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Key indicators for evaluating the performance of construction companies from the perspective of owners and consultants

Momen M.A. Abu Oda [a], Bassam A. Tayeh [a,*], S.A. Alhammadi [b], Yazan I. Abu Aisheh [c]

[a] Civil Engineering Department, Faculty of Engineering, Islamic University of Gaza, P.O. Box 108, Gaza Strip, Palestine
[b] Princess Nourah Bint Abdulrahman University, P.O. Box 84428, Riyadh, 11671, Saudi Arabia
[c] Department of Civil Engineering, Middle East University, Amman, 11831, Jordan

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ABSTRACT

The construction sector is considered as one of the largest and most important sector in many countries of the world. This research aims to determine the most important performance indicators to evaluate the performance of construction companies from the perspective of owners and consultants. To achieve the aim of this study a total of 107 questionnaires were distributed to owners such as ministries, municipalities, and non-governmental institutions in addition to consulting offices that supervised the implementation of a number of construction projects in Gaza Strip. The collected data was analyzed with Statistical Package for Social Science (SPSS) IBM version 22. The results of this research showed that the most important indicators for evaluating the performance of construction firms in Gaza Strip are, the time needed for construction works, compliance with technical specifications, quality of workmanship, the overall time for completion of all project work, acceptable quality, overall cost, time to prepare shop drawings, understanding the work, cost for construction works, and the availability of quality control system. This study may help in the future to set a comprehensive framework for evaluating the performance of construction companies that may serve as a benchmark against the competitors in this field, identifying weaknesses and addressing them, and developing strengths in order to continuously improve performance to achieve the optimal performance in order to satisfy the customer expectations and achieve desired results.

1. Introduction

Because of the different perceptions, the concept of success in construction projects remains ambiguous [1–3]. Two definitions for success were awarded, the first is the fulfilling of the results desired or wished, while the second is to realize positive outcomes [4]. Abiodun, Segbenu and Oluseye [5] stated that the iron triangle for project management emphasizes the originality of the relationship between schedule, quality, and cost, therefore the quality, time, and cost are among the early success indicators for construction projects. Jari and Bhangale [6] defined success as satisfying the desired expectation of the stakeholder and fulfilling its intended goal. Kasabreh and Tarawneh [7] told that the prequalification of the construction firms that are awarded the tender is a key step in all projects. Performance evaluation is one of the major aspects of firm administration [8]. Butcher and Sheehan [9] stated that clients with good performance indicators understand that performance indicators are essentially consistent with the level of inputs and that improving inputs such as team integration, high performance, and cultural issues lead to improved outputs and excellent performance. According to Sweis, Bisharat, Bisharat and Sweis [10], often the performance of the contractor is the main reason for the success of the project, as this success results from good site management and the strong skills of the contractor [11,12].

Since the construction industry involves many parties such as consultants, contractors, customers, and regulators, it is of a complex nature [13,14]. Construction industry is also affected by local economies [15]. Individuals are the component that administratively connects the nodes of time, cost, and quality. Therefore, their presence in the middle of the Golden Triangle helps to create a balance between these elements. In studies conducted recently, another important component was added, "stakeholder satisfaction" [5]. Performance indicators are related to multiple dimensions and groups such as cost, customer satisfaction, quality, health and safety, time and work performance [5,16–18].

Often, the performance of contractors is measured through a number

* Corresponding author.
E-mail address: btayeh@iugaza.edu.ps (B.A. Tayeh).

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of indicators such as the quality of machinery and raw materials, quality assurances, and the procedures used to ensure them, the presence of competent staff working on the project, their training and development of their performance [19–21].

The criteria and performance indicators in the projects differ among institutions and individuals, although they correspond to the traditional restrictions of the Golden Triangle, which represents the indicators related to time, quality and cost. However, these are not the only criteria. Quality is an essential criterion for success, in addition to two other crucial criteria was the absence of legal claims and the achievement of profit targets and fees [5]. Key performance indicators are groups of measurement data within systems, and this data used to measure the efficiency and effectiveness of the system and to assess performance [22]. Through KPIs, it is possible to predict trends in the future because they indicate specific operations, and often these indicators represent a future and early vision of many problems, so it is difficult to find them, so the performance indicators are a real opportunity for change as they affect the end result from the initial stages [23].

Benchmarking is a continuous measurement of services, practices, and products compared with the most famous and prominent competitors or companies that are considered leaders in a specific field [8]. Radujković, Vukomanović and Dunović [23] determine the use of key performance indicators through consultants like engineers and architects, an investor like sponsors and owners, and contractors like construction management, self-performance, and subcontractor. KPI scorecards are usually used to evaluate the performance of all aspects of output on plans of the construction sector [9]. The KPI model is used as a highly reliable instrument for measuring contractors' performance in projects, and through which weaknesses and strengths aspects can be identified [24].

Meeting stakeholder expectations and fulfilling the objectives, are considered indicators of success [8]. In the event that the project is completed within the limits of the budget and the time allocated to it and with the required specifications, and in the event of achieving the final outputs with the satisfaction of the stakeholders, the project is considered successful [25]. It is not possible to create a comprehensive framework for performance indicators to suit all projects [26].

In general, performance criteria may contain one or more indicators, and these indicators are influenced by the project's stakeholders and characteristics [5]. The most important and common success criteria in projects are radically related to the iron triangle (cost, time, and quality) [27]. The success or failure of projects is evaluated by the success criteria, but there is no unified framework of criteria for defining success, so assessing success is an extremely difficult task as success cannot be touched or unanimous about it [5].

According to Enshassi, Abdul-Aziz and Abushaban [15] the main groups of the most weighted indicators were related to quality, productivity, time, satisfaction within the organization, community satisfaction, environment, health and safety, learning and innovation. Heravi and Ilbeigi [24] state that through many studies related to measuring the success of the project, an additional number of criteria have been increased to measure success, such as stakeholder satisfaction, customer benefit, the organization's goals, and future development in the organization and others. According to study conducted by Hany Abd Elshakour, Al-Sulaihi and Al-Gahtani [8], with regards to indicators for measuring the performance of building construction companies in the Kingdom of Saudi Arabia, it was concluded that the most important performance indicators were related to the effectiveness of planning, work efficiency, quality of service, work executed, work efficiency, customer satisfaction and the organization's financial capabilities such as; financial stability, market share, protection and development in the organization. On the other hand, the least important indicators were the use of water and energy and the impact on biodiversity. According to the study conducted by Butcher and Sheehan [9] about contractor's performance in the UK construction sectors, it was concluded that the most important and clear indicators of the contractor's excellent performance were: mutual trust between the project parties, contractor's staff satisfaction, cultural compatibility between the contractor and clients, and commitment through senior management. According to Ref. [24], effective indicators for measuring performance are divided into two main sections, the first section relates to the administrative aspect which is represented by a number of indicators such as cash flow, cost, environment, safety performance, the efficiency of planning and schedule, while the second section relates to the success of the final products represented by product quality, customer satisfaction, profit, investment, and revenue for the contractor. According to a study conducted by Radujković, Vukomanović and Dunović [23] about the application of key performance indicators in south-eastern European construction, the top ten main indicators were: cost, quality, changes in project funding, delays, team satisfaction, understanding of customer needs, learning and innovation, number of investments and time. In causes related to performance evaluation, the dispute, claim, quality of work and stakeholder satisfaction should be taken into consideration [25].

The sets of performance indicators are unique and vary from project to project because construction projects are unique and each project has different objectives and limitations, so the senior engineer must define these indicators based on his assessments and experience in this field [16,20].

According to Enshassi, and Abdul-Aziz [11], Key performance indicators are used primarily for the purpose of benchmarking, which results in enterprise development leading to better performance and practices. By setting a framework for KPIs, it becomes possible to define a standard for evaluating performance in construction projects, as there is a vision to develop a reference for future research [28]. For the purpose of establishing a performance measurement system, it is necessary to define the key indicators from the beginning since the implementation of these steps correctly leads to providing accurate information for the performance evaluation of construction firms [7].

In the absence of previous studies in this field in Gaza Strip and the absence of a system that includes the key indicators and their weights through which to evaluate the performance of contracting companies in all respects, this study has been prepared as a reference that can be relied upon later.

This research aims to determine the most important indicators to evaluate the performance of construction companies from the perspective of owners and consultants. To achieve the aim of this study a total of 107 questionnaires were distributed to some owners such as ministries, municipalities, and non-governmental institutions in addition to consulting offices that supervised the implementation of a number of construction projects in Gaza Strip.

2. Methodology

1. A cross-sectional, descriptive and analytical design was utilized for this study as such a design is suitable for describing the standing of phenomena or for relating multiple phenomena where the data is collected during a single period of data collection [29]. To validate the hypothesis of this study related to key performance indicators from the perspective of the owner and consultant for evaluating construction companies in Gaza Strip, a qualitative and quantitative survey method was adopted. The targeted population were the owners and the consultants who work in the construction industry (Project manager, site engineer, office engineer, project coordinators, and other Job titles) of Gaza Strip.
2. A questionnaire was prepared and distributed for collecting data as using questionnaire was consider the easiest and the fastest approach to collecting data considering the behavior of the targeted population. Also, it helps to collect precise data which then makes processing and analyzing easy. LoBiondo-Wood and Haber [30] defined sampling as the process of selecting representative units of a larger population for the study in a research investigation.

3. A random sample was chosen as the type of sample of probability sampling or representative sampling. The statistical equations no. 1 and 2 were used to determine the sample size follow as:

$$n = \frac{NX}{\left((N-1)E^2 + X\right)} \quad (1)$$

$$X = Z^2 \times \pi \times (1-\pi) \quad (2)$$

Where:
Z: (1.96 for 95% C·I).
P: (0.50 used for "n" needed).
n: Sample size.
E: Maximum Error (0.07)

$$X = 1.96^2 \times 0.5 \times (1-0.5) = 0.9604$$

According to the Engineers' Association in Gaza Strip, there are 62 consultant offices.

Population size for consultants = 62

$$n = \frac{NX}{\left((N-1)E^2 + X\right)} = \frac{62 \times 0.9604}{\left((62-1)(0.07)^2 + 0.9604\right)} \cong 47$$

Based on the equation above shows that the required sample size for consultants equal to 47.

Forty-seven questionnaires were distributed to consultants, and returned 40 with a response rate = 85.11%.

The exact number of owners in Gaza Strip is not shown in any official reports since no union or association is representing them. However, the number of owners was estimated at approximately 85 after discussions with senior engineers from different organizations.

$$n = \frac{NX}{\left((N-1)E^2 + X\right)} = \frac{85 \times 0.9604}{\left((85-1)(0.07)^2 + 0.9604\right)} \cong 60$$

Based on the equation above shows that the required sample size for owners equal to 60.

As shown in Table 1, sixty questionnaires were distributed to owners and returned 45 with a response rate = 75%. Thus, a total of 85 questionnaires were recovered that were valid for statistical analysis.

Moser and Kalton [31] exhibited that a response rate of less than 30% is likely to produce results exposed to non-response bias. Based on their findings, it is reasonable to say that the obtained response rates of 85 and 75% are reliable and would reflect reasonable results.

The questionnaire was prepared by exploring previous studies on the subject of the study and was validated by industry experts. In addition to that an explanatory letter explaining the purpose of the study and the way of response along with a disclaimer of confidentiality was sent to the intended respondents to encourage high response. The questionnaire included multiple-choice questions widely used in the questionnaire. The diversity of these questions aimed at achieving research objectives, collecting all necessary data that can support discussion, findings and recommendations for this research. The questionnaire was prepared in Arabic and consisted of frequently asked questions.

A six-step research methodology was developed to achieve the objectives of this study:

1. Previously published research was extensively reviewed to investigate potential KPIs.
2. Based on the findings from step one, a structured questionnaire was developed and distributed among the targeted population of the construction industry.
3. The acquired responses were tabulated, and the preliminary data was analyzed.
4. The KPIs were segregated according to various phases of a construction project.
5. Required statistical data analyses, including a two-sample *t*-test and ANOVA test, were performed to determine the significance level of KPIs in order to prioritize the identified KPIs.
6. Results were organized along with discussions and comparisons with previous studies.

The questionnaire was divided into two sections:

The first section consists of some question related to general information about who is filling out the questionnaire. The second section consists of indicators for measuring the performance of construction contracting companies, which is divided into ten groups. Based on the literature review that was cited in this study, the performance indicators were determined through which the performance of construction companies can be evaluated. These indicators were reviewed and discussed through interviews with experts (3 of senior engineers) who worked in the field of construction projects in Gaza Strip and through the experimental sample identified during the preparation of the research tool in this study, which represents the questionnaire.

Table (2) shows the modifications, merge, and additions were made to these indicators to reach a framework consisting of ten groups, including a total number of (74) indicators:

The internal validity of the questionnaire was the first statistical test performed to test the validity of the questionnaire. Spearman correlation coefficients between each indicator in the group and the whole group was measured using scouting sampling. The sample consisted of (25) questionnaires. The significance values are less than 0.05 or 0.01 so the correlation coefficients of all the groups are significant at $\alpha = 0.01$ (p-value < 0.01) or $\alpha = 0.05$ ($0.01 <$ p-value < 0.05). It can be said that the groups are internally valid and will measure what was intended to achieve the main aim of the study.

Structure validity measures the correlation coefficient between one group and all of the other groups of the questionnaire. As shown in Table (3) the significance values are less than 0.05. Thus it can be said that the fields are valid to be measured what it was set for to achieve the main aim of the study.

The reliability of an instrument is the degree of consistency with which it measures the attribute it is supposed to be measuring. For most purposes, reliability coefficients above 0.7 are considered to be satisfactory. In order to measure the reliability of the questionnaire, Cronbach's coefficient alpha and Half Split Method were used through the SPSS software. The normal range of Cronbach's coefficient alpha value is between 0.00 and + 1.00. The higher values reflect a higher degree of internal consistency. Table (4) shows that the Cronbach's alpha values for each group and all groups together are greater than 0.00 and lower than +1.00. The formula that determines alpha is fairly simple and makes use of the items (K) in the scale and the average of the inter-item correlations (r) where:

$$\text{Alpha} = \text{Kr}/\ (1+\ (\text{K-1})\ \text{r})$$

As shown in Table (4), the Cronbach's coefficient alpha (Cα) was calculated for each group, as well as all groups together. The reliability

Table 1
Response rate of the questionnaires.

Population category	Total population	Calculated sample size	Distributed questionnaire	Number of respondents	Response rate (%)
Consultants	62	47	47	40	85.11
Owners	85	60	60	45	75.00

Table 2
Modifications of key performance indicators.

#	Indicators from literature	References	Note	Selected indicators after pilot study
Time group				
1	Time to prepare design.	[32–34]	Modified	Time to prepare shop drawings.
2	Construction time.	[32,35,36]	Selected	The time needed for construction works.
3	–	–	Added	Time for implement variation orders & amendments.
4	Availability of resources.	[37,38]	Modified	Time needed for supplies and installations.
5	Delays.	[23,39]	Selected	Extra duration/Delays.
6	Time predictability.	[23,35,40]	Selected	Ability to predict the actual duration of the project completion.
7	Overall time.	[5,15,23,25,40]	Selected	Overall time for completion of all project work.
Cost group				
1	Cost of construction.	[34,35]	Selected	Cost for construction works.
2	Cost for variation Orders & amendments.	[28,41]	Selected	Cost for variation orders & amendments.
3	Direct cost.	[42]	Selected	Direct cost (Cost of resources working on the project such as contractor's team, workers, and machines).
4	Indirect cost.	[42]	Selected	Indirect cost (Office expenses, taxes, insurance, etc).
5	–	–	Added	Cost of repairing/rectifying defects caused by the contractor.
6	Cost deviation (overruns/savings).	[25,27]	Selected	Deviation of the total cost of the project (overruns/savings).
7	–	–	Added	Cost of claims.
8	–	–	Added	Liquidated damage.
9	Overall cost.	[5,23,25,40]	Selected	Overall cost.
Quality group				
1	Defects (number & nature).	[9,23,25]	Modified	Defects (number, nature & percentage).
2	Quality of raw materials.	[19,33]	Merged	Quality of resources (Equipment & Materials).
3	Quality of workmanship.	[25]	Selected	Quality of workmanship.
4	Availability of quality assessment system.	[42]	Modified	An availability of quality control system(monitoring, control & guarantees for quality performance).
5	Quality of Design.	[23,43,44]	Modified	Quality of shop drawing prepared by the contractor.
6	Aesthetics (artistry).	[45]	Selected	Aesthetics (artistry).
7	Compliance with technical specifications.	[5,23,25]	Selected	Compliance with technical specifications.
8	Acceptable quality about outputs available for use.	[5,6,8,24,27]	Selected	Acceptable quality about outputs available for use.
Health & safety group				
1	Commitment to health and safety measures.	[5,8,16,46]	Selected	Commitment to health and safety measures in project.
2	Safety about the environment.	[16,25,47,48]	Modified	Commitment to safety procedures and concepts about society and the environment.
3	Risk minimization.	[5,49]	Modified	Preventive measures (Insurance, training courses, safety plan).
4	Accident rate.	[28]	Modified	Losses resulting from emergency events in the project.(Accident rate, injuries, damage).
5	Risk rate.	[39,49,50]	Selected	Risk rate(Chances of exposure to danger, injury or loss).
Relationship group				
1	Attitudes and behaviors.	[9]	Merged	Attitudes of contractor, behaviors, and flexibility.
2	Trust & Commitment.	[9]	Selected	Trust & Commitment (Between contractor and other parties).
3	Claims, disputes & litigation.	[5,8,23,25]	Selected	Claims, disputes & litigation.
4	Cultural & social alignment/issue.	[8,9]	Selected	Cultural & social alignment/issue between contractor and other parties.
5	Relationship/ Cooperation with subcontractors.	[23]	Modified	Contractor's relationship with his users(his employees, workers, subcontractors, suppliers, etc.)
6	Effective communications.	[9,23]	Modified	Effective communication & coordinating.
7	Impact on stakeholders/ participation and meeting their satisfaction & expectations.	[5,8,24,25]	Selected	Impact on stakeholders/ participation and meeting their satisfaction & expectations.
8	The contractor and his team are satisfied with their performance.	[9,23]	Selected	The contractor and his team are satisfied with their performance.
9	Benefit to the national infrastructure.	[51]	Selected	Benefit to the national infrastructure.
Environment group				
1	Environmental Complaints	[47,52]	Selected	Environmental complaints.
2	–	–	Added	Commitment the laws about the environment.
3	Environment impact.	[24,53]	Modified	The extent of damage and losses to the environment.
4	Impact on air and water	[8]	Selected	Impact on air and water.
5	Impact on biodiversity	[8]	Selected	Impact on biodiversity.(The variety of life in a specific area or ecosystem).
6	Land use.	[42]	Modified	Ideal land use.
7	Sustainability standards.	[25,48]	Selected	Commitment to sustainability standards.
8	Energy use.	[8,25]	Modified	Energy use rate and its consequences.
9	Noise reduction measures.	[42]	Selected	Noise reduction measures.
Innovation group				
1	Ability to innovate.	[15,23,54]	Selected	Ability to innovate.
2	The future potential and preparations.	[24]	Selected	The future potential and preparations.
3	Development & growth in the organization.	[23,55]	Selected	Development & growth in the organization.
4	Image of the company.	[32]	Modified	The ideal image of the company.
5	Training and learning.	[9,15,23]	Modified	Training and learning to develop capacities and expertise.
Project management group				
1	Site management.	[42]	Modified	Managerial actions by contractor.
2	Schedule & Planning performance.	[8,24]	Selected	Schedule & Planning performance/efficiency.

(*continued on next page*)

Table 2 (*continued*)

#	Indicators from literature	References	Note	Selected indicators after pilot study
3	Resource utilization.	[13,42]	Selected	Resource utilization.
4	Procurement system/method.	[42]	Selected	Procurement system/ method.
5	Waste management.	[42]	Selected	Waste management.
6	Capabilities.	[23]	Modified	Control capabilities & decisions effectiveness (orientation to the goal).
7	Functionality.	[28,51]	Merged	Functionality & Utility (serve the purpose; practicality).
8	Motivation and improvement in company performance.	[9,23]	Selected	Motivation, and improvement in company performance.
Qualifications group				
1	Staff experience.	[32]	Modified	Qualifications of human resources in the company.
2	Project team performance.	[56]	Modified	Contractor's team performance & integration.
3	Efficiency.	[8,25]	Selected	Efficiency(Implementation with the least resources and costs).
4	Understanding of the customer's business.	[9]	Modified	Understanding the work.
5	Effectiveness & Productivity.	[8,23, 25]	Selected	Effectiveness & Productivity(Achieve the desired results correctly & actively).
6	Technological capability.	[55]	Modified	Technological and technical capabilities of the company.
7	Contractor characteristics.	[57]	Modified	Contractor's features and characteristics (experience, skills, personality traits, etc.).
Financial group				
1	Capacity and financial stability of the company and market share.	[8,24]	Selected	Capacity and financial stability of the company and market share.
2	Investments by contractor.	[23,24]	Modified	Other financial investments held by the contractor.
3	Impact on tourism values.	[42]	Selected	Impact on tourism values.
4	Cost predictability.	[23,35, 40]	Selected	Predictability of actual cost.
5	–	–	Added	Cost effectiveness(Doing the right thing).
6	Profitability/yield.	[5,8,24]	Selected	Profitability/yield to the contractor.
7	Changes in project support	[23]	Selected	Changes in project support.

Table 3
Structure validity of the questionnaire.

No.	Groups	Correlation coefficient	*P*- value
1.	Time	0.752	0.000*
2.	Cost	0.874	0.000*
3.	Quality	0.734	0.000*
4.	Health & safety	0.721	0.000*
5.	Relationship	0.717	0.000*
6.	Environment	0.785	0.000*
7.	Innovation	0.735	0.000*
8.	Project management	0.801	0.000*
9.	Qualification	0.741	0.000*
10.	Financial	0.872	0.000*

Table 4
Cronbach's Coefficient Alpha for reliability (Cα).

Groups	Cronbach's Alpha (Cα)	Number of items
Time	0.726	7
Cost	0.849	9
Quality	0.848	8
Health & Safety	0.847	5
Relationship	0.826	9
Environment	0.924	9
Innovation	0.842	5
Project Management	0.885	8
Qualification	0.867	7
Financial	0.785	7
All groups	0.959	74

is considered high, where it is above 0.7 Thus, the result ensures the reliability of the questionnaire.

3. Results and discussion

3.1. Indicators for measuring the performance of construction companies

3.1.1. Group indicators related to "time"

This group consists of 7 indicators related to time. Views of respondents were taken on these items, and the results of the analysis are shown in Table (5). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for a group time were calculated.

"The time taken for construction works" was ranked at the 1st position as an indicator in the time group used to evaluate the performance of construction companies, with relative important index equals (90.8%), and *P*-value = 0.000. The result is consistent with Skibniewski and Ghosh [35] and Rankin, Fayek, Meade, Haas and Manseau [32] regarding what they concluded about the "Construction time" indicator (s).

"The overall time for completion of all project work" was ranked at the 2nd position as an indicator in the time, with relative important index equals (88.5%), and *P*-value = 0.000. The result is in line with Abiodun, Segbenu and Oluseye [5] and Radujković, Vukomanović and Dunović [23], regarding what they said about the "Overall time" indicator, as well as with Toor and Ogunlana [25] and Enshassi, Abdul-Aziz and Abushaban [15] on what they stated on the importance of "Finish (ing) a project within a certain time" indicator to measure the performance of construction companies.

"The time taken for construction works" indicator may have been chosen primarily ahead of the "Overall time" indicator because the construction period in construction projects in Gaza Strip is primarily related to the performance of contractors, unlike other project phases, such as the phase of preparation of project documents, which are usually prepared by the consulting offices in Gaza Strip.

"Ability to predict the actual duration for project completion" was ranked at the last position as an indicator in the time group, with relative important index equals (79.3%), and *P*-value = 0.000. Even though this indicator is the least important of all indicators related to the time group, it is still an important indicator to measure the performance of construction companies in Gaza Strip. This is consistent with what was confirmed by Radujković, Vukomanović and Dunović [23], Skibniewski and Ghosh [35] and Roberts and Latorre [40] about the importance of "Time predictability" indicator.

In general, it was found that the arithmetic mean of all time indicators together is statistically significant with a relative weight 84.9% and the probability value is less than 0.05. This means that overall time indicators are very important in measuring the performance of construction companies in Gaza Strip. For respondents, this means the importance of time indicators in evaluating the performance of construction companies in the Gaza Strip under the conditions of the siege,

fluctuations, and turmoil, and the extent to which the contracting companies are able to deal with these conditions and complete the project during the contractual period, and then operating the project and benefiting from it as soon as possible without delay.

Figure (1) confirms the result in Table (5). This indicates the interconnection between frequency and value of scale for indicators of time. Here it is clear that the highest point of respondents (represented in the vertical axis) occurred in the very high area, this ranging between (4.2–5.0).

Group indicators related to "cost".

This group consists of (9) indicators related to cost. The outcomes of the analysis were shown in Table (6). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for a group of costs were calculated.

"Overall cost" was ranked at the 1st position as an indicator in the cost group used to evaluate the performance of construction companies, with relative important index equals (85.9%), and a *P*-value = 0.000. The result is consistent with Abiodun, Segbenu and Oluseye [5] and Radujković, Vukomanović and Dunović [23] regarding what they reported about the "Overall cost" indicator.

"Cost for construction works" was ranked at the 2nd position as an indicator in the cost group, with relative important index equals (84.9%), and *P*-value = 0.000. The result is consistent with Skibniewski and Ghosh [35] regarding what they concluded about the importance of the "Cost of construction" indicator.

"Indirect cost (office expenses, taxes, insurance, etc.)" was ranked at the last position as an indicator in the cost group, with relative important index equals (71.1%), and *P*-value = 0.000. The reason for the low rating of this indicator in "cost group" may be that the percentage of office expenses, taxes and insurances represent a small percentage of the total costs of projects in the Gaza Strip compared to other countries that are more advanced in this field. Although this indicator is the least important among the indicators related to the cost group, it is still an important indicator to measure the performance of construction companies in Gaza Strip, this is consistent with what was stated by Ugwu and Haupt [42] about the importance of the "Indirect cost" indicator to assess the performance of construction companies.

In general, it was found that the arithmetic mean of all cost indicators together is statistically significant with a relative weight 77.7% and the probability value is less than 0.05. This means that overall, the cost indicators are important in measuring the performance of construction companies in Gaza Strip. This may be due to the difficult economic conditions that the Gaza Strip is going through, and the scarcity of funding for construction projects, the financing of which is largely dependent on foreign aid.

Figure (2) confirms the result in Table (6). This indicates the interconnection between frequency and value of scale for indicators of cost. Here it is clear that the highest point of respondents occurred in the high

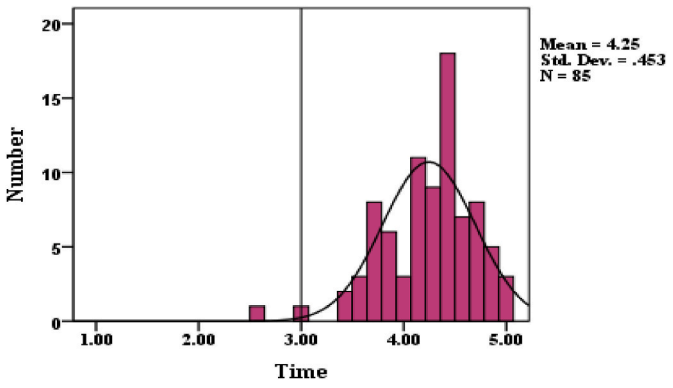

Fig. 1. Interconnection between frequency and value of scale for indicators of time **2.**

Table 5
RII and ranked for indicators of time.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Time to prepare shop drawings.	4.28	0.83	85.6	14.3	0.000	3
The time needed for construction works.	4.54	0.57	90.8	25.0	0.000	1
Time for implement variation orders & amendments.	4.07	0.80	81.4	12.4	0.000	6
Time needed for supplies and installations.	4.22	0.66	84.5	17.1	0.000	4
Extra duration/Delays.	4.21	0.87	84.2	12.8	0.000	5
Ability to predict the actual duration for project completion.	3.96	0.71	79.3	12.4	0.000	7
The overall time for completion of all project work.	4.42	0.66	88.5	19.8	0.000	2
All indicators	4.25	0.45	84.9	25.4	0.000	

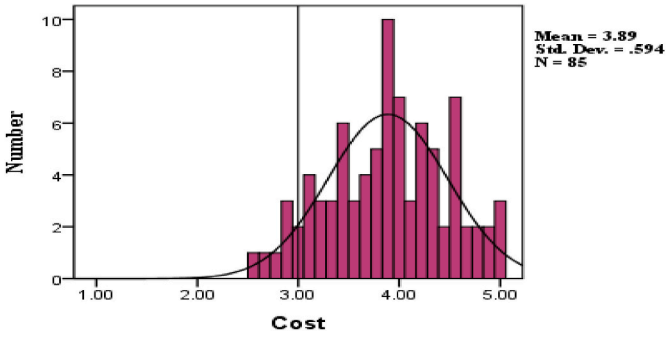

Fig. 2. Interconnection between frequency and value of scale for indicators of cost **3.**

Table 6
RII and ranked for indicators of cost.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Cost for construction works.	4.25	0.80	84.9	14.4	0.000	2
Cost for variation orders & amendments.	4.16	0.83	83.3	13.0	0.000	3
Direct cost. (Cost of resources working on the project such as contractor's team, workers, and machines).	3.93	0.72	78.6	11.9	0.000	4
Indirect cost. (Office expenses, taxes, insurance, etc.)	3.55	0.85	71.1	6.0	0.000	9
Cost of repairing/ rectifying defects caused by the contractor.	3.58	0.92	71.5	5.8	0.000	8
Deviation of the total cost of the project. (overruns/savings)	3.81	0.98	76.2	7.6	0.000	5
Cost of claims.	3.74	0.85	74.8	8.1	0.000	6
Liquidated damage.	3.66	1.05	73.2	5.8	0.000	7
Overall cost.	4.29	0.90	85.9	13.3	0.000	1
All indicators	3.89	0.59	77.7	13.8	0.000	

area, this ranging between (3.4–4.2).

Group indicators related to "quality".

This group consists of (8) indicators related to quality. These items were subjected to the views of respondents, and the outcomes of the analysis were shown in Table (7). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for the quality group were calculated.

"Compliance with technical specifications" was ranked at the 1st position as an indicator in the quality group, with relative important index equals (90.8%), and *P*-value = 0.000. The result is consistent with Abiodun, Segbenu and Oluseye [5], Toor and Ogunlana [25] and Radujković, Vukomanović and Dunović [23], regarding what they concluded about the importance of the "Compliance with technical specifications" indicator to measure the performance of construction companies.

"Quality of workmanship" was ranked at the 2nd position as an indicator in the quality group, with relative important index equals (88.9%), and *P*-value = 0.000. The result is consistent with Toor and Ogunlana [25] regarding what they said about the importance of the "Quality of workmanship" indicator.

These two indicators are ranked at the top of the quality group from the respondents' perspective, because they fall under the fundamental responsibility of the contractors and their crews working on the project, and the technicians and subcontractors they contract with to carry out the project's work.

"Aesthetics (artistry)" was ranked at the last position as an indicator in the quality group, with relative important index equals (73.4%), and *P*-value = 0.000. Even though this indicator is the least important of all indicators related to the quality group, it is still an important indicator, this is consistent with what was reported by Pheng and Chuan [45] about the importance of the "Aesthetics/artistry" indicator to evaluate the performance of construction companies.

In general, it was found that the arithmetic mean of all quality indicators together is statistically significant with a relative weight 84.6% and the probability value is less than 0.05. This means that overall quality indicators are very important in measuring the performance of construction companies in G.S.

Figure (3) confirms the result in Table (7). This indicates the interconnection between frequency and value of scale for indicators of quality. Here it is clear that the highest point of respondents occurred in the very high area, this ranging between (4.2–5.0).

Group indicators related to "health & safety".

This group consists of (5) indicators related to Health & Safety. These items were presented to the respondents for their input, and the outcomes of the analysis were shown in Table (8). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for a Health & Safety group were calculated.

"Commitment to health and safety measures in the project" was ranked at the 1st position as an indicator in the Health & Safety group used to evaluate the performance of construction companies, with relative important index equals (84.3%), and *P*-value = 0.000. The classification of these indicators in the first place is due to the importance of adhering to health and safety measures at the work site and its significant impact on reducing the rate of injuries and losses, the contractor and his crews working on the project are primarily responsible for complying with these measures. The result is compatible with Abiodun, Segbenu and Oluseye [5] and Hany Abd Elshakour, Al-Sulaihi and Al-Gahtani [8], regarding what they concluded about the importance of the "Commitment to health and safety measures" indicator.

"Preventive measures (Insurance, training courses, safety plan)" was ranked at the 2nd position as an indicator in the Health & Safety group used to evaluate the performance of construction companies, with relative important index equals (81.7%), and *P*-value = 0.000. The result is agreeable with Abiodun, Segbenu and Oluseye [5] regarding what he concludes about the importance of the "Directing and control Risk minimization" indicator.

"Losses resulting from emergency events in the project (accident rate, injuries, damage)" was ranked at the last position as an indicator in the Health & Safety group used to evaluate the performance of construction companies, with relative important index equals (78.3%), and *P*-value = 0.000. Although this indicator is the least important of all indicators related to the "Health & Safety" group, it is nevertheless an important indicator, this is consistent with what was presented by Chan [28] about the importance of the "Accident rate" indicator.

In general, it was found that the arithmetic means of all health & safety indicators together are statistically significant with relative weight (80.5%) and the probability value is less than 0.05. This means that all indicators related to security and safety are important from the respondents' opinion to evaluate the performance of construction companies in Gaza Strip, and this is consistent with many studies in many countries of the world that emphasized the importance of indicators related to security and safety to evaluate the performance of construction companies.

Figure (4) confirms the result in Table (8). This indicates the interconnection between frequency and value of scale for indicators of Health & Safety. Here it is clear that the highest point of respondents occurred in the high area, this ranging between (3.4–4.2).

Group indicators related to "relationship".

This group consists of (9) indicators related to relationships. These items were subjected to the views of respondents, and the outcomes of the analysis were shown in Table (9). The descriptive statistics, i.e.

Table 7
RII and ranked for indicators of quality.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Defects (number, nature & percentage).	4.20	0.69	84.0	16.1	0.000	5
Quality of resources (Equipment & Materials)	4.20	0.81	84.0	13.6	0.000	6
Quality of workmanship.	4.45	0.65	88.9	20.7	0.000	2
An availability of quality control system (monitoring, control & guarantees for quality performance).	4.25	0.82	84.9	14.1	0.000	4
Quality of shopdrawing prepared by the contractor.	4.18	0.88	83.5	12.4	0.000	7
Aesthetics (artistry).	3.67	0.84	73.4	7.4	0.000	8
Compliance with technical specifications.	4.54	0.68	90.8	20.8	0.000	1
Acceptable quality about outputs available for use.	4.35	0.70	87.1	17.8	0.000	3
All indicators	4.23	0.53	84.6	21.4	0.000	

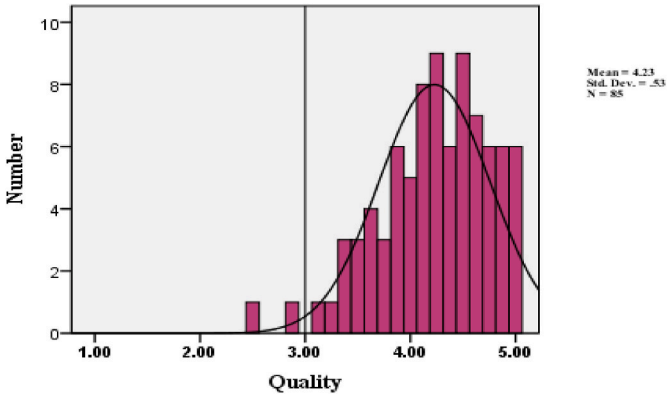

Fig. 3. Interconnection between frequency and value of scale for indicators of quality **4**.

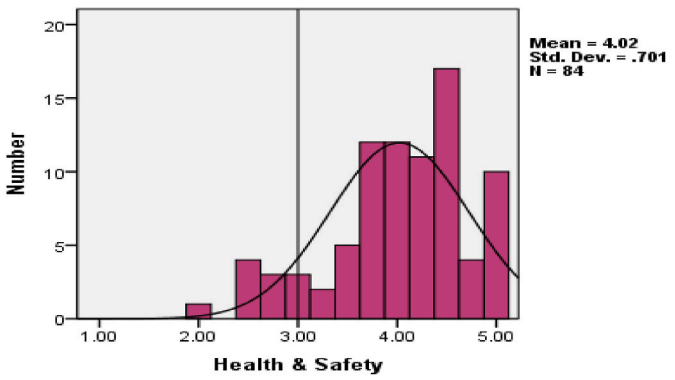

Fig. 4. Interconnection between frequency and value of scale for indicators of Health & Safety **5**.

Table 8
RII and ranked for indicators of health & safety.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Commitment to health and safety measures in project.	4.21	0.91	84.3	12.3	0.000	1
Commitment to safety procedures and concepts about society and the environment.	3.99	0.86	79.8	10.6	0.000	3
Preventive measures (Insurance, training courses, safety plan).	4.08	0.88	81.7	11.3	0.000	2
Losses resulting from emergency events in the project. (Accident rate, injuries, damage).	3.92	0.87	78.3	9.7	0.000	5
Risk rate (Chances of exposure to danger, injury or loss).	3.93	0.91	78.5	9.2	0.000	4
All indicators	4.02	0.70	80.5	13.4	0.000	

Means, Standard Deviations (SD), RII, *P*- values and finally, the order of indicators for a relationship group were calculated.

"Trust & commitment (between the contractor and other parties)" was ranked at the 1st position as an indicator in the Relationship group used to evaluate the performance of construction companies, with relative important index equals (81.4%), and *P*-value = 0.000. Because contracts are based on trust between all parties, the trust indicator was in the first place, according to the respondents' perspective. The result is consistent with Butcher and Sheehan [9] regarding what they concluded about the importance of the "Trust & Commitment" indicator.

"Attitudes of contractor, behaviors, and flexibility" was ranked at the 2nd position as an indicator in the Relationship group used to evaluate the performance of construction companies, with relative important index equals (80.5%), and *P*-value = 0.000. The result is consistent with Butcher and Sheehan [9] regarding what they concluded about the importance of the "Attitudes and behaviors" indicator.

"Cultural & social alignment/issue between the contractor and other parties" was ranked at the last position as an indicator in the Relationship group used to evaluate the performance of construction companies, with relative important index equals (66.4%), and *P*-value = 0.002. The low ranking of this indicator, according to the respondents, is due to the fact that the Gaza Strip is characterized by cultural and social unity, language, and religion. Even though this indicator is the least important of all indicators related to the "Relationship" group, it is nevertheless an important indicator. This is consistent with what was reported by Ref. [8] and Butcher and Sheehan [9] about the importance of the "Cultural & social alignment/issue" indicator.

In general, it was found that the arithmetic means of all relationship indicators together is statistically significant with relative weight (73.9%) and the probability value is less than 0.05. This means that overall relationship indicators are important in measuring the performance of construction companies in Gaza Strip. Given the multiplicity of parties in construction projects and the importance of each role for all participants in the construction process, it was necessary to unite all these efforts, synergize, and link them through good relationships, so that construction companies can accomplish the required work with the best performance.

Figure (5) confirms the result in Table (9). This indicates the interconnection between frequency and value of scale for indicators of relationship. Here it is clear that the highest point of respondents occurred in the high area, this ranging between (3.4–4.2).

This group consists of (9) indicators related to Environment. These items were reviewed by respondents, and the outcomes of the analysis were shown in Table (10). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for an environment group were calculated.

"Commitment to the laws about the environment" was ranked at the 1st position as an indicator in the Environment group used to evaluate the performance of construction companies, with relative important index equals (75.5%), and *P*-value = 0.000. This indicator was added through interviews with construction experts who represent the owners and consultants in Gaza Strip. This is confirmed by the results of the analysis of the questionnaire, which indicates that the "Commitment to the laws about the environment" indicator is very important to assess the performance of construction companies in Gaza Strip.

"The extent of damage and losses to the environment" was ranked at the 2nd position as an indicator in the Environment group used to evaluate the performance of construction companies, with relative important index equals (75.0%), and *P*-value = 0.000. The result is compatible with Heravi and Ilbeigi [24] according to what they concluded about the importance of the "Environment impact" indicator to measure the performance of construction companies.

"Impact on biodiversity (The variety of life in a specific area or ecosystem)" was ranked at the last position as an indicator in the Environment group used to evaluate the performance of construction companies, with relative important index equals (64.3%), and *P*-value = 0.043. Although this indicator is the least important of all indicators related to the "Environment" group, it is still an important indicator to measure the performance of construction companies in Gaza Strip. This is consistent with what was reported by Ref. [8] about the importance of the "Impact on biodiversity" indicator. Perhaps the decrease of importance of this indicator compared to other indicators is related to the "Environment group" due to the nature of the environment in Gaza Strip, where it is a small geographical area and has very little

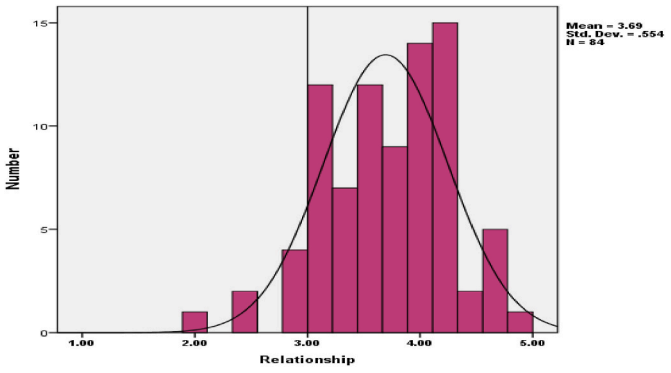

Fig. 5. Interconnection between frequency and value of scale for indicators of relationship**6**.

Table 9
RII and ranked for indicators of relationship.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Attitudes of contractor, behaviors, and flexibility.	4.02	0.85	80.5	11.0	0.000	2
Trust & Commitment (between contractor and other parties).	4.07	0.83	81.4	11.8	0.000	1
Claims, disputes & litigation.	3.87	0.79	77.4	10.1	0.000	3
Cultural & social alignment/issue between contractor and other parties.	3.32	0.92	66.4	3.2	0.002	9
Contractor's relationship with his users. (His employees, workers, subcontractors, suppliers, etc.)	3.33	0.88	66.7	3.5	0.001	8
Effective communication & coordinating.	3.85	0.81	76.9	9.5	0.000	4
Impact on stakeholders/ participation and meeting their satisfaction & expectations.	3.76	0.82	75.2	8.4	0.000	5
The contractor and his team are satisfied with their performance.	3.45	0.85	69.0	4.8	0.000	7
Benefit to the national infrastructure.	3.57	0.97	71.3	5.3	0.000	6
All indicators	3.69	0.55	73.9	11.5	0.000	

Group indicators related to "environment".

biodiversity compared to other countries.

In general, it was found that the arithmetic means of all Environment indicators together is statistically significant with relative weight (70.7%) and the probability value is less than 0.05. This means that overall Environment indicators are important in measuring the performance of construction companies in Gaza Strip.

Figure (6) confirms the result in Table (10). This indicates the interconnection between frequency and value of scale for indicators of Environment. Here it is clear that the highest point of respondents occurred in the high area, this ranging between (3.4–4.2).

This group consists of 5 indicators related to innovation. These items were subjected to the views of respondents, and the outcomes of the analysis were shown in Table (11). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for an innovation group were calculated.

"Development & growth in the organization" was ranked at the 1st position as an indicator in the Innovation group used to evaluate the

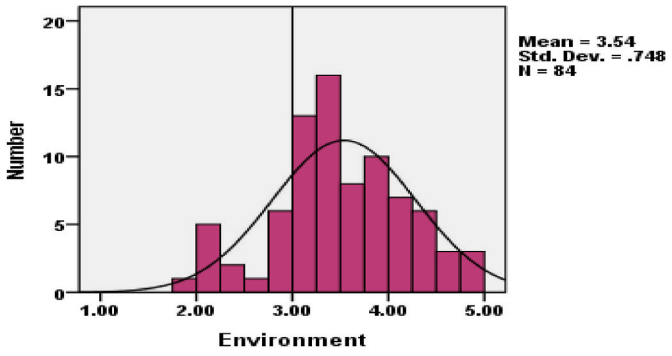

Fig. 6. Interconnection between frequency and value of scale for indicators of Environment**7**.

Table 10
RII and ranked for indicators of environment.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Environmental complaints.	3.52	0.81	70.5	5.9	0.000	6
Commitment the laws about the environment.	3.77	0.87	75.5	8.2	0.000	1
The extent of damage and losses to the environment.	3.75	1.00	75.0	6.8	0.000	2
Impact on air and water.	3.61	0.99	72.1	5.6	0.000	4
Impact on biodiversity (The variety of life in a specific area or ecosystem)	3.21	0.96	64.3	2.1	0.043	9
Ideal land use.	3.68	0.95	73.6	6.6	0.000	3
Commitment to sustainability standards.	3.60	1.01	71.9	5.4	0.000	5
Energy use rate and its consequences.	3.38	0.97	67.6	3.6	0.001	7
Noise reduction measures.	3.29	0.96	65.8	2.8	0.007	8
All indicators	3.54	0.75	70.7	6.6	0.000	

Group indicators related to "innovation".

performance of construction companies, with relative important index equals (73.6%), and *P*-value = 0.000. The result is consistent with Radujković, Vukomanović and Dunović [23] regarding what they concluded about the importance of the "Development & growth in the organization" indicator.

"Training and learning to develop capacities and expertise" was ranked at the 2nd position as an indicator in the Innovation group used to evaluate the performance of construction companies, with relative important index equals (73.2%), and *P*-value = 0.000. The result is compatible with Enshassi, Abdul-Aziz and Abushaban [15] and Butcher and Sheehan [9] regarding what they infer about the weight of the "Training and learning" indicator.

The importance of these two indicators is due to the importance of development and training in the organization, as it enhances the strengths of the company and treats weaknesses, which has a significant impact on the continuous improvement in the performance of contracting companies.

"Ability to innovate" was ranked at the last position as an indicator in the Innovation group used to evaluate the performance of construction companies, with relative important index equals (70.0%), and *P*-value = 0.000. The reason for the lower weight of this indicator compared with the other indicators is due to the nature of the contracts that are being held Gaza Strip with contracting companies, which mostly depend on the implementation contract system only, where the tender documents and design drawings for the project are prepared through consulting offices. Even though this indicator is the least important of all indicators related to the "Innovation" group, it is an important indicator. This is consistent with what was proposed by Enshassi, Abdul-Aziz and Abushaban [15] and Radujković, Vukomanović and Dunović [23] about the importance of the "Ability to innovate" indicator to evaluate the performance of construction companies. In general, it was found that the arithmetic mean of all Innovation indicators together is statistically significant with a relative weight (72.0%) and the probability value is less than 0.05. This means that overall innovation indicators are important in measuring the performance of construction companies in Gaza Strip.

Figure (7) confirms the result in Table (11). This indicates the interconnection between frequency and value of scale for indicators of Innovation. Here it is clear that the highest point of respondents occurred in the high area, this ranging between (3.4–4.2).

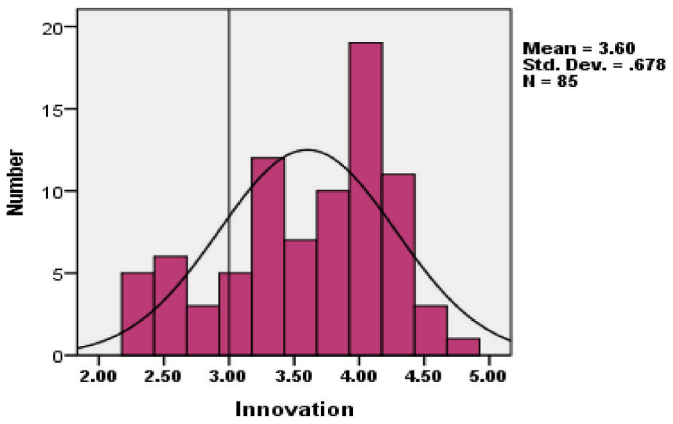

Fig. 7. Interconnection between frequency and value of scale for indicators of Innovation **8**.

Table 11
RII and ranked for indicators of innovation.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Ability to innovate.	3.50	0.88	70.0	5.2	0.000	5
The future potential and preparations.	3.57	0.81	71.4	6.5	0.000	4
Development & growth in the organization.	3.68	0.95	73.6	6.2	0.000	1
The ideal image of the company.	3.60	0.89	72.0	6.2	0.000	3
Training and learning to develop capacities and expertise.	3.66	0.91	73.2	6.7	0.000	2
All indicators	3.60	0.68	72.0	8.2	0.000	

Group indicators related to "project management".

This group consists of 8 indicators related to Project Management. These items were subjected to the views of respondents, and the outcomes of the analysis were shown in Table (12). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for a project management group were calculated.

"Schedule & planning performance/efficiency" was ranked at the 1st position as an indicator in the Project Management group used to evaluate the performance of construction companies, with relative important index equals (80.0%), and *P*-value = 0.000. The result is compatible with Hany Abd Elshakour, Al-Sulaihi and Al-Gahtani [8] and Heravi and Ilbeigi [24] regarding what they conclude about the importance of the "Schedule & Planning performance" indicator to measure the performance of contractors companies. As this has a great impact on the completion of the project within the approved plan and the desired goals for all parties.

"Resource utilization" was ranked at the 2nd position as an indicator in the Project Management group used to evaluate the performance of construction companies, with relative important index equals (79.5%), and *P*-value = 0.000. The result is agreeable with Ugwu and Haupt [42] concerning what they deduced about the importance of the "Resource utilization" indicator.

"Waste management" was ranked at the last position as an indicator in the Project Management group used to evaluate the performance of construction companies, with relative important index equals (68.9%), and *P*-value = 0.000. The lower ranking of this indicator compared to other indicators within the "Project Management" group may be due to, the waste generated from works in construction projects is few compared to the size of the projects, and is less dangerous than the waste generated by other industries. Although this indicator is the least important of all indicators related to the "Project Management" group, yet, it is an important indicator to measure the performance of construction companies in Gaza Strip, this is consistent with what is concluded by Ugwu and Haupt [42] about the importance of the "Waste management" indicator.

In general, it was found that the arithmetic means of all Project Management indicators together are statistically significant with relative weight (75.7%) and the probability value is less than 0.05. This means that overall Project Management indicators are important in measuring the performance of construction companies in Gaza Strip.

Figure (8) confirms the result in Table (12). This indicates the interconnection between frequency and value of scale for indicators of Project Management. Here it is clear that the highest point of respondents occurred in the high area, this ranging between (3.4–4.2).

Group indicators related to "qualification".

This group consists of 7 indicators related to Qualification. These items were subjected to the views of respondents, and the outcomes of the analysis were shown in Table (13). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for a qualification group were calculated.

"Understanding the work" was ranked at the 1st position as an indicator in the Qualification group used to evaluate the performance of construction companies, with relative important index equals (85.6%), and *P*-value = 0.000. The result is agreeable with Butcher and Sheehan [9] concerning what they concluded about the importance of the "Understanding of the customer's business" indicator.

"Contractor's team performance & integration" was ranked at the 2nd position as an indicator in the Qualification group used to evaluate the performance of construction companies, with relative important index equals (82.8%), and *P*-value = 0.000. The result is compatible with Dissanayaka and Kumaraswamy [56] on what they concluded about the importance of the "Contractor's team performance & integration" indicator.

This is evidence of the importance of understanding the contractor and all his employees working on the project, and the consequent improvement in the performance of the work team and the integration of efforts, which ultimately leads to an improvement in the contractor's performance.

"Technological and technical capabilities of the company" was ranked at the last position as an indicator in the Qualification group used to evaluate the performance of construction companies, with relative important index equals (76.7%), and *P*-value = 0.000. The lower ranking of this indicator compared to other indicators within this group may be due to the fact that the technological and technical capabilities of the construction companies in the Gaza Strip are limited, and these capabilities are not substantially used in construction projects compared to other more developed countries, despite that; respondents consider the importance of this indicator in evaluating the performance of

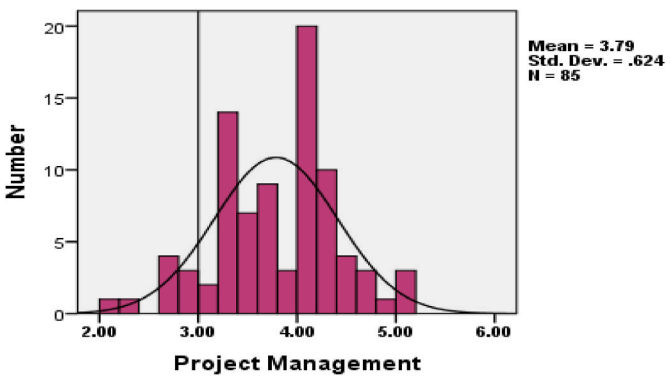

Fig. 8. Interconnection between frequency and value of scale for indicators of Project Management **9**.

Table 12
RII and ranked for indicators of project management.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Managerial actions by contractor.	3.89	0.84	77.8	9.7	0.000	3
Schedule & Planning performance/ efficiency.	4.00	0.91	80.0	10.1	0.000	1
Resource utilization.	3.98	0.79	79.5	11.4	0.000	2
Procurement system/ method.	3.79	0.76	75.8	9.6	0.000	5
Waste management.	3.45	0.93	68.9	4.4	0.000	8
Control capabilities & decisions effectiveness (orientation to the goal)	3.86	0.79	77.2	10.0	0.000	4
Functionality & Utility (serve the purpose; practicality).	3.68	0.81	73.6	7.7	0.000	6
Motivation, and improvement in company performance.	3.65	0.90	72.9	6.7	0.000	7
All indicators	3.79	0.62	75.7	11.6	0.000	

Table 13
RII and ranked for indicators of qualification.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Qualifications of human resources in the company.	3.99	0.79	79.8	11.5	0.000	5
Contractor's team performance & integration.	4.14	0.80	82.8	13.1	0.000	2
Efficiency (Implementation of the work with the least resources and costs)	4.13	0.89	82.6	11.8	0.000	3
Understanding the work.	4.28	0.77	85.6	15.4	0.000	1
Effectiveness & Productivity (achieve the desired results correctly & actively)	4.12	0.72	82.4	14.5	0.000	4
Technological and technical capabilities of the company.	3.84	0.77	76.7	10.0	0.000	7
Contractor's features and characteristics (Experience, skills, personality traits, etc.)	3.96	0.79	79.3	11.2	0.000	6
All indicators	4.07	0.59	81.4	16.7	0.000	

Group indicators related to "financial".

contractors in Gaza Strip, this is consistent with what is concluded by Yu, Kim, Jung and Chin [55] about the importance of the "Technological capability" indicator.

In general, it was found that the arithmetic means of all Qualification indicators together is statistically significant with relative weight (81.4%) and the probability value is less than 0.05. This means that overall Qualification indicators are important in measuring the performance of construction companies in Gaza Strip.

Figure (9) confirms the result in Table (13). This indicates the interconnection between frequency and value of scale for indicators of Qualification. Here it is clear that the highest point of respondents occurred in the high area, this ranging between (3.4–4.2).

This group consists of (7) indicators related to Financial. These items were subjected to the views of respondents, and the outcomes of the analysis were shown in Table (14). The descriptive statistics, i.e. Means, Standard Deviations (SD), RII, *P*- values, and finally, the order of indicators for a financial group were calculated.

"Capacity and financial stability of the company and market share" was ranked at the 1st position as an indicator in the Financial group used to evaluate the performance of construction companies, with relative important index equals (84.3%), and *P*-value = 0.000. This means that the indicator is statistically significant. The result is compatible with Hany Abd Elshakour, Al-Sulaihi and Al-Gahtani [8] and Heravi and Ilbeigi [24] regarding what they concluded about the importance of the " Capacity and financial stability of the company" indicator. Because

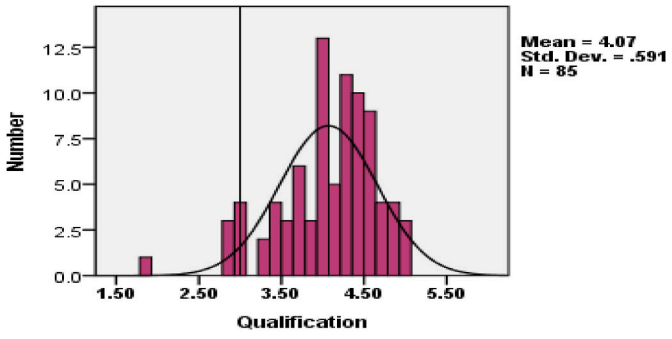

Fig. 9. Interconnection between frequency and value of scale for indicators of Qualification **10**.

stability and financial ability have a great impact on the stability and strength of performance of contractors, especially in areas that suffer from a fragile economy such as the Gaza Strip, where contracting companies are financially weak, and large construction projects are usually implemented through a coalition of a number of companies.

"Profitability/yield to the contractor" was ranked at the 2nd position as an indicator in the Financial group used to evaluate the performance of construction companies, with relative important index equals (78.1%), and *P*-value = 0.000. The result is compatible with Abiodun, Segbenu and Oluseye [5], Hany Abd Elshakour, Al-Sulaihi and Al-Gahtani [8] and Heravi and Ilbeigi [24] regarding what they concluded about the importance of the "Profitability/yield" indicator.

"Impact on tourism values" was ranked at the last position as an indicator in the Financial group used to evaluate the performance of construction companies, with relative important index equals (54.4%), and *P*-value = 0.007, there is evidence that this indicator is of medium importance in measuring the performance of construction companies in Gaza Strip. Even though this indicator is the least important of all indicators related to the "Financial" group, yet, it is an important indicator to measure the performance of construction companies in Gaza Strip. This is consistent with what is concluded by Ugwu and Haupt [42] about the importance of the "Impact on tourism values" indicator to assess the performance of construction companies. Perhaps the lower importance given to this indicator compared to other indicators is due to the nature of the conditions of siege in the Gaza Strip, political fluctuations, and security turbulence. In general, it was found that the arithmetic means of all financial indicators together are statistically significant with relative weight (74.0%) and the probability value is less than 0.05. This means that overall financial indicators are important in measuring the performance of construction companies in Gaza Strip.

Figure (10) confirms the result in Table (14). This indicates the interconnection between frequency and value of scale for indicators of Financial. Here it is clear that the highest point of respondents occurred in the high area, this ranging between (3.4–4.2) (see Fig. 11).

Analysis of all groups of indicators.

From Table (15), it is shown that, "indicators related to "Time group" was ranked in the first position by both the owner and consultant with RII of (86.2%), (83.8%) respectively. While the "indicators related to "Quality group" was ranked in the second position with RII of (85.3%),

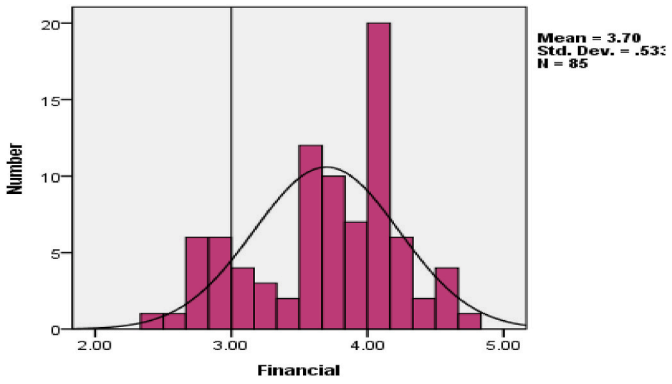

Fig. 10. Interconnection between frequency and value of scale for indicators of Financial **11**.

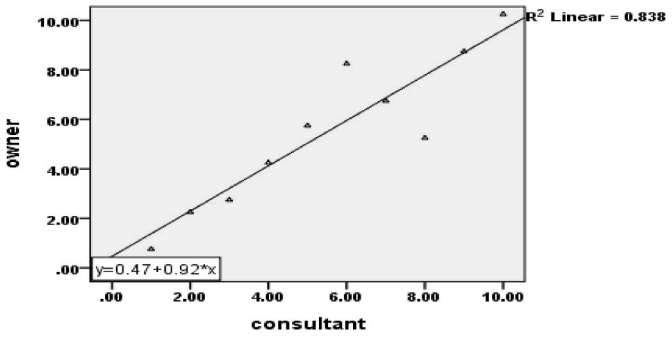

Fig. 11. The relationship between the owner and consultants in their evaluation of performance indicators in construction companies.

Table 14
RII and ranked for indicators of financial.

Indicators	Mean	Std. Dev	RII (%)	Test value	P value Sig.	Rank
Capacity and financial stability of the company and market share.	4.21	0.98	84.3	11.3	0.000	1
Other financial investments held by the contractor.	3.56	0.89	71.3	5.8	0.000	6
Impact on tourism values.	2.72	0.95	54.4	−2.8	0.007	7
Predictability of actual cost.	3.80	0.80	76.0	9.2	0.000	4
Cost effectiveness (doing the right thing)	3.89	0.82	77.9	10.1	0.000	3
Profitability/yield to the contractor.	3.91	1.00	78.1	8.4	0.000	2
Changes in project support.	3.80	0.84	76.0	8.8	0.000	5
All indicators	3.70	0.53	74.0	12.1	0.000	

(83.4%) respectively.

By consensus of the owners and the consultants, time-related indicators are the most important for evaluating the performance of construction companies in Gaza Strip. This is due to the importance of completing projects in Gaza Strip within the contractual period without delay, because of the conditions in Gaza Strip, which cause further delays in projects such as political fluctuations, the conditions of the siege, and the closure of crossings.

The indicators related to the "Quality Group" came in second position with the agreement of the owners and the consultants. This indicates the importance of these indicators in evaluating the performance of contractors in Gaza Strip, where many construction companies need the required quality in the projects being implemented, this is due to the low quality of manpower, technicians and the failure of contractors to comply with contractual technical specifications. This is confirmed by the statistical analysis of the results of the questionnaire, which indicated that these two indicators are the most important among the indicators related to the quality group.

The group of indicators related to qualifications came in third place by agreement of the owners and consultants. This indicates the importance of the indicators related to qualifications in evaluating the performance of construction companies in Gaza Strip.

The contractor team performance and performance indicator, and business understanding indicator are the two most important indicators in the group of quality indicators, according to the statistical analysis.

By agreement between the consultants and owners, the range of environmental group came in last place (tenth), perhaps due to the low impact of construction projects in Gaza Strip on the surrounding environment such as water and air, and the damage to the surrounding environment from construction projects is very trivial compared to other countries where large and diverse projects are implemented that significantly affect the surrounding environment and its features, as in Gaza, the environment lacks biodiversity (diversity of life in a particular area). In addition, construction companies adhere to local laws and regulations in force in Gaza Strip and have a fairly strict management through the local government.

As shown in Table (15), which represent the outcome analysis of the questionnaire for this study, it illustrates the considerable convergence of views of the representatives of the owners and consultants.

Table 16 shows the top ten indicators in evaluating the performance of construction companies ranked from high to low. From Table 16, it can be seen that, "The time needed for construction works" related to group time was ranked in the first position with RII of (90.8%). This emphasizes that, this is the most important indicator evaluating the performance of construction companies in Gaza Strip. Several literature reviews indicate that the most important indicators by which the performance of construction companies in a number of countries are evaluated fall within the groups of indicators related to (time, cost, quality). Some authors have called these groups as "Iron Triangle" or "Golden Triangle", such as Abiodun, Segbenu and Oluseye [5] and Toor and Ogunlana [25].

In this study, the results of the statistical analysis of the questionnaire are compatible with this literature review, where Nine out of ten of the most significant and important indicators for evaluating construction companies in Gaza Strip fall within groups of (time, cost and quality).

4. Conclusion

A questionnaire survey was administered in this study to identify and rank the most important indicators for evaluating the performance of construction companies from the perspective of the owners and the

Table 15
RII and rank of groups to evaluate the performance of construction companies.

	Owners		Consultants	
Groups	Average RII	Rank	Average RII	Rank
Time	86.2	1	83.8	1
Cost	78.6	6	76.8	5
Quality	85.3	2	83.4	2
Health & safety	83.4	4	77.3	4
Relationship	75.1	8	72.6	6
Environment	72.7	10	68.6	10
Innovation	73.1	9	70.8	9
Project management	79.5	5	71.5	8
Qualification	83.5	3	79.0	3
Financial	75.2	7	72.5	7

Table 16
Top (10) indicators in evaluating the performance of construction companies.

Group	Indictor	Average RII	Rank
Time	The time needed for construction works.	90.8	1
Quality	Compliance with technical specifications.	90.8	2
Quality	Quality of workmanship.	88.9	3
Time	The overall time for completion of all project work.	88.5	4
Quality	Acceptable quality about outputs available for use.	87.1	5
Cost	Overall cost.	85.9	6
Time	Time to prepare shop drawings.	85.6	7
Qualification	Understanding the work.	85.6	8
Cost	Cost for construction works.	84.9	9
Quality	An availability of quality control system (monitoring, control & guarantees for quality performance).	84.9	10

consultants in Gaza Strip.

This paper concluded with the aim of this study, which is to identify the most important indicators for evaluating the performance of construction companies from the perspective of owners and consultants in Gaza Strip. The ten most important indicators are the time needed for construction works, compliance with technical specifications, quality of workmanship, the overall time for completion of all project work, acceptable quality of outputs available for use, overall cost, time to prepare shop drawings, understanding the work, the cost for construction works and, availability of quality control system. It was also concluded from this study that all indicators related to (time, cost, quality, health & safety, relationship, environment, innovation, project management, qualification, and financial) groups are all without exception important groups to evaluate the performance of contractors from the perspective of owners and consultants, with varying the importance of these groups of indicators in Gaza Strip.

The recommendations were listed to the concerned parties such as the owners, consultants, and contractors based on identifying the most important indicators, to reach optimal performance by addressing the causes of poor performance and focusing on developing and supporting strengths.

Owners and consultants are recommended to select the appropriate contractors in accordance with the financial and technical criteria in order to ensure the completion of the project with the required quality and within the contracting duration and the budget allocated to the project, defining quality control criteria and taking all necessary measures for this, developing a clear vision for the mechanism for selecting the team works and technicians in the project, providing adequate funding for the project in all its stages, determining a sufficient percentage of the project's allocations for emergency and unforeseen conditions, and taking into account the prevailing conditions in terms of siege, disorders, and political fluctuations.

Author contributions

All authors contributed equally to conduct this research

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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