3.1 INNOVATION

Product innovation is essential for a country’s economic growth and for the competitive position of industry. Companies operate in a rapidly changing world in which customers’ needs and wants are not fixed and where they face increasing competition due to open markets and globalization. Companies that effectively integrate innovation in the product development process can gain significant competitive advantage.

Innovation is a broad concept that is used in many different contexts. As a result, there are many definitions of innovation. One useful definition is: “the commercial or industrial application of something new— a new product, process or method of production; a new market or source of supply; a new form of commercial, business or financial organization”.

Most definitions of innovation emphasize ‘newness’ and ‘successfulness’. There are distinctions made between product versus process innovation and sometimes amongst market, business and management innovation. For example:

> Product innovation is the introduction of new products that have characteristics and/or use applications that differ from existing products on the market.
> Process innovation is the introduction of a new method of production, that has not previously been used and/or a new way of handling a commodity commercially to make production more efficient or to be able to produce new or improved products.
> Market innovation involves entering new markets, new ways of serving customers, and/or market expansion.

> Business and management innovation involves developing new reward systems, organizational structures, ways of handling responsibilities and human resources etc. that positively affects product sales.

Within D4S the focus is on product and market innovation. Process innovation is often more linked to cleaner production and management innovation to environmental management systems like ISO 14000.

3.2 INNOVATION LEVELS

Innovation happens in different degrees and can be categorized into three levels: incremental, radical and fundamental (see Figure 6). Each category is progressively more significant and more far-reaching.

1> Incremental innovation_ Entails step-by-step improvements of existing products and tends to strengthen market positions of established companies in the industry.

2> Radical innovation_ Drastically changes existing products or processes. The risks and required investments in radical innovation are usually considerably greater than those needed for incremental innovation but they offer more opportunity for new entrants to the market.

3> Fundamental innovation_ Depends on new scientific knowledge and opens up new industries, causing a paradigm shift. In the early stage of fundamental innovation, the contributions of science and technology are important.
The majority of innovation efforts take place in companies that work from the incremental or radical innovation perspective. There is a wide range of innovation possibilities between these two extremes. Fundamental innovation often takes place only in large multinational companies, company clusters or (inter)national research programs because of the large human and capital investment needed. For D4S in developing economies it is less relevant.

Successful incremental or radical innovation requires different kinds of thinking, ways of working, and risk taking. To get more insight and a better understanding of both types of innovation, they are discussed in more detail below.

### 3.2.1 INCREMENTAL INNOVATION

As the name suggests, this type of innovation makes small changes at one given time and is sometimes referred to as continuous improvement. A simple product may be improved (in terms of better performance or lower costs) through the use of higher performance components or materials. A complex product that consists of integrated technical subsystems can be improved by partial changes at one level of a sub-system. Incremental innovations do not involve major investments or risk. User experience and feedback is important and may predominate as a source for innovation ideas. As an example, customer wants can be identified and added as features to the existing product.

Incremental innovation and the redesign of existing products are economically and commercially as important as radical innovations. Incremental innovation and design improvement are known as the ‘bread and butter’ of new product development for many firms. Many firms do not even attempt to explore radical innovation for a variety of reasons having to do with their size and resources, the nature of the industry, the level of research and development necessary, or the amount of risk involved. Even firms that successfully introduce radical innovation may not do so very often. Incremental innovation projects, due to the low level of involved risk usually follow a structured and predictable process.

### 3.2.2 RADICAL INNOVATION

Radical innovation involves the development of key new design elements such as change in a product component combined with a new architecture for linking components. The result is a distinctly new product that is markedly different from the company’s existing product line.

A high level of uncertainty is associated with radical innovation projects, especially at early stages. Due to high levels of uncertainty, the process cannot be described as an orderly structured process. Radical innovations are confronted with uncertainties on different levels. To be successful, uncertainty must be reduced in the following dimensions:

- **Technical uncertainty** are issues related to the completeness and correctness of the underlying scientific knowledge and the technical specification.
- **Market uncertainty** are issues related to customer needs and wants.

<table>
<thead>
<tr>
<th></th>
<th>INCREMENTAL INNOVATION</th>
<th>RADICAL INNOVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMPHASIS</td>
<td>Cost or feature improvements in existing products, services or processes.</td>
<td>Development of new businesses, products and/or processes that transform the economics of a business.</td>
</tr>
<tr>
<td>TECHNOLOGY</td>
<td>Exploration of existing technology</td>
<td>Exploration of new technologies</td>
</tr>
<tr>
<td>TRAJECTORY</td>
<td>Linear and continuous; evolutionary</td>
<td>Revolutionary and discontinuous; revolutionary</td>
</tr>
<tr>
<td>KEYS PLAYERS</td>
<td>Formal cross-functional team</td>
<td>Formal and informal cross-functional teams and individuals</td>
</tr>
<tr>
<td>TIME FRAME</td>
<td>Short term</td>
<td>Mid- to long-term</td>
</tr>
<tr>
<td>RISK &amp; SUCCESS</td>
<td>Predictable</td>
<td>Unpredictable and highly uncertain</td>
</tr>
<tr>
<td>PROCESS</td>
<td>Formal, phase-gate model</td>
<td>Informal, flexible model at early stages, due to high uncertainty; more formal at later stages after uncertainties have been reduced.</td>
</tr>
</tbody>
</table>

### FIGURE 6 __ DIFERENT DEGREES OF INNOVATION.

### TABLE 3 __ COMPARISON OF INCREMENTAL AND RADICAL INNOVATIONS CHARACTERISTICS.
Organisational uncertainty refers to organisational resistance that stems from conflict between the mainstream organization and the radical innovation team.

Resource uncertainty includes project discontinuities that influence the project’s funding, staffing, and management requirements. Radical innovations need a number of enabling factors such as a high level of technological capability, strong R&D and a pool of multidisciplinary skills whereas the incremental innovation adoption process needs less.

3.2.3 PRODUCT INNOVATION

The product innovation process involves a series of sub-processes dominated by the product development process followed by the realization (see Figure 7).

Product Innovation = Product Development + Realization

In the following paragraphs a general step-by-step product development process will be outlined.

3.3 PRODUCT DEVELOPMENT PROCESS

Product development can be defined as “the process that transforms technical ideas or market needs and opportunities into a new product and on to the market”. It includes strategy, organization, concept generation, product and marketing plan creation and evaluation, and the commercialization of a new product.

The product development process is a disciplined and defined set of tasks, steps, and phases that describe how a company repetitively converts ideas into salable products and/or services. The product development process itself can be split up into three phases: policy formulation, idea finding and strict development (see Figure 7).

Every step has two different kinds of activities (see Figure 8): first a divergent activity, followed by a convergent activity. These approaches identify relevant information in a creative way and then evaluate it. Divergent methods search for ideas and include searching for information, to explore the problem, to redefine it, to generate ideas and to combine concepts. Convergent methods impose value judgments and include methods to make sense of information, to prioritize items, to compare solutions, to assess ideas and to reject or select concepts. The product development process is often presented as a linear process. However, in practice it is often characterized as a linear process with iterative cycles, meaning that design teams often go back to earlier stages and decisions in the product development process to re-evaluate previous decisions that have been made.

![Figure 7](image-url)
3.4 POLICY FORMULATION

The product development process starts with formulating goals and strategies. Developing new or redesigned products without having clear goals and product strategies may lead to unsuccessful products and failures. For this reason, it is essential for a company to define its vision, mission, goals and (product) innovation strategies (see Figure 9).

3.4.1 MISSION STATEMENT

A company’s mission is its reason for being. The mission is often expressed in the form of a mission statement, which conveys a sense of purpose to employees and projects a company image to customers. The mission statement defines the purpose or broader goal for being in existence. It serves as a guide in times of uncertainty or vagueness. It is like a guiding light. It has no time frame and can remain the same for decades if crafted correctly.

When defining its mission statement, a company can consider including some or all of the following aspects:

> The moral/ethical position of the enterprise;
> The desired public image;
> The key strategic influence for the business;
> A description of the target market;
> A description of the products/services;
> The geographic domain; and
> Expectations of growth and profitability.

THE MISSION STATEMENT OF A PLASTICS MANUFACTURER IN TANZANIA:

> Our mission is to become a world-class provider of proprietary and innovative solutions in the East and Central African market.
> We will double turnover every three years.
> We shall take pride in becoming preferred partners to all our stakeholders and in exceeding their expectations.

TEXT BOX 2 ___ EXAMPLE OF MISSION STATEMENT.

3.4.2 VISION STATEMENT

The vision statement describes how the company management sees events unfolding over 10 or 20 years if everything goes exactly as hoped. A vision statement is short, succinct, and inspiring about what the organization intends to become and to achieve at some point in the future stated in competitive terms. Vision refers to the category of intentions that are broad, all-inclusive and forward-thinking. It is the image a business has of its goals before it sets out to reach them. It describes future aspirations, without specifying the means that will be used to achieve them.
A vision statement for a new or small firm spells out goals at a high level and should coincide with the founder’s goals for the business. Simply put, the vision should state what the founder ultimately envisions the business to be, in terms of growth, values, employees, and contributions to society. This vision may be as vague as a dream or as precise as a goal. The vision may contain commitment to:

- Developing a new product or service;
- Serving customers through the defined service portfolio;
- Ensuring quality and responsiveness of customer services;
- Providing an enjoyable work environment for employees; or
- Ensuring financial and sustainable growth of the company for the benefit of its stakeholders.

### 3.4.3 GOALS AND OBJECTIVES

After defining (or redefining) the company’s mission and vision, it is time to set practical goals and objectives for the organization based on these statements. The goals often lack specificity. The objectives are aims that are formulated exactly and quantitatively including time-frames and magnitudes. For example, the objectives of an annual earning growth target should be challenging but achievable. They also should be measurable so that the company can monitor its progress and make corrections as needed.

Once the firm has specified its objectives, it can analyze its current situation to devise a strategic plan to reach the objectives. This can be done for example with a **Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis** or by evaluating the product life cycle stage of its product portfolio.

### 3.4.4 SWOT ANALYSIS

In order to succeed, businesses need to understand their strengths and where they are vulnerable. Successful businesses build on their strengths, correct weaknesses and protect against vulnerabilities and threats. They also understand the overall business environment and spot new opportunities faster than competitors.

<table>
<thead>
<tr>
<th>POSITIVE</th>
<th>NEGATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>STRENGTHS</td>
<td>WEAKNESSES</td>
</tr>
<tr>
<td>Technological skills</td>
<td>Absence of important skills</td>
</tr>
<tr>
<td>Leading Brands</td>
<td>Weak Brands</td>
</tr>
<tr>
<td>Distribution channels</td>
<td>Poor access to distribution</td>
</tr>
<tr>
<td>Customer Loyalty/Relationship</td>
<td>Low customer retention</td>
</tr>
<tr>
<td>Production quality</td>
<td>Unreliable product/service</td>
</tr>
<tr>
<td>Scale</td>
<td>Sub-scale</td>
</tr>
<tr>
<td>Management</td>
<td>Management</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OPPORTUNITIES</th>
<th>THREATS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing customer tastes</td>
<td>Changing customer tastes</td>
</tr>
<tr>
<td>Liberalisation of geographic markets</td>
<td>Closing of geographic markets</td>
</tr>
<tr>
<td>Technological advances</td>
<td>Technological advances</td>
</tr>
<tr>
<td>Changes in government politics</td>
<td>Changes in government politics</td>
</tr>
<tr>
<td>Lower personal taxes</td>
<td>Tax increases</td>
</tr>
<tr>
<td>Changes in population age-structure</td>
<td>Changes in population age-structure</td>
</tr>
<tr>
<td>New distribution channels</td>
<td>New distribution channels</td>
</tr>
</tbody>
</table>

**Figure 10. Example of SWOT Matrix.**
A tool that helps in this process is the SWOT analysis. **Strengths** are attributes of the organization that are helpful to achieve the objective. They have to be maintained, built upon, or leveraged. **Weaknesses** are attributes of the organization that are harmful to the achievement of the objective. They need to be remedied or stopped. **Opportunities** are external conditions that are helpful to the achievement of the objective. They need to be prioritized and optimized. **Threats** are external conditions that are harmful to the achievement of the objective. They need to be countered or minimized.

In addition, the company can explore its core competences - those capabilities that are unique to it and that provides it with a distinctive competitive advantage and contribute to acquiring and retaining customers (see Figure 10).

### 3.4.5 PRODUCT LIFE CYCLE FROM A MARKET PERSPECTIVE

A new product progresses through a sequence of stages in the market from introduction to growth, maturity and decline (see Figure 11). After a period of development, the product is introduced or launched into the market. It gains more and more customers as it grows. Eventually the market stabilizes and the product becomes mature. Then after a period of time, the product is overtaken by development and the introduction of superior competitors, and it goes into decline and is eventually withdrawn. It is essential for a company to be aware of at which stage the products in its product portfolio are in order to start up new innovation initiatives in a timely manner.

This product life cycle perspective from a marketing point of view should not be confused with the ‘sustainability’ life cycle approach (from cradle to cradle) as introduced in Chapter 2.

### 3.4.6 STRATEGIC INNOVATION GAP

Product innovation is necessary to survive and grow in a competitive market. Because sales of recent products tend to decline due to competitors development, a ‘strategic innovation gap’ develops, which interferes with growth. The strategic gap of a company can be measured as the difference between expected and desired turnover and profits from currently planned new products and the company objectives (as stated in the vision statement) (see Figure 12).

If there is a gap between future desired sales and projected sales, a company will have to develop or acquire new businesses and innovation activities to fill this strategic gap.

### 3.4.7 PRODUCT INNOVATION STRATEGY FORMULATION

Once a clear picture of the firm and its environment is in hand, specific product innovation strategy alternatives can be developed. There are different (product) innovation strategies for companies to innovate in order to become more competitive (see Figure 13). The competitiveness of companies in the long-run is often directly related to their new product development capabilities.
While firms may develop different alternatives depending on their situation, generic categories of strategies exist that can be applied to a wide range of firms. The innovation models of Ansoff and Porter are two approaches that companies and organizations can apply to analyse their current (and competitors’) product portfolio and can provide direction to new product innovation strategies.

### 3.4.8 Growth Matrix

The Ansoff Growth matrix is a tool that can help a business choose a product and market growth strategy. A company can address the innovation gap in 4 different ways that are based upon a combination of market and product innovation:

- **First**, a company can determine performance improvement opportunities. The growth matrix proposes 3 major intensive growth strategies:
  - **Market penetration strategy**. Management looks for ways to increase the market share of its current products in their current markets.
  - **Market development strategy**. Management looks for new markets for current products.
  - **Product development strategy**. Management considers new product possibilities.

    Diversification can offer strong opportunities outside the business. Three types of diversification exist. The company could seek new products that have technological and/or marketing synergies with existing product lines, although the product may appeal to a new class of customers. Second, the company might search for new products that might appeal to its current customers though technologically unrelated to its current product line. Finally, the company might seek new businesses that have no relationship to the company’s current technology, products, or markets.

### 3.4.9 Competitive Strategies Matrix

Another potentially useful approach is the Porter matrix that describes common types of competitive strategies as ‘overall cost-leadership’, ‘focus’, and ‘differentiation’ (see Figure 15):

- **Overall Cost Leadership**. The business works hard to achieve the lowest production and distribution costs so it can have a lower price than its competitors and win a larger market share. Firms pursuing such strategy must be good at engineering, purchasing, manufacturing, and physical distribution. They have less need for marketing skills.

![Figure 14: ANSOFF GROWTH MATRIX](ANSOFF, 1968)

![Figure 15: PORTER STRATEGY MATRIX](PORTER 1980)
Differentiation. The business concentrates on achieving superior performance in an identified customer benefit area valued by a large part of the market. It strives to be a leader in quality, technology, service, style etc. The firm cultivates the strengths that give it competitive advantages. Thus, the firm that wants to be a quality leader will make or buy the best components, put them together expertly, and inspect them carefully.

Focus. The business focuses on one or more narrow market segments rather than going after a large market. The firm gets to know the needs of these segments and pursues either cost leadership or a form of differentiation within the target markets.

These 3 generic types of strategies can be combined (see Figure 15).

A company should evaluate its current and future product portfolio with both models.

3.4.10 Risk and strategy selection

Companies will face conflicting goals trying to maximizing economic success while reducing risk. Only a small percentage of product innovation projects actually end up in the market. The more the projects differentiate, the higher the risk (see Figure 14). The risk of failure can be minimized if:

- Innovation is based upon mid- and long-term objectives and strategies;
- Innovations are appropriate for company size and resources;
- Information systems exist to integrate new and changing needs;
- Innovation is initiated by the market and not by technological developments;
- Innovation concentrates on the linkages within the value chain (they are more difficult to copy); or
- Innovation helps to differentiate a company from its competitors.

At the end of this stage, the company should be able to select a product innovation strategy that fits best to its internal and external environment and vision.

3.5 Idea Generation

The idea generation phase often refers to the creative component of the product development process in which solutions are put forward, built upon, and used to spawn new solutions.

Idea generation can involve many different techniques and people prefer different kinds of techniques. Typical methods include generating ‘search fields’ and creativity sessions. Idea management is important at this stage due to the large number of ideas that are generated and need to be selected and their diversity. Based upon a combination of the most promising ideas, product concepts are proposed.

3.5.1 Search Fields

The first step of the idea generation process is to develop ‘search fields’. For developing these search fields, the internal ‘strategic’ strengths of a company are the best place to start, for example, company strengths like its financial situation, knowledge on specific technologies or its export know-how. By combining the strengths of the company with the indicated opportunities and trends in the SWOT analysis, search fields for new product ideas can be generated (see Figure 16).

In order to use the results from a SWOT Matrix, it has to be adjusted to the search field matrix (see Figure 17). On the horizontal axis (cells A to F), the opportunities identified early in the SWOT analysis are written down.

![Figure 16](image-url)
Next, the internal strengths are put in the cells 1 to 8 on the horizontal axis. By combining the internal strengths with the external opportunities new product ideas can be generated.

As a result, the company might come up with several promising search fields. To facilitate the evaluation and selection of the best search field, it is useful to work them out in more detail. After selecting the most promising search fields, product ideas can be generated within them.

### 3.5.2 Creativity Sessions

Creativity sessions enable the production of a lot of ideas for new products. All ideas - no matter how ludicrous or extreme they may sound - should be gathered. Depending upon the search fields, the product development team can apply different kinds of creativity techniques to generate product ideas.

Chapter 9 presents different creative techniques in more detail with examples.

### 3.5.3 Concept Development

The concept development builds upon the creative ideas generated, merging them and developing more fleshed out concrete options for evaluation. A concept is a clearly written and possibly visual description of the new product idea, including primary features, consumer benefits, and an outline of technology needed. Concept generation can involve:

- Definition of target market and customers;
- Identification of the competition and formulation of a competitive strategy;
- Development of preliminary technical product and testing scheduling;
- Estimation of required resources for product development; and
- Creation of a preliminary business plan.

After the selection of the best concept, it is worked out in detail.
3.6 Realization

Product development is not a stand-alone process. Parallel to the product development process the product development and marketing planning takes place (see Figure 18).

The production planning is directly linked to design and visa versa. Equipment availability and investment needs should be considered during the design phase. Production management will need to plan how to introduce any production changes that result from design changes.

It is essential to market a new product targeting the needs and wishes of the customer. Therefore, information on market analysis, consumer behaviour, trends and future scenarios, government policies, environmental concerns, new technologies and materials can be useful. Company policies and needs should also be taken into account. The plan will provide guidance to design and marketing decisions.

Once the design has been set, it is essential to decide how best to communicate the product’s strengths, price, and distribution. Strategies need to be developed for these aspects.

3.7 Product Development in Developing Economies

Traditionally, product development activities were focused in developed countries. However, these activities are increasingly important for international competitiveness and developing economies are beginning to focus on building this expertise.

Up until the 1970s, developing economies had industrialization policies that subsidized locally produced products acted as barriers to imported products. In addition, high levels of state involvement in manufacturing and (partially) state run enterprises had a tendency to be more production- than market-driven. Closed markets economies created low incentives for companies to innovate.

Nevertheless, developing economies are increasingly concerned with design promotion and practice, especially in the light of globalisation of markets. For example, in South East Asia, formal product design activities have been established parallel to the industrial development policies. A successful example is South Korea. Due to the role played by foreign markets and multinational companies, South Korea began to differentiate products by incorporating product innovation into its economic policies. As a result, South Korea has developed from a country competing on low technologies, imitation and cost leadership in the 1960s towards a nation competing on user-centered design and pioneering approaches (see Figure 19).

In developing economies the bulk of product development activities are of an adaptive rather than innovative type, with minor changes in products. Product developers are often still seen more as “stylists” instead of “product innovators”.

Figure 18: Parallel activities: product development, production development and marketing planning.
Research shows that SMEs in developing economies have different attitudes towards product design compared to SMEs in developed economies. Some of the observed differences are:

> A tendency to design incremental improvements for existing products;
> Concern with product appearance over product function;
> An approach to design based on a tradition of technology import rather than a tradition of invention or innovation;

> A tendency not to design solutions that have no precedence in the market place (international and local);
> Lack of tools and experience to compare and evaluate alternative approaches to design problems; and a
> Difficulty in developing clear project briefs.

These aspects highlight the need to build capacity in product development. The next chapters provide step-by-step instructions on how to identify and carry out 2 different kinds of D4S efforts.

**Figure 19** Development of South Korea from cost leadership to design leadership (Chung, 2004).