Identify the main factors affecting labor productivity within different organizational structures in the Iraqi construction sector

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Abstract. The construction sector in Iraq has faced many challenges. One of the major challenges is the lack of productivity of laborers who are working construction sites. Although research studies have been conducted to investigate, explore, and identify factors influencing labor productivity in the Middle-east region, the lack of such research studies to address these challenges in Iraq. This motivates the researcher to explore and identify the key factors affecting labor productivity in construction sites across different organizational structures (Matrix, Projectized, and functional). A survey questionnaire has been conducted using Delphi technique in order to achieve a concrete and reliable view of the major factors influencing labor productivity in Iraq. Twenty-four experts from different construction sectors have participated in Delphi rounds. In addition, a total of 110 factors affecting labor productivity is considered in this study. The main findings of this study show a correlation between some of the identified factors and characteristics of the organizational structures. The poor communication and management of the construction site, lack of communication and coordination between construction parties, size and arrangement of the construction crew, on-time payment, and motivational program factors were found to be highly correlated with the characteristics of the selected organizational structures. Also, the study shows that explosive remnants and dangerous construction sites due to terrorist attacks are very influential factors on labor productivity.

1. Introduction
The factors affecting labor productivity have been attracting the attention of the construction sector for decades. By analysing and studying them, private and public sector construction companies, can improve their operational efficiency and provide better services within timelines. It is true that different countries face similar issues, especially if they come from the same region of the world. This research aims to study, analyse, and review the factors affecting labor productivity in construction sites in Iraq with respect to different organizational structures. The method selected to collect and analyse the survey questionnaire data is the Delphi technique.

In the construction sector of Turkey, 32 factors crucial to labor productivity have been studied, results show that the most effective group of factors were the organizational ones while economic and physical factors followed [1]. While study in [2] examined 45 factors crucial to labour productivity in the construction sector of Kuwait. The top ten factors identified are clarity of technical specifications, the extent of differentiation of orders during execution, coordination level among design disciplines, lack of labor supervision, proportion of work subcontracted, design complexity level, lack of incentive scheme, lack of construction leadership of the manager, strict inspection by the engineer; and delay in responding to information requests. Another study by [3] searched for 32 factors crucial to labor productivity in the construction sector of Saudi Arabia, and the top ten factors in the study include the...
lack of labor experience, poor communication between construction parties, bad relations between labs and management team, payments delayed by the owner, misusing of schedules, re doing work, labor’s low wage, financial conditions of the contractor, poor site management, and frequent change orders. While 30 factors crucial to labor productivity in the construction sector of Palestine were examined in [4] and the top five factors in the West Bank in Palestine was political and geopolitical uncertainty, equipment and tools shortages, old and inefficient equipment, lack of labor experience, and poor construction site management. In [5], 30 factors crucial to labor productivity in Egypt were examined, and the study showed that the top three groups are the management group, labor/human and industry.

The study in [6] examined 37 factors crucial to labor productivity in the construction sector of Bahrain. This study’s top ten factors were: workers skills, lack of coordination among design disciplines, lack or inadequate labor supervision, errors and omissions in design drawings, several delays in answering requested information, re doing work, stringent engineer inspections, working overtime for several hours, lack of workers incentives and severe weather conditions. In Iraq, 59 factors crucial to labor productivity were examined in [7]. In this study, Basra city was used as a case study. This study’s top four factors were: corruption, fraud dishonesty, wasting time and payment delay. Besides, [8] examined 42 factors crucial to labor productivity in Iraqi construction sites. This study’s top ten factors are; the availability of certain materials, climate situation, some religious occasions, number of working groups, dangerous experiences, severe absence of workforce surveillance, labor age, working at a high place, inadequate drawings and specifications being altered during the execution of a project. In Yemen, 52 factors crucial to the labor productivity were examined [9]. This study identified, five top factors: experience and skills, scarcity of materials in site, poor leadership and efficiency in site management, lack of materials in the market, geopolitical and security situation. In this paper, the researcher studied 101 factors that influence labor productivity within a matrix, projectized, functional organizational structures. The study revealed the key factors in each type of organization that influencing labor productivity in Iraqi construction sites.

2. Characteristics of organization factors
A matrix organizational structure settled between the functional and product-oriented organization, maximizes the strength of the product-oriented organization, minimizing the weakness of product-oriented organization [10]. The matrix structure is often the answer when organizations find that the functional, divisional, and geographic structures will not work. It is divided into three parts; balanced, functional and product matrix organization. The authority is given to the project manager in a Product matrix organization, while the functional manager is responsible for a Functional matrix organization while in a balance matrix organization the authority is divided between both project and functional managers [11]. The main characteristics of matrix organizations are the distribution of authority between functional manager, and project manager this would be misleading and sometimes violates the principle of organization, there are huge conflict points between functional and project managers and technical issues, pay and personal assignment would be sometimes unclear. Key advantages of the functional organization structure include, economies of scale, in-depth knowledge and skill development, this works perfectly for an organization with few products or projects and has standardized tasks for employers. While its main drawback is poor horizontal coordination between departments [12], slow response time to environmental changes, roles and tasks usually do not alternate which minimizes the learning time of the task otherwise, this may result in gathering decisions on top of the hierarchy that has a strong effect on horizontal coordination between departments [13]. Apart from those, a functional organizational structure offers significant learning opportunities for new employees, which may result in less innovation. In a Projectized Organizational structure, the project is separated from the home organization. It is the best-suited type of organization structure, for projects that have the major of interest closer to technological applications, while on the other hand it can lead to poor coordination between different projects and eliminate economies of
scale in the functional department, so it is considered a poor choice for projects focused on cost minimization [14].

3. Methodology
In this study, the Iraqi construction sector is going to be investigated, as, in the past few years, this sector has drawn international interest but, the factors that might affect the overall efficiency are not well studied. The survey to determine the key factors, within different organizational structures that affect labor productivity is conducted with a questionnaire, and the results will be analysed using the Delphi technique.

3.1 Delphi technique
The Delphi technique was developed in the early 40s as a facilitation method for attaining consensus from a group of experts [15]. The process followed, derives from the core of the Delphi technique and is the following:

- The chosen panel of experts receives the first questionnaire. First-round may involve, apart from the designed questions, the opinion of the panel in terms of predictions, judgments and their experience on the topic.
- The second round of questions is beginning. The experts are now asked to rank the items by importance, based on a specific criterion.
- The third round involves re-positions of the experts and some discussion for their exact choices.

In literature, studies with more than three rounds can be found, but the quality of the results decreases [16].

3.2 Selection of experts
The selection of experts in the construction field is the most challenging matter that faced the researcher because the Delphi technique needs to be conducted over a long period of time. Besides, the required number of experts should be nominated for three types of organizational structure (Matrix, Projectized, and Functional). So, the research followed the following criteria to select appropriate experts [16]:

- Years of experience, as the selected expert would have extensive experience in the field of the construction industry in Iraq. Also, working on large scale projects or infrastructure projects was one of the constraints that had been considered along with years of experience.
- Experience and/or good knowledge in construction management.
- Diversity: the selected experts are working in different organizational structures and various types of projects (e.g., buildings, oil refinery, electrical substation, roads, bridges, etc.) to reach a comprehensive conclusion regarding the main factors affecting labor productivity in Iraq.
- willingness of the expert to participate in Delphi rounds.

Figure (1) shows the distribution of the participants academic achievement. The majority of the participants are holding a Bachelor degree. Figure (2) shows the distribution of organization type for the experts. In terms of organization type, 33% of the total number of participants for each type of organizational structure (Matrix, Projectized, and Functional) participated in the Delphi rounds. Figure (3) illustrates the distribution of the participating experts by construction sector. The figure shows that 75% of the total participants were from the public sector while 25% from the private sector. In addition, figure 4 shows the distribution of the participating experts by specialization. The figure shows that the majority of the experts are civil engineers followed by electrical engineers.
Figure 1. Experts academic degree.

Figure 2. Organizations type.

Figure 3. Work-sector of experts.

Figure 4. Specialization of experts.
3.3 Conducting Delphi rounds

The first round of the Delphi method has the objective of identifying the main factors after the expert’s consultation [17]. Furthermore, twenty-four experts (24) participated in the Delphi rounds. After a thorough literature review and expert’s opinion, three lists of factors affecting labor productivity in Iraq for three types of organizations (Matrix, Projectized, and Functional) were identified. Each list consists of eight major groups of factors; management, economic and financial, project characteristics, human and motivation, technical, environment and environmental, external and material and equipment group. The first opinion was drawn about the factors affecting labor productivity in the Iraqi construction sector. At this point of the investigation, the second round begins with a questionnaire, which is the core of how the study is conducted, that is given to the experts to evaluate the factors (by using Likert scale) based on the degree of influence as can be seen in Table 1.

Table 1. The scale of ranking the impact of factors by experts.

| Impact               | Degree Influence |
|----------------------|------------------|
| No Impact            | 1                |
| Low Impact           | 2                |
| Medium Impact        | 3                |
| High Impact          | 4                |
| Very High Impact     | 5                |

In the second round, factors with a mean less than three (low Impact) were eliminated from the list in order to be used in the next round of the Delphi technique.

In the third, which is the final round, the results obtained in the previous round (round two) were re-evaluated by the experts using the same scale for ranking. The main objective of this round is to increase the degree of consistency between experts and results.

4. Research Findings and results

The data collected from the three rounds for the three organization types was analyzed by SPSS software. The internal consistency of the expert's evaluation for the survey in the Delphi third round was tested using Cronbach’s alpha test. The results of (SPSS) software showed that all the values of alpha were positive and more than 0.70, which indicates that the evaluation of experts was stable and consistent [18][19]. In addition, the results of the Delphi third round were consistent with the results of the second round so that no additional round will be required.

The results of the Delphi third round showed that eighty-nine (89) factors affecting labor productivity distributed in eight (8) major groups were identified in a matrix organization structure. In projectized organization, eighty-eight (88) factors with eight (8) main groups affecting labor productivity. Furthermore, eighty (80) factors that were affecting labor productivity in the functional organization were identified.

Table (2) below shows the overall group ranking for the three types of organizational structure. Regarding matrix organizational structure, technical group and management group were
rated the most influential groups with an average rating of 4.13 and 4.07, respectively. When considering the projectized organizational structure, economic and financial group and tools and material and equipment group were rated the most influential groups with an average rating of 4.23 and 4.12, respectively. In terms of the functional organizational structure, the results showed that material and equipment group and the economic and financial group were rated the most influential groups with an average rating of 4.24 and 4.20, respectively based on the expert's opinion.

Table 2. The overall group ranking for the three types of organizational structure

| Groups                       | Matrix Mean | Projectized Mean | Functional Mean |
|------------------------------|-------------|------------------|-----------------|
| Management Group             | 4.07        | 3.88             | 3.84            |
| Environment and Environmental Group | 3.80        | 3.65             | 3.76            |
| Economic and financial Group | 3.72        | 4.23             | 4.20            |
| Project characteristics Group | 3.76        | 3.60             | 3.88            |
| External Group               | 3.50        | 3.97             | 3.93            |
| Human and motivation Group   | 3.72        | 3.85             | 3.94            |
| Technical Group              | 4.13        | 3.76             | 3.97            |
| Material and Equipment Group | 3.70        | 4.12             | 4.24            |

Table (3) below presents the top two and/or three factors that affect labor productivity from each group in the matrix organizational structure based on the expert's evaluation in the Delphi third round along with the calculated mean, standard deviation, and Cronbach's alpha test. The results showed that management of the construction site and a work progress schedule that ensures the flow of work factors are the top two influential factors on labor productivity for the management group. For the environment and environmental group, working under pressure, type of soil, and severe weather conditions (high temperature, humidity, sandstorms, etc.) are the most influential factors on labor productivity. When considering the economic and financial group, the financial situation of the contractor and the effect of land acquisition are the top two influential factors on labor productivity. In terms of the project characteristics group, the difficulty of entering or access in the construction site because it requires entry and exit permissions or due to security threats by terrorists, and project location are the top three influential factors on labor productivity. The findings for this group can be justified by the fact that in the last five years, the country faced war against terrorism in different provinces across the country, which resulted in creating these factors. For the external group, the emigration of skilled labors due to the availability of better job opportunities elsewhere and the security, political and social situation of the entire country are the most influential factors on labor productivity. The findings for this group can be justified by the instability of the political situation for the country. Language and absence of supervisors are the top two influential factors on labor productivity for the human and motivation group. Regarding the technical group, change orders and complexity, quality and adequacy of design are the top three influential factors on labor productivity. Furthermore, type and availability of materials, tools, and equipment in the local markets and inadequate storage locations for materials are found to be the most influential factors on labor productivity.
productivity while motivational programs and project duration factors were rated lower influential factors on labor productivity across the entire list of factors with an average rating of 3 (medium impact).

Table 3. The top two and/or three factors affecting labor productivity from each group in the matrix organizational structure

| Groups                  | Factors                                                                 | M (mean) | S. D  | α(alpha) |
|-------------------------|------------------------------------------------------------------------|----------|-------|----------|
| Management Group        | Management of the construction site                                    | 4.80     | 0.45  | 0.94     |
|                         | Work progress schedule that ensures the flow of work                   | 4.60     | 0.55  | 0.94     |
| Environment and         | Working under pressure (e.g., working in military or political control site) | 4.20     | 0.84  | 0.94     |
| Environmental Group     | Type of soil (rock, loose)                                             | 4.00     | 1.22  | 0.94     |
|                         | Severe weather conditions (high temperature, humidity, sandstorms, etc.)| 4.00     | 1.00  | 0.95     |
| Economic and Financial Group | The financial situation of the contractor (good standing or poor standing) | 4.60     | 0.55  | 0.96     |
|                         | Effect of Land acquisition                                             | 4.60     | 0.55  | 0.96     |
| Project characteristics Group | Difficulty of entering or accessing the construction site because it requires entry and exit permissions | 4.80     | 0.45  | 0.85     |
|                         | Project location (city center, district, township, village)            | 3.80     | 1.30  | 0.76     |
|                         | Difficulty of entering or accessing the construction site due to security threats by terrorists) | 3.80     | 0.84  | 0.74     |
| External Group          | Emigration of skilled labors due to the availability of better job opportunities elsewhere | 3.80     | 1.10  | 0.88     |
|                         | The security, political and social (poverty, emigration, illiteracy)    | 3.80     | 0.84  | 0.94     |
situation of the entire country

| Human and motivation Group | Language | 4.40 | 0.55 | 0.88 |
|----------------------------|----------|------|------|------|
|                            | Absence of supervisors | 4.20 | 1.10 | 0.85 |

| Technical Group | Change orders due to change in design, specifications, and unforeseen works | 4.60 | 0.55 | 0.94 |
|-----------------|---------------------------------------------------------------------------------|------|------|------|
| Complexity of design (typical, complex, unique) | 4.60 | 0.55 | 0.94 |
| Quality and adequacy of design (compatibility or incompatibility between architectural, structural, mechanical and electrical) | 4.60 | 0.55 | 0.94 |

| Material and Equipment Group | Type of tools and equipment (heavy, light, advanced) | 4.20 | 0.84 | 0.83 |
|-----------------------------|-----------------------------------------------------|------|------|------|
| Availability of materials, tools, and equipment in the local markets | 3.80 | 0.84 | 0.80 |
| Inadequate storage locations for materials | 3.80 | 0.45 | 0.84 |

Some of the factors are highly linked with the type of organization structure, and several examples can verify this link. For instance, management of the construction site is one of the most effective factors based on the rating of experts. This factor is correlated with the characteristics of the matrix organizational structure which has the distribution of authority among different levels that might lead to conflict and unclear personnel tasks or assignments that could be found in this type of organization due to the size of the organization. Furthermore, personal development and technical excellence can be achieved in a matrix organizational structure which is correlated with work experience and skill level factor. In addition, the factor for delay of the payments by the owner to the contractor is highly correlated with the slow response time of this organization (weak matrix structure) because it can handle a vast amount of information and required frequent meetings.

Table (4) below illustrates the top two and/or three factors that affect labor productivity from each group in the projectized organizational structure based on the expert's evaluation in the Delphi third round. For the management group, good management of the construction site, size and arrangement of the construction crew, and overtime hours are the top three influential factors on labor productivity. When considering the environment and environmental group, severe weather conditions (high temperature, humidity, sandstorms, etc.) and radioactive pollution and pollution of soil and air of
the construction site are the most influential factors. When considering the economic and financial group, on-time payment and motivational programs are the top two influential factors on labor productivity based on the expert's evaluation. In terms of the project characteristics group, explosive remnants in the construction site and a dangerous construction site due to terrorists' attacks are rated the most affecting factors. For the human and motivation group, absence of skilled labor and addiction (drugs, alcohol, smoking) are the top two influential factors on labor productivity.

Regarding the technical group, clarity, and adequacy of design and technical specifications and inadequate instructions and approvals by the owner (before or during the construction) are considered the top three factors that are affecting labor productivity. Furthermore, type and availability of materials, tools, and equipment in the local markets are rated the most influential factors. While, a work progress schedule that ensures the flow of work, specialized and Health and safety training sessions for labors, and groundwater factors were rated the least influential factors on labor productivity across the entire list of factors with an average rating of 3 (medium impact).

Table 4. The top two and/or three factors affecting labor productivity from each group in the projectized organizational structure

| Groups                        | Factors                                                                 | M (mean) | S.D  | α(alpha) |
|-------------------------------|-------------------------------------------------------------------------|----------|------|----------|
| Management Group              | Good management of the construction site                                | 4.60     | 0.89 | 0.97     |
|                               | Size and arrangement of the construction crew                           | 4.60     | 0.55 | 0.97     |
|                               | Overtime hours                                                          | 4.60     | 0.89 | 0.97     |
| Environment and Environmental Group | Severe weather conditions (high temperature, humidity, sandstorms, etc.) | 4.60     | 0.55 | 0.94     |
|                               | Radioactive pollution and pollution of the soil and air of the construction site | 4.00     | 0.71 | 0.94     |
| Economic and financial Group  | On time payment                                                          | 4.60     | 0.55 | 0.75     |
|                               | Motivational programs (appreciation and gratitude, monetary rewards, early leaving) | 4.60     | 0.55 | 0.85     |
| Project characteristics Group | Difficulty in entering or accessing the construction site because it requires entry and exit permissions | 3.40     | 0.89 | 0.82     |
|                               | Project duration                                                         | 3.80     | 0.45 | 0.82     |
| External Group                | Explosive remnants in the construction site                             | 4.80     | 0.45 | 0.86     |
|                               | Dangerous construction site due to terrorists' attacks                   | 4.60     | 0.55 | 0.86     |
| Human and motivation Group    | Absence of skilled labors                                               | 4.60     | 0.55 | 0.98     |
|                               | Addiction (drugs, alcohol, smoking)                                      | 4.40     | 0.89 | 0.97     |
Furthermore, the size and arrangement of the construction crew were rated one of the most important factors affecting productivity. This is highly linked with one of the characteristics for this organizational structure which is the poor coordination between different projects because multiple authorities would take decisions without coordinating with each other. Furthermore, this type of organizational structure requires more facilities and resources which could lead to a delay in payment and a decrease in a motivational program, which were found to be the top factors that were influencing labors productivity. Good management of the construction site is highly linked with the main characteristics of the projectized organizational structure which is the suitability of this structure to change fast in an unstable environment and the decentralization of decision making.

Table (5) below demonstrates the top two and/or three factors that affect labor productivity from each group in a functional organizational structure based on the expert's evaluation in Delphi third round. When considering the management group, poor or good management of the construction site and lack of communication and coordination between construction parties are top three influential factors on labor productivity. In terms of the environment and environmental group, working under pressure (e.g., working on a military or political constriction site) and severe weather conditions (freezing, heavy rain, snow, etc.) are rated the most influential factors. Regarding the economic and financial group, the financial situation of the contractor, delay of the payments by the owner to the contractor, and motivational programs are the top three influential factors based on the expert's evaluation. For the project characteristics group, the results show that the two factors of difficulty to entering or accessing the construction site and the size of the project are the top factors affecting labor productivity. Regarding the external group, a dangerous construction site due to terrorists' attacks and explosive remnants in the construction site are considered the top two influential factors. Again, the findings for this group can be justified by the fact that the country faced war against terrorism in the last five years. Regarding the human and motivation group, age, work experience, and skill level and addiction are rated the top two factors affecting labor productivity. In terms of the technical group, inadequate instructions and approvals by the owner, and the coordination between construction and design team are the top two influential factors on labor productivity. For the material and equipment group, ease of arrival of materials, tools, and equipment and type of tools and equipment to the construction site factors were rated very influential on labor productivity on a construction site. While, contract type, accidents in construction sites, and financial and health insurance factors were rated the least

| Technical Group | Quality and adequacy of design (compatibility or incompatibility between architectural, structural, mechanical and electrical) | 4.00 | 0.00 | 1.00 |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------|------|------|------|
|                 | Clarity and adequacy of technical specifications | 4.40 | 0.55 | 0.95 |
|                 | Inadequate instructions and approvals by the owner (before or during the construction) | 4.00 | 0.71 | 0.95 |

| Material and Equipment Group | Inadequate instructions and approvals by the owner (before or during the construction) | 4.00 | 0.71 | 0.95 |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------|------|------|------|
|                              | Type of tools and equipment (heavy, light, advanced) | 4.40 | 0.55 | 0.89 |
|                              | Availability of materials, tools, and equipment in the local markets | 4.40 | 0.55 | 0.89 |
influential factors on labor productivity across the entire list of factors with an average rating of 3 (medium).

**Table 5.** The top two and/or three factors that are affecting labor productivity from each group in the functional organizational structure

| Groups                               | Factors                                                                 | M (mean) | S.D  | α(α)  |
|--------------------------------------|-------------------------------------------------------------------------|----------|------|-------|
| **Management Group**                 | Poor management of the construction site                               | 4.80     | 0.44 | 0.97  |
|                                      | Lack of communication and coordination between construction parties     | 4.40     | 0.54 | 0.97  |
|                                      | Good management of the construction site                               | 4.40     | 0.54 | 0.97  |
| **Environment and Environmental Group** | Working under pressure (e.g., working on a military or political construction site) | 4.20     | 0.84 | 0.96  |
|                                      | Severe weather conditions (freezing, heavy rain, snow, etc.)           | 4.20     | 0.45 | 0.97  |
| **Economic and Financial Group**     | The financial situation of the contractor (good standing or poor standing) | 4.60     | 0.55 | 0.89  |
|                                      | Delay of the payments by the owner to the contractor                   | 4.60     | 0.55 | 0.89  |
|                                      | Motivational programs (appreciation and gratitude, monetary rewards, early leaving) | 4.60     | 0.55 | 0.89  |
| **Project characteristics Group**    | Difficulty of entering or accessing the construction site because it requires entry and exit permissions | 4.80     | 0.45 | 0.92  |
|                                      | Size of the project (large, medium, small)                             | 4.20     | 0.84 | 0.87  |
| **External Group**                   | Explosive remnants in the construction site                           | 4.60     | 0.55 | 0.92  |
|                                      | Dangerous construction site due to terrorists' attacks                  | 4.80     | 0.45 | 0.93  |
| **Human and motivation Group**       | Age, work experience, and skill level                                  | 4.60     | 0.55 | 0.93  |
|                                      | Addiction (drugs, alcohol, smoking)                                    | 4.60     | 0.89 | 0.94  |
| **Technical Group**                  | Inadequate instructions and approvals by the owner (before or during the construction) | 4.60     | 0.55 | 0.96  |
|                                      | Coordination between designer, site or supervisor engineer, and the owner | 4.40     | 0.89 | 0.96  |
The material and equipment group ease of the arrival of materials, tools, and equipment to the construction site is rated 4.60 with a standard deviation of 0.55 and a coefficient of determination of 0.89.

The type of tools and equipment (heavy, light, advanced) has a mean score of 4.40, standard deviation 0.55, and coefficient of determination 0.88.

The quality and ease of use of the materials also have a mean score of 4.40, standard deviation 0.55, and coefficient of determination 0.88.

The experts identified poor communication and management of the construction site and lack of communication and coordination between construction parties being the most significant factors that were influencing labor productivity. Those factors are highly correlated with characteristics of the functional structure, which is the poor coordination between departments and the slow response time to environmental changes. Those characteristics are considered to be a disadvantage of this type of organizational structure. The lack of communication between departments results from the poor horizontal linkage, which also results from the powerful vertical linkage and the centralization of decision making in this type of organization. In addition, work experience and skill level were rated one of the most influential factors on labor productivity. This factor correlated with another feature of the functional organization which is the promotion of in-depth knowledge and skill development of the labors that would result from the fact that most of works and tasks in this organizational structure are concentrated in a dedicated discipline.

### 5. Conclusion

The objective of this study is to focus on identifying the main factors affecting labor productivity in the Iraqi construction sector with different organizational structures. The study conducts a survey questionnaire delivered to a group of experts using Delphi technique. The experts were asked to assess and rank the relative factors in terms of importance through a one-to-five scale (Likert scale). After three rounds of assessment, the study identifies eighty-nine (89), eighty-eight (88), and eighty (80) factors that are affecting labor productivity in the matrix, projectized, and functional organizational structures respectively. The identified factors are distributed in eight (8) major groups, including management, environment, environmental, economic and financial, project characteristics, human and motivation, external, technical, and material and equipment group.

In terms of the Matrix organization structure, the most influential factors on labor productivity are the management of the construction site, work progress schedule that ensures the flow of work, financial situation of the contractor and the effect of land acquisition, difficulties with entering/exiting the construction site, the security, political and social situation of the entire country, change orders, language differences and heavy-advanced equipment. Furthermore, management of the construction site is correlated with the main characteristic of the matrix organizational structure, which is the distribution of authority among different levels that results in unspecified personnel tasks. While the most important factors that affect labor productivity in the projectized organizational structure are good management of the construction site, size and arrangement of the crew, motivational...
programs, explosive remnants, dangerous construction site due to terrorists' attacks, and quality and adequacy of design and technical specifications. On the other hand, size and arrangement of the construction crew and motivational program are found to be highly correlated with characteristics of projectized organizational structure which are poor coordination between different projects and elimination of the economic scale.

Regarding the functional organization structure, poor management of the construction site, working under pressure, experience and skill level, delay of the payments, difficulty of entering or accessing the construction site, ease of arrival of materials, tools, and equipment to the construction site, and danger to laborers due to explosive remnants or terrorists' attacks according to experts are the key factors that caused loss of productivity for labors. Finally, the primary factors, which are the poor management of the site and lack of communication and coordination between construction parties are linked with the characteristics of the functional structure, which are the poor coordination between departments, centralized decision making, and the slow response time to environmental changes.

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