

# 005

## OUT-OF-THE-BOX: RADICAL SUSTAINABLE PRODUCT INNOVATION

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*The incremental innovation approaches of redesign are not enough to achieve long-term sustainable development. Out-of-the-box, or radical, innovation strategies on the other hand can lead to more sustainable impacts while providing the breakthroughs necessary to ensure industries' continued growth.*

*This chapter outlines the benefits of radical innovation and the need for more of these initiatives. It should be noted that radical innovation differs significantly from incremental innovation in that it involves more risk. However, this chapter provides a number of tools proven to effectively manage and minimise these risks.*

*This chapter serves as an introduction to Chapters 6 and 7, in which the specific methodologies for radical product innovation are described. Chapter 6 deals with new products and system innovation and Chapter 7 with Product-Service Systems.*

### 5.1 THE NEED FOR RADICAL SUSTAINABLE INNOVATION

Previous chapters in this publication have outlined the process for improving an existing product.

While these strategies are effective for initiating D4S projects and beginning to address sustainability challenges, more drastic approaches are needed to achieve a long-term balance between the economic, environmental, and social pillars of sustainable development. Radical sustainable product innovation, including breakthroughs and leapfrogging, is required to reach the desired improvement factor of 10-20 (incremental redesign only yields improvement factors of 2-3). Refer back to Chapter 2 Section 2.5.2 - Improvement Factors for a review on factor thinking of D4S. This chapter details the principles of radical product innovation and provides examples of higher product-system sustainability.

The effectiveness of Product-Service Systems (PSS) is dependent on 3 factors: the design of the product, the design of the service, and the system in which the product-service combination functions. The system itself is characterised by (1) the organisation or business that runs the service or activity-chain and by (2) the selected infrastructure.

Successful and sustainable PSS are designed so that the system has value for the end-user and is profitable

for other actors in the chain. Optimising the use of existing infrastructure, such as buildings, roads, and telecommunications networks, will lower investment costs and increase potentials gains.

While most PSS are developed using existing or slightly redesigned products (see Box 5-1), ideally entirely new products would be developed to create superior sustainability solutions. Use of existing products provides designers with expediency to better compete with other services in a highly competitive market, but it also limits the sustainability gains that can be made. While the development of new products can be challenging and as complex as setting up a new business or venture, the rewards are significant.

Research in the radical product innovation field is still in the early stages but initial studies have yielded valuable insight into the project implementation process. This insight is detailed in following sections however it is important to note that the approach should be tailored to fit the selected product and implementing company or organisation.

BOX 5-1 More and more responsible business actors and service designers are incorporating existing products into their services, for example,

many green car renting companies select their vehicle fleet by evaluating fuel usage and integrating innovative Information and Communication Technology (ICT) based renting and reservation systems. Additionally, Dutch Railways combined the train reduction card with a bicycle renting card. Under this system, passengers can rent a bicycle at any train station within less than 30 seconds for only €2.75. This combination makes renting bicycles convenient and affordable.

## 5.2 MANAGING RADICAL PRODUCT INNOVATION

There is abundant existing research on product innovation management (see references section for additional reading). An underlying theme of the existing research is the importance of product innovation managers drawing upon the lessons learned from successfully implemented radical innovation projects. A few of the main lessons from radical product innovation are summarised below.

In today's literature a distinction is usually made between two types of radical innovation, new-to-the-market and breakthrough. In this context, radical refers to product innovations that have the potential to disrupt existing industries and are able to create new businesses, services, consumer behavior, and infrastructures.

- > New-to-the-Market: Novel substitutes, based on products that are new to society; and
- > Breakthrough: Significantly changes the existing industry or creates a new business.

There are several variables that contribute to the achievement of radical product innovation. First, is the vision of the innovator or innovative organisation. Second, is the ability to develop new and emerging technologies that are not easily replicable. Thirdly, the use of management tools to streamline the radical innovation process. In summary, radical product innovation is a function of vision, technology and management.

The risks associated with radical innovation are significantly higher than those of traditional business innovation. It is more volatile, the outcomes less certain, and the time horizon tends to be much longer. In many cases, existing companies are not able to create new-to-

the-market or breakthrough solutions because of the high risks associated with these strategies.

The Ansoff Growth Matrix is a tool that can help companies evaluate growth strategies and analyse risk. As shown in Figure 5-1 when new products and new markets are developed simultaneously, companies are assuming a greater level of risk. There are three types of diversification, first, companies can seek new products that have technological and marketing synergies with existing product lines, in which case the resulting product may appeal to a new class of customers. Second, companies can search for new projects that are technologically unrelated to the existing product line that possess market demand with their current customers. Finally, companies can seek new businesses that have no relationship to the company's current technology, products, or markets.

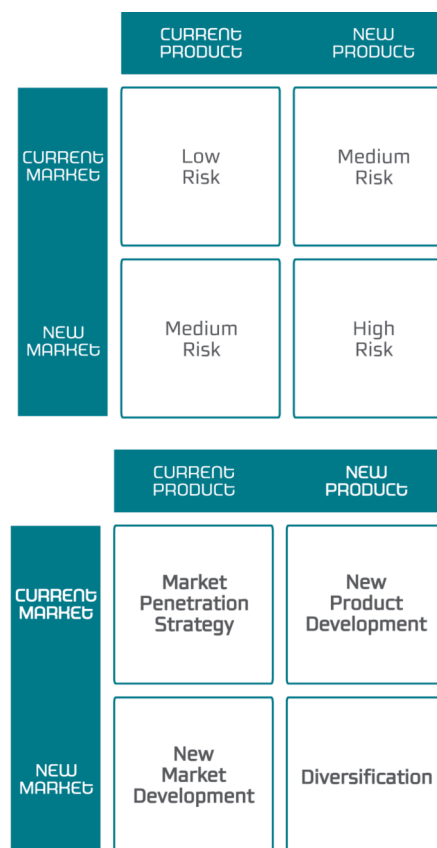


FIGURE 5-1 ANSOFF GROWTH MATRIX

## NEW COALITIONS

In most cases radical product innovation requires a new venture or the support of external partners to provide additional competencies and capabilities. When additional expertise is required, companies should form a new coalition with external partners to support implementation efforts. This outside support can be in the field of design creativity, complementary technologies and markets, production facilities, etc. In finding the right partners, it is important to avoid conflicts of interest and to strive for a win-win situation with an attractive cost-benefit ratio for coalition partners. The formulation of new coalitions can be a difficult process as the necessary trust building requires time and working effectively together requires flexibility. The progress of radical undertakings can be hindered by obstacles such as a breach in confidentiality or overlapping markets among coalition partners which may lead to excessive competition.

## NEW VENTURES

If radical product development is not feasible within the existing company structure, one alternative is to create a new business venture. If the new business is linked to the existing company a certain element of 'intrapreneurship', is required, if it is created separate from the company, venture capital and entrepreneurship may be in store.

Developing a new business venture outside the existing company is often the best option for entrepreneurs in radical product innovation as new activities are often met with resistance within an organisation when the idea (1) goes beyond the demands of environmental or social legislation; and (2) poses significant risk.

Anyone with a challenging idea - be it inventor, artist, or manager - can start a radical undertaking. Numerous programmes supported by chambers of commerce, innovation agencies, financial institutions, and government agencies exist to support the new entrepreneur. In addition, many universities around the world facilitate the creation of these new ventures as their environments provide students and other academic entrepreneurs with the support (in the way of infrastructure and entrepreneurial expertise) necessary to establish university spin-off businesses.

A number of sustainable innovations originate from university spin-offs, this is due to the supportive environment for innovations and because the younger generation tends to be more open to new ideas and technologies. Examples of university spin-offs from the Delft University of Technology include the Epyon, an efficient battery charging system in which the charge time is reduced to minutes instead of hours. The Epyon system is designed for the batteries of vehicles and mobile products. The Senz umbrella, a windproof umbrella (up to a wind force of 10) that is more resistant to inversion (less destructible and more resilient). These umbrellas are more durable and have a much longer life-time. The Evening Breeze, an air-conditioned bed which if used to replace traditional cooling systems can save 60 percent on the hotel room's energy consumption (see Figure 5-2).

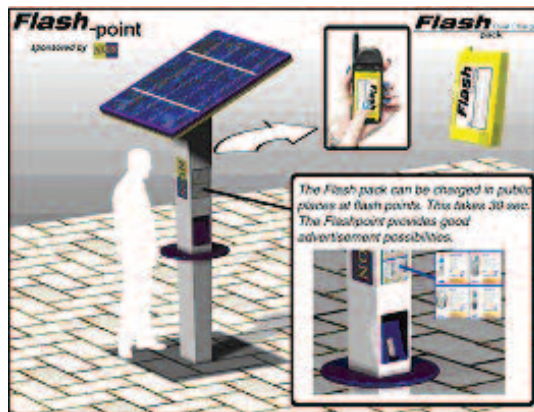




FIGURE 5-2 \_\_ EXAMPLES OF SUSTAINABLE PRODUCTS FROM UNIVERSITY START-UP COMPANIES IN DELFT UNIVERSITY OF TECHNOLOGY: PREVIOUS PAGE TOP: FAST CHARGER FORM EPYON, PREVIOUS PAGE BOTTOM: INNOVATIVE UMBRELLA FROM SENZ UMBRELLAS, AND ABOVE: INNOVATIVE AIR-CONDITIONED BED WHICH SAVES ON HOTEL ENERGY USE.

As shown in Figure 5-3, the 'innovation funnel' is comprised of 4 stages. The stages are (1) problem orientation and strategy; (2) idea generation and design; (3) demonstration and launch investment; and (4) production, roll-out, and exploitation.

The tollgates I, II, and III are the points in the funnel where key decisions are made. Options at each of the tollgates are as follows:

- > *Continue to the next stage:* for instance when all goals are positively met;
- > *Move the project from 'out-of-the-box' to 'inside-the-box':* for instance when profitable opportunities for the innovation emerge at existing markets, the innovation project could be fitted in the existing business portfolio;
- > *Stop the project:* for instance when the idea seems not to be able to make money or – on the contrary – is very good, but doesn't seem to fit the company profile.

Box 5-2 provides a number of relevant guidelines for managers using the innovation funnel.

## 5.3 METHODS AND TOOLS FOR RISK REDUCTION

### THE INNOVATION FUNNEL\*

There are a variety of methods and tools available to assist managers in reducing the risk involved in radical product design. The 'innovation funnel' is a common approach among larger research and development driven companies. The 'innovation funnel' can be viewed as a stage-based approach to innovation. (See Figure 5-3)

#### Box 5-2

Guidelines for managing the innovation funnel

- 1- The funnel needs to be loaded with innovations at all stages
- 2- Projects have to move forward through the funnel as in a supply chain
- 3- The stages are sequential and interdependent
- 4- Each stage and tollgate has to be managed separately

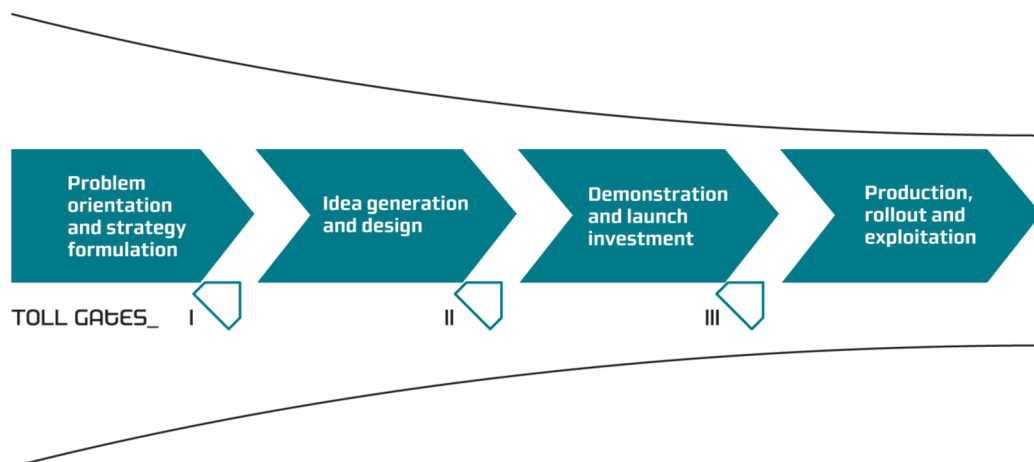


FIGURE 5-3 \_\_ INNOVATION FUNNEL

\* Parts of this section are - with permission - directly cited or adapted from: Verloop 2004 (see references)

- 5- Each stage and the overall process can be optimised with respect to resource use and reaching the objectives
- 6- Clear guidelines and criteria should be in place at each tollgate and all actors should understand and be in agreement
- 7- Each consequent tollgate requires the same criteria, but with an increasing demand for detail and quantification
- 8- Tollgate III requires a comprehensive and detailed business and launch plan
- 9- The innovation manager is responsible for keeping the momentum, managing the tollgates and optimising the supply chain
- 10- The innovation manager is responsible for the link with the innovation strategy, the identification of stakeholders, and balancing efforts –i.e. between ‘bottom-up’ and ‘top-down’ and the position of the radical innovation team

## BRICOLAGE

Bricolage is another tool used to minimise the risk involved in radical product development. Berchicci underlines the additional difficulties an entrepreneur might encounter when trying to achieve highly ambitious sustainable goals by radical product innovation. Berchicci stresses the need for a step-by-step or bricolage approach, even in cases where the environmental ambition is high. Bricolage involves starting with small actions, with regular feedback loops from potential future users to maximise the use of experiment and trial-and-error. In this case, goal setting may emerge in the second stage, instead of at the onset of a radical undertaking. Berchicci encourages environmentally driven designers to integrate flexibility into their vision and innovation process to develop breakthrough products. This approach posits that the best way to build up capabilities and simultaneously decrease uncertainty is to conduct simple tests, or pilots. Therefore, radical sustainable product innovation is best achieved through a series of incremental innovations as the integration of a number of smaller solutions can produce significant results while reducing risks and failure. The Bricolage approach is recommended for SMEs and new ventures with limited research and development budgets.

CASE The case on new mobility concepts provided in the Case Study section on the web describes an example of a bricolage approach in radical D4S innovation. Starting from the ‘MITKA’ project, several others concepts for sustainable new mobility were developed.

## 5.4 CREATIVE INDUSTRY AND DISTRIBUTED ECONOMIES

In addition to models on product and business innovation, a new paradigm has recently emerged stressing the importance of cities as facilitators of societal innovation. Richard Florida is the main representative of this paradigm. His book ‘The Rise of the Creative Class’ further details this concept (see references at the end of this publication). The main points are outlined below:

- > Technology is a partial collection of a much broader class of activities, called ‘creativity’
- > Technological creativity – our capability to invent new products and processes is crucial, for a successful economy
- > Other creativity, such as aesthetic, stylistic, cultural, artistic and musical, is also necessary for successful commercial entrepreneurship
- > Supporting the creative class with an attractive, active and inspiring infrastructure and synergy of the different creative variables in all societal sectors is a precondition for successful innovation.

In Florida’s theory, cities and particular neighbourhoods have become the central organising factor.

However, this model does not explicitly address sustainable development. Therefore, other models complement the creative class paradigm with the concept of Distributed Economies (DE). They argue that growth, which is dominantly driven by production efficiency, is accompanied by the dynamics that undermine sustainability. To address this concern, the authors introduced DE, which advocates to decentralise a portion of production activities and distribute them throughout the region in the form of small-scale, flexible, and synergistically interconnected production units. DE serves to establish a renewed balance between small and large-scale production units and the three pillars of sustainability.