

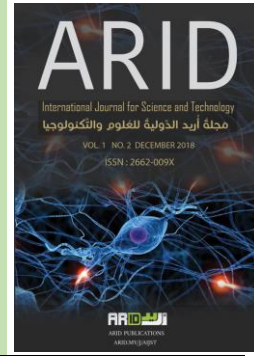


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## مَجَلَّةُ أُرَيْدُ الدَّوَلِيَّةُ لِلْعُلُومِ وَالتَّكْنُولُوجِيَا

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### **IDENTIFY THE KEY PERFORMANCE INDICATORS FOR BOT(BUILD- OPERATE-TRANSFER) PROJECTS IN FEASIBILITY AND BIDDING STAGES IN TURKEY**

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تحديد مؤشرات الأداء الرئيسية لمشاريع البناء والتشغيل والنقل في مرحلة دراسة الجدوى ومرحلة  
المناقصة في تركيا

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**ABSTRACT**

Although Public-private partnership (PPP) is a widely used project delivery system in the recent years, it is also criticized due to their low performance. Therefore, there is a need for achieving more efficient and effective PPP projects. For that purpose, the performance of the PPP projects should be managed carefully. However the performance of PPP projects is affected by various variables through the projects' life cycle. In addition, PPP projects have their certain applications, which in turn lead to having its own features (for example intricate system of procurement, management of transfers, the regulations of the government and management of stakeholders). Therefore, the performance management models developed for traditional project delivery systems are not applicable to the PPP projects, and specific performance management models should be developed for PPP projects. Especially, performance measurement should be performed carefully. Key Performance Indicators (KPI) are very important to comprehensively evaluate PPP projects, and they should be identified prudently. In this study, the KPIs of feasibility and bidding stages of PPP projects are identified by conducting a literature survey. A questionnaire based on this literature review is prepared, and a total of 80 questionnaires were collected. These KPIs are evaluated by performing descriptive analyses. Consequently, the most important KPIs are determined as selection of appropriate PPP model and sound financial analysis at feasibility stage. For bidding stage, these are detailed tender procedure and government's knowledge of PPP.

The performance of PPP is influenced heavily by the process variables which were ignored by previous studies as their major focus was on risk management, success measurement and planning.

In addressing this need, Liu et al. suggested that a phase-oriented evaluation process that accommodates key performance indicators (KPIs) in each phase of a project's life-cycle should be considered.

Keywords:

Public Private Partnerships (PPPs); Key Performance Indicators (KPIs); Performance management; Performance measurement

## الملخص

على الرغم من أن الشراكة بين القطاعين العام والخاص (PPP) هي نظام تسليم مشروع يستخدم على نطاق واسع في السنوات الأخيرة ، إلا أنها تنتقد أيضًا بسبب أداؤها المنخفض. ولذلك ، هناك حاجة إلى تحقيق مشاريع أكثر كفاءة وفعالية من تعادلات القوة الشرائية. ولهذا الغرض ، ينبغي إدارة أداء مشاريع الشراكة بين القطاعين العام والخاص بعناية ، إلا أن أداء مشاريع الشراكة بين القطاعين العام والخاص يتأثر بالعديد من المتغيرات من خلال دورة حياة المشاريع. بالإضافة إلى ذلك ، فإن مشاريع الشراكة بين القطاعين العام والخاص لها تطبيقات معينة ، والتي تؤدي بدورها إلى وجود ميزاتها الخاصة (على سبيل المثال نظام الشراء المعقد ، وإدارة التحويلات ، ولوائح الحكومة وإدارة أصحاب المصلحة). لذلك ، لا تنطبق نماذج إدارة الأداء التي تم تطويرها لأنظمة تسليم المشاريع التقليدية على مشاريع الشراكة بين القطاعين العام والخاص ، ويجب تطوير نماذج إدارة أداء محددة لمشاريع الشراكة بين القطاعين العام والخاص. خاصة ، ينبغي إجراء قياس الأداء بعناية. تعتبر مؤشرات الأداء الرئيسية (KPI) مهمة جدًا لتقييم مشاريع الشراكة بين القطاعين العام والخاص بشكل شامل ، ويجب تحديدها بحكمة. في هذه الدراسة ، يتم تحديد مؤشرات الأداء الرئيسية لمرحلة دراسة الجدوى ومرحلة المناقصة في مشاريع الشراكة بين القطاعين العام والخاص عن طريق إجراء مسح للأدبيات. تم إعداد استبيان يستند إلى مراجعة الأدبيات هذه ، وتم جمع ما مجموعه 80 استبيانًا. يتم تقييم مؤشرات الأداء الرئيسية هذه عن طريق إجراء تحليلات وصفية. وبالتالي ، يتم تحديد مؤشرات الأداء الرئيسية الأكثر أهمية على أنها اختيار نموذج الشراكة بين القطاعين العام والخاص والتحليل المالي السليم في مرحلة الجدوى. بالنسبة لمرحلة عروض التسعير ، هذه هي إجراءات المناقصة التفصيلية ومعرفة الحكومة بـ PPP.

يتأثر أداء PPP بشكل كبير بمتغيرات العملية التي تم تجاهلها من قبل الدراسات السابقة حيث كان تركيزها الرئيسي على إدارة المخاطر وقياس النجاح والتخطيط.

في معالجة هذه الحاجة ، ليو وآخرون. اقترح أن يتم النظر في عملية تقييم موجهة نحو المرحلة والتي تستوعب مؤشرات الأداء الرئيسية (KPIs) في كل مرحلة من دورة حياة المشروع.

الكلمات المفتاحية:

الشراكات بين القطاعين العام والخاص (PPPs) ؛ مؤشرات الأداء الرئيسية (KPIs) ؛ إدارة الأداء؛ مقياس الاداء

## 1. Introduction:

There are different project delivery systems for delivering public services and infrastructure, vary between absolute privatization to straightforward provision of the government, with growing rewards, commitments, risks and responsibilities are being handed over to the private sector from the government [1]. As an example, usually, the duration of the service and supply contracts is considered short. Within these contracts, specific duties are being performed by the private contractor (for example, maintenance of the facilities, work construction and supplying equipment/material) while it has no responsibility to provide associated services. About lease-and-operate contracts, the facilities are maintained and operated at the risk of private contractor against payment of the lease fees. Regarding build-operate-transfer, which can be abbreviated to (BOT), financing and building the project are the main responsibilities of the private contractor, also, at the end of concession term, the facilities of the project should be transferred in operational state to the government. In divestiture, the private contractor will own the present property and will be responsible for future maintenance and expansion, along with proceeding and financing the investments which are needed to fulfill the commitments defined in the contract or/and a common regulatory structure [2].

PPP can be defined as a long term plan between the private sector and the public agency were both of them utilize their complimentary services and undertake various levels risks and responsibilities to develop a public facility [3].

Essentially, public-private partnership incorporates various infrastructure services and projects which ranges from outsourcing to full privatization (Li 2003; Zhang 2005). In the past twenty years, the concept of public-private partnership was spread quickly, mainly in nations related to evolving regions (World Bank 2015). Recently, many governments in various advancing nations are considering the concept of public-private partnership PPP as a ground-breaking method for bridging their big infrastructure gaps [4]. Even though public-private partnership cannot be considered as a solution to all infrastructure requirements of advancing nations [5], it presents a better chance for governments to improve modernized and sustainable general infrastructure compared to the old-style procurement method [6], [7].

Initially in 2017, investment obligations in emerging markets and developing economies (EMDEs) involved fundamental infrastructure for information and communications technology (ICT). The fundamental infrastructure of ICT denotes to physical resources like mobile towers,

fiber-optic cables, and more hard resources which have an active government component. In the year 2017, Private Participation in Infrastructure (PPI) investment come to \$93.3 billion through 304 projects, that is of (37%) increment over the levels of 2016. This important growth in 2017 was mostly because of an unexpected investment levels in East Asia and Pacific (EAP), that was caused via several mega-projects in Indonesia and China, in addition to the improvement in South Asia, particularly in Pakistan. Yet, overall investment in 2017 is still (15%) lesser than the average for the past 5 years (US\$109.8 billion), also there was a growth in the number of projects, that growth came by (9%), as the number of projects elevated from 280 in 2016 to 304 in 2017. This rise was chiefly because of Egypt, as the number of projects raised from 2 to 25, as well as a marginal growth in India (32 to 43) and (64 to 73) in China. Nevertheless, the number of projects decreased notable in Turkey (16 to 5), Colombia (15 to 1) and Brazil (68 to 24). Similarly, Private Participation in Infrastructure investment transactions happened in 52 nations in 2017, and that is an important growth over the levels of 2016 of 37 nations, and the average of 41 nations for the previous 5 years.

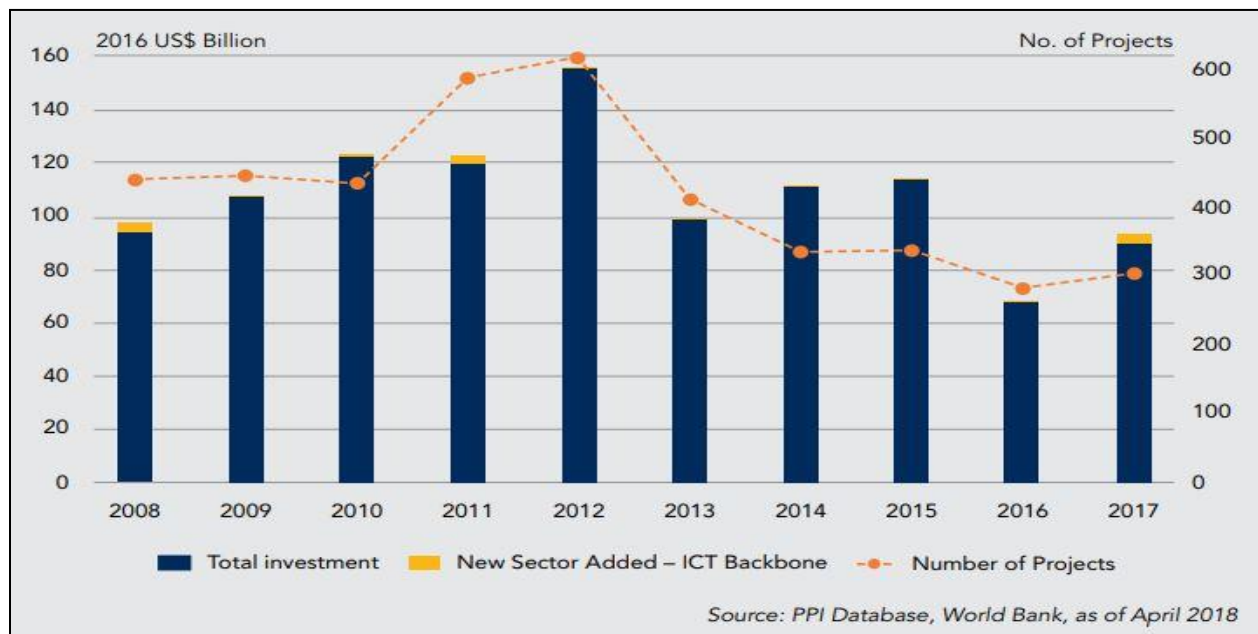


Figure1: Investment commitments in infrastructure projects with private participation in EMDEs, 2008–2017

## 2. Literature Review:

### 2.1. *The Preceding Researches On PPPs*

PPPs can be defined as contractual relations between the public sector and the private sector in developing infrastructure. The Canadian Council for Public Private Partnerships (2004) gave the

definition of PPP as “a cooperative venture between the public and private sectors, built on the expertise of each partner that best meets clearly defined public needs through the appropriate allocation of resources, risks and rewards.” PPPs were under practice all over the world in each of the developing and developed countries with numerous aims, such as the promotion of enhancement of infrastructure, minimizing expenses, maximizing the efficiency of each of construction and operation, and the improvement of the quality of service via using the knowledge, expertise, and capital of the private sector.

Regrettably, there are limited literature sources that provide information about managing this type of interorganizational relationships, process controlling. Generally, the available sources are concentrated on studying PPPs at merely the broad level of society or organization, thereby ensuring limited information about the current managerial PPP life. This insufficient number of sources is a considerable gap in the comprehension of PPPs. [8] had the conclusion that lacking in the analysis of micromanagement and lacking in the analysis of stage-specific are two considerable issues in this study. None the less, a limited number of researchers have utilized their knowledge in the procedure of the PPP projects [8], this study is mainly focused on the sole factor of the process, which in the results of their analyzing could result in neglecting the impact of the rest of the factors. This is why it's highly important establishing an integrated system for controlling and measuring the entire procedure of a PPP project for the sake of helping PPPs in achieving the required goals, i.e., every factor should be taken under consideration in the case where they could have an impact on the process, implementing and efficiency of a PPP project.

## **2.2. *Build-Operate-Transfer (BOT)***

The BOT (Build-Operate-Transfer)/ BOOT (Build-Own-Operate-Transfer) model is a method allowing a project firm established for planning, financing, designing, constructing and operating the facility with an agreement for a specific range of time prior to transferring the ownership to the host government again [9]. In some studies, researchers have argued that the BOT and the BOOT models are the same since both of them involve every phase of design, build, finance, operation, and transfer. As noted by Stein (1994) [9] the BOT approach is mainly aiming to substitute governmental responsibility for implementation of a given project thorough the private sector investors' initiatives; to sum up, transferring the responsibility temporarily, or permanently for definite services or operations from the public sector to private sector.

BOT method is considered as a way of cutting back the public expense and borrowing, attracting foreign investors in their countries' infrastructure or industrial projects as well, the idea instantly captured the world's attention accordingly, particularly in developing countries such as Malaysia and Thailand [10]. The BOT method was first coined in 1984 in Turkey by the Turkish Prime Minister, Turgut Özal, as a part of the privatization of Turkey's public sector projects. The BOT concept in India is a blend of the US "toll road" and the European "concessions" — the government keeps the ownership of physical asset and the BOT concessionaire finances and collects the operating revenues during the contract period.

The advantage of the BOT/BOOT structure, which is shown in Figure 2, for host government is the reversion of ownership [9]. This model is commonly applied for transportation infrastructure, energy, and environmental projects. In BOT concept, the governments participate in the concession agreement with their regulatory company which is in charge of constructing, operating and taking operating revenues during the concession period. If a required know-how is not available in the consortium members, the project will be undertaken by hiring contractors and operators through sub- contracting .

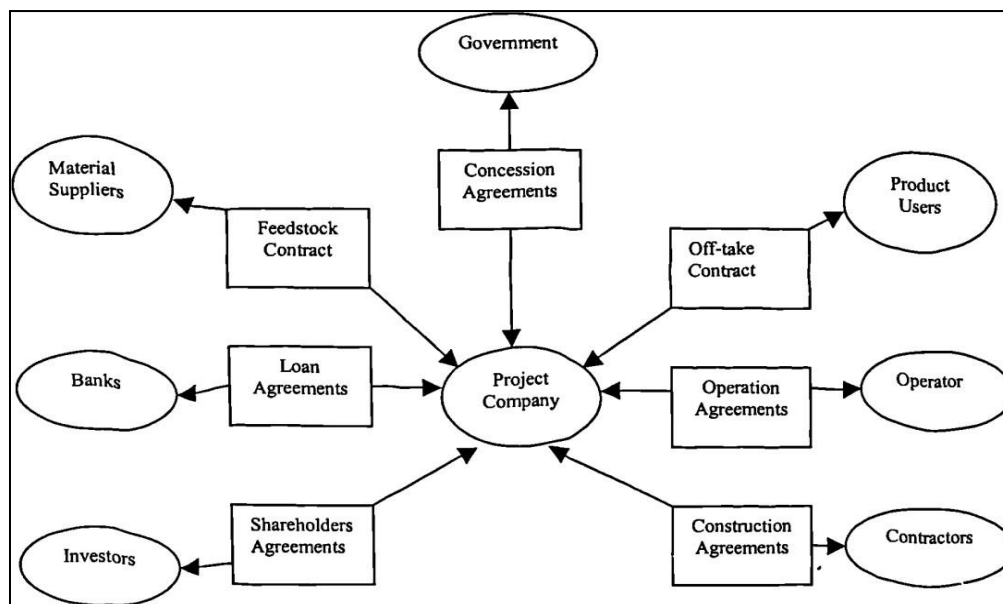


Figure 2: Structure of BOT/BOOT Contrast [10].

The BOT/BOOT concept differs from more conventional approaches mainly in having only the project's expected cash flows as a resource to indicate the economic viability from the lender's point of view. The project owner has the responsibility for considering not only the role of borrower but also their financial advisers, structuring the financial package to make it



more attractive for possible lenders, while simultaneously offering minimum option to themselves in case things go wrong.

### **2.3. KPIs (Key Performance Indicators)**

KPIs are known as key success indicators (KSI) and help organizations define and assess the progress to achieve the predefined objectives of the organization. Measures of efficiency are utilized virtually in a wide range of industries like hospitals, constructions, software development, logistic applications, manufacturing, mining and fleet maintenance. Measures of performance are related to the initiatives of performance enhancement.

KPIs play the role of useful tools in the evaluation of PPP projects. Yuan [11] performed a research on managing the efficiency of PPP projects for achieving value for money where some of KPIs have been chosen. This research gives knowledge about the performance management to manage the PPP process for the sake of improving the result of PPP projects. “Yuan et. al.”’s research indicated that those KPIs are good tools for the assessment of the strong and weak points of PPP projects. KPIs are utilized by management for the evaluation of performance via the comparison of the actual and expected performances according to quality, effectiveness, efficiency and workmanship. “Yuan et al. (2009)” introduced a conceptual framework of KPIs constructed according to the needs of stakeholders, which can affect the projects’ performance. The performance indicator system that has been utilized in their study was made up of 3 parts. First, the features and characteristics of the PPP projects that will influence the efficiency of projects at the initial step. Those measures will have an impact on selecting the concessionaire, agreement between the public and the private sectors, risk allocation and the degree at which the projects will be successful under the impact of political, economic and legal environments. Second indicators include indicators of finance and marketing, indicators of learning and innovations, in addition to indicators of stakeholders, which represent economical, innovational, cultural and benefits of the indicators of stakeholders [11].

The third group of indicators includes variables affecting processes of maintenance, construction, operation, transferring and post-transferring. “Yuan et al” focused on the fact that the 2<sup>nd</sup> and the 3<sup>rd</sup> indicators have to be dynamical and measurable for the sake of evaluating business success, efficiency, customer satisfaction, future possibilities and product requirements of PPP projects.

### 3. Methodology:

The research was conducted in Turkey on many companies operating the ppp system, where the questionnaire was distributed to 80 respondents in these companies, where a comprehensive questionnaire was conducted for two stages of construction or stages of referral for construction projects, namely the feasibility study phase and the bidding phase, which included a kind of ppp, the bot where the opinions of engineers working in Based on the successful performance criteria derived from previous research. The opinions of the engineers working in these companies were obtained to arrange these indicators or criteria based on the results obtained from the respondents in order to reach the order of priorities of these standards

### 4. Results:

The results were collected through a group of engineers working in the Turkish investment and construction companies, where the experience of the workers in these companies was counted in the field of investment projects in addition to their certificates and the sizes of the companies working for them. The results were as in the forms below.

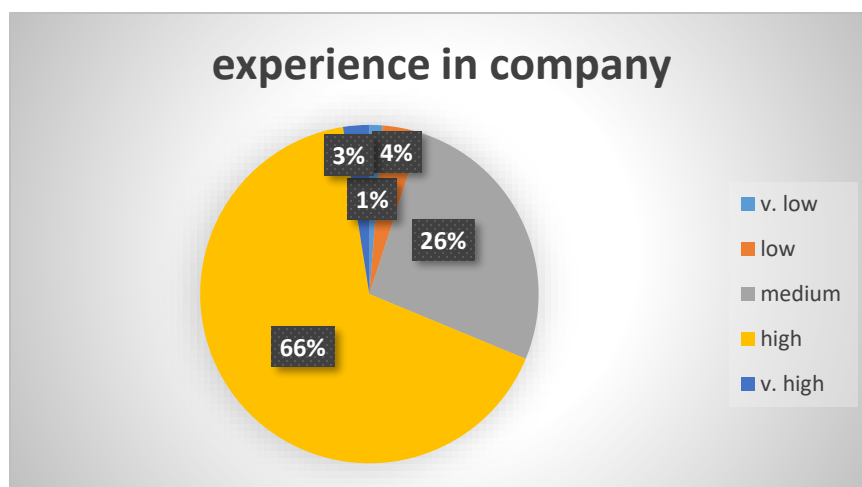


Figure 3: Experience of responders in company

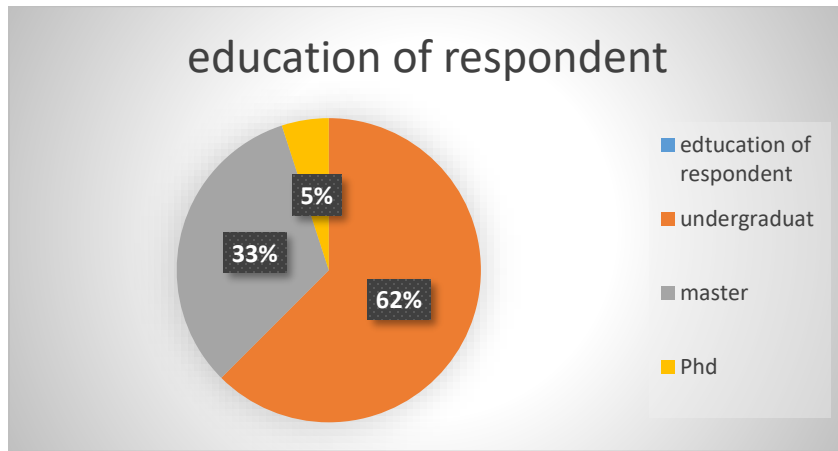


Figure 4: Education of respondent

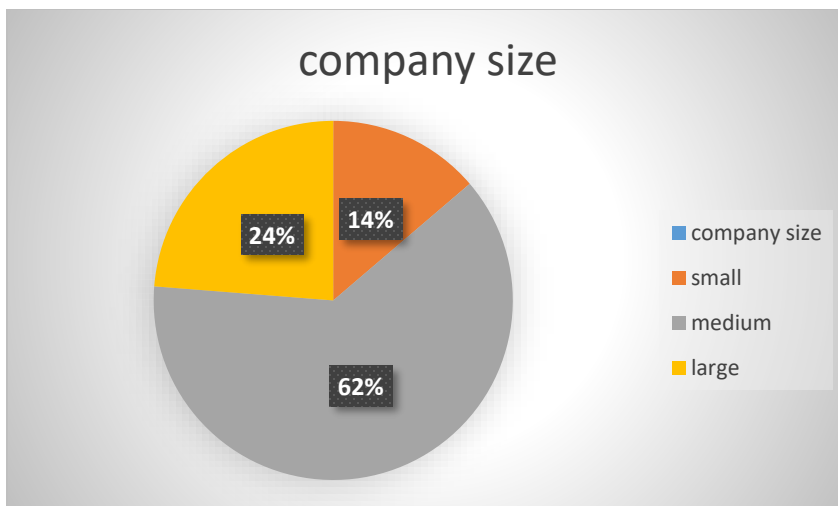


Figure 5: Company size

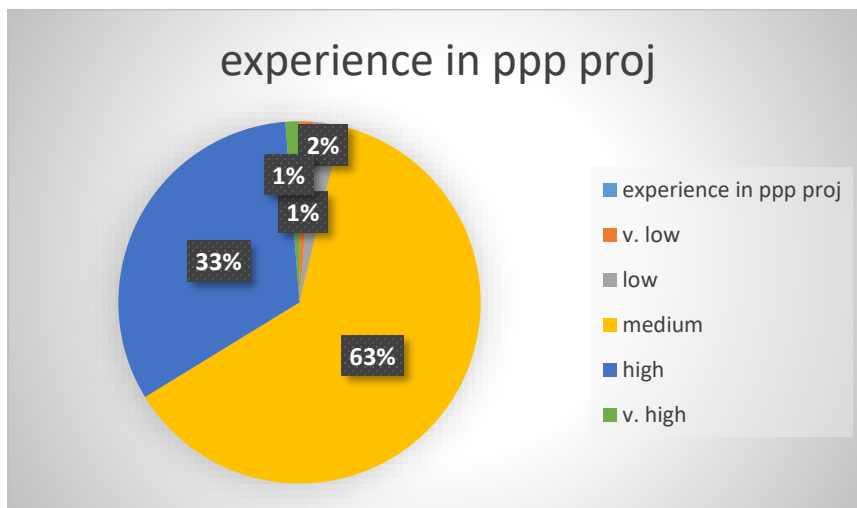


Figure 6: Experience of responders in PPP projects

The results obtained from the respondents in the first phase of the project life cycle show that the Selection of appropriate PPP model topped the ranking based on the obtained rate, where the

value of the mean is equal to 4.1375 and came after that the sound financial analysis where it obtained an average of 4.0375 and followed by the risk identification with a mean of 4 and the key to the order is the sound environmental impact analysis where the mean is equal to 3.3125.

**Table 1: Ranking of KPIs in feasibility stage**

Feasibility	Sum	Mean	Rank
Risk identification	320	4	3
Sound financial analysis	323	4.0375	2
Project technical feasibility	309	3.8625	4
Project constructability and maintainability	301	3.7625	6
Sound environmental impact analysis	265	3.3125	9
Definition of service need and output	301	3.7625	6
Selection of appropriate PPP model	331	4.1375	1
Development of flexible financial model	298	3.725	8
Feasibility study	306	3.825	5

While the results show in the second phase of life cycle of BOT project show the order of performance keys as follows where the date came in the first place with the highest rate reached 8686 followed by in the ranking detailed tender procedure obtained 4.0375 and then comes the government's knowledge of PPP with a mean equal to 3.9625 while we see the detailed contract draft and specifications came in the final stage with an average rate of 3.8625.

**Table 2: Ranking of KPIs in bidding stage**

Bidding	Sum	Mean	Rank
Government's knowledge of PPP	317	3.9625	2
Detailed tender procedure	323	4.0375	1
Competitive tender procedure	312	3.9	3
Standard PPP contract with enough flexibility	300	3.75	6
Stages of tender procedure	303	3.7875	5
Detailed contract draft and specifications	309	3.8625	7
Timeline of tender procedure	298	3.725	4

## 5. Discussions:

Public-private partnerships are widespread in developing infrastructures; one of the vital elements for their success is the efficient performance measurement. The goal of this study is to recognize efficient KPIs for BOT projects in 2 phases, bidding and feasibility.

Later, the categories of KPI and their related measures were summarized in terms of concept. These issues could be beneficial to project stakeholders of public-private partnerships via offering them comprehensive measures for their projects and feasible direction for developing suitable KPIs. The results of this study could be considered as a conceptual outline and theoretical foundation for developing efficient PMSs and improving the excellence of project delivery in relation with public-private partnerships [12].

This study, which was carried out as mentioned above, is carried out in two important stages of the life cycle of the BOT projects, namely the feasibility stage and the bidding phase. These two stages are the starting point of the project and the first stages on which the rest of the project will be based. Selection of appropriate PPP model is one of the most important keys to the success of this stage, depending on the statistical analysis by finding the key to the participation in the questionnaire, indicating that the choice of the model and the quality of the project at this stage is one of the key keys to success and considering the following keys sound financial analysis of the project is considered an important key, especially in investment projects where we see that most of the authors who worked in the field of PPP projects focus on the profits and the amount of money that will run the project and comes after these important keys important key that affects significantly in most engineering projects, PPP or other projects where risk identification is an important factor to move the project to safety, as the identification of these risks protect the beneficiary of a lot of errors that may affect the project pathway[13,14].

In the second phase of the contract, we find that the tender and attention to detail came in the first ranks where we find that the details of the tender, which is one of the most important key in this stage and then the competition in tenders is also important key, this means that the tender is a priority to be taken care of. This stage, in addition to the knowledge and information of the government about the quality and nature of the projects of the PPP, where there must be full knowledge of the projects where there must be full and complete knowledge of projects (in terms of type, method of work, characteristics of projects, mechanism of projects, etc.)[15].

From this study that KPIs were useful for the company, especially in these two stages the company is now capable of identifying its strong and weak points and can now be focused on potentials for enhancement. Most significantly, the KPIs indicate the company's goals, missions and vision that are main requirements for the success of the company [16].

## **6. Conclusions:**

The success of the project has been an important subject in the area of construction managing for years. The review of papers on success of projects indicates that expense, duration and quality are the 3 fundamental and most significant measures of performance in projects of construction. Other measurements like satisfaction, safety, functionality, and so on, are drawing a considerable interest. A group of KPIs that are measured quantitatively and qualitatively are developed due to this comprehensive review. For the verification of the usefulness and practicality of those KPIs, researches on the two stages of BOT projects refer to several KPIs effects in these stages [17].

It has been shown that the identified KPIs are generally sufficient measures of efficiency of projects if constructions. They offer a good framework to measure and compare efficiency of the projects for following researches. In addition to that, they furnish managers of the projects, clients and other project stakeholder's useful information for the successful implementation of a project [18].

From the results of this research, it is possible to conclude that numerous KPIs are researches, which will enhance the efficiency of PPP projects in Turkey. The most significant of those KPIs based on the results of this research are [19,20]:

- In the feasibility study there are many factors that have accepted the admissibility of the respondents in addition to obtaining high percentages through their views, but the most prominent of these indicators Selection of appropriate PPP model, Sound financial analysis risk identification and Project technical feasibility.
- In the bidding phase, the Detailed tender procedure, Government's knowledge of PPP and Competitive tender procedure indicators have advanced.

From this study that KPIs were useful for the company, especially in these two stages the company is now capable of identifying its strong and weak points and can now be focused on potentials for enhancement. Most significantly, the KPIs indicate the company's goals, missions and vision that are main requirements for the success of the company.

## List of Abbreviations

BOT	Build Operate Transfer
PPP	Public Private Partnership
KPI	Key Performance Indicator
EMDEs	Emerging Markets and Developing Economies
ICT	Information and Communications Technology

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