Software Development

Topic: Project Planning Tools

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Introduction:

In the early project section, the shape of the project is normally represented at an aggregated level as a Work Breakdown Structure (WBS), which decomposes the project into manageable activities, and on a precise level as a precedence diagram to represent the technological and execution dependencies among the activities of the project. To this end, the activities are related by precedence relations. It is without a doubt properly really well worth mentioning right here that most project manage techniques expect the very strict hypothesis of linear relations among the activities. In practice, however, projects are normally executed in an accelerated mode, via way of overlapping phases (such as the engineering with the procurement and creation phases), with the intention to deliver projects extra quickly (Berthaut et al. 2014) . The concept behind overlapping is to loosen up the sequential execution of based activities via way of rescheduling activities in parallel. While theoretically right modelling of overlapping activities with conventional precedence relationships is impossible, continuous precedence relations can now accommodate for this issue (Hajdu 2015). At the project network stage, the time required to perform every activity is likewise estimated, based on a stated resource level required (manpower, machinery, etc.) for each activity. Given the network and the period of the activities, the earliest and latest start and end times of the activities are then calculated and a resource profile displaying the amount of resource capacity required over time is created. Project scheduling is frequently visible because the remaining step of the initial challenge making plans cycle. This step corresponds to the generation of a baseline schedule, in which the activities are ordered concern to finite capacities of resources.

Despite that most researchers present a project schedule as a completely specific deliverable, and therefore scheduling as a one-time activity in the scope of a project, that is not often the case in real-life projects. For instance, developing a completely unique schedule early withinside the project life is unrealistic for most large-scale tasks. Indeed, those tasks are scheduled in a hierarchical manner. Aggregate schedules are first generated for a large horizon on the tactical level and exact schedules are then decided for the operational level. This iterative and progressive schedule elaboration, additionally referred withinside the literature because the rolling wave approach, recognises that firm commitments can't be made on incomplete knowledge (Cherkaoui et al.2017). Binding commitments are usually made on the primary section of the project, at the same time as budgetary commitments are made on subsequent phases. These commitment decisions are up to date because the project rolls through to the end of 1 section (Pender 2001). This multi-level schedule hierarchy is typically correlated with the WBS levels, transferring from making plans high-level deliverables (departments and disciplines), through making plans work programs, to scheduling detailed activities (de Leon 2011).

Within that rolling horizon project framework, the tactical making plans level consists of Rough-Cut Capacity Planning (RCCP)decisions approximately vital due dates and milestones of the project and project cost, which might be commonly updated each six months or so, relying on predicted project durations (De Boer 1998). These dates, milestones, and costs become constraints to the underlying making plans levels. RCCP creates a network of work packages with strong estimates of resource

requirements and minimal periods under global resource availability constraints over aggregate periods. Resource allocation to work packages may be considered flexible over periods, which permits the period of the work packages to be adapted according to International Journal of Production Research and cost-associated considerations (Baydoun et al. 2016) . In large engineering and creation tasks, RCCP schedules are typically prepared during the project front-end level to help complete project funding requests.

The functional level is performed based on the most detailed information about resource and material requirements available from the engineering and process planning phase. At this stage, the work packages because of the RCCP degree are divided down into smaller activities with constant periods and resource rates (De Boer 1998). Precedence relations among activities also are precise through a more detailed activity network. Given the detailed resource availability profiles decided on the RCCP stage, the Resource-Constrained Project Scheduling (RCPS) section is composed in figuring out the begining and end times for every activity accomplished via way of means of positive resource groups. At this level, the resources (team of workers or machines) are assigned to the activities for the subsequent weeks. The RCPS level commonly corresponds to detailed schedules generated throughout project execution in large engineering and creation tasks. Finally, extra detailed schedules may be prepared or discrete parts of the full project in preference to producing this quantity of detail for the complete project. These schedules can be taken into consideration as manufacturing schedules used for setting up each day or weekly work necessities.

In practice, the schedules at the 2 levels (tactical and operational) are up to date periodically both to shift the making plans horizon or to account for more accurate data that turns into step by step to be had. The interval of periodicity is about via way of means of the management and is obviously smaller as we pass downward withinside the hierarchy. However, the schedules must additionally be up to date each time a new information happens that might have an effect on the validity of the schedule outputs. As the level of detail increases, the making plans horizon decreases and using the schedule migrates from making plans to performance-level and control (de Leon2011).

Techniques And Tools For Project Planning:

Traditionally, strategies in project making plans and control have a tendency to be in large part schedule-driven via way of means of tracking project development in terms of activities' precedence relationships and their associated statistical fluctuations of the delivery time (Al Nasseri, Widen, and Aulin 2016). Moreover, the general overall performance of scheduling plans derived from those techniques is typically evaluated via way of means of a conformance measure of the as-constructed schedules in opposition to the as-planned schedules. In contrast, modern techniques for project making plans and manage are particularly concerned with figuring out and mitigating the schedule risks and integrating quality as a R.Pellerin and N. Perrier manage variable, while taking into account all constraints arising in practice at the activity level as well as at the project level. A variety of those new techniques and strategies for project making plans and control are represented withinside the papers surveyed.

Methods And Techniques Of Project Planning:

Project making plans provides plenty of decision problems. These may be widely categorized into 4 categories: project representation, project scheduling, resource allocation, and risk analysis. Over the years, a wide variety of techniques and strategies were proposed to solve those four classes of project making plans problems.

Tools For Project Planning:

Various project management software packages have been developed over the years to assist project managers. EXCEL software has been widely used in various planning and project management activities, especially WBS, but the most frequently cited project planning and management software packages in experimental and comparative studies are Microsoft Project and Primavera (Baumann and Primavera). Trautmann 2015, 2016; Cicibas, Unal and Demir2010; Gharaibeh2014; Hekimoglu˘2007; Kolisch 1999; Maroto, Tormos and Lova 1999; Stilgenbauer, Nicholas and Brizendine 2001; Trautmann and Baumann 2009a, 2009b, 2009c). These software, often referred to as project management tools, actually plan and control the information system and compare it to a fully integrated project management information system (PMIS) that supports all project management functions(Pellerin et al. 2013). Moreover, Wang et al. (2014) showed that most of the reported systems concentrate on the schedule management and only on cost management.

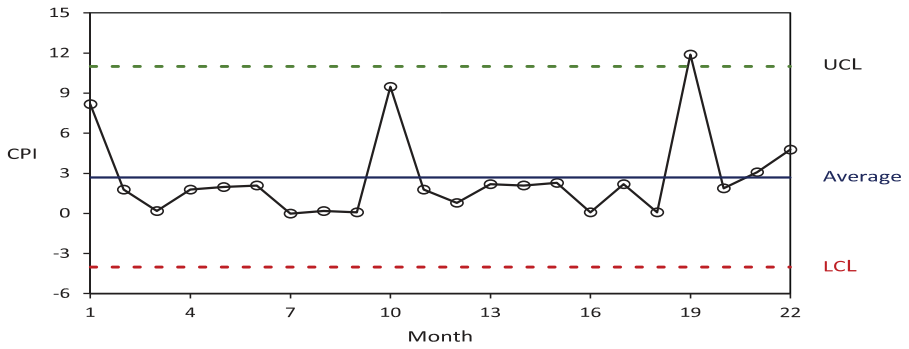

FIG: CPI CONTROL CHART

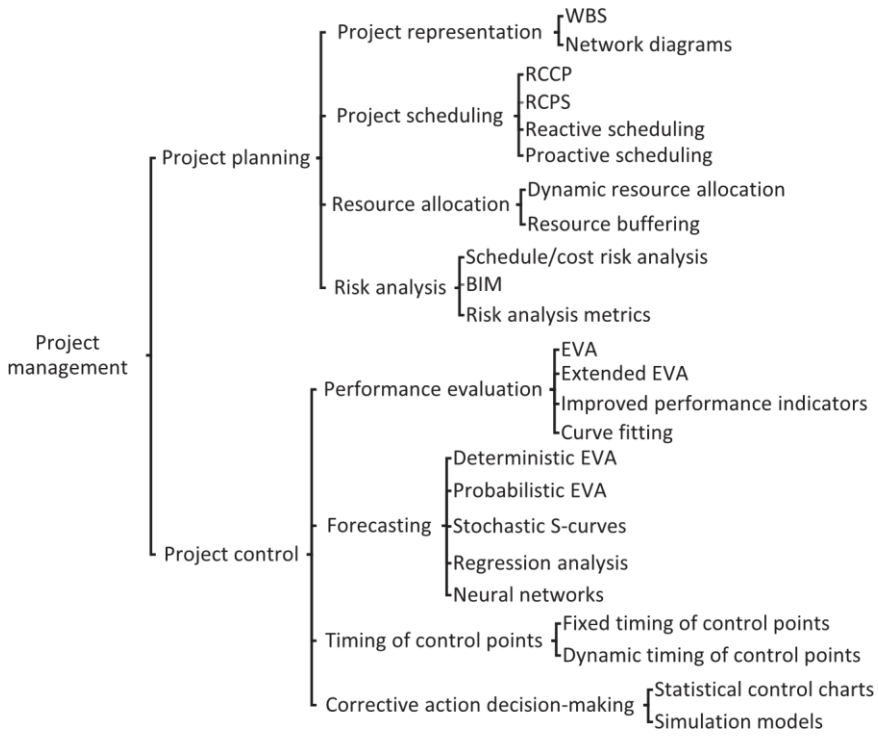

Figure 4.Overview on methods and techniques for project planning and control.

Since Scheduling is a key element in assignment making plans software program, maximum of those software program applications consist of a technique for RCPS, time cost tradeoff scheduling, useful resource allocation, and/or scheduling below uncertainty. For the generation of resource viable schedules, a lot of optimisation techniques are actually embedded in assignment control software program applications. High first-class schedules (in terms of task duration) may be generated via actual branch and bound processes (Deblaere, Demeulemeester, and Herroelen 2011) for small instances of projects, or classical heuristic answer processes and metaheuristics, including priorityrule heuristics (Baumann and Trautmann 2015; Tormos and Lova 2001; Trautmann and Brandinu 2011), forward backward development techniques (Trautmann and Baumann 2010), tabu search (Deblaere, Demeulemeester, and Herroelen 2011), genetic algorithms (Pakgohar, Childe, and Zhang 2013), and evolutionary algorithms (Tackenberg et al. 2017) for largescale projects. In addition, common techniques and strategies embedded in assignment control software program applications consist of WBS charts, community diagrams, Gantt charts, PERT charts, Scurves, resource charts, earned value charts, monitoring tools, and assignment conversation structures (Bidanda and Hackworth 2004) . Risk control tools which

includes the Project Definition Assessment Index have additionally been evolved to become aware of and degree the dangers related to defining assignment scope withinside the early stages of project development (Batson2009).

However, current computerized project planning systems have limited price manage talents because of the issue of accumulating and studying records (Wang et al. 2014). Kings, etc. to address this problem. (2014) Developed a prototype of an incorporated 5D CAD device which include BIM 3-d version, 4D version (time) and 5D (fee) to aid assignment fee and schedule management. Similarly, Zhang and Gao (2013) show how the usage of BIM technology can help lessen assignment prices and optimize assignment schedules. Today, the usage of BIM 4D and 5D gear is common in big engineering, construction, and project management companies. Several tools have additionally been proposed to discover out-of-manage conditions and offer action strategies. For example, De Falco and Falivene (2010) designed a computer-aided simulation-based tool for project control. You can use this tool to calculate a selected overall performance index (primarily based totally on CPI and SPI). This can reason the consumer to see a caution sign in comparison to the formerly described threshold. Then, based on a selected matrix, you may recommend feasible choices that hyperlink viable warnings to suitable corrective actions.

In addition to these tools, the usage of advanced technology in project making plans and management has proven an important positive effect on project success (Jessen2011). These technologies consist of computerized project monitoring tools which includes RFID or GPS alerts, information systems, databases and cloud technology. These tools facilitate information collection, assist build knowledge databases and visualize project data. For example, Cho, Cho, and Kim (2014) proposed an operational-stage computerized information processing system for incorporated value and schedule control. The system includes a real-time location system for detecting device region, a wi-fi mesh network for sending region information to department offices, and a prototype model for changing signals into value and schedule data. Recently, Rasmussen, Hansen, and Lazarova Molnar (2017) have created simulation models and internet programs that project planners can use to research unique project planning techniques and visually examine consequences in terms of time and cost Developed. From a project management perspective, extra included measures which includes the implementation procedure of organization resource planning have been additionally considered (Chofreh, Goni and Jofreh 2011; Pellerinetal. 2013; Tasevska, Damij and Damij 2014).

Main Functions of the Project Planning Tools:

- Gantt chart builder (or view the overview of the Gantt chart tool)
- Drag and drop edit of schedule
- File sharing and file management
- Work management (task board, task list)
- Team Collaboration Tool (or see Collaboration Tool Overview)
- Workflow Management (or See Workflow Management Tool Overview)
- Analysis and Reporting Tool (or See Reporting Tool Overview)
- Budget Management and Planning
- Analysis and reporting tools (or see report tool overview)
- Resource planning (or see resource management tool overview)
- Requirements management (or see requirements management tool overview)

The Great Project Planning Software and Tools:

- ProWorkflow
- GoodDay
- Forecast
- Runn
- Hive
- CROOW
- Monday.com

Analysis Of Existing Research:

The biggest challenge in project planning and control seems to be related to the uncertainty and risk inherent to large and highly complex projects. While project managers usually express the progress of works referring to the time schedule or to the cost plan, changes inevitably occur during project execution, disrupting these plans. To overcome uncertainties, the underlying statistical basis of project planning and control tools and methods has been modelled and integrated with suitable simulation and computerized methods. For instance, as it is possible that the compression of activities cannot be sufficient to compensate for the project`s delays, the implementation of proactive scheduling strategies, such as the employment of different buffers, has been studied. Moreover, stochastic curve fitting techniques now allow to better estimate the final project performance by providing a confidence interval around the estimates. Tools for monitoring project performance data, such as statistical management cards, have also been proposed to identify adverse changes in a timely manner. This allows analysis of ongoing project cost and schedule performance fluctuations, indicating that corrective action may be required (Leu and Lin2008).

Despite these developments, researchers need to do more research to develop more integrated tools. Many timing tools are currently being developed. When it comes to project cost control, little effort has been made to develop cost control techniques (Zhang and Gao2013). However, time and cost continue to be treated as separate functions during the control phase. Regardless of the EVA approach, which focuses on time and cost, and the relationships between these variables, little work has been done to integrate schedule and cost into project governance. Therefore, it is necessary to develop various integration methods and models that lead to a more comprehensive project control system that can perform both cost and deadline control. More recent work by the kings. (2014) The possibility of linking BIM model data with other features of 5D CAD (such as cost control) represents a concrete step in this direction. Integrating other goals such as quality, sustainability, and safety into a time-cost framework is also often mentioned in the literature as a path to future research. However, very few publications cover this topic.

Conclusion:

In the light of latest studies projects and reported case implemented inside and outside the project control domain,we can predict that important changes will occur in the way projects are planned and controlled. Indeed, the developing improvement and implementation of latest data capture and treatment equipment will bring way more data accessible than we used to and in a much faster way. Similar to the Industry 4.0 wave taking place in modern production environments (Moeuf et al. 2018), project control companies are adopting sensors, IoT, drones, VR, AR, GPS, AI and different equipment and strategies to higher display initiatives activities and to enhance decentralized real-time decision-making in various stages in their works. We can consequently be expecting that there can be an essential shift withinside the project making plans and manage studies field, which has been in large part ruled by the project scheduling literature withinside the past, as short term and reactive decision-making will bring new challenges and opportunities to project organizations and researchers.

References:

- Berthaut, F., R. Pellerin, N. Perrier, and A. Hajji. 2014. "Time-cost Trade-offs in Resource-constraint Project Scheduling Problems with Overlapping Modes." International Journal of Project Organisation and Management 6 (3): 215–236.
- Berthaut, F., R. Pellerin, N. Perrier, and A. Hajji. 2014. "Time-cost Trade-offs in Resource-constraint Project Scheduling Problems with Overlapping Modes." International Journal of Project Organisation and Management 6 (3): 215–236.
- Hajdu, M. 2015. "Continuous Precedence Relations for Better Modelling Overlapping Activities." Procedia Engineering 123: 216–223.
- Cherkaoui, K., R. Pellerin, P. Baptiste, N. Perrier, and A. Haït. 2017. "Proactive Tactial Planning Approach for Large Scale Engineering and Construction Projects." Journal of Modern Project Management 5 (2): 93–105.
- Pender, S. 2001. "Managing Incomplete Knowledge: Why Risk Management is not Sufficient." International Journal of Project Management 19 (2): 79–87
- de Leon, G. P. 2011. "Scheduling a Project at Different Levels." Paper presented at the PMI College of Scheduling 8th Annual Conference, San Francisco, May 1–4
- De Boer, R. 1998. "Resource-constrained Multi-project Management – A Hierarchical Decision Support System." Ph. D. thesis, University of Twente, The Netherlands.
- Baydoun, G., A. Haït, R. Pellerin, B. Clément, and G. Bouvignies. 2016. "A Rough-cut Capacity Planning Model with Overlapping." OR Spectrum 38 (2): 335–364.
- Keshvari, A., H. Mirzapour, J. Ebrahimpour, and N. Manteghi. 2011. "Planning and Project Control with EXCEL Software in Asalouyeh 5th Olefin Project." Proceedings of the International Conference on Communications in Computer and Information Science, 254 CCIS, PART 4, Springer, Germany, 253–264.
- Pellerin, R., N. Perrier, X. Guillot, and P. M. Leger. 2013. "Project Characteristics, Project Management Software Utilization and Project Performance: An Impact Analysis Based on Real Project Data." International Journal of Information Systems and Project Management 3 (1): 5–28.
- Wang, X., P. Yung, H. Luo, and M. Truijens. 2014. "An Innovative Method for Project Control in LNG Project Through 5D CAD: A Case Study." Automation in Construction 45: 126–135.
- Deblaere, F., E. Demeulemeester, and W. Herroelen. 2011. "RESCON: Educational Project Scheduling Software." Computer Applications in Engineering Education 19 (2): 327–336.
- Wang, X., P. Yung, H. Luo, and M. Truijens. 2014. "An Innovative Method for Project Control in LNG Project Through 5D CAD: A Case Study." Automation in Construction 45: 126–135

- Baumann, P., and N. Trautmann. 2015. “Resource-constrained Project Scheduling with Project Management Information Systems.” In Handbook on Project Management and Scheduling, edited by C. Schwindt and J. Zimmermann, 1385–1400. Switzerland: Springer.
- Tormos, P., and A. Lova. 2001. “Tools for Resource-constrained Project Scheduling and Control: Forward and Backward Slack Analysis.” Journal of the Operational Research Society 52 (7): 779–788.
- Trautmann, N., and G. Brandinu. 2011. “A Serial Scheme for Minimizing the Duration of Resource-Constrained Projects within Microsoft Project.” Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management, IEEE, 893– 897.
- Trautmann, N., and P. Baumann. 2010. “An Iterative Backward/Forward Technique for the Scheduling of Resource-constrained Projects within Microsoft Project.” Proceedings of the IEEE International Conference on Industrial Engineering and Engineering Management, IEEE, 1558–1562.
- Deblaere, F., E. Demeulemeester, and W. Herroelen. 2011. “RESCON: Educational Project Scheduling Software.” Computer Applications in Engineering Education 19 (2): 327–336.
- Pakgohar, A., S. J. Childe, and D. Z. Zhang. 2013. “A DSS Solution for Integrated Automated Bidding, Subcontractor Selection and Project Scheduling.” In Decision Support Systems II - Recent Developments Applied to DSS Network Environments, edited by J. E. Hernández, S. Liu, B. Delibašic, P. Zaraté, F. Dargam, and R. Ribeiro, 72–85. Berlin, Heidelberg: Springer-Verlag.
- Tackenberg, S., S. Duckwitz, C. Schmalz, and C. M. Schlick. 2017. “Resource-constrained Project Scheduling Problem: Investigation of the Quality of Project Plans.” In Advances in Ergonomic Design of Systems, Products and Processes, edited by C. M. Schlicket al., 31–59. Berlin, Heidelberg: Springer.
- Bidanda, B., and D. Hackworth. 2004. “Project-management Software: A Guideline for System Selection and Use.” In Field Guide to Project Management, edited by D. I. Cleland, 426–447. Hoboken, NJ: John Wiley & Sons.
- Batson, R. G. 2009. “Project Risk Identification Methods for Construction Planning and Execution.” Proceedings of the 2009 Construction Research Congress, ASCE, 746–755.
- Wang, X., P. Yung, H. Luo, and M. Truijens. 2014. “An Innovative Method for Project Control in LNG Project Through 5D CAD: A Case Study.” Automation in Construction 45: 126–135.
- Zhang, D., and Z. Gao. 2013. “Project Time and Cost Control Using Building Information Modeling.” Proceedings of the 2013 International Conference on Construction and Real Estate Management, ASCE, 545–554.
- De Falco, M., and L. Falivene. 2010. “Improving Project Control and Guidance Through a Time-frame Simulation Approach.” IFIP Advances in Information and Communication Technology 338, AICT: 417–424.
- Jessen, S.-A. 2011. “The Impact on Project Success of Using Technology in Modern Project Planning and Control.” Proceedings of the 1st International Technology Management Conference, IEEE, 801–805
- Cho, D., H. Cho, and D. Kim. 2014. “Automatic Data Processing System for Integrated Cost and Schedule Control of Excavation Works in NATM Tunnels.” Journal of Civil Engineering and Management 20 (1): 132–141.

- Rasmussen, T. H., N. Hansen, and S. Lazarova-Molnar. 2017. “A Discrete-event Simulation Tool for Decision Support in Selecting Project Scheduling Strategies.” Paper presented at the 2017 7th International Conference on Modeling, Simulation, and Applied Optimization, Sharjah, United arab emirates, April 4–6.
- Chofreh, A. G., F. A. Goni, and M. G. Jofreh. 2011. “Enterprise Resource Planning (ERP) Implementation Process: Project Management Perspective.” Advanced Materials Research 338: 152–155.
- Pellerin, R., N. Perrier, X. Guillot, and P. M. Leger. 2013. “Project Characteristics, Project Management Software Utilization and Project Performance: An Impact Analysis Based on Real Project Data.” International Journal of Information Systems and Project Management 3 (1): 5–28.
- Tasevska, F., T. Damij, and N. S. Damij. 2014. “Project Planning Practices Based on Enterprise Resource Planning Systems in Small and Medium Enterprises - A Case Study from the Republic of Macedonia.” International Journal of Project Management 32 (3): 529–539.
- Leu, S.-S., and Y.-C. Lin. 2008. “Project Performance Evaluation Based on Statistical Process Control Techniques.” Journal of Construction Engineering and Management 134 (10): 813–819.
- Zhang, D., and Z. Gao. 2013. “Project Time and Cost Control Using Building Information Modeling.” Proceedings of the 2013 International Conference on Construction and Real Estate Management, ASCE, 545–554.
- Wang, X., P. Yung, H. Luo, and M. Truijens. 2014. “An Innovative Method for Project Control in LNG Project Through 5D CAD: A Case Study.” Automation in Construction 45: 126–135.
- Moeuf, A., R. Pellerin, S. Lamouri, S. Tamayo, and R. Barbaray. 2018. “The Industrial Management of SMEs in the Era of Industry 4.0.” International Journal of Production Research. doi:10.1080/00207543.2017.1372647.