Adopting Risk Management Professional Methodologies as an Effective Strategy to Protect Heritage Sites in Syria

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Abstract

Located at the crossroads of the Mediterranean with Nine millennia of civilization; Syria has had a rich, diverse, and stunning cultural legacy. There is an imperative to assess the current situation of Syrian heritage and develop a comprehensive and effective risk plan to protect this spectacular legacy due to the Syrian war. Considering each site as a single project, and adopting Risk Management Professional Methodologies as have been stated by Project Management Institute "PMI," we can effectively achieve valuable objectives through the following processes: 1) Plan Risk Management to develop the overall risk management strategy, 2) Identify Risks: Risk cannot be managed unless it is first identified, 3) Perform Qualitative Risk Analysis: To assess and evaluate characteristics of individually identified risks and prioritize them, 4) Perform Quantitative Risk Analysis for the most and critical sites, 5) Plan Risk Responses to determine the set of actions and put strategies for both Threats and Opportunities, 6) Monitor Risks to ensure the risks plans are executed at the appropriate time and evaluate their effectiveness

Keywords: Building Information Modelling (BIM); Heritage management; Project management institute; PMI; Risk; Rsk management professional

1. Introduction

The Syrian heritage is rich, diverse, and rooted in human civilizations, and this civilizational and cultural heritage extends over the entire Syrian land. But what happened in the last ten years had distorted many important historical monuments and threatened her distinction and identity. But, escalating violence in Syria since 2011 has had devastating effects on the historical and architectural legacy and the armed conflict has irreversible implications for the most significant and symbolic sites [1].

Therefore, it was necessary to develop a plan to manage the Risks that could threaten this invaluable legacy.

Although risks that may affect each site may vary or intersect according to the location, prevailing climate and environmental conditions, and the intensity of armed conflict, however, an individual risk management methodology can be developed for the whole Syrian heritage as a cornerstone for detailed sub-plans for each site, especially with the rapidly growing advancements in the construction industry and the arising pressure due to the continuously decreasing resources [27].

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This research has benefited from the methodology adopted by the Project Management Institute "PMI" for professional Risk Management and proposed Building Information Modelling (BIM) as an effective risk response strategy. As [2] BIM is rapidly growing worldwide as a viable tool for improving the efficiency of the AEC industry to solve its salient issues, [3] increases the quality, and profitability and improves projects' performance and efficiency. However, employees in public organisations in Syria are not familiar with BIM [25].

2. Related Work

Project Risk Management includes the processes concerned with conducting risk management planning, identification, analysis, responses, and monitoring. The objective of project risk management is to increase the probability and impact of positive events that may and decrease the probability and impact the negative events

Figure 1: Risk Management Processes

Project Risk management includes seven processes:

1- Plan Risk Management:

In order to get the risk management plan as a guideline that describes how risk management activities will be structured and performed for both threats and opportunities.

Table 1: Elements of Risk Management Plan

Document Elements	Description
Strategy	The general Approach
Methodology	How to use tools and approaches in each process
Roles & Responsibilities	Who will do what?
Risk Categories/RBS	grouping individual project risks in a hierarchal decomposition.
Risk Management Funding	funding needed
Frequency & Timing	frequency of formal risk management activities and the timing of any specific activities.
Stakeholder Risk Appetite	Identify the risk (thresholds – tolerance) of the organization(s)

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Risk Tracking & Audit	How risk activities will be tracked, assessed and audited
Definition of Probability	how probability will be measured and defined
Definition of Impact	how impact will be measured and
Probability & Impact matrix	Rate the risks as Low, Moderate, or High priority

1- Identify Risks:

It is a process to document anticipated risks that may affect the project.

Risk Identification should be:

- Performed early as possible
- Iterative, since not all risks can be identified at any given point of Heritage protection management.
- Emergent, any time, not limited to regular events or processes.
- Comprehensive, considering the broad and varied range of risk sources. In addition, make sure all opportunities are considered.
- Multiple perspectives, since identifying risks should be carried out by engaging a broad range of stakeholders to ensure all perspectives are considered.
- Should be clearly described at a level of detail.
- Should be objective without bias.

It could be distinguished three perspectives of Risk Identification for each site:

Historical Reviews (Past): Historical review approaches rely on careful selection of comparable situations which are genuinely similar to the current site and filtering of data to ensure that relevant previous risks are considered.

Tool & Technique: Checklists analysis, even though it is exhaustive to build one, it remains a simple, quick, and effective way to identify risks based on historical information that has been accumulated

In heritage sites, the following risks can be identified and grouped in a checklist and are not limited to:

Table 2: A Checklist with typical structure of Category, Subcategory and Potentiality

Site Name: ----------		
Risks Checklists		
Main Category	Subcategory	Potentiality Yes/no
Technical Risks	- Scope Definition	☐
	- Requirement Definition	☐
	- Estimates	☐
	- Assumption and Constraints	☐
	- Technology	☐
	- Technical Processes	☐
	- Complexity and Interfaces	☐
	- Performance and Reliability	☐
	- Quality	☐
Management Risks	- Project Management	☐
	- Organization	☐
	- Resourcing	☐
	- Communication	☐
	- Funding	☐

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Commercial Risks	- Contractual terms &Conditions	☐
	- Internal Procurement	☐
	- Suppliers and Vendors	☐
	- Subcontractors	☐
	- Partnership &Joint venture	☐
External Risks	- Legislation	☐
	- Exchange Rates	☐
	- Site/Facilities	☐
	- Environmental/Weather	☐
	- Regulatory	☐
	- Economic	☐
	- Social issues	☐
	- Development issues	☐

1- Current Assessment (Present): Unlike historical reviews, current assessment tools and techniques do not rely on external references but only on the examination of the site itself.

Tools & Techniques:

a- Assumption Analysis: Several project decisions are based on (conscious or unconscious) assumptions. Since each assumption could be false, each is a potential risk. It identifies risks to the project from inaccuracy, instability, inconsistency, or incompleteness of assumptions. An example is shown in Table.3:

Table 3: Example of an Assumption Analysis with fields for Description and Analysis Results

Site Name …….			
Assumption	Could be False Yes/No	If False → Would affect the project Yes/No	Convert to a Risk
All materials for maintenance & restoration Process would be in Time	Yes	yes	There is a risk of acquiring materials the project needs in Time
The tourist season is postponed until the restoration is completed	Yes/Exceptions could be occurred	Yes/ Restoration and Maintenance Process could stop	A Works could stop and thus the completeness date would be postponed
etc.	……..	……..	……

b- SWOT Analysis: 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.

Table 4: Example of SWOT analysis

Strengths	Weaknesses
- Accommodation facility - Clear approaches and guidelines methodologies - Lessons learned from previous projects etc.	- Lack of skilled resources - The scarcity of distinguished young cadres, most of whom left the country as a result of deteriorating living situation -Inadequate Hardware technology - Inadequate BIM (Building Information Modeling) experience/Complexity of BIM -Insufficient supplementary services etc.
Threats	**Opportunities**
-Changing demographics and cultures because of the migration -Armed conflict	-strict government policies towards heritage protection -heritage awareness and education campaigns organized by local youth organizations

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-Economic conditions etc.	-Digitization, technology development and the evolution of BIM (Building Information Modeling) etc.

1- Creativity Techniques (Future): Allow the stakeholders to imagine and anticipate probable events that would have an impact on the project.
Tools & Techniques:

a- Brainstorming: generating ideas to get a comprehensive list of project risks.
b- Delphi Technique: a gathering data technique used to reach a consensus of experts, who participate anonymously. It helps reduce bias in the data.

A facilitator sends out background information on the project along with questionnaire to each expert participant → The responses are summarized and re-circulated to the experts for further comment → Consensus may be reached in a few rounds of this process

c- Interviews: An interview is conducted with project participants, stakeholders and experts to identify risks.
d- Root – Cause – Analysis: determined to identify a problem, discover the underlying causes thar lead to it, and develop prevention actions. One way of diagramming Root Cause is shown in Figure 2.

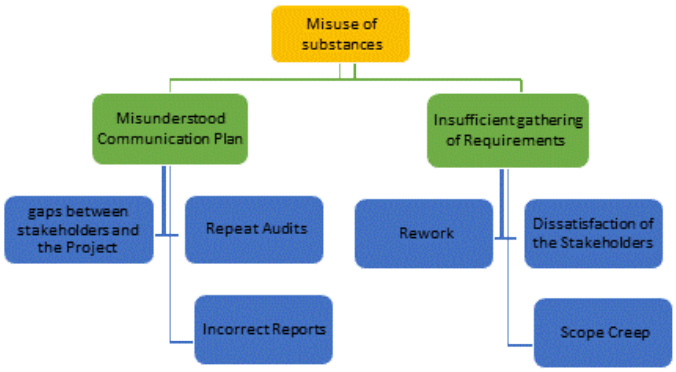

Figure2: Example of a Root Cause Analysis

a- Risk – Meta – Language: offers a useful way of distinguishing a risk from its cause(s) and effect(s) describing each risk using three parts of statement:

As a result of Cause → Risk may occur → which would lead to Effect.
Risk Breakdown Structure (RBS) can be used to organize the categories of potential risk on the project as shown in Table 5:

Table 5: Risk Breakdown Structure (RBS)

All Sources Of RISKS Level 0	1- Technical	1-1 Scope Definition	1-1-1 Adding features not approved 1-1-2 Un properly analyzed requirements 1-1-3 Uncontrolled scope changes/Scope creep [26] 1-1-4 Poor impact analysis
		1-2 Requirement Definition	1-2-1 Missing/Wrong stakeholders 1-2-2 Ambiguous requirements 1-2-3 Poor document analysis 1-2-4 Lack of traceability 1-2-5 Inadequate validation
		1-3 Estimates	1-3-1 Schedule estimation/ Basis of estimates 1-3-2 Cost estimation/Basis of estimates 1-3-3 Resources estimation/Basis of estimates
		1-4 Assumption and Constraints	1-4-1 Poor realistically analyzed assumptions

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			1-4-5 Poor identified Constraints
		1-5 Technology	1-5-1 Data security (hacking) – failed storage, lost or compromised hardware, corrupted files 1-5-2 Legacy systems 1-5-3 Unscalable software
		1-6 Technical Processes	1-6-1 Maintenance/Performance deficiency
		1-7 Complexity and Interfaces	1-7-1 can engender problems of connection and transmission as well as material, chemical-physical, aesthetic or related to technological compatibility
		1-8 Performance and Reliability	1-8-1 not taking into account the effects of the construction process and subsequent life of the architecture, which it may have undergone alteration, deterioration or misuse
		1-9 Quality	1-9-1 Lack of proper training 1-9-2 Lack of communication 1-9-3 Inability to integrate cross-functional interactions 1-9-4 No focus on Metrics/Quality objectives 1-9-5 Standards are not set 1-9-6 Poor Quality Audit 1-9-7 Weak quality management
	2- Management	2-1 Project Management	2-1-1 Un proper Project Management Plan 2-1-2 Inappropriate Archaeological excavations 2-1-3 Inappropriate Conservation/ Restoration/Maintenance 2-1-4 Tourism Concessioner Activities
		2-2 Organization	2-2-1 Organizational Culture/Structure
		2-3 Resourcing	2-3-1 Team capability 2-3-2 Resources availability 2-3-3 Geographic Distribution of Facilities and Resources 2-3-4 Poor Resource Management Plan
		2-4 Communication	2-4-1 Lack of coordination among multiple agencies 2-4-2 Poor Communication Management Plan
		2-5 Funding	2-5-1 Sources of income 2-5-2 Limited funds 4-5-3 Delay in Payment
		2-6 Prioritization	2-6-1 Insufficient prioritization skills
	3- Commercial	3-1 Contractual terms &Conditions	3-1-1 Poor analysis of contractual terms
		3-2 Internal Procurement	3-2-1 poor vendor selection
		3-3 Suppliers and Vendors	3-3-1 loss of important suppliers
		3-4 Subcontractors	3-4-1 loss of control
		3-5 Partnership &Joint venture	3-5-1 Poor communication between partners 3-5-2 The level of expertise and investment isn't equally matched
	4- External	4-1 Legislation	4-1-1 Caesar law/ External Sanctions
		4-2 Exchange Rates	4-2-1 Unstable Exchange Rates/Inflation
		4-4 Environmental/Weather	4-4-1 Climate change 4-4-2 Natural Threats: Collapse – Earthquake – Erosion (water – wind) –Light and UV – Fire (forest fire – gas leaks – faulty electrical installation ….) 4-4-3 Pests (insects – Rats – Birds – Bats) 4-4-4 Inadequate lights (Incandescent lamps) – Heaters … 4-4-5 Pollutants (industries – vehicles – constructions and renovation works – storage materials that emit gases ….
		4-5 Regulatory	4-5-1 Syrian Antiquities Law 4-5-2 Financial Regulation of UNESCO/the World Heritage Fund)
		4-6 Economic	4-6-1 Fiscal crises 4-6-2 Failure of national governance 4-6-3 Unemployment/underemployment
		4-7 Social issues	4-7-1 Conflict armed

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			4-7-2 Lack of military awareness 4-7-3 Accidental damage 4-7-4 Human Threats: Looting/theft – Military activities – Reuse of ancient Masonry/Structure – Bedouin Camp – Vandalism
		4-8 Development issues	4-8-1 Urbanization 4-8-2 Quarrying 4-8-3 Mining

The second output of Identify Risks Process is RISK REPORT: It includes sources, summary information, metrics, trends on identified project risks This report is progressively developed

1- Perform Qualitative Risk analysis:

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.

Tools & Techniques:

a- Risk Data Quality Assessment: Evaluates the degree to which the data about individual project risks is accurate and reliable.

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. The Main Sources of information to analyze Risks In Heritage Sites comes from Geographic Information System (GIS) – Climate table – Natural Disaster Data – Government Data – Shared Data between Heritage Organizations – Surveys – Sites Documentation – Technical and Scientific Experts – Building Design Documents….

c- Probability & Impact matrix: Rate the risks as low, moderate, or high priority. This helps finding risks need immediate response, risks need additional analysis, and risks need to be put on the watch list as shown in Figure 3.

Risk Probability & Impact Matrix							Probability				
Risk Potential Sources			External Risks	Commercial Risks	Management Risks	Technical Risks	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 3: Example of a probability & impact matrix

d- Risk Categorization: Risks to the project can be categorized by sources of risk. 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.

e- Risk Urgency Assessment: Risks requiring near-term responses may be considered more urgent to address.

Outputs of this Process is RISK REGISTER Updates:

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2- Perform Quantitative Risk Analysis:

The key value of this process is that it produces quantitative risk information to support decision making in order to reduce project uncertainty

3- Plan Risk Responses:

This process enables the development of detailed response plans for each individual risk, and to ensure the success of this process the following conditions must be met:

1- Clearly Define Risk Related Roles & Responsibilities
2- Provide schedule, budget and resources for risk responses
3- Risk response planning needs to take a comprehensive view of all proposed responses and to ensure their coherence.

Risk Response Strategies:

The following schedule shows the appropriate response method for each risk (threat or opportunity), in addition to some suggestions and recommendations as shown in Table 6.

Table 6: Suggestions and recommendations as risk response strategies:

1-1-1 Adding features not approved 1-1-2 Un properly analyzed requirements 1-1-3 Uncontrolled scope changes/Scope creep 1-1-4 Poor impact analysis	AVOID	- identify all stakeholders and classify their attitudes, expectations and requirements in stakeholder register. - engaging stakeholders early, trust building, transparency, the well-defined requirements, a clear definition of roles & responsibilities, collaboration [4] - collect site-related requirements - using laser scanning technique for sites severely affected by armed conflicts to uncover hidden requirements - adopt requirement traceability matrix - documenting all project scope and detailed deliverables
1-2-1 Missing/Wrong stakeholders 1-2-2 Ambiguous requirements 1-2-3 Poor document analysis 1-2-4 Lack of traceability 1-2-5 Inadequate validation		
1-3-1 Schedule estimation/ Basis of estimates 1-3-2 Cost estimation/Basis of estimates 1-3-3 Resources estimation/Basis of estimates	METIGATE	- estimate schedule/ cost/ resources using the right tools & techniques (Expert judgment – analogous – parametric – bottom-up) and
1-4-1 Poor realistically analyzed assumptions 1-4-5 Poor identified Constraints	METIGATE	- Identify all Assumptions and Constraints in an Assumption Log. - Detailed Analysis to all data mentioned in the Assumption Log
1-5-1 Data security (hacking) – failed storage, lost or compromised hardware, corrupted files 1-5-2 Legacy systems 1-5-3 Unscalable software	AVOID	- Cloud storage - Control employee access - Modernize systems with the highest effect and value. But for complex and severely damaged sites - Select BIM software follows the strategic objectives to Heritage Risk Management [5] - Select adequate Hardware - put a network solution for sharing information and controlling access (the use of a single software database system) [6]
1-6-1 Maintenance/Performance deficiency	METIGATE	- Provide regular feedback - Document everything

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		- using laser scanning technology and photogrammetry to collect the most detail, accuracy and in high quality
1-7-1 can engender problems of connection and transmission as well as material, chemical-physical, aesthetic or related to technological compatibility	METIGATE	- Collaboration & Co-operation between parties to tackle interfaces early - regular meetings to identify and manage new interfaces
1-8-1 not taking into account the effects of the construction process and subsequent life of the architecture, which it may have undergone alteration, deterioration or misuse	METIGATE	- Taking into account Actual characteristics of structural materials, actions, geometric data and structural behavior
1-9-1 Lack of proper training 1-9-2 Lack of communication 1-9-3 Inability to integrate cross-functional interactions 1-9-4 No focus on Metrics/Quality objectives 1-9-5 Standards are not set 1-9-6 Poor Quality Audit 1-9-7 Weak quality management	AVOID	- Set a Quality Management Plan - Training - Suitable tools - Detailed quality metrics/ standards and objectives - Continuous process improvement - Periodic Quality Audit
2-1-1 Un proper Project Management Plan 2-1-2 Inappropriate Archaeological excavations 2-1-3 Inappropriate Conservation/ Restoration/Maintenance 2-1-4 Tourism Concessioner Activities	METIGATE	- Detailed Project Management Plan - Expert, Trained and Well-Organized Team - Customize specific and safe sites for Tourism Concessioner Activities - development of new and more effective digital technologies, such as building information modeling, 3D modeling, laser scanning techniques, animation, and simulation for maintenance and restoration
2-2-1 Organizational Culture/Structure	METIGATE	- Effectiveness of risk committee and governance processes
2-3-1 Team capability 2-3-2 Resources availability 2-3-3 Geographic Distribution of Facilities and Resources 2-3-4 Poor Resource Management Plan	METIGATE	- Develop Resource management plan - Acquire right resources with right quantities just in time - Training and develop qualified team
2-4-1 Lack of coordination among multiple agencies 2-4-2 Poor Communication Management Plan	METIGATE	- Develop Communication management Plan - Analyze stakeholders communication requirements - proper information management (IM) platforms [7]
2-5-1 Sources of income 2-5-2 Limited funds 2-5-3 Delay in Payment	METIGATE	- Encourage private investment - Government support
2-6-1 Insufficient prioritization skills	METIGATE	- Periodic team assessment
3-1-1 Poor analysis of contractual terms	TRANSFER	- Develop Procurement Management Plan - Detailed statement of work - Set detailed Source selection criteria - analyze all partners communication requirements
3-2-1 poor vendor selection		
3-3-1 loss of important suppliers		
3-4-1 loss of control		
3-5-1 Poor communication between partners 3-5-2 The level of expertise and investment isn't equally matched		
4-1-1 Caesar law/ External Sanctions	AVOID	- Depend on local investments/ local materials
4-2-1 Unstable Exchange Rates/Inflation		
4-4-1 Climate change 4-4-2 Natural Threats: Collapse – Earthquake – Erosion (water – wind) –Light and UV – Fire	AVOID	- Avoid risky practices such as lighting candles…. - Avoid food and other attractants for pests

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(forest fire – gas leaks – faulty electrical installation ….) 4-4-3 Pests (insects – Rats – Birds – Bats) 4-4-4 Inadequate lights (Incandescent lamps) – Heaters … 4-4-5 Pollutants (industries – vehicles – constructions and renovation work – storage materials that emit gases …. waste disposal system, sewage supply, pollution [8]		- Adopting BIM to Reduce environmental impact: thermal analysis, carbon footprint [9]
4-5-1 Syrian Antiquities Law 4-5-2 Financial Regulation of UNESCO/the World Heritage Fund) 4-5-3 Foundations of BIM in Syrian Engineering Syndicate and contribution of Syrian virtual university through BIMM master's program	EXPLOIT	- assessing BIM maturity namely information, people, policy, process, technology, organization and BIM outputs [10] - detailed strategic and operational methodology should be developed to support the systematic improvement of BIM implementation [11] - develop an in-depth methodology for the implementation of BIM frameworks based on a given criterion [12] - exploit the goal of BIMM master's programs to produce future BIM Managers in multiple competencies and interests [13]
4-6-1 Fiscal crises 4-6-2 Failure of national governance 4-6-3 Unemployment/underemployment 4-6-4 Readiness to Change against adoption BIM [14]	METIGATE	- Producing BIM guides, protocols and mandates [15] - Spreading BIM culture among Syrian Engineers [16] and establishing standards to adopt BIM training in the right way [17]
4-7-1 Conflict armed 4-7-2 Lack of military awareness 4-7-3 Accidental damage 4-7-4 Human Threats: Looting/theft – Military activities – Reuse of ancient Masonry/Structure – Bedouin Camp – Vandalism 4-7-5 Lack of electricity power	METIGATE	- skylight system [18] - developing systems using clean energies [19] - using Electrospinning technique [20]
4-8-1 Urbanization 4-8-2 Quarrying 4-8-3 Mining	AVOID	

4- Implement Risk Response:

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.

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5- Monitor Risks:

Monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and evaluating risk process effectiveness throughout the project.

3. Conclusion:

The ultimate goal of heritage risk management is to achieve heritage sustainability in a systemic and professional approach and that can be achieved by:

- It is recommended to establish a specific structure for Syrian heritage risk management that sets policies and procedures and facilitate risk governance processes
- To ensure the effectiveness of risk management in Syrian heritage sites, emphasis must be placed on effective communication with stakeholders and all parties, given that identifying and analysing risks depends on comprehensive input from stakeholders.
- Developing a clear and detailed strategy to apply Building Information Modelling (BIM) [21] as an effective method to protect, preserve and maintain Syrian Heritage so that it is integrated with the heritage risk management plan.

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