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Identifying and Mitigating delay factors in Engineering, Procurement and Construction Phases: With special reference to Solar Projects

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ABSTRACT- The solar projects are a complex industry with regards to its supply chain and EPC Phases. The identification and assessment of mitigation factors in the engineering, procurement and construction phases in solar projects help in timely completion of the projects. Effective collaboration between different phases in EPC projects helps identify and mitigate the delay factors. Time and cost are two factors which are significantly important in the EPC phases of solar projects. The problems of Delay and cost overrun in construction projects are two issues of concern which needs to be addressed. Another factor of the clients plays a major role, affecting the performance of the engineering and construction phases. The review of the literature indicated that the causes of delay vary from country to country; especially in the context of developing and developed countries. Therefore the primary purpose of this paper is to identify the delays factors and propose mitigation strategies to improve the performance of the projects. Top six causes of delays are identified in the solar projects using factor analysis and strategies are proposed to mitigate the delay factors to improve the project performance. The paper discusses the scope; direction for future research studies to suggest other pertinent causes of project delays.

Key Words: EPC Projects, Delay Factors, Mitigation strategies, Solar Projects

INTRODUCTION

The environmental issues and its impact on the planet earth is one of the major concerns of our times. Reduction in greenhouse gas emissions is the only solution to solve this problem. Different steps have been taken around the world to reduce Greenhouse gas emission, thus to reduce its harmful impact on the planet earth. The power sector is one of the major contributors to greenhouse gas emission. The use of renewable energy such as solar energy is one of the most effective alternatives for the different countries and India is no different. Solar is profitable and operationally most viable renewable energy resources and one of the largest power sources in terms of the renewable energy sector. India, being a tropical country, has an abundance of solar energy. Its advantageous geographical

location allows it to receive a vast amount of solar radiation throughout the year. India receives 500000 TWh of electrical energy from solar energy. All this makes India a very lucrative market for solar projects provided the delay factor does not play a spoiler. The project is generally a short-term effort to create a product. Every project tries to fulfil a predetermined goal of the project teams. Project management forms the bases of every project, as the study is concerning solar projects so these projects have been given special importance. The solar projects are organized operation which involves multiple tasks. Cost, time, and scope are the important parameters which are kept in consideration for effective project completion. So the success of EPC success is of paramount importance. In the solar industry, the term EPC stands for providing end-to-end solar services from designing the system, procuring the components and installing the project. Due to better economic performance of the country, and supportive government policies in terms of increased subsidies in the solar projects has lead to increased competition in this sector and therefore many companies are working to increase the efficiency of the projects and evolving new methods to mitigate the delay factors in the implementation of the solar projects. Poor project performance has been a debatable point amongst constructors and scholars in the past. The previous studies carried on the subject have proved that the effective performance of the construction project can be achieved by the successful implementation of Engineering, Procurement, and Construction (EPC) phases. The performance of Engineering, Procurement, and Construction (EPC) phases can be evaluated from the perspectives of three main points they are: schedule, cost, and quality. Out of the mentioned points, the quality is difficult to measure, but the remaining two points of cost and schedule have been used extensively used to measure the effectiveness of the projects. The solar projects face different types of risks like cost overrun and delays etc. which poses serious problems in the success of the project. The project cost and time are therefore considered to be important factors which need special attention of the management. The poor schedule and cost performance result from the performance of all Engineering, procurement and construction phases. Since the majority of the activities are concerned with the construction phases therefore it attracts the maximum attention. It does not mean that the importance of other phases performance can be neglected and their importance in the success of the project. For example, despite the small cost of the engineering phase, it has the highest impact on the total cost of the project. Minor deficiencies in the engineering phase can have serious implications on the cost and performance of the project. In general, the average time and cost overrun in the construction phase depend on various characteristics like project location, project type, industry, and time of construction. It is therefore pertinent to identify the leading causes of EPC performance

factors and minimize them to overcome the variations. The availability of literature is limited in construction phase performance in the case of solar projects and very few studies have been conducted on Performance Indicators based on cost and time. The significance of the engineering and procurement phases has almost been disregarded as compared to construction phases. Therefore the study tries to identify that gap. The study provides a list of significant delay factors and aims to provide solutions so that the delay factors can be mitigated in each of the EPC phases to reduce EPC cost overruns and delays in the solar projects. The recommendations of the study would help the EPC experts to effectively allocate the resources which result in time and money-saving. The study would also be helpful to academic scholars to carry out their researches and open new avenues for EPC phases in solar projects. A recent study by World Bank shows that developing countries are responsible for 6–9% of the GDP approximately in the construction industry which often leads to the economic growth of the country. So the engineering, procurement and construction (EPC) phases in the solar projects are the primary things for the success of the project. Construction projects involve multi-tasks, which are carried out by several professionals within the Project Life Cycle (PLC), which include engineering, procurement, and construction (EPC) phases. The construction phase is often grappling with low efficiency and productivity and their significance is increased in terms of cost and time overruns. The companies effectively managing their resource, which includes material, human resources, financial, and time achieve high efficiency in the projects. Even with today's advanced technology, the projects continue to suffer delays and completion dates get pushed back which causes negative impacts and effects, resulting in an increase in project costs and compromising in quality and safety aspects. This has an overall impact on the overall growth of the economy. The PDCA cycle (Plan, Do, Check, Act) which is iterative four-step method is applied in companies for the control and continual improvement of processes and PDCA also helps in incorporating the new things which are taking place in EPC phases. As far as the procurement phase is concerned with the relation to the solar projects it is well understood that the resource constraints have a very serious impact on the procurement phase. Shortage of materials, lack of equipment and non-availability of skilled and cheap labour is a barrier which affects the performance of the solar project in the procurement phase. The low value of the local currency and the exchange rate imposes many restrictions on the marketplace which increases the overall cost of the procurement phase. In the procurement phase, Quality Management, Material Management and Front End Planning enhance the time and cost of the project. Quality Management helps in the identification and correction of errors at an appropriate time. In several studies, the importance of the procurement phase ranks higher than the construction phase. Coming

to the various approaches towards enhancement in the efficiency of the projects, in this Toyota Production System (TPS) can be an effective method in waste minimization and effort maximization. Toyota Production System has originated from Lean Production (LP) which is a method used for designing and implementing construction activities to reduce waste in the construction industry in terms of time, quality and cost. In addition to TPS, Total Quality Management (TQM) is also an important tool to continuously improve the performance of the project. In TQM methods like six-sigma reduces the number of defects. Therefore the nature of the project, effective project management tools, and adoption of new innovative and contemporary technologies are the Critical Success Factors (CSF) for the solar projects. Critical Success Factors depends on many factors which include cost, time, quality, satisfaction, safety, technology, organizations, environment and resources. But the critical success factors have to be determined at the beginning of the project which increases the success rate of the project including time, cost, and scope. Absence of CSF leads to inefficiency in terms of time and cost overruns and poor quality, project delays, disputes, and losses. So the critical success factors become important in the success of the project. There is a lack of comprehensive research highlighting the poor performance of solar projects with regards to EPC phases (EPC) in India. The objective of this paper is to identify and mitigate the critical delay factors with a fresh perspective and brings out the critical causes of solar project delays in developed economies in general and developing in particular. Therefore, the objective of the study is to identify and mitigate these delay factors in each of Engineering, Procurement, and Construction (EPC) phases.

LITERATURE REVIEW

Oshodi Olalekan, S.; Rimaka, I. (2013) in their study focuses on identifying the similarities and commonalities between Iranian and Nigerian construction companies' and found the reasons behind the delays in project completion. This study recommends effective communication between both consultant and contractor to increase the construction phase efficiency. Another study conducted by (Minaie, H., 2013) identified the key success factors of construction projects in Iran. Shokouhinia, M., (2010) presented a model for the success of construction projects. Piran, M., (2010) predicted the project success by using the indexes of the business environment. The study identified key factors for project success in oil and gas projects. The same study was supported by (Abolhasani, A., 2012) which also evaluated the key factors of the project success in the largest gas project in Iran. Identification and evaluation of the key success factors in project-based organizations was also performed by (Dalirpour, A., 2012). EPC phases in solar projects incorporate complex tasks because the project requires to be completed within

the available resources and within a specific time otherwise the delays in project completion can lead to inflation in the costs. Due to this reason, the EPC phases are very critical phases of the construction projects, which have a direct impact on the success and failure of the project. Some of the studies identified three aspects of project success in EPC phases; Project execution, the project value, and client satisfaction. The importance of time, cost, quality, and satisfaction of customers in EPC phases was highlighted by (Nguyen, H.T.; Hadikusumo, B., 2017). Habibi, M. et.al. (2018) related the success of the projects to their lifecycle performance and the performance of the engineering, procurement and constructions phases on the important parameters of time, cost, and quality. A study by (Pal, R.; Wang, P.; Liang, X.,2017) highlighted the importance of Collaborative relationships between construction parties, effective communication, continual, objectives fulfillment, problem-solving, equitable risk allocation, supplier selection criteria, trust, as the important elements of EPC phases of construction projects. Le-Hoai et al., (2008) highlighted that the unintended effect of undesirable performances becomes visible in the construction phase only although the causes of poor schedule and cost results from all the performance of EPC phases respectively. The study also highlighted the importance of Procurement and Engineering phases and suggested that the majority of activities of construction phase attract the most attention. Mahamid, I. (2016) study concluded that "poor communication between participants of the project" and "payment delays" are the main factors from the owners' and contractors' points of view. Along with this, the construction projects are affected due to the poor planning and scheduling "Design changes" is another important factor that affects the efficiency of construction phase (Mohamad, M.I.et.al., 2012). These design changes usually bring excessive claims, disputes, additional work, and duplication of efforts. Habibi & Kermanshachi, (2018) concluded that design changes are often responsible for time delays and cost inflations in both the engineering and construction phases. The additions or deletions in the design changes can have an impact on the project. The resource constraints have a high impact on the procurement phase. Material shortage, lack of productive equipment, and unavailability of qualified labour and skilled technical personnel act as a strong barrier in the effective performance of construction projects, especially in the procurement phase (Sambasivan, M.; Soon, Y.W., 2007). The study also reported that the above factors are the significant causes for postponing the project from the proposed schedule. The depreciating value of the local currency as compared to that of exporter countries results in the hike in the prices of imported resources which affects the overall cost of procurement phase (Ameh, O.J., 2010). Rahman et al. (2009) studied the financial factors contributing to delay of projects and found that late payment, poor cash flow management, insufficient financial resources &

financial market instability as the critical factors. Yang and Wei (2010) concluded that client's requirement; unreasonable plans, change orders and project complexity are the main factors which cause delays in planning & design phases of construction projects in Taiwan. The critical success factors of time, cost, and quality in solar projects are important for the successful completion of the projects. Identifying the delay factors and mitigating them at the beginning leads to the enhanced performance of the projects. These critical factors have been studied by many researchers important amongst them is the study conducted by (Ngacho, C.; Das, D., 2014), which understood these critical success factors concerning EPC phases of the construction projects and prioritized the factors in the different phases of EPC which affects the project performance. There have been few studies earlier which identified and prioritized the critical factors that cause poor performance in the projects. It is pertinent to mention here that one size fits all approach doesn't work in the construction projects because of difference in size, nature, and level of complexity of the solar projects. Therefore the accurate identification and prioritization of critical factors of success or failures depend on a comprehensive analysis of the projects. Although the literature highlighted time, cost and quality as the main factors of project success which helps in identifying the various factors of project delays and mitigating them accordingly. Some of the limitations faced during the review are that many studies have focused on the causes of poor performance in the construction industry, but very few studies in India focused on solar projects. Another point is that Identification of factors causing poor construction performance concerning engineering, procurement, and construction (EPC) phases in solar projects is very limited and it should be the focus of future studies. And finally, up-to-date data on the EPC phases with regards to solar projects is not available.

Key takeaways from Literature Review:

Critical causes of delay

The Review of literature helped in identifying the critical success factors and the reasons for the delay in EPC phases. The main causes of delays in developing countries and developed countries are shown in the figure below:

Developing countries	Developed countries
▪ Payment Delays	▪ Weather / Ground conditions
▪ Design Changes	▪ Delay in drawings, changes & errors in designs
▪ Delays in planning & scheduling	▪ Order changes & changes in the scope of work
▪ Delay in the delivery of raw materials	▪ Slow decision making
▪ Change orders/increase in the scope of work	▪ Delay in approvals from competent authorities

▪ Poor site supervision and management	▪ Changes in site conditions / poor site conditions
▪ Political and economic factors	▪ Financial difficulties
▪ Slow decision making by the owner	▪ Delay in monthly payments from the client
▪ Lack of effective communication	▪ Legal disputes

The reasons for delay factor vary from country to country and especially causes for delay in a developing country are different from a developed country. Finally, the EPC includes three steps in each solar project: (1) Engineering (design); (2) procurement; and (3) construction. Each phase of EPC includes factors that affect project performance concerning time, cost, quality and scope).

ANALYSIS

The literature helped in identifying six factors which are the main reasons out of 16 for the project delays in solar power project by EPC organization. These six factors are used for follows:

1. Delays due to non-availability of raw materials.
2. Legal disputes
3. Design Changes
4. Lack of effective communication
5. Supervision and Management
6. Supply chain and logistics.

Although the above factors are country-specific these factors are more relevant for developing countries like India. All these six factors put a significant impact on the implementation of solar power projects by EPC organization. On a Likert scale of 5 points the ranking of each factor is as follows-:

Factor 1=3.452
Factor 2=3.406
Factor 3=3.462
Factor 4=3.42
Factor 5=3.405
Factor 6=3.38

Factor number 1 (Availability of raw materials) is delaying the implementation process by (3.452/5)*100=69.04% and is responsible for causing the delay in the implementation of Solar Power Project. Factor number 2 (Legal disputes) is delaying the implementation process by (3.406/5)*100=68.12%. Factor number 3 (Design changes) is delaying the implementation process by (3.462/5)*100=69.24% similarly the Factor number 4 (Effective Communication) is delaying the implementation process by (3.42/5)*100=68.40% the next Factor number 5 (Supervision and Management) is delaying the implementation process by

(3.405/5)*100=68.10% and lastly Factor number 6 (Supply chain and Logistics) is delaying the implementation process by (3.38/5)*100=69.04%.The combined effect of the delaying factors on the implementation of solar projects=3.421 on a Likert scale of 5 i.e. (3.421/5)*100=68.42%.

Descriptive Analysis of Each Factor

The mean of the means of the sub-factors included in the six factors derived through Exploratory Factor Analysis (EFA) will help in understanding the effect of each factor.

Those factors are as follows-:

1. Factor 1 (Delay Due to non-availability of raw materials) which includes Var011, Var022, Var020, Var001, Var021.
2. Factor 2 (Legal Disputes) which includes Var003, Var012, Var023, Var015, Var019.
3. Factor 3 (Design changes) which includes Var026, Var006, Var030, Var016, Var009.
4. Factor 4 (Effective Communication) which includes Var004, Var031, Var008, Var032.
5. Factor 5 (Supervision and Management) which includes Var013, Var018, Var014, Var024.
6. Factor 6 (Logistics) which includes Var002, Var029, Var020, Var025.

Mean values of each sub factor:

Table 1.1- Factor Naming

Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Var011=3.51	Var003=3.46	Var026=3.44	Var004=3.45	Var013=3.46	Var002=3.39
Var022=3.53	Var012=3.43	Var006=3.41	Var031=3.37	Var018=3.48	Var029=3.38
Var020=3.37	Var023=3.39	Var030=3.45	Var008=3.40	Var014=3.30	Var025=3.37
Var001=3.39	Var015=3.37	Var016=3.46	Var032=3.46	Var024=3.38	
Var021=3.46	Var019=3.38	Var009=3.55			

Total Mean Value of each factor-:

Factor 1=3.51+3.53+3.37+3.39+3.46=17.26
Factor 2=3.46+3.43+3.39+3.37+3.38=17.03
Factor 3=3.44+3.41+3.45+3.46+3.55=17.31
Factor 4=3.45+3.37+3.40+3.46=13.68
Factor 5=3.45+3.37+3.40+3.46=13.62
Factor 6=3.39+3.38+3.37=10.14
Mean of means for each factor-:

Factor 1=17.26/5=3.452
Factor 2=17.03/5=3.406

Factor 3=17.31/5=3.462
Factor 4=13.68/4=3.42
Factor 5=13.62/4=3.405
Factor 6=10.14/3=3.38

Total Overall Effect of All the factors=3.452+3.406+3.462+3.42+3.405+3.38=20.525
Mean Overall Effect of All the factors=20.525/6=3.421

So, the analysis shows that to identify the ways to mitigate these delay factors at various EPC phases of a solar project only these six factors are important and the other factors which are independent variable can be given less attention.

DISCUSSION

Although many studies have been carried on in the field of delay identification and prioritization of factors still there is are vital gaps in categorization and prioritization of these factors, an effort was made to fill this gap by a study conducted by (Pournader, M., et.al.,2015). The present study highlights the significant economic and environmental role which the solar projects play in the economic growth of developing countries like India. The six critical delay factors identified in the study are most general which are faced by many projects in different sectors but their importance in solar projects cannot be neglected. The mitigation of these delay factors will go a long way in improving the efficiency performance of the projects especially the solar projects. Delays due to non-availability of raw materials can be addressed by proper planning at the top level. Proper contractual arrangements and better relations with the vendors can help in timely procurement of raw materials. Efforts should be made by the contractors that no laws specifically the environmental laws are adhered to so that legal disputes can be minimized. Proper handling of legal disputes by an expert from the area will go a long way in minimizing

legal disputes. The design changes are due to cost overrun results from owner induced design changes, although they are not significant in number. Design changes are frequent in EPC phases. The design changes can be mitigated by improving the communication and coordination between stakeholders. Bringing together the causes of design changes under one platform would help manage the design process. Effective Supervision and management during EPC phases provide efficiency and quality control work for every phase of solar projects, assisting in attaining successful project completion. The EPC industry has been evolving at a dramatic pace over the last few decades due to technological advancements in this industry. Technology has taken rapid strides such as cloud and mobility, predictive analytics and virtual reality which have

completely transformed the logistics functions in the solar projects. A combination of best practices can shorten lead times as compared to manual processes. Digitizing procurement and supply-chain workflows will improve logistics management and just-in-time delivery. An effective logistics management is crucial in enhancing the efficiency of the projects which have an overall impact on the cost and time and quality. The above-discussed issues lead to an acceleration in terms of project initiation, precise design, estimation, and planning. After the review, it can be concluded that in the case of solar projects engineering, construction, and procurement phase rank second and third respectively after the construction phase. The quality of construction raw materials in the construction phase and proper design process in the engineering phase are important ingredients in the EPC project performance. Another technique called TOPSIS which is an acronym for 'Technique of Order Preference Similarity to the Ideal Solution' which is similar to the MCDA (Multiple criteria decision analysis) method. The Technique for Order of Preference by Similarity to Ideal Solution was originally developed by Ching-Lai Hwang and Yoon in 1981 with further developments by Yoon in 1987, and Hwang, Lai and Liu in 1993. Project financing issues can use the TOPSIS technique in prioritizing the allocation of resources.

This method is based on finding an ideal solution and comparing the alternatives also. This paper is that the critical success factors for better performance of solar projects in EPC phases of different general contractors can be directly compared in project management. Future research should be carried out to improve the effectiveness and efficiency of different EPC phases, in the solar projects which is important for future generations and also for sustainable development.

MITIGATING THE DELAY FACTORS

The mitigation of delays in the projects can be made possible by applying knowledge gained through previous projects experience and the feedback can be used to identify specific requirement in the project performance. Such knowledge management will help in mitigating delays factors and the feedback can help prevent the delays itself. As the literature indicates that 'safety', 'chances of success', 'resources availability', and 'time for implementation' are important factors which ensure that the project does not fail. The cost factor surprisingly was regarded as one of the least important factors by clients and contractors in some studies used in the literature. Due to advancement in the field, it can be now be ensured that the projects are completed on time and within the estimated budget cost. A study by (AlSehaimi et al.,2013) criticized previous studies because none of the studies provided recommendations to mitigate the delay factors, and even if the recommendations are provided with their

practical implementation was difficult. Studies suggested that delays in solar projects can be addressed in India and other developing countries.

Based on the literature review and the quantitative analysis some points have been identified which have been given in the form of a figure as below. The points mentioned below are very generic

Table 1.2**:** Attributes and Initial Measurement indicators

Project Phases	EPC Phases Performance
Engineering	• Poor Design • Poor project planning • Poor estimation • Design incompletion • Insufficient engagement of stakeholders • Legal Disputes
Procurement	• Reputation loss • Long-lead item delivery • Poor supervision and management • Poor project control • Changes in project execution • Availability of raw materials • Poor quality of construction materials • Redo of deficient tasks
Construction	• Inadequate or inefficient equipment or machinery • Sub-contractor's poor conditions • Skilled workforce • Changes in the workforce • Accidents or incidents • Effective communication • Logistics.

CONCLUSIONS

Given the infrastructural issues in India, it faces severe electricity problems in terms of shortage of electricity. The Indian government has predicted that the power demand will expand to 400,000MW by 2020. This needs additional power generation to meet the growing demand. Given the huge potential, easily availability of solar power the Indian government is emphasizing the solar projects through various government schemes. The main problems with the projects are the timely completion within the planned budget. These solar projects can create jobs and can also provide economic stability to India since it is economical. Therefore solar projects would solve the power problems in India. The results from this although general in

nature will help the inform clients, planners, and financiers in developing more quantitative ranking indicators and standards for project performance and make improvements over time. Clients also can use the TOPSIS indicators based on the past performances of contractors, since it provides a more realistic form of modelling and allows for better coordination between engineering, procurement, and construction phases. This study focused on identifying the delay factors and mitigating them concerning optimum cost, specified time, and quality of the project and to improve the solar project performance in EPC phases. The study found that the "Lack of Communication" results in slow and bad decision making which impacts the performance at the engineering phase. The stakeholder's Experience has a substantial effect on the cost performance at the engineering phase. The lack of coordination and communication between different stakeholders affects the construction schedule performance during the construction phase. Lastly, the procurement phase is related to the timely availability of the raw materials which have a huge impact on the timely completion of the project. Timely procurement of various resources helps in project completion in the planned budget. The unavailability of literature on solar projects and its delays in EPC phases has been the biggest limitation of this study. Some relevant factors related to sustainability could have been discussed in the study for project success but it can be used in future studies. To conclude the paper is an attempt to identify and mitigate the delay factors in EPC phases with special reference to solar projects, which will hopefully help in improving the timely project delivery in India and other developing countries.

REFERENCES

1. Abolhasani, A. Assessment of Success Factor in Construction Project; Tehran University: Tehran, Iran, 2012.
2. AlSehaimi, A., Koskela, L. and Tzortzopoulos, P. (2013). Need for Alternative Research Approaches in Construction Management: Case of Delay Studies. Journal of Management in Engineering, 29(4): 407-413.
3. Ameh, O.J.; Soyingbe, A.A.; Odusami, K.T. Significant factors causing cost overruns in telecommunication projects in Nigeria. Journal of Construction in Developing Countries, 2010, 15, 49–67.
4. Australian Journal of Multi-Disciplinary Engineering, 2016, 12, 27–38.
5. Dalirpour, A. Analysis of Success Factor on the Project-Based Organization; Tehran University: Tehran, Iran, 2012.
6. Habibi, M.; Kermanshachi, S. Phase-Based Analysis of Key Cost and Schedule Performance Causes andLe-Hoai, L.; Dai Lee, Y.; Lee, J.Y. Delay and cost overruns in Vietnam large construction projects: A

comparison with other selected countries, KSCE Journal of Civil Engineering 2008, 12, 367–377.

7. Mahamid, I. Factors contributing to poor performance in construction projects: Studies of Saudi Arabia.Minnie, H. Identifying Success Factor in Mass Buildings Construction; Tehran University: Tehran, Iran, 2013.
8. Mohamad, M.I.; Nekooie, M.A.; Al-Harthy, S.; Amur, B. Design changes in residential reinforced concrete buildings: The causes, sources, impacts and preventive measures, Journal Construction Developing Countries. 2012, 17, 23–44.
9. Ngacho, C.; Das, D. A performance evaluation framework of development projects: An empirical study of constituency development fund (CDF) construction projects in Kenya. International Journal of Project Management 2014, 32, 492–507.
10. Nguyen, H.T.; Hadikusumo, B. Impacts of human resource development on engineering, procurement, and construction project success, Built Environment Project Asset Management 2017, 7, 73–85.
11. Oshodi Olalekan, S.; Rimaka, I. A comparative study on causes and effects of delay in Nigerian and Iranian construction projects, Asian Journal Business Management Science 2013, 3, 29–36.
12. Pal, R.; Wang, P.; Liang, X. The critical factors in managing relationships in international engineering, Procurement, and construction (IEPC) projects of Chinese organizations, International Journal of Project Management 2017, 35, 1225–1237.
13. Piran, M. Identifying Success Factor in Oil and Gas Project; Tehran University: Tehran, Iran, 2010.
14. Pournader, M.; Tabassi, A.A.; Baloh, P. A three-step design science approach to develop a novel human Resource-planning framework in projects: The cases of construction projects in USA, Europe, and Iran, International Journal of Project Management 2015, 33, 419–434.
15. Preventive Strategies: Research Trends and Implications. Journal Engineering Construction and Architecture Management, 2018, 25, 1009–1033.
16. Rahman, I.A.; Memon, A.H.; Nagapan, S.; Latif, Q.B.A.I.; Azis, A.A.A. Time and cost performance of construction projects in the southern and central regions of Peninsular Malaysia. Conference Proceedings, Kota Kinabalu, Sabah, Malaysia, 3–4 December 2012.
17. Sambasivan, M.; Soon, Y.W. Causes and effects of delays in the Malaysian construction industry. International Journal of Project Management, 2007, 25, 517–526.
18. Shokouhinia, M. Analysis of Success Factor in Aria-Petro-Gas Company; Tehran University: Tehran, Iran, 2010.
19. Yang, J. and Wei, P. (2010). Causes of Delay in the Planning and Design Phases for Construction Projects. Journal of Architectural Engineering, 16(2): 80-83.