1.3 PRODUCT DEVELOPMENT PROCESS

A product development process is the sequence of steps or activities which an enterprise employs to conceive, design, and commercialize a product. Many of these steps are and activities are intellectual and organizational rather than physical. Some organizations define and follow a precise and detailed development process, while others may not even be able to describe their processes. Furthermore, every organization employs a process at least slightly different from that of every other organization. In fact, the same enterprise may follow different processes for each of several different types of development projects.

The generic product development process consists of six phases.

0. Planning: The planning activity is often referred to as “phase zero” since it precedes the project approval and launch of the actual product development process. This phase begins with corporate strategy and includes assessment of technology developments and market objectives. The output of the planning phase is the project mission statement, which specifies the target market for the product, business goals, key assumptions, and constraints.

1. Concept development: In the concept development phase, the needs of the target market are identified, alternative product concepts are generated and evaluated, and one or more concepts are selected for further development and testing. A concept is a description of the form, function, and features of a product and is usually accomplished by a set of specifications, an analysis of competitive products, and an economic justification of the project.

2. System level design: The system level design phase includes the definition of the product architecture and decomposition of the product into subsystems and components. The final assembly scheme for the production system is usually defined during this phase as well. The output of this phase usually includes a geometric layout of the product, a
functional specification of each of the product’s subsystems, and a preliminary process flow diagram for the final assembly process.

3. **Detail design**: The detail design phase includes the complete specification of the geometry, materials, and tolerances of all of the unique parts in the product and the identification of all of the standard parts to be purchased from the suppliers. A process plan is established and tooling is designed for each part to be fabricated within the production system. The output of this phase is the control documentation for the product—the drawings or computer files describing the geometry of each part and its production tooling, the specifications of the purchased parts, and the process plans for the fabrication and assembly of the product. Two critical issues addressed in the detail design phase are production cost and robust performance.

4. **Testing and refinement**: The testing and refinement phase involves the construction and evaluation of multiple preproduction versions of the product. Early (alpha) prototypes are usually built with production-intent parts—parts with the same geometry and material properties as intended for the production version of the product but not necessarily fabricated with the actual processes to be used in production. Alpha prototypes are tested to determine whether product will work as designed and whether the product satisfies the key customer needs. Later (beta) prototypes are usually built with parts supplied by the intended production processes but may not be assembled using the intended final assembly process. Beta prototypes are extensively evaluated internally and are also typically tested by customers in their own use environment. The goal for beta prototypes is usually to answer questions about performance and reliability in order to identify necessary engineering changes for the final product.

5. **Production ramp-up**: In the production ramp-up phase, the product is made using the intended production system. The purpose of the ramp-up is to train the work force and to work out any remaining problems in the production processes. Products produced during the production ramp-up are sometimes supplied to preferred customers and are carefully evaluated to identify any remaining flaws. The transition from the production ramp-up to ongoing production is usually gradual. At some point in this transition, the product is launched and becomes available for widespread distribution.

**References:**
1. Product Design and Development by Ulrich and Eppinger, TMH