Downside Risks in Construction Projects Developed by the Civil Service: The Case of Spain

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Abstract: The purpose of the work summarized here was to improve the efficiency of the construction project management processes performed by the Spanish civil service, identifying and analyzing the main risks in these kinds of projects, and also establishing potential risk responses. The scope of this effort included a list of 96 risk events, categorized and prioritized first by impact, then by frequency. The most relevant ones are related to issues such as an inadequate prequalification system, insufficient training of public servants, or political considerations prevailing over real needs, among others. A total of 117 potential risk responses were identified, categorized, and prioritized by potential efficiency and difficulty of implementation. Each risk event was associated to a set of potential responses. The paper includes the top 15 risk events with its main potential responses, including qualitative assessments. A survey was carried out among Spanish public servants working in construction projects, to validate risk identification and to obtain a qualitative assessment. Moreover, a Delphi analysis was developed to validate the risk response identification and obtain a qualitative assessment. One of the conclusions is that small and medium-sized Spanish civil service agencies should work toward increasing their maturity in managing projects and, mainly, project risks.

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Introduction

The management processes of public sector construction projects can have specific characteristics that those within private sector company projects do not. These contrasts can be more or less marked in different countries. Public sector projects normally have a higher complexity than private sector ones (Spittler and McCracken 1996; Project Management Institute 2002; among others).

Since the 1980s the Spanish civil service has been involved in large programs to update existing public infrastructures and also to construct new expressways, harbors, airports, railroad infrastructures (normal and high speed lines for trains with speeds of up to 350 km/h (220 mil/h), urban services and utilities, environmental infrastructures, and so on. Most projects have been developed in the traditional way, and some through different types of private finance (PF) systems. The authors have investigated ideas for improving the efficiency of construction project management (PM) processes carried out by the Spanish civil service, identifying and analyzing the main risks of these kinds of projects, and also establishing potential risk responses for each risk event. This paper summarizes their work.

Interest in this area of work can be easily understood, since civil services are the main proprietor in any developed country. In Spain (de la Cruz 1998) the construction sector constitutes about 10% of the total gross domestic product (GDP), and about 25% of the industrial GDP (all of the industrial domestic production, including construction). Moreover, the public sector is usually a significant or even a majority percentage within that 10 and 25% (for more information, see Novo 2002). In other developed European countries, the ratios can be very close. On the other hand, specific solutions for the Spanish environment can also be applied to similar problems in other countries.

Management of Public Sector Construction Projects in Different Countries

There are relevant differences among legal environments in terms of managing public sector construction projects across the world. In Spain or France, for instance, public procurement is regulated, in a more or less rigid manner, by acts and other mandatory regulations (République Française 1985, 1993, 2004; Ministerio de Hacienda 2000; de la Cruz and del Caño 2001; among others). Both countries have an established civil service (institutions and practices) based on and protected by written constitutions, laws, and legal norms. Reflecting an approach that provides a contrast, Britain (Flynn 1997) does not have an administrative law as such. In the United Kingdom, acts and regulations are usually generic, applicable to the public and private sectors. There is no legislation specifically covering public procurement, as is the case in Spain or France. Instead, general documents contain very flexible

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strategies for the public sector. It is common to find that the engineering office of a municipality is now run by a private sector company, within a policy of disbanding and privatizing the Property Services Agency. In any case, as a European Union member, the United Kingdom has adopted systems established by the European Union Public Sector Directives (that have a less market-driven approach) on advertising, tendering, and awarding procedures, among other points. However, those Directives should only be applied when the contract's value is higher than a specific amount (5 million Euros to date) and only deal with issues related to eliminating barriers between European countries, to assure a common market. However, in the United Kingdom the civil service is essentially much more similar to a private client in the way it manages projects, than its counterpart would be in interventionist countries. Other places, such as the United States (DOD/GSA/NASA 2005; DOT 2005), are situated midpoint between those extremes.

The aforementioned contrasts among the public procurement environments are related, among other issues, to an international trend, that has developed over the past 20 years. It is called new public management (NPM) (Barzelay 2001; McLaughlin et al. 2002; among others). To summarize, NPM is the result of applying general management theories (such as strategic management, client orientation, explicit standards and measures of performance, and results-oriented public management) to the public environment, after detecting the differences between the private and public sectors and adapting those theories to the special features of the latter. The pioneers of NPM were the United Kingdom and New Zealand, and this trend has also been followed by Australia. Other places in which the trend has been clearly embraced (McLaughlin et al. 2002) are Scandinavia and North America (United States, Canada), the Netherlands and, with a more limited scope, Germany and Switzerland. There have been further attempts to follow the trend (as may be the case of Spain), but with a more limited scope and success. Countries like France and other French-speaking European areas are involved in modernizing their public management, but are reluctant to introduce "pure" NPM reforms.

Environment in Spain

Spain has an interventionist system with more than 7,500 Acts of Central and Regional Parliaments and more than 159,000 regulations. It is also a highly decentralized system with three levels: central, regional, and local authorities. The Spanish Ley de Contratos de las Administraciones Públicas (translated here as the Public Procurement Act) (Ministerio de Hacienda 2000), and its Reglamento General (here translated as Public Procurement Regulations), are adapted to the European Union legal framework. The act explicitly defines the project life cycle of a construction project, with the various administrative and financial activities that are to be developed from its conception to the end of a 15 year guarantee period meant to cover hidden defects.

Only four types of contract system are permitted: design–bid–build with a general contractor, design–bid–build with several contractors, design–build, and owner–builder. The first is the most frequently used. The second is not very common and is limited to cases where each contract will produce a usable, independent facility, like a building or a sewage treatment plant. Thus, this type cannot be applied to separate work packages (civil, mechanical, or electrical, among others). Design–build contracts can only be used in a few special cases (for instance, urgency). Finally, the owner–builder system can only be employed in small projects of up to approximately $5 million (United States) to date.

Only two types of contract price are explicitly covered by the Act: unit prices, the normal one, and fixed price, which can only be used when it is not possible to establish unit prices for a minimum of 80% of the budget. The Act and other legislation allows specific types of payments to finance the project.

For instance, lump payment can be made at the end of construction, or payments may be deferred in the 10 years after completion. The private finance system is also involved. Issues related to build–operate–transfer projects (BOT) are also included in the Act and other legislation, but the licensee must follow the same management procedures that public agencies must rely on. Also related to private finance, public–private companies (companies with capital shared by the administration and a private sector company) for financing, constructing, and operating infrastructures are also used.

The Spanish Act establishes three types of tendering procedures, according to the European Union Public Sector Directives: open, restricted, and negotiated. Furthermore, two types of awarding procedures can be employed in the open and restricted tendering procedures. One is the lowest price (lowest qualified bidder); in case of excessively low prices, the bidder can be either excluded or forced to establish a guarantee for up to 20% of the contract value, instead of the normal 4%. The criterion to establish whether a price is excessively low is not related to realistic cost estimation, but to the average of the various bids. The other awarding procedure is the "most advantageous" or "best value" tender, with criteria, their prioritization and, if applicable, the minimum thresholds to be achieved, published in advance. Specific criteria can be established to avoid dangerously low prices. The open procedure is the most widespread one in Spain. The restricted procedure is frequently used when a public servant wants to be assured of the contractor's suitability, in cases of technical/technological complexity over a certain level. This is because there is a centralized contractor prequalification system established by the Act, although it is not really a very demanding system. The negotiated procedure only comes into play in special cases, such as urgency or secrecy, for instance; and also when there are no positive results with the other procedures. In general, on the other hand, the lowest price procedure is used in cases of low complexity projects with a well defined design and a certain degree of trust in the designer. In general, the "best value" tender procedure can be relied on by the public servant, and it is especially common in design–build contracts, and also in cases of certain organizational or technical/technological complexity.

The Spanish Public Procurement Act establishes a 2% bid guarantee, and a minimal performance guarantee of 4%, in normal circumstances. Finally, the payment to subcontractors must be established in similar or better conditions than those governing the payment to the contractor. To obtain proposals, it is mandatory to advertise in the Boletín Oficial del Estado (an official, centralized, periodical publication that includes all kinds of legislation). Very small projects or special circumstances, such as emergency situations, are exempt. According to European Public Sector Directives, those advertisements must also be published in the Official Journal of the European Union for budgets over a specific amount.

In relation to consultancy contracts, the Act establishes a similar environment, with specific characteristics. With cost overruns of more than 20% over the estimate made by the designer and caused by him/her, the designer will have a fee reduction that progressively increases with the cost overrun, with a maximum

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reduction of 50%. "Best value" is the normal way of awarding design contracts, and can include the decision made by a jury, after each professional/company is assessed against previously published criteria. The Act also specifies the minimum scope for the design in construction projects. Quality control of the design is mandatory in the case of large projects.

Down-Side Risks in Construction Projects Developed by Spanish Civil Service

Methodology

After analyzing the framework in Spain and other advanced countries, the authors tried to identify and analyze the main risks in construction projects undertaken by the Spanish civil service. As part of another work, the authors completed a bibliographic search combined with a Delphi analysis involving 20 professionals in the construction sector who were experienced in domestic and international construction projects. These experts were working as owners, engineers, consultants, and contractors. The research team's aim was to prepare a database containing risks in construction projects carried out in both the public and private sector worldwide (de la Cruz 1998). That database was the basis of several interviews with engineers, architects, and other technical and construction project management staff working as public servants for central, regional, and local authorities in Spain. The interviews helped to prepare a new database draft containing the main risk events in construction projects developed by the Spanish civil service. This initial subprocess included a total of 12 persons working for central and local authorities in Spain (Spanish Ministries of Public Works and Defense, municipalities), the United Kingdom, and France. The background of those professionals was varied (civil and industrial engineers, and an attorney).

There is currently a debate among the risk management community on the definition of risk. Hillson (2004) extensively covers the question of whether the term risk should include both opportunities and threats, or if it is exclusively negative. This paper does not dwell on that controversy. Nevertheless, as Hillson explains, the definition of risk most commonly used in the project management community includes both consequences of risk on project objectives. In any case, taking into account the risk management maturity of the Spanish civil service, the scope of the present project was confined to threats.

Once the initial risk database was developed, a survey was carried out among Spanish public servants working in construction projects. The objective at this point was to validate risk identification and also to build a more complete database, including a qualitative assessment of frequency and impact of each risk event. The survey's subjects remained anonymous. The structure of the final database included the risk events, their codes, the possible area impacts (scope, time, cost, quality, other), the participant that causes the risk, a short definition of the risk's causes, the project phase in which the risk originated, the first phase in which the impact could be suffered, and the results of the survey. The survey consisted of a presentation letter, instructions, glossary of the terms used, and the questionnaire. In relation to risk assessment, the subjects indicated, when applicable, and in a qualitative manner (high, moderate, low), the frequency and impact for each risk event. To reduce biases (Project Management Institute 2004), instructions for answering included guidelines associating the qualitative linguistic values to quantitative values. A total of 280 questionnaires were sent to central, regional, and local agencies spread out across the entire country of Spain. A total of 56 valid (coherently answered) replies were received (20% of the total questionnaires sent). From those 56 respondents, 12 (22%), 13 (23%), and 31 (55%) worked at central, regional, and local agencies, respectively. After the coherence of the answers was first contrasted, all the data for each completed questionnaire were introduced into the database. Taking into account the two dimensionality of risk and the fallacy of prioritizing risks by their expected value (Williams 1996), the risk list was sorted first by impact, and then by frequency. As a result of the survey, only two new risk events were identified, which were added to the database, now with a total of 96 items.

Then, the authors prepared a list of potential strategies and actions for risk reduction, based on their own experience in the private sector, a bibliographic search, and the environment of other countries. This list covered all the previously identified risks. As a final step, to validate strategy identification and to perform a feasibility analysis obtaining a qualitative assessment of potential efficiency and difficulty of implementation, a Delphi analysis was carried out with a total of 15 professionals working in the Spanish public construction sector. Two of these worked as lawyers; seven as contractors; five as designers; and as civil servants (six in local government; two in regional government; seven in central government; and two in other public agencies, respectively). The reader should take into account that most of the experts had varying roles during the course of their professional career. For instance, a person first worked as a contractor, then as consultant, and finally as a public servant. Besides that, some experts worked for different governments—local, regional, and central. The positions of the interviewees in the course of their professional career ranged from Municipal Engineer to Head of the Investments Office of a regional government or Executive Vice-President of a multinational construction company, including the Project Manager of the Valencia-2007 Infrastructures Project (Americas Cup), Coordinating Officer for Investments Assessment of the European Union Social Fund, or Head of the Engineering Department of an engineering company, among others. They had been involved in all kinds of public sector construction projects up to 2 billion Euros. The [min, max, average] years' experience of the respondents was 8, 41, and 23 years, respectively. The total number of different organizations joined by those people in the course of their professional life is 40. There were 15 companies and 25 public agencies, from small domestic companies to large national and multinational companies and from small municipalities to the Spanish Ministry of Public Works, including companies such as Dragados-ACS, Entrecanales y Tavora, Huarte, Bureau Veritas, Intecsa, or Initec, and public agencies belonging to the Ministry of Defense, Ministry of the Environment, Ministry of Health, Labor and Welfare, and Spanish Railways. A questionnaire was prepared with a total of 234 questions for qualitatively assessing (high, moderate, low) both the potential efficiency and difficulty of implementing the 117 potential strategies and actions for risk reduction. The feedback form consisted of a presentation letter, detailed instructions, and the questionnaire. After the different answers to the questionnaire were statistically processed, the assessment of both factors of each strategy was established using a qualitative system with five labels: high, high–moderate, moderate, moderate–low, and low, respectively, using uppercase and lowercase abbreviations for efficiency and difficulty of implementation: H, HM, M, ML, L

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and h, hm, m, ml, l. Finally, the prioritization of the strategies was performed mainly by efficiency, except when the implementation had a high level of difficulty.

Top Fifteen Risk Events and Main Potential Responses

This paragraph includes the top 15 identified risk events (according to the referred to prioritization, including qualitative assessment of impact and frequency, in brackets) and the main potential strategies to fight against them. In addition to a description, each specification/strategy includes, in brackets, three data: (code, potential efficiency label, and potential difficulty of implementation label). Short comments on the type of strategy (reduction, transfer, elimination, and acceptance) are also included, in square brackets [ ].

1. Sometimes the main evaluation criterion for awarding is the price; while other aspects influencing quality and functionality/performance are poorly managed or quasi-neglected. That could lead to claims, delays, cost overruns, and quality or functionality problems (moderate–high impact; moderate–high frequency). This could be addressed, mainly, as follows:
   a. Allowing [reduction] maximum flexibility in the use of the different tendering and awarding systems (32, H, m), and employing (58, H, l) "best value" awarding processes with balanced weighting for the different criteria and, preferably, using (59, MH, ml) life-cycle cost, instead of price, as the main criterion. Moreover, the professionals who were consulted considered as interesting (55, H, mh) specific measures to include in the "best value" awarding process of relevant projects the evaluation not only of cost, but also of quality for the whole facility's life cycle. And also (69, H, mh) to take into account sustainability criteria when designing and constructing and when contracting new facilities, through a formal public policy included in the Spanish legislation. In relation to the "best value" awarding processes, the respondents recommended (50 and 52, H, m) establishing "limit" value ranges for each specific awarding criteria (values outside a range will exclude a contractor). Since corruption is a secondary risk (a new risk that can arise after implementing a risk response) of using best value awarding procedures, the recommendation of the respondents was to publish in advance [reduction] the exact criteria weighting (as fixed ratios) and the way of assessing the technical issues (53, H, ml). Standard evaluation methods (49, H, ml) for awarding could be published in advance for the same purpose. The only possible exception should be the especially complex projects. The need for not publishing the exact criteria weighting should therefore be documented. The advertising should clearly explain if the criteria different from price, altogether, will be significantly more important than, or significantly less important than, or will have approximately the same importance as price. However, in this special case, the criteria should be published sorted by importance. Thus lowest price awarding should be limited to the cases recommended by the literature (Gordon 1994; Miller 1997; among others), normally low complexity projects with well defined design, and a relevant degree of trust in the designer. In any case, the professionals consulted agreed in avoiding the Spanish lowest price awarding procedure, whenever possible, due to the inadequate characteristics already referred to.
   b. If price is the only selection criterion, the respondents recommended [reduction]:
      (1) Changing (60, MH, ml) the legislation to establish more efficient criteria to determine whether a bid has an excessively low price, using a realistic estimation instead of the average, both that estimation and the average, or other more sophisticated methods (Crowley and Hancher 1995a,b; for instance).
      (2) Improving (61, H, mh) the current prequalification system by increasing technical and organizational demands, especially for the high budget categories. A feedback subsystem (62, H, mh) to register assessments and positive and negative events occurring in projects should also be added. This would allow the civil servants to enter evaluations in different fields, on the real capacity of contractors. This would, subsequently, allow the prequalification body to increase the information about contractors to detect repetitive patterns that are either positive or negative. These changes should be made slowly, in a progressive manner, to avoid unnecessary conflicts.
      (3) Relying on (9, MH, m) "bidability" reviews to analyze how well the set of bidding documents provides contractors with the information required to develop accurate estimates and to make bona fide bids: completeness of the bidding/contracting documents. More on these issues can be found in Spittler and McCracken 1996.
2. The Spanish prequalification system of contractors is not adequate. The contractor is included in lists officially approved by the government as a consequence of the demonstrated results in previous projects. If the contractor is included on the list, then it can be invited to bid. If the normal prequalification system is applied, the contractor could lack the right experience despite passing the preselection test (moderate–high impact; moderate frequency). This could be addressed mainly by the following measures:
   a. Reference has already been made to improving the current prequalification system and implementing adequate feedback (61-62, H, mh) [reduction].
   b. The respondents recommended [reduction] reducing and even avoiding lowest price awarding if the current contractor prequalification system is maintained without changes (64, H, m). The civil service must understand that a market exclusively based on price will lead to merciless, cut-throat competition, with poor scope and quality results. Moreover, this will generate, in a short or medium period of time, a sector undercapitalized in human resources. The best professionals will escape to other sectors or roles. In general (WS Atkins International Limited 1993), public clients have to safeguard the use of taxpayers' money, but without using the power to obtain prices lower than those obtained by a private client.
3. Funds for training public servants (architects, engineers) are clearly insufficient. In specific projects that could lead to project personnel lacking the necessary skills and knowledge. This, in turn, could result in claims, delays, cost overruns, and quality or functionality problems in specific

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projects (moderate–high impact; moderate–high frequency). This risk could be reduced, mainly by [reduction]:

a. Increasing technical/technological training for public servants. The respondents considered this the most important issue (15, H, ml), especially in new construction technologies related to materials, systems, and equipment. Increasing PM training for public servants is also important (2, H, m). Training is a must for project sponsors and project managers.
b. Organizing (3, H, m) activities so that civil servants can exchange experiences among themselves. A case in point would be (Chittenden 1997) project management fora "to discuss ideas and approaches for project management, share successes as well as horror stories, and demystify project management." Specific project web pages and fora (13, H, mh) could be used in large and complex projects. More details on these issues can be found in Spittler and McCracken (1996).
c. Establishing (5, MH, m) systems to improve the PM culture and organization of specific agencies through (Chittenden 1997) reviews undertaken by professional associations or by project management consultants, who oversee the project procedures used by an agency.
d. There is a potential issue that could also help in addressing this risk. As seen at a later stage, it is necessary to build more multidisciplinary project teams with greater human resources than are available at present. This will lead to an increase in public expenditure, normally avoided by the different governments in recent years. On the contrary, other solutions could be increasing outsourcing for consultancy services (18, H, mh) and the percentage of BOT projects (19, MH, mh), a trend promoted by the European Union. In the latter case, conditions for BOT projects should be improved to boost their attractiveness for the companies that might be interested. If this strategy is applied, funds could be released, and these could allow for an improvement in the public servants' training. Their salaries and therefore their motivation may also grow, closing the gap with the private sector.

4. Occasionally political motivations could influence the project more than other interest. These could mean that the infrastructure is not planned and constructed in accordance with real needs (moderate–high impact; moderate frequency). This can be tackled, mainly in the following ways:
   a. Politicians can make key decisions in project management. The background of politicians in central, regional, and large local agencies is usually adequate (or, at least, it is not very poor) to allow them to understand all the implications of those decisions. However, the background of their counterparts in small and medium municipalities can be very weak, as may also be the case with the project management background of all politicians. Sometimes it is difficult to limit specific decisions to be made by politicians. However, to address this problem, the authority, responsibility, and liability of politicians must be better defined by the Public Procurement Act (68, H, mh) [reduction]. Specifically, the respondents considered it interesting to include, at least, the mandatory existence (66, H, m) of the project office (Chittenden 1997), as well as the project sponsor and project manager roles, with a detailed description of authority and responsibility [reduction]. The project sponsor should be civil service personnel that will serve throughout the project life cycle, with enough authority and in-depth knowledge of the agency's business and users' requirements. He/she will be the link with senior management, users, and managers. Moreover the project manager could be civil service personnel or outside professionals/companies that will act as a link with contractors and designers: skilled and experienced construction professionals that will manage the design and construction on a day to day basis. Knowledge, experience, and seniority must be seen as essential in the selection of both persons.
   b. Furthermore, the civil service should increase its client orientation (67, MH, m), mainly allowing the active participation of users and maintainers, at least in the project planning, design, and closing-down phases. The respondents take a favorable view of legislation, establishing that project teams/offices should include persons representing the users and maintainers [reduction]. A secondary risk could arise from this, since a higher organizational complexity could lead to a slightly longer project duration. On the contrary, that participation should normally shorten the project duration since the project needs will be better defined and, obviously, other project results, such as functionality, quality and life-cycle cost, should be dramatically improved [acceptance].
   c. In relation to the final users, developing (108, MH, m) a higher amount of public reviews (Project Management Institute 2002), could help detect real public opinion about programs and projects [reduction, elimination].

5. Frequently there is no overall quality control plan, including that of the design (provided by an independent auditor), and there is only quality control for the construction phase, on site. Furthermore, generic external design manuals (nonmandatory standard codes) are not used to ensure quality, and there are no internal design standards. In projects of a certain complexity, this could lead to quality problems (moderate–high impact; moderate–high frequency). This could be lessened by [reduction]:
   a. Generating and promoting (90, MH, ml) the use of modern new codes of practice for project management. In this case, a special effort must be made to establish quality issues for those codes. A more complete quality control of the design should be mandatory, at least for relevant projects, including an assessment of the adequacy of the design solutions, value engineering, and constructability analysis, or sustainability analysis, among other issues. The current public offices for design control (Oficinas de Supervisión de Proyectos) do not perform that kind of analysis, so the scope of the work performed by those offices (104, MH, mh) should be changed.
   b. Incrementing (70, H, mh) the number of steps in the design phase, following the example of the French system, including detailed reviews at each design stage.
   c. As an obvious suggestion, updating and improving the current codes of practice for design (The Spanish NTE building codes and others that are similar) (91, H, ml), and also extending their scope to cover all kinds of constructions, including the wide variety of transport, environmental, building, and other urban constructions that civil service must undertake (92, H, m). Creating a

complete set of documents containing standard designs for the most frequent typologies of transport, environmental, building, and urban facilities could also be helpful in this field (94, H, mh). Existing codes could be updated.

6. In specific projects the budget has to be reduced within a predetermined range, independently of real needs. This could result in very tight budgets and tense project management environment, with potential errors in decision making, possible delays and quality, functionality, or scope problems (moderate–high impact; moderate–high frequency). This could be addressed, principally, in the following ways:
   a. The main solution [reduction, elimination] could be increasing the percentage of BOT projects (19, MH, mh).
   b. Another idea [reduction] is to include structured, formal project risk management (PRM) processes (del Caño and de la Cruz 2002), at least for large projects (22, MH, mh). The problem could also be alleviated through adequate personnel training for managing projects in this environment. In this way, previously mentioned suggestions could be helpful, such as increasing PM training for public servants (2, H, m). In general, any effort to improve PM practice is essential, because strategic project organizing (involving all key stakeholders from the outset) can bring savings of 15% of the total project cost; project controls can bring savings of 10%; management of quality can bring savings of 8%; contracting practices can bring savings of 5% (in Spain, that could be higher); and combined integrated effective PM practices can bring savings of 25% (estimation performed by the USA Construction Industry Institute, reported by Cox and Townsend 1998). Organizing fora (3, H, m) to exchange experiences among the public servants, and generating and promoting the use of modern new codes of practice for project management (90, MH, ml), could also be useful.
   c. It could also be helpful (71, MH, ml) [reduction] to include the possibility of the detailed design being developed by the contractor in the traditional design–bid–build process, to improve constructability and reduce the number of changes during the construction stage. This is the case in the United States and French systems, for instance. Incorporating contractors' involvement in design can increase design effectiveness bringing savings of 10% over the total project cost (estimation performed by the USA Construction Industry Institute, reported by Cox and Townsend 1998).
7. Sometimes designers are inadequate or are slipshod with quality, and this could lead to errors, omissions, a lack of detail in the design, or contradictions between the design documents (moderate impact; moderate frequency). This could be overcome, mainly in the following ways [reduction]:
   a. Spanish legislation defines a specific prequalification system for designers. However, to avoid entry barriers, the 66/1997 Act establishes a temporary exclusion of this requirement, still in force. The respondents considered it important (63, MH, ml) to abrogate that Act, regardless of establishing prequalification thresholds capable of avoiding barriers to entry in small-sized, low-complexity projects. If the 66/1997 Act remains in force, the respondents recommended again (64, H, m) reducing and even avoiding the use of lowest price awarding.
   b. In both cases, as previously mentioned, it is necessary to improve the processes for contracting designers (47, H, mh), establishing detailed awarding procedures to assure the quality of the design, and using mainly the "best value" tender awarding procedure. Other measures are to increment (70, H, mh) the number of steps in the design phase, including detailed reviews at each design stage; generate and promote (90, MH, ml) the use of modern new codes of practice in this field; and even include a complete mandatory quality control of the design, at least for relevant projects.
   c. In relation to the lack of detail in the design, it could also be of some help to include the possibility of the detailed design being developed by the contractor in the traditional design–bid–build process (71, MH, ml).
8. Potential insolvency, bankruptcy, or bankruptcy protection of the contractor or subcontractors (suspension of payments/the contractor files for administration) can cause delays or a drop in quality (moderate impact; very infrequent risk event). This could be reduced, mainly in the following ways [reduction]:
   a. The Spanish private sector companies usually utilize very efficient specific practices to provide a thorough analysis of a company's financial condition. Public sector practices are not as efficient and are very difficult to change. In any case, the system is not inefficient, since this is a very infrequent risk event. Some changes could be indirectly helpful, such as (76, MH, m) improving the current terms of payment established in Spanish legislation. Presently the contractor will be paid with an additional amount in the case of a delay longer than 2 months; they can also stop construction if the delay reaches 4 months. Despite this, the payment delay can presently reach 7 months without the possibility of contract cancellation on the part of the contractor. Taking into account that there are many companies whose main or even only client is the government, this can mean insolvency, bankruptcy, or bankruptcy protection for them. Spanish legislation should establish terms of payment with a maximum delay of 90 days, without the possibility of longer delays through mutual agreement. Unfortunately, this will lead to a situation where the company is pressed to accept longer delays to be contracted.
   b. Another helpful idea would be (46, H, m) to modify the current system for subsidizing small municipalities, accelerating the process for transferring funds.
   c. Obviously, reducing the use of lowest price awarding may also be a good idea (64, H, m).
9. Present law and legislation, the contractors need to win contracts, and a certain permissiveness on the part of the client (government agencies, in this case) can lead to contractors lowering their offers disproportionately. At the very least, this can produce a decline in quality (moderate impact; moderate frequency). This could be mainly decreased in the following ways:
   a. Employing (58, H, l) "best value" awarding processes with balanced weighting for the different criteria [reduction] and, preferably, using (59, MH, ml) life-cycle cost instead of price, as the main criterion [reduction, elimination]. One could also even (55, H, mh) include

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quality for the whole facility's life cycle as another important criterion.

b. In other instances, also dealt with above (60, MH, ml), the legislation could be changed, establishing more efficient criteria to determine whether a bid has an excessively low price [reduction].

c. The British Egan Report (Egan 1998) concludes that choosing a new team of designers, constructors, and suppliers competitively for every project inhibits learning, innovation, and the development of skilled and experienced teams. Industry has been then prevented from developing products and an identity or brand that can be understood by its clients. Egan goes on to say that teams that only construct one project learn on the job at the client's expense and hence will never be as efficient, safe, productive, or profitable as those that work repeatedly on similar projects. Working repeatedly on similar projects will allow the designer and contractor a real and complete understanding of client needs. The report states that industry must replace competitive tendering with long term relationships based on a clear measurement of performance and sustained improvements in quality and efficiency [reduction, elimination]. This way of procuring may be viewed as problematic when applied to public clients, taking into account the European and United Kingdom procurement rules on open competition. However (Egan 2002), the National Audit Office concluded that provided it was undertaken in an open and transparent way with adequate measurement in place to ensure best value was in fact being delivered, then this method of procurement did comply. This kind of tool could be helpful in avoiding excessive rivalry and cut-throat competition and, at the same time, in progressively cutting construction costs. The respondents felt that this would be difficult to implement (54, MH, h), but they thought that the Spanish government should analyze the possibility.

10. Sometimes there is a gap between the authority granted to and the amount of responsibility held by the engineers and architects of the agency. This could lead to delays, among other problems (moderate impact; moderate–high frequency). This could be addressed, mainly in two ways that have been looked at earlier [reduction, elimination]: explicitly including (66, H, m), at least, the mandatory existence of the project office, and the roles of the project sponsor and project manager; and amending the Public Procurement Act for adequately defining the responsibility and liability of politicians (68, H, mh).
11. The contractor could prepare poor estimates at the bidding phase, and this may produce difficulties when the work is being carried out (moderate impact; moderate frequency). This could be resolved, mostly by:
    a. Improving (61, H, mh) the current prequalification system by increasing technical and organizational demands, especially for high budget categories [reduction].
    b. Using (9, MH, m) "bidability" reviews [reduction].
    c. Increasing PM training for public servants. This is essential here (2, H, m), particularly in contractor selection and, especially, in analyzing the contractors' estimates [reduction, elimination].
    d. Sometimes agency personnel are adequately trained, but there are limitations in staffing. In these cases it will be necessary to increase (105, H, mh) the number of internal or external professionals assigned to a project on the part of the agency [reduction, elimination].
12. At times, the agency experiences limitations in staffing or other resources, and this can hamper the control of the design and construction. One of the main difficulties is to carry out an adequate audit of the design, an in-depth analysis of the contractors' bids, and suitable site supervision (moderate impact; moderate–high frequency). This could be countered by:
    a. Increasing (105, H, mh) the number of in-house or outside professionals assigned to a project on the part of the agency and, mainly, the multidisciplinary nature of the agencies teams [reduction, elimination].
    b. In other instances [reduction], increasing flexibility (32, H, m) in the use of the different contract types and contract prices. For example, turn-key contracts will reduce the need for control personnel; in any case, the contract strategy should be defined taking into account the other project characteristics.
13. Occasionally there are time limitations established by the client, for political motivations or other reasons, that could prevent an adequate soil report, a good quality design, an audit of this design, or an in-depth analysis of the various contractors' bids (moderate impact; moderate frequency). This could be reduced, mainly by [reduction]:
    a. Explicitly including new contracting systems in legislation (29, H, mh). Here, these systems would allow for "fast-tracking" (for instance, with agency and at risk construction management), providing maximum flexibility in the use of the different contractual strategies. Guidance documents could be produced to help the public servant in establishing the contracting strategy. A "fast-track" contracting system would be recommended in the case of a significant time constraint (36, MH, m). Obviously, the "fast track" systems would not be used if there is a major financial constraint. A secondary risk could arise from this, threatening the cost objective. That risk could be countered [reduction] with personnel training for managing projects in this environment; adequate cost control and risk management processes; and the possibility of the detailed design being developed by the contractor.
    b. Amending Spanish legislation to include not only disincentives, but also incentives, in contract documents (85, MH, mh).
    c. Establishing (78, MH, m) a monitoring and control system common to all agencies, including a simplification for use in small/medium projects. Other countries like the United States have specific systems for this purpose. Many years ago the United States implemented the cost/schedule control system criteria replaced in 1996 by the earned value management systems criteria. This system should be integrated with the resources, risk/uncertainty/contingency, and scope management systems.
    d. Embracing structured, formal project risk management processes, at least for large projects (22, MH, mh).
14. Sometimes there is a lack of information about the facilities affected (plumbing, electrical, among other areas), or about existing buildings. Alternatively, this information may not have been updated or distributed. As a result, there are errors or omissions in the design (moderate impact; moderate–high frequency). Countermeasures include [reduction] undertak-

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ing (95, H, h) a national program to revise the written and graphical information related to existing infrastructures. It is also advisable to include in this program an update of the cadastral and other related information to allow for faster expropriation arrangements, when necessary. The program scope should cover (96, H, mh) a new, computerized, national system for maintaining and updating this information in the future. The system should include a web based subsystem that public servants could consult.

15. Changes in the planning policy from higher levels could render a project unnecessary due to shifts in policy or in the makeup of the administration itself after general or local elections, for example (moderate impact; very infrequent risk event). Solutions include [reduction]:
    a. Generating and promoting (90, MH, ml) the use of modern new codes of practice for project management. These should include templates to help the civil servant and especially, in this case, those involved in project planning. Another idea is to develop (108, MH, m) a higher amount of public reviews.
    b. Better defining the authority, responsibility and liability of politicians in the Public Procurement Act (68, H, mh).

Other Points Raised by Delphi Respondents

The respondents also considered it interesting, in general, to increase public sector efficiency, or to address other less important risks, to explicitly include other contracting systems, and contract price types (reimbursable, maximum guaranteed price), and to allow for a maximum flexibility in their use. This could include types of contracts such as agency and at risk construction management or, in general, the ones with contractor participation during the design phase. Maintenance during a reasonable period of time may even be added. Another suggestion was writing contract forms for the new and current types of contract. The respondents also considered it very interesting to promote arbitration, together with creating commonly accepted construction price databases to help in the arbitration process. In relation to other issues, they contemplated analyzing the possibility of creating a Spanish movement similar to the one called "Rethinking Construction" in the United Kingdom, and also to increase the funds for research and development in the field of public sector construction project management.

Conclusions

The risk events with the highest impacts, as the reader can see in the paper, are related to issues such as an inadequate prequalification system of contractors and designers, insufficient training of public servants, political considerations prevailing over real needs and, mainly, an insufficient PM and PRM maturity. The PM maturity level can vary from one agency to the next (central, regional, local) of a specific country, and among different countries. Ibbs (2000) defines five levels of PM maturity: ad-hoc, planned, managed, integrated, and sustained (respectively, Levels 1–5). After analyzing the survey presented in this paper, and taking into account the opinions of the Delphi respondents, in Spain the civil service agencies undertaking construction projects can range from Level 1 (ad-hoc; for instance, local agencies in very small villages only undertaking small-sized projects) to Level 4 (integrated; for instance, specific departments of the Ministry of Public Works), while the majority are at Levels 2 and 3. In relation to risk management maturity, Hillson (1997) established a risk management maturity model including four evolution phases: "naive," "novice," "normalized," and "natural," respectively (Levels 1–4). Excluding health and safety and environmental issues (the maturity level in these fields is adequate, similar to other advanced European countries), and taking into account the Delphi results, Spanish civil service agencies undertaking construction projects can range from Level 1 (naive; for instance, some local agencies in very small villages only undertaking small-sized projects) to Level 3 (normalized; for instance, specific departments of the Ministry of Public Works), and the majority are at Levels 1 and 2. Indeed, as one of the anonymous reviewers remarked, a lack of PM and PRM maturity is not a problem specific to Spain. Many developing and some developed countries suffer from the same. In Spain the main obstacles preventing a higher maturity level are related to political issues. On the one hand, politicians are not very worried about the importance of project management and, besides that, the funds devoted to public servants' training are not generous. On the other hand, the Spanish environment is very "rigid" or "interventionist," with mandatory acts and regulations establishing the management procedures in construction projects in a schematic, incomplete, and unwieldy manner; some areas within the PM body of knowledge, such as risk, are overlooked (except for health and safety and environmental risk). As a result, the public servant is worried about the issues included in that legislation, but no others. In other words, Spain has an adequate maturity level related to health and safety and environmental risk management, with extensive legislation in these fields; therefore, if adequate legislative conditions are created, the risk maturity related to other kinds of risks should increase.

With risk responses, the reader must take into account that, in a project, some of these can be implemented at the project level, but others can only be implemented by the management. In this case, since Spain is a very interventionist country, many specific strategies can only be implemented by the Head of the public agency, the politicians governing the agency or, above all, the legislator. Another fact, as the paper reflects, is that many of the main risk responses are common to several risk events: this gives a greater relevance to those strategies. On the other hand, on analyzing the procurement environments in other countries, it was decided that not everything that seemed advantageous could be easily or effectively applied to Spain. Benchmarking must not be viewed as a panacea, at least in this case, because differences in culture and values, the overall legislative framework, or the construction sectors, for instance, may mean that practices that are successful in one country could be inappropriate in another. However, due to current globalization, the differences among the several approaches for managing those projects are slowly decreasing and this will continue to be the case. Thus, the specific strategies presented here could also be suitable for solving similar problems in other countries. Finally, the authors want to add that a noticeable percentage of the potential strategies that the respondents considered interesting are related to the New Public Management trend mentioned. It seems that this trend will keep growing, permeating all public procurement agencies worldwide, including construction related agencies.

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