Scheduling and Cost Optimization for School Buildings in Public Sector

A Thesis Submitted in Partial Fulfilment of the Requirements for the Master Degree in Engineering Management

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Abstract

Nowadays, globalization and growing competition in construction industry have created increasing challenges for project managers to deliver their projects on time and within allocated budget. Scheduling, cost effectiveness and strict project control are the keys of success of any construction project. Inappropriate scheduling leads to completion delays and cost overruns.

The main aim of this thesis is to develop and use a scheduling and cost optimization model to overcome the challenging and competitive environment in school building construction in the public sector. Two well-established local contractors are selected to investigate their school construction scheduling practice for two school buildings in the Ministry of Works, Municipality Affairs and Urban Planning (MoWMAUP) in Bahrain.

As a result, a new school scheduling model (SSM) has been developed which involves the following: 1) The vertical relation between the repetitive structural core activities; 2) The horizontal constraints within each floor and the vertical constraints within the different floors; 3) Crew synchronization and the continuity of the work; 4) Work interruptions & deadlines, and resource constraints; and 5) The factors of productivity and learning curve.

Moreover, Genetic Algorithms technique (GA) is used along with SSM to reduce construction cost. GA is a unique optimization technique that is useful to examine an optimal solution for any complex problems with so many variables such as school buildings.

Optimization is used to select number of crews, best construction methods, and works interruptions for any activity that results in an optimum schedule with minimum total construction cost. Furthermore, SSM illustrates graphical reports of the large schedule data to assist crew and project control throughout construction.

The application of SSM functions require a Visual Basic for Applications (VBA) macro that uses the language of Microsoft Project software. Later, a case study is carried out on school building construction in Bahrain to examine and prove its suitability. The consistency and suitability of SSM to the school building environment is proven through various optimization experiments.