



## **The Synchronous Development Model: Insights into Leadership and Organization Design for Improved Product and Process Innovation**

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Advanced product-based technology organizations face the challenge of leading rapid product technology innovation while maintaining a focus on market demands, competitive pressures, rapid globalization, operational efficiency, and product delivery costs and schedule. Management science provides scholarly theories of organizational design to effectively manage innovation. Technical management theories provide models for understanding the life cycle of both products and markets for leading successful innovation projects. The combination of models from both disciplines can provide useful insights to address the challenges of product-based companies faced with the need to encourage and capitalize on continuous innovation. This article presents a new model derived from the combination of management and technical sciences, providing a framework for additional research into the optimal design of modern product-based technology companies.

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### **Overview - Challenges of Modern Product Technology Companies**

**A**dvanced product technology organizations face the challenge of leading rapid product development in response to market dynamics, competitive pressures, and globalization. At the same time, they are aiming to improve operational efficiencies and reduce product delivery cycle times to increase the bottom-line profitability of mature product manufacturing. Successful organizations meet these challenges through a continual emphasis on innovation. The term innovation is used to describe many creative activities, from new inventions to new processes and business models. Pierce and Delbecq examined many theoretical models for organizational innovation, developed over two decades, defining innovation as the “initiation, adoption and implementation of new ideas or activity in an organizational setting.”<sup>1</sup> The multiple dimensions of product innovation “pull” the organization in at least two directions including innovations focused on process improvements to maintain the profitable manufacturing of existing products; and product innovations needed for continual product improvements and new market expansion. How do leaders of successful business encourage innovation, identify the best ideas to solve existing problems, and apply the best ideas in ways that realize the desired results consistent with their business strategy? How do leaders balance the demands of both the daily

operation of manufacturing mature products with the need to develop new products? This article addresses a combination of models from both the scientific disciplines and modern management science to provide useful insights to address these questions, beginning with a discussion of the product life cycle, the market life cycle, and a model for linking these two models together in a synchronous manner to provide insight into organizational design for innovation.

### **Innovation and the Product Life Cycle: An Internally Focused Model**

The science and technology profession models the product life cycle as a framework to define various phases of product creation, development, production, usage, and termination<sup>2</sup> and to systematically manage product activities through each of these phases.<sup>3</sup> Modern models of the product/service life cycle include as many as seven stages.<sup>4</sup> For simplification, these stages will be grouped into four high-level product phases; 1) early product invention and validation, 2) product prototyping and manufacturing, 3) full scale production and 4) production scale down and termination. A summary of each phase follows:

- **Early product invention and validation** includes the initial invention of an idea, the research associated with the idea, the investigation of customer interest and requirements, and the development of business requirements. This phase usually starts with the invention of an idea with the potential of meeting a customer need and then proceeds to the concept exploration phase through the implementation of a pilot development project aimed at validating the viability of a product concept on both technical and business merit.<sup>5</sup> Typically a “change champion”<sup>6</sup> will sponsor the innovation.
- **Product prototyping and pilot manufacturing** includes the detailed design of a form-fit-functional prototype, the development of any manufacturing processes associated with volume production of the product, and the establishment of a materials supply chain needed to “feed” the factory with the raw materials and components needed to cost-effectively manufacture the product.<sup>7</sup> Validation of the cost-effectiveness of the product and the attractiveness of the market at an established cost and profitability level sets a threshold for success.
- **Full-scale product production** applies the full force of the manufacturing, quality assurance, supply chain and marketing organization to the delivery of a product at price levels the market will accept and at a product value the market demands.<sup>8</sup>
- **Production scale down and termination** includes the gradual reduction of market demand, reduction of production rates, and the shifting of resources away from the production of the product.<sup>9</sup> Ideally, the organization exits the market at the trailing end of the product life cycle with a satisfied market, happy customers, and reasonable profit margins.

The product life cycle provides a time-based perspective of the “life” of the product. However, a clear understanding of the market is critical to achieve sustainable competitive discrimination in the modern product technology marketplace. One model that provides insights into the optimum synchronization of product development decisions is the category maturity life cycle model.<sup>10</sup>

### Market Demands and the Competitive Landscape: An Externally Focused Model

The category maturity life cycle model<sup>11</sup> provides valuable insights into the critical timing of new process and/or product innovations. The term “category” is defined as a grouping of economic outcomes derived from either the purchase of a product or service with certain expected benefits, or as an investment made with the promise of eventual financial gains.<sup>12</sup> When applied to a product-based model, a category applies to a specific market for a set of products that have similar characteristics. The market rewards “different types of innovation at different points in time and exhibit[s] a life cycle associated with this tendency to reward innovation.”<sup>13</sup> The category maturity model is divided into five phases to comprise the lifecycle of the market as summarized below:

- **The Technology Adoption Phase**<sup>14</sup> - represents the early introduction of a new product to a market and the associated response of the market to the product. The acceptance of the new idea by “early adopters”<sup>15</sup> could potentially lead to the early success or failure of a new product. If the product is successful at generating additional interest in the market at acceptable profit margins, the product will move successfully through the product acceptance and into the market growth stages.
- **The Growth Market**<sup>16</sup> - is characterized by rapid growth in market share and associated profitability. The product is mature, the associated manufacturing processes are stable, and pricing strategies generally enjoy high demand for the product. Company risk in this stage is reasonably low and resources from product sales are relatively abundant.
- **The Mature Market Stage**<sup>17</sup> - is characterized by a flattening market, as consumer “appetite” for the basic product features and capabilities has been replaced with new demands. Competitors have entered the market, creating pricing competition, with alternative products or product features. Generally, this phase of the category maturity life cycle demands attention to the details of manufacturing process innovation of baseline product and on product innovations to provide new products.
- **Market Decline and End of Life**<sup>18</sup> - the eventuality of an unfavorable market leads to the declining phase of the category maturity lifecycle. There is high potential for product disruption, and company risk is on the rise. At this point, the successful innovating company is already engaged in a new product introduction and in exploration of new markets.

How does the innovating organization remain ahead of the competition in new product releases or new market penetration? To explore the answers to this question, a linkage between the product life cycle model and the category maturity model begins to illuminate ideas through a new “lens” to view organizational design and strategic leadership.

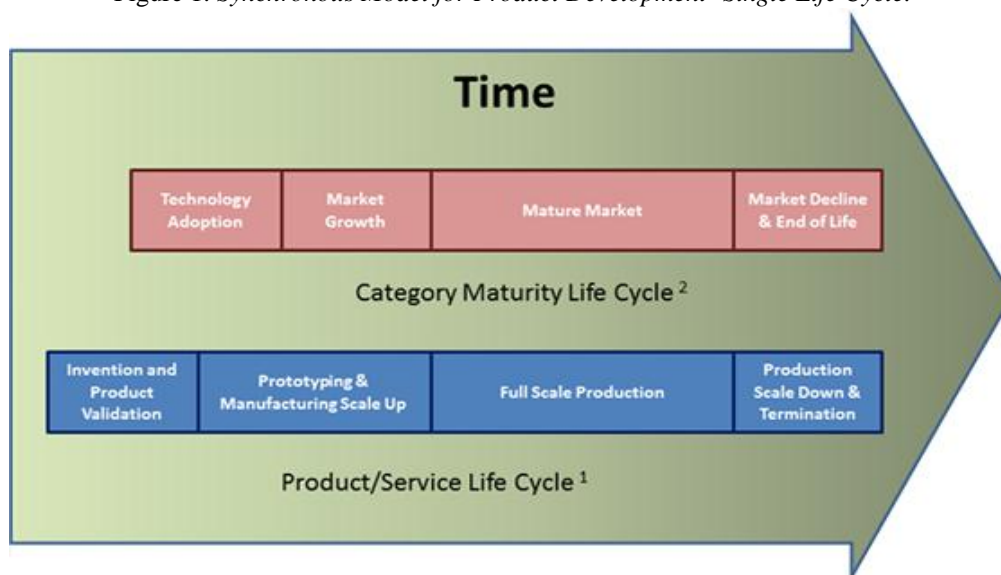
### A Synchronous Model for Product Development

The illustration in figure 1 provides a linear representation of both the product life cycle model and the category maturity (or market) life cycle model, with time progressing from left to right. The specific length of time associated with either model has been “scaled” to simplify the interrelationship and to create an idealized synchronization for illustration purposes. It is

important to start with a description of the specific overlaps and the interrelationships between these two models:

- **Early product validation,<sup>19</sup> prototyping,<sup>20</sup> and technology adoption<sup>21</sup>** occurs within the overlap of the early technology adoption stage of the category-maturity model and the early prototyping activities of the product life cycle model. The “pilot product development project” described previously, is the link between the internal activities of the product validation/prototyping and the external activities associated with market introduction and eventual adoption.
- **Manufacturing scale up<sup>22</sup> and market growth<sup>23</sup>** involves the internal activities associated with the scale up of manufacturing driven by the demands of the market. During this growth period, product requirements have stabilized and product sales are increasing. The overlap of the model shows the ideal completion of the manufacturing scale-up to be synchronous with the end of the market growth period and the beginning of the market maturity phase.
- **Full scale production<sup>24</sup> in response to the mature market<sup>25</sup>** represents the most obvious overlap of the two models during the full-scale production and the mature market. Not as obvious are the demands for continual process and product innovation during this period. As new competitors enter the market and consumers’ “appetite” for the existing product remains, the battle for lower prices drives a need for process innovation, while the demand for product improvements drives the need for product innovation.
- **The “twilight years” of the aging product<sup>26</sup>/market<sup>27</sup>** is the eventual loss of favor in the market place, under the demands for lower prices, competition for new product features, or the introduction of an entirely new product “category.” Profit margins begin to drop along with sales forecasts, driving the need to scale down production. This ultimately leads to the transition of the manufacturing resources to other opportunities within the company.

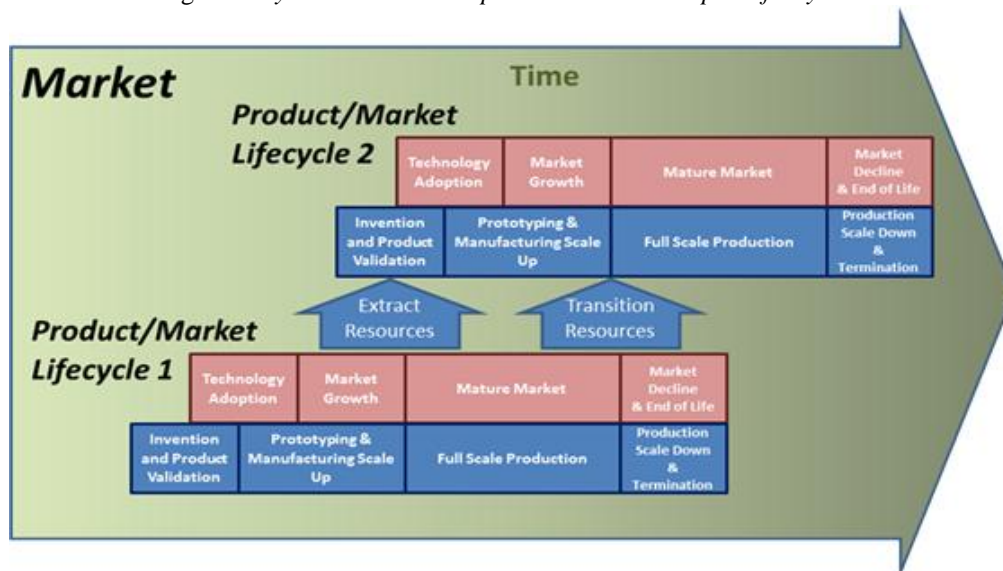
Figure 1. *Synchronous Model for Product Development- Single Life Cycle.*



- <sup>1</sup> Yang, K., & El-Haik, B. (2009). *Design for Six Sigma: A roadmap for product development* (2<sup>nd</sup> ed.). McGraw Hill, 1.2, 5.13-5.15. Retrieved November 15, 2009, from <http://skillport.books24x7.com>
- <sup>2</sup> Moore, G. (2008). *Dealing with Darwin: How great companies innovate at every phase of their evolution*. Penguin Books, Ltd., England, 14.

The repeating cycle of product and process innovation that must occur to maintain a competitive advantage in the marketplace, combined with the desire to retain a talented workforce and maintain the financial leverage of capital investment, drives the need for product innovation in the high technology industry. The desirable “discontinuous” product development within an established market is modeled in figure 2. The model includes the synchronization of the product and category maturity life cycle model to form a single product/market “life” (labeled Product/Market Lifecycle 1), with additional overlapping cycles linked through the transfer of resources to create new product/market “lives” (labeled Product/Market Lifecycle 2). The synchronous relationship between these multiple overlapping “lives” forms a product/market “family” that share a common market and progress through parallel life cycles. These product/market family members link through the transition of resources and the synchronized “growth” through multiple phases of the product/market life cycle.

Figure 2. *Synchronous Development Model - Multiple Life Cycles.*



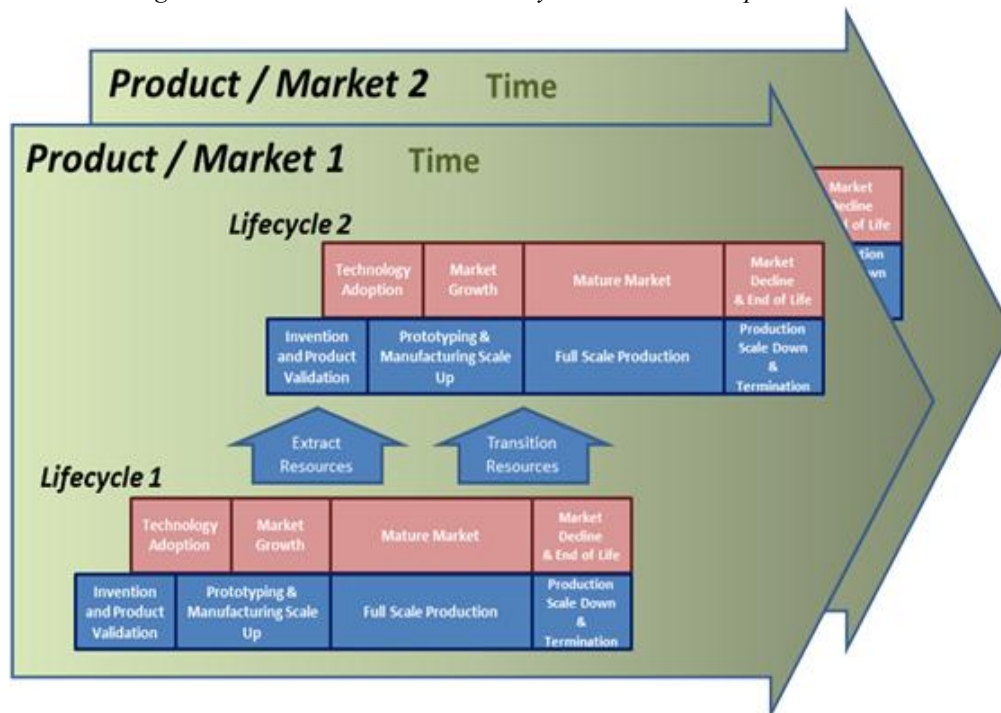
As a product evolves and begins to progress toward full-rate production in a mature market, there is an ideal opportunity to extract resources from this baseline Product/Market Lifecycle 1, in the form of financial investment, employees, and capital infrastructure needed to support innovation. Allowing key personnel to move from one innovation project to the next encourages an entrepreneurial spirit within the element of the organization dedicated to both product and process innovation. Additionally, capital infrastructure from Product/Market Lifecycle 1 can benefit early manufacturing process validation of the second product. Less obvious is the extraction of new requirements for product innovations, derived from the market trends in response to the growth of the baseline product. These requirements help form the basis for new

product innovations, with a higher degree of confidence in the accuracy of requirements extracted from the same information used to manage the baseline product scale up.

As new competitors enter the market, improved operational efficiencies can also be translated into price reductions, to maintain an “edge” on the competition and to extend the duration of a product/market lifecycle, as “late adopters” enter the market.<sup>28</sup> Finally, as the product reaches the “twilight phase” of the life cycle, the scale down of the baseline product will displace resources. Linkages to other product/market “lives” help to minimize disruption of the workforce, building a path to organizational transition through proper synchronization of multiple product/market “generations” within a product/market family.

There is a third dimension of the Synchronous Development model to be considered; the creation and co-existence of multiple product/market “families,” as illustrated in figure 3. A product/market family exists on a single plane in this figure (Product/Market 1), with additional families of products and markets co-existing on multiple planes within the model (Product/Market 2). This represents the desirable possibility that an organization may develop a product innovation so disruptive that entirely new product lines and new markets emerge, initiating an entirely new product/market family.

*Figure 3. The “Three Dimensional” Synchronous Development Model.*



### Organizational Design and the Synchronous Development Model

Examining the three dimensional Synchronous Development model provides useful insight into the idealized timing of the extraction and transition of resources, the relative synchronization of new product innovation within a family, and the creation of new product/market families. Classical models for product “aging”<sup>29</sup> highlight the fact that products age much faster than the

organizations that create them. This implies that a single organization will innovate through multiple life cycles of a product/market family and could create multiple new product/market families, presenting challenges for optimal organizational design for effective continual innovation. This leads to consideration of organizational charters related to the various activities reflected in the Synchronous Development model.

### **Organizational Charters and the Synchronous Development Model**

There are multiple organizational charters associated with activities within the Synchronous Development model. First is a “Product Development” organization with the charter associated with both incremental and discontinuous innovation. Incremental innovations are small improvements to baseline products or to the processes used to produce and deliver them to market.<sup>30</sup> Discontinuous innovations result in radically new products or new ways of producing or delivering products, “that profoundly alter the basis of competition in an industry, often rendering old products or ways of working obsolete.”<sup>31</sup> The Product Development organization charter would include the creation and early development of *new* generations of products within a given product/market family, as well as that of *entirely new* product/market families.

The second charter is assigned to a “Stable Product-Manufacturing” unit responsible for the “middle to late life” of a product/market family, starting at early product verification and production scale up.<sup>32</sup> This organizational unit would also create incremental product and process innovations intended to optimize operational efficiencies within the *mature* phase of product/market lifecycle and to extend the market lifecycle by capturing “late adopters”<sup>33</sup> through improved product cost and/or features.

Finally, there are two marketing charters emerging from the Synchronous Development model. One “Expansion Marketing” charter focuses on maintaining and growing markets associated with a *mature* product/market family. The second “Exploratory Marketing” charter would focus on developing *new* markets: leveraging *disruptive* product innovations to develop completely new product/market families.<sup>34</sup>

A Product Development unit might be formed and organized to optimize a horizontal information flow,<sup>35</sup> maximizing broad-based innovation. The unit would lead product innovation through the early life cycle phases, transitioning leadership to a Product-Manufacturing unit at the optimum point during the prototyping and scale up phase. The Product Development unit would focus on multiple product/market innovation projects at any point in time. This suggests the need to manage multiple product/market families within the early phases of a life cycle,<sup>36</sup> to enable coordination of new product releases within a product/market family and across families of new products and markets. The development of new product/market families would be coordinated with the Exploratory Marketing unit. The development of new products within an existing family would be coordinated with the Expansion Marketing unit and the product support specialists within the Product-Manufacturing unit.

In contrast to the Product Development unit, the leadership and followers of the stable Product-Manufacturing unit would place a high value on operational efficiency and the control of specialized repeatable processes, to ensure repeatability and uniformity of manufactured products.<sup>37</sup> As the product and market matures, highly specialized teams would be formed to



ensure the support and adherence to rules of practice.<sup>38</sup> A relatively small number of focused teams would oversee daily operations and the introduction of incremental process or product innovations.<sup>39</sup> A product/market family portfolio would be managed by a centralized authority,<sup>40</sup> along with the capital infrastructure and supply chain needed for the repeatable production of the product, which would maximize uniformity, ensure timely cost-effective delivery, and minimize the opportunity for unnecessary change.

Each of these units would be organized with either vertical or horizontal structures, different mission and vision statements, and fundamentally different value systems, making the integration of these organizations challenging.<sup>41</sup> However, separating these organizations into individual units without consideration of interdependent activities within the Synchronous Development model would also be a concern.<sup>42</sup> This leads to the conclusion that a “hybrid” organizational model may be needed to optimally organize these units to manage innovation.

### **The Ambidextrous Organization**

The ambidextrous model describes two basic organizational units chartered with either 1) creating new ideas, or 2) capitalizing on their utilization.<sup>43</sup> In this model, the “organic creative department” explores and develops new ideas while looking for expanded opportunities. Organizations chartered with the creation of new disruptive ideas generally lack the structure and discipline to carry a new idea to the level of maturity needed to move beyond the earliest phase of the product lifecycle.<sup>44</sup> Therefore, another unit, referred to as the “mechanistic using department” exploits these innovations, maturing them through product scale up and production. The highly mechanistic organization might resist the introduction of change, but is skilled at bringing a new idea to a high level of maturity and uniformity in production. This model suggests the division of ownership between two distinct product/market lifecycle phases within the Synchronous Development model previously discussed. But how are these two units organized to operate through multiple product/market lifecycles and across multiple product/market families? A recent study of major product technology firms and their effectiveness at leading innovation provides some insight.

The organizational structure of several leading technology companies were analyzed for their effectiveness at leading and capitalizing on innovation.<sup>45</sup> Each company included a “creativity department” responsible for leading innovation activities. The most effective companies organized their creativity departments with an ambidextrous approach “where the breakthrough efforts were organized as structurally independent units, each having its own processes, structures, and culture but integrated into the existing senior management hierarchy.”<sup>46</sup> The study showed that ambidextrous organizations were significantly more successful at creating the desired innovation and at realizing the desired business performance than those companies who organized their innovation departments after classical organizational models.<sup>47</sup>

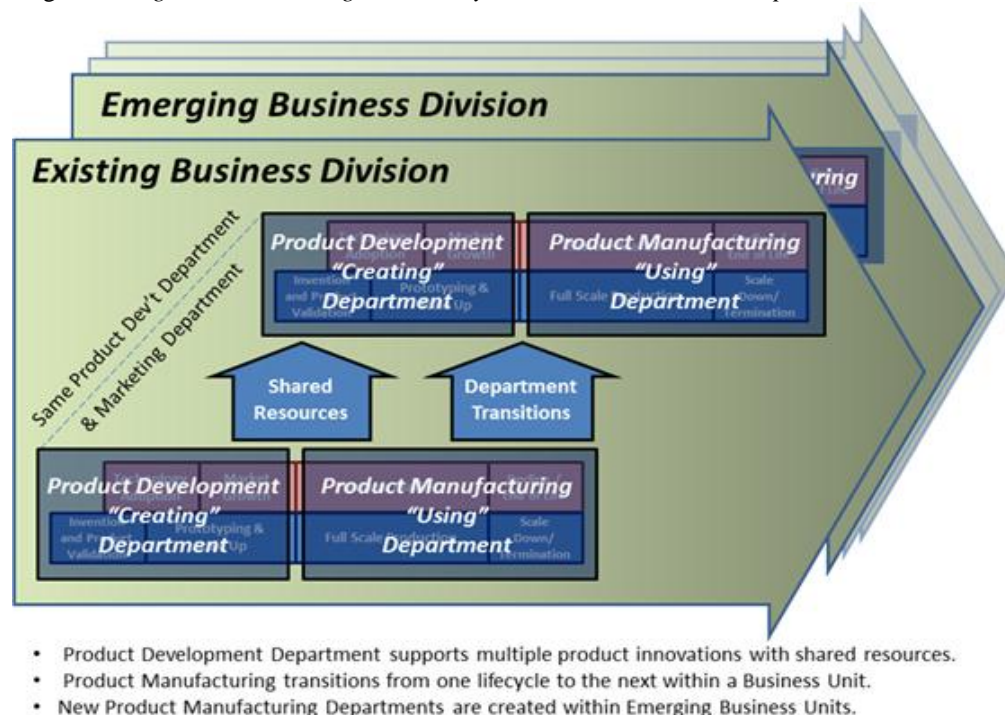
A basic assumption underlying the ambidextrous approach in this study is the co-existence and optimum coordination of the activities associated with both a stable business and an emerging business by a single organizational unit operating with a “super-set” of management processes.<sup>48</sup> The organization is divided into two units described as “existing” business units and “emerging” business units.<sup>49</sup> Within the Synchronous Development model, the “existing” business units organize the activities of innovation, marketing, and manufacturing to maintain and develop an



existing product/market family. The “emerging” business unit would organize the activities of innovation, marketing, and manufacturing to capture new markets and to develop new product/market families.

With this additional perspective of the ambidextrous approach, an organizational structure linking both the “existing/emerging business units”<sup>50</sup> and the aforementioned “creative/using departments,”<sup>51</sup> is overlaid onto the Synchronous Development model in Figure 4 to create a model for the Synchronous Development organization.

Figure 4. *Organizational Design and the Synchronous Product Development Model*



### The Synchronous Development Organization

At the highest level of the model, each of the product/market families are now associated with the two forms of business units, referred to as the Existing Business Division and the Emerging Business Division. These divisions manage all activities within a product/market family and report to senior executive leadership, who is responsible for coordination between the business divisions. As described earlier, the Existing Business Division would coordinate all activities within a product/market family, isolated from other business divisions. An Existing Marketing Department, operating within this division, would be structured and incentivized to understand their market and the multiple generations of products that market contains. The Emerging Business Division would coordinate activities across multiple emerging product/market families, with a priority placed on capitalizing on discontinuous product innovations to capture or create new markets and new product/market families. An Emerging Marketing Department, within this division, would be highly agile and incentivized to be highly entrepreneurial.

Within an Existing Business Division, we have also segregated the product/market lifecycle by the aforementioned charter definitions of the “creating” and the “using” departments. The

Product Development “Creating” Department “moves” across multiple lifecycles of the product/market family as they innovate to create new products innovations within a baseline family and to develop next lifecycle generations of products within the product/market family. They also move across multiple product/market families. This “movement” is facilitated by their organizational design and their processes. “Shared resources” extracted from the mid-phase of a product/market lifecycle support their activities. “Centralized” leadership of the Business Division manages the reallocation of resources within a product/market family, with the day-to-day activities of product development managed within a horizontal structure by the Product Development Department’s “decentralized” leadership.

In contrast, most of the followers of the Product Manufacturing Department are organized around a more vertical information flow, with the centralized leadership managing the day-to-day operation of secondary phases of the product/market lifecycle. The Business Division leadership also controls the resources needed for product and process innovation within a given product/market lifecycle, which are extracted from the profits of the maturing product/market lifecycle. As a given product/market lifecycle begins to decline, the transitions of product-manufacturing resources to adjacent product/market lifecycles are coordinated by the leadership of the Product Manufacturing Department and the senior leadership of the Business Division. It is unlikely that resources would be transitioned to adjacent product/market families without coordination being directed by the senior executive leadership of the multiple business divisions.<sup>52</sup>

Finally, the discontinuous innovation that is developed by the Product Development Department and focused on the creation of new product/market families is closely tied to the activities of the Marketing Department of the Emerging Business Units. Ultimately, new Product Manufacturing Departments would emerge within the Emerging Business Division to support the new and maturing product/market family.

### **Conclusion**

A new perspective combining the conceptual model of the ambidextrous organization with a new three-dimensional synchronous model for product and market development has been developed. The Synchronous Development model provides new insights into how an organization might be structured, with “time” as a factor in examining the dynamics within a product/market family and across multiple product/market families. The preliminary conclusions offered by “connecting” these two models with organizational designs and leadership theory provide a framework for future study of the effective design of innovating organizations. Modern companies must effectively organize around both incremental and discontinuous innovation, providing the very best value for their customers and their investors. Effective innovating companies must also create a “welcoming” environment for a diverse array of followers, whether they are drawn to incremental or discontinuous innovation and to existing or emerging business. The Synchronous Development model, built around the concept of the product/market lifecycle, provides a framework for exploring new organizational models for the effective innovating organization.

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