



جامعة الجميع الذكية  
EVERYONE'S SMART UNIVERSITY

## Everyone's Smart University

### Project (Spring 2021)

|              |                       |               |
|--------------|-----------------------|---------------|
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Section

Master

Date

Thursday

18 / 03 / 2021.

Course Code

(PMG510)

## Project Risk Management

### Instructions:

- اخر موعد للتسليم هو يوم السبت 2021-05-08 في تمام الساعة ٩ مساءً.
- الإجابة متاحة باللغة الإنجليزية أو اللغة العربية مع مراعاة أن تكون المصطلحات العلمية باللغة الانجليزية.
- يتم تسليم المشروع في صيغة ملف pdf مع الالتزام نموذج الجامعة ولن تقبل أي مستندات أخرى.
- يجب مراعاة أقسام البحث الرئيسية (مقدمة Introduction، دراسات علمية سابقة Literature Review، طريقة البحث Methodology، النتائج والمناقشة Results and Discussion، وأخيراً المراجع References. وان كان هناك ملحقات Appendices يتم إضافتها)
- يجب الالتزام بـ Theme موحد كما يلي:
- حجم الخط 12.
- نوع الخط Arial.
- لون الخط أسود.
- المسافة بين الأسطر line spacing 1.5
- عدد صفحات البحث (لا يقل عن ثلاث صفحات ولا يزيد عن ست صفحات).

Instructor's Name: Eng. Mosaab M. Hamed

## Project:

### **Risk Identification and Analysis (Based on the project you chose in APM)**

The objective of this report is to identify project risks, prepare a risk probability matrix, and carry out an analysis of selected risks. Referring to the project you select in Advanced projects management APM course, your task is to prepare a risk management plan that identifies potential risks in the selected stage of the project and identify risk management strategies.

From the course content and readings, you know that the overall purpose of risk planning is to anticipate possible risk events and be ready to take appropriate action when risk events occur—to eliminate or reduce negative impacts on the project.

You may wish to begin this exercise with a brainstorming about potential risks to get candidate risks “on the table” for consideration. And then identify and refine that wording for risks that have some realistic chance of occurring in this stage. For example, potential weather problems present a real obstacle to completing field data collection by the planned completion date. It is also an issue that the project manager will ultimately have to plan for, as opposed to other issues such as a major disaster (e.g., your office burning down), is not a high-enough probability event that requires much time in planning. As described below, you will select several of the identified risks and carry out a risk analysis.

You will use the distilled list of risks to make a risk probability/impact matrix. The matrix will have at least three categories (high/medium/low) for probability and impact.

Remember that it is important to name risks effectively—use words that describe the risk event and point to the impact on the project (e.g., “injury of field technician disrupts data installation work”).

After completion of the risk matrix, document a risk analysis for the selected risks. This detailed documentation for that selected risk will include:

- a description of the risk and potential impacts (schedule, quality of work, cost, etc.) on the project.
- indicators or triggers that would be monitored to help identify the risk as early as possible.
- specific risk response strategies to take.

Using probability and impact matrix calculate the Expected Monetary Value (EMV) for all risks that have the impact in terms of cost \$\$.

Best of luck...

## المشروع:

التعرف على المخاطر وتحليلها (بحث مبني على مشروعك الذي اخترته في مادة ادارة المشاريع المتقدمة)

الغرض من هذا التقرير هو التعرف على المخاطر المحيطة بالمرحلة التي تختارها المرحلة من مراحل مشروعك (نفس المرحلة التي اخترت التطرق لها في مشروعك لمادة إدارة المشاريع المتقدمة Advanced project management) حيث أن مهمتك هي تحضير خطة متكاملة لإدارة المخاطر تشمل التعريف بالمخاطر المحتملة التي تحيط بتلك المرحلة وتحضير مصفوفة احتمالية المخاطر ومن ثم القيام بالتحليل لهذه المخاطر المختارة وتحديد استراتيجيات ادارة المخاطر المناسبة لكل خطر على حدة.

من محتويات المقرر والمصادر الأخرى المتاحة أصبحت تعلم الآن أن الغرض العام لمرحلة التخطيط للمخاطر هي توقع أحداث المخاطر المحتملة والتجهز لاتخاذ ردة الفعل المناسبة عند وقوع الخطر – لمنع أو تقليل الآثار السلبية على المشروع.

قد تحبذ بداية هذا البحث بعصف ذهني عن ماهية المخاطر التي قد تحيط بتلك المرحلة من مراحل مشروعك, وذلك للحصول على قائمة بتلك المخاطر. ومن ثم تحديد وتصفية هذه القائمة للوصول إلى قائمة مختصرة بالمخاطر التي لها فرصة واقعية أكبر في الحدوث. على سبيل المثال: المشاكل الجوية المتوقعة والتي تمثل عقبة حقيقية أمام اكتمال جمع البيانات من المواقع في أو قبل الوقت المحدد، هذه تعتبر مشكلة على مدير المشاريع أن يضعها في الحسبان. من ناحية أخرى، فإن المخاطر غير الواقعية مثل الكوارث الطبيعية والأعاصير (تلك التي تسبب حريقاً بمكتبك وفقدان الأوراق المهمة) ليست لها احتمالية وقوع عالية وبالتالي لاتستدعي تضيق الكثير من الوقت في التخطيط لها. كما سيتبين لك، ستقوم باختيار عدة مخاطر من تلك التي قمت بالتعرف عليها لتحليلها.

ستقوم باستخدام هذه القائمة المختصرة لعمل مصفوفة المخاطر (الاحتمالية/الأثر). المصفوفة ستحتوي على الأقل على ثلاث تصنيفات (عالي/متوسط/منخفض) للإحتمالية والأثر.

لاتنس استخدام أسماء تصف طبيعة المخاطر بصورة فعالة – قم باستخدام كلمات تصف الحادثة الخطرة وتشير الى أثرها على المشروع (مثل: إصابة أحد الفنيين في الموقع مما يؤثر على أعمال التركيب).

بعد انتهاءك من مصفوفة المخاطر، قم بتوثيق تحليلك للمخاطر المختارة. هذا التسجيل المفصل للمخاطر يجب أن يتضمن:

- وصف للخطر واثاره المحتملة (الجدولة، جودة العمل، التكلفة، الخ)
- المؤشرات والمحفزات التي يجب مراقبتها للمساعدة في التعرف على هذا الخطر قبل وقوعه
- تفصيل للاستجابة المقترحة للتصدي لهذا الخطر

باستخدام مصفوفة الاحتمالات والتأثير ، احسب **القيمة النقدية المتوقعة (EMV)** لجميع المخاطر التي لها تأثير من حيث التكلفة \$\$.

مع تمنياتي بالتوفيق..

## **A Risk Assessment for Constructing Power Substation Projects using Expected Monetary Value: Case of Saudi Electricity Company**

### **1. Introduction**

Saudi Electricity Company (SEC) has been encountering massive economic growth that leads to the launch of several initiatives that have positive impact on the company's operation and performance, herewith improving power supply reliability, enhancing the level of service, and promotes the company financial, technical, and administrative efficiency (SEC, 2014). The rapid demand for electrical power in Saudi Arabia requires large investments with huge funding to beat the arisen challenges which are mainly associated with the aggressive demand for electricity. SEC strives to provide a reliable power supply around Saudi Arabia and generate more revenue.

SEC is implementing mega projects that enhance and enforce the electrical system: generation, transmission, and distribution. However, several uncertainties and risks are encountered during the construction of power substation projects which may delay the project completion (Zhao & Li, 2015). Hence, project risk management, as a significant branch from project management, is a necessary approach for power substation projects to improve performance and ensure successful project completion. This research presents a scientific procedure for performing a risk management process for the power substation projects using the Expected Monetary Value (EMV) technique.

### **2. Literature Review**

Googling the word risk results in a variety of definitions in addition to thousands of books about risk and risk management. Hence, what is a risk? Many sentences may come after the word "risk is...". Regardless of the variety of ways that conceptualize risk, the following ingredients can be seen as risk management, risk assessment, risk classification, risk analysis, and risk evaluation, etc. Even though there are a range of definitions for the word risk, each organization should decide on what definition is most suitable for its own purposes (Hopkin, 2010).

The institute of risk management (IRM) defines risk as "the combination of the probability of an event and its consequence. Consequences can range from positive to

negative.” Hopkin (2010) defines risk as “an event with the ability to impact (inhibit, enhance or cause doubt about) the effectiveness and efficiency of the core processes of an organization.” Alhallaq (2003) claimed that several risks can be identified in the construction contracts which include: physical works, delay and disputes, direction and supervision, damage and injury to persons and property, and other external factors.

## **2.1 Risk Management**

A guide to the project management body of knowledge (2017) defines risk management as “ the process of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk in the project.” Risk management is useful when it is applied systematically from the early stages of the project to closing. Therefore, the current century is a witness to the wide adoption and application of risk management as it has gained great attention from academics and project practitioners. A variety of approaches have been proposed to assess project risk which includes the influence diagram method, Probability-Impact model, risk matrix analysis, etc.

Nowadays, one of the important aspects of successful project management is efficient risk management. In other words, appropriate risk management allows a project manager to mitigate against known and uncertain risks. On the other hand, the unsuccessful performance of risk management may affect the project’s timeline, performance, budget, or exhibit any combination of these troubles. Frimpong et al., (2003) contended that several investigated works of literature on construction projects proposed that the common criteria for project success are mainly cost, time, and quality.

## **2.2 Expected Monetary Value (EMV) & Contingency Reserve**

Expected Monetary Value (EMV) is one of the fundamental parts of risk management. It is a technique that helps in performing quantitative risk analysis (Hopkin, 2010). It involves basic mathematical calculations in which two quantities are required: probability and impact in order to perform the calculation. Usmani (2020) defines probability as “the likelihood that any event will occur.” While the impact is defined as the amount that you will spend if any identified risk occurs. EMV calculates the average outcome of all future

events that may or may not happen by multiplying the probability with the impact of the identified risk.

$$\text{Expected Monetary Value (EMV)} = \text{Probability} * \text{Impact}$$

Usually, projects have multiple risks, therefore, the EMVs of all risks will be summed together and this will provide the expected monetary value of the project. Once calculating the EMV of the project, it will be summed up to the work package costs estimate and generate the cost baseline.

The sum of the EMV of all events is called the contingency reserve. Shuttleworth (2017) defines contingency reserve as “an amount of money included within the overall project budget for use by the Project Manager in response to the occurrence of known risks”.

### 3.0 Methodology

The research methodology is based on a real project risk register obtained from SEC Project Department using a quantitative risk analysis approach. The research will demonstrate how the following identified risks are managed during the construction of power substation projects using the EMV technique:

- A. Insufficient contractors/suppliers participation.
- B. Weather conditions.
- C. Delayed due to unexpected issues (Covid-19)
- D. Minimizing the Working hours during the holy month of Ramadan.

Alphapitacl letters will be assigned to each risk instead of the description of the risks while preparing the risk matrix and calculating EMV.

### 4.0 Discussion

In this section, a value of risk probability and risk impact are assigned for each of the four risks to find out the risk score and the level of each risk, i.e., low, medium, high, and very high. Table 1 shows that risk **A** and **D** have a very high level of risk, risk **B** has

a high level of risk while risk **C** has a medium level of risk. Figure 1 shows a representation of the risk by plotting the probability and the impact of the risk on the risk matrix.

| Risk Description | Risk Probability (P) | Risk Impact (S) | Risk Score (P×S) (EMV) | Risk Level |
|------------------|----------------------|-----------------|------------------------|------------|
| A                | 0.2                  | 25,000          | 5,000                  | Very High  |
| B                | 0.4                  | 17,000          | 6,800                  | High       |
| C                | 0.6                  | 7,000           | 4,200                  | Medium     |
| D                | 0.1                  | 30,000          | 3,000                  | Very High  |

Table 1: Risks' Score & levels

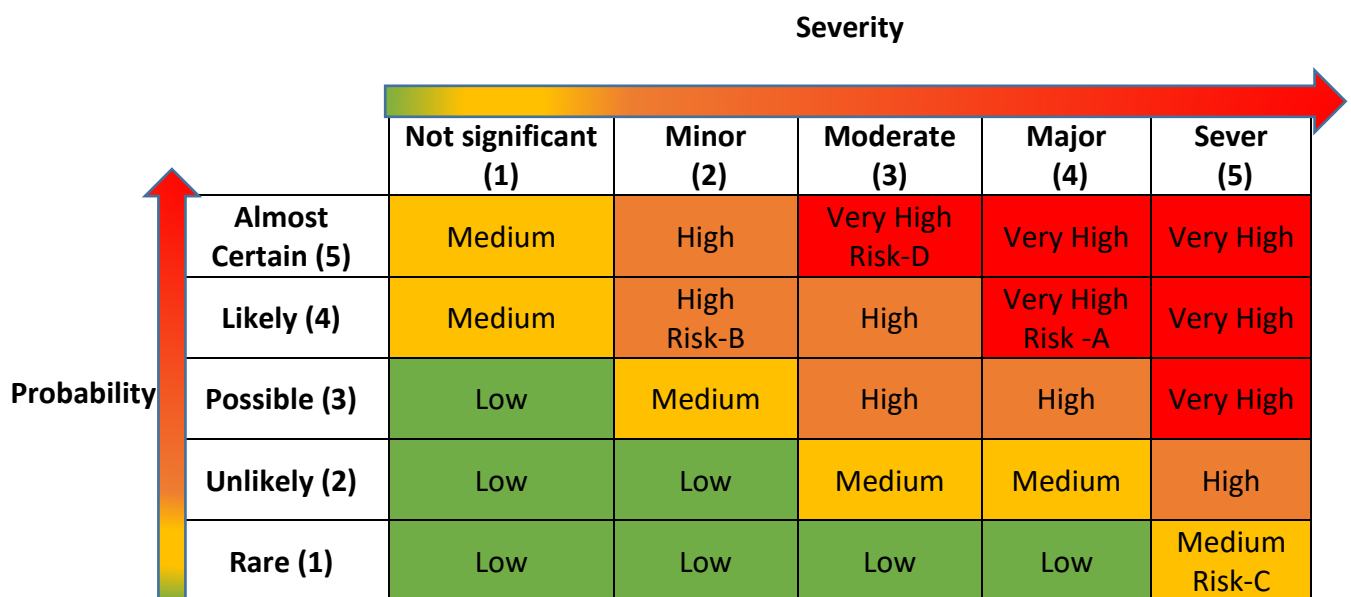


Figure 2: Severity- Probability Risk Matrix

### Expected Monetary Value (EMV) Calculation

In the EMV calculation, risk impact in (\$) is assigned for each risk in addition to the assigned probability. The multiplication of the probability by the impact of the individual risk will provide the EMV for each risk as shown in Table 1. For example, the EMV for risk A is calculated using the formula:

$$\text{EMV} = \text{Probability} * \text{Impact}$$

$$\text{EMV (Risk A)} = 20\% \times (\$25,000) = \$ 5,000$$

| Risk Description | Risk Impact                                                                                                   | Risk Probability | Risk Impact (\$) | EMV (\$)      | Severity  | Risk Response Strategy | Risk Response                                                                                                                                                         |
|------------------|---------------------------------------------------------------------------------------------------------------|------------------|------------------|---------------|-----------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A                | It can delay the site readiness to start our civil construction activities                                    | 20%              | 25,000           | 5,000         | Very High | Avoid                  | Instructed the main contractor to appoint necessary key personnel in the early stage of the project                                                                   |
| B                | If the weather condition is not supportive, it can stop our construction activities and can delay the project | 40%              | 17,000           | 6,800         | High      | Adopt                  | When there is a chance of rain take the necessary precautions by providing tarpaulin or something else to continue work which can affect by rain like concreting etc. |
| C                | The virus COVID-19 outbreak in the world. It is delayed the project                                           | 60%              | 7,000            | 4,200         | Medium    | Adapt                  | Try to reduce the milestones delays by working in a different way                                                                                                     |
| D                | If working hours decreased, the project schedule may slip for some activities.                                | 10%              | 30,000           | 3,000         | Very High | Accept                 | The action was taken by having two working shift, day & night shifts                                                                                                  |
|                  |                                                                                                               |                  | <b>79,000</b>    | <b>19,000</b> |           |                        |                                                                                                                                                                       |

Table 2: EMV calculation

The total EMV for our project is the summation of all EMV for all identified risks and are calculated as follow:

$$\text{EMV (Total)} = \text{EMV (Risk A)} + \text{EMV (Risk B)} + \text{EMV (Risk C)} + \text{EMV (Risk D)}$$

$$\text{EMV (Total)} = \$79,000$$

Therefore, the total EMV for the construction of the power substation project (assuming only those risks are identified) is \$79,000. However, what does \$79,000 represent? It is the value of the risk if all the identified risks occur. The cost to the project would be \$19,000 if the risks actually occurred.

## 5.0 Conclusion

The EMV analysis is a significant concept in project risk management that can be used for different types of projects to generate a quantitative risk analysis. It supports quantifying and comparing risks in various aspects of the project. It is used to convert the risk into a quantity and helps project managers to calculate the contingency reserve. Its application enhances staff's ability to identify the exposure to risk in all construction processes and guides them in calculating the contingency reserve.

## References

- A guide to the project management body of knowledge*. (2017). Newtown Square, PA: Project Management Institute.
- Alhallaq K (2003). Causes of contractor's failure in Gaza strip. M.Sc. thesis, The Islamic University of Gaza, Gaza, Palestine.
- Frimpong Y, Oluwoye J, and Crawford L (2003). Causes of delay and cost overruns in construction of groundwater projects in developing countries; Ghana as a case study. *International Journal of Project Management*, 21(5): 321-326.
- Hopkin, P. (2010). *Fundamentals of risk management: Understanding, evaluating, and implementing effective risk management*. London: Kogan Page.
- Shuttleworth, M. (2017). Project risk and expected monetary value. Retrieved April 27, 2021, from <https://www.project-risk-manager.com/blog/expected-monetary-value/>
- Usmani, F. (2020). A short guide to expected monetary Value (EMV). Retrieved April 26, 2021, from <https://pmstudycircle.com/2015/01/a-short-guide-to-expected-monetary-value-emv/>
- Zhao, H., & Li, N. (2015). Risk evaluation of a UHV power TRANSMISSION construction project based on a cloud model AND FCE method for sustainability. *Sustainability*, 7(3), 2885-2914. doi:10.3390/su7032885