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Research Article

The impact of design approach and contracting practices on cost and execution period of school buildings

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ABSTRACT

More than two million school-age children in Yemen are unable to enroll in education because of a shortage of school buildings. This is one of the reasons the country missed the Millennium Development Goal of achieving Education for all by 2015. The struggle to afford school accommodation will continue, because of the lack of resources and high unit cost. Construction cost as time schedule for an identical school building vary by the implementing agency. This paper aims to study in-depth this multi-dimensional issue to find out the factors that lead to this variation, as well as the reasons for the high unit cost and lengthy periods of construction. To achieve this objective, comprehensive raw data that was resourced from agencies that are assigned to implement the largest part of the construction program along with data collected through questionnaires and semi-structured interviews were utilized. Complete sets of design and contracting documents of representative schools were used for deeper analysis and evaluation. The analysis shows that the employed design approaches lead to large structural elements and consequently to longer implementation period and 30% increase in cost. It also shows that contractors add up to 20% for the client's procurement procedure, approvals, and payment cycle. Additionally, bidders price risks related to accessibility to building sites, availability of building materials, and how trouble-prone is the region. The findings are of relevance to researchers, education planners, and practitioners as they are of high importance to policy makers and financiers whose main concern is to meet the growing need for school accommodation.

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1. Introduction

Yemen is among the poorest countries in the world and is the poorest country in the Middle East (The World Bank, 2013). Yemen is a mountainous country with more than 75% of the 25 million population scattered in more than a hundred thousand of tiny settlements that are built in very rugged and inaccessible mountains. This habitation pattern imposes serious constrains in achieving developmental plans (AlMunifi, 1997).

Recognizing education to be one of the key factors in reducing poverty and promoting economic development, the Government has committed to give a high priority to the education as a fundamental tool to the development of the country. The Article (54) of the Yemen Constitution states the following "Education is a right for all citizens, and basic education is obligatory" (Yemeni government, 2018). The government also is committed to meeting the Millennium Development Goals (MDGs). Specific targets that are linked to the MDGs in primary education outlined in the Country Proposal to the Education for All Fast Track Initiative (EFA FTI) (Khan and Chase, 2003). Five major national strategies were endorsed to address education issues. The Basic Education Development Strategy (BEDS) 2003–15 aims to increase enrollment in basic education to reach 95-100 percent by 2015 (Brown, 2013).

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2. Background of the Problem

Yemen has low basic enrollments (60% GERs), and high population growth, at 3%, the number of out-school children will peak at 2020 and a 3.7 million children ages 6-15 will lack a place in school, Fig. 1 (The World Bank, 1999).

Given the above-mentioned facts, a considerable deficit of nearly 80,000 classrooms remains for Yemen to achieve 100% GERs in basic education. The Quantitative requirements for basic education for all are shown in Fig. 2 (The World Bank, 1999).

In 2013, the Ministry of Education (MOE) developed a Mid Term Results Framework (MTRF), which informed the achievement of 87% Gross Enrolment Rate (GER) toward Universal Primary Education. The MOE projected to achieve 89.3% (GER) in basic education by 2015. However, the MTRF emphasizes the structural challenges that the education sector faces including lack of school buildings, and lack of resources that totaled up to US$ 4.0 Billion. The MTRF concluded that Yemen is unlikely to achieve the MDG of Education for All by 2015, given that only 87% of children are enrolled in schools in 2013 (MOE, 2013).

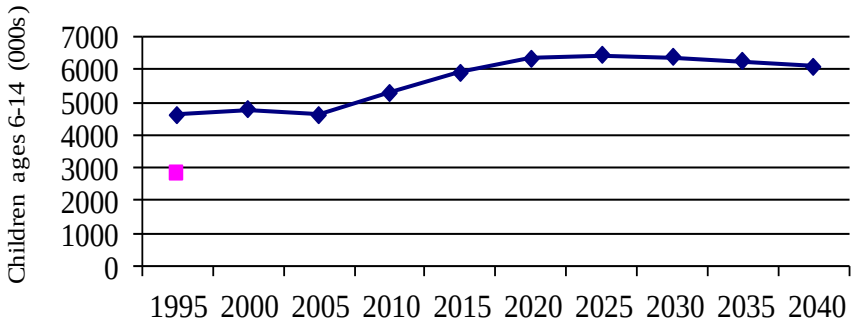

Fig. 1. The number of out-school children, World Bank staff estimates using data from 1994 Population Census 1997 DHS.

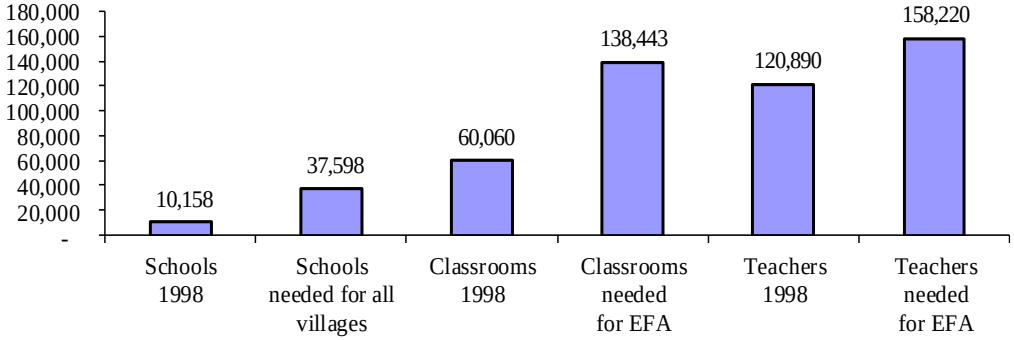

Fig. 2. The quantitative requirements for basic education (The World Bank, 1999).

There is a shortage of classrooms particularly in rural areas, where 28% of out-school children reported that they were not enrolled in school because there was no school close by or because travel to the local school was too difficult (Brown, 2013). The situation became alerting with the break of war in 2015 and escalating violence over the past four years. More than 2,500 schools are out of use. 66% were damaged by the heavy violence, 27 have closed down, and 7% used to shelter displaced families or for military purposes. This has disrupted children's schooling and contributed to a 20% increase in the number of out-of-school children, from 1.6 million before the war to 2 million today (UNICEF, 2018).

To accommodate out-of-school population, it will require significant investments and tangible reform in school construction program in term of school design approaches and contracting practices. AlMunifi (2004) stated that to support the MOE in expanding access, the World Bank-Government financed-projects allocated nearly 70% of the resources to increase the number of classrooms for students in critically deficient areas.

The need is huge in the very normal situation without taking into consideration the effects of the ongoing war on school buildings. The MOE should afford to add annually approximately 12000 classrooms to accommodate out-of-school children. This is an increase of 50% of the annual plan and current capacity production. A set of policies such as, building new classrooms based on school mapping, rehabilitating unserviceable schools, and improving mechanisms for routine maintenance of existing schools, should be in-place, and be accompanied with a program to strengthening the capacity of the MOE in school construction.

The war has caused a serious deterioration of the economic and social conditions in the country; nevertheless, education will continue to be the cornerstone to rebuild the country given that 50% of Yemen's population is under the age of 18.

3. Literature Review

Despite that high cost of school construction is a hot topic and is making headline in the country, a very limited research work has been conducted in this aspect. There is a lack of background research papers in the subject area and about the country of interest in particular. Most of the available reports and researches are focused on comparing delivery cost of a classroom among different implementing agencies; And those with further details, the value of school contract divided by the gross built area to get the cost per square meter. Without giving attention to the big variations in the components of schools, the distance and accessibility to building sites, urban-rural, and types of construction material. The impact of design approach and most importantly the regulations and contracting practices that are followed by the implementing agencies have not yet been given any attention.

A direct cost comparison between different school types built by the various implementation agencies is difficult if not even impossible. Some implementing agencies are mainly active in rural areas, other in both rural and urban. The working paper: Yemen Experience with the Fast Track Initiative that presented in the Fast Track Initiative Partnership Meeting in Brasilia in 2004 shows that the variations in costs of school construction in two governorates hit the range of US$15000 to US$19000 per classroom (Fast Track Initiative, 2004). Yet, what factors led to such variation.

The MOE, in the context of preparing school construction plans and policies, conducted in 2004 school construction cost analysis for projects implemented between 1997 and 2002. The outcome of the analysis is US$146/sq. m. This was considered as good basis for 2004 with estimated inflation rates of the Yemeni construction sector (MOE, 2004).

Ogawa, K (2004) in his task to assess school construction costs to estimate the financing requirement to achieve Universal Primary Education reviewed school construction in Yemen. He found the unit cost of classroom varies from US$5,000 (UNICEF), between US$10,044 and US$12,171 (SFD, PWP, BEEP), between US$14,000 and US$16,000 (the Ministry of Education), to US$26,000 (Japan). He assumed that the difference in costs depends on school design, type of construction, and administrative procedures. Nevertheless, comparing to other countries he found that the unit cost in Yemen is very high-US$3,100 in India, US$3,900 in Bangladesh; US$4,700 in Mauritania; US$7,500 in Guinea; US$8,200 in Brazil; and US$10,000 in Mexico (Ogawa, 2004).

As far as the authors are aware, the tendering procedure for Japan supported school construction program took place in Japan with participation of only Japanese contractors who in their turn subcontracted local constructors. Therefore, the very high unit cost is justifiable.

The WB & YG Mission Report (2005) Reviewed civil works components in four education projects. They found that the very low unit cost per classroom in the Child Development Project implemented by UNICEF is mainly due to the lack of other facilities than classrooms in most of the new schools. In addition, the dimensions of classrooms are smaller, and built by small contractors who are contracted by local communities. With the addition of new facilities to the initial standard design, the unit costs will probably increase up to US$10,000. The report concluded that a comparison between different designs would be more accurate by square meter in gross area (The World Bank & Yemen Government, 2005).

Döring, (2010) attempted to identify solutions to reduce the cost of school construction. He avoided comparing the unit cost of different school types erected by the various implementation agencies. His work based on the assumption that there should be minimum requirements set for a school to be regarded as being "fully functional". The study concluded that there has an overall potential for cost reductions of up to 25% compared to current practices, combining a series of short-term improvements with a set of long-term capacity building measures (Döring, 2010).

The delivery system in school construction sector differs by implementing agency. Each has its procurement framework, procedures and disbursement flow. This variation in procurement procedures and disbursement arrangements reflects the procurement guidelines of the financier.

The Law No. 23 for 2007 on Tenders, Auctions, and Government Storehouses regulates the public procurement in the country. All government entities, ministries, and corporations should refer to this legal framework and must use Standard Bidding Documents to carry out any procurement activity (National Info. Centre, 2018).

The MOE has an accumulated procurement experience practicing the Government Procurement Law, as a government entity. It has been the main implementing agency for school buildings. The procurement methods used for the procurement of construction services is mainly National Competitive Bidding and is used for all types and sizes of schools. It is a practice that payment certificates take time to be processed and approved, and a very long time to be disbursed.

The PWP and the SFD are covering all the Country Governorates in both rural and urban areas. The two agencies are funded by a number of donors with a World Bank lead. Based on The PWP and the SFD long and successful experience in administering school construction programs and public works in general, they have developed a Simplified Standard Bidding Documents for Works. The standard size of schools is different for each project. The SFD project has ten different standard schools corresponding to rural or urban areas, number of floors (one to three floors) and number of classrooms or half classrooms (3 to 36). The PWP has also ten standard schools with only 3, 6, or 12 classrooms or half classrooms. (SFD 2018 and PWP, 2018).

Both agencies are governed by the procurement guidelines of the financiers that are documented in the Credit Agreements as in the Projects documentation. The two agencies procurement procedures are much shorter comparing to the MOE that follows the government extended regulations. MOE Reports have shown that the two agencies, the PWP and SFD, have a good reputation with contractors as reliable contract partners with streamlined processing of decisions and most important fast payment cycles on delivered works (Ministry of Education, 2003).

Vincent and Monkkonen (2010) studied the impact of state regulations on the costs of public-school construction. They have measured the impacts of three regulations on the costs of construction and found that states with all three regulations have construction costs that are roughly 30% higher than states with none of the three regulations. AL-Kohlani, (2009) found that SFD and PWP have good procedure in place that ensures securing projects funds before the tender and making payments on time. Therefore, contractors trust these two agencies and do not seriously consider issues related to delay in payments. Zaghloul, and Hartman, (2003) indicated that a trust relationship between the contracting parties should exist first. This can be done through a clear understanding of the risks being born by each party and can result in cost saving in the construction industry.

4. Research Questions

This paper is addressing the high cost of investment in school construction program. The main objective of our research is to analyze to what extent the design approach as well as the contracting practices impact the school construction cost and time schedule. To accomplish this objective, the following questions are to be answered:

Does the design approach have an impact on cost and execution period of school Building?

Do the contracting practices have an impact on cost and execution period of school Building?

5. Research Contribution to Knowledge

Many developing countries struggle to afford the required infrastructure for the increasing school-age population. The analyses and findings of this research would enrich the knowledge and would serve as a tool in the hands of education planners, practitioners, policy makers, and financiers to meet the growing need for school accommodation. It is also a challenge for researchers for further research to study the impacts of risks related to accessibility to building sites, distance from asphalt roads, availability of building materials, and how trouble-prone the region is.

6. Research Methodology

After an extensive and thorough review of relevant documents and the authors' archive with a good number of unpublished reports and communications, the researchers decided to adopt a combination of qualitative and quantitative methods. Targeted groups were identified, namely: individual designers, engineering consulting firms, administrative and procurement staff, contractors, site supervisors, and financial staff. Short questionnaires were structured to collect data from each targeted group.

To elaborate more on the responses obtained from the questionnaires, semi-structured interviews were conducted. This enabled the researchers to get in-depth responses, and to reach key senior staff that usually are either busy to respond to questionnaires or their responses were not considered carefully.

Designers were targeted with questions to get information about design approach, used building codes, combination of design loads, soil investigation, and site conditions.

Administrative and procurement staff were targeted with questions related to tenders preparation, initial cost estimates and budget allocation, bid solicitation, bids evaluation and contract awarding.

Contractors were targeted with questions to get information on how they take the decision to participate in a bidding process, how they prepare bids in term of cost estimate and calculation of indirect cost, and profit, and how specifically they price risks.

Site Engineers were targeted with questions to get information about their duties, rights, and payment terms. Are they conducting works according to contractual terms and following contractors' works to ensure execution according to specifications and time schedule? Are there any grey areas that allow any for any misconduct?

Very valuable data were received from all parties. The analysis of the data shows that each agency has its own procurement procedure and follows different design approach. Therefore, the researchers moved further and acquired complete sets of contractual documents for a number of schools to study and analyze in-depth.

For the purpose of this study, five schools (3 rural and 2 urban) that are financed by the three school implementing agencies, namely, Social Fund for Development (SFD), Public Work Project (PWP), and the MOE, and have full sets of contractual documents available were selected. The schools were contracted and implemented in 2013 (before the break of war in 2015).

Taking into account the repetitive procedures, the researchers consider the sample as adequate and very representative. Full analysis of designs and contractual documents was carried out. Cost estimate was conducted according to the market price. Indirect costs were considered.

7. Design Approach

Based on the analysis of data collected from questionnaires and interviews, and after studying the school design documents and drawings, it was found that all the three agencies used Working Stress Method for structural design. This leads to an exaggeration in the dimensions of structural elements, and consequently larger quantities of concrete and reinforcing steel.

It was found that there is an overestimation in the presumption of live loads applied to the school buildings, especially by the MOE and PWP designers. Soil investigation and site topography and conditions are neglected in the design, which leads to variation orders that resulted in cost, and schedule overruns. Günhan et al. (2007) outlined in their study that is of relevance to practitioners involved in school design and construction projects that the large number and magnitude of change orders in projects constitute an impediment to the rapid and economic delivery of these projects. They found from the analysis of

a large number of change orders in school projects that the school projects can be completed with change orders not exceeding 5% of the contract value. This is valid if measures such as: choosing the right construction management firm, emphasizing the definition of project scope early in the project, and effectively managing the pre-contract activities by conducting value engineering and constructability reviews, Günhan et al. (2007).

The five schools were redesigned using the Ultimate Stress Method, and quantities of concrete and steel of the main structural elements were compared to the available designs as shown in Tables 1 to 10.

Table 1. Amount of concrete in S1 School.

Quantities of concrete (m^3) in main structural elements			
School Code	S1 (Three-Story Building)		
Structure Member	SFD Design	Re-Designed by USM	Percentage of saving in m^3
Footing	91	59	35%
Columns	54	49	9%
Ground Beams	21	17	19%
Beams	94	71	24%
Slabs	102	102	0%
Lintel	10	10	0%
Stairs	12	12	0%
Total	384	320	17%

Table 2. Amount of steel reinforcement in S1 School.

Quantities of steel reinforcement (kg) in main structural elements			
School Code	S1 (Three-Story Building)		
Structure Member	SFD Design	Re-Designed by USM	Percentage of saving in kg
Footing	5848	4333	26%
Columns	12086	8009	34%
Ground Beams	2647	2029	23%
Beams	15085	11151	26%
Slabs	13540	10155	25%
Lintel	1437	1437	0%
Stairs	1050	840	20%
Total	51693	37954	27%

Table 3. Amount of concrete in S2 School.

Quantities of concrete (m^3) in main structural elements			
School Code	S2 (Three-Story Building)		
Structure Member	PWP Design	Re-Designed by USM	Percentage of saving in m^3
Footing	46	25	46%
Columns	29	24	17%
Ground Beams	8	7	13%
Beams	57	30	47%
Slabs	47	47	0%
Lintel	8	7	13%
Stairs	12	10	17%
Total	207	150	28%

Table 4. Amount of steel reinforcement in S2 School.

Quantities of steel reinforcement (kg) in main structural elements			
School Code	S2 (Three-Story Building)		
Structure Member	PWP Design	Re-Designed by USM	Percentage of saving in m^3
Footing	3919	2118	46%
Columns	5635	4620	18%
Ground Beams	882	646	27%
Beams	8813	4793	46%
Slabs	7366	5565	24%
Lintel	820	656	20%
Stairs	2011	1900	6%
Total	29446	20298	31%

Table 5. Amount of concrete in S3 School.

Quantities of concrete (m^3) in main structural elements			
School Code	S3 (Two-Story Building)		
Structure Member	MOE Design	Re-Designed by USM	Percentage of saving in m^3
Footing	56	34	39%
Columns	27	21	22%
Ground Beams	22	17	23%
Beams	53	30	43%
Slabs	48	48	0%
Lintel	5	4	20%
Stairs	12	8	33%
Total	223	162	27%

Table 6. Amount of steel reinforcement in S3 School.

Quantities of steel reinforcement (kg) in main structural elements			
School Code	S3 (Two-Story Building)		
Structure Member	MOE Design	Re-Designed by USM	Percentage of saving in m^3
Footing	3166	2513	21%
Columns	3788	3487	8%
Ground Beams	2016	1540	24%
Beams	8283	3705	55%
Slabs	6227	4731	24%
Lintel	516	516	0%
Stairs	700	570	19%
Total	24696	17062	31%

Table 7. Amount of concrete in S4 School.

Quantities of concrete (m^3) in main structural elements			
School Code	S4 (Two-Story Building)		
Structure Member	PWP Design	Re-Designed by USM	Percentage of saving in m^3
Footing	188	82	56%
Columns	76	52	32%
Ground Beams	40	27	33%
Beams	99	81	18%
Slabs	104	104	0%
Lintel	9	8	11%
Stairs	12	11	8%
Total	528	365	31%

Table 8. Amount of steel reinforcement in S4 School.

Quantities of steel reinforcement (kg) in main structural elements			
School Code	S4 (Two-Story Building)		
Structure Member	PWP Design	Re-Designed by USM	Percentage of saving in m^3
Footing	14950	6424	57%
Columns	14855	9758	34%
Ground Beams	7225	3607	50%
Beams	20450	12914	37%
Slabs	12942	11742	9%
Lintel	1902	1202	37%
Stairs	2112	1998	5%
Total	74436	47645	36%

Table 9. Amount of concrete in S5 School.

Quantities of concrete (m^3) in main structural elements			
School Code	S5 (Three-Story Building)		
Structure Member	SFD Design	Re-Designed by USM	Percentage of saving in m^3
Footing	170	119	30%
Columns	123	114	7%
Ground Beams	54	40	26%
Beams	224	180	20%
Slabs	264	211	20%
Lintel	14	12	14%
Stairs	22	19	14%
Total	871	695	20%

Table 10. Amount of steel reinforcement in S5 School.

Quantities of steel reinforcement (kg) in main structural elements			
School Code	S5 (Three-Story Building)		
Structure Member	SFD Design	Re-Designed by USM	Percentage of saving in m^3
Footing	11857	9353	21%
Columns	29846	23739	20%
Ground Beams	7445	7225	3%
Beams	36770	28415	23%
Slabs	32027	19725	38%
Lintel	3450	2890	16%
Stairs	4276	3895	9%
Total	125671	95242	24%

Examining the quantities of concrete and steel that resulted from redesigning schools, it shows that are much less comparing to the contracted quantities by the MOE and PWP. The SFD is doing better and this is justifiable. As stated earlier, the three agencies use the WSM for design. Moreover, the MOE and PWP adopt large live loads, while the SFD refers to the Uniform Building Code to estimate the live load.

In Summary, the quantities of concrete would be reduced by 17 to 31%, and the quantities of steel reinforcement would be reduced by 24 to 36%, if the implementing agencies changed the design approach, as shown in the following Figs. 3 and 4.

8. Contracting Practices

The contractual practices that are followed by client play a major role in bids pricing. A lengthy procurement and less transparent procedure, and payments delay lead to a 40% increase in bid proposal. This case was registered for an identical project in which two proposals were submitted to two different implementing agencies by the same contractor (Authors' archive).

9. Procurement Procedures

The procurement procedures that are practiced by the three agencies were reviewed.

It is a mandatory for the MOE, as a government entity, to practice the government procurement law, which involves lengthy procedures. It seems that they were doing well, but with the pass of time and the appearance of new competitive implementing agencies, it became clear that the MOE tendering process is very lengthy and less transparent. There is also an extensive decentralization and delegation of authorities to lower governorates level, where technical capacities are minimal. In addition, interventions of influential people are badly influencing the process.

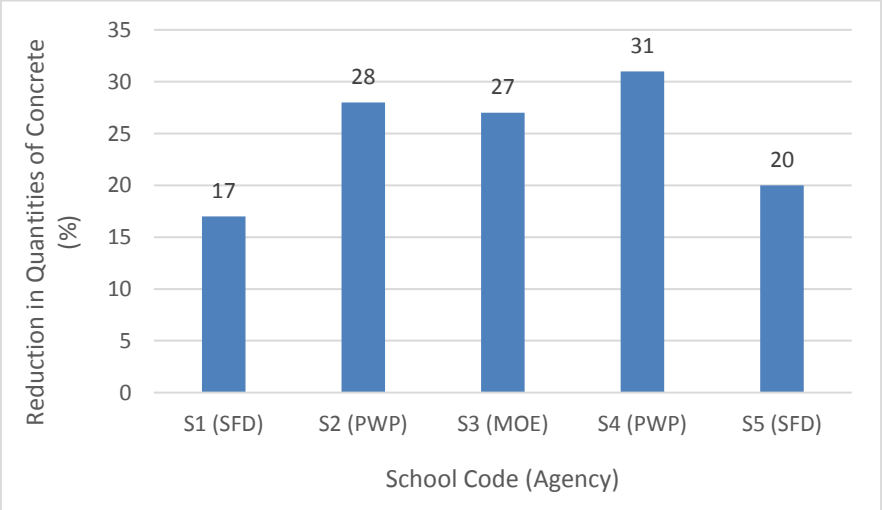

Fig. 3. The reduction percentage in quantities of concrete between agencies' designs and re-design by USM.

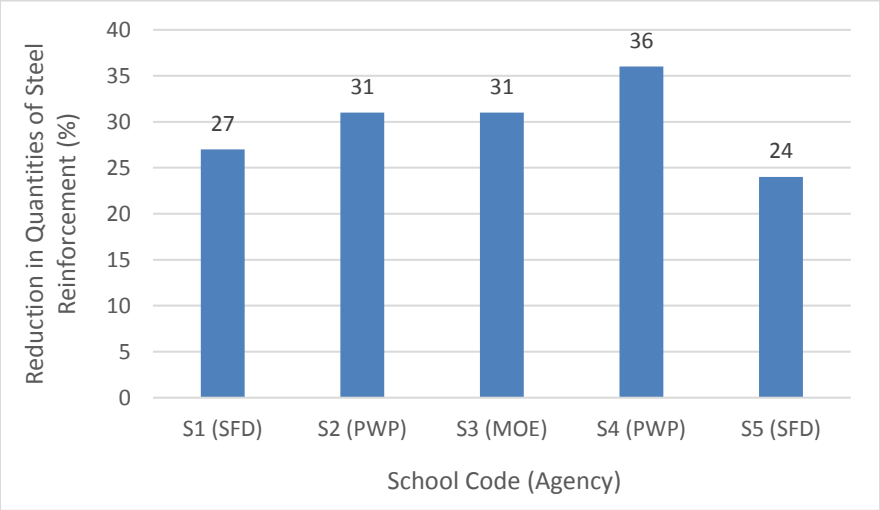

Fig. 4. The reduction percentage in quantities of steel reinforcement between agencies' designs and re-design by USM.

The delay in processing payment certificates is also one of the factors that have serious impact in bidder decision, and contractors usually price the risk of payment delays. It is a typical practice, that the procurement and financial departments request a long list of documents to activate payments to contractors. These documents differ according to the construction phase and are to be endorsed by various authorities and attached to any claim. It is quite an exhausted procedure for contractors for which they make up their calculations. As a result, contractors working for the MOE are consistently late in delivering projects and in particular if they are not technically and financially capable.

The PWP and the SFD have been established as part of the country financial and administrative reform program. They are impermanent structures that are staffed with competitively recruited staff. The remunerations of their staff are much higher than the government staff and usually covered from credits and grants. These two agencies carry out their procurement activities in accordance with the World Bank guidelines for Works. They also respect other donors procurement guidelines wherever and whenever is required. They have competitive and well-experienced management. This is supported by consulting engineers, well-performed contractors, and well-established local units that spread over all the country. Consequently, the procurement procedures and approval requirements are shorter with limited cycle of approvals comparing to the MOE.

Analyzing the collected data relevant to contracting processes, from tender announcement until the project handing over, it was found that: the SFD given 9 out of 10, the PWP given 8 out of 10 and the MOE given 6 out of 10, as shown in Fig. 5.

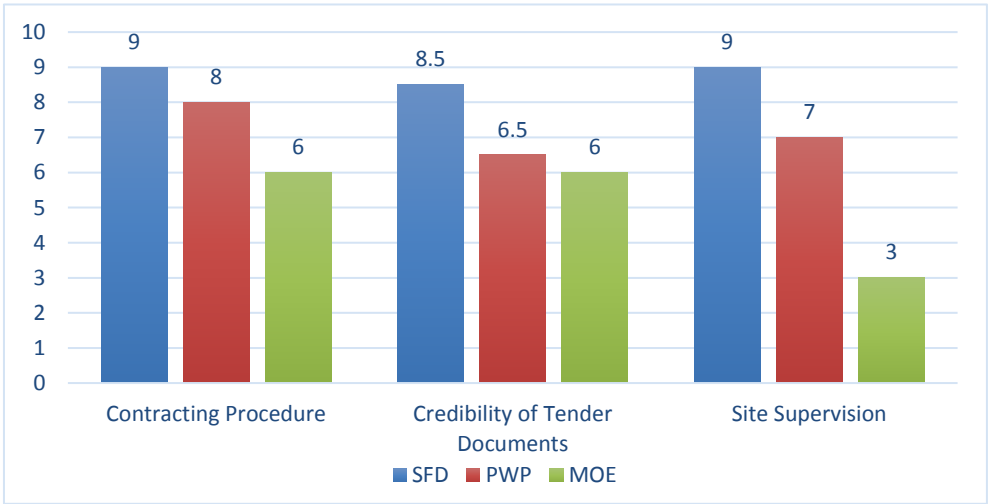

Fig. 5. Contracting process, credibility of tender documents, and site supervision for the three agencies.

10. Tender Documents Credibility

There are also other factors influencing bids costing as how clear and credible are the designs, bills of quantities, and technical specifications. There is a big doubt about the accuracy of the tender documents contents. Dosumu (2018) investigated the prevalent errors in contract documents and their effects on construction projects. The results indicate that errors in contract documents were moderately prevalent. However, over

measurement in bill of quantities was prevalent in private, institutional and management procured projects. Drawings contain the highest number of errors, followed by bill of quantities and specifications.

The contractors price this risk according to their experience with the implementing agency. Laryea and Hughes (2008) studied the complex relationship between risk and price in the bidding practices of contractors. They found that contractors select projects carefully in order to avoid unnecessary tendering costs and determine the appropriate risk to price, negotiate, or avoid. It was found that the SFD tender documents are more reliable and rated 8.5 out of 10, the PWP 6.5 and the MOE 6.

11. Site Supervision

Another factor that is worrying the contractors is the site supervision and follow-up by client engineer, which is connected to immediate solving of any problems that may arouse. Much more important is, the existence of an engineer supervisor to facilitate and approve payment certificates on time. The SFD is doing very well by assigning supervisors to construction sites. They got 9 of 10 comparing to only 3 given to MOE and 7 to PWP, as shown in Fig. 5.

Laryea and Hughes (2008) describing how trust and relationships influence prices, they found that most contractors would offer a certain, favorable level of prices to a client with whom they have a previous positive relationship.

12. Conclusions

In view of the accumulated challenges, it has become necessary to adopt a set of policies that are based on the best practices in school construction. This work is an attempt to put a cornerstone and open the doors for further discussions and research to investigate the main reasons and factors that are affecting the cost and execution period of school buildings.

The scope of this research is limited to areas where immediate steps can be taken to improve the sector performance. Therefore, the study handled the two most influential dimensions of the problem and did not go further to list all playing factors, because a number of those listed as problems are in fact environmental and few things can be done to alter.

Accommodating the out-of-school population requires significant investments and reform in school construction program in term of school design approach, procurement procedures, contracting practices, sites supervision, and payments processing. From the analysis, it was found that the delivery system in school construction sector differ by implementing agency. Each has its procurement framework; procurement procedures and payments release requirements and processing time. This is inevitably reflected in contractors' bids pricing. It was found that contractors are quoting higher prices to the MOE comparing to what quoted to SFD and PWP. Taking into accounts the increase in quantities because of the design approach, and pricing different risks, the contractors quoted prices to MOE, PWP, and SFD that are 50%, 30%, and 25% higher than the actual price, respectively.

Can we get much better prices that reflect actual cost of materials and direct cost related to any contract? The data analysis shows that there is a high competition and a contractor would be very happy to receive a contract award, and would be happier if he can accomplish work as soon as he can in order to get payments.

If any improvement to be done it should be from the implementing agencies side. Good engineers should be contracted to produce school designs that are safe, functional, economic, and with minimal discrepancies. Choudhry (2017) attempted to identify the major causes of discrepancies in building construction. The results of the analysis indicate that the provision of incomplete data to designers, lack of interest by approving authorities to carefully check the design, and owner-proposed changes due to financial problems are the top three causes of discrepancies.

From the other side, more transparent and shorter cycle procurement procedure should be in place. Oyeyipo et al. (2016) conducted a study to evaluate the factors that affect contractors' decisions to bid for a project and to evaluate the importance of the identified factors to decision makers. The results indicate that the financial capability of clients, availability of capital and availability of material are the most important factors that contractors consider when making a bid/no bid decision.

In addition, contractors should be trained technically, and on procurement procedures so that be aware about their duties and rights. Site supervisors are a nightmare to contractors. Agencies should be selective, should train site engineers to play the right role of problem solvers rather than fishing mistakes, and create problems to both contractor and client.

Accommodating out-of-school children is a multi-dimensional issue, and is not only a matter of school building, but integrated educational policies and planning. Further studies on the subject matter will be of benefit to the findings of the current research work.

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References

AL-kohlani M (2009). An investigation of the causes and extent of delay and cost overrun in school construction projects in Yemen. *M.Sc. thesis*, Bartlett School of Graduate Studies- University College London, UK.

AlMunifi A (1997). Lessons learned from Yemen earthquakes - engineering and environmental aspects. *29th General Assembly of IASPEI*. Thessaloniki, Greece.

AlMunifi A (2004). The vision of the Ministry of Education: Programs and policies. *The Pre-appraisal Workshop for the Preparation of the Basic Education Development Project*. Sana'a, Yemen.

Brown G (2013). Accelerating progress to 2015-Yemen. A Report Series to the UN Special Envoy for Global Education.

Choudhry R, Gabriel HF, Khan MK, Azhar S (2017). Causes of discrepancies between design and construction in the Pakistan construction industry. *Journal of Construction in Developing Countries*, 22(2), 1–18.

Döring C (2010). Cross-Sector and Multi-Institutional Assessments Study on School Construction Costs in Yemen. *The Proceedings of the 13th Architecture & Behaviour Colloquium*. Lausanne, Switzerland.

Dosumu OS (2018). Perceived effects of prevalent errors in contract documents on construction projects. *Construction Economics and Building*, 18(1), 1–26.

Fast Track Initiative (2004). Yemen experience with the fast track initiative. *Fast Track Initiative Partnership Meeting*. Brasilia.

GET German Education and Training (2008). School Construction Costs in Yemen. Sana'a, Yemen.

Government of Yemen (2018). Yemen Constitution. retrieved from http://www.yemen.gov.ye/. Jan 2019.

Günhan S, Arditi D, Doyle J (2007). Avoiding change orders in public school construction. *Journal of Professional Issues in Engineering Education and Practice,* 133(1), 67–73.

Khan Q, Chase S (2003). Yemen and the Millennium Development Goals. Working Paper Series. The World Bank.

Laryea S, Hughes W (2008). How contractors price risk in bids: Theory and practice, *Construction Management and Economics*, 26(9), 911–924.

Ministry of Education (2003). Analysis of the school construction 1996-2003. Sana'a, Yemen.

Ministry of Education (2004). Preparation of the school construction plans and policies.

Ministry of Education (2013). Yemen Education Sector Plan-Mid Term Results Framework 2013-2015.

National Information Center (2018). Law No. (23) for the year 2007 regarding tenders and auctions. https://www.yemen-nic.info/db/laws_ye/detail.php?ID=15594, Jan. 2019.

Ogawa K (2004). Achieving education for all in Yemen: Assessment and current status. *Journal of International Cooperation Studies*, 12, 2.

Oyeyipo O, Odusami KT, Ojelabi RA, Afolabi AO (2016). Factors affecting contractors' bidding decisions for construction projects in Nigeria. *Journal of Construction in Developing Countries,* 21(2), 21–35.

PWP (2018). Contracting procedures. Retrieved from www.pwpyemen.org/index.php/en/. Jan. 2019.

SFD (2018). Contracting procedures. The World Bank (2013). Report No: 72143-YE. Project Appraisal Document. Retrieved from www.sfd-yemen.org. Jan. 2019.

The World Bank (1999). Republic of Yemen-Education Sector Assistance Strategy. Human Development Sector.

The World Bank and the Republic of Yemen (2010). Education Status Report. Challenges and Opportunities. A joint publication of the International Bank of Reconstruction and Development.

The World Bank and Yemen Government (2005). Review of civil works components in four education projects. Mission Report.

UNICEF (2018). If not in school - The paths children cross in Yemen. Report.

Vincent M, Monkkonen P (2010). The impact of state regulations on the costs of public school construction. *Journal of Education Finance*, 35(4), 313–330.

Zaghloul R, Hartman F (2003). Construction contracts: The cost of mistrust. *International Journal of Project Management,* 21(6), 419–424.