### **Production Activity Management and Critical Path Analysis**

Student

Institution

Course

Instructor

Date

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#### **Part 1: Activities in Production Management**

**Initiating Production Activities**

Production starts can be defined by several key steps which include planning where definitions are made on the scope, goals, and outcome of the project. The management of scope definition facilitates the setting of clear limits and objectives thus avoiding the acts of scope creep and thus maintaining the focus of the undertaking (Xia et al., 2020, p. 57). Resource deployment is significant since it entails applying a scarce resource mix that is essential to execute the project. Schedules help in mapping out how the project’s activities will be accomplished while kick-off meetings make sure that everyone starts on the right track with the general goal and procedure of the project.

**Controlling Production Activities**

Activities that go under the control of production are set to involve the overseeing and direction of the flow of the project. This involves defining the activities and working out when they are likely to be completed then monitoring the progress of each activity against the schedule to identify any changes that may have occurred in the time frame or scope of work (Xia et al., 2020, p. 57). Economic objectives are important to take care of to meet organizational requirements and thus help to determine the effectiveness of various resources that are being utilized by the business through the help of definite performance indicators. Further, the risks are to be managed and quality control measures need to be in place to ensure needed levels of accomplishment are maintained on a project.

**Measuring Performance**

Performance measurement entails a comparison of the performance of the production activities against predetermined yardsticks. Productiveness is determined by quantity and quality output per input resource while efficiency estimates resource utilization of the project goals (Xia et al., 2020, p. 57). Quality is measured by comparing the result to the prespecified standard to achieve the final goal. Evaluating performance and tracking the progress against the set objectives is done with the help of the KPIs and EVM tools.

**Flow-Shop Scheduling**

Flow-shop scheduling implies arranging the jobs to be produced in a sequence that will allow smooth flow usually found in repetitive production industries. In actual production, jobs pass through consecutive stations that cannot be altered to reduce the total production time and increase efficiency (Wu et al., 2021 p. 343). This kind of schedule implies effective organization of the work since the time required for performing the tasks is clearly defined and there is no unnecessary time in between. This means that the primary objective is aimed at increasing efficiency and shortening the time required for production.

**Job-Shop Challenges**

Structuring a wide array of jobs that have a range of specifications is the concept of job-shop scheduling which has the following issues. Analyzing the nature of the job reveals that variability requires controlling different specifications and flexibility (Wu et al., 2021, p. 343). Scheduling is complicated due to the number of jobs that have to be processed and their specificity about the required resources and processing time. It explains that the distribution of resources is important so that one is not overwhelmed by resource utilization or is underutilizing it, as such it affects productivity.

**Machine Scheduling**

Machine scheduling can be defined as the arrangement of jobs on the machines to make the production system efficient. This includes identifying as to which of the jobs should be best allocated to each of the machines to achieve the highest possible throughput without much of a lag time (Wu et al., 2021, p. 343). It is crucial to always ensure that the time between job changes is minimal to ensure that production is continuous. The aim is to optimize job scheduling to increase the level of production productivity and decrease idle time.

**Part 2: Definitions concerning PERT and CPM**

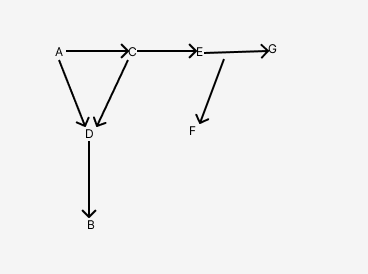
* **Critical Path:** The critical path is defined as the longest chain of activities that are chronologically consecutive and dependent on a project (Bodunwa & Makinde, 2020, p. 6). It defines the least time within which the project can be executed. That means that activities on this path cannot be put on hold without in some way extending the duration of the project.
* **Slack Time:** Float or slack time is the extra time an activity can be carried out without the extension of the total time of the project (Bodunwa & Makinde, 2020, p. 6). It can be defined as the latest start time minus the earliest start time of an activity.
* **Resource Leveling:** According to Bodunwa and Makinde (2020, p. 6), resource leveling is a technique used to balance resource utilization across a project. In order to avoid overstuffing resources, it entails modifying the project plan, frequently by postponing tasks or shortening their durations to accommodate resource availability.
* **Dummy Activity:** According to Bodunwa and Makinde (2020, p.6), a dummy activity is a placeholder in PERT/CPM diagrams used to illustrate dependency relationships between activities. It doesn't take any time or money, yet it's essential for showing the right order of chores.

#### **Part 3: Critical Path Arrow Diagram and Analysis**

***Project Activities and Dependencies***

|  |  |  |  |
| --- | --- | --- | --- |
| **Job** | **Description** | **Predecessor** | **Expected Time (days)** |
| A | Prepare preliminary sketches | NA | 2 |
| B | Outline specifications | NA | 1 |
| C | Prepare drawings | A | 3 |
| D | Write specifications | A, B | 2 |
| E | Run prints | C, D | 1 |
| F | Have specifications printed | B, D | 3 |
| G | Assemble bid package | E, F | 1 |

**Diagram**



**Calculations:**

1. **Early Start (ES) and Early Finish (EF):**
   * **Activity A**: ES = 0, EF = 2
   * **Activity B**: ES = 0, EF = 1
   * **Activity C**: ES = 2, EF = 5
   * **Activity D**: ES = 2, EF = 4
   * **Activity E**: ES = 5, EF = 6
   * **Activity F**: ES = 4, EF = 7
   * **Activity G**: ES = 6, EF = 7
2. **Late Start (LS) and Late Finish (LF):**
   * **Activity A**: LS = 0, LF = 2
   * **Activity B**: LS = 1, LF = 2
   * **Activity C**: LS = 2, LF = 5
   * **Activity D**: LS = 2, LF = 4
   * **Activity E**: LS = 5, LF = 6
   * **Activity F**: LS = 5, LF = 8
   * **Activity G**: LS = 6, LF = 7
3. **Slack Time:**
   * **Activity A**: Slack = 0
   * **Activity B**: Slack = 1
   * **Activity C**: Slack = 0
   * **Activity D**: Slack = 0
   * **Activity E**: Slack = 0
   * **Activity F**: Slack = 1
   * **Activity G**: Slack = 0

**Critical Path:**

* The critical path is A → C → E → G and A → D → E → G, both with a duration of 7 days.

**Total Slack:**

* Activities A, C, E, and G have no slack.

**Free Slack:**

* Activities B and F have free slack, where they can be delayed without affecting the start of dependent activities.

This analysis provides a comprehensive view of the project's scheduling and critical path, assisting in effective project management and timely completion.

**References**

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