IMPACT OF COLLABORATIVE ENGINEERING ON TECHNOLOGICAL FLEXIBILITY AND ENGINEERING PROJECTS MANAGEMENT

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Abstract: *The traditional approach to management of projects in general and engineering projects in particular has been through use of age old classical models of PERT/CPM. These models are based on activity, its precedence relationship among themselves, estimation of activity duration, resource requirements. But in practice they are of little importance in managing projects when multiple agencies are involved and they are located in different places, and different portion of job is being handled by different agencies. Limitations of traditional classical approach have been studied by several researchers. In today's networked environment, collaborative approach for engineering projects is getting due importance in recent years.*

In management of real-world project where multiple agencies are involved right from engineering design to implementation, the collaborative approach, providing technological flexibility and information system flexibility, is being considered a useful tool in managing engineering projects. In this paper a case study of Oil and natural Gas Corporation Ltd. (ONGC) describing use of SAP collaborative Folders (cFolder) where engineering design consultants, contractors, suppliers and owner interact and contribute in collaborate basis for engineering projects. It has added advantages such as virtual team working, speedy implementation, reduction of cycle time, travel time, documentation, cost and greening the chain. It is aiming to revolutionalise the working of EPC project management.

Keywords: Collaborative Project Management (cPM), Project Lifecycle Management (PLM), Project Flexibility, Collaborative Engineering.

Type: Case Study

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Introduction

The traditional approach to management of projects in general and engineering projects in particular has been through use of age old classical models of PERT/CPM. These models are based on activity, its precedence relationship among themselves, estimation of activity duration, resource requirements. But in practice they are of little importance in managing projects when multiple agencies are involved and they are located in different places, and different portion of job is being handled by different agencies. Limitations of traditional classical approach have been studied by several researchers. In today's networked environment, collaborative approach for engineering projects is getting due importance in recent years.

In management of real-world project where multiple agencies are involved right from engineering design to implementation, the collaborative approach, which is providing technological flexibility, is being considered a useful tool in managing engineering projects. Case study of implementation of SAP collaborative Folder (cFolder) in Oil and natural Gas Corporation (ONGC) is presented in this paper. Design consultants, contractors and ONGC collaborate through cFolder for engineering project. It is a internet based collaboration solution where project owner can share structured information with external partners, aiming to revolutionize the working of EPC project management creating technological and information system flexibility and thus improving the efficiency and cost reduction on various counts.

Traditional and Collaborative Project Management

The limitations of classical methods of project management (PM) have been studies by several researchers. It is now well known that network based planning and scheduling is not sufficient cause of success but there are number of critical factors leads to success of project. PM in past was focused on top down view i.e. few top management individuals had total picture of project, planned project and assigned tasks to others for completion (Evaristo and Fenema, 1999). This type PM works for repeat process and product but due to globalization, technology advancement, high personnel turnover and distributed team, it is not valid in today's projects. PM, in recent years, has been shifting towards collaborative model. In a distributed or virtual project, contributors from different cultural background, lacking face-to-face interaction, IT facilitating remote cooperation and reduce real-time communication (Evaristo and Fenema, 1999; Graham and Englundm, 1997). Traditional PM focuses on management, scheduling and project outcome while distributed PM emphasizes on

collaboration and project processes (Helbrough, 1995). Distributed PM poses three major challenges: collaboration (supporting high level of interaction, communication, and coordination); knowledge management (capturing tacit knowledge, turning it to explicit knowledge and then sharing it); and work process (analyzing risk inter-dependence, documenting decision rationale and work process itself).

There are many potential pitfalls to traditional PM viz. over-emphasizing project reporting aspects, ineffective and inefficient communication, managing project inputs and outputs but not the processes, reactive PM, and lack of project repository/MIS (Clarke, 1999; Turner, 2000).

According to study by Zimmerer and Yasin (1998), parameters for project success are team building, communicating, demonstrating trust and focusing on results. Tony and Powers (1997) identified in their study three areas of project success viz. project strategies, project management professionalism, and standardized methodologies and procedures. Loo (2002) reported best project management practices which included five technical factors viz. integrated project management system, effective scope management, effective project planning, scheduling and controlling, and effective contract management, and four people related factors viz. high caliber project team, stakeholder participation, effective communication internal and external, customer satisfaction.

In traditional PM, divergent communication methods like mail, phone, fax, drawing, voice and documents pose problem of different version. As a result it leads to mistakes in procurement and construction and thereby increasing project cost and time over runs. Web based collaborative IT solution enables convergence of different media such as discussions, minutes, meetings, video calls and documents which are stored in respective place holders on real-time basis and thus enabling single version of truth. This process helps in time reduction and material wastage in procurement and construction phases of the EPC project. Collaborative project management addresses many problems of traditional PM as it focuses on explicit representation of project information, and its timely sharing. The aim is to get right information to right people at right time.

Collaborative Methodology

It provides a method and apparatus sharing customization to a filing system in which documents are stored in shared repository. They are categorized and assessed by multiple users through an application program interface (API). API receives input for defining core

filing structure and customized filing structure having hierarchically organized filing categories.

Importance of Flexibility

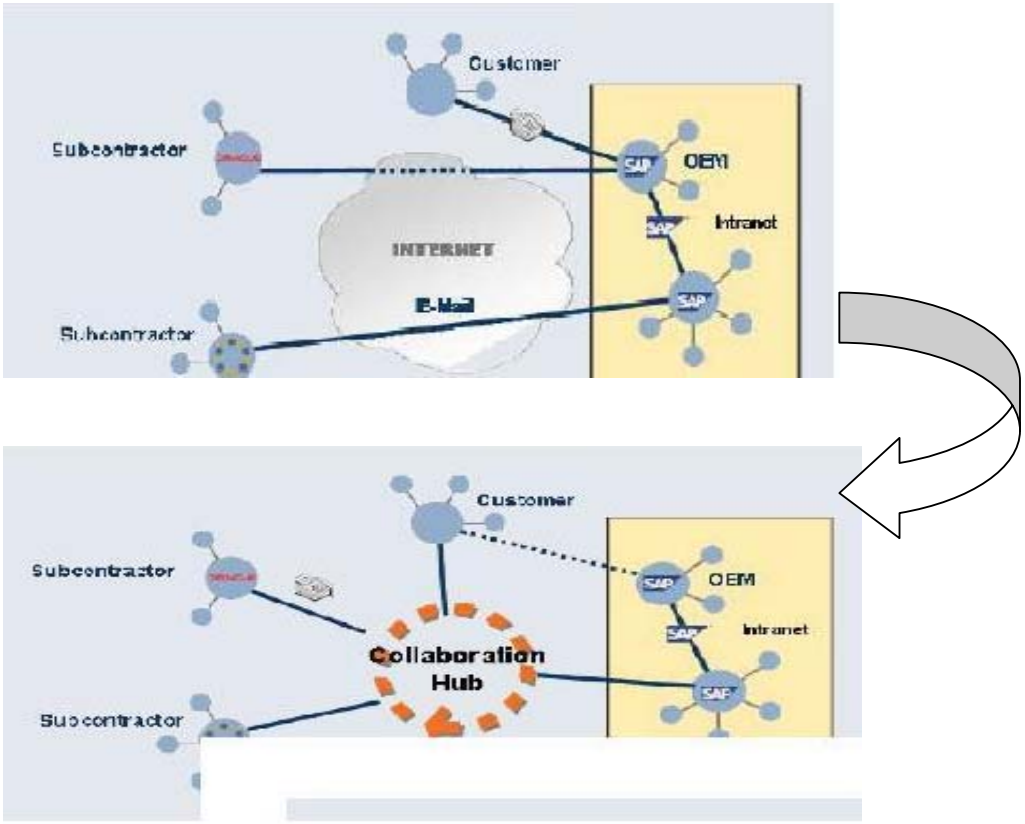
Flexibility is a multi-dimensional concept associated with change, innovation and novelty; demanding agility and versatility; coupled with robustness and resilience; implying stability, sustainable advantage and capabilities that may evolve over time (Bahrami, 1992). Technological flexibility refers to freedom of choice to the organization in terms of available technology platform. Flexibility created in core processes of technology of related business, which help in gaining competitive advantage (Parsons, 1983; Clemons and Row, 1991). Information technology Flexibility required in information system in terms of flexibility to use and flexibility to change the information system (Gebauer and Lee, 2008).

Flexibility in engineering projects has been studied by several researchers. Project flexibility is compared to an option-the right but not the obligation to take an action in the future (Amram and Kulatlaka, 1999). Koskela (2000) describes lean construction where last responsive moment to achieve flexibility in project. According to Eikeland (2001) room for manoeuvring where a decision is within if it does not violate consequences of previous decisions. According to Samset (2003), distinct strategy in combination with sufficient tactical flexibility is characteristics of successful projects. According to Olsson (2006), project flexibility is double edged sword. Owner is more likely to be interested than contractor, flexibility in front-end phase increases probability of success, and flexibility in execution phase is likely to reduce efficiency. Kreiner (1995) points out that under uncertainty traditional focus on stability of PM get challenged creating drifting environment, which may occur not necessarily by actual changes in project context but when project strakeholders get better understanding of their actual needs. According to Millar and Lessard (2000) there is importance of bold commitment from key stakeholders, irreversibility of large engineering projects and once front-end is over there should be no flexibility.

Impacts of IT on flexibility are manifold. According to Lucas and Olson (1993), information technology (IT) contributes to flexibility by changing the nature of organization boundaries and the time where work occurs, altering the nature and pace of work, and helping firms respond to changing market conditions. Research has emphasized the flexibility of IT infrastructure as a significant determinant of its organizational contribution (Byrd & Turner, 2001; Duncan, 1995).

Collaborative Folders (cFolders)

The project management approach in recent years has shifted towards collaborative model with advent of ICT technology. Collaboration Folder (cFolders) is SAP web-based application for collaborative sharing of information and integrates project management, knowledge management and resource management in collaborative inter-enterprise and intra-enterprise environments. It allows organizations, their partners and suppliers to work on distributed design and manufacturing in a collaborative web based environment. SAP collaborative Folder approach is presented diagrammatically in Figure 1.



Note: Adopted from SAP

Fig 1: SAP Collaborative Folder Approach

The cFolders enable the sharing of documents and product information with members of various virtual teams that are either part of your enterprise or trading partners e.g., customers and suppliers. cFolders is typically setup outside of the enterprise firewall and accessed via web browser. It is integrated to SAP Project Systems (PS), SAP Supplier Relationship Management (SRM), and SAP Knowledge Management (KM). Virtual teams can access, view online, subscribe for changes, and redline documents and product

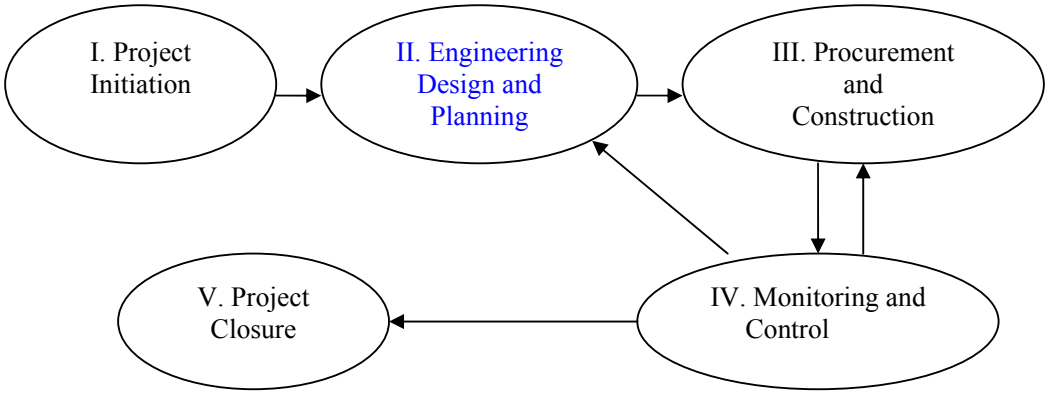
information. Partners and suppliers can interact with cFolders in predefined collaborative or competitive scenarios.

Case Illustration of cFolders in Engineering Design

Major engineering projects in ONGC are implemented on turn-key basis where various agencies are involved in design, tendering, procurement, fabrication and execution, third party inspection, monitoring and control and project completion and handover.

Project processes in engineering project management as depicted in Figure 2 are as follows:

I. Project Initiation,
II. Engineering Design and Planning,
III. Project Procurement and Construction,
IV. Project Monitoring and Control,
V. Project Closure.



Note: Arrow represents flow of information

Fig 2: Engineering Project Process Groups in ONGC

The case study deals with Process Group II i.e. Engineering Design and Planning. Engineering design and planning is done using SAP cFolders where third parties design specialist, engineering contractors and customer (ONGC) are interacting in collaborative mode. Earlier it was manual engineering design, where all design and documentation will be circulating among three stakeholders in number of iteration resulting in delay, different version of document, lot of paper work and associated cost. With introduction of cFolder, the engineering designs converted into csv file type are uploaded in cFolder central repository, which creates majors nodes for each major activity and number of tasks under each node.

Users from are created with requisite access control for different teams such as design consultant, contractor and customer teams, who can see whole document or part document based on their authorization. The customer can put his comments of acceptance, required modification or rejection of particular documents in design, which is communication to other partners by notification as well as he can see it online the comments. The design document goes back to designer for further modification and it is re-uploaded into system and new version is assigned by the system, which is always current version. All the collaboration partners can track the change history of the document and they are informed about relevant changes by way of notification. The collaborative process not only helps to bring in efficiency in design process but it also brings in technological flexibility by providing a web-based platform for convergence of various medias of communication and it reduces the design cycle time, redesign and rework cycle considerably. Once design document is finally approved by the owner, it is placed in document management system (DMS) which provides a single and final version to stakeholders. The system generates specifications, bill of materials (BOM), product catalogue and standards which become input to procurement process. This helps faster procurement. There is provision to provide backward integration to SAP Project Systems module (PS) for monitoring and controlling the project progress and cost.

Impact of cFolder on Project Flexibility and Project Management and Conclusion

The application of collaborative Folders (cFolders) in engineering design is helping to a great extent as design and approval process are taking place in iterative basis and it maintains single version of truth. Engineering design is part of total project management cycle. This has removed the place and time boundary and resulted into manifold benefits of implementation. Benefits of implementation are taken from SAP websites, users' feedback and our experiences and summarized as under:

1. It facilitates structured documents sharing with other team members and business partners.
2. Facilitates collaborative engineering design and enabling to work in virtual team.
3. Supports online and real-time collaboration and latest version is visible to all.
4. Provide web-based access to many stakeholders which helps in speedy collaboration.
5. The methodology helps in reduction of design cycle time 25-40 %.
6. Involves customer and external partners in development process as a cohesive team and thus increasing efficiency of development.

7. Reduces rework cycle time to a great extent.
8. Design team spread across the globe interacts seamlessly and software maintains latest version as current and thus eliminates different version.
9. Also reduces travel time by 30 to 50 %.
10. Administrative cost reduction by 15-20 %.
11. It also brings in technological flexibility and thereby improving overall efficiency.
12. Provides tight authorization and access control for complete document or single document.
13. Helps in improved communication between stakeholders.
14. Provides base document for procurement and execution processes.
15. Helps in greening the chain in engineering design by storing documents online, reducing paper work in iterative processes of design, and avoiding to maintain various version.

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