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Risk Severity Matrix for Sustainable Public-Private Partnership Projects in Developing Countries

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Abstract: The concept of a Public-Private Partnership (PPP) is not new for developing countries, although many initiatives are being contemplated for potential implementation. This paper evaluates the crucial success factor for the effective execution of PPP projects and it also investigates the appropriate distribution of the risks involved in PPP projects. Quartile analysis of features has been made after a detailed literature review for risk identification. The risk severity analysis is done using a quartile assessment. The data is collected from various contractors working on PPP projects in Pakistan. The comparative analysis has been conducted using available research work on PPP in developing countries. A risk severity rank model is created using 47 key risks in PPP projects for developing countries. Finally, the top risks identified by this research are compared with the previous studies conducted in China, India and Egypt. It is concluded that inflation, revenue risk from end-user, foreign exchange fluctuation, political situation, law and order, and corruption are the major risks in developing countries for better management of PPP projects. Most of the PPP projects are public-oriented. The society of any city is directly affected by most PPP projects. This paper presents the identified key risks of PPP projects in developing countries which are mostly financial and public-oriented. This work will support the PPP concept significance, meeting United Nations Sustainable Development Goal (SDG) 8 and 11. Recent countries' political and economic circumstances and sustainability have transformed PPP ventures into a successful way to support the governments to develop roads, energy and facilities through private partners' financial and technological capacities. Although PPP is used worldwide, its effective utilization in developing countries is still lacking. This paper is an enhancement to its successful use of the PPP domain for developing countries.

Keywords: employment growth; gross domestic product; infrastructure; public-private partnership; risk; sustainable economy

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1. Introduction

Throughout recent years, the Public-Private Partnership (PPP) has evolved to be a crucial mechanism for implementing social development projects throughout developed countries [1]. PPP fosters development growth, enhanced operating and building efficiency, growth in the local economy, improved service quality through the integration of private sector skills, experience and knowledge base that has drawn growing attention from politicians, industry practitioners and academics. It is an approach taken to increase the economic value of infrastructure goods and includes a wide range of services in the public

sector [2,3]. PPP has grown into a way of providing infrastructure services worldwide. However, as compared to developing countries, most emerging markets have struggled to draw private investment in recent years [4,5]. PPP is a form of private participation in a public project in which the public and private sectors collaborate and work towards a common objective. Two parties assume responsibility for the purchase and delivery of public goods; financing may be either charged or given by the private sector, depending on the particular scope of the project [6]. As a result, PPP has been used in different sectors around the world, particularly in the infrastructure sector, as it is considered a catalyst for economic growth [7]. PPP relates to a complex procurement mechanism in which arrangements are carried out between public and private entities over a wider selection of contractual deals involving a value and/or commodity. The PPP model is popular in infrastructure project development (e.g., roads, tunnels, bridges, etc.) [8,9], as these projects usually involve considerable expenditure, which is a heavy financial strain on most governments, especially in developing countries [10]. PPP effectiveness depends in large part on the efficiency of the tendering process [11].

The PPP is increasingly becoming the preferred form of delivering public services in developing countries [12,13]. In several countries, pressure from the lowering of public debt has prompted their policymakers to include private sector companies in several investments of economic and social infrastructure, such as toll roads, colleges, hospitals, car parks and facilities [14]. Risk management in PPP projects differs radically from conventional public projects where the public sector buys an asset from private sector contractors and consultants whose responsibility is limited to product design and development, and where financial and operational risks remain with the public sector [15,16]. Risk management is a major concern when carrying out a PPP project, particularly in PPP technological infrastructure projects [1,17]. Risk evaluation was one of the most challenging problems of building and PPP [18,19]. Fostering government-investor discussions is essential to an effective risk reduction strategy [20]. Public organizations find forming PPP beneficial but pose unnecessary risks [21]. Developing mega infrastructure cost a lot, and it is very difficult for a country like Pakistan with a very tight budget to meet the requirements and the speed to meet the needs. Given the difficult economic situation, the public sector announced its collaboration with the private sector to take advantage of the private sector's expertise, financial ability and technical skills, which is why PPP was created. The PPP scheme is thought to be able to provide a better value for money especially for infrastructure projects [22]. Because of its existence, developed and developing countries around the world have broadly embraced the definition of PPP in the past decade and are steadily growing [23]. PPP contracts are of a very complicated nature, and several factors include the performance of PPP ventures. One of the factors that plays a vital role in any PPP project's performance is risk recognition and its proper (public and private) distribution between the parties. The first step towards a successful risk management framework is to conduct a reasonable risk assessment and risk distribution between the private sector and the public sector in such a way that each party carries with it the risks it can handle better [22]. Therefore, the public sector must contend with some of the risks associated, the private sector must handle other risks and all sides will bear the remaining risks.

PPP contracts are of a long-term sort, and given the contract length, the scope of this contract structure is much greater than most other forms of contracting arrangement [3]. There are other main reasons for the project's effective completion, such as political environment, law and order situation, financial access, stronger procurement policies, government incentives, capital sector accessible, etc. In developing countries like Pakistan, where the country's economic condition is not stable enough, it is believed that PPP contracts are the most favorable public goods procurement option. To order to render every PPP initiative a success story, there is a critical need to consider the roots of previous PPP failures. The idea of implementing the PPP in Pakistan was very positive and was intended to be very effective but the lack of regulations, the continuity of policies at the government level and the unequal sharing of risk between the parties restricted the impact of PPP projects in

Pakistan [24]. The key purpose of this study is to define the risk factors involved in PPP programs, as well as the partner's wise risk distribution. [25] notes that good risk control is one of the most critical aspects of PPP project performance. There have been several of the ventures proposed in the past under the framework of the PPP contract program but much of the project was ineffective due to lack of government-level regulations and inadequate risk management. There is an urgent need to recognize and distribute the risks associated with PPP ventures in developing countries like Pakistan to prevent these kinds of problems. Still, the risk allocation and severity model for PPP projects in Pakistan has not been assessed in such detail. In the lack of such a report, evaluating the PPP programs successfully becomes quite challenging for government departments, business staff, etc. An analysis to avoid these problems is needed; the risks involved should be classified in Pakistan's PPP projects and would be beneficial in determining the extent, and in allocating the risks to the group who can best manage the danger [16].

PPP is becoming increasingly critical in improving the sustainability of society [26]. Since the 1980s the Malaysian government has introduced the PPP plan for infrastructure creation. The literature suggests that owing to a lack of risk management, a variety of PPP projects have struggled to achieve their targets [27]. India is one of the world's largest PPP markets, with over 1300 major national infrastructure projects [28,29]. PPP reflects an important and tested procurement method for the network. While several countries have implemented PPP for infrastructure development in recent years, not all of the projects were successful. Most PPP failures result from inadequate risk distribution and a lack of knowledge about success factors in countries in particular [30]. Consequently, this study aims to define the risk factors involved in PPP programs and the partner's wise risk distribution in PPP projects. It also aims to build a risk intensity index to assist stakeholders employed in developing countries' construction industry in managing PPP projects in general and risks explicitly associated with PPP.

2. Research Methodology

This research has been conducted in three phases. The Delphi approach was adopted to carry this research. In phase one, qualitative analysis was conducted through a detailed literature review followed by unstructured interviews with the experts working on PPP projects. A total number of 53 risk factors were identified in the literature review process. These risks were discussed with five experts currently working on different PPP projects. A list of 47 risk factors was finalized after the expert's opinion in the unstructured interviews. The interviews were conducted in October 2019. After the expert's feedback, a final set of questionnaires was designed to get detailed expert opinion working on various PPP projects. The respondents were requested to rank the significance level and impact level of all risk factors using a scale ranging from 1 to 5 where 1 stands for least significant and 5 stands for highly significant risk. A similar approach was applied to the impact scale. A total number of 51 questionnaires were sent in-person, hard post and by email and 42 questionnaires were received successfully. The success recipient rate is 88% which is quite a good response from the experts. The reason behind this lower number is the limited PPP projects and professionals in Pakistan. The data was collected between December 2019 and January 2020.

The data were analyzed in Statistical Package for Social Sciences (SPSS) using various ranking methods and a final rank of the risk is generated. In the last phase, the mapping and risk severity matrix is made and it is finally compared with the recent studies conducted in neighboring countries. The complete research sequence is shown in Figure 1.



Figure 1. Research sequence.

3. Data Collection and Analysis

The questionnaire was distributed among 42 professionals working in the public and private sector of Pakistan. As the concept of PPP has only been introduced in recent years, limited professionals are have PPP experience. The number will increase with the increase of projects in the country. Regarding the experience of respondents managing PPP projects, Figure 2 shows the experience of respondents in PPP projects.

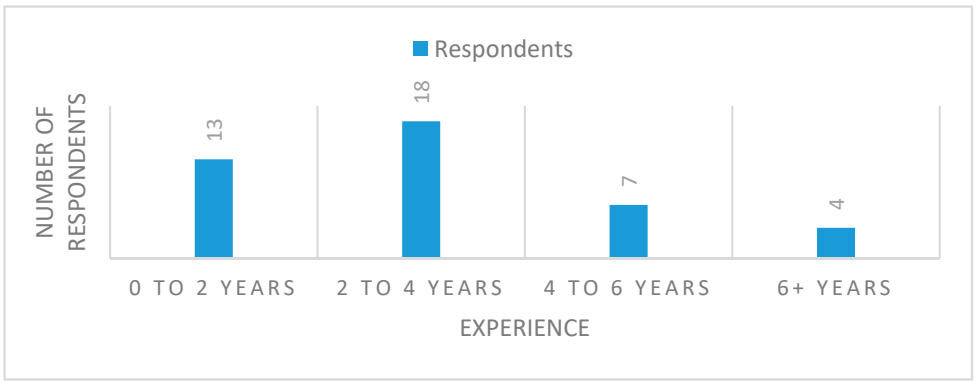


Figure 2. Respondent's experience profile working on Public-Private Partnership (PPP) projects.

The respondents have experience of PPP projects within Pakistan and other countries including United Arab Emirates, Kingdom of Saudi Arabia, United Kingdom, the Philippines, United States of America, Australia, Canada and Qatar. Of the respondents currently working on various development projects on PPP, the majority had experience in infrastructure projects; along with infrastructure projects, some of the respondents had experience in the education sector, health sector, power sector, etc.

Regarding the domain of respondent's work, 62% of respondents were working in the private sector while 38% of respondents worked in the public sector, as shown in Figure 3.

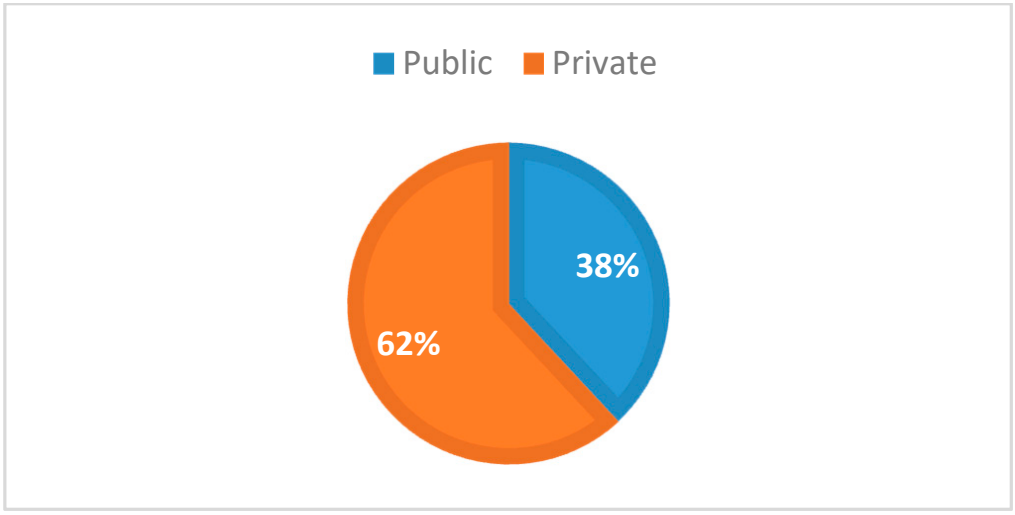


Figure 3. Respondent domain of work.

All of the defined risks were listed in a 12-category questionnaire. Based on their experience in the field of PPP projects, the respondents were asked to answer the probability as well as the impact of each risk on the Likert scale from 1 to 5, where 1 represents the least likelihood and the smallest impact, and 5 represents the highest likelihood and impact. Each risk has a different likelihood of occurrence that any specific risk may occur whereas each risk has a different impact on the project. One risk may have a higher likelihood but its impact on the project may be low. Therefore, based on this rationale, any risk with a higher likelihood of occurrence and higher potential to impact the project is termed as serious risk whereas any risk with a lower likelihood of occurrence and lower potential to impact the project is termed as less significant risk. The respondents were also asked to determine which party will efficiently bear the particular risk: whether both parties will bear the private party, the public party or the risk equally.

4. Risk Severity Matrix for PPP Projects in Developing Countries

The risk ranking was made on a quadrant assessment approach and the four-quadrant grid is described as follows:

- 1st Quadrant: High probability, high impact: Risks having probability and impact more than 2.5 were included in 1st quadrant; 1st quadrant risks are actively monitored and are mitigated as soon as they are identified.
- 2nd Quadrant: Low probability, high impact: Risks having a probability less than 2.5 but the impact of those risks is greater than 2.5 belong to the 2nd quadrant; these risks are examined and proper allocation of these risks can be helpful to minimize their effect.
- 3rd Quadrant: High probability, low impact: Risks having a probability greater than 2.5, but the impact of those risks is less than 2.5 are included in the 3rd quadrant; an eye is being kept on these type of risks and the occurrence of these risks is minimized.
- 4th Quadrant: Low probability, low impact: Risks having impact and likelihood of occurrence less than 2.5 are included in the 4th quadrant; these risks can be managed by proper allocation of risks (See Figure 4).

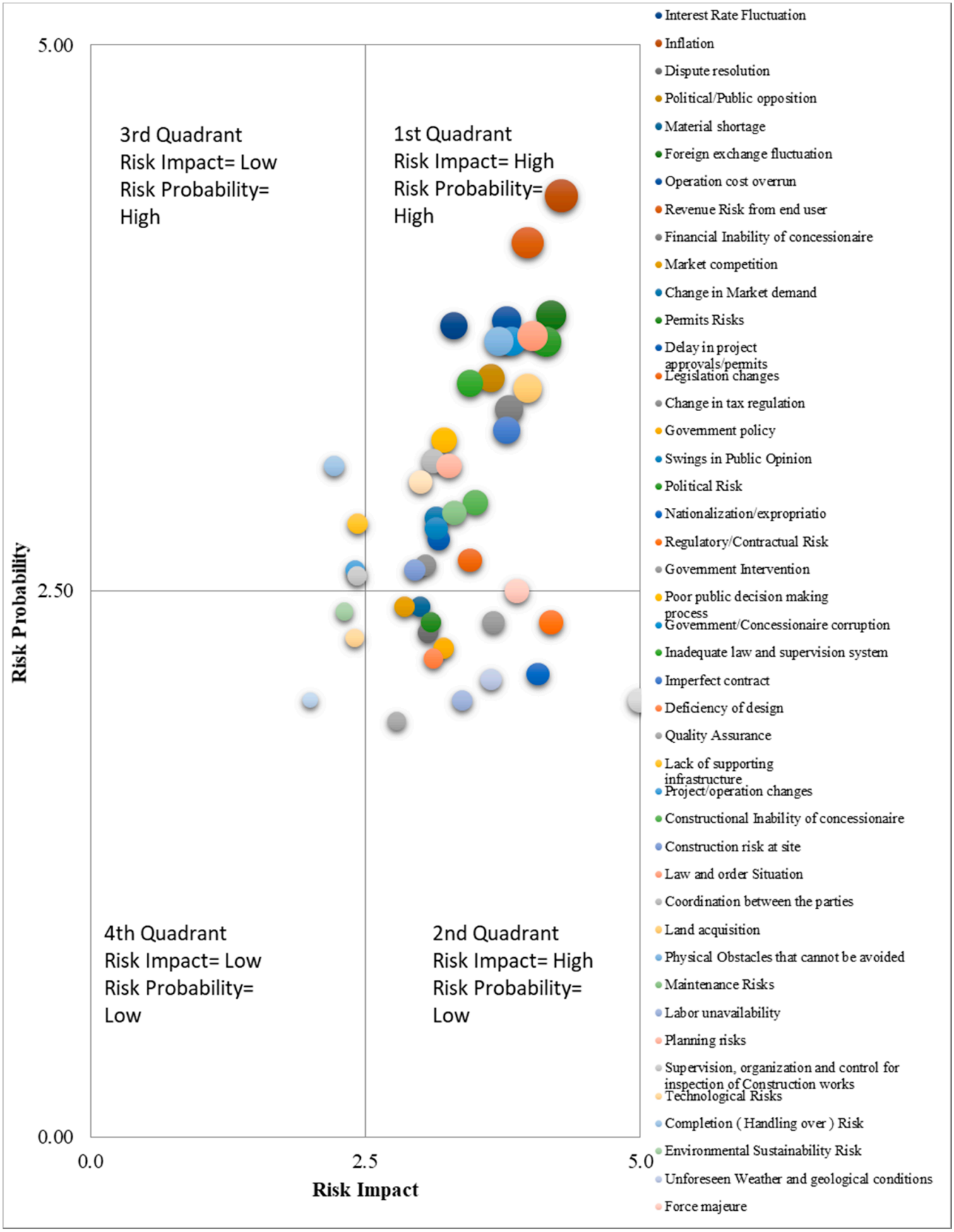


Figure 4. Risk severity matrix.

In the last stage, based on the quadrant assessment, each risk is ranked based on its severity. It is observed that inflation is the most important risk because it has a higher possibility of risk occurrence and it has higher potential to damage the project. As the economy of developing countries like Pakistan is not sustainable, the current account deficit and dollars unavailability in the country leads to inflation and foreign exchange fluctuation which stands at third in the risk severity list of this study. This can cause inflation in the country and it will impact human life, other industries and construction projects. Revenue risk from the end-user is ranked as a second important risk, because due to the political and governance instability of the country the investor is reluctant to invest in the PPP projects. Such conditions may lead to project holdups and the revenue issues are normalized with the stabilization of the political and governance situation. Political risks rank as a fourth important risk in this study because a PPP investor will never invest in a country where there is no political stability. The investor feels a threat to its investment and every investor investing in PPP projects are expecting a return and investment outcomes from the projects. Due to political instability and week governance, there are higher chances of a law-and-order situation disturbance which also has a great role in the success of PPP projects execution and attraction of other investors possibly investing in PPP projects in any country. Similarly, all other risk types in this study have been ranked on the same principle mentioned earlier.

5. Comparative Assessment

As stated earlier, PPP contracts are gaining in importance in various countries due to various benefits and ease. According to Chan et al. [31], there were about 2400 infrastructure projects in the implementation phase in China under the umbrella of PPP contract system with a total investment of over RMB 470 billion (75 billion USD); while on the other hand there were up to 142 PPP transport projects under commencement between 2007–2011 amounting 402 billion USD [32]. According to the website of Acer Pakistan the estimated cost for PPP projects in Pakistan is around 16 billion USD at the moment, including projects which are in the planning and implementation phase [33]. Therefore, a detailed comparative assessment was also done for a better understanding of the concept.

Case 1: In this case, the results of this country are given and the case represents the construction sector of Pakistan.

Case 2: In this case, a recent study conducted in China was considered to analyze the results. The reason to select this case is that China is one of the growing economies in the Asian region and many companies working on PPP projects for many years are from China.

Case 3: In this case, a study conducted in India was considered to analyze the results. The reason to select this case is that India is a neighboring country of Pakistan and there are many similarities in both countries including governance style, political stability and others. India is also one of the growing economies in the Asian region and there are many ongoing PPP projects in India.

Case 4: In this case, a study conducted in Egypt was considered to analyze the results. The reason to select this case is that Egypt is a country with different regions, political setup and governance style. Egypt also introduced various PPP projects for infrastructure development.

To compare the identified risks in Pakistan, a comparison was made between the top risks identified in this study with the risks identified in three countries including China, India and Egypt through the literature review as shown in Table 1.

Table 1. Risk rank relationship between Pakistan, China, India and Egypt.

S.No	*PPP Risk Relationship in Pakistan, China, India and Egypt*				
	Risk Factor	**Risk Ranking in the Pakistani Case**	**Risk Ranking in the Chinese Case [31]**	**Risk Ranking in the Indian Case [34]**	**Risk Ranking in the Egyptian Case [35]**
1	Inflation	1	14	5	3
2	Revenue risk from end user	2	6	6	21
3	Foreign exchange fluctuation	3	13	——	1
4	**Political risk**	**4**	——	**3**	**2**
5	Law and order situation	5	——	10	——
6	Operation cost overrun	6	12	11	25
7	Government/concessionaire corruption	7	3	——	9
8	Land acquisition	8	27	2	42
9	Physical obstacles that cannot be avoided	9	——	——	54
10	Financial inability of the concessionaire	10	4	9	44
11	Political/public opposition	11	33	3	6
12	Interest rate fluctuation	12	8	6	17
13	Imperfect contract	13	9	6	41
14	Inadequate law and supervision system	14	5	——	16
15	Poor public decision-making process	15	2	7	4
16	Constructional inability of concessionaire	16	20	——	50
17	Planning risks	17	——	——	32
18	The event of default of any partner	18	——	9	——
19	Regulatory/contractual risk	19	9	——	18
20	Force majeure	20	30	6	15
21	Coordination between the parties	21	26	——	45
22	Maintenance risks	22	——	——	40
23	Legislation changes	23	24	4	10
25	Change in market demand	25	10	6	47
26	Swings in public opinion	26	——	7	12
27	Delay in project approvals/permits	27	18	12	19
28	Government intervention	28	1	——	23
29	Nationalization/expropriation	29	35	——	14
30	Change in tax regulation	30	31	6	8
32	Unforeseen weather and geological conditions	32	34	11	59
33	Permits risks	33	27	——	24
34	Material shortage	34	32	10	35
35	Government policy	35	——	——	5

Table 1. *Cont.*

S.No	*PPP Risk Relationship in Pakistan, China, India and Egypt*				
	Risk Factor	**Risk Ranking in the Pakistani Case**	**Risk Ranking in the Chinese Case [31]**	**Risk Ranking in the Indian Case [34]**	**Risk Ranking in the Egyptian Case [35]**
36	Dispute resolution	36	——	——	13
37	Market competition	37	29	——	49
38	Deficiency of design	38	——	11	37
39	Lack of supporting infrastructure	39	21	——	7
40	Completion (handling over) risk	40	16	——	22
41	Labour unavailability	41	32	10	55
43	Project/operation changes	43	15	10	30
44	Environmental sustainability risk	44	28	1	——
45	Technological risks	45	——	12	51

6. Discussion

This analysis of the findings reveals that, according to the researcher, inflation is the greatest obstacle for the effective execution of a PPP project in Pakistan, while it is number 14 in the Chinese case, number 5 in the Indian case and number 3 in the Egyptian case. The key explanation for this disparity is each country's economic situation. Political risk is very significant as PPP contracts are long-term in nature and changing policy may generate trouble for the private partner in the PPP arrangement; according to the experts, political risk is number four in Pakistan, number three in India and number two in Egypt. Foreign exchange is a factor affecting ventures in countries with poor economies such as Pakistan, Egypt, etc. in the studies carried out; according to experts from Pakistan and Egypt, foreign exchange fluctuation is number 3 in the case of Pakistan, number 1 in the case of Egypt, while number 13 in the case of China does not cover this possibility, according to a study carried out in India. There is a significant difference between the risk ranking of Pakistan, China and India whereas the results of Pakistan and Egypt are similar to each other. According to their opinion, the concept of PPP is new in Pakistan in comparison with China and India; secondly, there is a significant difference in the economies of Pakistan, China and India. While comparing the top 10 risks, it is understandable that in the ranking of Pakistan and Egypt, risks related to financing are in majority (i.e., 5 out of 10 in Pakistani case and 4 out of 10 in the Egyptian case). While in the case of China and India, risks related to the attitude of the government towards investors and political situation are amongst the top. The risk ranks of this study driven after the experts from the construction industry of Pakistan were compared with the previous studies conducted.

In the next phase, a comparative assessment is made to analyze the possible correlation of the risk ranks between different countries. The risk ranks of Pakistan PPP projects were compared with China, India and Egypt. The X axis shows the PPP risk rank in Pakistan and Y axis shows the PPP risk ranks of other countries as shown in Figure 5.

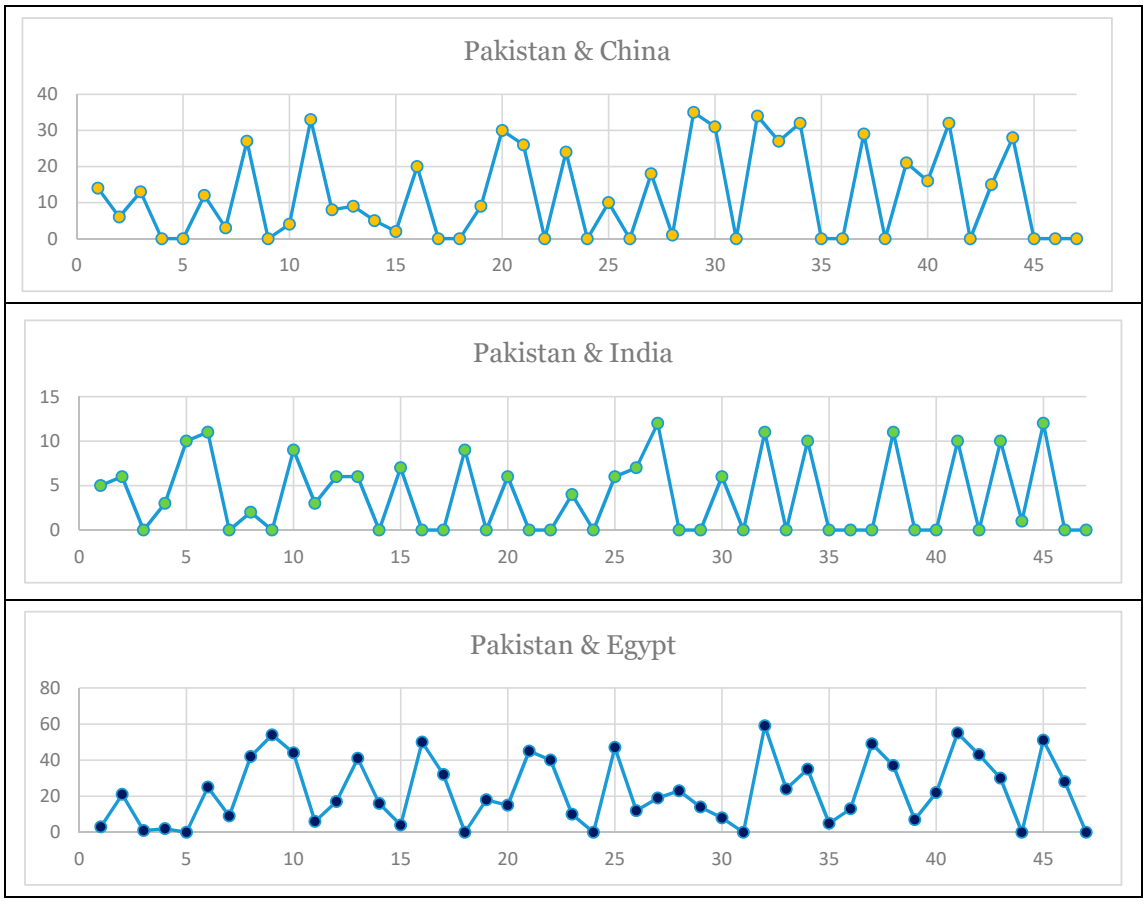


Figure 5. PPP risk ranks correlation.

It is evident from Figure 5 that the PPP risks in Pakistan and India are very close and it might be due to the similar region and governance systems. Whereas, PPP risks in Pakistan and Egypt are quite a wage and it is due to a different region and governance approach. It is also observed that the PPP risks in Pakistan and China are also similar but the similarity is not strong as compared to India. This is obviously due to the economic stability of China as compared to Pakistan.

As per Figure 6, It is observed that the risk position between Pakistan and India is the same but the Indian construction industry is a bit mature in PPP as compared to Pakistan and therefore risk intensity is low.

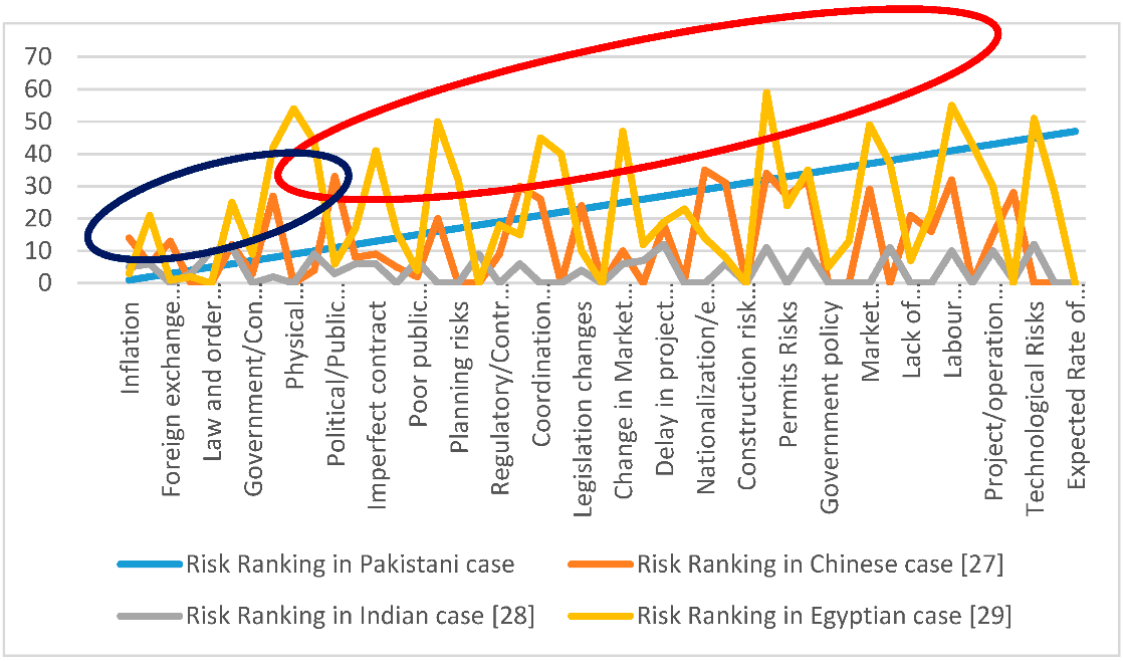


Figure 6. Risk intensity of PPP projects.

Similarly, there is a close relationship of PPP risk between Pakistan and the Chinese construction industry but there are few risks that vary because of strict governmental policies of the Chinese government over PPP projects. Whereas, it is analyzed that there is not a close relationship of risks between Pakistan and Egypt because the political and regional dynamics of both countries are different.

7. Contribution of Research with United Nations Sustainable Development Goals

PPP concept and construction projects have a high potential to support both Sustainable Development Goal (SDG) in the longer run. The public and private sector initiatives for meeting the basic needs of people can be effectively achieved by the PPP concept, especially in developing countries where governments are facing limited financial sources. PPP can also contribute significantly to job creation at all levels as more than 50 industries are directly and indirectly linked with the construction industry. Figure 7 shows the conceptual framework of PPP benefits meeting the UN SDGs.

As per SDG 8 (decent work and economic growth), it is estimated that 172 million people worldwide were without work in 2018 which is about 5% of the unemployment rate and as a result of an expanding labor force, the number of unemployed people is projected to increase by 1 million every year and reach 174 million by 2020 [36]. Similarly, as reported in SDG 11 (sustainable cities and communities), in 2018, 4.2 billion people, 55% of the world's population, lived in cities. By 2050, the urban population is expected to reach 6.5 billion [37].

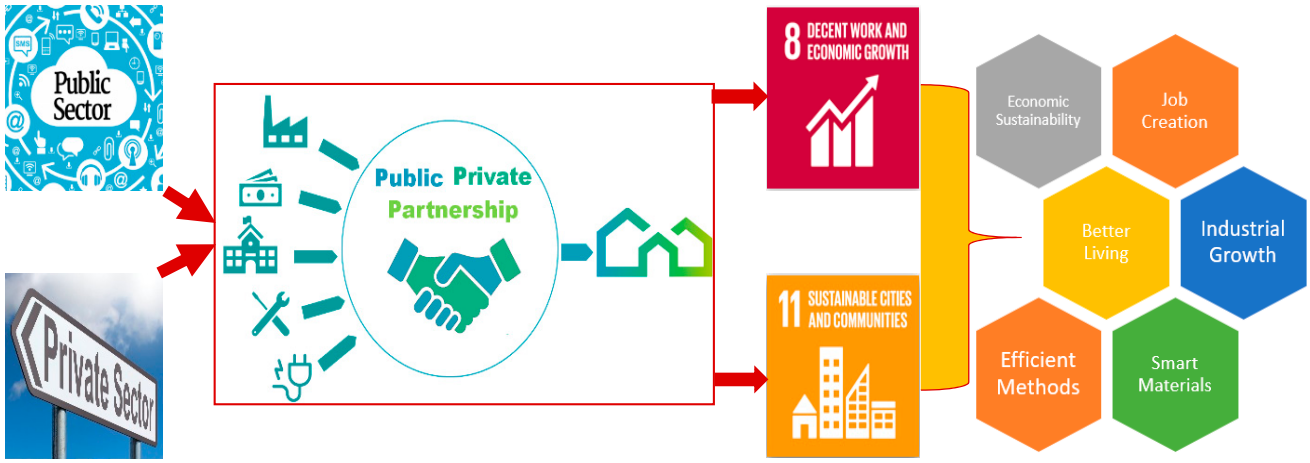


Figure 7. PPP projects integration with the UN Sustainable Development Goal (SDG)'s benefit framework.

In the future, 8 out of 10 mega-cities will be in the developing world. In the coming decades, 90 percent of urban expansion will be in the developing world [36]. Thus, meeting such key targets, the PPP procurement method can contribute significantly and it can support governments to meet the required targets by the next few years. PPP projects can play a role in reducing the unemployment rate in the world and especially in developing countries.

As shown in Figure 8, PPP projects have the potential to contribute to various indicators. PPP construction projects can contribute significantly to the GDP of any country (SDG 8.2.1) and also contribute to skilled, unskilled and semi-skilled jobs (SDG 8.6.1). PPP projects can be initiated to housing schemes where ordinary people cannot build their houses and shelters. The governments can execute various housing scheme project using PPP projects to support people to acquire shelter (SDG11.1.1). It is evident from the literature review that most of the government sector projects under PPP are infrastructure projects. The developing countries initiated various infrastructure projects including roads, bridges, train tracks, metro trains, industries and many other civil engineering structures (SDG11.2.1).



Figure 8. Contribution of PPP to SDG targets and indicators.

8. Conclusions

This study focusses on the risk evaluation for Pakistani PPP projects. The main objective of this study was to carry out a risk analysis for PPP projects in Pakistan by identifying and prioritizing the various risks affecting PPP projects in Pakistan and determining their partner-wise allocation, designing the risk severity matrix and finally benchmarking risks with neighboring states. A total of 47 risk factors were identified through the literature review and interviewing experts. It is concluded that one of the main causes of the failure of PPP projects is the improper risk allocation of risks between the parties; therefore, this study addresses the issue of risk allocation in the Pakistani context. A few major risks in PPP projects are inflation, revenue risk from end-user, foreign exchange fluctuation, countries political condition, law and order situation, operation cost overrun, corruption and land acquisition. PPP risks in Pakistan and India are very close and might be due to similar region and governance systems. PPP risks in Pakistan and China are also similar but the similarity is not strong as compared to India. PPP risks in Pakistan and Egypt are distinct. It is also observed that PPP project financers are very conscious to invest their money in any developing country. They want to assure that their investment is safe for the total life span of the contract they signed. They also look for a guaranteed offer by any country and arrange a deal that brings them benefit, like tax waivers.

9. Recommendations and Suggestions

It is recommended that the government of Pakistan and other stakeholders interested in PPP projects should design a new supplementary guideline to ascertain the concerns of PPP investors as they have already made huge efforts to attract PPP investors in Pakistan. The main risks highlighted by this study mostly depend on the political stability of country because the varying political condition may cause the PPP investor to hold off as he feels his invest is not secure. Political instability and weak governance may also lead to corruption in the governing department and will also hinder the PPP investor. Therefore, it is necessary to design guidelines which will provide security to PPP investors to the effect that, if the government will change, it will not harm their investment. They should be assured that in case of any inflation they will be compensated and their benefit will not be affected. In general, the governments of developing countries should provide a fair, reasonable and safe ground for PPP investors to invest money for providing better infrastructure, service and facilities to their people.

It is strongly suggested that the governments in developing countries should support and facilitate PPP projects on suitable terms with tax relaxation for both sides. The government and financers should both highlight their concerns under the PPP project. PPP procurement system can significantly contribute to United Nations SDG 8 and SDG11. PPP projects can support developing countries to improve their infrastructure, services and facilities, and directly support the GDP of a country as the construction industry is, directly and indirectly, interconnected with more than 50 industries.

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