

UNDERSTANDING AND DEVELOPING INNOVATIVE PRODUCTS AND SERVICES: THE ESSENTIAL ELEMENTS

A. R. Tan and T. C. McAloone

Keywords: radical and incremental innovation, product life thinking

1. Introduction

Companies are well aware that they have to develop and offer new and innovative products in order to survive, as well as take on greater environmental and social responsibility of the effects of their products. This challenges the way we perceive innovative products and requires a greater understanding of the socio-technical system a product becomes part of.

Innovation is synonymous with successful development and implementation, and therefore peculiar to innovation is that we do not know if something is innovative until it has been applied and adopted. An innovation has to prove itself on the market before we can deem it innovative. This leads to the challenge for companies aiming to develop innovative products, that during the development process they cannot be sure that that the result of their efforts will be an innovative product. The value of an innovative product is only apparent in the interaction of the product with its stakeholders within a given context.

This paper suggests an approach for understanding the principles for innovative products. Based on what characterises innovative products this paper attempts to broaden the view of what is traditionally considered essential in understanding during product development.

2. What defines an innovative product?

The word 'innovation' derives from the Latin word 'innovare', which means to renew or to make new. Distinctive of all innovative products is that they are novel in some way, but newness alone does not describe innovation sufficiently. Closer to the essence is the difference in value that an innovative product brings about compared to existing solutions. Adam Smith in his book 'Wealth of Nations' made this apparent in 1776 when he studied technical change and its impact on economic growth [Smith 1776]. Improvements in technological development allowed commodities to be produced with much less labour and thereby an increase in profit and wealth.

Most literature points to Joseph Schumpeter for formulating the origins of innovation theory that we know today. Schumpeter suggested that innovation was a driving force behind economic growth, commercial profit and thereby wealth in society. [Schumpeter 1934] Schumpeter defined product innovation as "... *the creation of a new good which more adequately satisfies existing or previously satisfied needs*".

Here we note that innovative products cannot be evaluated on an absolute scale, but should be seen in relation to existing products. In order to determine the characteristics of an innovative product one has to understand what the difference is between a new product and the products that existed before. A difference between two different states will always be measurable or perceivable. It could be an increase in performance, a new function or a completely new product that allows the user to do

something in a new or better way. The level of novelty will vary depending, not just on ‘new to the world’ but, on how new it is perceived by the adopter of the product. Innovation comes in many forms. Bessant [Tid, Bessant & Pavitt 2005] lists four areas of innovation which to a certain extent are interlinked (Figure 1):

- **Product innovation:** changes in the things (products or services) which an organization offers
- **Process innovation:** changes in the ways in which they are created and delivered
- **Position innovation:** changes in the context in which the product or services are introduced
- **Paradigm innovation:** changes in the underlying mental modes which frame what an organization does

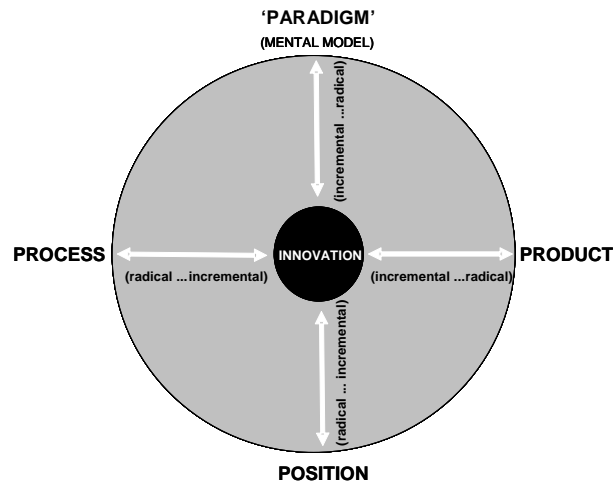


Figure 1. Innovation space [Tid, Bessant, Pavitt 2005]

Literature on innovation spreads over a broad and diverse range of approaches, reflecting its multidisciplinary nature, depending on field of study and perspective (e.g. innovation as scientific research, creative design, a knowledge creation process, an organisational culture). In general, innovation is viewed as the interplay between technological, economic and social development [MacNulty 1992]. For the sake of this paper we have chosen to limit our discussion to the activity of *product innovation*, and in summary can identify the following characteristics of product innovation [Roy 1986 & Trott 1998]:

- It derives from technology and is knowledge based.
- It either fulfils a need or seizes an opportunity.
- It is multi-disciplinary and includes a certain portion of creativity and novelty.
- It is a carrier of an idea or intent of changing something.
- It arises from a social activity, where humans work together in an integrated manner.
- Its effects are noticeable and has considerable influences its surrounding environment – most often in the form of successful business.

3. A holistic approach to understanding innovative products

Traditionally and still currently, most product development literature focuses on innovation as a phenomenon related to the product itself and its intrinsic characteristics, i.e. new materials, technology or features, rather than the product’s effect on the system into which it becomes part of. The effect of a product results from the interaction between the product and stakeholders in a certain context and is determined by the needs, values and desires of each of these stakeholders. This challenges us to consider the appropriateness of the conceptual boundaries we draw around product, which most often is evaluated in a system where it is servicing the user.

A product is a multi-dimensional creation and therefore has many different aspects applying to different life phases and levels of the product. These aspects again have multiple interpretations of the product depending on the different stakeholders that the product interacts with [Bijker 1995]. It is the totality of all these dimensions that makes the product. The point to be made here is that it is not only the designers of the company that define the product, but equally the customers, users and society. A more appropriate focus to innovative products is therefore, not on the product itself, but on the effect on stakeholders that the product induces. One way, therefore, to deem if a product is innovative is, not to look at the product itself, but look at the activity that emerges from the interaction between *product* and *stakeholder* within a *context* [Robotham & Guldbrandsen 2000] (See Figure 2). To exemplify our point here, we can consider instant messages or sms (short message service) on mobile phones. We cannot determine from a technical point of view whether instant messages are innovative, but we may say that the activity '*instant messaging*' is an innovation.

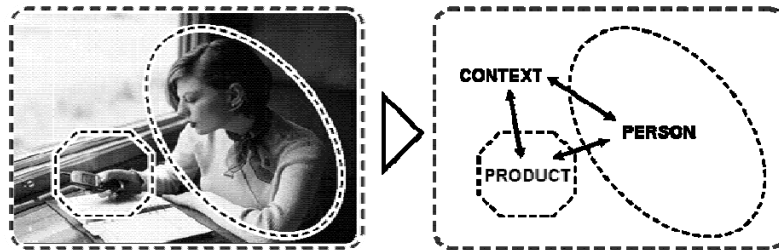


Figure 2. Innovation as the activity the product induces in the case of instant messaging

Hansen & Andreasen [Hansen & Andreasen 2002] draw our attention to this division of concept understanding, where they describe the product's make-up (material, technology, etc.) as the '*idea in*' and the product's benefit (with respect to need and value) as the '*idea with*'. To deal with this, Hansen & Andreasen advocate that the design team should be aware of both the technical and market-oriented aspects and how they are related when developing products (Figure 3).

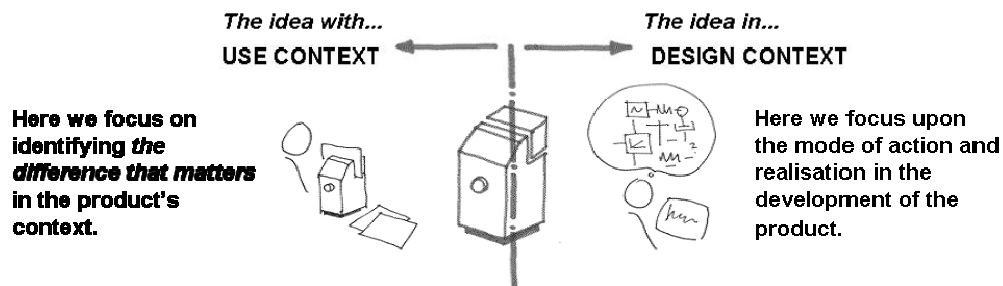


Figure 3. The conceptual aspects of a product - 1) the '*idea with*' the product – *its market oriented use context*, 2) the '*idea in*' the product – *its technical oriented design and realisation context* [Hansen & Andreasen 2002]

Since an innovative product is characterised by the effects it brings about, companies and designers should have a good understanding of the relations between these two aspects. We propose the following scheme for the relation between product and effect in Figure 4:

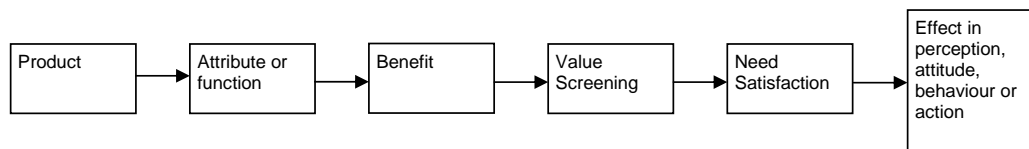


Figure 4. The relation chain between product and effect

A product has attributes or functions that may deliver benefits. Determined by the value set of the individual, the benefits may be perceived as desirable, and thereby able to satisfy the individual's needs within a certain context. This promise of need satisfaction may motivate the customer to buy the product, or the user to use the product (both are effects). The above scheme is of course crude, making no differentiation between the various types of activity in each stage. But the scheme does highlight the relationship and distance between product and perception of innovation, and some of the significant aspects in this chain.

4. How to evaluate innovative products?

For every product one can identify a multitude of stakeholders that either share or have conflicting concerns for the product. In general we may identify these stakeholders belonging to three main groupings that share similar views on the product: the company, the consumer and society. We propose that an innovative product must be feasible for the company, beneficial to the consumer and acceptable to society.

4.1 Model for evaluating effects

It is in our opinion that it is the very combination of the three major stakeholders – the company, the consumer and society – that determine whether a product is innovative or not. We believe that when designing innovative products, one has to consider all three stakeholders' needs, values and goals. This leads to a more holistic understanding of what defines an innovative product.

Main Stakeholders:

- The **element of the company** includes all the organisations, groups or individuals that are involved in conceiving, producing, selling, delivering and servicing the product.
- The **element of the consumer** includes the buyer, the user, and the people who are directly affected by the actual sale, delivery, use, leasing and ownership of the product.
- The **element of the society** includes society, government, public opinions – everyone in indirect contact with the product, who is affected by its impacts, of somebody producing or using it, or who has the power to regulate how others produce or use it.

It is important to recognise that the three stakeholders are also capable of interacting with each other and have mutual relations that do not involve the product (Figure 5).

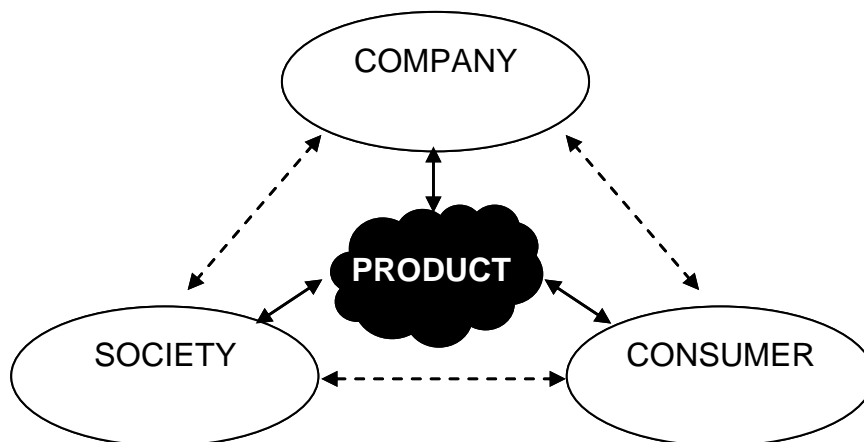


Figure 5. Model for evaluating product effects

It must also be noted that we chose not to include *nature* or *the natural environment* as stakeholders, as nature does not possess a conscious opinion of its own, and thus cannot be regarded as a master of its own. It is our opinion that society expresses itself on behalf of nature.

We argued earlier that when evaluating innovative products, the focus should be on the product's effects and not on its functions. However, what effects can we expect? The intent behind all

innovation is to change the present situation into an improved one. Sometimes this can even mean making a more technically inferior product (e.g. in the case of providing a 'low cost' product to a certain market segment). Based on this assumption that all design involves an intent to improve a situation, we can conclude that an innovative product is a product that induces positive effects. By positive, we mean in relation to the goals and values of the three main stakeholders listed above.

We define positive effects based on three dimensions related to values: appropriate, valuable, and desirable. The product's effects have to be appropriate, valuable and desirable within an acceptable time limit determined by the company, consumer or society.

Desired Effects:

- **Appropriate** - *the core value, having practical utility, benefits, effectiveness, 'what need does it fulfil?'*, relates to logical aspects.
- **Valuable** - *performance, functionality, relative advantage, efficiency, degree of fulfilment, 'how good is it'*, relates to the physical aspects.
- **Desirable** - *to wish or want, worthwhile having, doing or achieving, attractive, 'is it a good thing?'*, relates to psychological aspects.

At length, we propose our definition of innovative products as:

Innovative products are products that contain a difference (in relation to existing products) that induces appropriate, valuable and desirable effects on the company, consumer and society.

In the following we exemplify how our model for understanding innovative products may be used, through a case description of the Sony Walkman.

4.2 Case description: Sony Walkman – a portable audiocassette player with stereo headphones

In the spring of 1978 the Sony corporation brought in the idea of combining a personal stereo player and headphones. The main change from existing stereo players (tape recorders) was removing the recording feature and adding stereo sound and headphones. Some of the developers checking the prototype at home thought it could solve the eternal trouble with children's noisy stereo players. Akio Morita (Sony's CEO at the time) played an important part in the development and marketing of the Walkman (company insiders doubted that there was enough consumer demand for the device).

According to philosophers of the time, the Walkman was capable of creating an individual environment even whilst being used in public. The Walkman enabled its user to carry his or her 'inner soundscape' wherever he or she decided to go. The pleasure that music brings was no more bound to a certain place, it could follow the listener anywhere. It became universal: wherever in the universe you went, you could take your music with you. You could create your own 'soundscape'. The Walkman was to become one of Sony's most popular consumer products and is probably the item with which Sony is still most closely identified. The success of the Walkman fuelled the first consumer electronics explosion. It pioneered the way forward for other products, such as camcorders and mobile phones. As important as this was, the Walkman brought still more than a revolutionary change in miniaturising and portability. It opened a whole new market and became a symbol of a range of lifestyles. For many, the Walkman was a part of their identity; a means of expressing their individual personality.

In 1981 the word 'Walkman' made its way into Le Petit Larousse, the well-known French dictionary, and in 1986 into the Oxford English Dictionary.

4.2.1 Differences in the product

The Walkman was a new product that was very different from existing products of its time. The first Walkman started as an adapted miniaturised version of a light type of cassette recorder, but without the recording feature and with stereo sound and headphones (*'the idea in'*):

- a small portable audiocassette player with small and light stereo headphones.
- two headphone jacks.

These are descriptions of the physical product, if we relate it to the activity involved, the difference becomes (*'the idea with'*):

- a way of listening to your own music in stereo wherever you are.
- a way of listening to music with another person.

4.2.2 Effects of the product

It is now over 25 years since the Sony Walkman was introduced to the market. Since then more than 150 million Walkmans (together with their successors and variants) have been sold world-wide. Here we state the effects of the walkman that can be identified:

Company:

- a creation of a new market (appropriate)
- a new product line (appropriate)
- market domination and exploitation (valuable)
- the Walkman is one of Sony's popular consumer products and the product that the company is most often identified with (appropriate)

Consumer:

- a way to listen to music everywhere the listener goes (valuable)
- allowed the user a personal 'music environment' without disturbing others (appropriate)
- an electronic lifestyle product, a way to express individuality and personal identity (desired)
- part accessory, part companion (appropriate)

Society:

- the word 'Walkman' was accepted into Le Petit Larousse and into the Oxford English Dictionary, and hereby entered part of the world's cultural heritage (desirable)
- marked the start of personal electronic portable devices (e.g. mobile telephones, personal digital assistants, etc.) (appropriate)
- playing music at excessive volumes with headphones on has an increased risk of hearing damage and sometimes irritates surroundings in closed public spaces (inappropriate)
- led to concerns that the walkman fostered dangerous isolation and immersion (undesirable)
- led to traffic laws forbidding drivers to wear walkmans when driving (undesirable)

4.2.3 Summing up

In this example we have identified the differences between the situation with a Walkman and the situation before the Walkman and related these differences to the activity instead of the product. Furthermore we have identified the effects of products in relation to stakeholders and their values. It can be seen that the majority of the effects are either appropriate, valuable or desirable.

Since the Walkman has induced positive effects on both the company, consumer and society, we may deem it (after our definition from this paper) as innovative, due to its effects. It has changed many things within some of the stakeholder elements, but as a whole the relations between the elements have remained unchanged.

4.3 Innovation by degrees

Innovation literature distinguishes between what is considered incremental and radical innovation. According to literature, incremental innovation delivers major improvements to stakeholders within a system that already exists, whereas radical innovation delivers major improvements that creates new systems that allows possibilities to stakeholders not existing before [Leifer et al. 2000]. Following this distinction of innovation we may measure innovativeness in two dimensions: (i) the degree of adoption amongst stakeholders ('*doing the right thing*') and (ii) the degree of benefit in the activity ('*doing things right*').

5. Discussion

The model presented in this paper offers a framework for developing innovative products. The model is a simplified approach that mediates the essentials of innovative products. It is our opinion, that the model has its justification in that qualitative understanding, rather than quantitative prescription is needed when developing innovative products. In new product development, the model could be used to create a scenario for the desired state of the system. The present situation could be mapped against a desired state of the system, e.g. by asking questions such as "In which way do we want the use of our

product to affect the user and society?”. We believe that a company can obtain a more holistic view of the effects of their products by relating them to the model.

Traditionally most product development activities regarding innovation have been concerned with how the stakeholder element of the company can be optimised in development and manufacturing. Over the past few years the importance of the sub-sets of elements surrounding the consumer has been acknowledged, and is increasingly understood. The aspect of society is also receiving more attention these days, as environmental and ethical issues are proving to provide a competitive edge for companies that offer products that embody these issues. It is stressed that this model is not a working model of how to be innovative, but rather a model to understand the effects of and set goals for developing innovative products. For the company and designers it should be clear throughout the development process what are the relations between the design and their subsequent effects.

The approach presented in this paper has implications to the research methodologies typically used in engineering design and product development. Traditionally engineering design derives its research foundations on objective epistemology whereas socio-technical sciences that interpret the effects of products are mainly subjective. By using methods both objective and subjective we may better understand what defines innovative products.

6. Conclusion

In an attempt to understand the height of innovation of a product we describe in this paper a holistic model for the clarification of a given product's performance with respect to its context and the stakeholders that it meets in its lifecycle. This approach contributes to a relative scale of innovative performance, tested in relation to the contextual framework identified.

Using this approach to understanding and developing innovative products and services, a framework has been introduced in which the 'innovativeness' of a product can be discussed in relation to the effects on each of the main stakeholders: the company, consumer and society surrounding the product. This approach does not tell us how to develop innovative products, but suggests how companies might consider the essential aspects of a product and its effects throughout its life cycle.

Acknowledgement

This paper is based to a large extent on the work of Claus Allan Christensen and Adrian Tan in their Masters' Thesis "Developing Ideas for Innovative Products", 2000, Technical University of Denmark (DTU).

References

- Bijker, W.E., *"Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change"*, The MIT Press, Cambridge, MA and London, England, 1995.
- Hansen, C.T., Andreasen M.M., *"The Content and Nature of a Design Concept"*, *Proceedings NordDesign 2002*, P. Boelskifte & J.B. Sigurjonsson (Ed.), NTNU, Trondheim, Norway, 2002, pp. 101-110.
- Leifer, R., McDermott, C.M., O'Connor, G.C., Peters, L.S., Rice, M.P., Veryzer, W.V., *"Radical Innovation"*, Harvard Business School Press, Boston, Massachusetts, USA, 2000.
- MacNulty, C.A.R., *"The Interaction between Technology and Culture"*, TeknoVision, Technology – A servant of Man, Samfundslitteratur, 1992.
- Robotham, A.J. Guldbrandsen, M., *"What is the new paradigm in product quality?"*, *Proceedings NordDesign 2000*, DTU, Lyngby, Denmark, 2000.
- Roy, R., *"Introduction: Design evolution, technological innovation and economic growth"*, *Product Design and Technological Innovation*, Open University Press, 1986.
- Schumpeter, J. A., *"The Theory of Economic Development"*, Harvard University Press, Cambridge, Massachusetts, 1934.
- Smith, A., *"Wealth of Nations"*, Dent, London, UK, 1776.
- Tidd, J., Bessant, J., Pavitt, K., *"Managing Innovation"*, 3rd Edition, John Wiley & Sons, 2005.
- Trott, P., *"Innovation Management and New Product Development"*, Financial Times Management, 1998

Adrian R. Tan, M. Sc. Mech. Eng.
PhD Student
Technical University of Denmark (DTU), Department of Mechanical Engineering
Building 404, Nils Koppels Allé, 2800 Lyngby, Denmark
Tel.: (+45) 4525 5564
Fax.: (+45) 4593 1577
Email: at@mek.dtu.dk
URL: <http://www.kp.mek.dtu.dk>