UNIT 6

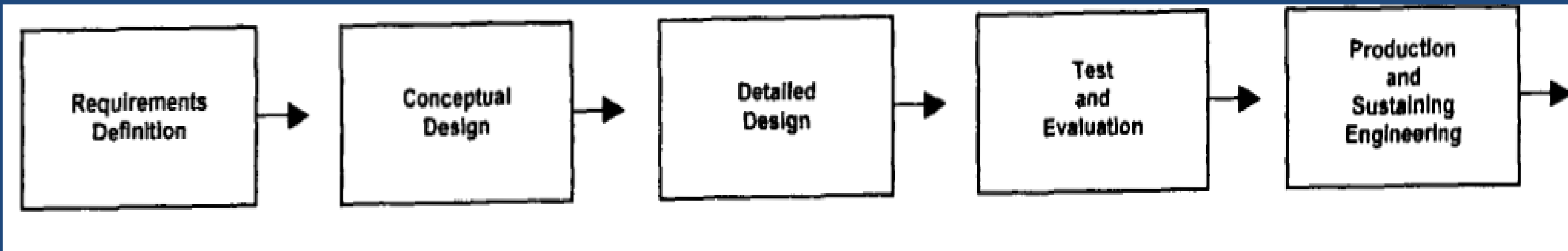
Product life cycle Management-II

Product life cycle Management

Content

- PRODUCT DEVELOPMENT
- TRENDS AFFECTING PRODUCT DEVELOPMENT
- BEST PRACTICES FOR PRODUCT DEVELOPMENT
- PRODUCT DEVELOPMENT PROCESS AND ORGANIZATIONS
- COLLABORATIVE PRODUCT DEVELOPMENT
- CONCURRENT ENGINEERING
- RISK MANAGEMENT
- STAGES OF PRODUCT DEVELOPMENT

PRODUCT DEVELOPMENT PROCESS



- Market research and analysis
- Customer requirements and needs
- Systems requirements, including producibility and reliability

- Trade studies
- Simulation and modeling
- Functional allocation
- System specifications
- Design requirements
- Design guidelines
- Design to cost
- Program plans

- Analysis, modeling simulation, and prototypes
- Detailed design specifications
- Circuit design
- Parts selection
- Component design
- Part qualification
- Mechanical design
- Thermal design
- Logistics engineering
- Human engineering
- Safety engineering
- Packaging design
- Software design
- Production design
- Quality engineering
- Design to cost
- Testability
- Documentation
- Make or buy analysis
- Test planning
- Producibility
- Quality specifications
- Manufacturing planning
- Environmental testing
- Off-line maturing of new technologies

- Developmental testing
- Test, analyze, and fix
- Process engineering
- Test software development
- Failure analysis
- Design to cost
- Producibility
- Manufacturing prototypes
- Environmental stress screening
- Configuration Management
- Customer tests

- Production readiness
- Specification verification
- Drawing release
- Documentation
- Manufacturing procedures
- Tooling design and release
- Quality control
- Configuration management
- Quality assurance
- Spares provisioning
- Environmental stress screening
- Sustaining engineering

IMPORTANT DEFINITIONS

- **Quality -** Measure of how well a product satisfies a customer at a reasonable price. Dr. Juran, a famous pioneer in quality, defined quality as "fitness for use". Any deviation from the customer's requirements is called the "cost of quality" whether it is caused by design or manufacturing. Product quality is measured by sales, customer satisfaction, customer feedback, and warranty costs.
- **Design quality** - how well the design meets all requirements of the customer and other groups that interact with the product. Design quality can be measured by how well the product's design performs as compared to its product requirements and to the competition.
- **Software quality** - when the final product performs all functions in the manner intended under all required conditions. To achieve quality, software must contain a minimum of mistakes as well as being void of misconceptions. This includes problems in requirements, architecture, domain, design, coding, testing, and installation.

❖ **Manufacturing quality -** measured as the percentage of products that meets all specified design and manufacturing requirements during a specified period of time. This is also expressed as failures, yield or as a percentage of products with defects. Many experts believe that manufacturing quality should be measured as a process's variance or uniformity about some target parameter.

PRODUCT DEVELOPMENT TEAMS

❖One product development strategy is to organize the assets and resources of a company into integrated Product Development Teams or PDT, with complete responsibility for designing, producing and delivering valuable products to customers.

❖Accountable for delivering quality, performance, program profitability, and additional business.

- Every team member is problem solver. The team is made up of combinations of people from different disciplines or functional organizations. Vendors and customers are often included. This approach relies on teams of people with the right skills working together smoothly to meet business objectives. In the future, firms will compete more on the basis of what they know, than on what they do. The skills and knowledge embodied in the work force will become the key competitive asset.
- Reasons why a Product Development Team approach is vital
  - Product design that is compatible with manufacturing or service capabilities and life cycle requirements.
  - Speed up the design process, delivery and service
  - Use of new technologies and tools, such as the Internet, enable communication and collaboration between personnel in different organizations, functional areas, disciplines, and locations.

CONCURRENT ENGINEERING

- Concurrent Engineering (CE) or Simultaneous Engineering (SE) is a watchword for world-class companies to speed up and improve their product development process.
- CE is defined as "a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user requirements."
- The major objective of concurrent engineering is to overlap the different phases of design to reduce the time needed to develop a product. It requires the simultaneous, interactive and inter-disciplinary involvement of design, manufacturing and field support engineers to assure design performance, product support responsiveness, and life cycle reliability products.

- Product development teams use CE to break down the traditional functional barriers by integrating team members across different business entities within an organization.
- Development and deployment of an effective CE approach requires:
  - Flexible decision models to represent the process by which a product development team could simultaneously design, debate, negotiation, and resolve.
  - Knowledge representation schemes and tools to support and implement the integration requirements imposed by CE .
  - Tools that facilitate simultaneous collaborative communication .
  - Quantitative and qualitative tools that measure the impact of decisions on all product parameters.

PROGRAM ORGANIZATION

- ❖ Process of allocating the resources needed to develop a product and the organizational leadership to successfully manage the program, organize the team by establishing roles, encouraging risks, and rewarding innovation.
- ❖ A primary goal is to facilitate communication between people whose work is interrelated.
- ❖ The best companies proactively focus on the customer and consider life cycle performance in determining how the product is designed and how it will be delivered and serviced.
- ❖ A design policy is a management's statement of its overall goals for the design process and includes proven product development methods and guidelines.
- ❖ Design policies should include a mechanism for setting schedules that are realistic and allow adequate time for design, analysis, and development
- ❖testing.

TECHNIQUES USED IN PROGRAM ORGANIZATION

❖ WORK BREAKDOWN STRUCTURE (WBS)

- ➢ Management develops a structure that defines responsibilities, resources, goals, and milestones.
- ➢ Hierarchical family tree that identifies and defines all task elements required for the program.
- ➢ A unique identification number is assigned to each task element. An effective structure identifies all reporting-level task elements of the program and provides a baseline for measuring financial, technical, and schedule progress on each individual element.
- ➢ The WBS provides a framework for detailed resource and financial planning of the program. Staffing requirements are then determined and the proper personnel are organized. Actions are started for developing various plans, standards, goals, and schedules. Determination of resource requirements and allocation of these resources is a major activity of program organization.

❖ NETWORK DIAGRAM

- Design activities usually involve a multitude of smaller tasks that must be done to complete the project. Each of the smaller tasks requires specific time and resources.
- Network diagram aids in visualizing the various connections between these work elements and the sequence in which they are required to be performed.
- The Program Evaluation and Review Technique (PERT) is one type of network diagram approach used on many programs, in which start and completion events are shown as blocks with interconnecting lines showing the dependency relationship and present activity times allowed. The amount of time required for each activity is estimated and entered on the dependency relationship line and represents activity time. With identifier numbers, the network information can be input to a computer program for plotting the network diagram and identifying critical paths for further planning consideration.

SCHEDULE DIAGRAMS

- Prepared by listing task activities in a column on the left and a calendar-related time scale on a row across the top of the chart.
- A start-and-stop time span line (or bar) is placed in the row corresponding to each task activity to indicate the calendar relationship.
- Very useful planning and control tools but provide limited visibility of task interrelationships.

TASK RESOURCE BUDGETS AND SCHEDULES

- Carefully prepared task estimates are necessary to establish project or program budgets.
- Several cycles of adjustment and review by program management are usually required to establish a realistic budget for production of a customer acceptable product at a management-acceptable profit margin.
- Progress and performance are expected to stay within the budget and schedule constraints and produce a product that meets requirements.

❖TECHNICAL CONTROLS

- A major method of technical control is documentation.
- Technical documentation includes specifications, block and interface diagrams, design guidelines, drawings, process capabilities, purchased part information, and technical files.
- Specifications are usually required for the system and address the performance, environmental, reliability, producibility, and quality requirements.
- No design activity should proceed without written task definitions and specifications.
- The system block diagram depicts in block form the functional and physical partitioning of the elements of the system and indicates the major I/O flow. A well-prepared block diagram is a very useful working document for communicating essential interface information and functional operations.
- Design guidelines and rules are prepared to encourage the use of proven design practices and promote consistency of design for the specific development program.

❖ COST AND SCHEDULE CONTROLS AND ASSESSMENT

- Budgets and schedules are established at the start of the program for each element of the WBS. A forecast of resource expenditures are prepared by labour category, time frame, and entered into a cost and schedule status-reporting system.
- Periodic updates are made available for review of trends and corrective action.
- Gantt charts can then be used effectively to indicate the progress of each activity against a time scale. The end points of the task are clearly defined, but judgment is required to measure progress between the end points.
- In setting up the lower level activities, the task scope and time span should be broken into small enough units of time to provide good visibility of progress.
- Schedule control is then aided by weekly informal reviews and periodic formal reviews.
- Computer software programs are commercially available to help in these tasks.

❖ DESIGN REVIEWS AND AUDITS

- Design reviews are a crucial communication link between the designer and specialists from all the applicable disciplines.
- The purpose of design reviews is to evaluate technical progress, identify potential problems, and to provide suggestions for design improvements.
- It also provides an opportunity for the support areas, such as manufacturing, maintenance, test, and logistics to communicate with the project.
- The intention should be to evaluate and criticize the design, not the designer!
- It is not design by committee, but rather a systematic method to ensure that all aspects of the design are thoroughly evaluated prior to production.
- Best in class companies use weekly meetings with a strategic planning team made up of upper management from various areas. This leads to better design and better acceptance of the final design.

❖ PRODUCTION READINESS AND DESIGN RELEASE

- At some point in product development, creative design must cease so that the product can be released to production. This point in the developmental phase is called design release.
- Scheduling a design release is closely related to the status of other design activities, such as design reviews, production design, test results, and configuration control. Care must be taken to prevent the release of a design that is incomplete, inaccurate, or premature.
- Deviating from standard procedures allows inferior-quality products to reach users. By using uniform practices and procedures concerning technical requirements and by evaluating current manufacturing capability, more realistic design release dates can be established.
- The design should be validated in stages, using experienced personnel from technical and production disciplines to ensure that the design is producible, documentation is complete, and released on schedule.

TECHNICAL RISK MANAGEMENT

- Technical risk is a measure of the level of uncertainty for all of the technical aspects of the development process.
- Technical risk management identifies and tries to control this uncertainty found in product development. It is essential for identifying and resolving potential problems to ensure that the proposed system will work as intended and be reliable when it reaches the user.
- The steps in technical risk management are to:
  - Systematically identify areas of potential technical risk
  - Determine the level of risk for each area
  - Identify and incorporate solutions that eliminate or reduce the risk
  - Continue to monitor and measure progress
- Technical risk assessment is a managerial planning and control system for quantifying design and technical progress during program development.

- Technical risk assessment can be performed to decide whether to start new designs, to evaluate alternative technologies, or to make or buy a particular technology. This systematic approach allows management to regularly evaluate program status and assign additional resources as problems are identified.
- Technical risk management requires a considerable amount of effort and cost to be properly incorporated into the program. The up-front cost, however, is well spent and should provide a superior product with reduced risk in the production phases.

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Thank you