Leveraging Digital Technology in Utkal Alumina Expansion Project

Chandan Kishore[1], Abhishek Raj[2], Yogitha Rayabharapu[3] and Potti Venkata Koti Ratna Krishna[4]
1. Manager
2. Assistant Manager
3. Assistant Manager
4. Vice President
Utkal Alumina International Limited, Doraguda, Rayagada, Orissa, India
Corresponding author: chandan.kishore@adityabirla.com

Abstract

Utkal Alumina International Limited (UAIL) has its captive alumina refinery facility at Rayagada, Odisha. To bolster the existing alumina production capacity, by leveraging the ownership of existing high yield bauxite mine, UAIL is expanding its capacity by 0.5 MTPA. The ongoing Project is a true reflection of Marquee investment plan as part of the Company's transformation journey. Leveraging digital technology for Project Management has been one of the success factors for Project strategy and execution. Digitalization across the entire Project lifecycle has been instrumental for productivity improvement, safety, and resource management. Drone based analytics is being used for better visualization, real time analysis and broader coverage among others. Project Improvement and Visualization Online Tool (PIVOT) has been adopted for effective monitoring and control. Implementation of CCTV surveillance has facilitated rich insights, progress, mitigation of risk elements, virtual tour, etc. Utilization of Primavera P6 for schedule integration & analysis and Document Management System (DMS) for engineering management has played a pivotal role for Project governance protocols. Application of Realwear tool for virtual assistance has been effective during the construction and commissioning of critical equipments. Digitalization has been effective in visualizing real time progress, resolving troubleshoots, mitigating challenges and risks, managing interfaces and complexities, etc.

Keywords: Project Management, Digital technology, Drone based analytics, Rich insights, Schedule integration & analysis, Virtual assistance.

1. Introduction

Utkal alumina refinery, located at Doraguda, in Rayagada district of Odisha, India is a 100% subsidiary of Hindalco Industries Ltd., of the Aditya Birla Group. The refinery nameplate capacity was 1.5 MTPA and the greenfield plant was taken in operation since October 2013. The strategic decision to include similar Plant and Machineries by adding equivalent capacity of 0.5 MTPA to make the complete plant capacity as 2.0 MTPA was the scope of this brownfield expansion – Project Suryaprabha.

Utkal Alumina International Limited (UAIL) has recently commissioned its expansion hydrate circuit for 0.5 MTPA. The Project is a true reflection of UAIL's transformation journey. The Project has sailed successfully through the unprecedented COVID crisis, which derailed Projects across industries, posing numerous challenges regarding contractual obligations, availability of resources, deliverables, health and safety measures, and project delays or cancellations. Despite the challenges, UAIL continued to execute site works by adopting strategies vis-à-vis New Normal in the context of COVID by taking proactive measures like quarantine & testing protocol and continuous engagement with workmen.

For the Brown Field expansion Project. Hybrid Contracting Model was adopted, comprising of in-house basic engineering and overall coordination, combination of LSTK, EPCM and Item-rate contractors, and PMO for Project oversight and optimisation support. The Project witnessed several challenges like presence of extensive volume of hard rock in major expansion facilities, varying sub-surface soil conditions, high labor attrition, movement of heavy equipment through hilly terrain and interfacing with existing facilities.

2. Technical Details of Expansion Project

Following are the basic concept of Utkal brownfield expansion by 0.5 MTPA:

- Utilizing the capacity of existing areas such as Power plant, Bauxite transportation, Security filtration, main pipe rakes etc.
- Utilizing the existing standby system as common standby for existing as well added facility in almost all area.
- Addition of new facilities, similar to existing one for better maintainability and spare management

Based on the above philosophy, detailed engineering was done. Following are the area wise expansion details of major Process areas:

- One bauxite reclaimer and one crusher in Bauxite Handling unit.
- One Bauxite Silo, rod mill and pumping system in Bauxite Grinding unit
- 3 IBSH, 4 PDS tanks and pumping system in Predisilication unit.
- 1 digestion unit of 4 digester vessel, 2 sets of heaters, 4 flash vessels and accessories in Digestion unit.
- 1 High rake decanter, 6 washers, Flocculant dosing arrangement in Mud wash unit.
- 1 evaporation unit
- 10 precipitation tanks
- 3 Coarse seed filters
- 1 Calciner unit

Project Scope:

- Around 80000 m^3 of Concrete work
- ~ 21000 MT of Structural steel and 14000 MT of equipment
- 11.3 lakh Inch meter of Piping
- ~ 1000 km of electric cable

Project Challenges:

- Two waves of Covid-19 during peak time of project
- Remote location
- High labor attrition
- Local conflicts
- Appropriate local engagement basis competency level
- Brownfield Project - Interfacing with external and internal stakeholders
- Presence of hard rock in major areas of the expansion; varying soil conditions

Strategies adopted for project management:

- Effective planning and scheduling – monthly review of the package schedules and identification of optimization opportunities
- Procurement – action plan to optimize procurement timeline, develop ordering calendar, prioritization of packages
- MIS reporting – Real time monitoring of project parameters through PMO online dashboard, drone-based analytics
- Project governance – DMS for engineering management, Primavera for schedule analysis
- Project commissioning – stakeholder alignment on the targets and requirements, prioritized activities for early sequential start-up
- Risk management – Rating and prioritization of 200+ nos. of risk elements, Capturing concurrent risks and devise mitigation measures for the same

Although the challenges were mitigated through the implementation of mechanized construction techniques and well-chalked out execution strategies, leveraging digital technology across the entire Project lifecycle was one of the critical success factors for productivity improvement and effective resource management. Digital initiatives such as Drone-based analytics, 3D Modelling, Project Improvement and Visualization Online Tool (PIVOT), CCTV-based monitoring, Primavera P6, and Document Management System (DMS) led to improved Project governance, managing interfaces and complexities, and real-time analysis among others. Application of Realwear tool for virtual assistance was effective during the construction and commissioning of critical equipment.

3. Adopted Technologies

The revolutionary digital technology contribute to project management lifecycle is countless and significant in terms of efficient management, identification of risk, early recognition of conflicts, improved collaboration, and communication. Even though, using digital technology is considered as an additional effort to traditional project management, the focus on technology have become binding and driven by senior leadership for across all assessments in project life cycle.

3.1 Drone based Analytics

Digitalization has taken the project management to next level from traditional approach. Digital platforms like Drone visualization have helped the transparent construction life cycle and it has provided the larger picture of project and helped to updated integrated project management in terms of Engineering, procurement & construction sequences. It also helped to identify the future conflicts at the earlier stage itself which ultimately used to frame for mitigation plan.

Drone survey and drone video-based project progress monitoring is one of the most efficient and transparent way of project progress monitoring. Drone images help to capture as-is status of the project site. Development in drone technology has changed outlook of project monitoring. Adopted drone video and collaboration platform helped to compare the status between multiple dates for quick project progress monitoring.

Orthophoto and 3D Models: Drone based project monitoring has provided the information for 3D object creation and orthophotography map of the construction area. The information was continuously updated and stored as an online map on our database for interactive viewing of the multiple areas of the project sites. This has provided the better work progress control and the ability to provide top management with the most recent visual information.

Drone Videos Geotagged for Project monitoring: Drone videos of project sites were periodically taken and integrated with the videos with the drone flight paths, which helped to correlate the video footage with the exact location of the site so that project monitoring can be done even from office without having to go to the site. During pandemic of COVID-19, this has helped in monitoring without being physical visits of site of all the stakeholders.

Cut Fill estimation and Volumetric analysis*:* Using accurate aerial photogrammetry techniques, sub-areas were scanned and measured within centimeter level accuracy in short span of time. By using accurate cut-fill estimation, its project progress was estimated.

3.2 Project Improvement and Visualization Online Tool (PIVOT)

One of the greatest and most important challenges of project management is communicating clearly with the team about both the details and the big picture of the project. The critical communication was passed through the online visual tools. These tools are used for the following:

Schedule monitoring and Project tracking*:* Project tracking is the method in which the progress of tasks in a project is tracked. By using this tool, the actual vs planned progress can be compared, and issues may be identified that may prevent the project within the timeline and budget.

In Project Suryaprabha, the project tracker templates were used as a single source of data for the project's progress in the online tool. The input details were gathered by project team about the project's progress on the template, which was shared to show the project manager and stakeholders the project status at any given time. Online tools are updated in real time, and that data is shared throughout the software. An automated report generation system makes the robust system.

Procurement tracking: The online procurement tracker was used in the procurement stage. It is an online Gantt chart that allow to plan the contract of procurements. The procurement status updates are instantly reflected, which helps to track the progress of the supplier to make sure the supplies are in line with site requirement. The online Gantt chart also helped for the procurement adjustment required (if any) due to other constraint.

Issue register: Despite the best planning practices, and immediate addressing / solving the problems, like any other projects, Project Suryaprabha has also witnessed several issues. An online issue logging was made for the purpose to log the issues when they arise. Further the responsibility and time frame were assigned by the Project Manager for their resolution.

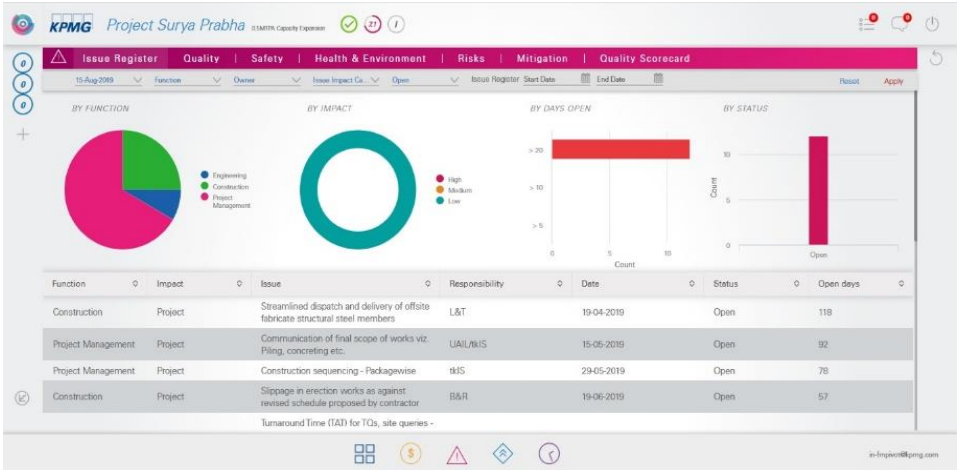

Figure 1. Issue register

Budget Monitoring: The project budget was monitored through the online dashboard.

Safety: The safety dashboard is also made in which all relevant data were monitored. This includes the incident management, near miss records, safety behavior records, PPE status etc.

Risk register: The risks were identified during risk identification session and logged in risk register. Further, they were analyzed based on their severity and probabilities and planned for their mitigation. The risk register was updated on regular intervals.

Project Dashboard: All the Key performance indicators were captured in the online project dashboard.

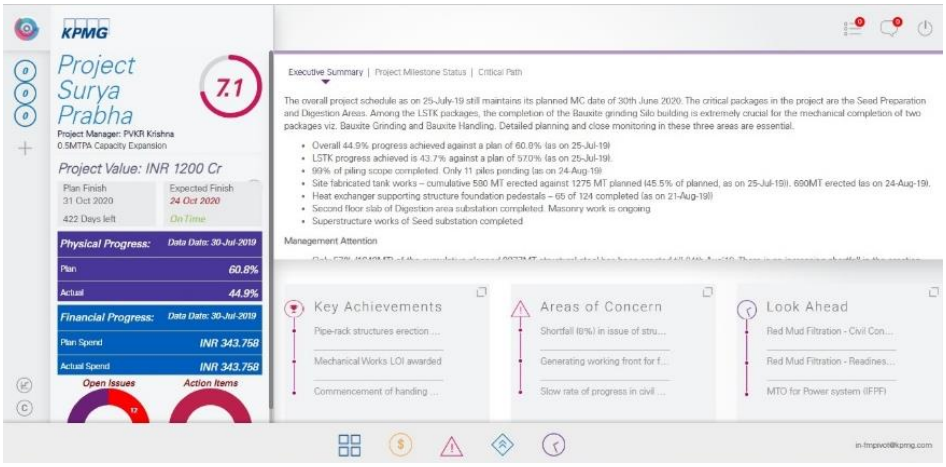

Figure 2. Project dashboard

3.3 Implementation of CCTV surveillance:

The CCTV system were basically used as security system by its design & application. However, these are important to ensure and promote workers safety at site. The CCTV were very useful to monitor during COVID-19 unprecedented time when social distancing became the new norms.

Figure 3. CCTV monitoring

During this project, a total of twelve cameras were installed in identified elevated locations, with auto / command rotation and tilt mechanism. two monitors were installed in the project office, one monitor installed in the security cabin. Few authorized team members had given access to their mobile through app. The real time data or recorded data were available in CCTV system and helped to monitor entire construction activities in extremely effective way. In addition to this, it has contributed towards improving construction site security, monitoring safe working conditions, providing guidance in discussion of constructability & sequencing of construction activities.

3.4 Document Management System (DMS) for engineering management

Project documentation provides about how information and ideas are created and shared. It is a key factor of project success. For Project Suryaprabha, a well-designed Document management system were implemented to get easy access of all required files and documents within the team. Data security was also taken care. Some of the key features of DMS are:

- Defined nomenclature for the documents of various discipline
- A defined workflow for the Document approval
- Daily notification of uploaded / edited document
- Notification while change in document status
- Read/Write access to the user
- File versions – The multiple revisions of the document can be uploaded with new version

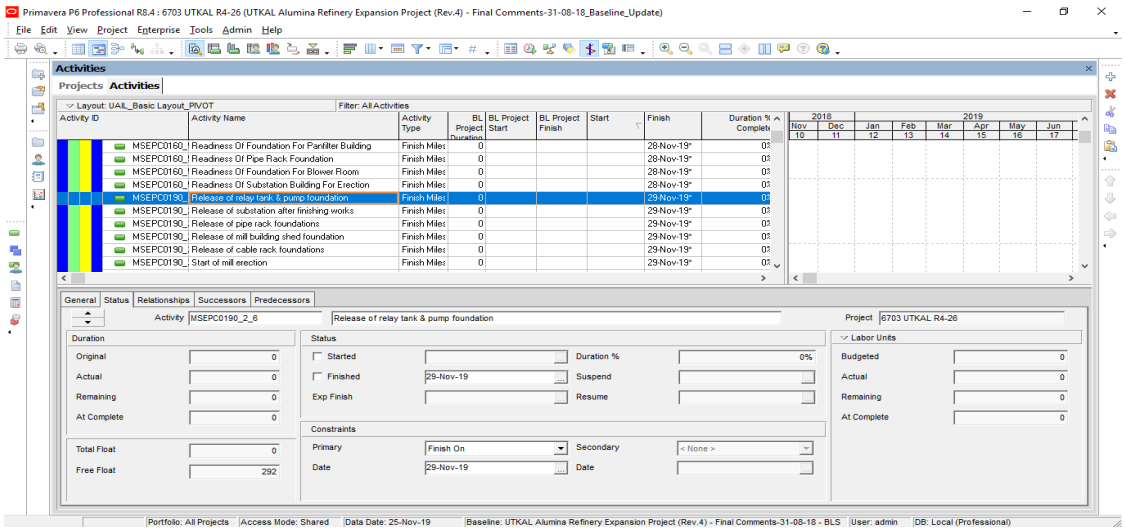

Figure 4. Document Management System

DMS has included the defined directory structure which is familiar to the project group. Approval workflows simplifies the documents circulation within the stakeholders and made job simple. Daily notification of uploaded / edited documents.

3.5 Application of Realwear tool for virtual assistance

A realwear tool - A video capturing tools which can be added to the online meeting was used to getting online assistance from the remote location. The tool was very useful to get assistance as during COVID-19 restrictions, the travel was barred. This was helpful for getting remote support of vendors for Equipments trials & commissioning.

3.6 Others:

- Facial recognition for attendance management system:
- Contactless - Face recognition gate entry
- The attendance of all project manpower captured in system
- Analysis of manpower trend
- Time analysis of entry & exit
- Periodic movement of project workers

4. Results and Discussions

It is generally obvious that digital technology has improved our everyday lives. Whether it is online banking and shopping, ticket booking, or virtual meetings with people around the world. But the advantages for project management by adopting digital technology are sometimes a little less evident. The below digitalization benefits list often includes:

Improved operational efficiency: Every organization is always looking for the increase in operational efficiency. By adopting digital technology, the manual error can be mitigated. By working smarter and more dynamically (with the inclusion of digital technology), it is usually very easy to be cutting down the losses and the productivity will be increased.

Improved health, safety, and wellbeing: Along with the regular business of the companies, they have a legal and moral responsibility to ensure the health and safety of their workforce and ensuring environmental sustainability. Digital technology can significantly improve the safety standards in the workplace, for example, by ensuring that a person has the correct certification and have the correct assessment before accessing a hazardous area.

Better quality products and services: By using digital technologies, people can work smartly, which will lead to cost savings and a better-finished product. This is great for the reputation of the organization, and it will strengthen the customer relationship.

Improved communication (internal and external): Communication is always the key element in any business, and so there is a competitive advantage if it is efficient and dynamic. The days of filling out sheets of paper and sending these to the head office are well and truly numbered.

Employee retention: No one likes to work with outdated technologies and in a stagnant environment. Working in ways that use inefficient practices is terrible for the company's bottom line, and it's also bad for staff morale. Employee happiness is one of the parameters for their retention.

Attracting new talent: It has been seen that many people, particularly younger generations, are keen to embrace modern technology in their working lives, and they are adopted to use them. Keeping up to date with technology is likely to be a more appealing proposition for potential employees, which is vital for long-term growth.

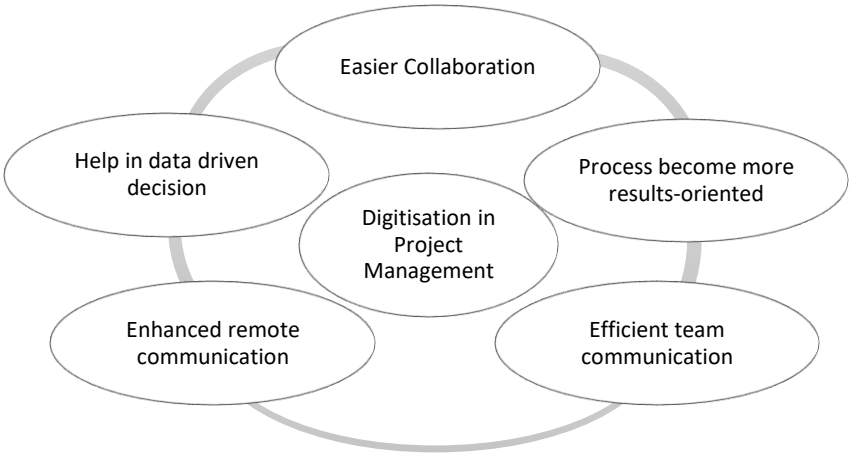

Figure 5. Benefits of Digitization in Project management

Barriers to digitalization

Every organization is unique and will face challenges and barriers to implementing digital technology, but some common themes arise. One of the barriers that are cited most often is the investment cost. While there will inevitably be an expenditure required, this can be put into perspective by the return on investment and by phasing in the digitalization process to help spread the cost.

There are also sometimes organizational barriers. These can include the internalization of IT developments, the absence of managing budgets, and the fact that it is not a strategic subject and, therefore, not always prioritized. There might be a lack of internal resources and a resistance to changing established and traditional practices at the departmental level. Usually, these factors can be overcome with the mindset change in mindset and appropriate management decisions.

Finally, a lack of time, the time elapsed in implementing newer technology, and scrapping traditional methods are frequently mentioned as a barrier to digitalization. The organization has to understand that the changes are not always easy and could not be seen in terms of the payback period only. Sometimes, for being the competition, it is required to adopt the changes. However, any changes will bring in saving, whether direct or indirect.

Consequences of non-digitalization

The inefficient and error-prone information collection from the site, and the poor management of material and human resources, will inevitably lead to poor decision making and subsequently higher costs. The delays and unplanned costs of operations will impact the budget and schedule and could also be detrimental to quality. The failure to increase productivity and operational efficiencies will mean that the company stands still rather than develops and moves forward.

If the organization is not updated with the latest technologies for the communication system, the costs will increase as well the communication would not be effective. For example, none of the companies are still using fax machines or ledgers for communication purposes. There are also ‘invisible’ costs associated with traditional communication, such as paper, photocopier maintenance, printer ink, etc., not to mention time costs, that are sometimes overlooked.

These negative consequences will be a lead to degradation of the customer relationship and will increase in lack of competitiveness in the marketplace. There might be a talent shift of employees away from the company.

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