

## Cost Estimation Practice in The Gaza Strip: A Case Study

Adnan Enshassi<sup>1</sup>, Sherif Mohamed<sup>2</sup> and Ibrahim Madi<sup>3</sup>

<sup>1</sup>School of Civil Engineering, IUG, Palestine, <sup>2</sup>School of Engineering, Griffith University, Australia, <sup>3</sup>UNRWA Contracting Section, Gaza, Palestine

### ممارسة تقدير التكاليف في قطاع غزة - حالة دراسية

**ملخص:** هناك دور استراتيجي لصناعة الإنشاءات في دول العالم المتطور ودول العالم التي تحت التطوير. تعتبر صناعة الإنشاءات في فلسطين من أكبر الصناعات التي تعمل على تشغيل الأيدي العاملة، كما تساهم بنسبة 17% من قيمة الدخل القومي. تهدف هذه الدراسة إلى عرض حالة دراسية عملية يتم فيها توضيح كيفية تقدير التكاليف بواسطة المقاولين المحليين وكذلك معرفة العوامل التي تؤثر على تقدير التكاليف. أظهرت النتائج بأن أهم خمس عوامل تؤثر على تقدير التكاليف هي: الوضع المالي للمالك، نوع المشروع، حجم عمل المقاول، موقع المشروع و طريقة دفع (VAT).

**Abstract:** The construction sector has a strategic role in developed and developing countries. Employing more than 16 per cent of Palestinian work force, the sector is the largest industrial employer in Palestine. The construction industry accounts for 17 per cent of the value added to the gross national product. Cost estimation is a fundamental part of the construction practice as it represents the compilation and analysis of many items that influence, and contribute to, the total cost of project. The aim of this paper is to present a practical case study on cost estimation practice of a construction project implemented by a local contractor while project clients' was the United Nations Relief and Works Agency (UNRWA). The findings obtained from the case study showed that the most five important factors that affect contractors' cost estimate are financial status of owner, type of project, contractor workload, location of project, and method of paying Value Added Tax (VAT). Excluding VAT from the quotation analysis sheet will provide more accurate and obvious bid estimates. Therefore, clients and owners are encouraged to advertise their projects based on zero VAT rating. The results of this study recommend that there is a need to change the traditional awarding system for contracts from the first lowest bidder to the most accurate one.

**Keyword:** Cost estimation, accuracy, contractors, economy.

## **Introduction**

### **UNRWA Contracting Section**

The UNRWA contracting section was established towards the end of 1988 and came into operation in 1989 in order to solve the serious problems associated with the implementation of UNRWA's projects in Gaza Strip. These problems include:

- Contractors' reluctance to tender for Agency projects located in areas where they are frequently prevented from having access due to the curfews imposed by the Israeli authorities. This has also led to a considerable increase of the tender's price.
- Contractors' reluctance to commence projects and frequently had to be issued with warnings by owners for delay, so the contract periods were frequently overrun.
- There was also the widely held view that contractors were conspiring to influence prices (i.e. operating rings or cartels).

The contracting section was established as a Self-Support Unit and was therefore required to cover its own overheads and operating costs, including all staff costs. The Unit was initially established with a total of five staff members employed under fixed term contracts, which were later increased to eleven. With the completion of peace implementation projects and the reduction of funding for new projects, staffing was reduced down to seven at the end of 1997. Since January 2003, the staffing was increased to eight as shown in Figure 1.

The contracting Section staff act as a construction management team with work being undertaken either by sub-contract, piecework or by direct labor on a daily paid casual basis. This approach is identical to that used by all contractors worldwide. The contracting section is required to comply with all relevant UNRWA procedures (e.g. tendering and finance procedures). All materials are purchased via the Agency's procurement and logistics department in accordance with UNRWA procedures.

When the contracting section was initially established in 1988/89, contracts were awarded directly without competitive tendering. However, since 1991 the contracting section has been considered as an independent contractor, which is required to compete with local contractors. The contracting section implemented 170 projects with a total value of 8 millions dollars during the period from 1989 to 2001. The contracting section has the privilege of having first-hand knowledge of the UNRWA system. However, this is of limited value when it comes to tendering, as they have to submit tenders to the tender opening committee on equal basis

like any other contractor. On the other hand, when it comes to the execution of projects they are probably at a disadvantage, as it is required to provide higher standards than any other independent outside contractor.

One of the advantages of the contracting section is the ability to complete the projects whenever the performance of the external contractor is unsatisfactory. Under such circumstances it is difficult to hire another contractor to undertake the partially completed works. This is obviously not the case with the contracting section. The quality of work produced by the contracting section is of a good standard. UNRWA obviously has greater control over the contracting section than it has over an independent contractor. Furthermore, it has played an important role in controlling of prices regarding agency construction contracts by giving UNRWA a better insight into contracting section in Gaza Strip. From a financial viewpoint, the profit realized by the contracting section is handled as a net income earned by UNRWA. Since the establishment of the contracting section, it has achieved a net income of approximately \$840,000.00. An indirect saving is achieved by lowering the prices of contractors due to participation of the contracting section in the competitive tendering.

Since the contracting section is exempted from paying VAT, UNRWA achieves substantial savings on the contracts awarded to the contracting section. However, the contracting section pays VAT on materials purchased. In a recent major contract, it was found that the contracting section paid VAT equal 8.6% of the contract value i.e., a potential saving of 8.6% of the contract value. The aim of this paper is to present a practical case study on cost estimation practice of a construction project implemented by a local contractor while project clients' was the United Nations Relief and Works Agency (UNRWA).

### **Background**

An estimate is a judgment, opinion, forecast or prediction. A cost estimate therefore, is judgment or opinion of the cost of a process, product, project or service. It is a prediction or forecast of what a work output or work activity will cost. The verb "estimate" means to appraise, evaluate, value, rate or assess [1]. Cost estimating is crucial to construction contract tendering, providing a basis for establishing the likely cost of resources elements of the tender price for construction work [2]. Construction is a unique industry, which is inherently risky because most projects must be priced before they are constructed, whereas in other industries the selling price is based on known manufacturing costs. A serious industry problem is inaccurate estimating. Numerous failures of construction companies can be

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attributed to faulty or inaccurate estimating. Inaccurate estimates contribute to the squandering of valuable resources [3].

A key factor for a successful construction project is the preparation of an accurate estimate, which can influence issues ranging from project feasibility to profitability. A cornerstone of a successful estimate is determining the cost of labor, which is dependent on determining the expected labor productivity [4]. Estimating is a fundamental part of the construction industry. The success or failure of a project is dependent on the accuracy of several estimates throughout the course of the project, that is, from conceptual and feasibility estimates through to the detailed or bid estimates [3]. The contractor's bid estimate is his foundation for a successful project. He must bid low enough to obtain the work, yet high enough to make a profit [5]).

Construction estimating is the compilation and analysis of the many items that influence and contribute to the total cost of a project. Estimating which is done before the physical performance of the work requires a detailed study of the bidding documents. It also involves a careful analysis of the results of the study in order to reach most accurate estimate possible of the probable cost consistent with the bidding time available and the accuracy and completeness of the information submitted [6]. Tender documentation used in the preparation of cost estimates includes drawings, specifications, conditions of contract, and bills of quantities. In corroboration with other departments within the company, the estimation department undertakes various tasks to arrive at the consolidated net cost estimated for the project [1].

Building projects generally have two types of estimates: approximate estimates (sometime called preliminary, conceptual or budget estimates) and detailed estimates (sometimes called final, definitive, or contractor's estimates). For large owner organizations the approximate estimate is prepared by the owner during the feasibility study of the project's need, priorities, and scope definition. For small owner organizations it is usually prepared in cooperation with the design organization that is contracted by the owner to design the project and prepare the contract documents. The level of accuracy of the approximate estimate can vary significantly, depending upon the amount of information that is known about the project [7].

The compilers of all types of published cost information do not claim that the information is accurate. They are correct to suggest that the prices quoted are nothing more than a guide. Perhaps the only exception is the builder's merchants' price lists, but these even include disclaimers that the

prices are subject to change at very little notice. But how good a guide is this information? This can be measured in two different ways, through accuracy and consistency [8]. Accurate estimates optimize good contracting. As a corollary, inaccurate estimates provide improper guidelines for the project management. Unrealistic targets produce unrealistic expectations [3]. Akintoye and Fitzgerald [9] have argued that the precision of estimates depends not only on the method but also on the type of work and on the intended use of the estimate. Accuracy implies closeness to the actual value, whatever that is consistency, on the other hand, is a measure of how often this accuracy can be relied on [8]). Conceptual estimate is normally produced with an accuracy range of – 15 to +30%, while definitive estimates are detailed and normally produced within an accuracy range of –5 to + 15%. This type of estimate is developed from much defined technical data through specifications and drawings [10].

The definitive estimate usually produces accuracy with range of –5 to +15%. This type of estimating assumes that skills labour, hours, and materials can be identified for each work element [1]. On this basis, contracting companies should be familiar with the factors that affect the unit cost of the resources needed for the construction project. The more detailed approach in cost estimation will produce more accurate tender price. The difference on early price estimate and the accepted tender from a contractor represents an inaccuracy. This can be expressed in percentage terms [8]. A range of accuracy levels usually expresses as a plus or minus percentage, should be assigned to any estimate by the estimator based on his or her best assessment of the project true cost.

There is no industry standard that has been agreed on regarding the amount of plus or minus percentage that should be applied to an estimate. The level of accuracy of the approximate estimate can vary significantly, depending upon the amount of information that is known about the project. With no design work it may range from +40% to –20%. After preliminary design work, it may range from +25% to –10%. On completion of detailed design work it may range from +10% to –5% [7]. Ashwarth [8], outlines three important factors to improve the accuracy of cost estimation, these factors are:

- An improvement in the quality of designer's information, since a vague design can result only in an accurate estimate.
- A reappraisal of the methods currently used for estimating.
- Identifying the qualities in the quantity surveyor which contribute towards accuracy in estimating and considering how they might be improved.

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### Case study

A case of constructing a single sided school at Rafah elementary “A and E” girls school is studied, in order to get in-depth information about the actual estimation in a real case. As mentioned previously, the client of the project is the United Nations Relief and Works Agency (UNRWA).

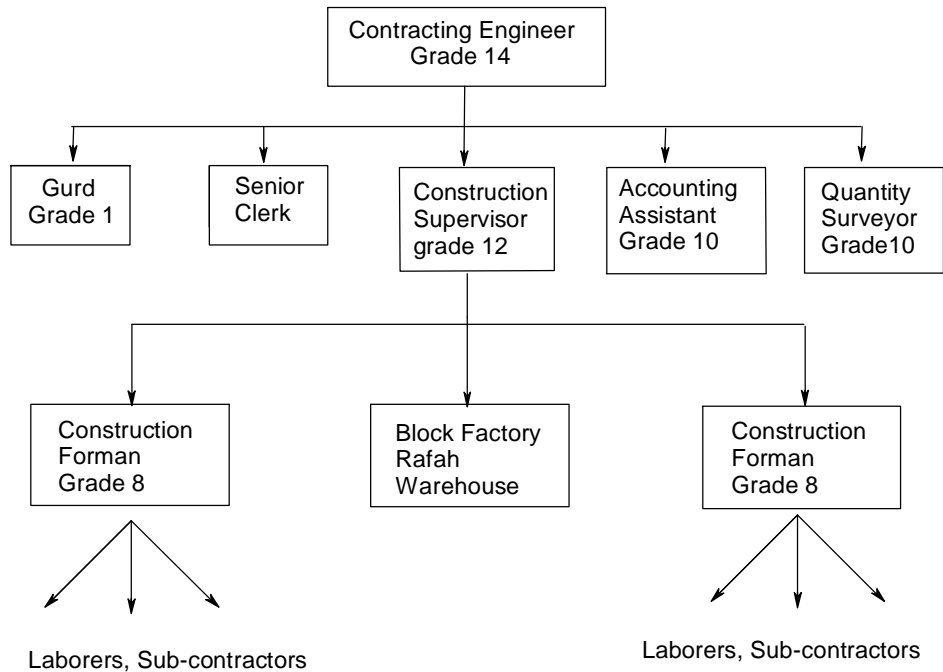
### Project Description

The school of Rafah elementary “A & E” girls’ school is located in the middle of Rafah city and consists of three-storey building with a total space of 2763 M<sup>2</sup>. The main building of the school is a U - shaped and comprises 21 classrooms, two rooms for teachers, library and multi-purpose room and four staircases. The school is designed to accommodate 2300 pupils and 60 teachers and other administrative staff working on two shifts. The project includes also construction of standard toilet block consisting of 10 units with a total area of 34 M<sup>2</sup>, steel shading shed 124 M<sup>2</sup>, renovation of existing two classrooms with area of 101 M<sup>2</sup>, and concrete-surfaced playground of 600 M<sup>2</sup>. The project design was prepared locally by the design unit at UNRWA technical department.

### Contract type

The contract of the project is a UN standard form of building contract with bid bond. The tender for the project was advertised as a competition unit price contract, which consists of four bills of quantities as follows:

- **Bill No. 1:** for the main building, which contains demolishing and alterations, excavation and earth works, concrete works, block works, carpentry and joinery, metal works, finishing, internal plumbing, external plumbing, roofing, painting and decorating, electrical installations, and drainage works.
- **Bill No. 2:** for girls’ toilet block which contains excavation and earth works, concrete works, block works, carpentry and joinery, metal works, finishing, internal plumbing, external plumbing, painting and decorating, and drainage works.
- **Bill No. 3:** for renovation of existing two classrooms, which contains painting and decorating and electrical installations works.
- **Bill No. 4:** for external works, this contains grading and leveling, playground, paths and steps, retaining walls, boundary walls, water surface disposal and landscaping.



**Figure 1** Organization chart for UNRWA's contracting section

**Procurement of the contract**

The tender was advertised in the local / national newspaper and on notice boards available in all UNRWA installations in Gaza Strip. The tenders invited by means of open tendering, in which all contractors of first category registered with Gaza Contractors Union and those registered as category "A" with UNRWA were invited to submit tenders. Eleven contractors collected tender documents and submitted completed tenders before the specified tender closing date. The categories and registration of the eleven contractors are summarized in table 1. UNRWA collected an amount of \$ 300 per set of tender to offset the cost of advertising and tendering and to ensure offers from *bona fide* contractors. All metal and carpentry items were provided by UNRWA Carpentry Production Unit. However, loading, transportation and fixing costs of such items were included in the tender and to be carried out by the contractor.

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### Technical evaluation of lowest recommended tender

The first lowest bidder is registered with UNRWA as category “C” contractor. However, he registered with Gaza contractors union as first category/class B contractor. The price of lowest tender was \$ 361,848.00, which was lower than the Agency estimate of \$ 442,791.50 by 18.28%. The contractor, with lowest tender, had satisfactory executed a number of projects for PECNDAR, UNDP, and the Ministry of Education. Some of these projects were similar to UNRWA projects such like the following:

**Table 1** Classification and registration of the invited contractors.

S/N.	Contract	UNRWA’s Contractors List	Contractors Union List
1.	A	Category “C”	First Category Class “B”
2.	B	Category “A”	First Category Class “A”
3.	C	Category “B”	First Category Class “B”
4.	D	Category “A”	First Category Class “A”
5.	E	Category “A”	First Category Class “B”
6.	F	Category “A”	First Category Class “A”
7.	G	Category “B”	First Category Class “B”
8.	H	Category “B”	First Category Class “B”
9.	I	Category “A”	First Category Class “B”
10.	J	Not registered	First Category Class “B”
11.	UNRWA Contracting Section	Category “A”	Not registered

- I. Construction of Tal-Sulatn Kindergarten.
- II. Construction of a kitchen at Naser Hospital at Khanyounis city.
- III. Construction of a cafeteria and toilets at Shuhada’ Garden at Rafah city.
- IV. Finishing works for welfare building at Khanyounis city.
- V. Construction of a closed hall at Gaza.
- VI. Rehabilitation and extension of Amina Bent Wahab preparatory girls’ school and Rafah preparatory boys’ school.
- VII. Construction of 10 classrooms at Khansa’ secondary school at Abasan city.
- VIII. Construction of audiovisual building at Khanyounis.

The UNRWA's field office engineer interviewed the contractor with the lowest tender and inspected a number of projects carried out by him. As the result, UNRWA was satisfied that the contractor had both the ability and financial resources to undertake the project. The price of the concerned tender was low and very competitive. The cost of construction per square meter for the main building was \$ 127 compared favorably with previous received prices for other schools, the costs of which were as follows:

New Gaza preparatory boys' school.	(Double Sided)	\$ 134/M <sup>2</sup>
Beach elementary "A" and Asma School.	(Double Sided)	\$ 144/M <sup>2</sup>
Beit Lahia elementary school.	(Single Sided)	\$ 151/M <sup>2</sup>

Field Contracts Committee (FCC), which is responsible for reviewing all contracts submitted to UNRWA Gaza Field, noted that the UNRWA contracting section came last in the list of the tenders. The Field Technical Officer (FTO) clarified this point highlighting that the contracting section received only 8.6% from the Value Added Tax (VAT) for purchasing raw materials by UNRWA, while other local contractors received the full percent of VAT equaling 17%.

The contractor with lowest tender was requested to sign an undertaking whereby he confirmed his low prices, in order to minimize misunderstanding during execution of the project. UNRWA's contracts committee recommended accepting the lowest tender based on overall offer, while certain sections of the work such as concrete works, carpentry, metal works, finishing works, external plumbing, and painting works were priced considerably lower than the Agency estimate. This recommendation was based on UNRWA policy to accept the lowest tender within the required specifications. The Headquarter Contracts Committee (HQCC) approved the contract proposal based on the recommendation of the FCC and stressed that the Gaza Field Office should pay more attention in supervising those items which were priced particularly lower than the Agency's estimate.

### **Project execution**

The work started on 6 April 1999 and was completed on 8 March 2000. The work was delayed by 16 days of which 14 days were considered to be outside the contractor's control, while the contractor paid \$600.00 as liquidated damages for the remaining two days. Eight variation orders were issued during project execution with a total amount \$29,001.00. Final

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measurement sheets were calculated for the four bills of quantities. The measured value was \$312,865.00, \$9,272.00, \$1,980.00, and \$31,502.00 for bills No 1, 2, 3 and 4 respectively. Strict supervision was exercised during construction to achieve good quality and to enforce good adherence to the required specifications according to tender document.

#### **Accuracy and consistency analysis for prices excluding VAT.**

Table 2 represents quotation analysis sheet for the received eleven bids compared with Agency estimate. The prices exclude Value Added Tax (VAT) and are expressed in US dollars. The first lowest bidder is less than the Agency estimate by 18.28% while the bid of UNRWA contracting section is higher than Agency estimate by 4.12%. According to this analysis, the contract was awarded to the lowest bid without taking into account the concept of accuracy in cost estimation during the review of the contract. On the other hand, Table 3 provides accuracy analysis for the same bids; the figures for each tender were converted into a series of price relatives, giving the mean price of the eleven tenders a value of 100 as outlined by Ashwarth [8].

For example the mean price for demolition and alterations works is \$3,350.45 which represents the average of demolition and alterations works for the eleven tenders. By giving the mean price a value of 100, then the relative price of the agency estimate will be  $(1250/3350.45)*100 = 37.31$ . Accordingly, all figures were converted into a series of price relative as summarized in Table 3. On an un-weighted basis the mean price represents a value of 100, the contractor "J" giving the highest value of 145. If it were assumed that the mean price of the received tender was the most accurate, contractor "F" would provide the most accurate bid for this tender, with a mean value of 101. The standard deviation represents the measure of consistency, and shows that while contractor "C" provides the sixth accurate bid, it is the most consistent in its pricing compared with the overall mean prices with 14.03 as standard deviation. Furthermore, the results show that while contractor "A" provides the lowest bidder, it is the tenth accurate tender. , It is worth noting that while UNRWA contracting section has the highest tender price, its bid has ranked fifth in terms of accuracy. .

#### **Accuracy and consistency analysis for prices with VAT**

The tender price should exclude VAT, but for the purpose of analysis only and to show how the VAT affects the accuracy of the estimation, the received tenders will be analyzed including VAT. Table 4 represents quotation analysis for received tenders including VAT, which equals 17% of

the prices of external contractors, while including partial percent of VAT (8.6%) to UNRWA contracting section prices. The first lowest bidder is less than the Agency estimate by 4.39%, while UNRWA Contracting Section is the sixth lowest bidder and higher than the Agency estimates by 13.07%.

Table 5 provides accuracy and consistency analysis for the received bids with VAT. The figures for each tender were converted into a series of price relatives, giving the mean price of the eleven tenders a value of 100 as outlined by Ashwarth (1994). Contractor "F" provided the most accurate tender price with a mean value of 101.72, while the first lowest bidder has the tenth accurate tender with a mean value of 75.90. The standard deviation represents the measure of consistency, and shows that while contractor "C" has the sixth accurate bid it is the most consistent in its pricing compared with the overall mean prices with 14.16 as standard deviation.

### **Results of interview of the lowest bidder**

The winning contractor was interviewed in order to establish more about the methods he followed in estimating the tender, and the highest ten factors that affected the accuracy of his prices. Two interviews were held with the contractor, the first aimed to identify the contractor's profile while the second aimed to analyze the highest ten factors affected the contractor's cost estimate.

### **Contractor profile**

During the project's tendering process, the contractor had been classified by UNRWA as category "C" contractor. However, his company was re-classified to the "A" category after completion of the project (i.e. the reported case study). The contractor failed to complete his registration with Gaza contractors' union after completion of the project. However, he was registered as first category/class "B" contractor when he estimated the tender for construction of Rafah elementary "B and F" girls' school.

The contractor has established his company in 1992 and has executed about 25 projects with approximate total amount of 2.5 millions dollars during the period from 1992 to 1998. The contractor continued to have seven staff members: 4 engineers, 2 construction foremen, and one secretary for the period from 1992 until he completed the project in 2000. Because he failed to win further contracts, he was unable to pay the wages of his employees whose contracts were consequently terminated. The contractor ran his work without having an estimation support. He explained that tender's estimation is the responsibility of the manager of the company. He added that his

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engineers always provide over-estimated tender price due to their relatively poor knowledge of market conditions.

### **The highest ten factors affecting tender cost estimate**

During the second interview, the contractor outlined the highest ten factors that affected his cost estimate as follows:

#### **1. Financial status of the owner**

As the UNRWA is the client and it has a very good financial status, the contractor, accordingly minimized his mark-up during estimation by intentionally decreasing the margin of profit. So the contractor participated with a low tender price in order to secure working for UNRWA.

#### **2. Type of owner**

The contractor preferred to work for UNRWA, which has a good reputation in making payments to contractor on time. As a result, the contractor, once again decreased his price in order to win the contract.

#### **3. Volume of company's workload during estimation of new contract**

The workload with the contractor was light during the tendering time. The company had a work of approximately \$ 100,000.00, which was considered not enough to cover the cost of contractor's overheads. The contractor decreased his cost estimate in order to win the project and to essentially cover his overhead.

#### **4. Location of project (hot areas, near settlements)**

The location of the project is close to the main street of Rafah city, which was classified as quiet area. This suitable location minimizes the cost of transporting of both raw materials and laborers and also minimizes the project risks. Based on his fact, the contractor decreased his estimate in order to maximize the chance of winning the contract.

#### **5. Method of paying Value Added Tax (VAT).**

The project tender was advertised based on paying the VAT of 17% to the contractor except UNRWA's Contracting Section. The VAT for this project was estimated to be \$61,000.00, which was paid by UNRWA to the contractor and it was assumed that it would be paid to Palestinian Authority Costumes and Excise Department (PACED). The contractor estimated many items of the tender using their real cost(s) without adding any profit to such items especially for the finishing works depending on the amount of VAT

that would be collected from UNRWA as output tax. This point was deeply discussed with the contractor to identify how this factor affected cost estimating practice of the tender. The contractor explained, without hesitation, that he collected the full percent of VAT, which was 17%, but he paid only 4% to PACED. The difference between the two amounts estimated by \$ 47,000.00 was covered by collecting many invoices for purchasing construction materials not directly related to the project under investigation. These invoices were introduced to PACED as input tax.

#### **6. Availability of project's resources**

The contractor had all necessary construction equipment, shuttering timber and miscellaneous small tools, needed to execute the project. The contractor, however, planned to execute the project by hiring various construction gangs of laborers on a daily basis for shuttering, building, plastering works etc. This method of work reduced the cost of construction and enabled the contractor to reduce his tender estimate. As a result of executing the project by hiring casual laborers, the contractor reduced sharply the cost of shuttering and casting concrete from \$32.00 to only \$15.00 per cubic meter. Implementing the works using casual laborers on daily base wages decreased cost of other contractual works.

#### **7. Number and classification of the competitors to the contractor**

The market condition was mainly characterized by tough competition during the tendering stage. All competitors for the tender were classified first category in Gaza contractors union and they had small workloads during tendering. The contractor prepared the first estimate of the tender with total amount of \$ 379,000.00, but as his competitors were classified as strong contractors especially contractors "B" and "D", the contractor decreased his price with \$ 18,000.00 just before submitting the tender. The second ranked cost estimate was valued at \$ 361,848.00, while contractor "B" and "D" valued their prices at \$ 362,632.50 and \$ 394,901.40 respectively.

#### **8. Tender's currency**

The tender's currency was in US dollars, so the problem of inflation was ignored during tender estimation. This assumption was reinforced by the fact that there were only small changes in the relative values of various construction items during the life-cycle cost analysis. The contractor did not pay any attention to materials price fluctuations, since the tender's currency was in US Dollars. The contractor mentioned that if the tender's

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currency was in the local currency, he might have increased his tender's price to minimize the risk of any potential increase in the unit price of construction materials.

### 9. Experience of consultant engineer

UNRWA as the client has provided the project with a resident engineer, this arrangement affected positively the tender cost estimate. This kind of contractual arrangement gave the contractor the chance to minimize his estimate based on assumption that many supervision problems would be solved by having an externally-funded qualified resident engineer.

### 10. Accuracy of the project's bills of quantities

The more accurate quantities and information provided in tender bills, the more likely this would be to be reflected in cost estimate of the tender. For this reason and as the client of the project i.e. UNRWA provided accurate bills of quantities, the contractor provided realistic unit rates. The contractor estimated the four bills of quantities by \$309,665.00, \$12,884.00, \$1,970.00, and \$37,329.00, while the measured quantities for the same bills were \$312,865.00, \$9,272.00, \$1,980.00, and \$31,502.00. Table 6 summarizes the estimated bills and the actual values after completion. As shown in table 6 the variance between the total estimated bills of quantities and their actual measured amount is too small and equals (- 1.72%).

Table 6 Summary of estimated bills and their actual measurements

Bill No.	Description	Estimated Amount	Actual Measured Amount	Variation
1.	Main Building	\$ 309,665.00	\$ 312,865.00	+ 1.03%
2.	Toilet unit	\$ 12,884.00	\$ 9,272.00	- 28.03%
3.	Renovation of 2 classrooms	\$ 1,970.00	\$ 1,980.00	+ 0.50%
4.	External works	\$ 37,329.00	\$ 31,502.00	+ 15.61%
	Total	\$ 361,848.00	\$ 355,619.00	- 1.72%

### Conclusion

The findings obtained from the reported case study show that the most four important factors that affected contractor's cost estimate are financial status of owner, type of project's owner, contractor workload and location of project relative to hot areas. The results of the case study evidently support that the project's client and its financial status are playing an important role in cost estimation. The contractor preferred to work for

UNRWA, which is a reliable Agency with a stable financial status. It is not surprising that the contractors pay more attention when they participate in new tenders on the grounds that some clients suffer from unstable or poor financial status. In this case, contractors tend to increase their tender estimates to mitigate the effect of difficulties in their cash flow during implementation.

Results of the case study also show how the contractor paid more attention to project's location. The more secured project's location the less tender price can be submitted to the client. Method of paying the value added tax (VAT) has a very important effect in tender's estimation practice. When the contractor collected the VAT from the client, the tender price will be decreased. On other hand, the contractors usually increase their tender price when they do not receive VAT from the client. It was found in this case study that the contractor used part of the received VAT in covering the real cost of some items of the project. This method of dealing with VAT created biased and unfair competition with other contractors who paid the real input tax to PACED. UNRWA had suffered from VAT problem as it paid the full percent of VAT to contractors, while these amounts were not reimbursed to UNRWA by PACED. For these reasons, UNRWA applied, since 2001, a tendering system with zero VAT ratings to avoid paying additional funds to contractors with a view to accomplishing a fair and competitive tendering process.

The contracting companies in Gaza Strip are encouraged to execute their projects by hiring casual laborers on a daily basis, which considerably reduces the cost of execution instead of hiring sub-contractors. This approach creates employment opportunities to Palestinian labors who are suffering from high unemployment rate. Excluding of value added tax (VAT) from the quotation analysis sheet will provide more accurate and obvious bid estimates. Therefore, clients and owners are encouraged to advertise their projects based on zero VAT rating. The results of this study recommend that there is a need to change the traditional awarding system for contracts from the first lowest bidder to the most accurate one. The contracting companies are requested to keep computerized historical data of finished projects and to pay more attention to training needs of their employees in order to improve their performance in tender pricing. More efforts should be spent to develop special pricing software with associated database of construction materials in order to improve the cost estimation practice in Gaza Strip.

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**Table 2** Quotation Analysis Sheet without Value Added Tax (VAT)

ITEM	DESCRIPTION	Agency Estimate	Contractor A	Contractor B	Contractor C	Contractor D	Contractor E	Contractor F	Contractor G	Contractor H	Contractor I	Contractor J	UNRWA Contracting
	<b>Bill No. 1.(Main</b>												
1	Demolition & Alterations	1250	8000	1100	1850	3000	1720	4900	3800	3600	2995	3000	2890
2	Excavation and Earth	9706	8592	6246	7810	5413	10742	10920	7832	10956	7028	12245	8717
3	Concrete Works	171160.5	148775	145548.4	150423.5	161963	151853	166093	165574	155053	163078.5	151868	177975
4	Block Works	5398	3778	5121	6759	5394	5394	5667	5394	7556	6737	19171	6737
5	Carpentry and Joinery	5813	1947	5286	5665	4486.5	4594	3753	4021	6601	6410	19557	6370
6	Metal Works	58764	38474	44900	40603	40021	56016	50707	44839	53620	60477	45792	50885
7	Finishing	70374	52569	50746.6	59177	67916.9	58786	63939	65643	64045	72846.5	64843	71565
8	Internal Plumbing	2167	1074	2242	2074	1947	1726	2600	3694	2693	2092	1911	2536
9	External Plumbing	5549	2938	5701	5601	3520	7054	6850	6159	6480	5100	5762	7670
10	Roofing	10098	7024	7989	8092.5	7745	10554	10142	8106	10622	11051	8661	11843
11	Painting & Decorating	25162	15149	17792.5	17587.5	19056	21310	24131	22417	26193	23878	22603.5	23737
12	Electrical Installations	14785	17365	13658	13524	15593	17983	16680	17928	20525	13294	13500	17412
13	Drainage	3845	3980	6006	6490	5075	4300	9140	10340	8420	7735	5025	6470
<b>Total</b>		<b>384071.5</b>	<b>309665.0</b>	<b>312336.5</b>	<b>325656.5</b>	<b>341130.4</b>	<b>352032</b>	<b>375522</b>	<b>365747.0</b>	<b>376364</b>	<b>382722</b>	<b>373938.5</b>	<b>394807</b>
	<b>Bill No.2,(Girls Toilet</b>												
14	Excavation and Earth	936	1288	751	815	534	1282	1174	1074	1453	1022	1153	1280
15	Concrete Works	6736	5494	5168	6509	5423	5104	5941	7603	6395	7885	5570	6683
16	Block Works	281	255	288	420	723	255	255	255	425	425	869	590
17	Carpentry and Joinery	312	175	320	305	246	780	278	265	530	390	1318	530
18	Metal Works	730	190	420	480	275	350	420	480	840	570	980	700
19	Finishing	3539	2839	3098	2438	3315	3284	3850	3919	3908	4198.5	3622	4128
20	Internal Plumbing	2129	1220	2300	2333	1525	1875	2095	3330	3016	1595	2000	1852
21	External Plumbing	485	365	380	390	590	640	710	950	775	425	542	550
22	Painting & Decorating	186	93	182	186	186	186	186	338	186	186	279	279
23	Drainage	850	965	1090	1180	990	1120	1770	1525	1210	1750	1020	775
<b>Total</b>		<b>16184</b>	<b>12884</b>	<b>13997</b>	<b>15056</b>	<b>13807</b>	<b>14876</b>	<b>16679</b>	<b>19739</b>	<b>18738</b>	<b>18446.5</b>	<b>17353</b>	<b>17367</b>
	<b>Bill No. 3,(Renovation of</b>												
24	Painting & Decorating	1799	923	924	1510	934	1113	1918	2985	1611	2207	2546	1274
25	Electrical Installations	965	1047	793	897	895	960	1080	1078	1193	1160	1966	1610

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<b>Total</b>		<b>2764</b>	<b>1970</b>	<b>1717</b>	<b>2407</b>	<b>1829</b>	<b>2073</b>	<b>2998</b>	<b>4063</b>	<b>2804</b>	<b>3367</b>	<b>4512</b>	<b>2884</b>
	<b>Bill No 4,(External</b>												
26	Grading & Leveling	300	300	500	500	100	100	500	500	1000	500	2000	400
27	Playground	9386	9577	8550	9239.5	9249	10617	10347	13047	11236	12378	12213	9547
28	Paths, Paving & Steps	16974	16529	14050	13439	16718	16821	17259	18355	17133	18710	18160.5	16334
29	Retaining Walls	6332	5506	5240	6408.5	6262	5426	5028	5994	7802	6726	6248	7401
30	Boundary Walls	2620	1763	3273	3300	3397	3257	3026	3161	4775	3706	4206	3793
31	Water Surface Disposal	1705	1030	828	1660	925	868	1530	1730	1380	1850	2140	3300
32	Landscaping	2455	2624	2141	2465	1484	9290	3319	4420	2968	1904.5	17215	5185
<b>Total</b>		<b>39772</b>	<b>37329</b>	<b>34582</b>	<b>37012</b>	<b>38135</b>	<b>46379</b>	<b>41009</b>	<b>47207</b>	<b>46294</b>	<b>45774.5</b>	<b>62182.5</b>	<b>45960</b>
	<b>General summary</b>	<b>442791.5</b>	<b>361848</b>	<b>362632.5</b>	<b>380131.5</b>	<b>394901.4</b>	<b>415360</b>	<b>436208</b>	<b>436756</b>	<b>444200</b>	<b>450310</b>	<b>457986</b>	<b>461018</b>
	(+) Higher, (-) Lower/Estimate		<b>-18.28%</b>	<b>-18.10%</b>	<b>-14.15%</b>	<b>-10.82%</b>	<b>-6.20%</b>	<b>-1.49%</b>	<b>-1.36%</b>	<b>0.32%</b>	<b>1.70%</b>	<b>3.43%</b>	<b>4.12%</b>

N.B : \*Prices Are without Value Added Tax ( VAT 17 %)

\*Analysis Expressed in US Dollars.

**Table 3** Accuracy Analysis Sheet without Value Added Tax (VAT)

ITEM	DESCRIPTION	Mean Price	Agency Estimate	Contractor A	Contractor B	Contractor C	Contractor D	Contractor E	Contractor F	Contractor G	Contractor H	Contractor I	Contractor J	UNRWA Contracting Section
1	Demolition &	3350.45	37.31	239	33	55	90	51	146	113	107	89	90	86
2	Excavation and	8772.82	110.64	98	71	89	62	122	124	89	125	80	140	99
3	Concrete Works	158018.58	108.32	94	92	95	102	96	105	105	98	103	96	113
4	Block Works	7064.36	76.41	53	72	96	76	76	80	76	107	95	271	95
5	Carpentry and	6244.59	93.09	31	85	91	72	74	60	64	106	103	313	102
6	Metal Works	47848.55	122.81	80	94	85	84	117	106	94	112	126	96	106
7	Finishing	62916.09	111.85	84	81	94	108	93	102	104	102	116	103	114
8	Internal	2235.36	96.94	48	100	93	87	77	116	165	120	94	85	113
9	External	5712.27	97.14	51	100	98	62	123	120	108	113	89	101	134
10	Roofing	9257.23	109.08	76	86	87	84	114	110	88	115	119	94	128
11	Painting &	21259.50	118.36	71	84	83	90	100	114	105	123	112	106	112
12	Electrical	16132.91	91.64	108	85	84	97	111	103	111	127	82	84	108
13	Drainage	6634.64	57.95	60	91	98	76	65	138	156	127	117	76	98
14	Excavation and	1075.09	87.06	120	70	76	50	119	109	100	135	95	107	119
15	Concrete Works	6161.36	109.33	89	84	106	88	83	96	123	104	128	90	108
16	Block Works	432.73	64.94	59	67	97	167	59	59	59	98	98	201	136
17	Carpentry and	467.00	66.81	37	69	65	53	167	60	57	113	84	282	113
18	Metal Works	518.64	140.75	37	81	93	53	67	81	93	162	110	189	135
19	Finishing	3509.05	100.85	81	88	69	94	94	110	112	111	120	103	118
20	Internal	2103.73	101.20	58	109	111	72	89	100	158	143	76	95	88
21	External	574.27	84.45	64	66	68	103	111	124	165	135	74	94	96
22	Painting &	207.91	89.46	45	88	89	89	89	89	163	89	89	134	134
23	Drainage	1217.73	69.80	79	90	97	81	92	145	125	99	144	84	64

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24	Painting &	1631.36	110.28	57	57	93	57	68	118	183	99	135	156	78
25	Electrical	1152.64	83.72	91	69	78	78	83	94	94	104	101	171	140
26	Grading &	581.82	51.56	52	86	86	17	17	86	86	172	86	344	69
27	Playground	10545.50	89.00	91	81	88	88	101	98	124	107	117	116	91
28	Paths, Paving &	16682.59	101.75	99	84	81	100	101	103	110	103	112	109	98
29	Retaining Walls	6185.59	102.37	89	85	104	101	88	81	97	126	109	101	120
30	Boundary Walls	3423.36	76.53	51	96	96	99	95	88	92	139	108	123	111
31	Water Surface	1567.36	108.78	66	53	106	59	55	98	110	88	118	137	211
32	Landscaping	4819.59	50.94	54	44	51	31	193	69	92	62	40	357	108
Mean [Represents the measure of accuracy]			91	75	79	87	80	94	101	110	115	102	145	111
St.Dev. [Represents the measure of consistency]			23.15	37.13	16.45	14.03	26.71	32.66	22.54	31.76	21.59	20.85	80.53	26.20

N.B : \*Prices Are without Value Added Tax ( VAT 17 %)

\*Analysis Expressed in US Dollars.

**Table 4** Quotation Analysis Sheet with Value Added Tax (VAT)

ITEM	DESCRIPTION	Agency Estimate	Contractor A	Contractor B	Contractor C	Contractor D	Contractor E	Contractor F	Contractor G	Contractor H	Contractor I	Contractor J	UNRWA Contracting Section
	<b>Bill No. 1.(Main)</b>												
1	Demolition &	1250	9360	1287	2164.5	3510	2012.4	5733	4446	4212	3504.15	3510	3138.54
2	Excavation and	9706	10052.64	7307.82	9137.7	6333.21	12568.14	12776.4	9163.44	12818.52	8222.76	14326.65	9466.66
3	Concrete Works	171161	174066.75	170291.63	175995.5	189496.71	177668.01	194328.81	193721.58	181412.01	190801.8	177685.56	193280.85
4	Block Works	5398	4420.26	5991.57	7908.03	6310.98	6310.98	6630.39	6310.98	8840.52	7882.29	22430.07	7316.38
5	Carpentry and	5813	2277.99	6184.62	6628.05	5249.205	5374.98	4391.01	4704.57	7723.17	7499.7	22881.69	6917.82
6	Metal Works	58764	45014.58	52533	47505.51	46824.57	65538.72	59327.19	52461.63	62735.4	70758.09	53576.64	55261.11
7	Finishing	70374	61505.73	59373.522	69237.09	79462.773	68779.62	74808.63	76802.31	74932.65	85230.41	75866.31	77719.59
8	Internal	2167	1256.58	2623.14	2426.58	2277.99	2019.42	3042	4321.98	3150.81	2447.64	2235.87	2754.10
9	External	5549	3437.46	6670.17	6553.17	4118.4	8253.18	8014.5	7206.03	7581.6	5967	6741.54	8329.62
10	Roofing	10098	8218.08	9347.13	9468.225	9061.65	12348.18	11866.14	9484.02	12427.74	12929.67	10133.37	12861.50
11	Painting &	25162	17724.33	20817.225	20577.375	22295.52	24932.7	28233.27	26227.89	30645.81	27937.26	26446.095	25778.38
12	Electrical	14785	20317.05	15979.86	15823.08	18243.81	21040.11	19515.6	20975.76	24014.25	15553.98	15795	18909.43
13	Drainage	3845	4656.6	7027.02	7593.3	5937.75	5031	10693.8	12097.8	9851.4	9049.95	5879.25	7026.42
<b>Total</b>		384072	362308.1	365433.7	381018.1	399122.6	411877.4	439360.7	427924.0	440345.9	447784.7	437508.0	428760.40
	<b>Bill No.2.(Girls)</b>												
14	Excavation and	936	1506.96	878.67	953.55	624.78	1499.94	1373.58	1256.58	1700.01	1195.74	1349.01	1390.08
15	Concrete Works	6736	6427.98	6046.56	7615.53	6344.91	5971.68	6950.97	8895.51	7482.15	9225.45	6516.9	7257.74
16	Block Works	281	298.35	336.96	491.4	845.91	298.35	298.35	298.35	497.25	497.25	1016.73	640.74
17	Carpentry and	312	204.75	374.4	356.85	287.82	912.6	325.26	310.05	620.1	456.3	1542.06	575.58
18	Metal Works	730	222.3	491.4	561.6	321.75	409.5	491.4	561.6	982.8	666.9	1146.6	760.20
19	Finishing	3539	3321.63	3624.66	2852.46	3878.55	3842.28	4504.5	4585.23	4572.36	4912.245	4237.74	4483.01
20	Internal	2129	1427.4	2691	2729.61	1784.25	2193.75	2451.15	3896.1	3528.72	1866.15	2340	2011.27
21	External	485	427.05	444.6	456.3	690.3	748.8	830.7	1111.5	906.75	497.25	634.14	597.30
22	Painting &	186	108.81	212.94	217.62	217.62	217.62	217.62	395.46	217.62	217.62	326.43	302.99
23	Drainage	850	1129.05	1275.3	1380.6	1158.3	1310.4	2070.9	1784.25	1415.7	2047.5	1193.4	841.65
<b>Total</b>		16184	15074.28	16376.49	17615.52	16154.19	17404.92	19514.43	23094.63	21923.46	21582.41	20303.01	18860.56
	<b>Bill No.</b>												
24	Painting &	1799	1079.91	1081.08	1766.7	1092.78	1302.21	2244.06	3492.45	1884.87	2582.19	2978.82	1383.56

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25	Electrical	965	1224.99	927.81	1049.49	1047.15	1123.2	1263.6	1261.26	1395.81	1357.2	2300.22	1748.46
<b>Total</b>		2764	2304.9	2008.89	2816.19	2139.93	2425.41	3507.66	4753.71	3280.68	3939.39	5279.04	3132.02
	<b>Bill No</b>												
26	Grading &	300	351	585	585	117	117	585	585	1170	585	2340	434.40
27	Playground	9386	11205.09	10003.5	10810.215	10821.33	12421.89	12105.99	15264.99	13146.12	14482.26	14289.21	10368.04
28	Paths, Paving &	16974	19338.93	16438.5	15723.63	19560.06	19680.57	20193.03	21475.35	20045.61	21890.7	21247.785	17738.72
29	Retaining Walls	6332	6442.02	6130.8	7497.945	7326.54	6348.42	5882.76	7012.98	9128.34	7869.42	7310.16	8037.49
30	Boundary Walls	2620	2062.71	3829.41	3861	3974.49	3810.69	3540.42	3698.37	5586.75	4336.02	4921.02	4119.20
31	Water Surface	1705	1205.1	968.76	1942.2	1082.25	1015.56	1790.1	2024.1	1614.6	2164.5	2503.8	3583.80
32	Landscaping	2455	3070.08	2504.97	2884.05	1736.28	10869.3	3883.23	5171.4	3472.56	2228.265	20141.55	5630.91
<b>Total</b>		39772	43674.93	40460.94	43304.04	44617.95	54263.43	47980.53	55232.19	54163.98	53556.17	72753.525	49912.56
	<b>General summary</b>	442792	423362.16	424280.03	444753.86	462034.64	485971.2	510363.36	511004.52	519714	526862.7	535843.62	500665.55
	(+) Higher, (-)		-4.39%	-4.18%	0.44%	4.35%	9.75%	15.26%	15.41%	17.37%	18.99%	21.01%	13.07%

**Table 5** Accuracy Analysis Sheet with Value Added Tax (VAT)

ITEM	DESCRIPTION	Mean Price	Agency Estimate	Contractor A	Contractor B	Contractor C	Contractor D	Contractor E	Contractor F	Contractor G	Contractor H	Contractor I	Contractor J	UNRWA Contracting Section
1	Demolition & Alterations	3897.96	32.07	240	33	56	90	52	147	114	108	90	90	80.52
2	Excavation and Earth Works	10197.63	95.18	99	72	90	62	123	125	90	126	81	140	92.83
3	Concrete Works	183522.66	93.26	95	93	96	103	97	106	106	99	104	97	105.32
4	Block Works	8213.86	65.72	54	73	96	77	77	81	77	108	96	273	89.07
5	Carpentry and Joinery	7257.53	80.10	31	85	91	72	74	61	65	106	103	315	95.32
6	Metal Works	55594.22	105.70	81	94	85	84	118	107	94	113	127	96	99.40
7	Finishing	73065.33	96.32	84	81	95	109	94	102	105	103	117	104	106.37
8	Internal Plumbing	2596.01	83.47	48	101	93	88	78	117	166	121	94	86	106.09
9	External Plumbing	6624.79	83.76	52	101	99	62	125	121	109	114	90	102	125.73
10	Roofing	10740.52	94.02	77	87	88	84	115	110	88	116	120	94	119.75
11	Painting & Decorating	24692.35	101.90	72	84	83	90	101	114	106	124	113	107	104.40
12	Electrical Installations	18742.54	78.88	108	85	84	97	112	104	112	128	83	84	100.89
13	Drainage	7713.12	49.85	60	91	98	77	65	139	157	128	117	76	91.10
14	Excavation and Earth Works	1248.08	75.00	121	70	76	50	120	110	101	136	96	108	111.38
15	Concrete Works	7157.76	94.11	90	84	106	89	83	97	124	105	129	91	101.40
16	Block Works	501.79	56.00	59	67	98	169	59	59	59	99	99	203	127.69
17	Carpentry and Joinery	542.34	57.53	38	69	66	53	168	60	57	114	84	284	106.13

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18	Metal Works	601.46	121.37	37	82	93	53	68	82	93	163	111	191	126.39
19	Finishing	4074.06	86.87	82	89	70	95	94	111	113	112	121	104	110.04
20	Internal Plumbing	2447.22	87.00	58	110	112	73	90	100	159	144	76	96	82.19
21	External Plumbing	667.70	72.64	64	67	68	103	112	124	166	136	74	95	89.46
22	Painting & Decorating	241.12	77.14	45	88	90	90	90	90	164	90	90	135	125.66
23	Drainage	1418.82	59.91	80	90	97	82	92	146	126	100	144	84	59.32
24	Painting & Decorating	1898.97	94.74	57	57	93	58	69	118	184	99	136	157	72.86
25	Electrical Installations	1336.29	72.21	92	69	79	78	84	95	94	104	102	172	130.84
26	Grading & Leveling	677.67	44.27	52	86	86	17	17	86	86	173	86	345	64.10
27	Playground	12265.33	76.52	91	82	88	88	101	99	124	107	118	117	84.53
28	Paths, Paving & Steps	19393.90	87.52	100	85	81	101	101	104	111	103	113	110	91.47
29	Retaining Walls	7180.62	88.18	90	85	104	102	88	82	98	127	110	102	111.93
30	Boundary Walls	3976.37	65.89	52	96	97	100	96	89	93	140	109	124	103.59
31	Water Surface Disposal	1808.62	94.27	67	54	107	60	56	99	112	89	120	138	198.15
32	Landscaping	5599.33	43.84	55	45	52	31	194	69	92	62	40	360	100.56
Mean [Represents the measure of accuracy]			78.60	75.90	79.88	88.14	80.90	94.24	101.72	110.84	115.60	102.92	146.27	103.58
St.Dev. [Represents the measure of consistency]			19.97	37.35	16.55	14.16	26.93	32.89	22.64	31.94	21.70	20.99	81.03	24.74

N.B: Prices with Value Added Tax (VAT) ,  
 \*(17%) for all Local Contractors.  
 \*(8.6%) for UNRWA Contracting Section.

Adnan Enshassi, Sherif Mohamed, Ibrahim Madi

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