

# Commonalities in the Development Process

## Part 3: Designing Products and Manufacturing Processes Efficiently

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Abstract:

To design development processes efficiently, products have to be aligned along commonalities. When utilizing the same components in multiple products, a significant reduction of development efforts for variant-rich product ranges can be achieved. But also the production processes show opportunities to utilize commonalities.

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# Commonalities in the Development Process

## Part 3: Designing Products and Manufacturing Processes Efficiently

Richard Dellanoi, Ph.D.

The first part of this article outlined how different forms of advantages in product development can be realized through commonalities. Possible developments of the structural and solution commonality were then specified in the second part. This third and last part of the series will proceed to describe process and component commonality. Additionally, a development process adjusted for commonalities is presented.

### Component Commonality

Utilizing commonality potentials by reusing already existing components is the most common and widespread form of commonality management. Identical components are used in different product variants and these parts are variant neutral until the beginning of assembly. This principle of modular systematics enables the combination of individual products by relying on components from a limited supply. The

resulting products can be sold at competitive prices, relying on economies of scale in production and procurement.

Additional advantages can be achieved during the product development process by reusing components. Much effort is expended on the design of components and administering the related information flow, for example for CAD volumes and drawings. Reducing the number of necessary parts by using commonalities between different product variants can therefore lead to a substantial decrease of necessary time and technical resources.

In general, four types of component commonalities can be distinguished: physical product platforms, product platforms with module variants, module component systems with fixed structures as well as open modular design (Fig. 1).

Physical product platforms consist of platform modules and individual parts that complete the product for each variant. More frequently however, product platforms are combined with modular systems. A defined inventory of module variants extends the common platform. The combinatorics allow for multiple individual final products. A commonality structure with defined interfaces is a necessary precondition.

The third type of component commonality is the multi-use of modules based on stable interfaces. The module component system together with the fixed product structure forms the system in which the kit

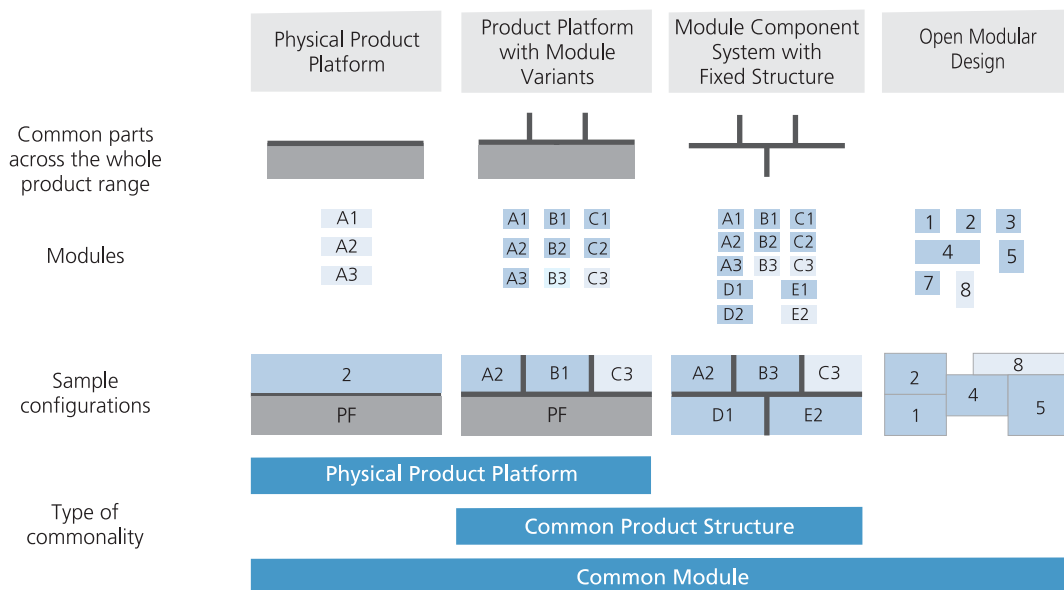


Figure 1: Realizations of Component Commonalities

contains the components and the structure implies the rules of the module combinations. Open modular design refers to the configuration of different functional modules without restrictions and almost arbitrary combinations. This design principle is in particular suitable for the layout of large and complex plants.

**Using Common Parts in Physical Product Platforms.** A physical product platform is the sum of the components, which realize variant-neutral product functions and are common to a certain number of product variants.

The fixed and variable allocation of value is separated from the product and the variance of the product family. The fixed part corresponds with the product platform itself, while the variable completes the product and makes it marketable. The development of a product platform usually causes an initial additional expenditure in comparison to the development of the individual variants. However, the broad application of the parts in several product variants justifies this investment, but also requires the consideration of different use cases during the design of the platform.

**Using Common Parts in Modular Systems.** A component system consists of different components or modules. Each module fulfills a specific single function in the product. The user-specific combination of the components configures the modular system. In order to keep the modular system useful over the long-term, the separation of single marketable functions is important. Separating the realization of functions into individual elements guarantees that modules can be used as long as the realized function sufficiently fulfills the customer needs. The enhancement of the elements because of new functional requirements takes place individually. Stable interfaces are created and assume an aligned modular product architecture in order to seclude the configurable functions.

### Process Commonalities

The creation of competitive products requires not only the development of a suitable product architecture, but also an effective and efficient process that allows the actual supply of these products. Variant rich product families need a flexible production process. The principle of modularity increases this flexibility, yet for cost-effective manufacturing or assembly of products, the use of existing process expertise is also required. The fourth category of commonalities therefore comprises all forms of multiple use of existing production processes.

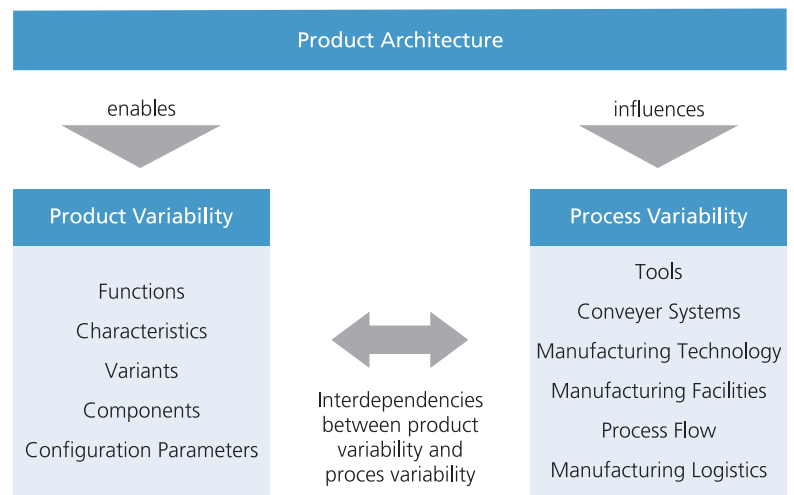


Figure 2: Correlation between Product Architecture and Production Process

**Focused Use of Production Technologies.** Similar to the development of product technologies, the supply of suitable process technologies needs sufficient lead-time. The efficient and high quality production is one of the most important competitive factors in many industries. Often the process technology is of higher value than the product technology. A concentration on the crucial production processes of a company does not only reduce the expenditures of the technology development, it also leads to an acceleration of the technological progress in development and production.

**Process Knowledge and Plant Utilization.** The creation of stable production processes and the associated realization of scale effects made mass production such a success in the past century. Today small lot sizes and high variance are more relevant. The increasing range of products and services and their individualization cannot contradict the use of process commonalities. In many cases, synergies can be realized by creating a common production process for variant-rich product families. However, focusing solely on customer requirements is not sufficient. In order to secure a universally effective process, the effects of possible product changes or probable variants has to be known or at least assessed. Besides the expertise of well-known product solutions, the exact knowledge of the effects of variable characteristics of the product on the cost drivers of the production flow is necessary. The creation of process similarities also relies substantially on the organization of the product architecture (Fig. 2).

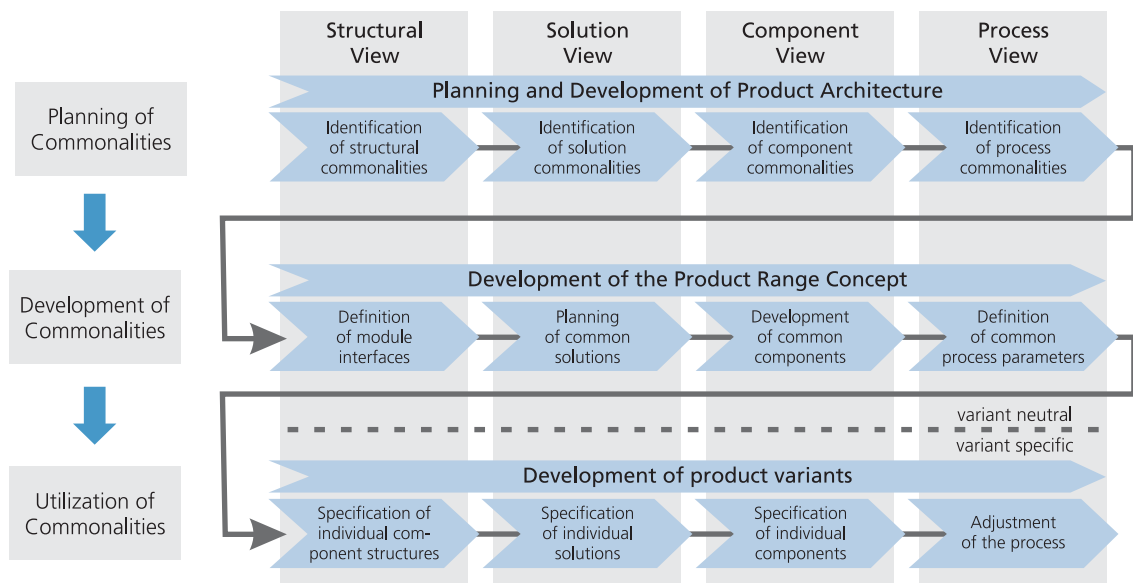


Figure 3: Product Development along commonalities

**Stable Value Chain.** The influence of the product architecture is not limited to company-internal processes. In particular, small and medium-sized companies are very frequently at the beginning of a multi-level added value chain. Depending on the condition of the final product, the architecture of subsystems can have a substantial influence on the value creation in subsequent stages up to the final use of the product. Keeping the processes stable through the long-term interpretation of the product architecture can become a competitive advantage of the system supplier.

#### Development Processes Along Commonalities

The use of commonalities during the development process is based on the consolidation of development activities of several variants of a product family. To realize these advantages turning away from conventional single product development is necessary because the final products cannot be developed during a separate continuous process anymore. The product architecture determines which parts of the product are common and which are variant specific. The design of the product architecture contributes to facilitate commonalities considerably. After defining the product architecture, common parts of the product family are developed, precisely the product family concept, upon which product variants are based. Between the last two steps, variants are determined according to production

development along commonalities (Fig. 3). Therefore, holistic commonality management consists of three steps: the planning of the product families with consideration for variant and commonality aspects, the development of the product family concept including the design of a product architecture which fulfills these requirements and finally the development of the final product variants with use of the commonalities.

#### Conclusion

Timely production development processes must be coordinated to make individual customer requirements and marketable products available. The creation of suitable commonalities as well as having the correct product architecture play therefore an important role.

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