Usage of Local Knowledge in International Project Management: Case Study of Regional Waste Management Centre in Subotica, Republic of Serbia

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Abstract. International project management can largely depend on the initial parameters that international companies face when entering to new and unknown markets. Observing and using local knowledge in early stages of project development can minimize potential risks. This paper thus presents an example of the impact of perceiving or disregarding local knowledge during project implementation, as well as during the trial period of Regional Waste Management Centre (RWMC), executed by the international joint venture, in regards to the impact on the efficiency and effectiveness of the project cycle per Contractor. Through a causal loop diagram (CLD) the study shows that local knowledge should be an integral within the project implementation adding its success. This is mainly shown trough the parameters capability to enhance the reinforcing dominance of the system in a positive direction. By doing so a base of local knowledge can be formed whose inclusion or elimination from the project has direct influence of the overall success of said project. The data collected and analysed within this study, thus shows applicability to a new international project and serves as an inspiration for future project developments.

1. Introduction

Studies have noted that these is a considerable and complex linkage between a country’s stage of development and its level of construction activity [1] With such, international infrastructure and construction projects represent one of the fastest growing sectors of the construction industry in developing countries. The construction market offers numerous opportunities for firms seeking to expand internationally [2]. As the trends of recent development in this sector manifest themselves trough large private sector participation in construction projects, increase foreign participation in domestic infrastructure projects as well as an overall increase in integration in projects [3]. One most noticeable manifestation of this content growth is the birth of "mega-cities" in the Middle East, China, and other resource-rich developing countries [2].

Projections and research are in constant support of this demand for the built environments [4] thus indicating demands for firms to engage in projects around the world [2]. There are tremendous opportunities for firms in the international construction market [2] not only in the social-economical domain but other aspects of this blooming niche opportunity [5]. However, international construction
projects also face numerous uncertainties and risks. Examples of fluctuation that emerge within an international project range from teams working in unfamiliar environments with differing regulations, norms and cultural beliefs, to situations of increased misunderstandings and costs [2], [6]. A key strategy that successful global firms adopt to reduce these costs is to increase their capabilities for acquiring and sharing information and knowledge about each local environment in which they have worked to use on their portfolio of international projects [2].

Even though there might be some disagreements between the project management literature as to what constitutes project successes and what ways this should be measured and examined [7]; there is an accepted consensus of the importance of management. Without effective management, projects and programs are unlikely to stay within the specified time, stay within budget, reach target quality, and develop objectives [2]. Some studies not that project success is directly linked to the effectiveness of planning, monitoring, and control at each stage of the life cycle, requiring a broad range of functional skills including communication, planning, financial management, procurement, risk and schedule management, monitoring, evaluation, and quality and human resources management, among others. Thus, a failure to understand the various aspects of an international project can lead to a significant negative impact on the firm’s profit [8], [9].

One key aspect for a project success as inferred from above is information circulation and its proper management. Studies have pointed to the importance of institutional knowledge and have emphasized the time needed to acquire this knowledge through direct experience [10]. However, the problems with information management are seen to be technological, organizational [11] as well as linked to uncertainty, i.e. lack of adequate information. This adequate information is important for appropriate decision making process, which can have significant impact on the final outcome of the project, especially in its early stages [12]. Thus, knowledge of the local market area and above mentioned differences is extremely important during internationalization [13]. Learning about institutions requires obtaining knowledge of the regulative, normative and cultural cognitive frameworks that undergird social life and constitute the unnoticed background of social behaviour. In a foreign environment, entrant firms are exposed to diverse organizations and cultures. Because a foreign environment has different institutions from the firm’s home market, institutional differences loom large. The firm must work under unfamiliar foreign laws and contend with different social norms and culture [10] that can thus fluctuate the success of an international project.

International projects have additional aspects of an already complex investment construction process. Due to the different backgrounds of investors and contractors, the main participants in the construction project, there are numerous opportunities for misunderstanding, for achieving different expectations and for implementing different methods and approaches in performing works [14]. Local knowledge is the factor that needs to be considered and introduced while planning construction projects. This approach can contribute to increasing the effectiveness and efficiency of the project objectives, as it will lead to minimizing the potential risks [15]. Considering all discussed it is evident that international companies are experiencing many challenges when entering into new and unknown markets. Thus this paper sets out to investigate how limited reliable information on local market conditions is related to investors and potential contractors and the overall outcome of the project. To adequately analyze this issue, a case study approach can be useful in providing suitable guidance within regulations and requirements with the current practice that involves resolving problems that require critical decision making such as time and cost overrun [16].

Taking into consideration that the key decisions are made in the initial stages of the project, the objective of this paper is to show one of the problems related to deal formulations. In more detail the overall aim of the paper is to illustrate, a problem that can serve to develop a decision-making approach and a quality perspective during bidding process. This will be done through the example of building a Regional Center for Waste Management for Subotica region, Republic of Serbia. Such an example can serve to develop an approach to decision making and quality consideration during bidding, and later, during the project implementation. The constitution of the local knowledge base, which is the consequence of the local market specifics on which it is built, represents assistance in the
implementation of the project, i.e. the implementation of the project carried out with reduced risk [17].
With this in mind this paper also provides an overview of how local knowledge is to be applied to an international project, and what its benefits are, especially during decision making process in the early project stages.

2. Materials and Methods
Environmental protection projects of this type are at an early stage of development in the Republic of Serbia, as well as in the region, with insufficient available experience, both in terms of complexity and in terms of projects in which foreign companies have participated.

The materials used and processed in this paper are data from the construction site during the trial operation of the system, collected and generated by the User („Regionalna deponija d.o.o. Subotica), in the exploitation phase (July-November 2019), and data from the period of bidding (winter 2014), construction contracts (published by Delegation of European Union in Republic of Serbia in coordination with Serbian Government), and the implementation of the contract process in Republic of Serbia. The methods applied in this paper are the analysis and synthesis of the state of the construction process. This included a comparison statistical analysis of the obtained data during trial period of the project implementation once the plant was built and put into operations. The analysis was done in Microsoft Excel (version 2016). The comparative statistics focused thus on expectations vs. reality of the project. The visual representation of the findings was constructed via Vensim 8.1 Software (2020, Ventana Systems, Inc.) available for free download.

3. Results and Discussion
As mentioned in the objectives above we will present an example of the need to use local knowledge during the bidding process as well as during the project implementation refers to the construction of Regional Waste Management Center for Subotica region (Figure 1), which covers seven municipalities in northern Serbia. As part of the national strategy for solving environmental issues in the Republic of Serbia, a project of this type is a project of national importance and as such covers a region of over 200,000 inhabitants’ equivalent.

The subject Plant, which is designed and built, includes the following: Material Recovery Facility (MRF), Composting plant, Wastewater Treatment plant, as well as sanitary waste disposal cells, with all associated infrastructure facilities, that make this project unique in the region. The basic principle, applied in this project, is an environmentally-friendly system, with the potential for self-sustainability in the future. The projected life span of the Regional Waste Management Center is 50 years and its investment value was approximately 25,000,000 Euros [18].

Project financing was provided by European Union funds, i.e. by IPA funds, where the project implementation was agreed with the local government and international financial institutions, and as such is contracted in accordance with international terms and conditions of the contract, i.e. in accordance with "Design - Build" FIDIC terms and regulations (“yellow book”) [19].

Tender procedure and the selection of Contractor were carried out in accordance with standard practice and in accordance with international terms and conditions of contract, according to "Design - Build" FIDIC terms and conditions of contract.

The following documents available to all bidders in order to submit valid bids, were as follows: Employer’s Requirements, Feasibility Study for Regional Solid Waste Management, General Project with a Preliminary Feasibility Study for Subotica Waste Management Centre, Regional Waste Management Plan for Subotica Region, Feasibility study for regional waste management schemes for Subotica region.

In accordance with the Employer’s Requirements, bidders have formed a bid for Design and Build phase, which integral part for these types of contracts is breakdown of prices.

The contract price, in "Design - Build" types of contract represents the entire compensation to Contractor by the Investor, for all costs related to the works necessary for successful completion of the project, including, but not limited to, all fees, unforeseen works, as well as all tax and customs duties.
Tender, launched by the Delegation of the European Union to the Republic of Serbia in cooperation with the Ministry of Environmental Protection and the Government of the Republic of Serbia, won the international Joint Venture consisting of one foreign and two domestic companies.

Design of the subject Plant and facilities in question was carried out in accordance with the conditions and data provided by the Investor, which relate to the process of waste collection and selection.

Regional Solid Waste Management Center includes technical and technological solutions and procedures implemented at the Regional Center, which represent a series of measures to ensure the controlled disposal of solid waste, with the maximum protection of the environment from pollution caused by the waste gases, doors, leachate, etc. Regional Waste Management Center is equipped with the necessary technological, hydro-technical, mechanical and electrical equipment, as well as with accompanying mobile equipment and other necessary devices.

Based on the accepted design documentation, the construction of the Plant was conducted. After finalization of the Plant construction phase, the contract stipulates the trial work of the whole Plant. Trial period, i.e. Defects Notification Period, in accordance with the terms and conditions of contract, covers the period of twelve months, within which the Contractor is obliged to monitor the operation of the Plant and eliminate any deficiencies resulting as the failure during construction works.

3.1. Analysis of the RWMC trial period results

Within the paper, only one part of the contractually agreed process, related to project management during the Trial period i.e. during Defect Notification Period, is analyzed.

All this relates to the importance of local knowledge in the realization of process. In order to record this segment in overall project management, which has been contracted in accordance with "Design-Build" FIDIC Conditions of Contract, the analysis starts from the state of the system in the Trial process and problems that the Contractor is facing.
Trial period of the Plant, and in particular the Material Recovery Facility (MRF), is monitored and recorded on a daily basis. Data collected, during 4 months of Trial period, are as follows:

- The amount of waste collected and treated is given in Table 1, accompanied with the designed quantities’ comparison.
- After waste separation, quantities of individual types of waste were obtained, i.e. secondary raw materials, as shown in Table 2, where a comparison with designed quantities of separated waste is presented.

### Table 1. Design and actual quantities of waste. *

| Design quantity of waste (t/shift) | 1. month (t/shift) | 2. month (t/shift) | 3. month (t/shift) | 4. month (t/shift) |
|-----------------------------------|--------------------|--------------------|--------------------|--------------------|
| 140                               | 39.48              | 51.07              | 73.55              | 74.55              |

*Source – Data collection on the construction site during trial period (July-November 2019). Data obtained from “Regionalna deponija d.o.o. Subotica” by first author

The designed quantities of incoming material, in this case mixed municipal waste, are 20 tons/hour, or 140 tons per shift, i.e. 280 tons/day, in case the plant operates in two shifts, as shown in Table 1. It can be concluded that the designed values are far above the actual input raw material values during the Trial period, which was expected taking into account that only in the upcoming period the plant will reach its full capacity.

### Table 2. Relationship between designed and actual input raw material values by waste types. *

| Designed waste types | 1. month (t) | 2. month (t) | 3. month (t) | 4. month (t) |
|----------------------|--------------|--------------|--------------|--------------|
|                      | 829.04       | 1,174.61     | 1,470.92     | 1,565.66     |
| Type of waste        | Quantity (%) | Quantity     | %            | Quantity     | %            | Quantity     | %            |
| Organic waste        | 50.03%       | 360.03       | 43.43        | 508.82       | 43.32        | 522.54       | 35.52        | 816.60       | 52.16        |
| Fraction 0-30mm      | 12.94%       | 362.85       | 43.77        | 536.94       | 45.72        | 581.58       | 39.54        | 489.52       | 31.27        |
| Aluminum             | 0.67%        | 1.18         | 0.14         | 1.53         | 0.13         | 1.59         | 0.11         | 0.93         | 0.06         |
| Fe                   | 1%           | 12.12        | 1.46         | 12.70        | 1.08         | 10.90        | 0.74         | 7.10         | 0.45         |
| Plastics             | 12.33%       | 5.00         | 0.6          | 6.76         | 0.58         | 7.50         | 0.51         | 6.96         | 0.44         |
| Paper                | 4.92%        | 4.02         | 0.48         | 6.22         | 0.53         | 4.60         | 0.31         | 3.56         | 0.23         |
| Cardboard            | 4.92%        | 7.06         | 0.85         | 9.75         | 0.83         | 8.78         | 0.59         | 9.38         | 0.6          |
| Glass                | 3.92%        | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Textile              | 3.93%        | 24.26        | 2.93         | 23.72        | 2.02         | 26.24        | 1.78         | 17.08        | 1.09         |
| Leather              | 0.44%        | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Diapers              | 3.70%        | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |
| Other                | 1.20%        | 0.42         |              |              |              |              |              |              |              |

*Source – Data collection on the construction site during trial period (July-November 2019). Data obtained from “Regionalna deponija d.o.o. Subotica” by first author

In Table 2 is presented status of waste selection in relation to the received waste in the target area, taking into account designed quantities of input raw material – waste, in relation to the actual
quantities, as well as designed percentages of secondary raw material extraction in relation to the achieved secondary raw material extraction percentages, during initial four months of the Trial period.

It can also be observed that there was no selection of certain designed raw materials, for example glass, leather, diapers, etc. In addition, an insight into the state of input raw materials can indicate that certain types of waste occur frequently, such as large amounts of green waste in the summer and early fall, as well as large quantities of ash during the winter season. The mentioned types of waste are not foreseen in the project documentation and as such affect the efficiency of the system, as their presence is the reason for the slowdown and occasional halts of the waste selection system.

3.2. The analyses of end result during the trial period

Based on the presented quantitative indicators of the plant trial operation that included both the facility functioning as well as the project management process, a discrepancy between the design output raw materials - selected waste and actual output raw materials was observed.

Designed waste selection technology did not envisage the fact that solid municipal waste contains significant amounts of green waste originating from grass mowing and as such enters the Material Recovery Facility. The same applies to the significant amounts of ash, which is generated by household heating during cold days.

The above mentioned content of incoming waste into the selection plant causes various operational deficiencies, which are manifested as follows:

- Frequent delays in regards to the malfunctions on conveyor belts due to green waste jamming
- Frequent delays in regards to the rotation screen malfunction due to green waste jamming
- Significant increase in plant pollution due to ash,
- System failure during baling process of waste due to high humidity ratio
- Inadequate quality of secondary raw materials - selected waste

All delays mentioned above are treated as errors, which the Contractor is obliged to remedy in the Defects Notification Period, i.e. during Trail period.

3.3. Importance of Local Systems

When analyzing the whole process from the submission of bid to the Trial Period (project completion), while taking into account the shortcomings shown above, the following can be observed:

- As part of the bid/BoQ, the bidders, except for design and construction, have anticipated certain costs for attendance during the Defects Notification Period (DNP), which is an integral part of these types of contracts, the period that occurs after the completion and taking over of works.
- However, the bid/BoQ does not foresee the costs that may arise from inconsistency between the input data in the bidding phase, on the basis of which bid itself was formed and the output quantities, in this case selection of recyclable raw materials. Specifically, input data on input raw material types and quantities were the basis for selection and design of solid municipal waste selection technology with the task of achieving design output parameters after selection, both in terms of recyclable materials’ types and quantities.

Within preliminary analysis and studies the local traditional method of waste collection in this region is not taken into account. In addition, during the period from studies’ preparation, the population has not been educated in regards to the waste selection. Moreover, the national waste management strategy has not facilitated primary selection within households. And research has shown that education in sectors of green technology serve an important pillar [20].

Solid waste management can be classified as one of the most important municipal services of our current society as it provides an important by-product of urban life [21] capable of being selected and
monetize for great economic value. However, such a complex system must take into consideration all of its elements when designing an approach. In the situation of our case study, the conditions, i.e. the actual input parameters, affect the efficiency and effectiveness of the system, which the Contractor could not have foreseen during the bidding period as well as during the construction phase. Studies note that management systems and management concepts must go hand in hand [22] to yield success thus highlighting importance of system components.

Discrepancy between designed quantities and types of input raw materials, in this case solid municipal waste, with actual quantities and types of input raw materials has led to increased costs of maintaining the waste selection system, which in the Trial period, i.e. during Defects Notification Period is Contractor’s responsibility, was not anticipated during the bidding procedure. In this example, the Contractor, as part of the offer, provided only funds for the professional staff presence during Trial period and DNP in the amount of 0.33% of the total project investment value (BoQ Item - General costs).

Funds for resolving of previously described halts and equipment failures, as well as the entire waste selection system, including funds for improving the equipment due to new circumstances, are not foreseen. Within the first four months of Trial work analyzed, due to inadequate input (waste structure) for the designed Plant, the Contractor is obliged to cover costs of repair and halt and failure repairs in the amount of ≈0.5% of the project investment value.

The basic information arising from local knowledge elements is that during the tender preparation, as well as during the construction of Regional Waste Management Center, the Investor did not start the process of inhabitants’ education, as well as development of technical support regarding primary waste selection, which would considerably increase efficiency of the waste selection. All of this is important as education and awareness of waste management and waste are of great importance as they not only educate on waste separation but the whole life cycle of waste [22].

Contractor designed and built the Plant based on the input parameters for system design (estimates of selected materials, both recyclable and organic materials, which are disposed to the sanitary landfill), which in this case are different from those foreseen (green waste, ash).

Moreover, the composition of the collected waste is not in accordance with the input data, which served as the basis for design and election of waste selection technology, since the input data indicate primary selection existence, i.e. waste management at a household - municipal waste collection companies, which cannot apply in this case.

To visually represent this a Causal Loop Diagrams (CLD) will be presented to aid the understanding of local knowledge importance. CLDs help us understand causal relationships and feedbacks in systems thinking. By doing so we are able to understand both causes and effects of a system, analyzing them and solving problems in a transparent way [23] [24]. The boundaries of this systems include:

- Local integration processes
- Laws of Republic of Serbia as well as rules and regulation
- Inclusion and entering processes to European Union
- Local state of infrastructure
- Level of public corporate culture
- Level of resources and state of market
Figure 2. A Causal Loop Diagrams (CLD) of the Case Study of Regional Waste Management Centre in Subotica, Republic of Serbia. The words represent the elements of the system. The ‘+’ near the arrow indicates that variables change in the same direction, an a ‘-’ sign near the arrow hear indicates that variables change in the opposite direction. The letter R indicates a loop that is reinforcing showing a system in growth. The letter B indicates a balanced loop showing a system of limited growth.
As seen from the CLD diagram Government influences the Investors, local authorities, Financiers Beneficiaries and Contractor, thus showing an overall influence on RWMC plant. Through the local authorities the Government also influences local population. As diagram is complex we are going to focus mainly on the interactions that directly influence the RWMC plant. With this in mind we can see relationship with local population and the plant where integrating local knowledge can have a direct impact (Figure 2 a). From Figure 2 b we can see that when local knowledge enters the system it has a direct influence on the whole system through local population (local authorities and the Government) and effectiveness of the RWMC plant. This is explained via the success of the plant; such as if the plant is successful the buyers have more secondary raw material to buy. With successful project implementation the Financier and the Investor will benefit by launching new projects of a kind enhancing the overall consciousness of international project in developing countries. All of this will influence more investors in said sectors producing an elevated and enhanced government. Since reinforcing loops can be both positive and negative (more increase lead to more increase or less increase leads to less [23]) it is evident that through its integration local knowledge will have an overall increase on the effectiveness and the stability of the system. It is a component that indirectly or directly influences all parts of the system.

When analyzing this subject it has to be taken into consideration specifics of the laws in Republic of Serbia for this type of infrastructure projects since they fall under the Law on Planning and Construction, article 133 – projects of national importance under direct supervision of the state authorities. These types of infrastructure project are relatively new in this region thus a study like this can aid in future project planning and enhance its success. Thus, this study necessarily serves as a pillar of inspiration as to how new methods of collecting local knowledge can be integrated in project creation. It is well familiar that a firm’s ability to acquire, absorb and assimilate knowledge in its systems is of great importance for the survival of the firm its growth and its economic performance [25].

4. Conclusion
International infrastructure and construction projects are usually burdened with an inevitable degree of uncertainty, primarily due to unfamiliarity with local knowledge, or insufficiently precise inputs which can increase the risk of project success [2].

There are tremendous opportunities for firms in the international construction market, but international construction projects also face numerous uncertainties and risks. These projects bring together teams working in unfamiliar environments with differing regulations, norms and cultural beliefs, which can lead to increased misunderstandings and costs. A key strategy that successful global firms adopt to reduce these costs is to increase their capabilities for acquiring and sharing information and knowledge about each local environment in which they have worked to use on their portfolio of international projects [26].

Complexity of the investment construction process on such projects increases the possibility of misunderstandings, where local knowledge, as an important factor, should be considered and introduced during the planning of construction projects. This approach can contribute to increasing the effectiveness and efficiency of achieving the project objectives, as it will minimize the potential risks to the project success. In this example, divergence between the input data as the basis for design/construction and the actual data, i.e. inadequate input raw materials, causes halts and consequent malfunctions of the technological equipment, evidenced during the Trial/Defects Notification Period. The input parameters, for example, did not cover certain types of waste, which are present on a daily basis in the deliveries of solid municipal waste by public utilities, such as significant quantities of green waste during the late summer and autumn, as well as ash during winter and early spring period.

Furthermore, the input data for design and selection of technological equipment refer to the case that primary waste selection has been applied and, as such, to some extent, is delivered to the Regional Waste Management Center.
Based on the Feasibility study and the Preliminary design, the Contractor did not foresee funds in the bid for possible halts and malfunctions of waste selection equipment, which may be the consequence of inadequate quality of input raw material during Trial period.

Perception of the impact of certain local knowledge elements in new markets, such as Balkans, could be noticed only at the end of the project.

Within this paper, the example of the type and form of local knowledge and the way of its collection and processing is given, which as such is becoming an integral part of all knowledge within the project implementation.

During the construction and in the final stages of project implementation (trial work, etc.), data, important for assessing the quality of the implemented process are collected. In this way, a base of local knowledge is formed, which are or are not taken into account, and have significantly influenced the success of the project. The data thus collected, which constitute local knowledge, are applicable to a new international project, especially during decision making process in the early stages of the project (preparation and submission of bids, etc.).

The use of local knowledge, as an important source of information in international investment projects, can significantly reduce uncertainty, which affects decision making processes. Furthermore, this approach can affect the final outcome of the project, while increasing efficiency and effectiveness for both the Contractor and Investor.

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