



Sustainable R&D portfolio assessment

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ABSTRACT

Research and development portfolio management is traditionally technologically and financially dominated, with little or no attention to the sustainable focus, which represents the triple bottom line: not only financial (and technical) issues but also human and environmental values. This is mainly due to the lack of quantified and reliable data on the human aspects of product/service development: usability, ecology, ethics, product experience, perceived quality and the like. Even if these data are available, consistent decision support tools are not ready available. Based on the findings from an industry review, a DEA model has been developed that permits to support strategic R&D portfolio management. The usability of this approach is underscored with real life examples from two different industries: consumables and materials manufacturing (polymers).

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1. Introduction

1.1. Description of the problem context

Today's innovation strength is more than ever determined by a company's ability to differentiate from the competition in delivering customer delight at the pace of the market, applying the best available technology. Sustainable innovation results in profitable, people oriented, and planet-minded products and services. It is a great challenge for innovation and R&D managers to permanently assure that R&D budgets are allocated to the best set of R&D projects in order to reach the innovation targets on both the shorter and the longer term (Cooper [10], Cooper et al. [11]). Factors with a traditionally strong influence on strategic innovation decision making, such as the business opportunity and the feasibility of a project, do not necessarily predict project success (Moenaert et al. [25]). From their study, competitiveness reveals to be a strong predictor for success. Competitiveness consists of the following three elements: a competitive answer to a threat or an opportunity, the size of the advantage over the competition (incremental or game changing) and the sustainability of the innovation.

Competitiveness is linked with differentiation and added value as perceived by the customer. In order to create a sustainable advantage there is a need for non-imitable features, such as non-technological, intangible aspects leading to product/service experience and meaning, in

line with the brand experience and corporate identity (Borja de Mozota [5]). This holds both for incremental as well as for radical innovations. However, the latter cannot be derived from actual user and market research, since they create new markets and envision the user of the future in a future context (Verganti [37]). Radical innovations, based on new technology, or addressing new user needs or creating new markets, are hard to evaluate, especially in the early phases of product development. There are many uncertainties and risks on all three types of innovation aspects: technology, economics and values, as shown in Fig. 1. "Values" are defined as the ethical, societal and personal values and perceptions leading to a product experience. Radical and incremental innovations differ dramatically in the availability of information on opportunities and risks. They are difficult to compare and equally serve the goals set by the business and innovation strategy. Industry practice shows that a separate approach in budget allocation and R&D organization for radical innovations is usually applied. This, however, does not solve the problem of evaluating the radical innovation projects. Optimal R&D budget allocation according to the innovation strategy requires incremental and radical innovations to be evaluated simultaneously.

Sustainability, as defined by the Brundtland Commission (UN documents [36]), was translated into the triple bottom line (people, planet and profit), and adopted by many companies through their mission statement and innovation strategy. However, the societal (people) and ecological (planet) dimension of sustainability are difficult to incorporate in formal decision making policies and decision support systems.

From a short term perspective, designing for user experience can lead to differentiation and innovation success and thus economic benefits. When embedded into a long term company strategy, aiming for "customer delight" involves human-centered design and experience innovation and leads to both incrementally and radically new

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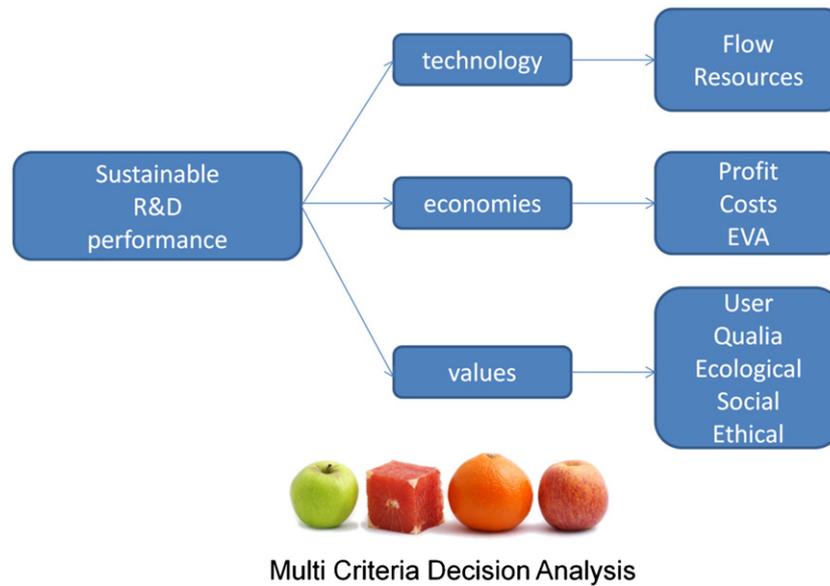


Fig. 1. The multi-criteria nature of R&D portfolio assessment.

products and services addressing today's and tomorrow's user needs. However, the economic benefits resulting from "user experience" are hard to estimate in the early phases of New Product Development (NPD). Moreover, the amount in which an innovation contributes to a user experience represents a completely different type of benefit for the company than the direct and short term economic consequences.

Ecology and human (or user) related aspects are part of the earlier defined as values, since they both involve ethical values, which can be commonly shared by a group of customers or they can be individually perceived. Values cannot be translated into monetary figures without loss of information. They can be very different, even conflicting in their nature and value. For instance an innovation idea can lead to a very high user experience but low ecological contribution. They will therefore be treated as separate dimensions in the decision support for strategic innovation decisions.

R&D managers are in search of a consistent way to translate the innovation strategy into an R&D portfolio, taking into account all three dimensions of the sustainability concept. Available decision policies and supporting tools for strategic innovation decision making are not well suited to handle the intangible aspects of customer delight and ecology; they are too slow to respond to changes in both endogenous and exogenous factors. They favor incremental innovation versus radical innovations, especially when these originate from a user centered perspective.

As a result, mainly the technological and financial (market related) aspects prevail in the ranking and selection of projects at the strategic level, defining the R&D project portfolio. The disability to evaluate a projects' performance level on the value based aspects, and to evaluate its overall performance on technological, financial and value based aspects forces ad hoc, subjective and informal decision making. This prevents a consistent value based innovation strategy and R&D portfolio.

Innovation processes such as the widespread stage-gate® process, have many benefits for the management of risks and the monitoring of KPI's along the innovation funnel. However, the sequential process is not a reflection of the real-life, parallel and iterative innovation activity, and it has a tendency of favoring projects who are in their later phases of development (Repenning [29]).

Next to adequate decision support models and processes, the implementation of a sustainable R&D strategy requires a new mindset, reconciling an analytic as well as an intuitive approach (Martin [24]). Decision

makers will face less certainty and will have to manage more risks and must be open to creative, intangible inputs during the R&D process. This will require a behavioral change in the decision making teams. In order to gain trust amongst the decision makers, it is of utmost importance to maintain transparency and consistency in the decision making, with a strong emphasis on communication based on the visualization of the data and results. This is a cornerstone of the "Design Thinking" way of R&D management, in which a holistic approach is applied and which applies rapid visualization of an idea and validation of each concept (Lockwood [23]). The decision support system aimed for should be capable to support Design Thinking on the strategic innovation level and therefore, besides transparency in the data, the system will have to possess quick recalculation functionalities and to provide an intuitive visualization of the model results.

The approach is in line with findings in the literature. For instance (Brodt 2007), discusses the observation that product success is not only dependent on the technological and economical characteristics, but also relies on the experience of the product. The latter overlaps with the third cluster as depicted in Fig. 1. Radical innovation design practice, based on product experience, has been developed by Hekkert et al. [16] through the ViP design methodology, in which user experience and contextual factors determine the innovation requirements. The corresponding dimensions are part of the "values" in Fig. 1.

1.2. Motivation: industry review

The first step in this research related to decision support for sustainability in R&D portfolio assessment, is a multilayered scan on how Flemish companies managed their R&D portfolio. Several ways have been adopted to reveal the relevance of the business process named 'R&D portfolio management' whereof portfolio assessment is a crucial part. This field research is a consolidation from the following sources:

- Systematic audits and interviews at over a hundred companies in Flanders across different sectors and ranging from SME's to large companies have given insights in the status of design management and R&D maturity. Most companies have a process and decision policies in place, but only very few realized the brand promise and company identity, including the values, in their innovation processes.

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