



CONSTRAINTS IN SCOPE MANAGEMENT FOR TURNAROUND/SHUTDOWN PROJECTS

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ABSTRACT Turnarounds are unique maintenance projects with a high probability of having many constraints in scope of works which results in time delay, and cost overrun. Constraints are a regular and inevitable occurrence in project management and expected to deliver the results while dealing with them regularly. Management of uncertainty is an essential condition for effective project management. PMBOK® describes Project Scope as the “The work that needs to be accomplished to deliver a product, service, or result with the specified features and functions.” A well-defined and controlled scope will be the primary key to delivering a safe and successful turnaround, in agreed cost and within specified schedules to the organization. The purpose of the project management is to foresee or predict dangers and problems as possible; and to conclude, organize, control, report these so that the project is completed as successfully as possible despite all the risks. Negative effects stemming from such uncertainties can be eliminated by following best practices for turnaround projects. This explores principal constraints of scope management and industry best practices to overcome.

KEYWORDS : Project Management, Turnaround Management, Shutdown Management, Risk Management, Turnaround scope of works.

INTRODUCTION

Turnarounds, also known as shutdowns, are exclusive and complex maintenance projects executed within limited durations and with many scheduled activities. Regrettably, turnaround projects are highly likely to suffer significant impacts on Safety of workers or properties, Quality of maintenance, incurred cost, and execution time.

Workers and property safety impacted by safety critical activities. Quality of maintenance may be impacted by deficient performance of execution team. Incurred costs may be impacted by problems such as loss of production during turnaround execution. And execution time due to the discovery of unanticipated mechanical issues upon cleaning and inspection of machine parts that are not visible during operation.

In Turnaround projects, finalizing the Scope of works is one of major milestone. Any changes in scope also impacts preparation time, resources availability, safety of people and assets, Quality of job, cost of project and execution time.

In Turnaround projects, scope of works plays significant role in successful completion of the projects. Therefore, project managers must always focus on the constraints and be prepared for the solutions. This paper is concerned uncertainty present in Turnaround projects scopes and proposed industrial best practices to manage them. *Figure 1 Scope finalization life cycle* In this paper, there are five constraints discussed along with its industrial best practices to manage them properly.



LITERATURE REVIEW

In construction, many industries' standard best practices have been developed and are widely applied. Construction Industry Institute (2014) (CII)[21] developed many industrial best practices, including project risk assessment, quality management, and front-end planning. Best practices for advanced work packaging and workface planning developed by the Construction Owners Association of Alberta (2014) [22]. However, there is a lack of industry standard best practices developed specifically for constraints in scope management for turnaround and shutdown even though applicable best practices exist in published research literature. Industry practitioners were interested in implementing the best practices to better their organization's performance of turnaround and shutdown projects, would benefit from a comprehensive review summarizing available literature on best practices relevant to turnaround projects scope management; This paper provides such a review.

This paper includes two parts. In the first part, we perform a comprehensive review of constraints in scope management for turnaround projects. The literature review provides a collection of constraints from which all companies involved in turnaround projects can draw. In the second part of this paper, we therefore provide a generic industrial best practice for those constraints. This will enable any company that engages in turnaround projects to compare its existing company-specific practices with the published industry best practices we have reviewed and suggested. While managers and engineers involved in turnaround projects will benefit from the recommendations provided to manage their constraints in Turnaround scope management.

Deprived Participation Of Stakeholders.

Mohammed K. Fageha, Ajibade A. Aibinu [9] confirming that projects are achieving better results when positive involvement of requestors by attending the required meetings, sharing the obligatory information, and coordinating with other team members. Mohammed K. Fageha, Ajibade A. Aibinu [9] did research on two projects in Saudi Arabia as case studies and concluded that delays at the design stage of project for more than four years due to inappropriate stakeholders' involvement.

Olander and Landin [10] stated that conflict and controversies about the implementation of a project can arise if stakeholders are inadequately engaged and their concerns and expectations are not managed well. To avoid this, project managers need to engage all stakeholders when making decisions on project scopes. They need to acknowledge the concerns of all stakeholders and mitigate conflicting interests.

Early Closure Of Scoping Stages.

As described in PMI certification training, the PMP Scope

Management defines what work is required and makes sure that all this work and only this work is done. The Scope collection, screening and finalization is one of the important milestones of the projects and during this process the project scope is concluded. Muhammad Nabeel Mirzaa, Zohreh Pourzolfagharb and Mojde Shahnazari [1] concluded that to produce a quality product, scope must be demarcated, communicated, and get it agreed. They also stated that spending the time at scope finalization stage and getting agreement on critical activities before writing requirements and beginning product development is essential.

Early completion of this stage benefits the project manager in the following way.

- Accurate Budget Estimation.
- Resources Calculation and Identification.
- Initiation of Procurement Cycle.
- Improves Quality of development/preparation.

However early closure leads to additional scope request which impact budget and resources which are planned according to initial scope.

Vast Scope Of Works.

Karim Ragab [12] clearly articulate that Turnaround work scope is loosely defined during scope collection stage and are usually from previous turnaround scopes, inspection findings, operational requests, preventive maintenances, corrective maintenances, and statutory obligations. He also adds that, Turnaround projects are characterized by many unrelated jobs because of multiple sources of work scopes. Input of these work items is obtained from process/production, maintenance, inspection, projects, quality, engineering, and safety departments. This result leads to huge works scopes. Problems that go unchecked can significantly impact the chances for hitting the time and budget goals. He is concluding that Operative and effective scope collection and screening must be prerequisite towards a successful Turnaround project completion.

Additional And Discovery Scopes.

Additional scope is scope request received from the end user to add the scope, after the scope freeze date. The most effective reason for the additional request is, Firstly, item cannot be completed economically or safely while plants in operations. Secondly, Loss of production due to plant intercepted operations if the work is not completed. And lastly, product quality impacts of not conducting the work in a turnaround, going beyond will result over budget and out of time. AP-Networks has documented this phenomenon [16], showing that the average cost and schedule overrun increases with additional scopes.

Discovery scope is the additional repair scope that is "discovered" as equipment items are opened for inspection during the turnaround. Discovery is an easy loophole for requestor to push through preferred scope that was previously challenged out.

- It consumes Contingency Budget.
- It affects critical resources availability.
- It Consumes extra time.

As noted in a previous study [17], on complex downstream/onshore turnarounds, the average growth in scope, combining both emerging and discovery scope is 23%. Top quartile performers manage to get this down to an average of 8%. But getting much below this level is likely to be unrealistic. Nevertheless, it is important to control and limit late scope changes if one wishes to control the risk engendered by those late changes.

Ambiguity Or Incomplete Scopes And Changes

Scope ambiguity is one of the costly problems in Turnaround projects. It occurs when the project's objectives, deliverables, requirements, and boundaries are not clearly defined, agreed upon, and communicated among the stakeholders. This can lead to confusion, conflict, rework, delays, budget overruns, and dissatisfaction. Scope misunderstanding leads to wrong estimation and preparation of resources. Conflict in works scopes results to ambiguity in contractor payment because contractor may estimate the resources and cost based on given scope, however during execution, they may find different scope, which needs extra resources and cost.

Incomplete scope leads to wrong preparation of works and ends to restart. It doubles the effort and time of planning team. Preparation and execution delays and time and cost overruns are causes of incomplete scopes.

Within Kerzner's [8] stressed that changes in requirements must be controlled, they could be the potential risk to destroy not only the morale on a project, but the entire project. Since, scope change is one of critical constraints, project cannot afford to have huge changes, however Safety, reliability critical scope changes must be included to be part of scope with proper control measure. They suggested to get the fund from requestor as a control measure. They also including that these scope changes may lead to affect availability of critical resources which are already committed for original scope. Project team shall take a decision based on primary schedule, which shall share realistic picture of resources committed, this will help company to determine quantum of additional work can accepted without affecting existing resources. Furthermore, if a resources bottleneck is detected, it shall indicate the additional resources requirements. Management should review the impact analysis before taking the final decision to either to include the scope changes (or) allowing additional resources (or) manage with scope with current resources.

ANALYSIS AND DISCUSSION

Scopes Management Influence

Senior Management first forms a steering committee team, which typically consist of Senior management of the organization. The steering committee provides direction and guidance to the turnaround manager and core team to ensure that the turnaround meets the needs of the business. The decision executive is typically the chairperson of this committee. In addition, it must ensure that the scope safety, Quality, Budget, and Time are in alignment. Senior management appoints a turnaround project manager and forms core team for upcoming turnaround.

Key Stakeholders are [18]:

- Planning Team – Who Plan and Coordinate
- Process Team – Who operates /Runs plants.
- Integrity Team – Who Inspect the equipment.
- Maintenance Team – Who Maintain equipment.
- Reliability Team – Who provide engineer support to operations and Maintenance.
- HSE Team – Who take care of Health, Safety, and Environmental subjects.
- Logistics Team – Who take care of Execution coordination arrangement.
- Material Specialist – Who take care materials.

This team should be formed immediately once turnaround announced. This team must be able to lead the planning and execution of turnaround. Continuous communication between core team and the steering committee is required to ensure concurrence, especially before moving on next phase.

Involvement of this team is playing critical roles in safe and successful turnaround completion. Robert Bruce Hey [18], shared lesson learned that resistance to change is greatest when long practiced people performing the task. Involvement of leadership and different approaches can make start to change, which stimulus the people to achieve turnaround objectives.

Category Wise Scope Closure

On time Scope closure help projects team on the followings. 1. Allows enough time to understand the scope by discussing with requestor and site visits. 2. Identification and ordering of critical resources well in advance. 3. Gives opportunity to procurement team to order long lead items with negotiated from sellers.

John lane [15], based on his consultancy experience, suggest that scope cut-off should be based on complexity of the Turnarounds. Overall Higher cost projects required more Turnaround window, the greater the complexity of the TA, therefore scope should be closed in well advance. He suggests scope freeze should be 12 months in advance of the start of TA execution. Early closure result to more additional scope. The proposed solution, for this constraint, is Category wise scope closure. Idea is to category the scope of works, For Example, Executor Wise (Contractor/Inhouse), Procurement Lead Time (Long/Short), Critical resources required (Yes/No), High-Cost Item (Yes/No) and Additional Resources Requirement (Yes/No). This categorization helps Turnaround project team and requestor to understand the scopes in better way.

Scopes, which need to be executed by contractor, freeze 12 months before start of TA execution, however scopes which can be executed or

managed by Inhouse maintenance resources can be concluded 6 months before TA Execution. The Same way if the scopes, required spares from original equipment manufacturer or long procurement cycle, should be determined 12 months before start of TA execution. Short lead procurement cycle and locally available items relevant scope can accomplish before 6 months.

Scope Screening

It is mandatory for the industries to focus on essential scope, rather than desired scope because of increased cost of turnaround. As an industries best practices, many businesses and many assets have embraced the concept of risk-based scope review (RBSR), to challenge whether each requested scope item should be included or not. The scope selection criteria define the rules by which a scope item should be assessed for inclusion in the event. Gordon Lawrence [13] list the important qualification criteria to include in scopes. As per his suggestion, there are two criteria, one is Specific scope selection criteria and second is General scope selection criteria.

Specific Scope selection criteria includes followings.

1. Retaining the license to operate:
 - a. Statutory Inspection
 - b. Compliance inspections
 - c. Safety-critical maintenance.
2. Maintaining Production
 - a. All corrective maintenance to enable the plant to run until next turnaround cycle.
 - b. Risk-based assessment determined preventive maintenances.
 - c. Process cleaning activity to achieve targeted production rate.
 - d. All catalyst changes required to meet the run length specified.
 - e. Reliability inspections required to provide reliability data for the future.
 - f. Modifications to achieve the reliability, safety, quality of target specified.
 - g. Inspections required by original equipment manufacturers to validate guarantees.
3. Upgrading the Assets.

Projects that are required to meet the long-range plan for the asset, including debottlenecking, production capacity increases and cost optimization projects.

General Scope selection criteria includes followings.

1. Cannot be done on-the-run is because the isolation valves are passing.
2. Most economical to perform in Turnarounds.
3. Lost production opportunity



Figure 2: Scope Screening workflow

Approval Workflow

Added late scope is inevitable. There will always be “emerging” scope, as plants are in operations equipment unexpectedly break down between scope freeze and the start of the turnaround.

John lane [15], explains, an effective scope change control necessitates the implementation of a formal Late Work Request (LWR) process. Change control for emerging scope leading up to the execution period. And Change control for discovery scope during the turnaround

execution window. Requiring the requestor to justify how this scope item meets the scope selection criteria laid out in the Premise. Requiring the requestor to explain why this scope was not included prior to scope freeze. Request approvals, such that as the turnaround approaches, the requestor must approach increasingly higher management to have the request approved.

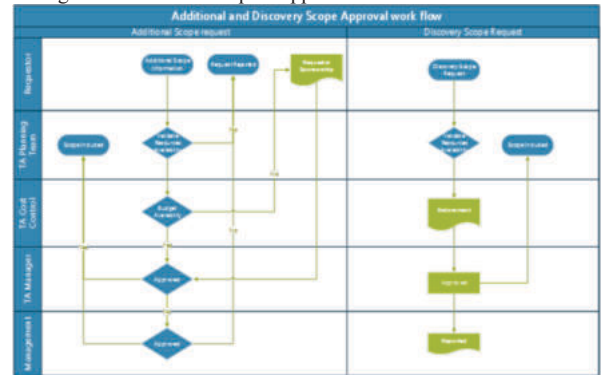


Figure 3: Approval Workflow

Document, Approvals, And Communicate The Scopes.

The turnaround projects involve hundreds of people and assets. Since assets are in operations and individuals working in the organization may move or change, some point, requestor may find uncovered scope that is essential and cannot be pushed off to the next Turnaround or dealt with by day-to-day maintenance or scope may change from initial request due to change in requestor. This results ambiguity or Incomplete scopes or scope changes. To solve this constrains, proposing to document each scope change systematically. The change document must include every factor that impacts on the time, budget, or resources needed to complete the turnarounds. These factors must be carefully considered before deciding to accept the change to the scope of work. Remember to refer the previously agreed scope and show what the proposed changes will require. Organization may use the any format based on their convenience; however, it must include the following:

- Individuals who approved the change
- The other work that will be impacted
- Costs in terms of labor, money, time, materials, etc.

Prometheus Group [20] proposing a Scope sign-off, from requestor and their supervisors, is one of the solutions based on their industrial experiences. All approval documentation regarding sign-off must be kept. Complete documentation can also help serve as a guide for next turnarounds. Signed off scope document must be communicated to all concerned stakeholders for their reference. This ensures that all stakeholder working on the turnaround is working towards the same goal.

CONCLUSIONS

The contribution of this paper is in providing list of constraints in scope management for turnaround and shutdown project and systematic industrial best practices to manage those constraints, which can help industries to manage the constraints of scope management of its turnaround projects. We reviewed past research regarding the constraints and its best practices related turnaround projects scope management. Previous research botched to identify the list of constraints and its solution for turnaround projects scope management.

This paper presents five different constraints related to turnaround and shutdown projects scope management and its solution to oversee them successfully based on real life industrial experiences. We illustrated our methodology using turnaround project experiences in oil and gas industries wherein we compared best practices we discovered through the literature reviews. Implementation of the recommendations and guidelines provided in this paper by managers and engineers involved in turnarounds is expected to contribute significantly to better performance, fewer possibilities of cost overruns, and less considerable time delays in future shutdown and turnaround projects. The constraints and control measures proposed here, can be implemented by any company involved in turnaround projects to improve their existing scope management functions in turnaround projects. In future, this research can be extended to identify new constraints in scope management because economical and industrial development will enable new challenges.

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