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IMPROVEMENT OF DECISION-MAKING IN CONSTRUCTION THROUGH RELIABLE AND TIMELY INFORMATION

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Construction firms usually perform certain part of production with their own force and the rest is obtained through subcontractors. The operation based methods of project scheduling are currently widespread within sector, whereas, available finance and resources are usually of the highest priority. Thus, multi-objective analysis within scheduling process was addressed throughout the research. Accurate information is the key factor for securing smooth construction execution as the sector is characterized by numerous variations in time. The activities of progress recording and reporting are often carried out as heterogeneous and segregate processes, however, their integration offers significant enhancements. Therefore, KPI based alert system together with standardized information input were suggested.

Keywords: reporting, scheduling, decision-making, computer aid, KPI, lag time, construction management, investment.

Introduction

Undeniably one of the most important management documents in construction production is the schedule. The approach to its development differs from case to case as it can include various information, numerous formats, or even different level of aggregation. On the other hand, its creation still has to follow basic rules and reflect on technical, legislative, financial, and resource constraints. The initial project plan development is shown in Figure 1 where the sequence of simplified steps is drawn. The Firms operating at the general contractor level preferably use schedules in form of bar charts, flow charts or Gantt charts in order to clearly indicate level of completion at any time in form of percentage progress. Relations among all charts representing different works are drawn based on project documents and management decisions where the Critical Path Method (CPM) or lately more and more spread Critical Chain Project Management (CCPM) method are widely used for determination of project duration and possible buffer times for each work [9]. The initial planning is usually in significant detail as the intention is to confine the production into long time predictions, however, it is clearly inappropriate due to the continuously changing nature of the process; therefore it represents wasted effort to some extent.

Moreover, common misconception is to deal with the financing part of project planning separately. The development of work schedule precedes the cash-flow projection where its ability for the following alignment with financial requirements is significantly limited. The financial stability and sufficient funding are the core needs of any construction company. Both

are prerequisites for efficient and smooth production on the project level and even secure overall investment. Therefore, the priority for financial planning is clearly arising. The clear example is when sufficient cash for scheduled works is not available, the planned production duration will immediately increase leading to an overhead cost increase, customer satisfaction jeopardy, and most importantly profitability decrease. Unfortunately, some firms in practice choose to defer payments of selected costs associated with their production in order to avoid that. Adversarial conditions among stakeholders are then initiated. The finance-based scheduling offers great deal of help to resolve such problems, where its simple principle for operation lays in combining all aspects of financing, work timing and resources allocation together resulting in vital concept for developing realistic plans.

However, even if the whole initial planning process was undertaken smoothly and successfully with clear and complete results, the construction production process nevertheless involves numerous unexpected factors with possible influence both negative and even positive ways. Thus, schedule requires continuous modifying in reaction to altered real conditions from expectation. Moreover, the schedule acquired as the result of initial planning does not include necessary detail for actual production execution resulting in requirement for further detailing in time. Resulting from above mentioned the production planning is continuous process comprising adjustments of previously intended schedule and gradual detailing of upcoming production where the most important factor of financial targets has to be taken into consideration. The frequency of production plan updating and detail

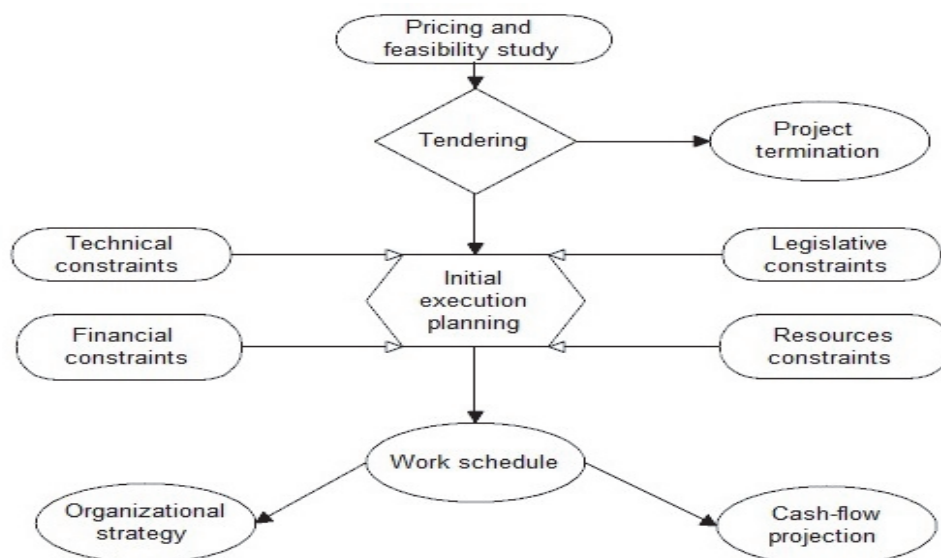


Figure 1. The initial production planning of project execution

expanding should be of the same periodicity as it would avoid some scheduling problem solving duplicity, however, effective decision-making is enabled based on quality information. Therefore, the project reporting system must be of the highest priority for the company in pursuing efficient and profitable management at the project and even portfolio level. Generally speaking, rescheduling as a deterministic system inherit certain inaccuracy due to delay from time-consuming process between information collection and revised schedule application as shown in Figure 2.

Above mentioned rescheduling inaccuracy could be eliminated by taking into consideration continuing production process and estimating production alternation ΔV between time A and B. That is equal to initially intended production volume multiplied by amount of delay cause by information processing $t_u = \Delta t_1 + \Delta t_2 + \Delta t_3$. It clearly desirable to shorten and streamline each of those steps in order to enhance information quality as the essence of efficient planning. Yet, desire for information reliability, objectivity, and clarity within project reporting representing data acquisition and processing often suffer from missing those requirements. Standardization within progress recording together with integration of all project information sources offer great deal of support in enhancing reporting system [1]. Moreover, development of unified project status list based on chosen Key Performance Indicators (KPIs) would enable access to necessary overall information in time and their easy comparability.

Scheduling

Project schedule is the most suitable tool for overcoming the management gap between company-

wide operations and single project performance. Therefore, its importance within production planning is marginal and significant emphasis for its quality development should be given. However, another common management gap even arises between the general contractor operation and finance company staff. The scheduling is usually perceived as operation-related matter, while financing is viewed as business-related one [4]. Unfortunately, it leads to lack of necessary linkage between production plan and financing which is essential for maintaining balanced cash-flow and secured profitability. The absence of linked schedule to finance untimely leads to development of non-executable plans in company's current situation and result in project failure due to failure in production financing. The basic solution for enabling creation of balanced distribution for works continuity, financial load, and resources allocation lays in their interconnection before initiating decision-making within planning. Therefore, the widely used schedule based on CPM or CCPM methods obtained within classical charts should be linked to information obtained from quantity survey where each bar representing different work step would contain the finance and resource need. Such an integration would enable better review and assessment of all interlinkages and should shorten and improve the decision-making process. However, the balancing or in other words looking for possible and most beneficial solutions could be proceeded based on either manual cyclic single-objective process or computerized multi-objective process within so called finance-based scheduling method where scheme of both processes is shown in Figure 3.

dules mean valuable tool not just for reporting but accommodate important rules in project delivery. Nevertheless, other ways of progress reporting are needed as well.

Construction Daily Log is maintained at every project due to legal requirements, however, its content is usually held in paper form with incoherent system of entries. Its purpose is to provide a snapshot of consecutive progress in activities on site as well as to record detected work obstacles. Those encountered problems as well as beforehand revealed unclear instructions in some instances inevitably lead to raising of Request for Information which is in certain instances followed by issuing Contract Change Directive, where both have to be continuously recorded and updated. Yet, consistency and availability of such records together with reliability of their updates are in many instances questionable just as for the cases of Submittals, Shop Drawings, and Samples likewise Purchases and Subcontracts Lists [6]. On the other hand, great deal of interest in financial tracking represented by Cost Analysis and Cash-flow overview can be recognized from project personnel as it obtains the highest attention from upper management.

Quality and syntactical reporting of production progress in all its aspects should be one of major constraints both on company and project levels. Different systems and their commercial solutions are available, nevertheless, construction production is characteristic with its complexity and uniqueness leading to need for better understanding of internal needs leading to necessary adjustments [7]. The desire for minimization of effort needed for information acquisition should be of priority where its clarity and easy understanding is the essence. However, each company has to take into consideration even other internal and external problems from previous experience and common practice among which has been recognized especially duplication of operations, subjectivity in progress indicating, redundancy of works, and reliability of both inputs and outputs. Interesting example for all is different approach of field personnel towards compulsory legal reporting in comparison with inner-company reporting, where the likelihood of objective and reliable output is higher due to different individual risk to gain ratio. The motivation of performance bonus is recognized but fear of legal liability is of much greater value.

Generally speaking, standardization together with integration could significantly help with reduction of some above mentioned struggles and even offer space for further improvements. Low standardization and unity in information records lead to additional work to already overloaded staff and reduce its possible efficient use in future. 'It is however important not to neglect the literature that expresses scepticism of increased standardisation in construction. It is often suggested that standardisation hinders or prevents innovative influences' [8]. Standardization enables to

record information in organized manner enhancing its readability when source integration offers in time access to information improving its usability. For instance Construction Daily Log is undeniably tremendous source of information as it keeps track of everything happening on site, whereas, the output even though fulfilling legal requirements is of ununified manner with no links to reporting system. Its input standardization would enable proper use of captured information and output integration could even process information in automated manner. Therefore, it is definitely worth of maybe long-track and significant effort for implementation.

Standardized input and integrated sources enable development of KPI system of reporting represents a great oversight of information for knowledgeable decision-making. The relevant and comparable information should be then accessible in real time for different layers of management based on the content aggregation and semi-automated data extraction without need for report creating. 'Through the literature review conducted, there were 48 KPI that were identified. Thirty-two KPI were selected as relevant to the strategic and business objectives of the company' [5]. However, tracking of KPI with negligible relevance to company would mean work redundancy leading to need for system tailoring. Moreover, relations between information sources and output of each KPI has to be defined as well as classification limits.

Conclusion

Application of improvement into already working system within company is a challenging and complex process including people, culture, structure, and technology. Therefore, even after completion and debugging of drafts for any suggested variant, its implementation plan development has to follow requiring a significant amount of time, energy, and resources. Such a change in inner working system of a company means risk for temporary decrease in work capacity and increase in resources need. That implies significant importance of well-prepared strategy for undertaking such a change illustrated in Figure 4 below.

The research's aim is to unite and improve reporting system together with scheduling methods within construction projects and even company-wide in order to enhance decision-making of management, resulting in balanced performance. Some of the troublesome areas of construction management were appointed throughout the paper offering clear examples and academic discussion reasoning for its relevancy. Ideas for improvement together with their core principles were suggested, however, negative aspects were uncovered as well. In terms of planning, especially finance-based scheduling deserves further development as financial planning is often planned only secondary after operational planning even though financial constraints are of the highest priority within project execution. The standardization and all sources integration in relation with reporting offers great opportunity for improve-

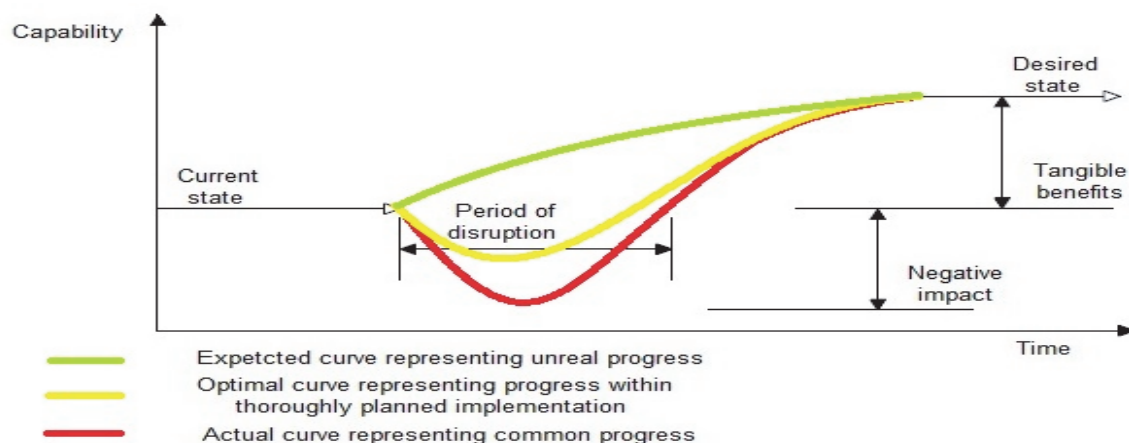


Figure 4. J-curve displaying possible progresses within innovation introduction

ment, where especially sophisticated KPI based project warning system deserves additional close attention.

There can be recognized certain mistrust or even scorn towards robust calculations and computerization in construction management systems. It is caused by previous and in a lot of cases needless to say negative experience with implementation of problem solving based on algorithms where some inherit mistake or deficit caused significant planning failure and led to certain level of disdain among professionals. On the other hand, continuously changing conditions on the market place result in greater demands for companies in terms of their efficiency and skills. Therefore, the need for sophisticated support is obvious and inevitable, whereas, it is important to realize that machine cannot solve problem but experienced person can. Resulting from that we should put the experience of personnel in the first place of trust when offer them to exploit any possible help with mechanical computations or variables.

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НЕКОТОРЫЕ АСПЕКТЫ ПОВЫШЕНИЯ НАДЁЖНОСТИ УПРАВЛЕНЧЕСКИХ РЕШЕНИЙ В ИНВЕСТИЦИОННО- СТРОИТЕЛЬНОМ КОМПЛЕКСЕ ЗА СЧЁТ ДОСТОВЕРНОСТИ И ОПЕРАТИВНОСТИ ИНФОРМАЦИИ

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Строительные фирмы, как правило, выполняют часть работ собственными силами, а остальные поручают субподрядчикам. В настоящее время в строительном комплексе широко распространены традиционные методы календарного планирования, в то время как характер строительного производства постоянно меняется, и особое значение приобретают финансовые и ресурсные ограничения. В данной статье рассматривается применение многофакторного анализа в календарном планировании. Точная информация является ключевым фактором для обеспечения своевременного выполнения проекта строительства. Деятельность по отчётности о ходе строительных работ часто представляет собой неоднородные и разделённые процессы, в то время как интеграция этих процессов позволит повысить вероятность обнаружения факторов риска. В работе предложено решение данных проблем за счёт внедрения системы предупреждения рисков на основе КРП, а также за счёт стандартизации информации.

Ключевые слова: отчётность, календарное планирование, принятие решений, автоматизация, КРП, временные задержки, управление строительством, инвестиции.

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