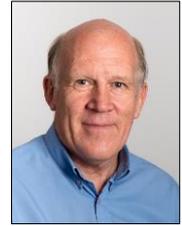




Introduction to Engineering Management



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Introduction

There is sometimes confusion regarding the role of, and need for, an engineering manager on a project. It is often stated that the project manager is the responsible person, and the use of an engineering manager is therefore superfluous. In this article the roles and responsibilities of an engineering manager and the interaction between the engineering manager and the project manager is explored.

OTC prescribes to the concept of an integrated project management team, as illustrated in Figure 1. In such a team all the required competencies are represented within the team to support successful completion of the project. As such, we believe that the project leadership team should be made up in such a way that these leaders have the right background and can guide the team effectively.

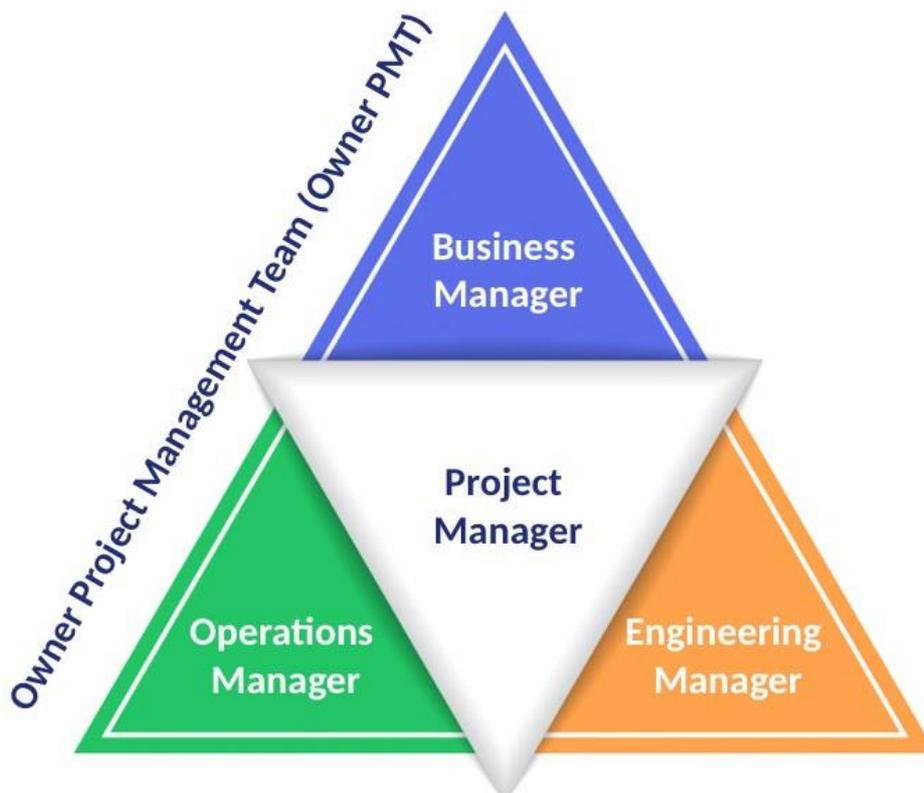


Figure 1: The owner project management team

In the case of industrial projects, the project manager should ideally be supported by a business manager, an operations manager and an engineering manager.

Roles and responsibilities of the Owner PMT

In the arrangement as reflected in Figure 1, the responsibilities within the overall team can be summarised as follows:

- **Project Manager:** The project manager is overall accountable for the project outcomes and is specifically responsible for meeting the schedule and cost objectives. Within these overall objectives he need to focus on the overall project execution strategy and plan, the contracting strategy, project commercial and legal issues as well as schedule, cost and change management. Safety, environmental and quality issues during the project execution is also of extreme importance.
- **Business Manager:** The business manager is responsible for business activities that includes for example overall business plans, business viability and economics, marketing, sales and all other support functions including legal, financial and business commercial issues. An issue that is also gaining prominence is product stewardship over the total logistics chain from raw material supply to final product delivery to customers.
- **Operations Manager:** The Operations manager is responsible for operations activities. This includes both operating and maintenance aspects. Operations personnel requirements, recruitment and training, variable and fixed operating costs, commissioning, operability and maintainability, operational safety and environmental compliance of the final facility are some examples within his area of responsibility.
- **Engineering Manager:** The engineering manager is responsible for the overall technical integrity of the project. As such this would include a facility scope that meets the business needs. An overall integrated technical solution requiring management of interfaces as well as management of technical/engineering quality of deliverables be it design deliverables or actual hardware like vessel, pipes or even control and IT systems. The execution of the engineering work in support of the overall project execution plan is also important.

If one considers the PMI Global Standard for project management, namely the PMBOK Guide, 6th edition (PMI, 2017) one will see that project management includes processes like integration management, scope management and quality management. Surely then, all issues listed as the responsibility of the engineering manager belongs with the project manager. Why would an engineering manager then be required?

In the following sections, I'll elaborate on the differences between the engineering and project management roles.

The relationship between project manager and engineering manager

It is important that the entire project team can translate the business objectives of a project into a properly defined scope, which meets both the schedule and cost objectives of the project. It is the primary responsibility of the project and engineering managers to have a full understanding of these objectives and to ensure they are met.

The project manager is required to be a project management professional. He understands all the work processes as per the PMBOK guide. The project manager is accountable for the overall project outcome. To achieve this, he uses professionals in various disciplines to achieve his goals. For example, a project controls professional responsible for cost and schedule issues, a legal professional to handle commercial and contractual issues, a risk management professional to handle risk management.

In the same way, the project manager requires a professional who understands all the technical and engineering requirements of the business within which the project is being executed. Only on small projects may the project manager have the knowledge and time to address both project and technical management. Even in such cases, if the project manager is a technical person, it often happens that he then starts to concentrate on the technical issues and project management suffers, or vice versa.

The engineering manager therefore needs to support the project manager in focusing on the project management work processes of a technical nature. The engineering manager needs to firstly be a technical/engineering professional who understands the business objectives and technical/engineering aspects of the business, such that a project can be developed that will meet the business needs. Secondly, he needs to have a sound understanding of project management processes so that the work is carried out within the project management framework.

One can probably call the engineering manager the “project manager for the technical work”. The engineering manager is no longer an engineer doing the design work, but the person managing the various engineering functions in getting the work done. He is also the person that must ensure that all the work done by the different functions is integrated into a whole that will deliver a functional end product. Very often a very good and capable engineer is appointed as an engineering manager, but he fails miserably at the job or leaves the job after a few days. This happens because he now becomes a high-level manager and an integrator having to align, support, coach, defend, justify and communicate with stakeholders rather than do engineering. Dedicated engineers often find this position very frustrating.

Who then makes a good project engineering manager? A person who has a good technical basis, that has a good grasp of all the different engineering disciplines and technical complexities of the business. He also needs to understand business development methodologies and the objectives of the business such that project will meet the business needs. A person who has been a project manager but would rather

focus on the technical management than the detailed project management aspects is also a good candidate. Additional thoughts are shown in Figure 2, courtesy of my colleagues.



Figure 2: Characteristics of a good engineering manager

Specific responsibilities of the engineering manager

The project and engineer manager need to work together in a close relationship to ensure all the PMBOK knowledge areas are fully covered on a project. In some areas the project manager needs to take the lead, while in other areas the engineering manager could take the lead.

If one considers the 10 PMBOK knowledge areas, one could possibly better define the role of an engineering manager as follows:

- **Integration management:** According to PMBOK, integration management is all about project integration like the project charter, project management plan and such. A very important activity for an engineering manager is technical integration management, including definition of battery limits for each package; definition of battery limit conditions like composition, pressure temperature; tracking these definitions and ensuring consistency between packages; and ensuring the technical integration of the new facility with peripheral facilities out of scope of the project;
- **Scope management:** The development and management of the scope of the final product to be handed over to the client in such a way that the completed project will meet the original business intent is primarily the responsibility of the

engineering manager. In addition to the product scope, the engineering manager must also develop the scope of technical services to be performed by his team or the scope that will be contracted out;

- **Schedule management:** The engineering manager needs to develop the schedule of technical/engineering activities and ensure that these are correctly integrated into the overall project plan;
- **Cost management:** The capital cost of a project is an outcome of the product scope. As such, the engineering manager is a main contributor to the final cost of the project. One of the tasks is to ensure that the product scope will be able to meet the quantity and quality requirements. In addition, the project must be economically viable. This often requires trade-offs to be made or alternative technical solution to be sought to generate a product scope that will result in an economically viable and sustainable project. The engineering manager must ensure that the right questions with regards to these alternatives are asked early on, to guide the engineering team in achieving the best cost-effective solutions;
- **Quality management:** It is of paramount importance that the engineering manager understands the quality drivers of a project early in the project. One of his key functions is achieving the required quality of the final deliverables. Whether it is the hardware and software being developed, the construction of the facility, or the quality of the final products that will be delivered once the project has been completed. Ensuring the quality of these rests squarely in the lap of the engineering manager;
- **Communication management:** Communication and ensuring alignment with stakeholders is a joint responsibility of the overall project leadership team. The engineering manager will concentrate on communicating with the engineering disciplines;
- **Resource management:** The engineering manager is responsible for determining the engineering resource competencies, numbers and the sourcing of these resources;
- **Risk management:** Although the project manager is overall accountable for project risks, each member of the leadership team is responsible for the management of risks in their specific areas. As such, all technical and engineering risks reside with the engineering manager;
- **Procurement management:** During the procurement activities, the engineers are required to do regular inspections to ensure that the quality requirements, as specified by them during the project development phase, are adhered to. This often results in a conflict between schedule and quality. It lies within the ambit of both the project and engineering managers to resolve this to the benefit of the project objectives; and

- **Stakeholder management:** Stakeholder management is a crucial activity to be performed by all members of the project team, but also, very importantly, by the project sponsor as the accountable person.

The engineering manager thus plays a crucial role in many of the PMBOK knowledge areas and his support to the project manager is extremely important. A good project manager will work together with his engineering manager on an equal basis and between the two of them they will ensure that all areas of project management are adequately covered. They can be considered as the two sides of the coin of project management on a project. If the one fails, the other will fail as well. The engineering manager can also be considered the assistant project manager and both he and the project manager should always be fully aware of all aspects of the project. The one should be able to stand in for the other at short notice and without adverse consequences to the project.

It is more than likely that there will be conflict between the roles of project manager and engineering manager, but it is crucial for these two role players to ensure that a healthy work relationship between them is fostered, to continually serve the project objectives.

Closing remarks

The ultimate objective of using an engineering manager is to enable the project manager to focus on the overall project management aspects, as per the PMBOK knowledge areas of the project and for him to use the engineering manager to ensure successful completion of the technical and engineering work.

We trust that this article has been 'insightful' (pun intended). More detailed articles on the key capabilities, work processes and competencies in engineering management are in planning.

References

PMI (Project Management Institute, Inc.), 2017, *A guide to the project management body of knowledge (PMBOK Guide)*, 6th ed. PMI Book Service Center, Atlanta.