White Paper

Construction Industry Positioning Paper

Introduction

In civil engineering, construction is the building or assembly of any infrastructure. Although this may be thought of as a single activity, in fact construction is a feat of multitasking, scheduling and collaboration. Construction companies aim to maximise revenue and reduce costs by effectively managing projects, resources, assets and suppliers (or partners). Recent research in the UK has indicated that successful projects are the combination of effective planning, team collaboration and integration, maintenance of knowledge, and flexibility in design during the construction process (Constructing Excellence, 2004).

The construction industry is so old – just consider the pyramids – that it may seem new innovations would be rare. However, the role of technology in the construction industry now adds a new dimension to the way construction projects can be carried out in future.

In the modern world, building construction usually involves the translation of paper or computer based designs into reality. The design consists of drawings and specifications, prepared by a design team including architects, civil engineers, cost engineers (or quantity surveyors) and structural engineers.

In an older form of a construction project, the design team tend to be employed by (i.e. in contract with) the client. Using this method of procurement, once the design is completed a number of construction companies or construction management companies may then be asked to tender for the work, either based directly on the design, or on the basis of drawings and a bill of quantities provided by a surveyor. Following evaluation of submitted tenders, a contract is (typically) awarded on the basis of lowest cost.

However in recent times it has become more common to ask construction management companies to prepare a design and to provide an accompanying quotation. In this case the construction company will employ and work in close cooperation with the design team. As the technology and techniques used in construction become more complex, it is increasingly difficult for architects and engineers alone to produce efficient designs.

Using the expertise of the construction management company has many advantages in terms of practicality, cost and time savings. The company can initiate the site preparation prior to finalisation of the design, this can save valuable time and provide useful on-site data for design and engineering. With the construction company in charge of the design, extra costs for the client are frequently also minimised, provided the client is able to resist requesting significant design changes (after the initial design has been finalised). In this case the client may not necessarily select the construction company on the basis of construction cost; but perhaps on design quality, or on the projected total cost of the building (and its running and maintenance cost) throughout its entire life (known as its life cycle cost).

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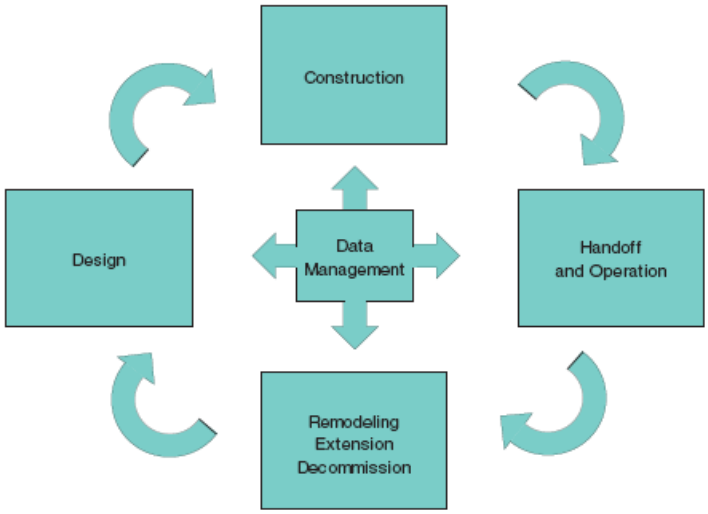
Key business issues for the construction industry are management of the following:

- Projects and schedules
- Project accounting
- Construction supply chain
- Production, inventory and assets
- Customers
- Workforce
- Integration and collaboration [1]

Projects and schedules

Construction projects involve a complicated mix of people, processes and materials. The construction process itself can consist of multiple silos, with complex handoffs for each stage that can create problems. This is compounded over a number of different projects that are underway simultaneously. Construction companies therefore need the capability not just to manage one project but a portfolio of them. Fundamentally, the issue is how the company manages and uses the information it is constantly receiving from a variety of different sources – clients, suppliers, sub-contractors and partners, and construction projects themselves.



Life cycle of a typical construction project (Gartner, 2003).

Unanticipated changes and delays add another issue – that of risk management. Construction delays in residential and light construction are most often the result of miscommunication between contractors, subcontractors, and property owners. These types of misunderstandings and unrealistic expectations are usually avoided through the use of detailed construction contracts, which specify the work, materials, and timetable to be used. However, in more complex projects, problems will arise that are not foreseen in the original contract, and so other legal forms are used, such as change orders.

[1] Construction industry specific functionality, such as bid management, and facility and plant operations, are not part of the SYSPRO solution and should be referred to a third party software vendor.

Project accounting

Closely aligned to project management is project accounting. In an industry with a reputation for hidden costs, a hammer can cost $1000 unless there is proper procurement management. Billings must also be invoiced and paid on time. So having access to accurate financial information is critical.

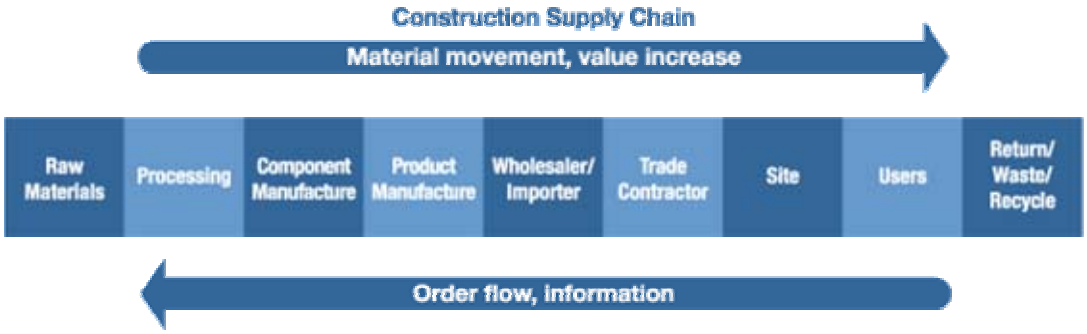
Project accounting must also be able to manage sub-contractors' progress, managing requests for payment and ensuring that work is done before payment is made. Clients also require status reports, this requires the functionality to combine project management information with accurate cost breakdowns.

As is often the case in construction projects, unforeseen circumstances can result in unanticipated work, which need to be approved first before work is continued. This may necessitate getting new quotes and revising works orders, which then have to be processed as a change request to the project owner.

The combination of accurate and timely project management and project accounting information enables more effective decision making, improved service delivery and ultimately better cash flow.

Construction supply chain

It may be difficult to recognise at first, but a supply chain exists even in the construction industry. This is an area where innovations in processes can be made. Improving these processes requires systems that can track and monitor supplier orders and shipments, component requirements and deliveries, costs and outputs.



In order to ensure consistent on-time, quality and pricing of orders and components, companies need to be able to monitor the performance of their suppliers and partners.

Production, inventory and assets

The variability of materials that make up the components of a construction operation pose similar problems to those found in process industries (e.g., plastics). This means that the quality of component materials has to be verified on each delivery, a specific quantity of components (e.g., sand) may not produce the same number of products (e.g. bricks), and so costs of components are difficult to standardise over the entire project. The construction management system must therefore be able to handle issues relating to quality management and cost estimation.

In the same way that a construction company can improve its supply chain, it can also benefit by monitoring and improving the “production” process. If there are systems that can track costs, activities, inputs and outputs, companies can consider applying a “lean construction” approach to reduce overheads, unnecessary activities and outputs (waste), thus improving quality, and ensuring the delivery “right first time and on time”.

To make further process improvements, companies should consider changes to the management and use of materials and capital equipment – in other words, inventory and assets. Unplanned and unexpected maintenance costs can contribute significantly to cost over-runs and construction delays. With current systems, usage of equipment can be monitored and maintenance scheduled after a required period.

Customers

The construction industry has been dealing with client issues since antiquity, but the ability to differentiate through customer service and delivery is as relevant to this industry as to others. Having a system that ensures contact with customers on a regular basis and improves communication around flexible design and construction changes has been found to make the whole construction process better. This also allows companies can keep track of clients’ design changes and handle issues more effectively. It also enables companies to establish customer management practices and apply them consistently.

Workforce

Managing the construction workforce is important for several reasons. For certain types of projects, specific knowledge or experience may be required therefore companies need to keep track of the knowledge-base of their staff and sub-contractors. In other instances, a shortage of staff requires the ability to manage the time and location of a scarce resource. And in all cases, companies need to record hours worked in order to get accurate information for wages and for billings.

Integration and collaboration

Much of the work of a project is outsourced, from the design stage onwards, which requires co-ordination of design, scheduling and cost. Design work is generally computerised these days, and so interoperability with design software is increasingly important.

Construction is an industry where delays can be costly, in cases where change orders have to wait for a decision, one way to reduce delay is to speed up information flow through better collaboration. The construction companies system therefore needs to be able to integrate with communication mechanisms, such as fax, Internet and mobile applications, so that any changes that require prior approval can be expedited quickly.

In contrast to sophisticated integrated projects, construction projects can also operate in areas where communications with a centralised management system are very difficult. The system running at the construction site must therefore be able to operate independently, without the need for a complex operational environment (i.e. poor power supply; dirt and dust), and be able to capture and deliver information for the central management system on a periodic, batch basis using simple technology infra-structure.

Summary

The construction industry is made complex due to the project nature of the work involved and the various elements and sub-contractors involved. Managing, planning and controlling the timing and cost elements associated with each stage of the project requires the ability to manage complex interactions of people, goods and information in a timely manner and with a high level of visibility.