A Model for Construction Contractor Selection Using Competitive Intelligence (CI)

Mahdi Safa [a], Arash Shahi [b], Carl T. Haas [c], Majeed Safa [d], Keith Hipel [e] Sandra MacGillivray [f], Dawn Fiander-McCann [g]

[a,b,c] Department of Civil and Environmental Engineering, University of Waterloo, Canada
[d] Department of Agricultural Management and Property Studies, Lincoln University, New Zealand
[e] Department of System Design Engineering, University of Waterloo, Canada
[f,g] Valency Inc., Canada

E-mail: msafa@uwaterloo.ca, arash.shahi@uwaterloo.ca, chaas@uwaterloo.ca, majeed.safa@lincoln.ac.nz, kwhipel@uwaterloo.ca, sandra@valencyinc.com, dawn@valencyinc.com

Abstract:

While comprehensive and ongoing competitive intelligence (CI) is employed in a variety of industries to provide valuable input for broad strategic decisions, the construction industry lags behind in adopting this technique. This paper presents a CI model for use in the construction contractor selection process, which is a critical element of construction project management and one that inherently entails risk and risk management. The use of CI for contractor selection is an important development in light of the realization on the part of many companies that the diffuse nature of the information and lack of robust analysis create numerous inconveniences during the decision-making process. Based on the application of the CI method for a competitive environment, the proposed model has the potential to improve the process for assessing and selecting contractors. This paper describes the proposed model, including background information, structural details, guidelines for its use and implementation, and key data analysis findings.

Keywords: Construction management, Competitive Intelligence (CI), Megaproject, Contractor selection, Risk

1 Introduction

Current trends suggest that construction project management may be well "behind the curve" in effectively applying the competitive intelligence (CI) approach. Construction project management is a challenging and complex process involving coordination of many tasks and multiple parties (such as consultants and contractors) with different priorities and objectives. Effective decision making approaches for construction projects require the deployment of various strategies, tactics, and tools. The selection of a contractor is one of the critical and strategic decisions that need to be made on a continuous basis during the life of a project. Hence, the main purpose of introducing a CI model in this context is to support decision makers with the contractor selection process. Since competitive intelligence (CI) has become more important to a firm's knowledge development and decision making efforts [1, 2], decision makers as the CI professionals must play an active role in the selection of contractors.

Several CI models and programs are in use in other industries, but the theories, methods, and results related to these industries cannot always be applied directly to the construction industry with the same level of success. The scope of this research focuses specifically on the industrial sector projects in the construction industry, but the concepts and models developed are applicable to other construction industry sectors. In general, the industrial construction sector involves projects such as power plants, refineries, and process facilities. It is characterized by a high concentration of participants (contractors, owners, etc.) and by a high level of engineering and project management sophistication. The research presented in this study concentrates on industrial construction and, in particular, on megaprojects.

Decisions made during the bidding process are concentrated at the managerial level, the point at which public officials and designated decision makers have the power to accept or reject a contractor for a specific project or its subprojects.

The contract is one of the most important parts of the bidding process. To accomplish well-executed projects, we must have knowledge about the contract management and contractor selection process and the

best ways to manage contracts more effectively. The contractor selection as well as many other multi-criteria decisions impacting the overall project should be made during the front end planning (FEP) of the projects. The bulk of the project costs, the major risks, and contractor selection strategy are defined during the FEP stage [3].

Therefore, using appropriate CI tools to facilitate informed decisions early in the process is, critical in making sure that measurable improvements can be realized with respect to the contractor selection. It should be noted that the ethical and legal risks of the selection process can be minimized by establishing clarity regarding the legal ways to gather information and to interact with source of information [4]. This approach builds a trust relationship and creates transparency with the contractors' communities [4].

There is no standard and universal definition for CI as experts and scholars with different background and experience have different views on CI. Blenkhorn and Fleisher (2013) defined CI as "the ethical and legal process of discovering, analysing, and delivering intelligence from publicly available, non-proprietary, and proprietary information sources for the purpose of becoming more competitive in the marketplace"[5]. In other words, "CI is a necessary, ethical discipline for decision making based on understanding the competitive environment"[6]. This information is about potential contractor' abilities and desires to assist project teams in making the correct strategic decisions. It should be noted that, it is critical that project teams have access to evolving knowledge and instruction in the field for decision makers to remain proficient in competitive intelligence [7].

2 Construction Contract Management Challenges

In large construction projects, optimally dividing the work among contractors is challenging. This process is typically executed during the pre-construction phase by project leadership team, who rely on their experience and judgment, making it difficult to demonstrate that the results are optimal or to defend the decision making rationale after the fact. Addressing these problems requires an auditable and robust method that still incorporates the expertise of the project leadership team.

The scope of knowledge required for conducting the selection phase is influenced by the type of project and the job situation [8]. The development of the CI model therefore includes consideration of the size, location, and schedule of the project as well as any cash flow constraints, the owner's philosophy, and the overall project strategies.

Significant changes, learning, adaptation, and growth are inevitable when a CI is implemented. As mentioned earlier, the evaluation of the contractor is a vital component of this system and is related to risk and risk management [9-11]. During the bidding and negotiating process, selecting the best contractors with respect to the relevant CI practice is highly critical for the overall success of the project. To select the best contractors and to prepare the most realistic and accurate bid proposals, the experts must be aware of all financial, technical, organizational culture and general information about the projects.

During the contract management process, a significant risk is ineffective partnership strength, which occurs when the relationships between managers (decision makers) and contractors are too personal. Unfortunately, a large part of decisions are affected by such connections. While this kind of personal selection practice has associated benefits, such as stability, mutual trust, and reduced transaction and search costs, it also entails a number of challenges. For the development of the system during this phase, a critical recommendation is the avoidance of any unsystematic CI tendencies and reliance. Instead, emphasis will be on a systematic method for designating a contractor. However, the managers ultimately make the final choices, while the CI model results approach the ideal optimal decisions.

The model developed in this research was created based on interviews with the construction project managers who are in charge of numerous mega projects in North America. The selection of the best contractor for each work package influences not only the success of the construction project but also the quality of the results produced by any model based on those decisions as outputs. In particular, during the bidding process, the optimal selection of the contractors is vital because it results in an accurate and realistic bid proposal. During this phase decisions are focused at the managerial level, the point at which public officials and designated decision makers have the power to accept or reject a contractor for a specific construction project based on management-level considerations.

An evaluation project team (CI professionals) is frequently involved in the contract management process. Five typical criteria are usually considered, four of which are quantitative, and one of which has a qualitative value: (1) cost, (2) time, (3) field service and engineering rates, (4) experience, and (5) the financial stability of the contractor. However, a comprehensive CI model is derived from a complex and creative process. The model should incorporate a wide range of activities, elements and attributes, including:

1. Using news aggregators, databases and journal subscriptions (Press analysis)
2. Pricing research
3. Interviews with potential contractors
4. Interviews with experts
5. Historical database analysis
6. Governmental and publicly held records
7. Avoiding surprises and identifying threats and opportunities
8. Understanding where a company is vulnerable and may have decreased reaction time

3 A Guide for Designing a CI Model for the Contractor Selection Process

CI is aimed at promoting the success of a construction firm by improving the use of information in a company and also the use of external sources. The performance of a construction firm depends much on the performance of its contractors and subcontractors during the different phases of a project. John E. Prescott provided a framework for designing a CI model that has been exercised for this study [12]. The design of a CI program for the proposed model in this study involves five key decision domains. The following table provides a summary of these decision domains.

Table 1 A CI Model for Contractor Selection Process

#	Decision Domain	Key Challenges
1	CI Projects	Project-based approach
		Focus on decisions
		Prioritize intelligence needs
		CI team
		Try a demonstration project
		Pitfalls
2	CI Products	Timely, Accurate, Relevant, etc.
3	CI Achievements	Early warning of opportunities and threats
		Strategic decision making support
		Tactical decision making support
		Competitor monitoring and assessment
		Strategic planning support
4	CI Ethics	Develop a code of ethics before first project
5	CI Structure	Decision Parameters
		Champion/Manager of CI
		Human Intelligence Network
		Information Specialists
		Analysts, Integrator, Researcher, etc.

Decision domain 1: Projects are the foundation of a CI model. Construction as a whole is usually dominated by "one-off" projects [13-15] so, each project is unique. The CI model helps the managerial team in gathering, analysing, and applying information about projects, potential contractors, regulators, partners, and clients for the short- and long-term planning needs of a firm [16]. The results of the intelligence audit through selecting the best practices could pose the benefits of CI.

Decision domain 2: the outputs of the CI model must have some value to the management team. Creativity is a valuable guide for CI professionals who are developing CI products.

Decision domain 3: the CI model needs to have an achievement such as identifying opportunities and threats, support for strategic and tactical decision making, and competitive monitoring and assessment.

Decision domain 4: Ethics is one of the most important topics of the CI field. The majority of ethical problems have concentrated on the methods used in the collection of information. In this case, the contract selection process should be an ethical instrument to provide a formalization of commitments, enforceable by the company's principle. Construction firms' concerns over reputational risk have led to steady growth of due diligence in researching and selecting contractors in ethical ways. The contract selection process therefore involves an increasing focus on ethical issues.

Decision domain 5: A CI department can be located anywhere in the organization. A standardized work process increases the efficiency of the model. The use of a pre-configured workflow also increases the rigor that is applied to the work process of design reviews and equips the engineering team to accurately track the resolution of comments regarding nonconforming items. The review indicated that someone in the organization should be recognized as, the CI manager (champion). This person is the focal point for the CI effort. There are potentially three additional roles for individuals assisting in the CI effort. Each of the roles requires different skills, and in some cases, training. The first role conducts the human intelligence (the capacity of the contractor to connect with the owner) network coordination. A second role involves the collection of

secondary information through information technology. The third role is the analyst. Analysts convert information into intelligence. The analyst needs to develop skills in a variety of areas including forecasting, profiling, financial analysis, and statistics.

The following section explains how a number of analytical tools could be applied for the analysis approach employed in the CI model. Specifically, the SWOT, Porter's five forces, and the PEST methods are introduced using a major contractor as a case-study. In this paper, authors have selected Company "A" (contractor) as an example of a globally recognized and leading Canadian engineering and construction contractor. Only public data and information have been used for this analysis, and they are presented in the next section prior to the introduction of the CI models.

4 Current State of the Canadian Construction Industry

The construction industry is diverse and significantly large in Canada, currently a $171 billion industry and divided into residential sector and non-residential sector [17]. It is strong and constantly evolving, consumes 40% of the country's energy and 50% of Canada's primary resources. It employs 1.24 million people, which is about 7% of Canada's total workforce [18]. Between the years 2002 and 2011, the annual GDP of the construction industry was growing at a compound annual rate of 3.2% [19].

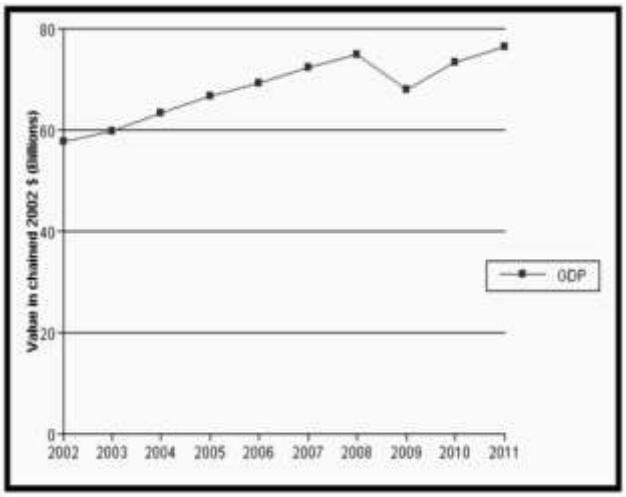

Figure 1. Global Construction Growth for Year 2013[20]

However, industry growth is projected to slow down slightly during the next decade mainly due to slower activity in the residential sector [20]. There will be an increased activity in non-residential sector, since the Canadian federal government has approved numerous large infrastructure projects worth approximately 200 billion dollars [21]. Another trend in this sector is investment in "greening" of the construction industry.

It is estimated that about 100,000 workers will need to be added to the current number by 2020, which would be about a 10% rise from current level [22]. The construction industry in Canada is comprised of about 250,000 firms, which are usually very small. About 90% of companies in the residential category have less than 5 employees, and only 1% has more than 50 employees. In the non-residential sector, about 70% of firms have 5 or less employees [23]. Some of the largest firms in this industry by revenue are listed in the Table 2.

Table 2 Largest firms in construction industry by revenue [24]

Company	2012 Revenue in billion $
A	$8.1
B	$6.9
C	$3.1
D	$2.9
E	$2.2
F	$1.5
G	$1.4

These large and other long existing firms have an advantage over new potential entrants, since they have established reputation, experience and stable relationships with subcontractors, suppliers and financial institutions. New entrants are at a big disadvantage, since contracts are usually obtained based on long time experience, reputation and overall capabilities of the firms. At the global level, Canada is expected to move from the seventh to fifth largest construction market in the world by year 2020 [25].

At this moment, the global construction sector is worth approximately US $7.5 trillion [26]. The construction industry closely follows the overall economy growth numbers and there is a 4.5% increase in construction industry predicted for this year. While Europe seems to be stagnant with little current or short-term increases, the emerging regions in developing countries around the world will likely be increasing their activities in construction industry in the next decade [27, 28].

5 Company A

Company A is the largest engineering and construction company in Canada and one of the top five design firms in the world. As one of the Canadian construction industry leaders, A has expertise in the following areas: agriculture and rural development, environment and water management, infrastructure, mass transit, mining

and metallurgy, oil and gas, operations, maintenance, pharmaceuticals, biotechnology, power, procurement and telecommunications. Currently, the Canadian market generates 62% of its revenue. The remaining 38% of revenue comes from Latin America, Europe, Africa, Middle East, United States, Asia-Pacific with individual contributions ranging from 1% to 10%. Revenue by industry segment is distributed more uniformly comparing to revenue by geographical area. It ranges from 26% for Infrastructure and Environment all the way to 5% for other industries [29].

A has slipped 19 notches on the Top International Ranking from 2012 to 2013 [30]. A's performance has suffered some major blows. The company CEO attributes this drop to fixed-price contracts being detrimentally impacted by a mining sector slowdown. Another view of this same scenario comes from industry analysts who claim some of the company's activities have become controversial. Rumours of A's suspect bidding practices and political involvement may well have played a part in 2013's net income drop to 10-50 million, down from the 355 million initially forecast [31].

5.1 Future of Company A

For the short term, the company hired a financial advisor to advise it on selling equity stake in its power transmission business. The company stated that all options were open for the unit, including a private sale or a strategic partnership. For year 2014, financial results will still remain negatively affected by the troubled contracts and rumours of questionable business dealings. Numerous projects will be facing cost reforecasts - even the company's latest contracts in the hospital and road sectors - which have not been previously the subjects of revisions. A expressed its hopes that the reforecasts will only be one-time events that will further not affect future profitability. In addition, the company plans to take a separate big-bath charge of $75-million to reorganize its European operations, which are in disarray in a number of countries, notably in France. Moreover, by the year 2015, the majority of the fixed-price contracts will be expired and the negative effect over the financial results will be eliminated [32].

Beyond 2015, A will target growth in key engineering and construction markets with a focus on mining and resources like oil and gas and it will attempt to change its revenue mix to increase the contribution made by service contracts. A's plan is to enhance its project financing capabilities to strengthen its competitiveness in major projects and infrastructure concessions [32].

5.2 Current Strategy

Current focus of the Company A is on infrastructure and clean power, and specifically on high growth and high margin sectors, building on its strengths. It is a market leader in Canada for renewable energy and it strives to keep it that way. In terms of infrastructure, Company A is focused on the growing transportation sector in North America and its strategy is to leverage experience they have with building airports, bridges, roads and highways, since such projects will remain a good source of sustainable growth. Being a diverse global company, Company A has a specific future strategy for every region. For example, it sees Africa as a strategic long-term growth area and Canada as a key region to grow market share.

In the future, Company A will be focused on three distinct industry areas: oil and gas, mining and environment and water. For the oil and gas area, it is looking to compete in this high margin business at a global level. It is hoping to build on its existing platform, expertise and know-how in this area. With respect to the mining industry, Company A is hoping to grow and solidify its tier 1 position and establish long-term profitability. Although it is aware that it scales well in this industry, it is looking to make further progress.

Finally, Company A is also contemplating participating in the environment and water market also on a global scale. It claims to have multiple opportunities in this area available, and have synergies it can build on with the oil and gas sector. Furthermore Company A is looking to better integrate and share resources, and promote greater interaction between business units, especially relaying on the newly appointed COO [33].

5.3 Analysis of Company A

The applications of the strategic analysing tools are introduced in this section. All these tools use the historical information and data for inducing future assumptions.

5.3.1 SWOT Analysis:

Company A SWOT analysis is a simple strategic tool that facilitates in understanding the strengths, weaknesses, opportunities and threats.

Strengths: Company A is the market leader in the Canadian construction industry and a significant international player. Considerable size and extensive experience over a wide range of industries makes it capable of approaching very large projects. It has a strong international business experience and world-class expertise. One subsidiary company Energy Inc. makes it the only company on Canadian market capable to design one type of nuclear reactors.

Weaknesses: In recent years, the company faced reputational issues due to questionable business practices. There is alleged evidence of unethical practices that have been used to win bids for major projects and the former CEO has been charged with fraud. Some locked fixed-price contracts negotiated in the previous years turned out to be costlier than expected. The mining industry, sector where the company is deeply involved, did not grow as expected in the recent years. Combined, these elements may have resulted in a financial decline over the last three years.

Opportunities: The mining industry is expected to recover in the near future with potential for considerable growth. The worldwide increased demand for power capacity can be another source of revenue. Continuously aging world population will increase demand on health care facilities, which is an area of interest and expertise of the Company A.

Threats: As a result of damaged reputation and accusations of illegal business practices, the company and all its subsidiaries are restricted by the World Bank to participate in bids for projects sponsored by the organization. This will restrict the company from winning extremely large international projects. The Canadian nuclear power market does not appear to be active in the near future, so the company will not benefit a lot from its market dominance. Another potential threat could be that the mining sector's recovery may be slower than anticipated.

5.3.2 Porter's Five Forces Analysis

Porter's five forces of competitive position analysis can be used for assessing and evaluating the competitive strength and position of a potential contractor.

Industry Competitors: There are about 250,000 firms in Canada, the majority of which are very small. 90% of these companies have less than five employees and only 1% have 50 or more. There are a small number of large and reputable construction companies that could compete for the largest projects in Canada. Among them are Aecon Group Inc., Graham, PCL Construction, Ellis Don Construction and Bird Construction. This has a positive impact and Company A could expect to potentially obtain many new large and profitable projects. However, the current scandals will have a negative impact on Company A, and other large companies may be given preference.

Threat of New Entrants: Although there are emerging new companies in construction industry, there is a low risk from potential entrants, since a lot of resources and time are necessary to build a strong and reputable construction company. The entry barriers are high as well as the overall risks for new entrants, which is to advantage for Company A.

Suppliers Bargaining Power: Construction materials can be obtained from numerous suppliers and any supplier can be substituted by another at no significant cost, effort or time suggesting that there is a high competition between suppliers to construction companies' advantage, as prices are driven down. Sub-contractors are also plentiful and the switching costs are low, which has a positive effect for Company A.

Clients Bargaining Power: For the less special and less complex project, the customers of construction companies have many firms available for completing the projects, thus, the customers/buyers have a stronger bargaining power. In general, customers select contractors by the lowest bid. However, the complexities for the selection of firms is less for special and more complex projects, since not all construction firms have the required capabilities. In such cases, the bargaining power is lower.

Substitutes: There are a limited number of large and well established construction companies that could be selected for the largest projects. However, once the assigned projects are completed, any other large company can be chosen for the new project. A's most important advantage over others is that it is licensed to design the CANDU reactors. The overall impact on A is positive in that the company has an established reputation and can leverage its capabilities, experience and well-developed project management and it is recognized as a leader in the industry. One major negative impact on the future of Company A has the World Bank's ban from participating in large projects sponsored by them.

5.3.3 PEST Analysis

PEST analysis is another strategic tool for understanding the political, economic, socio-cultural and technological environment that can be used for evaluating market direction (growth or decline). A has to stay on top of political changes, such as government subsidies for certain projects or initiatives common in this industry and newly introduced environmental legislations. It must stay involved in markets of countries rebuilding from war or natural disasters. In terms of economic factors, Company A has to monitor infrastructure spending by various bodies of government, how the disposable income of families is changing (for involvement in residential sector), and how business spending and government spending are trending.

For the social aspect, the green initiative is a very important emerging trend in the recent years. Low population growth and a retiring workforce may lead to potential employee shortages. The technological factor

is also important in this industry and Company A should ensure it stays involved in developments of new technologies, new sources of energy and other innovations. PEST Analysis is summarized in Table 3.

Table 3 PEST analysis of A

POLITICAL	ECONOMICAL
• monitor government subsidies • monitor environmental legislation • stay involved in rebuilding countries	• monitor infrastructure spending • monitor disposable income of families • stay on top of business spending • stay on top of government spending
SOCIAL	**TECHNOLOGICAL**
• follow green initiatives • watch population growth • consider retiring workforce	• keep up with new innovations • keep up with new energy sources

6 Conclusion

Competitive advantage in a globalized construction market can be gained or lost based on how well a construction firm is able to apply CI principles. The adoption of a rational process for the evaluation and selection of contractors has a direct and positive influence on such a competitive advantage. The proposed CI model should thus be considered a valuable approach for guiding the enhancement of an efficient bidding decision process: its use can decrease the time required for a decision and can generate additional options that may not otherwise be identified. Like other strategic analysis models, the CI model requires the use of strategic analytical tools (analytical methods). In the study presented in this paper, the SWOT, Porter's five forces, and the PEST methods were applied for analysing A as a sample contractor. The developed model also creates audit trails that can provide explanations of the reasons for decisions. The opinions of industry experts indicate that the model has the potential to become a valuable tool for construction contract management.

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