneously or successively. • Estimate of the duration of any project task or phase. • Consideration during the project's conception, study, and design of the Health and Safety Study or Basic Study as well as the previsions and information needed to perform the construction work in optimal health and safety conditions.	All construction workers have a role to play in assuring their own health and safety as well as in improving health and safety in the building sector. **All projects will endeavor to do the following:** • Eliminate hazards and reduce risks during the execution and/or maintenance phase by making previsions for accident prevention from the time of the project design (PtD). • Provide information regarding all other risks, giving priority to collective protection measures instead of to individual measures. **In *notifiable* projects, the following is necessary:** • Verify that the project developer is aware of health and safety rights and that a CDM coordinator has been named. • Provide all necessary information for the *Health and Safety File.*

The transpositions of the EU directive in Spain and the UK differ in the way that the construction sector is organized in each country. Figure 2 shows an organization chart of responsible parties, construction phases, and health and safety documents in Spain, according to Royal Decree 1627/97 [36]. The dotted lines represent theoretical links that generally do not exist in both building construction and civil engineering works, and which reflect a certain disconnection between the project design phase and the project execution phase.

[3] Construction work is notifiable if the following assumptions hold:
1. The budget for the project work is equal to or greater than 451.000 €.
2. The construction work is expected to last more than 30 days during which more than 20 workers are on the job at the same time.
3. The construction phase involves more than 500 person days of construction work.
4. The construction entails the building of tunnels, galleries, underground passageways and dams.

[4] A project is notifiable if the construction phase isto involve more than 30 days or 500 person days.

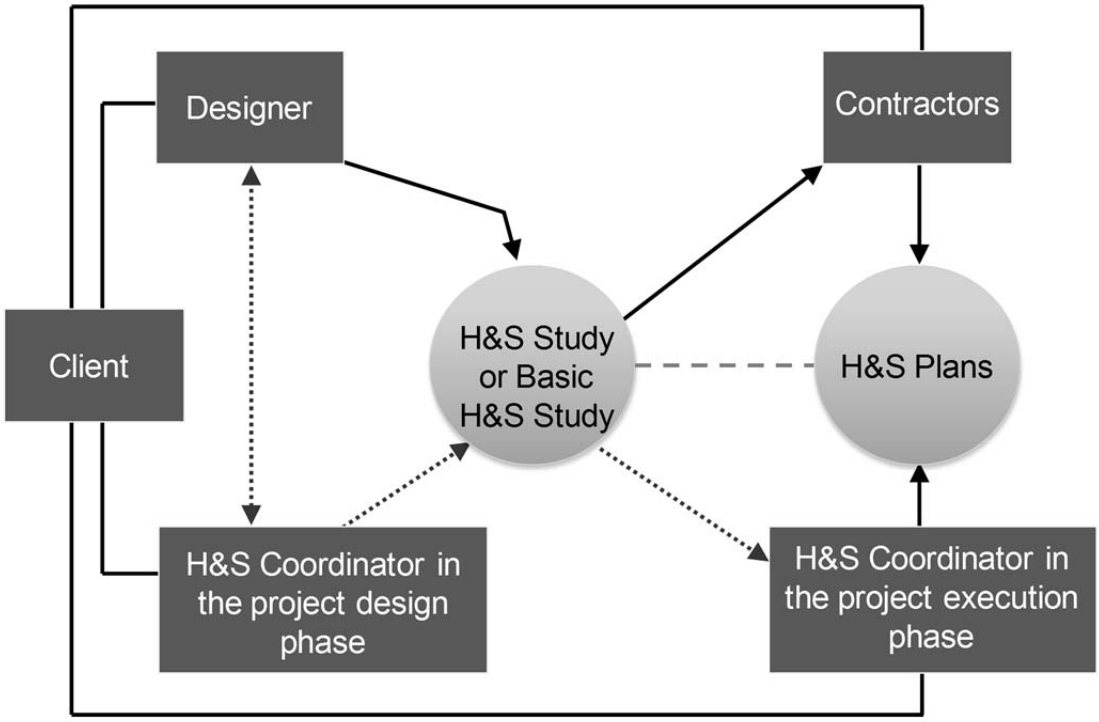

Figure 2. Spanish organization chart of project agents, construction project phases, and health and safety documents, as specified in Royal Decree 1627/97.

Figure 3 shows the organizational chart of responsible parties, construction project phases, and the Health and Safety File in the UK, as specified in the Construction (Design and Management) Regulations 2007 (CDM) [31]. As can be observed, CDM Coordinators should be aware of the risks in the project design phase as well as those in the pre-construction and construction phases. They should also be aware of risks that might occur during the repair and maintenance of the structure as well as during its possible demolition. For example, safe access to roof-mounted plant and equipment should be provided and potential methods for demolition considered at the design stage to check their viability. It is the link between all of the design and execution phases of a project. This should materialize in the construction phase plan, which includes information from the project design phase until the actual construction of the structure.

4. RESULTS AND DISCUSSION

Table 3 shows those aspects of the transposition of Directive 92/57/EEC in Spain and the UK, that have an impact on PtD, such as the people affected by the law, the health and safety documents, and the duties of the developer, designers, and coordinators concerning health and safety matters. As can be observed in Table 3, the implementation of PtD in the project design phase in the UK is clearer since the regulations explicitly state the obligations of project designers as well as those of the coordinator.

One of the most important differences is the existence of two documents in Spain: one project design phase and other in project execution phase. This same structure is repeated with the coordinators, who may be the same in both phases, but could alternatively be two different people. This fact means that a gap may exist between project design and execution safety.

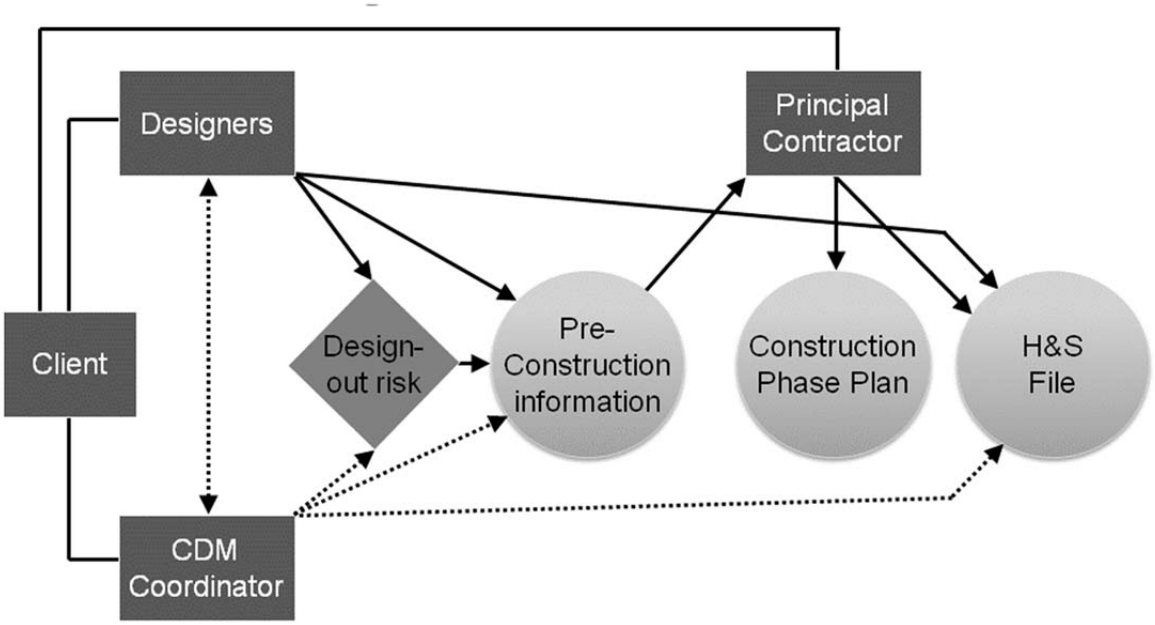

Figure 3. UK organization chart of project agents, construction project phases, and the Health and Safety File, as specified in *Construction (Design & Management) Regulations 2007* – CDM.

Moreover, the objective of this study was to establish the perceptions of the impact of the regulations on PtD. The results obtained from the interviews of the focus group participants are shown in SWOT matrices that reflect the strengths, weaknesses, opportunities and threats of PtD in the transposition of EU Directive 92/57/EEC in Spain and the UK. Both sets of regulations were regarded as the internal factor that conditioned the application of PtD. External factors were the construction sector in each country, affected by this directive. Table 4 shows the SWOT matrix for Spain (Royal Decree 1627/97) and Table 5 shows the SWOT matrix for the UK (CDM 2007). The data analysis to obtain the SWOT matrix was performed by researchers based on interviews and focus group information.

It can be seen as one of the weaknesses in Spain is linked to the fact that the term PtD is not sufficiently explicit in the regulations. Conversely, the UK Regulation has the strengths that PtD has come to have a more prominent role since the term 'design' appears in the title of the regulations.

The interviews with Spanish experts show that, in Spain, the prevention culture is not as strong as in the UK. Most of the Spanish work on safety and health is carried out more to avoid possible financial sanctions than to reduce the work accident rate. This situation is reinforced by judicial actions that penalize those who do not comply with the regulations rather than by actions that reward those who do. Accordingly, it is necessary (as confirmed in a comparative study of Spain and the United Kingdom by Cuatrecasas [34]) to carry out a set of sweeping reforms that would allow the legislation to fulfill its two most basic functions: (i) the establishment of punitive measures and financial restitution; (ii) risk management and the prevention of work accidents.

The interviews with Spanish architects and engineers indicated that, although they are not averse to including safety and health considerations in their project designs, greater priority is usually given to aesthetic aspects as well as to economic factors. It is thus necessary to create a package of incentives so that public and private developers will specifically require PtD to be included in the projects that they commission. This inclusion of PtD should also be regarded as a positive factor by project designers since it would give the project a quality seal that would lend added value to it.

It should also be noted that in the UK the innovations such as offsite production are frequently mentioned as encouraging the development of PtD. In Spain innovation in the sector appears to be limited to use of auxiliary work tools that incorporate occupational health and safety measures.

Table 3. Differences in PtD in Spain and the UK

	SPAIN	UK
Documents	• Health and Safety Study or Basic Health and Safety Study (project design phase); • Occupational Health and Safety Plan (project execution phase).	• Construction Phase Plan (project execution phase).
Duty holders	• Two coordinators: one in the project design phase and the other in the execution phase (though both jobs can be held by the same person).	• One coordinator: CDM Coordinator (design only). • The Principal Contractor takes on the role of the Execution Phase Coordinator.
Obligations of the project developer	• Designation of a Health and Safety coordinator during the project design phase. • Supervision of the elaboration of the Health and Safety Study or the Basic Health and Safety Study, depending on the nature of the project.	• Designation of a CDM Coordinator. • Supervision of the implementation of a Construction Phase Plan.
Obligations of the project designer	The project designer's obligations regarding accident prevention in the project design phase are not sufficiently clear.	When elaborating the project, the project designer should take the necessary steps to eliminate hazards and reduce risks during the project execution phase as well as subsequently in the maintenance phase.
Obligations of the coordinator in the project design phase	The definitions section states that the coordinator should make sure that project designers fulfill their health and safety obligations in the project.	The coordinator should supervise the inclusion of Health and Safety issues and work together with the other participants in the construction project.

Table 4. SWOT Matrix for Royal Decree 1627/97 and its implementation in Spain

INTERNAL FACTORS	**STRENGTHS** Since these regulations have been in force for ten years, sufficient experience has been accumulated to allow them to be revised and improved.	**WEAKNESSES** • The term PtD is not sufficiently explicit in the regulations. It is only referred to in Art. 15 of Law 31/95 (which states that developers must combat risks from the very beginning of the project). • A safety expert is only necessary when there is more than one project designer. • Small construction projects only have to provide a Basic S&H Study. • Even though the Occupational S&H Plan is implemented in the project execution phase, it is exclusively based on the study carried out in the project design phase.
EXTERNALFACTORS	**OPPORTUNITIES** • There is greater sensitivity towards health and safety issues. • Health and safety in large construction companies as come to be regarded as a synonym of *quality*. • The new degree programs for coordinators that intervene in the construction process are now being adapted to the Bologna Plan. • Auxiliary work tools that incorporate occupational health and safety measures are increasingly innovative.	**THREATS** • There is a certain reticence towards adopting new ways and methods of working. • Currently, an accident prevention culture does not exist. • Project developers, designers, and constructors have little or no specialized training in safety and health. • The bureaucratic demand for the huge quantity of documents required by the law often overshadows the most important objective, which is accident prevention. • Prevention measures are implemented as a way to avoid fines. • The government does not fine the worker, who violates regulations, but rather the constructor, who is regarded as responsible for the worker's actions. • The creation of a small construction company is a very simple transaction, and in each business, health and safety initiatives depend on the company owner.

Table 5. SWOT Matrix for CDM 2007 and its implementation in UK

INTERNAL FACTORS	**STRENGTHS** • CDM 2007 is now a much improved version of the original 1994 legislation, and many of its weaknesses have been eliminated. • Prevention through Design has come to have a more prominent role since the tern 'design' appears in the title of the regulations. • The Health and Safety File, which contains the health and safety measures for the maintenance and demolition phases, is an obligatory document. • CDM encourages cooperation between the various agents that intervene in the various phases of the construction project. • If project developers and architects do not apply PtD, they are severely penalized.	**WEAKNESSES** • No detailed description is given of the responsibilities of the CDM Coordinator. • The constructor does not necessarily intervene in the project design phase since PtD and its planning are the responsibility of the project designers. • More attention is paid to safety than to health. • The CDM does not tend to cover the design and manufacture of prefabricated constructions but rather focuses on their assembly and installation at the worksite. • Companies are reluctant to invest in R&D in health and safety-related research. .
EXTERNALFACTORS	**OPPORTUNITIES** • New prefabrications and innovations facilitate the development of PtD. • New project design professionals have a greater awareness of PtD. • Project developers are also becoming increasingly aware of PtD since they will be held responsible if they do not apply it. • Medium-size and large development and construction companies regard high occupational health and safety levels as an indication of prestige. • Multidisciplinary teams in the project design phase favor the development and implementation of PtD.	**THREATS** • Companies are reluctant to invest in R&D in health and safety-related research. • Engineers are more aware of the importance of PtD than architects are. • More emphasis is placed on health and safety in clean-up operations and maintenance than in the actual construction process. • Health and safety training for project designers should be included in university study programs. Such training should provide knowledge of construction processes and their risks. • PtD is made more difficult because project developers pressure constructors to get the work done more quickly and cheaply.

4. CONCLUSIONS

This paper has studied the implementation of Directive 92/57/EEC in the UK and Spain, as well as the perception of its influence in PtD. After analyzing the European Directive and national regulations, the most significant differences that influence PtD are linked to the Health and Safety Coordinator, and Health and Safety documents. Although the directive places a similar weight on the roles, responsibilities and authority in both the design and execution stages, the way in which each country applies the transposition is not balanced. In this sense, it was found that the Construction (Design & Management) Regulations 2007 in the UK pay more attention to the project design phase than the Spanish legislation. While in the UK there is only one coordinator, in Spain there are two: (I) a Health and Safety Coordinator during the project design phase; (ii) a Health and Safety Coordinator during the project execution phase. The first coordinator is virtually non-existent in the majority of construction projects, which constitutes one of the most significant weaknesses in the implementation of PtD in Spain. As explained previously, execution phase coordination in the UK is done by the Principal Contractor. It is also noted that the UK are considering incorporating the design-phase coordinator into the Principal Designer's role. Further work will be required in due course to establish the effect of this proposed change.

In order to assess the perception of how the directive improves PtD, different project participants of each country were interviewed. When participants in the focus groups were interviewed, they confirmed the proliferation of documents required for construction projects, some of which are only generated to comply with regulations. Moreover, in Spain, most of the agents that intervene in the construction process are unfamiliar with the concept of PtD. In this regard, project designers were found to be mainly unaware of their obligation to specify risk prevention measures during the project design phase, despite the fact that this responsibility is implicitly expressed in Article 8 of the RD 1627/97.

In the UK, PtD began to be implemented when the Construction (Design & Management) Regulations 1994 were enacted. The interviews with experts in the UK showed a growing knowledge and awareness of PtD. This was one of the main goals of these regulations, and it seems to have been achieved. Nevertheless, the interviewees in Spain as well as in the UK agree that project designers should receive specialized training in PtD. Since, in the UK, young architects and engineers who have recently obtained their degrees are, in theory at least, better trained in PtD, this will hopefully lead to a progressive increase in its implementation.

Although a PtD culture should be fomented throughout the production chain of the construction sector in both countries, the interviews with Spanish experts clearly showed that the current prevention culture in Spain is in great need of improvement. Most of the health and safety measures are carried out more to avoid heavy fines rather than to reduce the work accident rate. This situation is reinforced by legal actions that penalize those who do not comply with the regulations instead of rewarding those who do. The interviews with Spanish architects and engineers reflected the fact that, even though they are willing to include health and safety considerations in project designs, greater priority is given to aesthetic concerns as well as to economic factors. It is thus necessary to create a package of incentives so that public and private developers will specifically require the inclusion of PtD in the projects that they commission.

Most of the respondents agreed with the fact that the participation of the constructor in the project design phase would benefit PtD. Nevertheless, this participation seems to be complicated since it is thought that this would often raise project costs. The choice of procurement route, typically made for non-health and safety reasons, is likely to be the main influence on the extent of constructor involvement in design.

Finally, for future research, a more in-depth study of strengths and weaknesses is planned. Methodological tools that can be used to obtain research pointers include the following: (i) a research audit; (ii) an analysis of good practices incorporating comparison at an internal level of practices that work well and practices that are less successful, based on a set of indicators.

6. ACKNOWLEDGEMENTS

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