Improving Planning Process for ETO-Projects: A Case Study

Kristina Kjersem, Gabriele Jünge

Improving Planning Process for ETO-projects: A Case Study

Kristina Kjersem[1] and Gabriele H. Jünge[2]

[1] Møreforsking Molde AS, Norway
kristina.kjersem@himolde.no
[2] Norwegian University Trondheim, Norway
gabriele.junge@ntnu.no

Abstract. This research paper builds on a case study performed at a Norwegian company that deals with a large number of small Engineer-To-Order (ETO) projects. Recently, the company started an improvement process pursuing lean principles. One of the initiatives taken by the company is to improve the present planning process, which lacks a whole-project view that can give managers a better decision ground. Two important departments, engineering and production, develop project plans that are based on their own specific approaches and with little collaboration between the departments. This paper presents the preliminary results of implementation of Lean Project Planning (LPP), a planning tool developed within shipbuilding industry, a typical ETO environment.

Keywords: Last planner system · ETO · Project planning · Earned valuee

1 Introduction

Increasing competition on product quality, cost, rapid project delivery while maintaining a certain flexibility during the design, engineering and production phases of a project are a few of the challenges many Norwegian ETO organizations encounter nowadays. In [1], the authors state that this type of industry is "characterized by low-volumes, high degree of customization and project-based processes" which means that the customer is involved from the design phase of a project and can decide specific features of the product all the way to the delivery phase. The case company subject of our research is an ETO organization producing pressurized storage tanks used within industries like shipbuilding, offshore platforms and other similar environments that require such products. The company is located in Norway and it has a good reputation on delivery of highly customized products by offering market design, engineering, manufacturing and testing of the final products. However, the competition on this specific market is increasing and the company focuses now on improving its working processes at every level within the company. The leaders and the employees are all committed to the improvement program and one of the proposed actions is to implement lean ideas that will help them to define a way of working smarter

for achieving their goals: Shorter lead-time, lower production costs and better control over their projects. Another focus of the improvement program is on creating a proactive planning process that integrates all disciplines in a common project plan.

However, in traditional project management, the planning activity is often seen only as a technical process neglecting its human aspect and the need for collaboration [2]. In our paper, we argue for implementing a planning tool that combines both technical and human aspects of the planning process in a novel way: Lean Project Planning (LPP). The empirical data suggest that using traditional project management approach is not enough for ETO projects and among the reasons is the number and differences between project participants as well as the iterative nature of design and engineering activities.

The aim of this paper is: 1) to present the case and the challenges experienced by the company before implementing LPP; and 2) to present the preliminary results of implementing LPP. As a planning tool successfully implemented in other complex projects, LPP aims at improving the planning process by creating a project environment that inspires commitment and where open communication and a proactive planning attitude is the norm, not the exception. LPP combines Last Planner System and Earned Value Management concepts in a way that complete each other and give project team a good foundation for the decision process at the management level [3,4] as well at the project level.

2 Lean Project Planning

Lean Project Planning (LPP) is a management model that has been successfully implemented at Vard, a shipbuilding group in Norway [4,5]. LPP is based on several components : 1) Lean thinking ideas like the PDCA circle; 2) elements from Last Planner System (LPS) [6] used within Lean Construction environment; and 3) Earned Value Management (EVM) [7] used within project management practice.

LPP as it was implemented since 2009 at Vard Group [3,4]. LPP as a planning method distinguishes the system part and the planning process part within the project planning as a whole. For the system part, an IT tool (Primavera, Microsoft Project, etc.) is used as a planning and reporting structure. The planning process part is based on LPS, EVM elements and lean ideas.

The planning process focuses on collaboration, open communication and involvement from the people allocated to the project. The Project Plan is in fact the project's database as recorded in the IT system and only the planner manages the data in this plan. The plan that is first prepared and is a part of the contract signing is the Milestones Plan. This plan contains key events of the entire project from the contract signing to the delivery of the final product. The next plan is the Discipline Plan, which is created in collaboration among all disciplines (including relevant subcontractors) to be involved in the project. Together, Milestones Plan and Disciplines Plans generate the Master Plan that shows the whole project execution horizon. Activities within these plans are

quite general and have a long duration. A more detailed plan is created at the Period Plan level that contains activities with duration between five to eight weeks: A look-ahead plan per discipline.

Due to high number of activities and the need for flexibility at weekly plan level, EVM is applied at the Period Plan level that is a suitable level of detail, consequently making the EVM reporting process quite reliable. By focusing five to eight weeks ahead, the Period Plan gives project organization the possibility to avoid deviations from the plan by removing any constraints before the activity supposed to start. The Period Plan contains work packages that are defined so that they can be used within the EVM planning and reporting procedures. Each supervisor reports on a weekly basis the status of their work packages: Percent physical complete on each activity, remaining hours and, if necessary, a new finish date in case of delays from the plan. During the reporting process the seven preconditions or constraints (Preceding work; Resources; Information; Materials; Space; Tools; External conditions) [8] for an executable activity are analyzed, making people aware of eventual problems that can cause delays. After the reporting process is completed, the project planner creates project reports and sends them to the whole project team and to high-level management.

The Period Plan is further developed into a more detailed plan that is called Week Plan. This is a detailed and dynamic plan created and followed by each supervisor who reports the completion of planned activities during the weekly lean meeting. These lean meetings are steered by the technical or production coordinators and have the purpose of enhancing communication and commitment among project participants. Each lean meeting takes less than one and a half hour and follows a standard procedure so that people involved in more projects know what to relate to. Some general rules for these meetings are: 1) Attendance is not voluntary (all invited people must participate). 2) People must come prepared to the meeting; 3) Line management join the meetings from time to time (supervisors are evaluated on the way they are prepared for the meetings). 4) People have to explain to the rest of the team the status of their own activities, causes for deviations and measures for recovery of deviations (this is important for other disciplines that might need to replan some of their activities) as well as which activities are planned for execution for the next week or two. 5) People must follow the rules of the meeting and are invited to come with suggestions for improvement [3].

The system part of LPP as represented in the triangle shows the cost breakdown structure (CBS) and different levels of work packages as implemented in the IT systems: one used for project planning purpose and the other one used for the financial purpose.

The idea behind LPP is according to [3], that EVM is good at handling issues at a high level of project management, but fails to handle issues concerning improving project performances relevant to supervisors. Among the critics to EVM within lean construction literature, some authors argue that EVM treat project activities as independent when in fact they are interrelated [9], and that EVM does not provide indicators on the quality of the construction or the qual-

ity of the process [10]. On the other hand, [11], present an analysis showing that there is a statistic significant correlation between EVM and LPS and recommend to train project managers in the use of both methods in their work. The combination of these two methodologies add value to project planning and control involving and motivating the project team. The strength of LPS is that it systematically handles issues regarding project performance at supervisor level, but do not deal with high-level management issues as well as EVM does [3]. An important rule when using LPP is to find the right level of detail for each of the plans. Emblemsvåg [3], considering the level of uncertainty in an ETO project, recommends to *"train the organization to live with this uncertainty and then rely on the expertise of supervisors and coordinators to maneuver to find the best solution for given circumstances*" (p.6). The focus here is on planning as a communication process among all project participants from the lowest to the highest level of decision-making pyramid.

3 Research Methodology

We apply case study methodology to this research. Yin [12], states that a case study investigates a contemporary phenomenon in its natural setting and the outcome is on relevant theories generated from understanding gained through observing actual practice. The focus of our research project is on how to improve the planning processes at the case company by using LPP as a method that can help them achieve the desired results: integrated plans. The data is mainly qualitative and we collected it through observations, discussions and interviews as well as frequent participation in day-to-day organ-izational processes related to some of the projects. In addition, one of the authors worked directly with LPP at the shipyard and later with the implementation at the case company. The scope of this paper is to bring to discussion the need for better planning tools for ETO projects as well as presenting preliminary results from implementation of LPP, a planning tool tested only in shipbuilding industry until now. We argue this research contributes to developing a more scientific approach to planning process as a management tool that integrates engineering and production activities performed in complex ETO projects.

4 Case Company

The case company is an ETO manufacturer offering market design, engineering, project management and manufacturing of pressure vessels, process vessels and storage tanks to the oil and gas market. Products are highly customized and are manufactured at the company location, which can accommodate over 35 projects at a time. Based on the size and complexity of each project it can take from 7-8 months to 12-15 months from the contract to the delivery of a new product. This long project duration include long lead items (e.g. special forged parts that can take up to several months to be delivered). However, based on market demands,

the company is interested in shortening this lead-time by improving its working process.

We started the project by carrying out a mapping process that identified the working processes that were most beneficial to improve first. Together with company representatives, we decided to investigate a method for improving the project planning process. Currently, their project planning process is mainly divided in two sections: one performed by the technical manager and one performed by the production manager. There is very little integration between these two plans and the company is interested to achieve a total project overview that can give them a better control over their projects (even though the two departments disagree on the ownership of the total plan).

The organization model applied by the company is mostly line-organization (department leaders are part of the project team and allocate task to own people on a daily/weekly basis) type with only a few people allocated specifically per project. Such type of organization is not usually associated with ETO environment which, according to Gosling and Naim [13] is "*primarily associated with large, complex project environments such as construction and capital projects*"(p.741). However, the case company specifically designs, engineers and manufactures every product according to each customer specifications, which is an important characteristic of an ETO organization. The final products are quite complex and must conform to high quality requirements due to their purpose on offshore platforms, vessels and other specific environments. In addition, an important customer requirement is the possibility to introduce last minute changes to the product while under production.

Shortly before the sale is completed, the sale manager transfers projects to a Project Manager (PM) and, considering that the planning process starts often during the negotiation phase, the results is that the PM has, at the taking-over point, a prearranged milestones plan that is difficult to change.

Resource allocation per project is performed at department manager levels where Technical Manager and Production Manager distribute tasks to people in their departments on a weekly basis by taking into consideration priorities from a project portfolio perspective. That is not always in accordance with each PM own plan for execution of the project. In order to follow their own project plans, each PM applies a certain stress on the engineering and production teams to produce what PM acknowledge as important from own project perspective. When PM comes with some urgent activities for one project, people will delay other activities committed to other projects, and this leads to a constant firefighting working environment. Another important aspect is that having allocated tasks on a weekly basis, employees do not have the possibility to plan and prepare activities so that these will be executed on time. The process of preparing activities is about all the actions and procedures that identify and remove constraints for future work [14].

The reporting process is performed on a weekly basis and employees report physical percent complete on the allocated activities to the Technical Manager and Production Manager who report further to each PM and other company

leaders.

Technical department plans the design and detail engineering activities, which are performed both in Norway and in a foreign European subsidiary. The drawings are produced through an iterative process, as many of them need comments and approval from the customer and from classification societies. The drawing process is also dependent on the footprints from some of the suppliers of valves, pumps and other equipment to be installed inside and outside the tanks. The planning process for the entire engineering department is prepared by the Technical Manager in Norway who plans and allocates activities to all the engineers within the company on a weekly basis. There are no links between the engineering plan and the production plan prepared by the Production Manager for all the projects under execution. Planning of the procurement activities is mainly based on information from the production department and experience from previous project.

5 Discussion

The first step on the LPP implementation process at the case company started with hiring a planner who mapped the current planning processes and systems existing within the company. The result shows different thinking approaches as well as different IT systems between departments. We identify how different aspects of LPP can handle challenges in the planning process at the case company.

The next step of implementing LPP was to train some of the employees in using the different parts of LPP. However, the training was at a superficial level and did not get into significant details due to a high product order at the time of implementation.

The first department implementing some features of LPP was the production department where they introduced a constraint analysis for their planned activities and the result was a significant improvement in the number of activities completed as planned. According to the project planner, the percent of activities completed as planned before starting the new approach, was between forty five to fifty percent. After starting to use lean meetings and activity constrains analysis, the percent of completed activities increased to over sixty percent and the production department is now working for implementing the EVM reporting per project. However, there are some challenges due to the IT planning system that limits some of the EVM feature (the difficulty to report physical progress). The managers of the company are interested in this methodology and work for defining the best solution.

Another relevant result was an improved communication from people on the production department about which constraints might affect their activities on the near future. The supervisors' involvement and commitment resulted in a requirement for a white board containing weekly-actualized plans to be placed at the production department. These plans are created in collaboration with the production manager, the planner and relevant subcontractors.

The technical department remained reluctant to implementing LPP and one of the reasons is their difficulty and time-consuming planning activities with their iterative nature specific engineering activities. However, the planning process from the production department, showing constraints coming from the technical department, challenged the technical coordinator to take measures for eliminating these.

Overall, the preliminary results of implementing LPP show a significant improvement in the project planning process at our case company especially at the production department. The next step of the implementation is the technical department where we are in the process of defining what their typical constraints are when planning iterative engineering activities. Another aspect we are looking into is how to motivate engineers to plan the completion of their activities in close collaboration with the suppliers of technical documentation.

An important remark here is that the success of LPP implementation on the shipbuilding company was sustained by a dedicated training from the yard management. Without this type of training, the implementation of LPP is slower and the results might come after several projects. The preliminary results on our case company confirm this statement.

The preliminary results endorse also the idea that LPP is an appropriate tool for planning ETO projects and we are looking forward for the next phase of this implementation.

6 Conclusion and Limitations

In this study, we have investigated the planning process in the manufacturing company who organize and carry out projects in an ETO environment. The current processes have been analyzed and challenges and areas of improvement have been identified. Furthermore, the study demonstrates that LPP as a management model is able to meet these challenges and suggests specific measures to improve the planning process in this company.

By applying LPP principles, the company can first develop a good planning process that motivates people to participate and to make promises they want to keep. Then, in order to complete their activities as promised, people must communicate to each other, find out what can affect their plans and how would they avoid big deviations. However, a good reporting process showing the project status is an important issue both for the project team and for the leaders at the case company. Good routines on estimating budgets and durations must be developed for projects teams and managers.

Moreover, LPP gives leaders the possibility to make decisions based on right information from the people executing the work. Project reports obtained through the EVM elements can also support the managerial decisions by presenting a possible outcome of the project when no recovery measures are taken. LPP is most of all about facilitating a dynamic communication process that enhance the project team capabilities to deal with variation and rapid changes

during the project execution. However, implementation of LPP is dependent on the way people understand it and translate it to their working procedures.

References

1. Haartveit, D.E.G., Semini, M., Alfnes, E.: Integration Alternatives for Ship Designers and Shipyards. In: IFIP International Conference on Advances in Production Management Systems. pp. 309–316. Springer (2011)
2. Ballard, G.: If you can't say "no", you can't make a promise. In: Seminario Internacional de Confiabilidade da Petrobras. Brasília (2014)
3. Emblemsvåg, J.: Lean Project Planning: Using Lean Principles in Project Planning. International Journal of Construction Project Management,(Accepted for publication) (2014)
4. Emblemsvåg, J.: Lean Project Planning in Shipbuilding. Journal of Ship Production and Design 30(2), 79–88 (2014)
5. Halse, L.L., Kjersem, K., Emblemsvåg, J.: Implementation of Lean Project Planning: A Knowledge Transfer Perspective. In: IFIP International Conference on Advances in Production Management Systems. pp. 248–255. Springer (2014)
6. Ballard, H.G.: The Last Planner System of Production Control. Ph.D. thesis, The University of Birmingham (2000)
7. Sumara, J., Goodpasture, J.: Earned Value-The Next Generation: A Practical Application for Commercial Projects. In: Proceedings Project Management Institute. pp. 839–843 (1996)
8. Hamzeh, F.R., Ballard, G., Tommelein, I.D.: Improving Construction Workflowthe Connective Role of Lookahead Planning. In: Proceedings for the 16th annual conference of the International Group for Lean Construction. pp. 635–646 (2008)
9. Kim, Y.W., Ballard, G.: Is the Earned-value Method an Enemy of Work Flow. In: Proceedings Eighth Annual Conference of the International Group for Lean Construction, IGLC. vol. 6 (2000)
10. Cândido, L.F., Heineck, L.F.M., Neto, J.d.P.B.: Critical Analysis on Earned Value Management (EVM) Technique in Building Construction. 22nd Annual Conference of the International Group for Lean Construction pp. 159–170 (2014)
11. Olano, R.M., Alarcón, L.F., Rázuri, C.: Understanding the Relationship Between Planning Reliability and Schedule Performance: A Case Study. In: Proc. of 17th Annual Conf. of the Int. Group for Lean Construction (IGLC-17) (2009)
12. Yin, R.K.: Case Study Research: Design and Methods 5th ed. Sage Publications (2014)
13. Gosling, J., Naim, M.M.: Engineer-to-order Supply Chain Management: A Literature Review and Research Agenda. International Journal of Production Economics 122, 741–754 (2009)
14. Ballard, G.: Lookahead Planning: The Missing Link in Production Control. In: Proc. 5 th Annl. Conf. Intl. Group for Lean Constr (1997)