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إدارة مخاطر صناعة البناء في سوريا بالاعتماد على منهجيتي سكرم/كانبان  
**Managing Risks Based Scrum/Kanban Methodologies  
In Syrian Construction Industry**

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## Managing Risks Based Scrum/Kanban Methodologies In Syrian Construction Industry

بحث مقدم لنيل درجة ماجستير التأهيل والتخصص في إدارة  
ونمذجة معلومات البناء BIMM

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شكرا

لمن ترك بصمة في قلوبنا نحن طلاب ماستر البيم ومن نذكره بالعطاء الذي لا  
ينضب.. د. فايز جراد

الأساتذة الكرام في قسم ماجستير إدارة نمذجة معلومات البناء جزيل الاحترام  
والتقدير

## الإهداء إلى

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الثابت في ظلي دائما ...روح أبي

ركني الآمن الهادئ الحاني ...وجه أُمي  
 قلبي الذي يغادرني كل صباح ويمشي على قدمين ... ولدي علي  
 من جمعني به القدر فكان سكن وسكينة الروح... ربيع  
 رنا رشا ياسمين نيرمين محمد أحمد وحسام ...

الدفعة الثانية بيم رفاق الأوقات الحلوة واللحظات التي لن تتكرر

يومي لن يكتمل بدونهم أصدقاء بروعة الشمس...يد الله على الأرض

## Abstract:

Construction project risk management is one of the managements that receives huge attention in the world. As the success of any project is closely related to the effectiveness of risk management. However, in terms of the construction industry in Syria, there are clear shortcomings and gaps in risk management. So to assess the actual reality of the Syrian construction industry with all its details (project management methodologies - software - risk management methodologies - new technology), this study relied on the descriptive analysis method of data collected through a questionnaire, where the questionnaire was directed Syrian project management professional engineers over the entire area of the Syrian Arab country.

The novelty of this research comes from the fact that it provides a framework for managing the risks of construction projects in Syria with a methodology that combines the strengths of Scrum methodology and the strengths of Kanban methodology.

The importance of this study stems from the fact that the proposed risk management framework can be linked in an integrated manner to the development approach of project management, whether predictive or adaptive.

## ملخص:

تعتبر إدارة مخاطر مشاريع البناء من الإدارات التي تلقى اهتماما واسعا على مستوى العالم. حيث أن نجاح أي مشروع يرتبط بشكل وثيق بالإدارة الفعالة للمخاطر. لكن على صعيد صناعة البناء في سوريا، هناك قصور وثغرات واضحة في إدارة المخاطر. وكمحاوله لتقييم الواقع الفعلي لصناعة البناء السوري بكل ما تحتويه من تفاصيل (منهجيات إدارة مشاريع – برمجيات – منهجيات إدارة مخاطر – تكنولوجيا حديثة) تم الاعتماد في هذه الدراسة على الأسلوب التحليل الوصفي لبيانات تم تجميعها عن طريق الاستبيان حيث تم توجيه الاستبيان لمحترفي إدارة المشاريع من المهندسين السوريين على كامل مساحة القطر العربي السوري. تأتي حادثة هذا البحث من كونه يقدم إطار عمل لإدارة مخاطر مشاريع البناء في سوريا بمنهجية تجمع بين نقاط القوة لمنهجية سكرم ونقاط القوة لمنهجية كانبان .

تأتي أهمية هذه الدراسة من أنه يمكن ربط إطار العمل المقترح لإدارة المخاطر بشكل متكامل بأسلوب التطوير المعتمد بإدارة المشروع سواء كان تنبؤي أو رشيق.

## Key Words:

Adaptive Approach, BIM, Kanban, Risk management, Scrum, Syrian Construction Industry.

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## List Of Abbreviations:

AEC	architecture, engineering and construction
BIM	Building Information Modeling
CAPM	Certified Associate in Project Management
COBIT	Control Objectives for Information and Related Technologies
ETABS	Extended 3D Analysis of Building System
GIS	Geographic Information System
ICP	International Construction Project
ISO	International Organization for Standardization
IT	Information Technology
ITIL	Information Technology Infrastructure Library
MEB	Mechanical & Electrical Building
PMBOK	Project Management Body of Knowledge - Book
PMI	Project Management Institute
PMI_ACP	Agile Certified Practitioner
PMI_RMP	Risk Management Certification
PMO	Project Management Office
PMP	Project Management Professional
PRINCE2	PRojects IN Controlled Environments - Project Management Certification
PRM	Project Risk Management
RM	Risk Management
RMO	Risk Management Office
SAB	Systems, Applications and Products
SPSS	Statistical Package for the Social Sciences
SWOT	Strengths, Weaknesses, Threats and Opportunities

# CHAPTER 1

## INTRODUCTION & LITERATURE REVIEWS

## CHAPTER 1

### 1.1 Introduction:

As a result of the changes that occurred in the concepts of project management since its inception up till now, many professional methodologies have popped up like "PMP" provided by PMI (Project Management Institute) or as "Prince2" provided by Axelos. Even these professional methodologies have been modified in a way or another to cover and meet uncertain and variable requirement environment. To make way for the emergence of Lean, Scrum, Kanban, XP and other Agile management methodologies .

One of the main pillars of managing any project is Risk Management. Risk management is a global issue and a challenge should be managed effectively in order to meet project objectives and achieve stakeholders satisfaction. The same applies to AEC industry, with all this urban development all around the world and due to the rapid adoption of BIM (Building Information Modelling) the importance of risk management in the AEC industry is growing day by day. And it is necessary to understand the innovative project management methods and adopt the more compatible with BIM technology.

BIM\_Based Risk management has become an imperative as a result of the great changes that the industry sector is witnessing every moment,. Considering BIM not only allows design and construction teams to work more efficiently, but it allows them to capture the data they create during the process to benefit operations and maintenance activities.

Blowing up situation in Syria since 2011 and catastrophic Syria/Turkey February 6<sup>th</sup> earthquake have irreversible implication for civil and construction legacy. This situation has created the urgent need to assess the current situation of Syrian construction and develop a comprehensive and effective framework to manage issues and risks.

This research reviews a risk framework proposal using Scrum/Kanban methodologies for Syrian AEC industry based on BIM as a mitigation strategy

## 1.2 Research Problem

- The insufficiency of traditional project tools in the face of big changes in the construction industry highlighted by BIM - the technological boom - on one hand, and by the repercussions left by Corona pandemic since 2020 on the other hand. In addition to what mentioned and on the local Syrian level: the circumstances of the war that lasted for more than ten years and the devastating 6<sup>th</sup> February earthquake imposed a changing reality for Syrian construction industry characterized by an unexpected nature and whose requirements cannot be determined.
- in light of the aforementioned data, there is no clear and appropriate Risk Management Framework in the Syrian construction industry.

## 1.3 Research Hypothesis:

Agile methodologies specifically Scrum and Kanban represent an effective option to manage risks in construction projects that adopt BIM as a response strategy.

## 1.4 Research Questions:

- Are Scrum/Kanban effective methodologies to manage risks in construction projects?
- Does BIM Maturity Level in Syrian construction industry allow the use of BIM as a Risk mitigation strategy?
- What is the impact of developing a risk plan framework on the reality of Syrian construction industry?



### 1.5 Research Importance:

- Emphasizing the importance of Agile mindset, values and principles in order to encourage using of new methodologies in project management. and emphasizing also the importance to adopt new technologies and thus raising the grade of Syrian construction industry.
- Developing a clear and effective risk plan framework in Syrian construction projects by using suitable tools of Scrum/Kanban methodologies.

### 1.6 Research Aim:

Is to reinforce the reality of Syrian construction industry through establishing risk framework based on agile management processes and methodologies.

### 1.7 Research Objectives:

- To investigate the impact of applying both of predictive and agile management in the construction industry projects.
- To critically analyze the reality of project management in Syrian construction industry.
- To assess the maturity of Syrian construction organizations on the importance of Risk management.
- To reveal BIM maturity level in Syria.
- To establish a risk plan framework based on Scrum/Kanban methodologies
- To recommend BIM as a mitigation response strategy in Risk plan Framework

### 1.8 Research Limits:

- Human: Engineers and Contractors
- Temporal: Current time 2023.
- Geographic: Syrian Arab Republic
- Objective: Risk Management with agile management tools

### 1.9 Literature Reviews:

Review the latest findings of scientific studies closely related to the topic of the research:

- Chaouch, S., Mejri, A., & Ghannouchi, S. A. (2019). A framework for risk management in Scrum development process. *Procedia Computer Science*, 164, 187-192.

In 2019 a novel study proposed a new framework incorporating the principles of risk management and techniques into Scrum development Framework. Aiming to facilitate teams to manage easily the risks in the Scrum project and to improve the chances of a successful project.

This risk management process model consists of six phases: (1)Plan Risk Management (2)Risk Identification (3)Perform Qualitative and Quantitative analysis (4)Plan Risk Response (5)Implement Risk Response (6)Monitor Risks. The proposed model is Scrum model extended with risk management issues and this extended framework was obtained using the result of the survey that accurately reflected the opinions and experiences of the respondents.

- Ahmed, M. N., & Mohammed, S. R. (2019). Developing a risk management framework in construction project based on agile management approach. *Civil Engineering Journal*, 5(3), 608-615.

The necessity to have efficient methods which take into consideration that the projects are often initiated under large uncertainties led to a study in 2019 aimed to develop a framework for the risk management in construction projects based on Agile management principles to reduce the impact of risk and to find a bridge between Agile project management and traditional project management approaches. The authors developed a project risk framework consists of three basic elements, as follows:

- 1- Project management office represents the basics of the methodology of the Scrum.
- 2- PMBOK guide process group (Initiation, Planning, Executing, Monitoring and controlling, and Closing), that relate to risk management.
- 3- Functions of project management that represents a PMBOK knowledge area (risk management).

This study declares that Identification risk is implemented in Scrum processes throughout the project and The risk assessment is done with regard to proximity, probability, and impact.

- Ganbat, T., Chong, H. Y., & Liao, P. C. (2020). Mapping BIM uses for risk mitigation in international construction projects. *Advances in Civil Engineering*, 2020, 1-13.

Another study focused on the BIM as an advanced tool by which to manage project risk. Study mapped the relationship between International Construction Project (ICP) risk and BIM application to improve the adoption and selection of the BIM. The linkage between BIM application and ICP risks helped providing effective control or prevention of risks and thereby improve project performance. This study involved two main research tasks. First, a critical review was conducted to compile a list of ICP risks and BIM applications in construction projects. Second, a meta-network method was adopted to analyze which BIM applications would be of utility in ICPs to help achieve project objectives in terms of cost, time, quality, safety, and environment. this study did not consider the role of BIMs in international project management from the perspective of BIM technology and software development. The study only assessed and interpreted the role of BIMs in ICP risk management from a management perspective.

- Marle, F. (2020). An assistance to project risk management based on complex systems theory and agile project management. *Complexity*, 2020, 1-20.

A novel study introduced Complex Systems Theory-based improvements into some Project Risk Management (PRM) subprocesses and run the global PRM process using Agile Project Management principles in order to tackle conceptual and managerial issues with increasing the complexity of the projects

This new way of structuring and executing Project Risk Management offers the possibility to make decisions more frequently, when needed, with a more distributed authority, and with richer information about anticipation of events and consequences of actions. First results show an appropriation of this combined approach by project members due to agile principles that allows for getting the more reliable information promised by Complex Systems Theory

- Esteki, M., Gandomani, T. J., & Farsani, H. K. (2020). A risk management framework for distributed scrum using PRINCE2 methodology. *Bulletin of Electrical Engineering and Informatics*, 9(3), 1299-1310.

In 2020 a risk management framework in Scrum was proposed using the PRINCE2 methodology, Because of the Features of PRINCE2 and Scrum methodologies. PRINCE2 is the most popular used project management method in the world and is increasingly applied concurrently with agile methodologies. the main reason for this combination as the authors explained, is to get the benefits of Agile and distributed development simultaneously. A risk management framework was suggested. This framework has been used in a case study.

The company under study was a software company working on core banking systems. In the case study, teams were working in different sites. The delivery time of the product was estimated at 150 days and the duration of each Sprint was

2 weeks. A risk management framework was developed by inclusion Scrum in PRINCE2 methodology and identifying risk factors along with five categories of software development including lifecycle, collective awareness, project management, external stakeholder collaboration, and the launch of the technology. The application of the framework in the case study was carried out by addressing 52 known risks in the literature review and their occurrence in practice.

The results showed: The proposed framework succeeded to fill the risk management gap in Scrum, effectiveness in detecting and avoiding potential risks in the case under study. Also, using this framework drove to higher team efficiency in terms of team velocity each sprint.

- Younus, D., Muayad, A., & Abumandil, M. (2021). The Impact of Agile Risk Management Utilization in Small and Medium (Smes) Enterprises. *International Journal of Scientific Research and Engineering Development*, 4(3).

A research aimed to compile consumer perspectives and recommendations for enterprises to prepare for the use of the agile risk management model and the contextual inquiry of enterprises. This research examined just 4 organizations across six Middle Eastern nations. The results Showed that most workers are adapting to the new agile management approach they have used at work, and the majority express satisfy action with the new system. This study was characterized as positive in many ways, such as the adopting of technology in the work environment to incorporate sudden changes in energy management schemes and various government policies on energy conservation. Furthermore, employee training, and flexibility in dealing with programs that can affect the process of achieving the goals.

- Alzoubi, H. M. (2022). BIM as a tool to optimize and manage project risk management. *International Journal of Mechanical Engineering*, 7(1).

A research in 2020 investigated and analyzed significance of BIM as the most appropriate method in mitigating project risks. Inductive and Deductive approach were used. Data collection technique through the use of case study and literature examination was conducted. The cases came from the internet and other sources and the outcomes of these have been analyzed. The case study shows how BIM can minimize the risks of time and cost to the minimum as it clearly indicates that time has been reduced to 50% and cost by 15% by only implementing BIM that manages the supply chain required for the design of the project and manage the long lead item and ensure the delivery just in time as well as the cost can be reduced by having a clear image about the required materials and compete more competitively on tenders that will forward their tender offer in cost and time wise in addition they can order in advance and have the time to negotiate prices with the vendors

- Ozkan, N., Bal, S., Erdogan, T. G., & Gök, M. Ş. (2022, September). Scrum, Kanban or a Mix of Both? A Systematic Literature Review. In *2022 17th Conference on Computer Science and Intelligence Systems (FedCSIS)* (pp. 883-893). IEEE.

A comprehensive literature review investigated the characteristics of the empirical studies which involve Scrum and Kanban by comparing or integrating them.

Both Scrum and Kanban seem to be good in delivery time, tracking and overview of projects, and teamwork. Where one is weak, the other one can be strong. These and similar situations still make these two methods preferable. However, the reported disadvantages of the particular methods (especially Scrum) open gates to

integrating the most advantageous part of the methods and eliminating their disadvantages at the same time by hybridizing them

Considering Kanban's linear and Scrum's deterministic approaches and due to the findings that they complement each other and they produce better solutions together. The authors recommended to blend the methods according to the needs instead of blindly adhering to one method.

- de Sousa Neto, A. F., Barbosa, F., Albuquerque, D., Dantas, E., Perkusich, M., Almeida, H., & Perkusic, A. (2023). Towards a Recommender System-based Process for Managing Risks in Scrum Projects.

in 2023 a solution for managing risk in Scrum projects based on using a recommender system was proposed. The recommender system is based on the KNN algorithm. And it is composed of three steps:

- 1- Data Structuring: The authors identified the features of a project that are relevant to their recommender system using three steps: (i) literature review, (ii) interview with specialized researchers, and (iii) questionnaire with practitioners
- 2- Scrum Instrumentation: Since the solution is knowledge-driven, the authors proposed a process aiming to (i) populate the risk memory with useful information and (ii) systematically reuse knowledge through the recommender system.
- 3- Risk Recommendation: Design the recommender system to retrieve information from the Risk Memory. The proposed recommender system comprises the following components: Data Collector, Data Transformer, and Recommender.

This approach demonstrated the feasibility of automating agile risk identification through past project data. Therefore, it can be considered a baseline for future

works that intend to research the subject. Also it created an organizational memory of risks for reuse in software companies.

Through previous studies, it was noted that most of the research focused on the importance of the role of scrum in risk management and the importance of the role of kanban in leading lean processes. many Risk Management frameworks have also been Developed Based on Scrum both in software projects and construction projects. In this research, the focus was on the strengths of Kanban, which are considered weaknesses in Scrum, and vice versa, with the aim of developing a hybrid methodology that captures the strengths of the two methodologies in managing risks in Syrian Construction Projects.

#### 1.10 Research Keywords:

**Agile:** is an iterative and incremental approach to project development which is performed in a highly collaborative manner by self-organizing teams with just enough ceremony that produces high-quality software in a cost-effective and timely manner which meets the changing needs of its stakeholders."

**Agile Life Cycle:** an approach that both iterative and incremental to refine work items and deliver frequently.

**BIM:** Building Information Modeling is the holistic process of creating and managing information for a built asset. Based on an intelligent model and enabled by a cloud platform, BIM integrates structured, multi-disciplinary data to produce a digital representation of an asset across its lifecycle, from planning and design to construction and operations.

**Kanban:** is a popular framework used to implement agile and software development. It requires real-time communication of capacity and full transparency of work. Work items are represented visually on a kanban board, allowing team members to see the state of every piece of work at any time.



**Predictive Life Cycle:** a more traditional approach, with bulk of planning occurring upfront, then executing in a single pass: a sequential process.

**Risk Management:** includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project/'

**Scrum:** is one of the leading agile techniques developed in the 1990s by Ken Schwarber and Jeff Sutherland. It allows us to focus on delivering the highest business value in the shortest time.

# CHAPTER 2

## THEORETICAL FRAMEWORK

## CHAPTER 2

### 2. The Theoretical Framework

#### 2.1 Concept of Risk Management

##### 2.1.1 Preface:

Project Risk Management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring and control on a project (Project Management Institute, 2019)

The objectives of Project Risk Management are to increase the probability and impact of positive events, and decrease the probability and impact of negative events in the project. (Project Management Institute, 2019)

Project Risk Management aims to identify and prioritize risks in advance of their occurrence, and provide action-oriented information to project managers. This orientation requires consideration of events that may or may not occur and are therefore described in terms of probability of occurrence and their impact on objectives. (Project Management Institute, 2019)

Risk exists at two levels within every project:

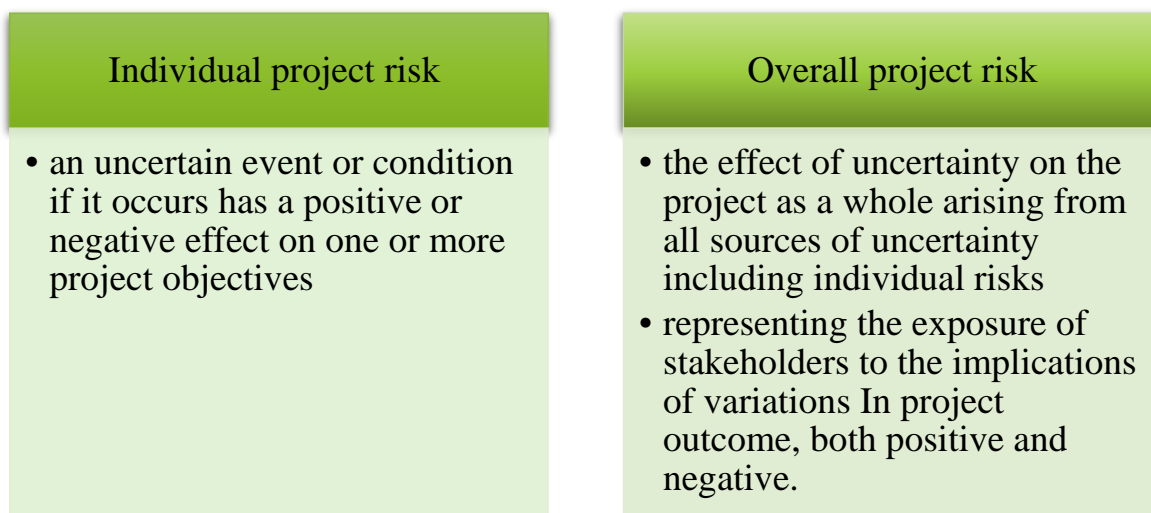


Figure (2-1) Risk Levels within each project (PMI, 2017)

Risk can be classified into:

<p><b>Unknown-Known</b> (Hidden fact)</p> <p>Knowledge exists in the community but not with the entity working on the endeavor.</p>	<p><b>Unknown-Unknown</b> (Emergent risk)</p> <p>Knowledge does not exist within the sphere of influence.</p>
<p><b>Known-Known</b> (Facts and requirements)</p> <p>Managed as a part of scope. Not a risk.</p>	<p><b>Known-Unknown</b> (Classic risk)</p> <p>There is knowledge to identify probability and impact.</p>

Figure (2-2) Risk Classification (Project Management Institute, 2019)

### 2.1.2 Project Risk Management Processes:

Five processes in Planning , one in executing and one in controlling and monitoring process. (PMI, 2017)

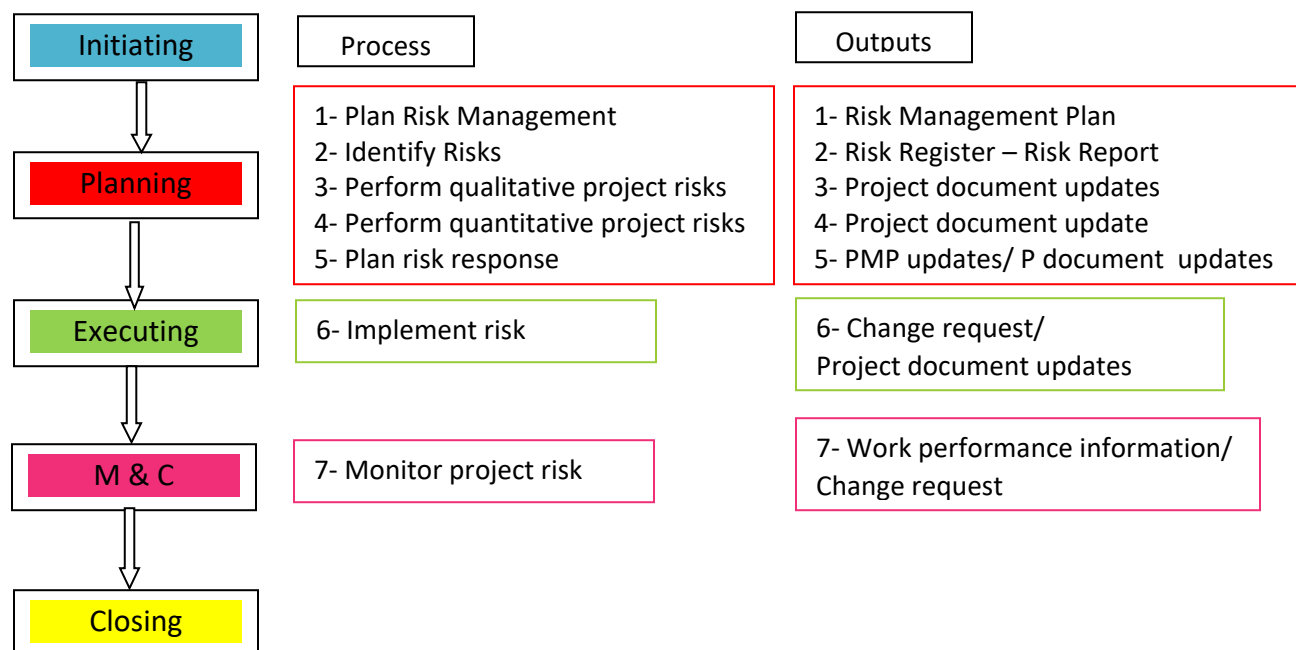


Figure (2-3) shows Risk Management Processes (Author, 2023)

### 2.1.2.1 Plan Risk Management:

The objectives of the Plan Risk Management process are to: develop the overall risk management strategy, decide how the risk management processes will be executed, and integrate risk management with all other activities. (Project Management Institute, 2019)

#### Elements of a Risk Management Plan (Guide, 2017):

- ✓ **Strategy:** What is the general approach to managing risks
- ✓ **Methodology:** Tools, approaches, or data sources that will be used.
- ✓ **Roles and Responsibilities:** Who will what
- ✓ **Risk Categories:** Identify categorization groups to sort and organize risks.
- ✓ **Risk Management Funding:** Document the funding needed to perform the different risk management activities
- ✓ **Frequency and Timing:** Determine the frequency of conducting formal risk management activities and the timing of any specific activities.
- ✓ **Stakeholder Risk Appetite:** Identify risk thresholds
- ✓ **Risk Tracking and Audit:** Document how risk activities will be recorded, tracked and assessed and how risk management processes will be audited.
- ✓ **Definitions of Probability**
- ✓ **Definitions of Impact by Objective**
- ✓ **Probability and Impact Matrix**

Project's Name:					
Project Duration 36 months					
Project Budget 180 M \$					
What	How		Who	How Much	When
	Tools	Methodology Description			
Identify Risk	Brain Storming, Interviews, Experts.....	.....	.....	3000	2 W
Perform qualitative Risk analysis	Probability & Impact assessment, Data quality assessment	Probability will be defined on 1 to 5 scale.....	.....	.....	....
Perform Quantitative Risk analysis	.....	.....	.....	.....	.....
Plan Risk Response					
Implement Risk Response					
Monitor Risk					

Figure (2-4) Risk Management Plan Template (Author, 2023)

### 2.1.2.2 Identify Project Risk:

Identify Risks is the process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics. (Guide, 2017)

.

Key Success Factors For Identify Risks (Project Management Institute, 2019)

- ✓ Early, iterative, emergent and comprehensive identification
- ✓ Multiple perspectives
- ✓ Risks linked to objectives
- ✓ Ownership and level of detail

- ✓ Frequent and effective communication
- ✓ Objectivity to minimize bias

### Tool & Technique:

- Checklists analysis

Site Name : -----		
Risks Checklists		
Main Category	Subcategory	Potentiality Yes/no
Technical Risks	- Scope Definition	<input type="checkbox"/>
	- Requirement Definition	<input type="checkbox"/>
	- Estimates	<input type="checkbox"/>
	- Assumption and Constraints	<input type="checkbox"/>
	- Technology	<input type="checkbox"/>
	- Technical Processes	<input type="checkbox"/>
	- Complexity and Interfaces	<input type="checkbox"/>
	- Performance and Reliability	<input type="checkbox"/>
	- Quality	<input type="checkbox"/>
Management Risks	- Project Management	<input type="checkbox"/>
	- Organization	<input type="checkbox"/>
	- Resourcing	<input type="checkbox"/>
	- Communication	<input type="checkbox"/>
	- Funding	<input type="checkbox"/>
Commercial Risks	- Contractual terms & Conditions	<input type="checkbox"/>
	- Internal Procurement	<input type="checkbox"/>
	- Suppliers and Vendors	<input type="checkbox"/>
	- Subcontractors	<input type="checkbox"/>
	- Partnership & Joint venture	<input type="checkbox"/>
External Risks	- Legislation	<input type="checkbox"/>
	- Exchange Rates	<input type="checkbox"/>
	- Site/Facilities	<input type="checkbox"/>
	- Environmental/Weather	<input type="checkbox"/>
	- Regulatory	<input type="checkbox"/>
	- Economic	<input type="checkbox"/>
	- Social issues	<input type="checkbox"/>
	- Development issues	<input type="checkbox"/>

Figure (2-5) Shows a Checklist template example (Guide, 2017)

- Assumption Analysis: Assumption could be false, each is a potential risk.
- SWOT Analysis is one of the important tools that help identifying the Strengths and Weaknesses and realize the nature of Threats and Opportunities that may affect the site. (Project Management Institute, 2019)
- Brainstorming: generating ideas to get a comprehensive list of project risks.

- Delphi Technique: a gathering data technique used to reach a consensus of experts, who participate anonymously. It helps reduce bias in the data. (Project Management Institute, 2019)
- Interviews: Conducted with project participants, stakeholders and experts.

The main outputs of Identify Project Risk:

a- Risk Register:

The risk register picks up the details of identified individual risks. risk analysis results, risk response strategies, response implementation, and current status. It is used as an effective way to risk management processes. (PMI, 2017)

Risk Register includes (John Wiley & Sons, 2017):

- ✓ Risk identifier
- ✓ Risk statement
- ✓ Risk owner
- ✓ Probability of occurring
- ✓ Impact on objectives if the risk occurs
- ✓ Risk score
- ✓ Response strategies
- ✓ Revised probability
- ✓ Revised impact
- ✓ Revised score
- ✓ Actions
- ✓ Status
- ✓ Comments



ID	Risk Categorization	Risk Description	Root Cause	Risk Owner	Proposed Risk Response
1	Designing Risk	Lack of acceptance by the customer	Delays in approval	Design office	Market observation, alternative designing solutions
2	...	..	...	...	..
3					
4					

Figure (2-6) Shows Risk Register Example (Author, 2023)

#### b- Risk Report:

The risk report presents information on overall project risk and summarizes information on individual project risks. It provides information for each of the processes from identification of risks, through analysis, response planning and implementation, and monitoring risks (PMI, 2017).

Risk Report Includes (John Wiley & Sons, 2017):

- ✓ Executive summary
- ✓ Description of overall project risk
- ✓ Description of individual project risks
- ✓ Quantitative analysis
- ✓ Reserve status

#### 2.1.2.3 Perform qualitative Risk Analysis Process :

Is the process of Prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics. it focuses efforts on high-priority risks (PMI, 2017).

Critical Success Factors for Perform quantitative Risk Analysis Process (Project Management Institute, 2019):

- ✓ Used agreed-upon Approach (Probability–Impact–Urgency–manageability)

- ✓ Used agreed-upon Definitions of Risk Terms
- ✓ Collect High-quality information about the Risk
- ✓ Perform Iterative Qualitative Risk Analysis

#### Tools & Techniques:

- a- Risk Data Quality Assessment: Evaluates the degree to which the data about individual project risks is accurate and reliable. (Project Management Institute, 2019)
- b- Risk Probability & Impact Assessment: Risks can be assessed (Likelihood of each risk & Potential Effect on project objectives) in interviews or meetings with participants selected for their familiarity with the types of risk recorded in the risk register (Project Management Institute, 2019)
- c- Probability & Impact matrix: Rate the risks as low, moderate, or high priority. as shown in Figure (3)

Risk Probability & Impact Matrix			Probability				
Risk Potential Sources			Almost Impossible	Not Likely to occur	Could occur	Know to occur	Common Occurrence
			1	2	3	4	5
Potential Impacts	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
	Nil	1	1	2	3	4	5
			Low Risk		Medium Risk	Significant Risk	High Risk

Figure (2-7) Shows Probability & Impact Matrix Example (PMI, 2017)

- d- Risk Categorization: Grouping risks into categories can lead to the development of more effective risk responses by focusing attention and effort on the areas of highest risk exposure (PMI, 2017).

- e- Assessment of other risk parameters: Urgency – Proximity – Dormancy – Manageability – Controllability – Detectability – Connectivity – Strategic impact and Propinquity) (Project Management Institute, 2019).

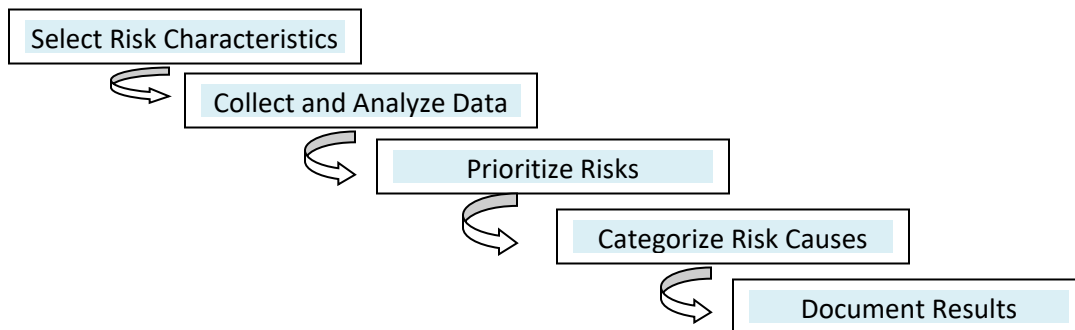


Figure (2-8) Shows quantitative analysis phases (Author, 2023)

#### 2.1.2.4 Perform Quantitative Risk Analysis Process:

Perform Quantitative Risk Analysis is the process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives (PMI, 2017).

#### 2.1.2.5 Plan Risk Response Process:

Once risks have been identified, analyzed, and prioritized, plans should be developed for addressing every risk the project team considers to be sufficiently important (PMI, 2017).

Critical Success Factors for Plan Risk Response Process (Project Management Institute, 2019):

- ✓ Clearly Define Risk Related Roles & Responsibilities
- ✓ Provide schedule, budget and resources for risk responses






STRATEGIES FOR THREATS		
Escalate		Escalated risks are managed at the program level, portfolio level and not on the project level. A threat is outside the scope of project.
Avoid		<ul style="list-style-type: none"> <li>• Eliminate the threat or protect the project from its impact .</li> <li>• Extending the schedule, changing the strategy, or reducing scope .</li> </ul>
Transfer		The project team shifts the impact of a threat to a third party. Ex: insurance, fixed-price contract
Mitigate		Reduce the probability of occurrence or impact of a risk. Ex: Conducting more tests
Accept		Active or Passive

Figure (2-9) Shows Risk Strategies Response for Threats (Author, 2023)






STRATEGIES FOR OPPORTUNITIES		
Escalate		Escalated risks are managed at the program level, portfolio level and not on the project level. A threat is outside the scope of project
Exploit		<ul style="list-style-type: none"> <li>• Wants to ensure that the opportunity is realized</li> <li>• Using new technologies to reduce cost, duration</li> </ul>
Share		<p>( joint ventures, partnerships)</p> <ul style="list-style-type: none"> <li>• Transferring ownership of an opportunity to a third party.</li> </ul>
Enhance		<ul style="list-style-type: none"> <li>• Increase the probability and/or impact of an opportunity.</li> </ul>
Accept		Active – Passive

Figure (2-10) Shows Risk Strategies Response for Threats (Author, 2023)

#### 2.1.2.6 Implement Risk Responses Process:

##### Purpose of this process:

- ✓ It ensures that agreed-upon risk responses are executed as planned in order to address overall project risk exposure, minimize individual project threats, and maximize individual project opportunities (PMI, 2017).

#### 2.1.2.7 Monitor Project Risks Process:

Track identified risks, monitor residual risks, identify new risks, ensure that risk response plans are executed at the appropriate time, and evaluate their effectiveness throughout the project life cycle. Also the effectiveness of all of the Project Risk Management processes should be reviewed and audited. (PMI, 2017) Critical Factors should be taken in consideration for Process (Project Management Institute, 2019):

- ✓ Integrate Monitor Project Risks with Project Monitoring and Control
- ✓ Continuously Monitor Risk Trigger Conditions.
- ✓ Maintain Risk Awareness

#### 2.2 Concept of Project Management Professional:

Project work ranges from definable and detailed scope to high-uncertainty scope. Definable and detailed scope projects are implemented by clear procedures that have proved successful on similar projects in the past. (Institute, 2021) Implementing building projects after the design is complete is an examples of definable and detailed scope. The whole processes involved are usually well understood and clear to all parties of the project so typically low levels of execution uncertainty and risk exist. So the best development approach here is Predictive Approach (Waterfall). (Project Management Institute, Inc., 2017)

For projects that Require research and development, have high rates of change, have unclear or unknown requirements, have a goal that is hard to describe. It requires experts to collaborate and solve problems to create a solution. (Project Management Institute, Inc., 2017)

High-uncertainty projects have high rates of change, complexity, and risk. These characteristics can present problems for traditional predictive approaches that aim

to determine the bulk of the requirements upfront and control changes through a change request process. Instead, agile approaches were created to explore feasibility in short cycles and quickly adapt based on evaluation and feedback. (Project Management Institute, Inc., 2017).

So What are The project methodologies/approaches that could be recommended:

<b>Methodology : Predictive</b>	<b>Methodology : Agile</b>	<b>Methodology : Hybrid</b>
<p><b><u>Best suited for:</u></b></p> <p>Projects where changes are expensive</p> <p><b><u>Example:</u></b></p> <p>Construction projects or</p>	<p><b><u>Best suited for:</u></b></p> <p>Projects where changes and waste is not costly. Projects in a complex environment where the end product is not fully known and user feedback is very valuable.</p> <p><b><u>Example:</u></b></p> <p>Software projects</p>	<p><b><u>Best suited for:</u></b></p> <p>Projects where stakeholders are Interested In another method, but not comfortable to fully adopt one method.</p> <p><b><u>Example:</u></b></p> <p>Projects with a mix of resources and experience levels or projects willing to learn new methods.</p>

Figure (2-11) Predictive Vs Agile Vs Hybrid (Author, 2023)

## 2.3 Concept of Agile Management

### 2.3.1 What is Agile:

Agile is a Timeboxed approach software delivery that builds software incrementally from the start of the project, instead of trying to deliver it all once near the end. (Project Management Institute, Inc., 2017) Which ends up with higher Productivity and lower cost (due to less waste and reduced cost of rework) this is achieved by developing what essentially needed by the customer, Improved stakeholder satisfaction (Younus, et al. 2021)

It works by breaking projects down into little bits of user functionality called user stories, prioritizing them, and continually delivering them in short (1-4) week cycle called iterations. (Project Management Institute, Inc., 2017)

Agile is an approach with set of methods, or frameworks that are optimized to help with specific problems that project teams run into, and kept simple so they're relatively straightforward to implement. (Project Management Institute, Inc., 2017)

Each of those methodologies or frameworks consists of practices, tools and techniques that optimized to make them easy as possible to adopt. It depends on collaboration, Transparency, Time to Value (Project Management Institute, Inc., 2017)

### 2.3.2 Agile Methodologies, Frameworks:

Agile approaches and agile methods are umbrella terms that cover a variety of frameworks.

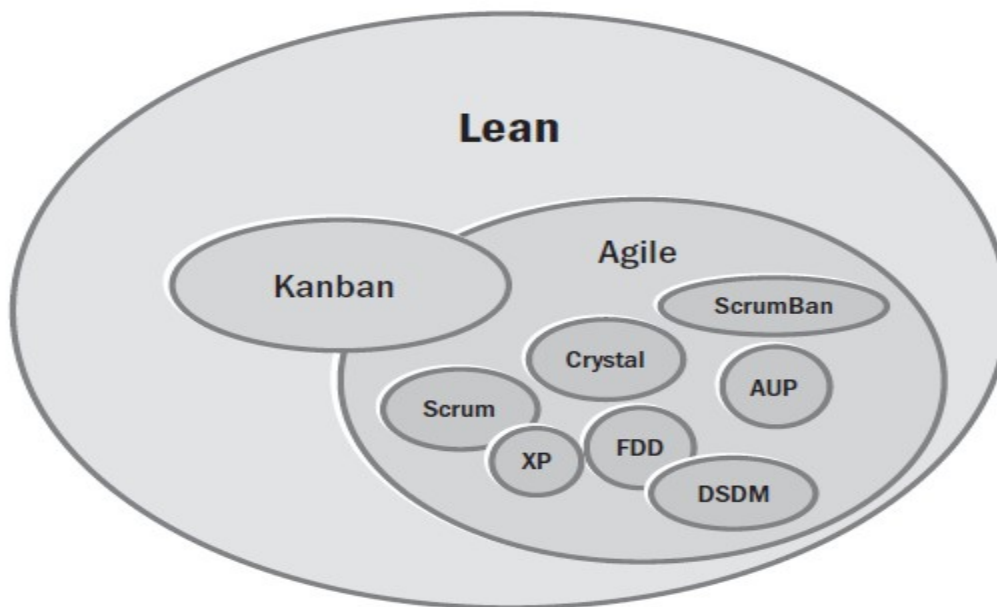


Figure (2-12) Shows different framework to apply agile (Project Management Institute, Inc., 2017)



### 2.3.2.1 Scrum:

Scrum is one of the leading agile techniques developed in the 1990s by Ken Schwarber and Jeff Sutherland. It is Iterative and Incremental agile software development framework for managing software projects and products or application development. (Sutherland, et al. 2020).

Scrum Focus on flexible, holistic product development strategy where a development team works as a unit to reach a common goal as opposed to a traditional sequential waterfall approach. Focus on delivering the highest business value in the shortest time frequently through short iterations known as sprints. This gives visibility to the work that's being done and creates opportunities for feedback. (Sutherland, et al. 2020)

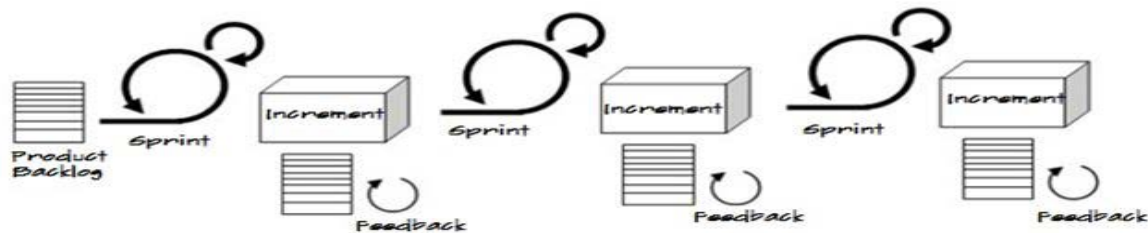


Figure (2-13) Shows Scrum as Iterative and Incremental framework (Kulkarni, Amit.2016)

#### 2.3.2.1.1 Scrum Framework (Roles – Ceremonies – Artifacts):

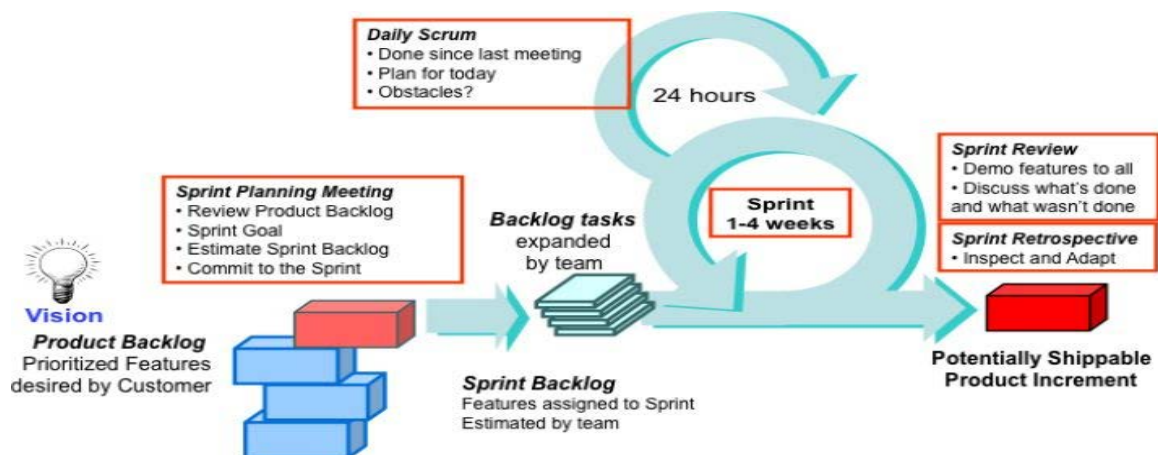


Figure (2-14) Shows Scrum Framework (Sliger,M. 2011)

Scrum Roles		
Product Owner	Scrum Master	Development Team
<ul style="list-style-type: none"> <li>- is accountable for maximizing the value of the product resulting from the work of the Scrum Team</li> <li>- Has the vision for the project</li> <li>- Ensuring the value of the work development team performs</li> <li>- Gathers inputs from end-users, customers, team and other stakeholders</li> <li>- Responsible for prioritizing the product backlog</li> <li>- Adjust features &amp; priority every iteration as needed</li> <li>- Responsible for the success of a product</li> <li>- Accept what has been completed</li> <li>- Owner of the product</li> <li>- Voice of the customer</li> </ul>	<ul style="list-style-type: none"> <li>- Is a Servant Leader</li> <li>- Responsible for the scrum process, ,making sure it's Used correctly and maximizes its benefits</li> <li>- Owner of the Scrum Process</li> <li>- Does not Directs but ENABLES</li> <li>- Clearly communicating vision, goals, product backlog items to the development team</li> <li>- Facilitates Daily meetings</li> <li>- Removing obstacles – blockers - impediments</li> <li>- Coach the team</li> <li>- Facilitates success by ensuring process is followed</li> </ul>	<ul style="list-style-type: none"> <li>Self-directed/ Self managed/ Self organizing, organize and manage their day to day tasks</li> <li>- A cross-functional team/no titles for Development Team members</li> <li>- Prepares Sprint Backlog.</li> <li>- Responsible for product quality, estimation, and delivery.</li> <li>- Responsible for converting product backlog into shippable product.</li> <li>- Prepares definition of Done.</li> <li>- Team size between three and nine.</li> </ul>

Figure (2-15) shows Scrum Roles (Sutherland, et al. 2020)

<b>Scrum Ceremonies</b>	
<b>Sprint Planning Meeting</b>	<p>Conducted before the start of the sprint</p> <ul style="list-style-type: none"> <li>• Evaluate the Product Backlog</li> <li>• Select a Sprint(Iteration) Goal Plan how to achieve it</li> <li>• Create Sprint(Iteration) Backlog tasks from prioritized Product Backlog items</li> <li>• Estimate Sprint Backlog tasks in hours</li> </ul>
<b>Daily Standup Meeting</b>	<p>This is a 15-minute time-boxed meeting. The daily scrum is for the development team only.</p> <ul style="list-style-type: none"> <li>• Each team member answers three Questions: <ul style="list-style-type: none"> <li>* What have you done since yesterday?</li> <li>* What are you planning to do today?</li> <li>* Do you have any problems?</li> </ul> </li> </ul>
<b>Review Meeting</b>	<p>Held at the end of every sprint.</p> <ul style="list-style-type: none"> <li>• Team presents what it accomplished during the sprint</li> <li>• Attendees will be the team, the product owner, scrum master, and sometimes other project stakeholders</li> <li>• Team will demo the work created in the increment</li> <li>• The group will decide if "Done" has been achieved</li> </ul>
<b>Sprint Retrospective Meeting</b>	<p>DISCUSS:</p> <ul style="list-style-type: none"> <li>*What worked well?</li> <li>*What didn't work well?</li> <li>*What can we improve upon for next time?</li> </ul>

Figure (2-16) Shows Scrum Ceremonies (Sutherland, et al. 2020)

Scrum Artifacts		
Product Backlog	Sprint Backlog	Artifact
<ul style="list-style-type: none"> <li>- A list of all the expected work (Features – Requirements) to deliver the product.</li> <li>- Is a living document, it changes throughout the project</li> <li>- Product backlog items are edited and clarified as more is known as product requirements may change</li> <li>- It's compiled from input sources like customer.</li> <li>- Items in the product backlog is re-prioritized at the start of each sprint</li> </ul>	<ul style="list-style-type: none"> <li>- Lists work to be done in the current sprint.</li> <li>- This list is determined in the sprint planning meeting</li> <li>.</li> <li>- Pulled from product backlog.</li> <li>- Items are broken into tasks.</li> </ul>	<ul style="list-style-type: none"> <li>- The Increment is the sum of all the Product Backlog items condition (Potentially shippable product) completed during a Sprint and all previous Sprints.</li> <li>- At the end of a Sprint, the new Increment must be "Done,"</li> <li>- It must be in useable</li> </ul>

Figure (2-17) Shows Scrum Artifacts (Sutherland, et al. 2020)

#### 2.3.2.1.2 Sprint:

**SPRINT (1-4 weeks):** Time box of month or less during which a “DONE” , Useable and potentially releasable product INCREMENT is created by development team. (Sutherland, et al. 2020)

#### **During the sprint:**

No changes are made

No changes to development team members

Quality goals do not decrease (Sutherland, et al. 2020)

#### 2.3.2.2 Kanban

Kanban: is a Japanese word meaning "sign board (Damanellore Karthik, et al. 2021) Kanban: is a popular framework method to implement agile and software development. It requires communication of capacity and full transparency of work. Work items are represented visually on a kanban board, allowing team members to see the state of every piece of work at any time. Using cards, physical or electronic boards can track work as it progresses. (Damanellore Karthik, et al. 2021)

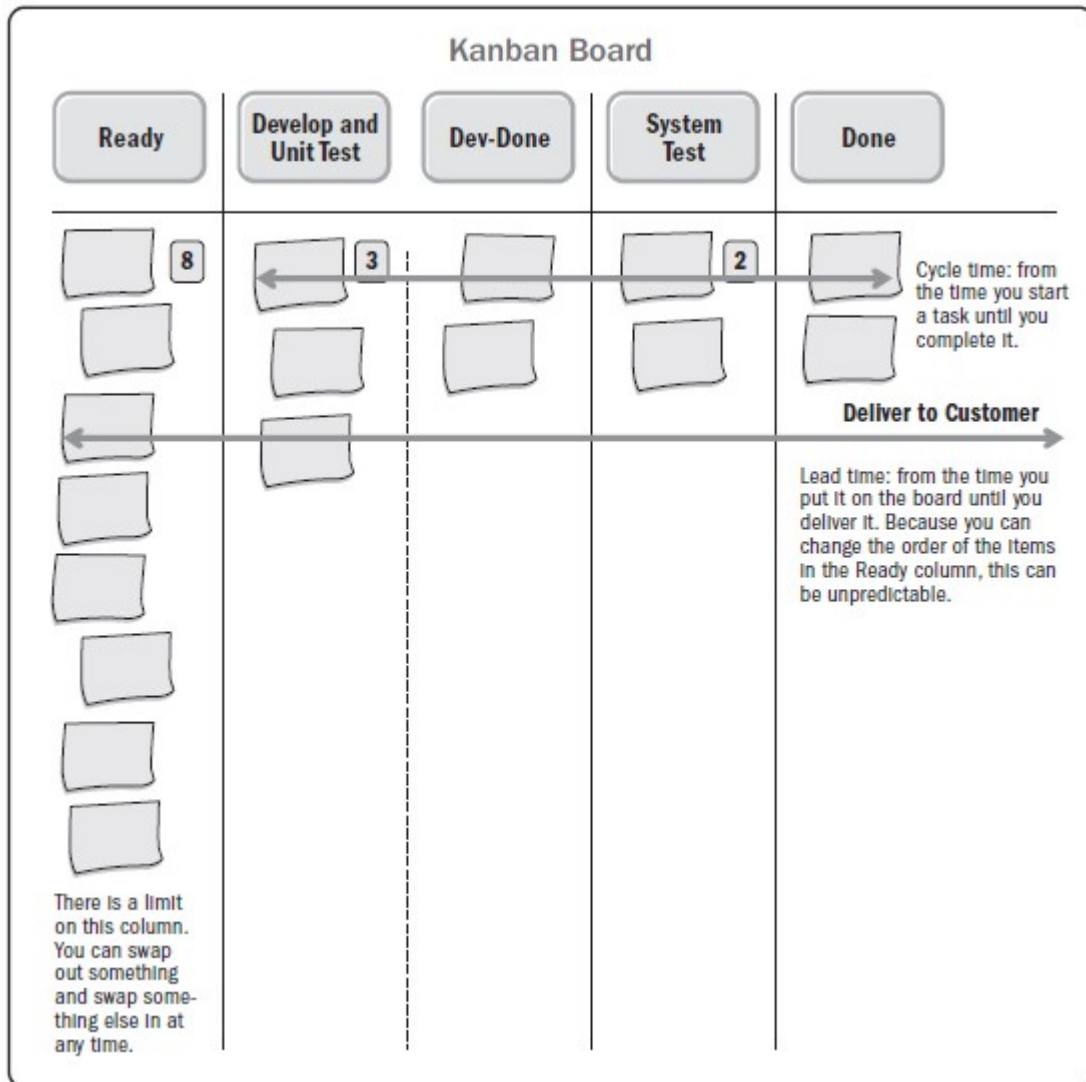


Figure (2-18) Shows Kanban Board Example (Project Management Institute, Inc., 2017)

In Kanban it is important to complete the work than to start a new work  
NO VALUE Derived from work is NOT COMPLETED so the team work together to implement and adhere to the work in progress (WIP) limits  
 Kanban Makes Process policies clear. (Damanellore Karthik, et al 2021)

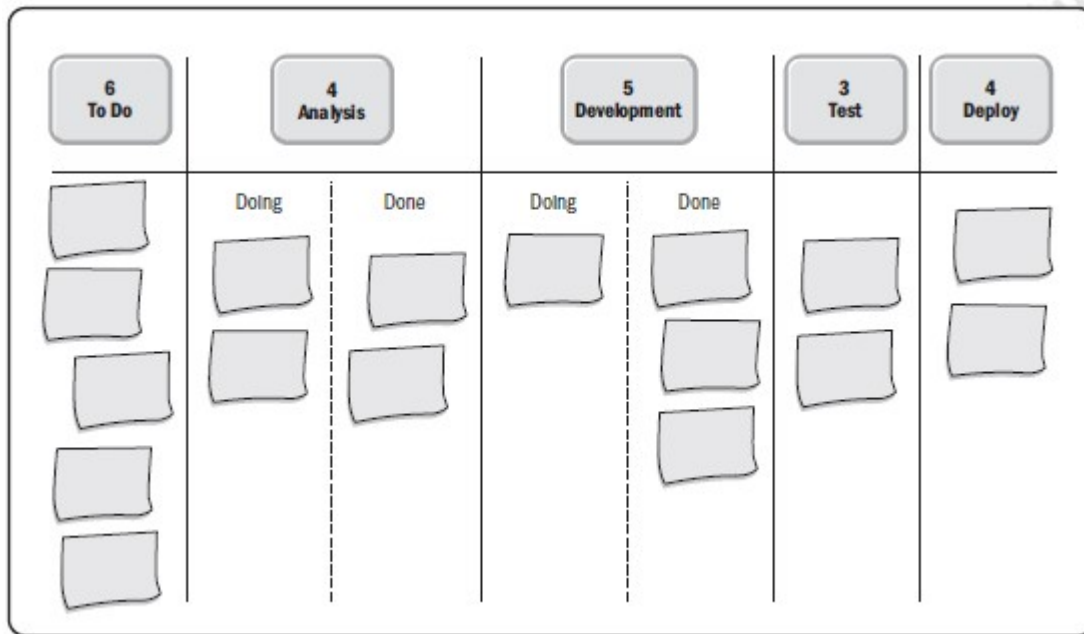


Figure (2-19) Shows work in progress limits and a pull system to optimize the flow of work  
(Project Management Institute, Inc., 2017)

## 2.4 Concept of Building Information Modelling

Building Information Modeling (BIM) is the foundation of digital transformation in the architecture, engineering, and construction (AEC) industry.

Building Information Modeling has great benefits such as:

- Promote design and engineering creativity and ensure coupling between the design, construction and operation of the built environment (Ahmed O. S., 2018)
- As Construction risk could affect badly project's feasibility. (Shibani, et al. 2022) BIM Provides analytical capability to enhance project and enterprise level functions such as risk management .
- Cooperation between all departments and avoiding problems that were previously occurring. (Alzoubi,H.M. 2022)
- Enhance performance through effective involving of all parts of the project. (Salamah, et al. 2023)

- Higher productivity as it reduces waste and time loss, reduces cost and improves quality. (Ahmed S. D. et al. 2018)
- Allocate more effective resources and reduce wasted materials in the project
- Reducing planning defects (Ganbat, et al. 2020)
- Reduce information loss and reducing human errors. (Ahmed O. S., 2018)
- Integration between the analysis / design model and the construction model (Lepkova, et al. 2019)
- Simulating the stages of the project from the beginning of excavation at the site to the end and facilitating communication between all parties. (Shaban, et al. 2018)
- Detecting conflicts during design and avoiding re-work. (Ganbat, et al. 2020)
- Improve risk management as the updated construction model with all changes made during construction provides an accurate source of information (Ganbat, et al. 2020)



# CHAPTER 3

## RESEARCH METHODOLOGY & ANALYTICAL STUDY

## CHAPTER 3

### 3. Research Methodology and Analytical Study:

#### 3.1 Research Instrument and Data Collection:

Descriptive – Analysis Methods were used in this research:

As a systematic, arranged method supports collecting research-related data and also serves clarifying the relationship between the research variables in the form of questions or hypotheses, this method also enables using statistical analysis tools that suit the nature of the research data.

The main research method in this study was a survey. The most important part of the survey process is the creation of questions that accurately reflect the opinions and experiences of the respondents. The questions are adopted from previous studies with some modifications to suit the context of this study. In this research, to measure attitudes, Likert scales were used. The questionnaire elements were designed in 5 Spectrum options. Likert scales can be described as a survey where participants normally select a value that equates to a value or attitude. In their original form, the scale was: 1=strongly approve, 2=approve, 3=undecided, 4=disapprove and 5=strongly disapprove. The structure of the questionnaire is divided into four main themes: (1)Demographic and company information. (2)Agile Project management: (3) Scrum risk management (4) BIM in Construction.

The questionnaire survey is conducted via Google's online survey, electronic mail and a direct face- to- face approach.

A set of questionnaire consisting the cover letter explaining the purpose of the study and details of the researchers and the questionnaire survey will be provided to each respondent.

### 3.2 Research Community:

Community: Construction industry companies in Syria that are interested in applying new technologies.

Sample: professionals engineers with experience on Syrian construction projects are selected as the sample in this study. The respondents come from various departments that could generally be classified as a research department, design come from various levels of non-executive to management level since they are directly involved in a business unit, function, or process in organization.

Number of respondents 53.

### 3.3 Data Collection And Analysis Tool:

SPSS program (Statistical Package for the Social Sciences) was used to develop useful information and measurements from collected data.

### 3.4 Analysis Process:

Frequency Table

Table (3-1) 1- Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25 - 30	27	50.9	50.9	50.9
	31 - 39	9	17.0	17.0	67.9
	40 - 49	13	24.5	24.5	92.5
	50 -	4	7.5	7.5	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents was for ages ranging between 25-30 with a rate of 50.9, followed by a rate of 24.5% for ages ranging from 40-49 and the lowest percentage was for ages 50s and more

Table (3-2) 2- Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	27	50.9	50.9	50.9
	Male	26	49.1	49.1	100.0
	Total	53	100.0	100.0	

The table shows 50.9% of respondents were female and 49.1% were male

Table (3-3) 3- Qualification

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor Degree	27	50.9	50.9	50.9
	High Diploma Certificate	2	3.8	3.8	54.7
	Master Degree	20	37.7	37.7	92.5
	PhD	4	7.5	7.5	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents hold a university degree with a percentage of 50.9%, followed by those with a master's degree with a percentage of 37.7%, a PhD with a percentage of 7.5%, and the lowest percentage with a postgraduate diploma with a percentage of 3.8%

Table (3-4) 4- Field of Study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Architecture Engineering	13	24.5	24.5	24.5
	Civil Engineering	33	62.3	62.3	86.8
	MEB Engineering	5	9.4	9.4	96.2
	Other	2	3.8	3.8	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents are civil engineers with a percentage of 62.3%, followed by Architecture engineer with a percentage of 24.5%, a MEB with a percentage of 9.4%, and the lowest percentage for other fields with 3.8%

Table (3-5) 5- What best describe your current Position

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Business Analyst	1	1.9	1.9	1.9
	Construction Manager	1	1.9	1.9	3.8
	Designer	6	11.3	11.3	15.1
	Environmental Administrative	1	1.9	1.9	17.0
	IT	1	1.9	1.9	18.9
	Maintenance Engineer	1	1.9	1.9	20.8

Marketing	1	1.9	1.9	22.6
Other	1	1.9	1.9	24.5
Professor at University	1	1.9	1.9	26.4
Project Manager	8	15.1	15.1	41.5
Research Engineer	8	15.1	15.1	56.6
Site Engineer	12	22.6	22.6	79.2
Supervisor Engineer	11	20.8	20.8	100.0
Total	53	100.0	100.0	

The table shows that the highest percentage of respondents working as a site engineer with 22.6% , supervisor engineer with 20.8% and research , followed by those working as a research engineer and a project manager with a percentage of 15.1%, followed by designer with a percentage of 11.3%, and the lowest percentage 1.9% for the other positions

Table (3-6) 6- Certification that You hold

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6 Sigma	3	5.7	5.7	5.7
	Advisor Certificate	1	1.9	1.9	7.5
	Autodesk Revit structure advanced	1	1.9	1.9	9.4
	CAPM, ISO	1	1.9	1.9	11.3
	ICDL	1	1.9	1.9	13.2
	ISO	6	11.3	11.3	24.5
	ISO,	1	1.9	1.9	26.4
	None	12	22.6	22.6	49.1
	PMI_ACP	1	1.9	1.9	50.9
	PMP	16	30.2	30.2	81.1
	PMP course	1	1.9	1.9	83.0
	PMP preparation course	1	1.9	1.9	84.9
	PMP,	2	3.8	3.8	88.7
	PMP, CAPM,	1	1.9	1.9	90.6
	PMP, ISO	1	1.9	1.9	92.5
	PMP, PMI_ACP, PMI_RMP,	1	1.9	1.9	94.3
	PMP, PRINCE2, COBIT	1	1.9	1.9	96.2
	PMP, PRINCE2, PMI_RMP	1	1.9	1.9	98.1
	PRINCE2,	1	1.9	1.9	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents had PMP preparation course with a percentage of 30.2%, and had PMP certified with a percentage of 3.8%, ISO with a percentage of 11.3%, and the lowest percentage distributed among all the other certifications with a percentage of 1.9% and 22.6% of respondents didn't have any certification.

Table (3-7) 7- Software You are good at

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	AutoCAD	3	5.7	5.7	5.7
	AutoCAD, 3D MAX	1	1.9	1.9	7.5
	AutoCAD, 3D MAX, GIS and civil 3d	1	1.9	1.9	9.4
	AutoCAD, 3D MAX, Photoshop - Microsoft word	1	1.9	1.9	11.3
	AutoCAD, 3D MAX, Revit	3	5.7	5.7	17.0
	AutoCAD, 3D MAX, Revit, ArchiCAD, Navisworks, Synchro, MS Project, Primavera	1	1.9	1.9	18.9
	AutoCAD, 3D MAX, Revit, ArchiCAD, SAB, ETABS, Navisworks, Synchro, MS Project, Primavera	1	1.9	1.9	20.8
	AutoCAD, 3D MAX, Revit, Ecotec,	1	1.9	1.9	22.6
	AutoCAD, 3D MAX, Revit, Navisworks, Synchro, MS Project, Primavera, Bentley	1	1.9	1.9	24.5
	AutoCAD, 3D MAX, Revit, Safe, ETABS, Primavera	1	1.9	1.9	26.4
	AutoCAD, 3D MAX, Revit, Synchro, Primavera	1	1.9	1.9	28.3
	AutoCAD, ETABS	1	1.9	1.9	30.2
	AutoCAD, MS Project, Primavera	1	1.9	1.9	32.1

AutoCAD, Navisworks, Primavera	1	1.9	1.9	34.0
AutoCAD, Primavera	1	1.9	1.9	35.8
AutoCAD, Revit	3	5.7	5.7	41.5
AutoCAD, Revit, ArchiCAD, MS Project	1	1.9	1.9	43.4
AutoCAD, Revit, ETABS, MS Project	1	1.9	1.9	45.3
AutoCAD, Revit, ETABS, Primavera	1	1.9	1.9	47.2
AutoCAD, Revit, MS Project	1	1.9	1.9	49.1
AutoCAD, Revit, Navisworks, MS Project	1	1.9	1.9	50.9
AutoCAD, Revit, Navisworks, Primavera	1	1.9	1.9	52.8
AutoCAD, Revit, Navisworks, Synchro, MS Project	3	5.7	5.7	58.5
AutoCAD, Revit, Robot, ETABS, MS Project	1	1.9	1.9	60.4
AutoCAD, Revit, Robot, Navisworks, MS Project, Primavera	1	1.9	1.9	62.3
AutoCAD, Revit, Robot, Navisworks, Synchro	1	1.9	1.9	64.2
AutoCAD, Revit, Robot, Safe, ETABS, Navisworks	1	1.9	1.9	66.0
AutoCAD, Revit, Robot, Safe, ETABS, Navisworks,	1	1.9	1.9	67.9
AutoCAD, Revit, Safe, ETABS, Navisworks, MS Project, Primavera	1	1.9	1.9	69.8
AutoCAD, Revit, Safe, ETABS, Navisworks, Synchro, MS Project	1	1.9	1.9	71.7
AutoCAD, Revit, Safe, ETABS, Navisworks, Synchro, MS Project, Primavera	2	3.8	3.8	75.5
AutoCAD, Revit, Safe, ETABS, Primavera	1	1.9	1.9	77.4

AutoCAD, Revit, Safe, ETABS, Synchro, MS Project, Primavera	1	1.9	1.9	79.2
AutoCAD, Revit, Safe, SAB, ETABS	1	1.9	1.9	81.1
AutoCAD, Revit, Safe, SAB, ETABS, MS Project	1	1.9	1.9	83.0
AutoCAD, Revit, Safe, SAB, ETABS, Navisworks	1	1.9	1.9	84.9
AutoCAD, Robot, Safe, SAB, ETABS	1	1.9	1.9	86.8
AutoCAD, SAB, ETABS, Primavera	1	1.9	1.9	88.7
LCA life cycle assessment tools	1	1.9	1.9	90.6
MS Project	2	3.8	3.8	94.3
Primavera	1	1.9	1.9	96.2
Revit, Rhino	1	1.9	1.9	98.1
Revit, Robot, ETABS, Navisworks	1	1.9	1.9	100.0
Total	53	100.0	100.0	

The table shows that the highest percentage of respondents good at AutoCAD, 3D MAX, Revit, AutoCAD, Synchro and Naviswork with a percentage of 5.7%, followed by those with who good at ETABS, SAFE, MS Project and Primavera with a percentage of 3.8%, and good at the other software with 1.9%

Table (3-8) 8-Years of Experience in Project Management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5 - 10 Years	5	9.4	9.4	9.4
	Less than 5 Years	37	69.8	69.8	79.2
	More than 10 Years	11	20.8	20.8	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents had less than 5 years experience in project management with a percentage of 69.8%, followed by those with who had



experience more than ten years with a percentage of 20.8%, and the lowest level for those who had experience between 5-10 years

Table (3-9) 9- Kind of the project you participate

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Large – High Risk Projects	2	3.8	3.8	3.8
	Medium Size – Moderate Risk Projects	10	18.9	18.9	22.6
	Small – Low Risk Projects	32	60.4	60.4	83.0
	Small – Moderate Risk Projects	9	17.0	17.0	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents participated in small- low risk projects with a percentage of 60.4%, followed by those who participated in medium – moderate risk projects with a percentage of 18.9 %, that almost were equaled to those who participated in small – moderate risk projects with 17% and the lowest level for those who participated in large – high risk projects with 3.8%

Table (3-10) 10- What are the Approaches that your company must use to manage Projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agile/Scrum/Kanban	3	5.7	5.7	5.7
	Hybrid	10	18.9	18.9	24.5
	None	29	54.7	54.7	79.2
	PMBOK Based Approach	10	18.9	18.9	98.1
	Predictive	1	1.9	1.9	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents replied that no approaches had been followed to managing projects in their company with a percentage of 54.7%, followed by a percentage of 18.9 % to companies followed PMBOK Based Approach equaled to companies percentages followed hybrid approach followed by 2.7% for companies that

followed agile/scrum / kanban and the lowest level were 1.9% for companies followed predictive approach

Table (3-11) 11-Does your Company Use any method to identify Project Risks?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Don't Know	13	24.5	24.5	24.5
	No	25	47.2	47.2	71.7
	Yes	15	28.3	28.3	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents for companies didn't use a method to identify risks with a percentage of 47.2%, followed by companies used a method to identify risks with a percentage of 28.3 %, but 24.5% of respondents didn't know if their companies use any specific method to identify risks

Table (3-12) 12- Does Your Company have a (Project Management Office) PMO?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	41	77.4	77.4	77.4
	Yes	12	22.6	22.6	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents for companies didn't have PMO with a percentage of 77.4% and 22.6% of companies had PMO

Table (3-13) 13- Does Your Company use New Technologies to manage Projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	34	64.2	64.2	64.2
	Yes	19	35.8	35.8	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents for companies didn't use new technologies to manage projects with a percentage of 64.2% and 35.8% of companies used new technologies.

Table (3-14) 14-Types of Project Management training offered by the organization?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agile	2	3.8	3.8	3.8
	Agile, Risk Management	1	1.9	1.9	5.7
	None	18	34.0	34.0	39.6
	PMP Project Management Professional	4	7.5	7.5	47.2
	PMP Project Management Professional, Risk Management	1	1.9	1.9	49.1
	Project Management	8	15.1	15.1	64.2
	Software trainings (Primavera, MS project, Synchro...)	19	35.8	35.8	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents were offered PM training (Software training) in their organizations with a percentage of 35.8% that almost equaled to those who didn't offered training with 34% followed to those who offered training in PM with 15.1% followed with 7.5% to those who offered PMP training and 3.8% for Agile training. and the lowest percentages to those who offered Risk Management 1.9%

Table (3-15) 1- Your organization follows a clear methodology for managing projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	17	32.1	32.1	32.1
	Disapprove	11	20.8	20.8	52.8
	Strongly Approve	5	9.4	9.4	62.3
	Strongly Disapprove	4	7.5	7.5	69.8
	Undecided	16	30.2	30.2	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve that their organization following a clear methodology for managing projects with a percentage of 32.1% followed by 30.2 didn't decide, 9.4% strongly approve and the lowest strongly disapprove.

Table (3-16) 2- Your organization is well known enough with core agile practices at present

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	14	26.4	26.4	26.4
	Disapprove	13	24.5	24.5	50.9
	Strongly Approve	5	9.4	9.4	60.4
	Strongly Disapprove	6	11.3	11.3	71.7
	Undecided	15	28.3	28.3	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents didn't decide that their organization well known enough with core agile practices with a percentage of 28.3% followed by 26.4% approved, and with 24.5% strongly disapproved, and the lowest strongly disapprove with 9.4%.

Table (3-17) 3- The organization structure supports use of agile methods

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	13	24.5	24.5	24.5
	Disapprove	15	28.3	28.3	52.8
	Strongly Approve	4	7.5	7.5	60.4
	Strongly Disapprove	6	11.3	11.3	71.7
	Undecided	15	28.3	28.3	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents disapproved and undecided that their organization structure supports using agile methods with a percentage of 28.3% followed by 24.5% approved, 11.3% strongly disapproved and the lowest strongly approved with 7.5%.

Table (3-18) 4- Team members have the willingness to learn and change

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	19	35.8	35.8	35.8
	Disapprove	6	11.3	11.3	47.2
	Strongly Approve	17	32.1	32.1	79.2
	Strongly Disapprove	1	1.9	1.9	81.1
	Undecided	10	18.9	18.9	100.0
	Total	53	100.0	100.0	

The table shows that percentages of respondents almost equaled between approved or disapproved

Table (3-19) 5- Team members have strong interpersonal and communications skills

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	29	54.7	54.7	54.7
	Disapprove	7	13.2	13.2	67.9
	Strongly Approve	9	17.0	17.0	84.9
	Strongly Disapprove	2	3.8	3.8	88.7
	Undecided	6	11.3	11.3	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approved and strongly approved that team members had strong interpersonal and communications skills with percentage of 71.7% and 11.3% undecided

Table (3-20) 6- Team members have collaborative attitude

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	29	54.7	54.7	54.7
	Disapprove	5	9.4	9.4	64.2
	Strongly Approve	7	13.2	13.2	77.4
	Strongly Disapprove	3	5.7	5.7	83.0
	Undecided	9	17.0	17.0	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that team members have collaborative attitude with a percentage of 67.9% and 17 not decided

Table (3-21) 7- To what extent you think the use of agile methods allow to predict the delivery of projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	1	1.9	1.9	1.9
	40% - 60%	7	13.2	13.2	15.1
	60% - 80%	32	60.4	60.4	75.5
	More than 80%	13	24.5	24.5	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that agile method allow to predict the delivery pf projects with a percentage of 84.6%

Table (3-22) 8- To What extent you think using Agile enables achieving business value

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	40% - 60%	9	17.0	17.0	17.0
	60% - 80%	27	50.9	50.9	67.9
	More than 80%	17	32.1	32.1	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that agile method enables achieving business value with a percentage of 83%

Table (3-23) 9- Keys to Project Success?

- o **Team's Technical Skill**
- o **Interactive Communication**
- o **Good Project Management Approach**
  - o **Risk Management**
  - o **Change Management**
- o **Effective stakeholder engagement**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	24	45.3	45.3	45.3
	Disapprove	2	3.8	3.8	49.1
	Strongly Approve	27	50.9	50.9	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved about keys to project success with a percentage of 96.2%

Table (3-24) 10- Barriers to Project Success:

- o **Inaccurate requirements**
- o **Change in project objectives**
- o **undefined Risks**
- o **Poor Communication**
- o **Confusion with team Roles & Responsibilities**
- o **Inadequate Cost estimates**
- o **Inadequate Duration estimates**
- o **Not Engaging stakeholders early in the project**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	22	41.5	41.5	41.5
	Disapprove	2	3.8	3.8	45.3
	Strongly Approve	27	50.9	50.9	96.2
	strongly Disapprove	1	1.9	1.9	98.1
	Undecided	1	1.9	1.9	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved about barriers to project success with a percentage of 92.4%

Table (3-25) 1- To what extent you think the impact of Risk Management application is really effective in Project Success

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	1	1.9	1.9	1.9
	40% - 60%	3	5.7	5.7	7.5
	60% - 80%	20	37.7	37.7	45.3
	Less than 20%	1	1.9	1.9	47.2
	More than 80%	28	52.8	52.8	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that the impact of Risk Management application is really effective in Project Success with a percentage of 90.5%

Table (3-26) 2- To what extent risk management is applied in your organization?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	2	3.8	3.8	3.8
	40% 60%	1	1.9	1.9	5.7
	40% - 60%	1	1.9	1.9	7.5
	60% - 80%	47	88.7	88.7	96.2
	Less than 20%	2	3.8	3.8	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve that Risk Management is applied in their organizations with a percentage of 88.7%



Table (3-27) 3- To what extent Your organization considers Risk in determining the best action through managing projects?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	17	32.1	32.1	32.1
	40% - 60%	1	1.9	1.9	34.0
	40% - 60%	10	18.9	18.9	52.8
	60% - 80%	13	24.5	24.5	77.4
	Less than 20%	11	20.8	20.8	98.1
	More than 80%	1	1.9	1.9	100.0
	Total	53	100.0	100.0	

The table shows that percentages almost were equaled between approved and disapproved

Table (3-28) 4- The best course to identify Risks in Projects through:

**o Historical Information**

**o Brainstorming**

**o Interviews**

**o SWOT Analysis**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	32	60.4	60.4	60.4
	Disapprove	2	3.8	3.8	64.2
	Strongly Approve	16	30.2	30.2	94.3
	Undecided	3	5.7	5.7	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved about the best course to identify risks in projects with a percentage of 93.6%

Table (3-29) 5- Your organization documents historical information about risks identifies in previous projects

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Approve	24	45.3	45.3	45.3
	Disapprove	9	17.0	17.0	62.3
	Strongly Approve	8	15.1	15.1	77.4

strongly Disapprove	1	1.9	1.9	79.2
Undecided	11	20.8	20.8	100.0
Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that their organization documents historical information about risks identifies in previous projects with a percentage of 58.4%

Table (3-30) 6- To what extent you are familiar with SCRUM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	6	11.3	11.3	11.3
	40% - 60%	13	24.5	24.5	35.8
	60% - 80%	12	22.6	22.6	58.5
	Less than 20%	18	34.0	34.0	92.5
	More than 80%	4	7.5	7.5	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents almost were equaled between approved and strongly approved about to what extent their familiar with SCRUM

Table (3-31) 7- To what extent you think applying new methodology (Scrum) is effective in managing project risks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	10	18.9	18.9	18.9
	40% - 60%	9	17.0	17.0	35.8
	60% - 80%	22	41.5	41.5	77.4
	Less than 20%	4	7.5	7.5	84.9
	More than 80%	8	15.1	15.1	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that applying scrum effective in managing projects with a percentage of 56.6%

Table (3-32) 8- To what extent you are familiar with KANBAN

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	10	18.9	18.9	18.9
	40% - 60%	15	28.3	28.3	47.2
	60% - 80%	11	20.8	20.8	67.9
	Less than 20%	16	30.2	30.2	98.1
	More than 80%	1	1.9	1.9	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents almost were equaled between approved and strongly approved about to what extent their familiar with Kanban

Table (3-33) 9- To what extent you think applying new methodology (KANBAN) is effective in managing project risks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	14	26.4	26.4	26.4
	60% - 80%	25	47.2	47.2	73.6
	Less than 20%	9	17.0	17.0	90.6
	More than 80%	5	9.4	9.4	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that applying scrum effective in managing projects with a percentage of.55.6%

Table (3-34) 1- How important do you think BIM use is for more effective architecture, engineering and construction (AEC) companies?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	5	9.4	9.4	9.4
	40% - 60%	3	5.7	5.7	15.1
	60% - 80%	8	15.1	15.1	30.2
	More than 80%	37	69.8	69.8	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that BIM use is really effective and important with a percentage of.84.9%

Table (3-35) 2- To what extent you are aware of Roles and Responsibilities that BIM Provides?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	5	9.4	9.4	9.4
	40% - 60%	6	11.3	11.3	20.8
	60% - 80%	11	20.8	20.8	41.5
	Less than 20%	5	9.4	9.4	50.9
	More than 80%	26	49.1	49.1	100.0
	Total	53	100.0	100.0	

The table shows that the highest percentage of respondents approve and strongly approved that they aware of roles and responsibilities BIM offers with a percentage of 69.9%

Table (3-36) 3- To what extent government play leading role in promoting BIM implementation?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	14	26.4	26.4	26.4
	40% - 60%	12	22.6	22.6	49.1
	60% - 80%	7	13.2	13.2	62.3
	Less than 20%	10	18.9	18.9	81.1
	More than 80%	10	18.9	18.9	100.0
	Total	53	100.0	100.0	

The table shows that the percentage of respondents almost were equal between approved and strongly approved from one hand to disapproved and strongly disapproved

Table (3-37) 4- To What extent new technologies (Hardware – software ..) are available in your organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	13	24.5	24.5	24.5
	20% - 60%	1	1.9	1.9	26.4
	40% - 60%	12	22.6	22.6	49.1

60% - 80%	17	32.1	32.1	81.1
Less than 20%	7	13.2	13.2	94.3
More than 80%	3	5.7	5.7	100.0
Total	53	100.0	100.0	

The table shows that the percentage of respondents almost were equaled between approved and strongly approved from one hand to disapproved and strongly disapproved

Table (3-38) 5- To what extent the business environment is suitable for building strong relationships with management in your organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	16	30.2	30.2	30.2
	40% - 60%	15	28.3	28.3	58.5
	60% - 80%	9	17.0	17.0	75.5
	Less than 20%	3	5.7	5.7	81.1
	More than 80%	10	18.9	18.9	100.0
	Total	53	100.0	100.0	

The table shows that the percentage of respondents almost were equaled between approved and strongly approved from one hand to disapproved and strongly disapproved

Table (3-39) 6- To what extent an interactive communication system is available between various departments in your organization?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	12	22.6	22.6	22.6
	40% - 60%	14	26.4	26.4	49.1
	60% - 80%	20	37.7	37.7	86.8
	Less than 20%	4	7.5	7.5	94.3
	More than 80%	3	5.7	5.7	100.0
	Total	53	100.0	100.0	

The table shows that the percentage of respondents almost were equaled between approved and strongly approved from one hand to disapproved and strongly disapproved

Table (3-40) 7- To what extent you think BIM is important to reduce change orders number

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	3	5.7	5.7	5.7
	40% - 60%	6	11.3	11.3	17.0
	60% - 80%	15	28.3	28.3	45.3
	more than 80%	1	1.9	1.9	47.2
	More than 80%	28	52.8	52.8	100.0
	Total	53	100.0	100.0	

The table shows that the percentage of respondents approved and strongly approved that BIM is important to reduce change orders number with a percentage of 81.1%

Table (3-41) 8- To what extent you think BIM is really effective in mitigating the potential effects of risk.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20% - 40%	3	5.7	5.7	5.7
	40% - 60%	4	7.5	7.5	13.2
	60% - 80%	17	32.1	32.1	45.3
	More than 80%	29	54.7	54.7	100.0
	Total	53	100.0	100.0	

The table shows that the percentage of respondents approved and strongly approved that BIM is BIM is really effective in mitigating the potential effects of risk. with a percentage of 86.6%

The result analysis shows that there is sufficient awareness of risk management importance un construction industry projects in Syria and a lower to a moderate segment of engineers possessing the necessary tools and skills in project management such as international professional certificates, training courses and software application.

# CHAPTER 4

## PROPOSALS

## CHAPTER 4

### 4. Proposals

#### 4.1 Development Risk management Framework

Based on the results of the questionnaire and analysis of the results, a proposal for Risk Management Framework was developed based on three Pillars

I- Risk Management Office (RMO)

II- Risk Processes

III- Roles

##### 4.1.1 Risk Management Office:

Risk Management Office (RMO) is an organizational structure linked directly to the General Manager of the organization or contracting company. The office is headed by the Risk Manager and consists of the following departments:

- ✓ The Consult Office, headed by a Risk Expert
- ✓ Risk Follow-Up Office, headed by Risk Owner
- ✓ Logistics Support Office, headed by Logistics Support Officer

Logistics Support Office consists of:

- ❖ Internal & Externals Relation Unit
- ❖ Internal & External Reports Unit
- ❖ Documentation Unit



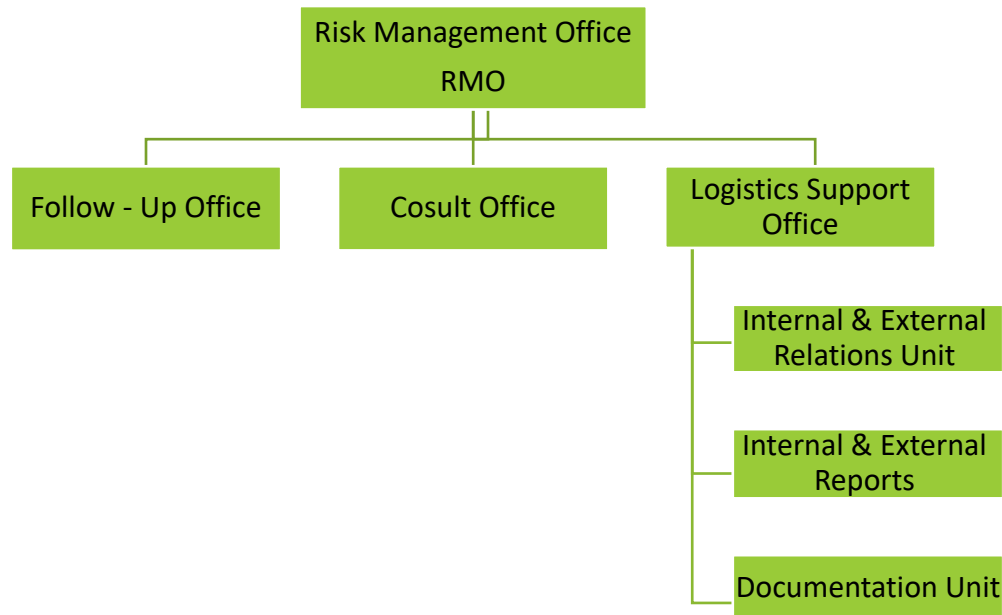


Figure (4-1) Risk Management Office (RMO) Organizational Structure (Author, 2023)

The responsibilities of a RMO can range from providing a consultative role to projects by supplying templates , best practices, training, access to information, and lessons learned from other projects to monitoring role.

RMO serves as a project risks repository and as an auditor to risk management processes.

The RMO may:

- Make recommendations, Lead knowledge transfer.
- A primary function of a RMO is to support Risk Owners in a variety of ways, which may include but are not limited to:  
Coaching, mentoring, training, and oversight.
- Monitoring compliance with risk management standards, policies, procedures, and templates by means of project audits.
- Developing and managing project policies, procedures, templates, and other shared documentation (organizational process assets); and  
Coordinating communication across projects.

#### 4.1.2 Risk Processes:

The outcome of construction Projects is accomplished through the applicable and integration of three phases: Design – Implementation - Operation.

In this proposal, it was considered each phase is a project with five processes (Initiating – Executing – Monitoring and Controlling – Closing). With separate Risk Processes in each phase.

Kanban Methodology with Scrum Ceremonies are applied in this proposal to manage project risks. So it was named each phase by an iteration or sprint.

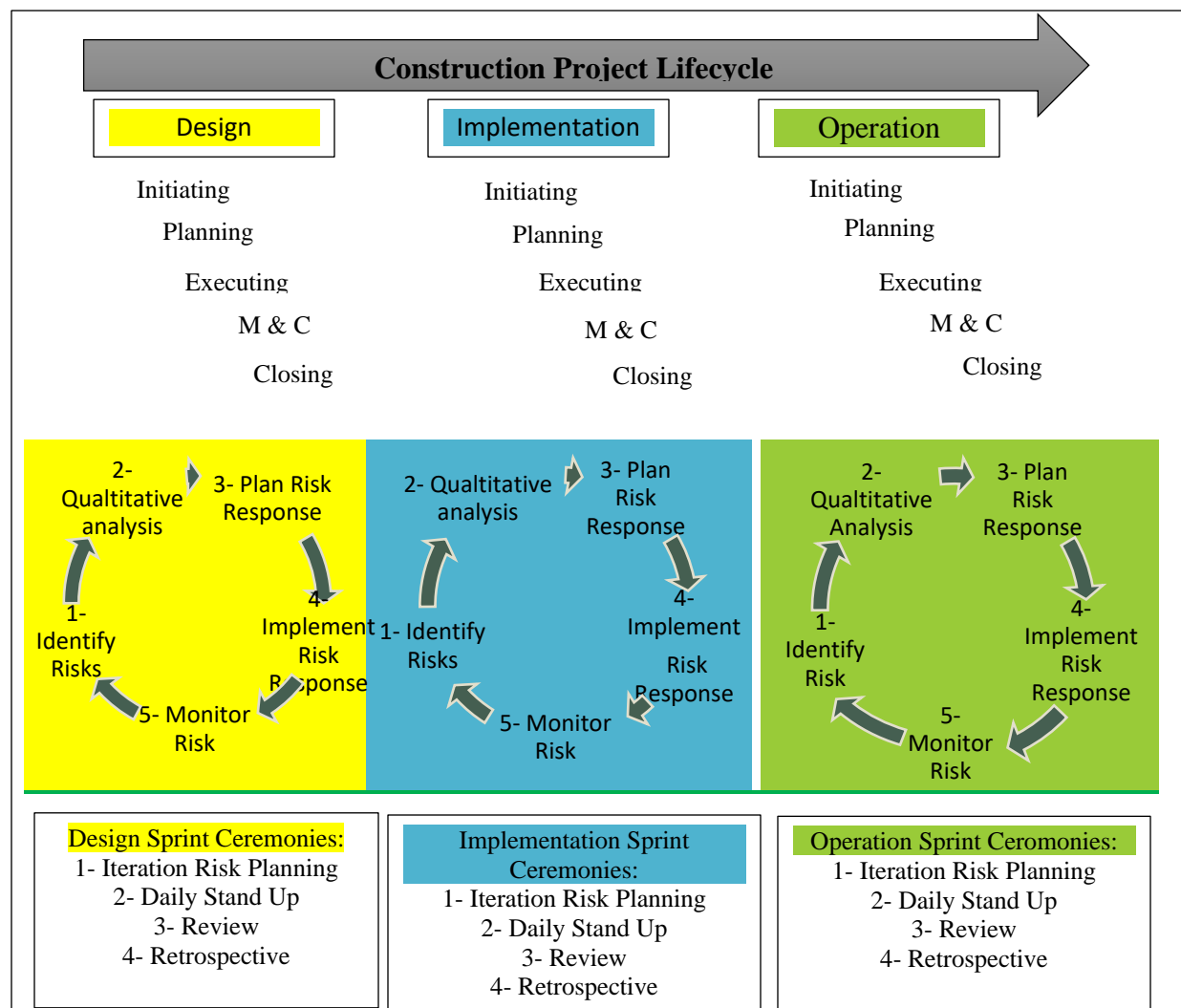


Figure (4-2) Shows Risk Management Process Based on Scrum/Kanban (Author, 2023)

#### 4.3.1.2.1 How the Process Works?

##### 1- Identify Project Risks:

Risk Owner with Risk Experts are responsible to identify project risks and to document all project risks in Risk Register (Sousa Neto, et al. 2023):

ID	Risk Description	Risk Category	Risk Action Owner	quantitative Analysis	Response Strategy	Risk Trigger	Risk Status

Figure (4-3) Shows Risk Register Example (John Wiley & Sons, 2017)

In this process all identified risks should be categorized and risk action owners should be stated for each one those identified risks, in order to perform qualitative risk analysis later. Every risk and corresponding risk responses should have been allocated to a risk action owner as part of the Identify Risks process. (Project Management Institute, 2019).

Risk Identification should depend on stakeholder collaborative and business environment. (Esteki M. G.,et al. 2020)

##### 2- Perform Qualitative Risk Analysis:

Risk Owner and Risk Experts are responsible for this process, Risk Action Owner could help.

In this process all identified project risks are prioritized and rated from High Priority – Medium – Low to Nil Priority. The outcomes of this process should be stated in the risk register.

After that Risk Owner should Prepare and Refine Risk Backlog:

Risk owner documents all identified project risks in the Risk Backlog then he refines the risk backlog through Refinement Meeting in order to prioritize and rate risks from most high priority to nil priority (Marle, F 2020), according to outputs

of Perform qualitative Risk Analysis Process as following and according to other risk assessments parameters (urgency – proximity – dormancy – manageability – controllability – connectivity – strategic impact and propinquity).

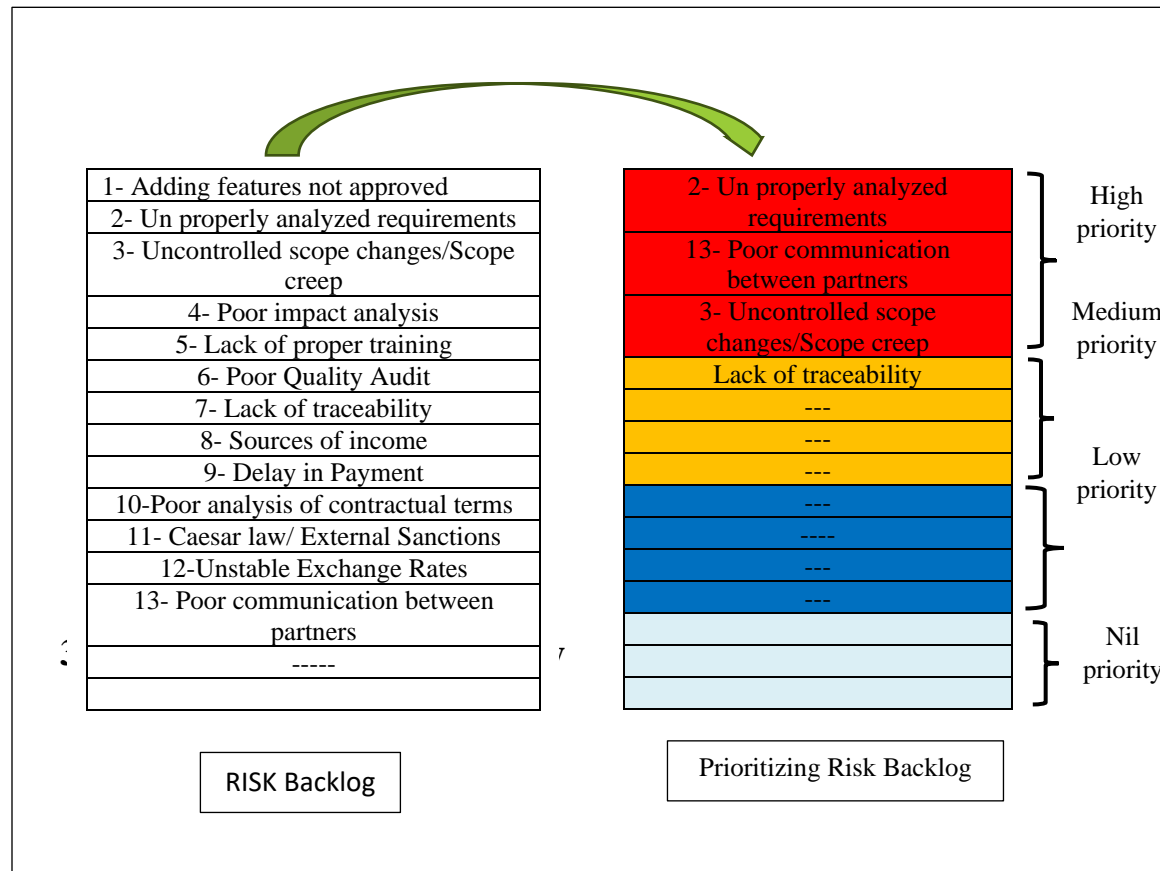


Figure (4-4) Shows RISK BACKLOG and Risk Backlog Prioritizing (Author, 2023)

Risk Owner, Risk Experts and Risk Action Owner are responsible for this Process.

The output of this process which should be documented in the risk register:

- ✓ Agreed-upon response strategies;
- ✓ Specific actions to implement the chosen response strategy;
- ✓ Trigger conditions, symptoms, and warning signs of a risk occurrence;
- ✓ Budget and schedule activities required to implement the chosen responses.
- ✓ Contingency plans and risk triggers that call for their execution.
- ✓ Fallback plans for use when a risk that has occurred and the primary response proves to be inadequate.

### **3- Plan Risk Response Strategy**

#### **4- Preparing to Implement Risk Response Strategies:**

Risk Action Owners are responsible for this process.

According to urgency and high priority project risks in the risk backlog. Risk Action Owners pull the high priority project risks and put it in Risk Progress implementation list.

#### **5- Implement Risk Response Strategies:**

The most priority risks and risk that appears its trigger should be implemented first.

The risk owner is responsible for ensuring that the risk response is effective and for planning additional risk responses if required .

The risk action owner is responsible for ensuring that the agreed-upon risk responses are carried out as planned, in a timely manner.

#### **6- Monitor Project Risks**

This process is achieved by these three ceremonies:

##### ✓ Daily Stand – Up Meeting

After ending the process of Plan Risk response Strategies a Daily Stand – Up Meeting should be held by risk action owners every day in the same place at the same time and they should answer to three questions?

- 1- What Risks we Encountered yesterday?
- 2- What Risk should we deal with today (any triggers)?
- 3- Any problem with risk response strategies?

This 15 minutes every day meeting provides transparency to risk processes flow and also provides which is risks is outdates and if new ones appear.

##### ✓ Review Meeting

This meeting is held periodically in order to track identified risks, monitor residual risks, identify new risks, ensure that risk response plans are executed at the appropriate time, and evaluate their effectiveness throughout the project life cycle.

Risk action owner should keep risk owner aware of status of the response actions so that risk owner can decide when risk has been effectively dealt with, or whether additional actions need to be planned and implemented.

It is the responsibility of the risk action owner to ensure that trigger conditions are effectively monitored and the corresponding actions are carried out as defined, in a timely manner.

Risk manager should ensure that periodic risk reassessment, including risk identification, analysis, and response planning, is repeated in response to project events .

So in Review Meeting two essential things should be attention to:

- Risk Reassessment: in order to (1) Identify new risks, (2) Reassessment of current risks and (3) Closing of risks that are outdated.
- Risk Audit: in order to (1) Examine and document the effectiveness of risk responses in dealing with identified risks and their root causes and (2) Examine and document Effectiveness of the risk management process.
- Status Reviews: here an agenda should be prepared by risk owner in order to document these following
  - \* Top priority risks at present (Are there any changes?)
  - \* Risks or trigger conditions that have occurred (What is the status of the actions?)
  - \* Risks responded to in the last period (Effectiveness of actions taken & Are there any additional actions required?)
  - \* Risks closed in the last period (Impact on the plans)
- ✓ Retrospective Meeting:

This meeting is held after closing any risk and during closing process of the project. Risk action owners review their work, identify opportunities for improvement risk processes in subsequent sprints and document lessons learned and review of the risk owner's feedback about the last iteration. They DISCUSS:

- \*What worked well?
- \*What didn't work well?
- \*What can we improve upon for next time?

To Do	On Progress	Audit	Done
<div>2- Un properly analyzed requirements</div> <div>13- Poor communication between partners</div> <div>3- Uncontrolled scope changes/Scope creep</div> <div>7- Lack of traceability</div> <div>----</div> <div>----</div> <div>----</div> <div>----</div> <div>----</div>	<div>Risk 2</div> <div>Risk 7</div> <hr/> <div>Limit the Progress</div>	Risk 13	Risk 3
All Prioritized risks are listed by Risk Owner in the (To Do) List	Risk Action Owners pull the high priority project risks and put it in (On Going) List		Risk Owner decides what Risk is Closed according to Review meeting
<b>Risk Refinement Meeting:</b> <ul style="list-style-type: none"> <li>- Risk Owner Responsibility</li> <li>- Rating Risks from the most high priority risk to nil risk</li> </ul>	<b>Risk Planning Meeting:</b> <ul style="list-style-type: none"> <li>- Risk Action Owners Responsibility</li> <li>- Pulling the most urgency risks from To Do list to On Progress List</li> </ul>	<b>Risk Review Meeting:</b> <ul style="list-style-type: none"> <li>- Risk Reassessment</li> <li>- Risk Audit</li> <li>- Risk Reviews</li> </ul>	<b>Risk Retrospective Meeting:</b> <ul style="list-style-type: none"> <li>- What worked well?</li> <li>- What didn't work well?</li> <li>- Improvements?</li> <li>- Lessons Learned</li> </ul>
<b>Daily Stand-Up Meetings</b> <ul style="list-style-type: none"> <li>- Held by Risk Action Owners</li> </ul>	<b>Daily Stand-Up Meetings</b> <ul style="list-style-type: none"> <li>- Held by Risk Action Owners</li> </ul>	<b>Daily Stand-Up Meetings</b> <ul style="list-style-type: none"> <li>- Held by Risk Action Owners</li> </ul>	

Figure (4-5) Shows Risk Processes Based on Kanban Boards and Scrum Ceremonies

(Author, 2023)

### 4.1.3 ROLES:

#### ❖ **Risk Manager:**

Responsible for:

- The effectiveness of the risk management processes
- Ensuring periodic risk reassessment, including risk identification, analysis, and response planning, is repeated in response to project events

#### ❖ **Risk Owner:**

Responsible for

- Identify project risks
- Prepare Risk Backlog and prioritize Risk Backlog
- Risk Reassessment
- Risk Audit
- Status Reviews
- Decides which risk is closed

#### ❖ **Risk Action Owners:**

Responsible for:

- Pulling the most high risk from to do list to on going list
- Implement risk response strategies
- Ensuring that the agreed-upon risk responses are carried out as planned, in a timely manner.

### 4.2 Adapting BIM as a Risk Mitigation Strategy:

Considering that most of the construction industry risks come from the fact that the projects do not meet business needs or economic feasibility, and that the design drawings are usually insufficient for construction, and there are risks of wasting the resources used in construction. (CMAA Owners survey 2005, 2005,2007,2002)

And considering that resorting to BIM is a good escape from the heavenly problems that may occur in construction industry projects



So as a result of analyzing the results of the questionnaire, and according to previous study (Safour, et al. 2021) it was found that BIM maturity level in Syrian construction industry is in the process of ascending to the level 1. It could be implemented BIM as a risk mitigation response strategy.

# CHAPTER 5

## CONCLUSION & RECOMMENDATIONS

## CHAPTER 5

### 5.1 Conclusion:

In the context of the rapidly changing environment and the complexity of projects Risk management is being the cornerstone for project success.

This research proposed a risk management framework deploys both of risk management processes and Scrum ceremonies within Kanban Boards. as an effective method to focus on continuous risk monitoring, and an easy method to apply.

Risk management processes in this framework could be integrated with any project management methodology. Also Risk Management Office (RMO) could be consolidated within the related organization structure

This research also suggested adapting BIM as an effective strategy to mitigate construction project risks.

### 5.2 Recommendations:

- Diligent work to disseminate risk culture management at the organization level in particular and at the country level in general through intensive workshops and continuous seminars to introduce effective risk management tools, techniques and methods.
- Working to spread the culture of new technologies as an effective methods for project management among engineers from the university stage until project site .
- Emphasis on making BIM a priority for Syrian Engineers Syndicate and
- Analyzing strengths and weaknesses of the relative organization to fill gaps before applying the proposed risk framework.

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## 7. Appendix:

### Survey Questions:

#### I- Demographic and Company information:

##### 1- Age

- ☐ 25 – 30
- ☐ 31 – 39
- ☐ 40 – 49
- ☐ 50-

##### 2- Gender

- ☐ Female
- ☐ Male

##### 3- Qualifications

- ☐ High Diploma Certificate
- ☐ Bachelor Degree
- ☐ Master Degree
- ☐ PhD Degree

##### 4- Field Of Study

- ☐ Civil engineering
- ☐ Architecture Engineering
- ☐ MEB Engineering
- ☐ Other

##### 5- What best describe your current Position:

- ☐ Research engineer
- ☐ Supervisor engineer
- ☐ Site Engineer
- ☐ Project manager
- ☐ Contractor

- Designer
- Tester
- Business analyst
- Other

6- Certification that You hold

- PMP
- PRINCE2
- CAPM
- PMI\_ACP
- PMI\_RMP
- SCRUM
- ISO
- ITIL
- COBIT
- SIX SIGMA
- Other

7- Software You are good at:

- AutoCAD
- 3D MAX
- Revit
- ArchiCAD
- Rhino
- Robot
- Safe
- SAB
- ETABS
- Navisworks

- Synchro
- MS project
- Primavera
- Bentley
- Ecotec
- Other

8- Years of Experience in Project Management

- Less than 5 years
- Between 5 – 10 years
- More than 10 years

9- Kind of the project you participate:

- Small – Low Risk Projects
- Small – Moderate Risk Projects
- Medium Size – Moderate Risk Projects
- Large – High Risk Projects

10- What are the Approaches that your company must use to manage Projects?

- PMBOK Based Approach
- PRINCE2
- AGILE/SCRUM/KANBAN
- Hybrid
- None
- Others

11- Does your Company Use any method to identify Project Risks?

- Yes
- No
- Don't Know



- 12- Does Your Company have a (Project Management Office) PMO?
  - Yes
  - No
- 13- Does Your Company use New Technologies to manage Projects
  - Yes
  - No
- 14- Types of Project Management training offered by the organization?
  - Project Management
  - Project management Professional "PMP"
  - Agile
  - Software trainings (Primavera, MS project, Synchro...)
  - Risk Management
  - None
  - Other

## II- Agile Project Management:

- 15- Your organization follows a clear methodology for managing projects?
- 16- Your organization is well known enough with core agile practices at present
- 17- The organization structure supports use of agile methods
- 18- Team members have the willingness to learn and change
- 19- Team members have strong interpersonal and communications skills
- 20- Team members have collaborative attitude
- 21- To what extent you think the use of agile methods allow to predict the delivery of projects?
- 22- To What extent you think using Agile enables achieving business value

23- Keys to Project Success?

- Team's Technical Skill
- Interactive Communication
- Good Project Management Approach
- Risk Management
- Change Management
- Effective stakeholder engagement

24- Barriers to Project Success:

- Inaccurate requirements
- Change in project objectives
- Undefined Risks
- Poor Communication
- Confusion with team Roles & Responsibilities
- Inadequate Cost estimates
- Inadequate Duration estimates
- Not Engaging stakeholders early in the project

### III- Scrum Risk Management:

25- To what extent you think the impact of Risk Management application is really effective in Project Success

26- To what extent risk management is applied in your organization?

27- To what extent Your organization considers Risk in determining the best action through managing projects?

28- The best course to identify Risks in Projects through:

- Historical Information
- Brainstorming
- Interviews

- SWOT Analysis

- 29- Your organization documents historical information about risks identifies in previous projects
- 30- To what extent you are familiar with Scrum?
- 31- To what extent you think applying new methodology (Scrum) is effective in managing project risks
- 32- To what extent you are familiar with KANBAN?
- 33- To what extent you think applying new methodology (KANBAN) is effective in managing project risks

#### V- BIM in Construction:

- 34- How important do you think BIM use is for more effective architecture, engineering and construction (AEC) companies?
- 35- To what extent you are aware of Roles and Responsibilities that BIM Provides?
- 36- To what extent government play leading role in promoting BIM implementation?
- 37- To What extent new technologies (Hardware – software ..) are available in your organization
- 38- To what extent the business environment is suitable for building strong relationships with management in your organization
- 39- To what extent an interactive communication system is available between various departments in your organization?
- 40- To what extent you think BIM is important to reduce change orders number
- 41- To what extent you think BIM is really effective in mitigating the potential effects of risk.

