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Practical Application of SWOT Analysis in the Management of a Construction Project

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ABSTRACT: This analysis shows strengths, weaknesses, opportunities, and threats (SWOT) from both the investor's and the contractor's point of view in the planning, contracting, and construction phases of a project. With the current market economy, and when private interests provide significant financing, construction within time and budget limits is very important. To identify potential risks for both the investor and the contractor, it is desirable to conduct a SWOT analysis. A decision maker must then decide which risks are worthwhile in order to realize the expected investment benefits.

An analysis of strengths, weaknesses, opportunities, and threats (SWOT) implies an analysis of the internal possibilities (strengths and weaknesses) of a project and its external environment (opportunities and threats that might be faced during project management). Since risk is present in all aspects of our lives, risk analysis and consideration, as well as risk management, is a universal activity based on common sense, relevant cognition, experience, and application of appropriate procedures. We can understand risk management as a need to recognize and eliminate (or at least reduce) uncertainty using control activities.

Research Process

Information about the project environment, together with knowledge of the project's possibilities, enable a team to determine the critical success factors that will satisfy the demands of end product buyers. The analysis, as a rule, includes the team (firm) managing the construction. Using the analysis, the so-called strategic holes should be discovered, and a clear plan for filling them in should be adopted (Fig. 1; Hepworth 1998).

It is important to continually evaluate the factors that influence the project's goals—for example, construction time limits, prearranged costs, and quality standards—so they can be addressed by the contractor or by the project manager. After defining the goals, internal and external possibilities for

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Figure 1. Research method framework

realizing the goals need to be identified, as well as obstacles to realizing those goals. To do this, we identify and then analyze strengths, weaknesses, opportunities, and threats, and if needed, we respond to them. We also extract those critical success factors that have an impact on achieving the goals. Critical success factors can be complex and can include organization, management, and synchronization of construction. The external domain for critical success factors can be found in the interrelation of the physical environment and building site conditions, and the investor, supplier, customs agents, government, local government, or local community. It is noteworthy that external critical success factors represent a large challenge because they are difficult to control. Using the brainstorming method, a team should be able to identify 10 internal and external domains for critical success factors and then extract several of the most important and stick to them. Finally, we analyze strengths, weaknesses, opportunities, and threats and identify ways to eliminate the weaknesses and threats (Eccles and Pyburn 1992).

During project management, new strengths, weaknesses, opportunities, and threats can crystallize, and the team must continually recognize them and enter them into the SWOT analysis. The team also evaluates which of the new elements are critical success factors. Then we begin to determine the differences between the current and ideal critical success factor level. For strengths and opportunities, it is possible to fall short of the ideal conditions because that difference will represent a potential for improvement in meeting the goal (e.g., accelerating the schedule to meet deadlines). This difference is subjectively evaluated by the team, adopting, first of all, a measuring scale. When it comes to weaknesses and threats, it is obvious that they need to be eliminated to the greatest possible extent. Noticing these differences between current and ideal levels of critical success factors helps the other people responsible for the project—for example, the investor and the suppliers on whom the elimination of the weaknesses partly depends.

After determining the differences—that is, the deviation from optimal critical success factor levels—there are three options: (1) accept the difference, (2) reduce the difference somewhat, or (3) reduce the difference significantly. If the elimination of a small difference would take too much of the team's time, or if there is a doubt that in spite of the invested labor, the difference will remain, leaving the difference at the current level is reasonable. The strategies for reducing and eliminating the differences can be immediate concrete steps and activities, or they can be long-term activities that could last the whole project. The need for those activities can be addressed in further planning (Bourne et al. 2000).

The Construction Project and Investment

The project we examine is a business situated in Belgrade, the capital of Serbia, referred to as "Azzaro." It is situated parallel to Yuri Gagarin Street, so it continues a row of businesses with modern architecture that for the past several

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Figure 2. SWOT analysis from the contractor's point of view using the Azzaro project in New Belgrade as an example

years has fronted this busy street. The architecture is modern by domestic standards and uses glass and Alucobond facade plate. (Alucobond is a lightweight composite material consisting of two prefinished 0.5-mm-thick aluminum cover sheets laminated to a core of polyethylene plastic. Alucobond panels also maintain an extremely flat surface due to the laminated construction of the material, thus reducing or eliminating oil canning.) The gross area of the building is 5,800 m^2. The building's construction consists of an armored concrete shaft of raster walls (7.2 × 5.4) and two armored concrete cores, each with two lift shafts. The building is situated on an armored concrete ground plate. The mezzanine ceiling is an armored concrete plate 22 cm thick on the floor and 24 cm thick on the gallery; the plates above the ground floor are also 24 cm thick, with an armored concrete girder 40 cm thick. The total value of the investment is US$5 million.

SWOT Analysis from the Contractor's Point of View

Examples provided for the SWOT analysis are from the Azzaro construction project. Using the software package Pertmaster (an application for risk assessment and analysis), influence and risk factors on the Azzaro project were measured during the entire lifespan of the project. Factors that influenced project costs were subjectively evaluated. A detailed mathematical analysis of the risk and the results of the evaluation are given in the article "Application of the risk analysis software package Pertmaster when managing a construction project" (Milosevic in press).

The risk analysis for each of the registered contractors can be based on the purchaser's risk analysis, if it is included in the documentation. The better the analysis, the lower the contractor's price, because there are fewer unknowns. In this case, the risk analysis had to determine whether the contractor could meet the demand, but it also had to give the right balance: whether the contractor's quote would be accepted and the risk if the money was accepted and the contractor happened to have a loss (Fig. 2).

Strengths from the Contractor's Point of View

Advanced Project Management

While working on this project, we used an advanced system of project management with direct communication between the construction site and the head office of the contractor's firm. On this project, the contractor had the opportunity to hire experienced engineers and foremen and made excellent use of all employees on the project.

Workforce Stimulation

On this project, workers' wages were increased and equalized with respect to earlier projects. The wages of the high-ranking workers (craftsmen and specialized workers) were

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370 dinars per hour (US$ 1 = 70 Serbian dinars), and the wages of the low-ranking workers were about 300 dinars per hour. During the hard summer months, the contractor offered a bonus to the best craftsmen and all participants in the project who had higher-level responsibilities.

Knowledge of the Subcontractor

On previous projects, the contractor had done business with many subcontracting firms and had established good relations with them. When the contractor knows what to expect of the subcontractors, it makes project planning go much easier.

Modern Technology

Modern materials and work automation have contributed to rapid advancements in construction. This is a strength of the contractor and was reflected in the effective and efficient organization on the Azzaro project.

Use of Modern Machinery

The contractor rented modern machinery for use while managing the construction of the building.

Use of PERI Trio Prefabricated Formwork

Trio formwork enables rapid progress during construction. Apart from that, the reasons to choose the Trio system were exploitation load, minimal working time on a site, and minimal labor expenses. The principal considerations were the agreed-upon quality of work and the schedule.

Skillful Work Team

This was an additional contractor strength. It was specified that workers who had already worked on the construction of residential and business projects of similar size and similar heights would participate in the construction of this building.

Good Relationship with Material Suppliers

This contractor had been cooperating with the same material suppliers and the same concrete factory for a long time, so he was familiar with their working methods, and the risk factors regarding shipment delays and other problems were significantly reduced.

Weaknesses from the Contractor's Point of View

Inexperienced Workers

The workers may need some time to adopt a method for working with the PERI Trio formwork. This, in turn, could influence the scheduled deadlines. The workers need to be trained at the beginning of the project and then supervised and assisted as needed.

Resistance to New Methods of Working

Some senior and more experienced workers may find it difficult to adopt new techniques and strategies. To help the workforce accept modern technology, offer training and, if possible, monetary bonuses for meeting deadlines. Supervisors should demonstrate patience and respect during the learning period.

Lack of Coordination

This weakness means that a problem related to coordinating the workers can arise within the organization. The use of a modern formwork system and new materials positively influences coordination among workers.

Possibility of Injury at Work

Because the workers are not accustomed to working with new construction technology, there is an increased possibility of injury at work.

Undeveloped Relationship with the Subcontractor

Unlike the concrete manufacturer, the contractor worked with new vendors for both the locksmith and plastic work. Signed contracts should stipulate high penalties for missed deadlines.

Opportunities from the Contractor's Point of View

Favorable Contract Terms

Contract terms should realistically allow the contractor to finish the project within the anticipated time limit. It is very important for the contractor to study the contract and carefully examine his responsibilities, as well as the investor's rights and responsibilities. Only with the knowledge of these rights and responsibilities, as well as the risk he is undertaking, can the contractor set prices and schedules. The contractor produces the budget for the specific project when he gets a formal inquiry from the investor. Replying to inquiries entails considerable expense, which only the investor bears the risk for. A thorough evaluation of expenses should result in a competitive price (estimated expenses plus profit), which is usually an excellent criterion for obtaining the job and for the contractor's success on the project. Underestimated expenses always result in business losses, while overestimated expenses can be a cause for losing the business (Lee and Ko 2000).

Reliable Investor

Former cooperative and positive experiences with a specific investor represent another very favorable circumstance and an opportunity to respect any deadlines for the estimate.

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The Possibility of Working on Future Projects
When the contractor wins the investor's trust, he will be more likely to partner on new projects in the future.

Favorable Financing Arrangements
The contractor needs to receive sufficient advance funding to do all necessary and planned activities until the next agreed-upon payment. Mutually agreed-upon financial arrangements represent an opportunity for a favorable project outcome.

Possibility of Developing a Well-Coordinated Project Team and Project Management Strategy for Future Projects
The contractor has an opportunity to put together a functional and coordinated project team for managing the project and to implement a standardized project management system.

Threats from the Contractor's Point of View

High Level of Groundwater
This threat originates from the beginning of construction in the period of concreting the bed plate.

Small Area for Storage and Manipulation on the Construction Site
The large gross area of the buildings coupled with tenants' moving into the buildings brings the possibility of problems related to lack of space. The problem can be solved by using a neighboring parcel of land without any reimbursement of expenses.

Supervisory Board with an Interest in the Project
A supervisory board (a group of individuals chosen by the stockholders of a company to promote their interests through the governance of the company and to hire and supervise the executive directors and CEO) for the construction cannot be objective, because it has a conflict of interest in the project. This often happens among the participants of a project in Serbia.

Repeated Changes in Allocation of Space
The investor's repeated changes in the allocation of space inside the building present difficulties for the contractor, who must deal with frequent improvisation and changes to the plan.

SWOT Analysis from the Investor's Point of View

From the moment he decides to undertake construction, the investor is in suspense regarding the final outcome. A construction project lasts for a specific period of time; however, the benefits from the investments are realized in the future, so a decision maker should decide what risk he is willing to take in order to see the expected return on investment.

When evaluating a project, investment decisions depend on the decision maker's attitude toward the risk. As a rule, most investors accept a project that is likely to succeed because they have a natural aversion toward risk. However, there is always an element of risk about the project outcome, and the decision maker has to determine how much risk he is willing to take.

When he sets priorities among the project goals, the investor has to consider carefully the risks he can be exposed to during construction, and he has to predict all the consequences of those risks. If the investor is not qualified to consider the potential risks, he can hire specialized consultants to help with the risk assessment and develop a plan to minimize any risk.

During the Azzaro project, all of the investor's desires, the communication problems that occurred, and the conflict of interests between the investor and contractor were noted. All the key influences that increased the expenses and prolonged some activities on the project were documented. After a subjective evaluation, the following strengths, weaknesses, opportunities, and threats can be distinguished (Fig. 3).

Strengths from the Investor's Point of View

Good Selection of Contractor
The investor found a contractor who satisfied the criteria. This is an important strength that allows future projects with the investor and creates confidence in the contractor's ability to direct the suppliers. If the purchaser selects a bad contractor or vice versa, or if both sides accept bad contract terms, both can have serious problems, which can require more resources to solve than the risk analysis itself. Selection of the contractor who offered the lowest bid does not guarantee the lowest final expenses. A contractor will always be tempted to lower the prices and profit in order to beat the competition and get the job. Taking into account the difficulties they have in realizing a profit, these contractors will try to find other ways to make a profit, such as working with poor quality materials or constantly setting new conditions—a frequent practice in the construction industry. An irresponsible contractor can cause construction delays and substituting cheap and poor quality materials can affect building quality, which, together with constant new demands, increase construction expenses.

Successful Acquisition of Project Documentation and Building Permits
This is a strength the investor has because of good business contacts.

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Figure 3. SWOT analysis from the investor's point of view using the Azzaro project in New Belgrade as an example

Market Demand Related to Building in New Belgrade

Although the investor conducted an evaluation before investing, real estate prices increased during the construction.

Contractor and Subcontractor Willingness to Agree with Frequent Project Changes

In many cases, the contractor and subcontractors have been willing to oblige the investor and carry out changes in the project without any specific compensation.

Possession of Cash

The investor did not take any kind of credit and did not obtain any kind of loan.

Weaknesses from the Investor's Point of View

Absence of Determined Buyers

Although buyers of the end product should not have any direct connection with construction, they occupy a special place because of the influence they have on the investor. Because of their changes to space allocation on the premises, the project experiences a series of problems.

Lack of Protection of the Investor's Interests by the Supervisory Board

This is a consequence regarding the supervisory board; the engineer attempted to justify some positions by protecting his work and made an objective report to the investor impossible.

Inability to Use the Desired Materials

During the project, the investor wanted to use some materials with good aesthetics but weaker fire-fighting characteristics, which was against safety regulations.

Contractor's Unwillingness to Make Big Changes

The contractor could not oblige the investor all of the time because changes to the plans resulted in a lot of unexpected work. The contractor was not willing to accept the changing work dynamics and was unable to solve some of the problems resulting from plan changes.

Opportunities from the Investor's Point of View

Opportunity to Win the Contractor over for Future Projects

The investor creates an opportunity to work on another similar project with the contractor.

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Favorable Contract Terms

The terms of the contract determine a safe investment. The first thing the investor has to do is the risk analysis in order to give the same information to all participants in the project. For example, the contractor should not bear risks that cannot be quantified with certainty. Expenses should be related to the things that can be anticipated. If the investor is worried about who will bear the risks, then he should do the necessary analyses and, on the basis of those analyses, ask for a bid from a contractor. The more details he offers, the lower the risk in the contractor's bid. If the investor wants to transfer as much risk as possible to the contractor, he chooses a "lump sum contract" because most contracts of this type include restitution that equals a total lump sum. It often happens that one combines several different contract strategies for the construction of a single project. By applying several contract strategies, the investor gets more time to decide about and more precisely define his demands without delaying the beginning of construction. The investor often consults existing contracts and adapts them to create "hybrid contracts."

Good Expense Control

The investor's consultants should make it possible for the investor to monitor the project and communicate with the builder so that he gets information about the expected time necessary for finishing the project.

Good Communication with All Participants in the Project

This is another product of cooperation with the builder, which facilitates access to all the things that happen on the construction site.

Threats from the Investor's Point of View

Schedule Delays

Delays occurred on the Azzaro project because the locksmith's work dragged on and was directly related to reallocating space in the building. The schedule directly affects the increase of expenses and reduction in profit for the investor. The aim of the risk analysis regarding the construction schedule is to recognize all of the important influences that can affect the optimal time for construction, as well as the certainty regarding the construction deadline. The analysis includes factors that can cause delays, as well as the consequences of changing the conditions for the project outcome. Some of the principal risks are environmental conditions, contractor negligence (organizational disturbances, bad planning, negligence in purchasing supplies and materials, unsynchronized work, negligence in communication), incidents related to a higher force, investor negligence (payment not made on time, nonfulfillment of other contract responsibilities), additional demands and project changes, and incomplete and imprecise project solutions. Evaluation of expenses in construction depends on the complete project schedule, which is subject to the dynamics of scheduling various types of work. At the same time, it is sometimes important to eliminate parallel work as much as possible.

Reduced Construction Quality

This is a direct threat for the investor who, because of project delays and constant changes, can find himself not being able to sell units in the building to desired buyers. The risk analysis regarding quality needs to look at everything that could affect the quality or safety of materials and processes in each stage of construction. Quality standards are defined through the technical specifications, which define the material quality level, quality of work, and the overall building. Specific quality demands determine the schedule and cost of the building's completion. Most frequently, the risk analysis means an analysis with respect to the investor's demands, which have to be documented and understandable; technical documentation, which has to be defined; the possibility of purchasing materials needed for the project; changes in projected technology and construction dynamics; timely financial monitoring; and mutual profitable and honest interactions between the contractor and the investor, which make the continuity of quality construction possible.

Deviation in time and expenses can be addressed during construction; quality faults are incorrigible. Because of that, at the beginning the optimization goals have to be strictly and clearly defined and then examined, and the criteria should undergo changes as needed.

SWOT analysis for big projects can require extensive work from the whole team and could take hours. For smaller projects, the initial SWOT analysis can last only 10 to 15 min, but the project manager should incorporate constant reflection about the possibilities and project's environment into his analyses. Although the initial SWOT analysis can take valuable time and look overwhelming, the advantages lie in discovering a project's strengths and weaknesses before starting the detailed planning. In this way, the team immediately focuses on strategic weaknesses and threats and so prepares alternative scenarios and solutions. The investor has to recognize how much the contractor's estimate is based on goodwill in accepting the risks. A useful strategy for cost transparency requires that the expected expenses be divided into project expenses and risk expenses. The accompanying documentation should also show the contractor's risk perception.

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Strengths	Description
Diversified services Wide geographic base	Parsons Brinckerhoff (PB) has more than 200 offices on six continents spanning North America,South America, Europe, Africa, Middle East, and the Asia Pacific.
Opportunities	**Description**
New contracts Demand for environmental services	The new Transportation Equity Act act is expected to provide over $286 billion in authorized funding for construction
Weaknesses	**Description**
Lack of scale Risk involved with government contracts	The company is small in size compared to its competitors. Many of its competitors, such as Bechtel, Jacobs and URS are larger in size and enjoy a competitive advantage in accessing financial, technical and human resources.
Threats	**Description**
Highly competitive industry Political uncertainty in the internationa market Weak economic outlook for the US	Due to a boom in the global construction industry, the prices of raw materials such as cement and concrete have been increasing in recent years. The US and the world economy is likely to slowdown in the short to medium term.

Figure 4. SWOT analysis from Parsons Brinckerhoff. (Source: ⟨http://www.datamonitor.com/store/Product/parsons_brinckerhoff_inc?productid=D45F7560-E705-4BA4-A98B-B33085B9A96E⟩ .)

The Application of SWOT Analysis by the Construction Companies

Construction is an industry in which uncertainty is more common than in most others. Uncertainty includes situations in which there are no historical records or references describing the situation that is being analyzed. Completely certain situations in construction are rare. Aside from the possible bad influences of the environment on construction, the uniqueness of each project explains such uncertainty. With the conditions of market economy, and when private financiers significantly participate in project financing, keeping construction on schedule and within budget is very important. In the western European countries, it takes a lot of time to plan and little time to construct a project. In Serbia, we do it the other way around. This phenomenon is characteristic of a long period of socialism and making "dictatorial" decisions, very often without a rational reason. Project failure often relates to not paying enough attention to problems that occur on the majority of projects. If we could predict the problems and thus avoid them, managing expenses, schedule, and quality would be easier. For very large, complex, or new projects, there is a great possibility that they will be submitted to high risk levels. It may seem that the risk price is high, but the price for not handling the risk is even higher.

SWOT analysis should first be carried out at the company level. Every construction company in Serbia can do a SWOT analysis and use it to define its position with respect to competitive companies and to recognize its strengths in business dealings, as well as the risks of further development. All well-known construction companies in Europe (e.g., DPR Construction, Inc., Hensel Phelps Construction Co., Ames Construction, Inc., Parsons Brinckerhoff) make their SWOT analyses available through the Internet and use them as a marketing tool. In our domestic market, no company, except for the firm Komgrap, has tried to promote itself in this way. Using SWOT analyses, construction firms can determine their goals for further development, predict the future of the company, recognize the risks of their business dealings, and recognize their strengths over the competition.

SWOT analysis is also suitable for the planning and contracting phases. Sometimes, an experienced contractor can, before signing the contract, influence its form and content, especially if he has properly investigated the market and has done a large number of favors for the investor during the concept phase of the project. Taking into account that the one who finances the project is the one who decides, the investor still has the greatest influence on the text of the contract, and potential investors need to become familiar with contracts as much as possible (Fig. 4).

Conclusions

Mutual risk identification and SWOT analyses by both investor and contractor are desirable so that both sides can be informed about the risks. The investor has to be ready to make a distinction between good and bad quality and honesty. Bad quality and dishonesty can displace good quality

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and an honest approach. The investor can approach this problem by demanding transparent risk prices in estimates or by demanding that estimates include plans for handling the risk. This way, the differences between honest and dishonest estimates can be seen. In practice, bidders with experience in handling risk can show goodwill toward bearing the risk and give lower prices than the competition, which increases their strength in the marketplace.

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