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Risk assessment of industrial punch development works to avoid disputes

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Abstract
Industrial punch production stages have long and exhausting production cycles and, includes many risk factors. With the increase in detail and scale of the project, the severity and impact of the risks varies. To eliminate the negative risk and their impact on the development schedule and cost, effective management of risk is necessary. This paper aims the describe a simple and effective risk assessment in industrial punch development works. The purpose is to assess the risk factors and their impact on the project budget of the entire project.

Keywords: Risk assessment; industrial punch; risk; risk factors.

1. Introduction

Project risk is described as a probability of occurrence of an event that has a negative or positive effect on the goals of the entire project. Risks content both occurrence and occurrence probability of an event and their impacts on the objectives [1].

The main objectives of a successful project risk management are to increase possibilities and effects of confident activities and decrease possibilities and effects of unfavorable events [2]. Risk management is in operation in multiple engineering disciplines as counting how much manpower and resources should be used amid research and development of an engineering material or a system to prevent unforeseen types of threats and disputes [3, 4].

The first risk assessment tools were practiced by ancient Athenians for decision making around 384 BC [5]. Nonetheless, modern methods and tools are approximately 40 years old. [6] Today, modern and new techniques and processes are widely preferred in many sectors and disciplines. Project risk management processes include parts as threat identification, risk evaluation and control steps. These processes are fulfilled by various methodologies but mainly, Qualitative and Quantitative methods. Qualitative risk analysis includes the operations for arranging the identified risks for duly actions. Identified risks are assessed depending on their probability of realization. Contrary to qualitative risk analysis, quantitative risk analysis authorizes rigid numerical values to all utility and possibility of a product or a research [2].

First step of the risk management is the process of risk identification of risk causes. In many researches, risk factors in a project are classified in various categories depending on the point of view: owner originated factors (delay in progress payments, change orders, etc.), contractor risks (lack of technical skills, management mistakes, etc.), and material vendor risks (poor material quality, late shipping of materials, etc.), etc. [7-9].

Risk identification in the literature is generally in a repetitive and unorganized condition. The processes include many time-consuming works, and it is not guaranteed to achieve a final and exact solution to the risk based project errors [10,11]. Various methods have been widely preferred by academics as Brainstorming method, What-if analysis, Fault Tree Analysis(FTA) and, Hazard and Operability Study (HAZOP), etc. [12,13].

However; the accuracy of these methods only depends on the engineering experience of the related

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projects. In many risk evaluation studies R = P * C equation is generally used [14].

Industrial punch production costs are very high compared to the other punch types due to its long and exhausting production stages. For this reason, all negative risks should be carefully analyzed and avoided to positively affect the overall production cost and duration.

2. Material and method

In this section, the method used for risk identification is outlined. The research was carried out in a punch production factory in Turkey. First, projects requirements of the company were precisely taken into notice. Multiple internal and external meetings related to the project were held with the attendance of experts. A risk breakdown structure was prepared and finalized during the meeting. Brainstorming method was selected due to the availability of similar risk data which company faced in the past projects.

3. Risk identification

Risk identification processes must be completed in parallel with project early planning. After the detailed studies and meetings, risk breakdown schedule structure for industrial punch projects were arranged based on the literature and the opinion of the project teams and experts (Table 1). This table also cover the information regarding risk type and the severity of the risks.

Table 1. Risk factors affecting industrial punch production projects

Risk factor	Sub-criteria	Risk probability	Program impact
Non-standardized punch raw material	External	Very Low	High
Raw Material Supply Problem	Organizational	Moderate	Very High
Late XRD Analysis Report	External	Moderate	Moderate
Production environment workbench problem	Technical	Very Low	High
Faulty Cost Estimation	Management	Moderate	High
Labor Communication Error During Development	Management	High	Low
Key Personal Lost	Organizational	Moderate	Moderate
Quality Problems	Technical	Moderate	High
Inflation	External	Low	Very High
Deflation	External	Low	Very High
Early Finalization of Research Works	Management	Moderate	Moderate

Table 1 shows the detail of risk factors and sub-criteria. Sub-criteria include external, organizational, management and technical classifications. Risk probability was divided in to five degrees from very low to very high. And risk factors were attended to probability ratios according to the brainstorming method results. Program impact ratings were also added to the risk breakdown structure. Literature researches regarding risk factor calculations in similar engineering projects were also examined while defining the factors [15-18].

Probability and impact ratings matrices were prepared as seen in Table 2 and Table 3. Occurrence potential risk probability and program impacts converted into numerical values via these conversion tables.

Table 2. Risk probability and program impact scale table

Risk probability / program impact	Scale
Very High	5
High	4
Moderate	3
Low	2
Very Low	1

Table 3. Risk probability and program impacts

Probability			Impact: Threads				
			Very Low	Low	Medium	High	Very High
			1	2	3	4	5
	Very high	5	5	10	15	20	25
	High	4	4	8	12	16	20
	Moderate	3	3	6	9	12	15
	Low	2	2	4	6	8	10
	Very Low	1	1	2	3	4	5

Table 4. Overall risk rating table

Probability of occurrence						
	Very High					
	High	Labor Communication Error During Development				
	Moderate			Late XRD Analysis Report, Key Personal Lost, Early Finalization of Research Works	Faulty Cost Estimation, Quality Problems	Raw Material Supply Problem
	Low					
	Very Low				Non-standardized punch raw material, Production environment workbench problem	Inflation, Deflation
		Very Low	**Low**	**Moderate**	**High**	**Very High**
		Cost Impact				

As seen in Table 3, very high-risk factors (12<rixy<25) were painted as red color. Yellow color was selected for moderate risk and the green one was for the low risk. This color selection can be changed according to the experts and company's past experiences. All positive and negative risk factors were taken into accounts during the preparation of the matrices tables.

Overall risk ratings of the factors can be seen in Table 4. Factors: The Faulty Cost Estimation, Quality Problems, and Raw Material Supply Problem are in the red zone. Required precautions should be taken in case of the occurrence of these factors to avoid any delay and cost burden in the projects.

3. Cost estimation

Projects risk assessments are strictly connected with the schedules of the industrial punch production projects. All risk factors in red zone were analyzed in detail and the daily cost increase for each factor was estimated. It is also important to clarify hereby that the risk of cost increase of the punch production and any delay to completion of the project are equal due to short duration of the projects. Estimated costs are presented in Fig 1. Unit cost based cost estimation method was preferred in this analysis.

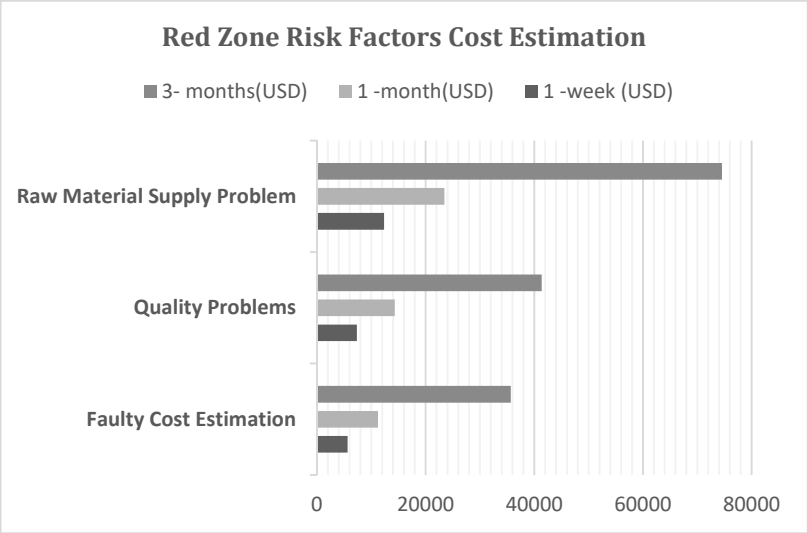

Figure 1: Cost estimation table.

Raw material supply problem took the first place in parallel with the cost impact table results compared to the other red zone risk factors. Quality problems and faulty cost estimation factor should be avoided to produce punch within the scope of foreseen budget.

4. Conclusion

This paper describes an example of industrial punch production risk identification with the aim of decreasing cost and the delays. As widely accepted, identification of risk and their cost impact are major factors for achieving a realistic budget and the schedule. In the light of the results of this study, realistic budget and financial targets can be reachable with the effective implementation of risk responses. If the risk cannot be avoided, especially for red zoned risk (Table 4), necessary precautions should be taken as transferring any unforeseen cost to the insurance company or a related subcontractor. On the other hand, the factors located in green zone have lower probability and impact, and they can be avoided. The recommended models in this research depends on more reliable data for scheduling and cost estimations. For this reason, proper estimations of work duration and cost should be count as the most important stages for high creditable risk identifications.

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