Chapter 1

PLATFORM-BASED PRODUCT FAMILY DEVELOPMENT

An Introduction and Overview

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1. PRODUCT VARIETY AND CUSTOMIZATION

Nearly a century ago, Ford Motor Company was producing Model T's in, as Henry Ford has been quoted, "any color you want—so long as it's black". Today, customers can select from more than 3.8 million different varieties of Ford cars based on model type, exterior and interior paint color, and packages and options listed on http://www.fordvehicles.com/. And that does not even include the staggering array of choices available with Ford's minivans, trucks, and sport utility vehicles, or any of the models offered under Ford Motor Company's "global family of brands", namely, Lincoln, Mercury, Mazda, Volvo, Jaguar, Land Rover, or Aston Martin. Ford is not alone as nearly every automotive manufacturer produces a wide variety of vehicles so that nearly every customer can find one that meets his/her specific needs. And it is not only in the automotive industry—consumers can purchase a nearly endless variety of goods and services: bicycles, motorcycles, appliances, computers, audio and video equipment, clothes, food and beverage, pharmaceuticals, software, banking and financial services, telecommunications services, and travel services.

Consequently, many companies struggle to provide as much variety for the market as possible with as little variety between products as possible. "New products must be different from what is already in the market and

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must meet customer needs more completely," says Pine (1993a), who attributes the increasing attention on product variety and customer demand to the saturation of the market and the need to improve customer satisfaction. Sanderson and Uzumeri (1997, p. 3) state that, "The emergence of global markets has fundamentally altered competition as many firms have known it" with the resulting market dynamics "forcing the compression of product development times and expansion of product variety." Findings from studies of the automotive industry (Alford, et al., 2000; MacDuffie, et al., 1996; Womack, et al., 1990) and empirical surveys of manufacturing firms (Chinnaiah, et al., 1998; Duray, et al., 2000) confirm these trends, as does evidence from Europe's "customer-driven market" (Wortmann, et al., 1997).

Since many companies typically design new products one at a time, Meyer and Lehnerd (1997, p. 2) have found that the focus on individual customers and products results in "a failure to embrace commonality, compatibility, standardization, or modularization among different products or product lines." Mather (1995, p. 378) finds that "Rarely does the full spectrum of product offerings get reviewed at one time to ensure it is optimal for the business." Erens (1997, p. 2) notes that "If sales engineers and designers focus on individual customer requirements, they feel that sharing components compromises the quality of their products." The end result is a "mushrooming" or diversification of products and parts that can overwhelm customers (Huffman and Kahn, 1998; Mather, 1995; Stalk and Webber, 1993); Nissan, for example, reportedly had 87 different varieties of steering wheels for one of their cars (Chandler and Williams, 1993). While offering a wide variety of products has both positive and negative effects (Anderson and Pine, 1997; Galsworth, 1994; Ho and Tang, 1998), the proliferation of product variety can incur substantial costs within a company (Child, et al., 1991; Ishii, et al., 1995a; Lancaster, 1990). "The imperative today," write Anderson and Pine (1997, p. 3), "is to understand and fulfill each individual customer's increasingly diverse wants and needs—while meeting the co-equal imperative for achieving low cost."

In the past decade, there has been a flurry of research activity in the engineering design community to develop methods and tools to facilitate product platform and product family design to provide cost-effective product variety and customization. In the next section, we discuss definitions, approaches, and examples of product platform and product family design to provide a foundation for the chapters that follow in this book. In Section 3, we discuss how the chapters in this book are organized to provide academia and industry with a collection of the state-of-the-art methods and tools for platform-based product family development from the engineering design community.

2. DEFINITIONS, APPROACHES, AND EXAMPLES

2.1 Defining product platforms and product families

Many companies these days are developing product platforms and designing families of products based on these platforms to provide sufficient variety for the market while maintaining the necessary economies of scale and scope within their manufacturing and production processes. In general terms, a *product family* is a group of related products that is derived from a product platform to satisfy a variety of market niches. Meanwhile, a *product platform* can be either narrowly or broadly defined as:

- "a set of common components, modules, or parts from which a stream of derivative products can be efficiently developed and launched" (Meyer and Lehnerd, 1997, p. 7)
- "a collection of the common elements, especially the underlying core technology, implemented across a range of products" (McGrath, 1995, p. 39)
- "the collection of assets [i.e., components, processes, knoweledge, people and relationships] that are shared by a set of products" (Robertson and Ulrich, 1998, p. 20)

A review of the literature suggests that product platforms have been defined diversely, ranging from being general and abstract (for example, Robertson and Ulrich, 1998) to being industry and product specific (for example, Sanderson and Uzumeri, 1995). Moreover, the meaning of platform differs in scope: some definitions and descriptions focus primarily on the product/artifact itself (Meyer and Utterack, 1993) while others try to explore the platform concept in terms of a firm's value chain (Sawhney, 1998). Additional definitions for platforms and families are given throughout this book, reflecting both industry- and application-specific perspectives with which the product platform and ensuing family of products are defined. Defining the product platform within a company is perhaps one of the most challenging aspects of product family design (see Chapter 2).

Regardless of the specific definition used, product platforms can offer a multitude of benefits when applied successfully. As Robertson and Ulrich (1998, p. 20) point out, "By sharing components and production processes across a platform of products, companies can develop differentiated products efficiently, increase the flexibility and responsiveness of their manufacturing processes, and take market share away from competitors that develop only one product at a time." Other benefits include reduced development time and system complexity, reduced development and production costs, and improved ability to upgrade products. A product platform can also facilitate customization by enabling a variety of products to be quickly and easily developed to satisfy the needs and requirements of distinct market niches (Pine, 1993a). Platforms also promote better learning across products and can reduce testing and certification of complex products such as aircraft (Sabbagh, 1996), spacecraft (Caffrey, et al., 2002), and aircraft engines (Rothwell and Gardiner, 1990). Additional and more specific benefits can be found in many chapters throughout the book.

For instance, platforms in the automotive industry enable greater flexibility between plants and increase plant usage—sharing underbodies between models can yield a 50% reduction in capital investment, especially in welding equipment—and can reduce product lead times by as much as 30% (Muffatto, 1999). In the 1990's, automotive manufacturers that employed a platform-based product development approach gained a 5.1 percent market share per year while those that did not lost 2.2 percent (Cusumano and Nobeoka, 1998). In the late 1990's, Volkswagen saved an estimated $1.5 billion per year in development and capital costs using platforms, and they produced three of the six automotive platforms that successfully achieved production volumes over one million in 1999 (Bremmer, 1999; Bremmer, 2000). Their platform consists of the floor group, drive system, running gear, along with the unseen part of the cockpit as shown in Figure 1-1 and is shared across 19 models marketed under its four brands: Volkswagen, Audi, Seat, and Skoda.

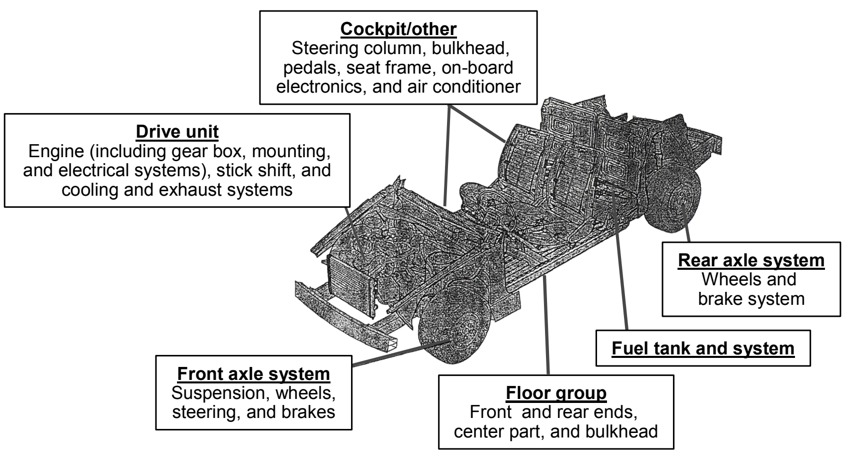

Figure 1-1. Volkswagen's platform definition; adapted from (Wilhelm, 1997).

While many researchers espouse the benefits of platforms, there are potential drawbacks and downsides to platform-based product development (see Chapter 3). For instance, despite the success of Volkswagen's platform strategy, it has been criticized for creating cars that are too similar

(Anonymous, 2002; Miller, 2002) and has suffered from its own success in platforming: lower-end models are cannibalizing sales of the higher-end models in the Europe and the U.S. The Audi TT also had unexpected technical difficulties at high speeds due to problems with the rear wheel down force, and the problems were attributed to the utilization of the aforementioned A-platform (de Weck, et al., 2003). Too much commonality can adversely impact a brand's image. For example, in the late 1980s, engineers at Chrysler were accused of having "fallen asleep at the typewriter with our finger stuck on the K key" (Lutz, 1998, p. 17) due to over-usage of the K-car platform and lack of distinctive new products. Platform-based approaches can also impose additional costs on product development. The fixed costs of developing a product platform can be enormous—Ulrich and Eppinger (2004) found that developing a product platform can cost two to ten times more than a single product—and sharing components across low-end and high-end products can increase unit variable costs due to over-designed low-end products (Fisher, et al., 1999; Gupta and Krishnan, 1998a). In the automotive industry, Muffato (1999) found that up to 80% of total vehicle development cost is spent on platform development (including engine and transmission); others argue that platform development accounts for only 60% of these costs (Sundgren, 1999). Krishnan and Gupta (2001) develop a mathematical model to examine some of the costs of platform-based product development and find that platforms are inappropriate for extreme market diversity or high levels of non-platform scale economies.

Therefore, the key to a successful product family lies in properly balancing the inherent tradeoff between commonality and distinctiveness: designers must balance the commonality of the platform with the individual performance (i.e., distinctiveness) of each product in the family (see Part I). As a result, designing a product platform and corresponding family of products embodies all of the challenges of product design while adding the complexity of coordinating the design of multiple products in an effort to increase commonality across the set of products without compromising their distinctiveness (see Part II). Successful approaches to product family design are discussed next along with several industry examples (see Part IV also).

2.2 Approaches to product family design

There are two basic approaches to product family design (Simpson, et al., 2001a). The first is a *top-down (proactive platform) approach* wherein a company strategically manages and develops a family of products based on a product platform and its derivatives. For instance, Sony has strategically managed the development of its Walkman® products using carefully designed product platforms and derivatives (Sanderson and Uzumeri, 1997).

Similarly, Kodak's product platform-based response to Fuji's introduction of the QuickSnap® single-use camera in 1987 enabled them to develop products faster and more cheaply, allowing them to regain market share and eventually overtake Fuji (Wheelwright and Clark, 1995).

The second is a *bottom-up (reactive redesign) approach* wherein a company redesigns or consolidates a group of distinct products to standardize components to improve economies of scale. For example, after working with individual customers to develop 100+ lighting control products, Lutron redesigns its product line around 15-20 standard components that can be configured into the same 100+ models from which customers could choose (Pessina and Renner, 1998). Black & Decker (Lehnerd, 1987) and John Deere (Shirley, 1990) have benefited from similar redesign efforts to reduce variety in their motor and valve lines, respectively.

The prominent approach to platform-based product development, be it top-down or bottom-up, is through the development of a *Module-Based Product Family* wherein product family members are instantiated by adding, substituting, and/or removing one or more functional modules from the platform. An alternative approach is through the development of a *Scale-Based Product Family* wherein one or more scaling variables are used to "stretch" or "shrink" the platform in one or more dimensions to satisfy a variety of market niches. We note that module- and scale-based product family design are also referred to by many as *configurable* and *parametric product family design*, respectively. Examples of both approaches follow.

2.1.1 Module-based (configurable) product families

There are numerous examples of module-based product families in the literature; some of the more frequently quoted examples follow.

- *Sony* builds all of its Walkmans® around key modules and platforms and uses modular design and flexible manufacturing to produce a variety of quality products at low cost, allowing them to introduce 250+ models in the U.S. in the 1980s (Sanderson and Uzumeri, 1997).
- *Nippondenso Co. Ltd.* makes an array of automotive components for a variety of automotive manufacturers using a combinatoric strategy that involves several different modules with standardized interfaces; for instance, 288 different types of panel meters can be assembled from 17 standardized subassemblies (Whitney, 1993).
- *Hewlett Packard* successfully developed several of their ink jet and laser jet printers around modular components to gain benefits of postponing the point of differentiation in their manufacturing and assembly processes (Feitzinger and Lee, 1997).

- *Bally Engineering Structures* offers an almost infinite variety of environmentally-controlled structures that are assembled from one basic modular component—the pre-engineered panel—that can be produced in a variety of shapes and sizes and customized with options, attachments, and finishes to fit into any size structure (Pine, 1993b).

These successful examples resulted from careful attention to customer needs and the underlying product architecture in the family. Ulrich (1995, p. 420) defines the product architecture as "(1) the arrangement of *functional elements*; (2) the mapping from *functional elements* to *physical components*; (3) the specification of the *interfaces* among interacting physical components". A product architecture is classified as either *modular*, if there is a one-to-one or many-to-one mapping of functional elements to physical structures, or *integral*, if a complex or coupled mapping of functional elements to physical structures and/or interfaces exists. For example, personal computers (PCs) are highly *modular*, and Baldwin and Clark (2000) trace the development of the IBM's System/360, the first modular computer family. Automotive architectures, on the other hand, are predominantly *integral* (cf., Muffatto, 1999; Siddique, et al., 1998), but modularity has become a major strategic focus for future product development within many automotive companies (Cusumano and Nobeoka, 1998; Kobe, 1997; Shimokawa, et al., 1997). For instance, the rolling chassis module produced by the Dana Corporation (see Figure 1-2) saved DaimlerChrysler nearly $700M when developing their new Dodge Dakota facility (Kimberly, 1999). The rolling chassis module consists of brake, fuel, steering, and exhaust systems, suspension, and drive-line assembled to the frame, and it is the largest, most complex module provided by a supplier, accounting for 25% of the vehicle content. Finally, modularity plays a key role in component reuse (Kimura, et al., 2001) as well as product evolution, upgradeability, and retirement (Ishii, et al., 1995b; Umeda, et al., 1999).

Figure 1-2. Rolling chassis automotive module; adapted from (Kimberly, 1999).

Approaches for developing modular product architectures and module-based product families abound in the engineering design literature. For instance, Mattson and Magleby (2001) discuss concept selection techniques for managing modular product development in the early stages of design. Wood and his co-authors (McAdams, et al., 1999; McAdams and Wood, 2002; Stone, et al., 2000b) present a methodology for representing a functional model of a product in a quantitative manner to assist in developing product architectures and facilitate the identification of a core set of modules for a product family. As part of their work, Stone, et al. (2000a) present a heuristic method to identify modules for these product architectures; this method is later extended by Zamirowksi and Otto (1999) to identify functional and variational modules within a product family. Allen and Carlson-Skalak (1998) develop a methodology for designing modular products that involves identifying and reusing modules from previous generations of products. Martin and Ishii (2002) consider multiple generations of products when presenting their approach for designing modular product platform architectures. Their approach is one of several that uses Quality Function Deployment (QFD) to help identify modules within a product family (Cohen, 1995; Ericsson and Erixon, 1999; Erixon, 1996; Huang and Kusiak, 1998; Sand, et al., 2002).

Modularity is the sole focus in several texts (Baldwin and Clark, 2000; Ericsson and Erixon, 1999; O'Grady, 1999) and is an important topic in many product design textbooks (see, e.g., Otto and Wood, 2001; Pahl and Beitz, 1996; Ulrich and Eppinger, 2004). While several chapters address modularity to a limited extent (e.g., the optimization-based approaches described in Chapter 9), we do not devote much attention to defining product architectures in this book *per se*. The reader is referred to the aforementioned texts as well as the seminal article on modularity by Ulrich (1995) and recent studies by Gershenson and his students (Gershenson, et al., 2003a; Gershenson, et al., 2003b; Guo and Gershenson, 2003; Guo and Gershenson, 2004; Zhang, et al., 2001).

2.2.2 Scale-based (parametric) product families

As stated previously, scale-based product families are developed by scaling one or more variables to “stretch” or “shrink” the platform and create products whose performance varies accordingly to satisfy a variety of market niches. While some consider scale-based product families to be a subset of module-based design (see, e.g., Fujita and Yoshida, 2001), platform scaling is a common strategy employed in many industries. For example:

- *Black & Decker* developed a family of universal electric motors that were scaled along their stack length to produce a range of power output for hundreds of their basic tools and appliances (Lehnerd, 1987).
- *Honda* developed an automobile platform that can be stretched in both width and length to realize a "world car", which was developed after failing to satisfy the Japanese and American markets with a single platform (Naughton, et al., 1997).
- *Rolls Royce* scaled its RTM322 aircraft engine by a factor of 1.8 to realize a family of engines with different shaft horsepower and thrust as shown in Figure 1-3 (Rothwell and Gardiner, 1990).
- *Boeing* developed many of its commercial airplanes, including the 777, by "stretching" the aircraft to accommodate more passengers, carry more cargo, or increase flight range (Sabbagh, 1996).

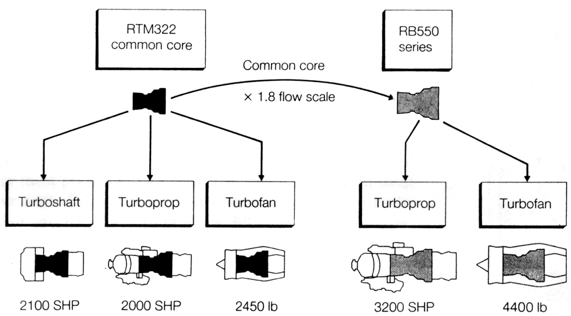

Figure 1-3. Rolls Royce's aircraft engine family; adapted from (Rothwell & Gardiner, 1990).

Scale-based platforms are prominent in the aerospace industry at large as well as small manufacturers. Airbus has recently enjoyed a competitive advantage over Boeing due to improved commonality, particularly in the cockpit. The A330 cockpit is common to all other Airbus types while Boeing's 767-400 cockpit is common only with the 757. This has enabled the A330-200, a less efficient "shrink" of a larger aircraft, to outsell Boeing's 767-400ER, a more efficient "stretch" design of a smaller aircraft (Aboulafia, 2000). Meanwhile, smaller manufacturers such as Embraer seek to exploit scaling and commonality among their aircraft to reduce development and production costs. As discussed on their website (http://www.embraer.com/), the 170 and 175 models have 95% commonality among subsystems as do the 190 and 195 models, and they boast 85% commonality among all four models, including common pilot type rating, avionics systems, fly-by-wire systems, and many high-level components.

Research in scale-based product family design has focused primarily on optimization-based approaches due to the parametric nature of platform scaling (see Chapter 8). For instance, Simpson and his co-authors use optimization-based approaches to design scale-based platforms for families of General Aviation Aircraft (Simpson, et al., 1999), universal electric motors (Simpson, et al., 2001a), and flow control valves (Farrell and Simpson, 2003). Hernandez and his co-authors have also looked at scalable platforms for the universal electric motor family (Hernandez, et al., 2002) as well as for families of absorption chillers (Hernandez, et al., 2001) and pressure vessels (Hernandez, et al., 2003). Fujita and Yoshida (2001) have investigated scale-based optimization methods for sizing families of commercial aircraft. Fellini, et al. (2002a; 2002b) used optimization to help scale automotive platforms for a family of cars. Indices for measuring the *degree of variation* in a scale-based product family have also been proposed (Messac, et al., 2002a; Nayak, et al., 2002; Simpson, et al., 2001b).

3. ORGANIZATION OF THE BOOK

There has been a flurry of activity that has helped the nascent field of product family design mature in the past decade. In this book, we showcase the efforts of more than thirty experts in academia and industry who are working to bridge the gap between (i) planning and managing families of products and (ii) designing and manufacturing them. Our intent in this book is to share the state-of-the-art in the engineering design community with both academia and industry by providing a collection of the methods and tools that are available to support platform-based product family design.

We have organized the book into four Parts that span the entire spectrum of product realization according to the domain framework (Suh, 2001) as noted in Figure 1-4. Part I focuses primarily on the Customer Domain and its mapping into the Functional Doman. These chapters discuss “front-end” issues related to platform-driven product development, platform planning, platform selection and evaluation, platform leveraging, and product family positioning. In Part II, several optimization-based methods for product family design are presented to address how the Functional Domain impacts the Physical Domain, including methods for module-based and scaled-based product family design as well as methods for requirements flow-down in a product family and platform portfolio planning. The chapters in Part III address “back-end” issues related to the realization of product families and the Process Domain, including techniques for estimating production costs, planning process platforms, and commonalizing shapes to facilitate manufacturing. Finally, Part IV includes four industrial applications that span multiple domains to demonstrate how platform-based product family development can impact product definition, product design, and process design. Detailed discussions of the chapters in each Part follow.

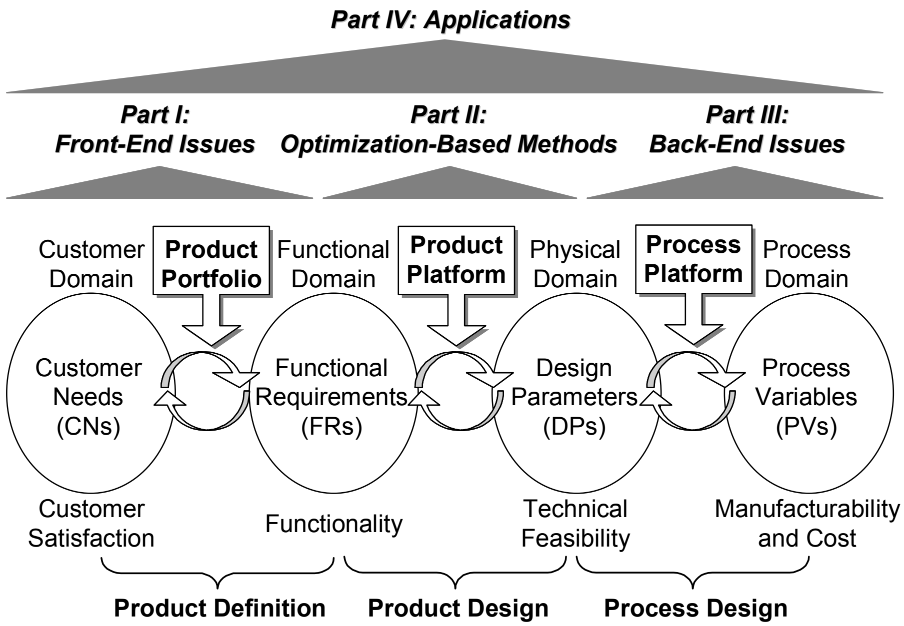

Figure 1-4. Organization of the book.

3.1 Part I: Front-end issues related to platform-based product family development

Of primary importance in product family design and platform development is the interaction with customers and the market. Manufacturers have been seeking for expansion of their product lines and differentiation of their product offerings with the intuitively appealing belief that high product variety may stimulate sales and thus conduce to revenue. At the technical side, designers have always assumed customer satisfaction with the designed product families and platforms is sufficiently high as long as the product meets the prescribed technical specifications. However, what customers appreciate is not the enhancement of the solution capability but the functionality of the product. Therefore, many dimensions of customer satisfaction deserve scrutiny, for example, identifying those product characteristics that cause different degrees of satisfaction among customers; understanding the interrelation between the buying process and product satisfaction; determining the optimal amount of variety and customer integration; explaining the key factors regarding the value perception of product families; and justifying an appropriate number of choices from the customers' perceptive. All these constitute the front-end issues of product platform and product family design.

Part I focuses on such "front-end" issues. Bowman (Chapter 2) discusses the topic of product platform planning from an industry perspective. A product/platform roadmap is introduced as the visual summation for the platform strategy, and for management to guide platform investment or rationalization decisions over the platform's useful life. Halman, Hofer and van Vuuren (Chapter 3) discuss the problems and risks related to implementing and managing product families and their underlying platforms. Using a multiple-case approach, three technology-driven companies are compared in their definitions of platform-based product families, as well as the reasons for and the risks of adopting platform thinking in the development process.

Hölttä-Otto and Otto (Chapter 4) introduce a platform concept evaluation tool that is multi-criteria in nature and scalable to include various alternative criteria as appropriate. This multi-criteria analysis results in a concept phase analysis that helps manage risk by making all aware of the criteria that a development project may need backup plans developed, extra effort applied, and management attention. To help address platform planning, Marion and Simpson (Chapter 5) explore the history of the market segmentation of product platforms. The principles and tools behind market segmentation are introduced, along with several examples, to show how companies have leveraged product platforms successfully into multiple market segments.

Jiao and Zhang (Chapter 6) discuss the issue of product family positioning. An optimization framework is developed by leveraging both customer preferences and engineering costs. Thevenot and Simpson (Chapter 7) discuss several commonality indices found in the literature. Examples are provided on how to use them for product family benchmarking and product family redesign. The study suggests that the combined use of optimization algorithms and commonality indices to support product family redesign provides useful information for the redesign of a product family, both at the product-family level as well as at the component-level.

3.2 Part II: Optimization methods to support platform-based product family development

Although the basic principles of product family design are understood and well documented in literature, quite a few fundamental issues need to be scrutinized. A prevailing principle of product family and platform design is a two-stage process. While product architectures and the range of possible variety are predetermined during a product family architecting stage, a subsequent design and development stage takes place in close interaction between the customers and the manufacturer. Based on what has been learned from the second stage, the product family architecture can be upgraded, which in turn leads to capability enhancement at the manufacturer part. The linchpin is the optimal design of product families and platforms.

Part II is devoted to the methods for optimizing product platforms and families. With emphasis on parameter (detail) design, Simpson (Chapter 8) overviews the fundamental issues and formulations of product platform and product family optimization problems. The design of a family of ten motors is introduced to shed light on the merits and pitfalls of optimization approaches to product platform and product family design. Fellini, Kokkolaras, and Papalambros (Chapter 9) present analytical methods for performing commonality decisions, with an additional design tool derived by combining these techniques. The design methodologies are applied to various automotive examples involving the design of the body and engine. Fujita (Chapter 10) expands the scope of the product family optimization problem and describes several different methods for product family design optimization based on problem classification. A simultaneous optimization method for both module combination and module attributes is introduced. The key in exploring optimal design for product family and platform exists in both development of optimization algorithm and formulation of individual problems. Kokkolaras, Fellini, Kim, and Papalambros (Chapter 11) presents an analytical target cascading (ATC) methodology for translating targets for a family of products to platform specifications for given commonality decisions. The ATC formulation is extended for a single product to a family of products to accommodate the presence of a shared product platform and locally introduced design targets. De Weck (Chapter 12) deals with product family and platform portfolio optimization. He aims to determine an optimum number of product platforms to maximize overall product family profit. A methodology is introduced based on a target market segment analysis, market leader's performance versus price position, and a two-level optimization approach for platform and variant design.

3.3 Part III: Back-end issues related to platform-based product family development

The primary objective in platform-based product family development is providing economical product variety. The underlying idea to achieve this objective by increasing commonality across multiple products through a platform approach. In order to ensure efficient product family, commonality needs to be considered for both product and process issues at component, module, platform, and product family levels. From the manufacturer's point of view, it is essential to design new products with a set of common features, components, and subassemblies that can lead to lowering production cost by eliminating new resource use and sharing existing resources. A firm needs to consider and balance the costs and benefits of all strategic perspectives that a platform-based product development approach generates. A comprehensive product family realization process needs to consider not only customer needs, function requirements and technical solutions, but also incorporate issues related to the backend of the product realization, which includes the production processes.

Perspectives, issues, models, and processes to efficiently consider "back-end" issues are the emphasis in Part III. Fixson (Chapter 13) provides a comprehensive discussion of how individual product architecture characteristics affect specific cost elements over a product's life cycle can serve as a guideline when formulating various tradeoffs. An Activity-Based Costing (ABC) approach is presented by Park and Simpson (Chapter 14) to facilitate use of cost information during product family design and allow designers to investigate possible platforms by examining the effects of differentiated products on activities and resources in production. Siddique (Chapter 15) also uses ABC and extends it to estimate cost and time savings, while considering design and production factors, for implementing a platform-based approach. Generic variety representation, generic structures and generic planning are incorporated by Jiao, Zhang, and Pokharel (Chapter 16) to develop process platforms to configure production processes for new members of product families. Identifying common shapes for components when developing a platform, to facilitate the use of common manufacturing and assembly processes, is discussed by Siddique and Natarajan (Chapter 17). Williams, Allen, Rosen, and Mistree (Chapter 18) discuss the concept and a design methodology for realizing process parameter platforms from which a stream of derivate process parameters can generate a customized product efficiently despite changes in capacity requirement.

3.4 Part IV: Applications of platform-based product family development

Research in platform-based product family development has been driven by the need of industry to compete in the current marketplace and address the problem of providing greater variety, with existing challenges of providing greater quality, competitive pricing, and greater speed to market. Many companies have successfully implemented platform-based product families to satisfy customer needs. These successful implementations provide insight into issues, methods, and benefits related to product family development. Consequently several industry cases are presented in Part IV.

Shooter (Chapter 19) presents a top-down approach to platform-based product development for a family of ice scarpers for a small company. The company started the design with full intent of using platform strategies for developing their product family. Nidamarthi and Harshavardhan (Chapter 20) discuss an approach to architecting successful product platforms within ABB. The platform approach has been applied to allow customers to not only buy products from their catalogues, but also place a turnkey order for a system including design, build, and commissioning. Moreover, the ABB case provides insight into how organizational constraints can be overcome during implementation. Roach and Cox (Chapter 21) describe a web-based tool for a turbine disk product platform, for constructing a web-based product platform customization application to automatically create all of the design artifacts and supporting information necessary for the design of a particular product. Finally, Holmqvist, Lindhe, and Persson (Chapter 22) present a case of creating the platform and the modules for a heat exchanging system by analyzing how the market offer could be achieved by using a smaller assortment of products, modules and components.

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