Upon its completion, the Shanghai Tower (left) will be the tallest building in China, and second tallest in the world after the Burj Khalifa

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Proactive project management: documentation and control suggestions for megaprojects

The success of a megaproject is dependent, in part, upon the establishment of appropriate project controls to monitor project execution on a 'real-time basis'. The contract should require the timely submission of the type, quantity and quality of information that the owner needs for the early identification and resolution of schedule, cost or performance issues that can jeopardise the megaproject.

Proactively identifying and addressing cost and schedule issues minimises risk on large capital projects. While adequate project controls are also critical to the contractor's ability to effectively manage a project, the ability of an owner to anticipate that a contractor is behind schedule, over budget, financially strained, at odds with its key suppliers or otherwise experiencing significant issues often determines whether a project can be successfully completed. This article outlines the importance to the owner of establishing adequate project controls to monitor contract execution on a 'real-time basis'. Also discussed is the need for the contract requirements on schedule, cost and job progress to be integrated with the project control processes being utilised by the owner.

For the purpose of this article, it is assumed that the project involves a very large capital expenditure and has been bid on an Engineering, Procurement and Construction (EPC) project delivery system basis under which the owner has established payment

and schedule milestones, together with various performance guarantees. The owner has essentially agreed to pay a risk premium in exchange for: (i) a single source of supply for all design, procurement, construction, testing and commissioning activities; (ii) a fixed price or guaranteed maximum price; (iii) a fixed project completion date; and (iv) strict compliance with performance guarantees. The contractor is contractually responsible for preparing the initial project schedule in conformance with the owner's milestones and guaranteed completion date, including engineering, procurement, construction, testing and commissioning activities and for submitting it to the owner for review and approval. While an EPC delivery system is assumed, the owner's establishment of adequate project controls is important to the success of the project, regardless of the project delivery system selected.[1] This 'baseline schedule', which contains thousands of activities, was agreed between the EPC contractor and the owner at the time of project award.

'The owner's project control process provides the framework for effective and prudent project management during the life of the project'

Prior to addressing these issues during the project execution phase, it is useful to highlight the project life cycle and the role of project controls during each phase of the project.

Project life cycle

The life cycle of large capital projects generally consists of the following phases:

- feasibility, strategic planning and project development;
- project scope, definition and refinement;
- procurement;
- execution; and
- closeout.

The owner's project control process provides the framework for effective and prudent project management during the life of the project. Internal project controls are generally established to document and monitor each step in the project life cycle. While the EPC contractor is hired to execute the project, the owner's internal project control process begins during the feasibility and strategic planning stages, and intensifies as the project scope is refined, the contracts let, and the EPC contractor begins execution of the work. At the outset, the owner must document the need for the project, its regulatory and financial feasibility, and its overall plan and strategy for the procurement and execution of the project. During the strategic planning and project development stage, the following are examples of the types of decisions that must be documented and supported:

- have appropriate processes and approvals been established for technology selection, initial scope, budget and schedule development, and financing decisions?
- what type of project delivery system is appropriate for this project?
- were reasonable alternatives considered?
- have regulatory requirements and considerations been addressed?
- have appropriate internal and governmental approvals been addressed?
- has an appropriate internal project management team been selected? Is it prudent to retain outside expertise to assist the internal project management team (legal, project management, scheduling and project controls, engineering, auditing, risk management, document retention and other functions)?

The following are examples of considerations that should be addressed and documented during the scope definition and procurement stages:

- have key stakeholders been engaged regarding major project decisions?
- have competing technologies been adequately vetted?
- how were the project vendors and contractors selected? What criteria were used in the selection process? Are those the appropriate criteria for this project?
- have project risks been identified and reasonably allocated through the procurement and contracting strategy?
- has an auditing or other feedback loop been established? Has an adequate quality assurance and quality control strategy been implemented?

During the project execution and closeout phase, the following are examples of the types of decisions that should be addressed and documented:

- has an established project management strategy been implemented? Is the

staffing appropriate?

- has an adequate project controls framework been established? Do the cost and schedule controls address the project needs? Does the system provide accurate and reliable data?
- have communication and reporting systems been established to allow executive management to make timely and informed decisions?
- are periodic reviews of the project controls and processes conducted? Are they independent?
- do the project controls allow early issue identification? Are steps in place to assure compliance with applicable laws?
- do the project controls facilitate quality assurance and quality control compliance?
- has a process been established to document major project decisions, including change management? Is there an independent process in place to provide a continuous improvement loop on identified project issues? Is the process adequately documented?

'A principal goal of the owner's project control function is to timely identify and address cost, schedule and other performance issues as they develop'

Internal project controls must be designed to document the decision-making process and must identify risks to schedule, budget and other project specific criteria.

Integrating the contract documents with the owner's project control processes

In drafting and negotiating the contract documents, the owner must be mindful of its information needs for the project. During the feasibility, strategic planning and project development, project scope definition and refinement, and procurement stages of the project life cycle, most of the information that the owner needs to monitor, document and support its decision-making process, its budget, its schedule, the regulatory and financial environment, its staffing and the myriad of other decisions and analyses that must be performed is within its control. While some of the information may be provided by its advisors or professionals (such as legal, accounting, engineering, risk, and the like), and preliminary pricing information may be provided by engineers, contractors and vendors, the owner gathers the information that it needs to establish that its decision-making processes are prudent. As the project moves into the execution stage, some of the significant information that the owner needs to proactively manage the project is developed by the EPC contractor. This is not to suggest that the owner may not independently verify work progress, installed qualities, design maturation, contractor labour and equipment quantities or other objective and observable criteria. However, much of this type of information is developed by the EPC contractor in the first instance. It is important that the owner, through the contract documents, require the periodic submittal of information from the contractor in a form that can be readily used in the project controls process. The process of integrating the information and submittal requirements of the contract documents with the owner's project controls process is a critical function that is sometimes overlooked during the contract drafting process. The requirements of the contract documents must meet the structure of the owner's project management and controls process.

Project controls: the project execution phase and the EPC contractor

One of the goals of the owner's project controls process is to minimise project risk. While the discussion focuses on the owner's project controls system, the concepts are equally applicable to the monitoring of the performance of vendors and suppliers by the EPC contractor or the monitoring of the performance of the consortium or joint venture partners. Project controls should allow the early identification of performance, budget and schedule risks, and allow the owner to make prudent decisions in light of the issues identified. The level of detail and definition of the owner's project controls system and staff varies based on the size, location, complexity, contract type and risk profile of the project. However, the owner's project control process should be designed to timely identify and address issues as they develop.

On most large capital projects, the owner needs to perform the following functions during the execution phase of the project:

- report costs to date and forecast costs to completion;
- monitor, verify and document project status against various metrics, including budget, schedule and payments;
- verify schedule status, including schedule status of major engineering, procurement and construction activities;
- monitor status of major subcontractors;
- change management, including design maturation; and
- internal and external reporting of project data.

EPC contractors are typically required to submit the following types of information on a monthly basis as a precondition to invoice approval and payment: contract and payment status; schedule status; schedule progress; quantities installed; quantities stored; work-in-process; total project costs; project progress and other project metrics; submittal logs; drawing logs; status of pending change status; status of requests for information; and a myriad of other important project information. This information is typically provided through a detailed monthly progress report. The key from the owner's perspective is to ensure that the contract provisions require the contractor to submit the quantity and quality of information that the owner needs in the form most useful to the owner. At a minimum, the information must meet the tracking and reporting needs of the owner and must be sufficient to allow them to verify the validity of the construction and schedule progress. The project control process should work in 'real-time' to allow them to proactively address any identified issues. Generally, they would implement, at a minimum, the following internal processes for information, reporting and project management purposes:

- project cost and budget controls;
- schedule management;
- earned value or other progress management;
- change management; and
- risk management.

Conclusion

A principal goal of the owner's project control function is to timely identify and address cost, schedule and other performance issues as they develop. The contract documents should be drafted so that adequate reporting requirements are incorporated to meet the needs of this project control system. The contract documents should likewise reflect the risk management plan. The contract provisions for scheduling, schedule updates, earned values, project costs and project progress must assist in managing project risks at the appropriate level by meeting the information, tracking and reporting needs of the owner.

Note

1 For detailed discussion of the advantages and disadvantages of various project delivery systems, see Bates, 'Strategic Considerations in North American Megaprojects: Common Project Delivery Systems and the Risks and Rewards of the EPC Consortium', Chapter 18 of the forthcoming book, *Managing Gigaprojects: Advice from Those Who've Been There, Done That* (American Society of Civil Engineers Press, 3rd Quarter 2012).

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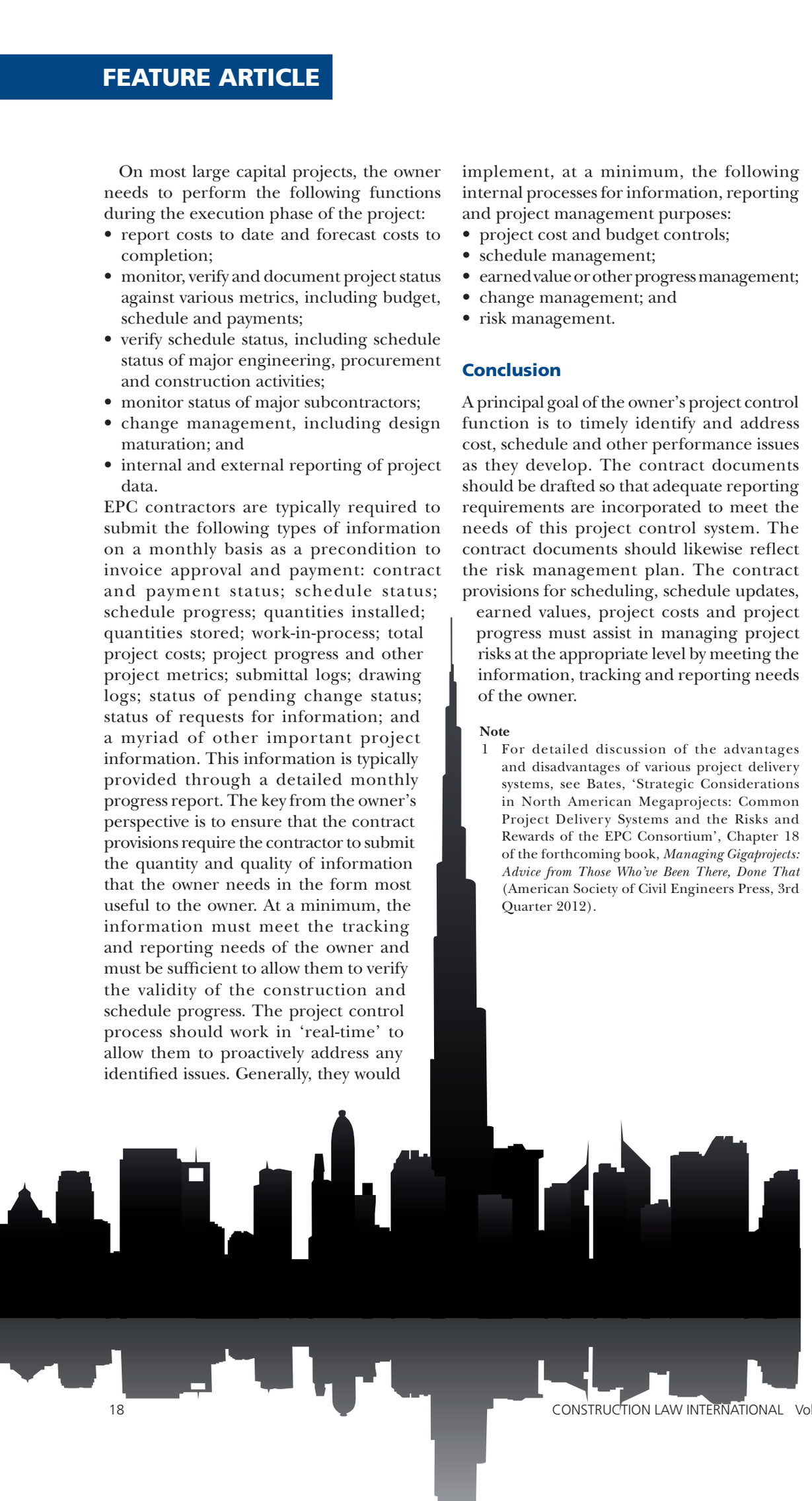

Left: Illustration of the Burj Khalifa, currently the tallest building in the world