

# The Commodity Battle: a product-market perspective on innovation resource allocation in the Process Industries

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Companies in the Process Industries nowadays often try to avoid being simply commodity producers and therefore strive to develop and produce more functional products that offer more customer added value with higher profit margins. When such products are introduced on the market, they are usually imitated before long. Prices then gradually decline, and the functional products degenerate in a never-ending product contest here called the Commodity Battle. The company's position in the supply chain from raw materials to product end-users has been used as a point of departure for guiding and improving the strategic allocation of resources to different kinds of innovation activities in such a contest. First a number of product competitive dimensions in different positions in such industrial supply chains are discussed. Using those dimensions, four related matrices have been designed to serve as part of a conceptual framework and a roadmap for the allocation of corporate resources to a spectrum of innovation and innovation-related activities. The conceptual framework and the exploratory empirical findings give initial theoretical insight for further empirical research, but can already be deployed as one tool for innovation resource allocation by companies in the Process Industries facing the Commodity Battle.

**Keywords:** Process Industry, innovation, commodities, functional products, supply-chain, resource allocation

## 1. The Commodity Battle

The Process Industries span over several industrial sectors such as minerals & metals, pulp & paper, food & beverages, chemicals & petrochemicals and pharmaceuticals, and thus constitute a substantial part of all manufacturing industry. Companies in the Process Industries are sometimes producers of commodities, functional products or both. Examples of commodity products include not only minerals, agricultural products, crude oil and such, but also commodities and so-called "commoditised" products like personal computers in other manufacturing industry. The most important issue for the commodity manufacturer in his relations to its customers is the price: their conversation boils down to "How much?", "At what price?" (Bomsel and Roos, 1990). The functional product producer in the Process Industries does not, however, work for a market

(unlike the commodity producer) but for a group of customers, and must not only develop product functionalities but also associated services and other added value.

### *1.1 Commodities and functional products*

In the original and simplified sense one could lexicographically define commodities as things of value of uniform quality, produced in large quantities by many different producers (Wikipedia, Webster, 1989), or simply as materials with standard specifications sold on a world market. For commodities, the items from each different producer can thus be considered equivalent and more or less interchangeable, a property which is sometimes referred to as the fungibility.

It is the contract and this underlying standard that define the commodity, not any quality inherent in the product. Functional materials, on the other hand, are developed through collaboration between customer and supplier according to the functional demands on the final product and the services demanded by the user. The following definitions will be used in this article:

Commodity products are of uniform quality, with a low degree of differentiation which makes them more or less interchangeable. Prices are set on active markets that respond to changes in supply and demand. There are often many suppliers, and goods are easy to transport and store, often in bulk quantities. Customers are often business-to-business (B2B), but sometimes business-to-consumer (B2C).

Functional products have differentiated properties which mean that they are not normally easily interchangeable. Prices are set by suppliers on a cost-plus basis and not as a market price. Products are produced by a limited number of suppliers and they are not usually delivered in bulk quantities. Customers are sometimes B2B in often long internal and external supply chains, sometimes consumers as end-users, B2C.

One could alternatively extensionally define commodities as products traded on commodity exchanges like the London Metal Exchange (LME), Tokyo Commodity Exchange (TOCOM), Nymex, Tokyo Grain Exchange, etc (Rogers, 2005). Such markets for trading commodities are often efficient, and they will quickly respond to changes in supply and demand to reach an equilibrium price and quantity. Many companies in various sectors of the Process Industries usually experience some sort of cyclic nature of the market for their products (Rogers, 2005), which is sometimes referred to as a “boom” or “bust” market behaviour (Morrison, 2005). Such behaviour occurs when the prices of products tend to go up and down in more or less cyclic patterns, not so easy to figure out in advance. The last cycle of a boom character in this decade was however, to everybody’s surprise, well extended over a longer span of time for the first time. Because of that it was referred to as a “super cycle”. The mechanisms for the cyclic behaviour of markets for commodity products will not however be further discussed in this article, but will be left to the economists to explore and explain. Products that conform to such a cyclic nature of the market are however often also discussed in terms of “commodities”, while products that are not so sensitive to those kinds of market fluctuations are often characterised as “functional products”.

## 1.2 Innovation in the upgrade-downgrade product life cycles

Companies in the Process Industries nowadays often try to avoid being simply commodity producers and strive to develop more functional products that offer more benefits to customers with higher profit margins and less turnover volatility. When such products with improved functional properties are introduced on the market, they are usually imitated before long by competitors who try to produce the same type of product with the same performance at a lower cost (Linn, 1984); prices then gradually decline, and the functional products degenerate into commodities, as illustrated in Figure 1.

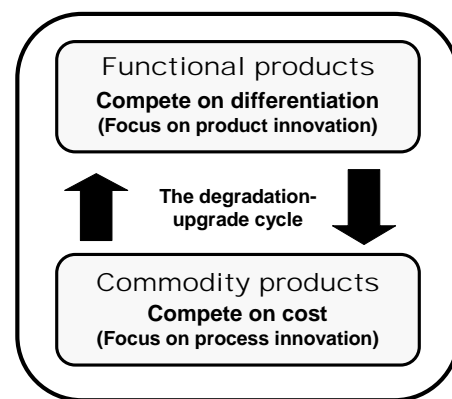


Figure 1. The product degradation-upgrade cycle in the Process Industries (Lager, 2000). The arrows illustrate how functional products degrade into commodities unless product functionalities are continually improved. Upgrading commodities into functional products is not however the most common route in product development.

Producers of more functional products, competing on differentiation (performance), as well as commodity producers with the desire to produce more functional products, benefit from excellence in product development (Cobbenhagen et al., 1990). The ability to be a cost-competitive commodity producer is however related more to a clear understanding of the dynamics of the total cost structure in the production process and an ability to develop and introduce cost-efficient process technology in the production processes. As such, the introduction of breakthrough process technology by a competitor may totally change the name of the game and eliminate a market leader (Utterback, 1994 p.112). The consequences of the cyclic behaviour of the market for products produced in companies that belong to the Process Industries also influence companies’ innovation strategies. Commodities surviving in the “bust” market periods not only benefit from cost-efficient production technology, but also often from the

advantage of a strong raw-material supply base. It must however be recognised that commodity production and the production of more functional products may readily go together in one company, depending however on the selected business models deployed (Johnson et al., 2008).

The well-known concept of the product life-cycle curve, which gives product profitability and sales volume as a function of product time on the market, is certainly also useful for products in the Process Industries; for a good discussion of this product model, see for example Urban & al. (1987). The concept can be used on a product level and maybe also on an aggregated product level such as “product line”, but does not really make sense on a company level of analysis if the company is producing several different product lines. The concept of “product lifecycle” can be applied to both commodities and functional products. The lifecycle of many commodities in the Process Industries may however often extend over a considerable span of time compared to functional products. The life cycles of some commodity products may thus be extended indefinitely (e.g. metals like copper and nickel and chemicals like sulphuric acid), and sometimes functional products do not become obsolete at all, but only degenerate into commodity products with smaller profit margins. This kind of product dynamics is treated in this article within the framework of the Commodity Battle, which will be used as follows:

The Commodity Battle has been conceptualised in this context as companies’ endless struggle to stay competitive (profitable) in their production of functional products, commodities or both. For the commodity producer this may either involve a “functionalisation” of its existing commodities or the improvement of the competitive position of its commodities. For the producer of functional products this may involve either the improvement of its products to avoid involuntary “commoditisation” or a voluntary “commoditisation” of its functional products into more competitive commodities.

One should thus not look upon the upgrade-downgrade cycle in a deterministic or defeatist manner. The point is more that being a profitable commodity producer, depending on company and product competitive perspective, may be just as good as being a profitable producer of functional products! The different positions may, however, call for different business models (Barabba et al., 2002) and completely different related modes of innovation resource allocation.

## **2.0 The industrial supply and value chains - a point of departure**

Successful development of new products and processes depend to a high degree on the understanding and experience of operating in the chain-like structures of companies in the Process Industries (Tottie and Lager, 1995). The importance of supply-chain collaborations and considerations for improved innovation performance has thus been stressed in many studies (Cantista and Tylecote, 2008, Sahay, 2003, Soosay et al., 2008), and because of that a supply value chain perspective was selected as a point of departure.

### ***2.1 Modelling the supply and value chain in the Process Industries***

The upgrade-downgrade cycle for commodities and functional products, as illustrated in Figure 1, was thus introduced in a supply chain perspective. Using the definitions presented in the previous section, four different positions have been identified in the supply chain in Figure 2, from in-situ raw materials to end-users. Internal or external supply chains of different length and complexity may naturally also exist within each position. As a consequence of different competitive dimensions on the market, commodities have been further differentiated in this model into “upstream” and “downstream” commodities.

Upstream commodities are defined in this context as primary raw material resources like cultivated agricultural products, forest products, crude oil, mineral products etc. Products of a kind often traded on raw material exchanges. Downstream commodities, on the other hand, are defined as upstream commodity products that are further processed such as metals (copper, lead, zinc, etc.), structural steel, orange juice, aggregates, petrol, standard wood pulp, etc. Such products are sometimes traded on raw material exchanges, but most often prices are set on the world market. This product group is sometimes called “commodity-plus”, and is more customer-oriented as specifications can be modified to some extent to meet individual customer needs (Cobbenhagen et al., 1990). Here one also finds commodity products that are marketed to consumers (B2C) like detergents and food products like milk. Downstream commodities are then also often interface products to functional B2B products.

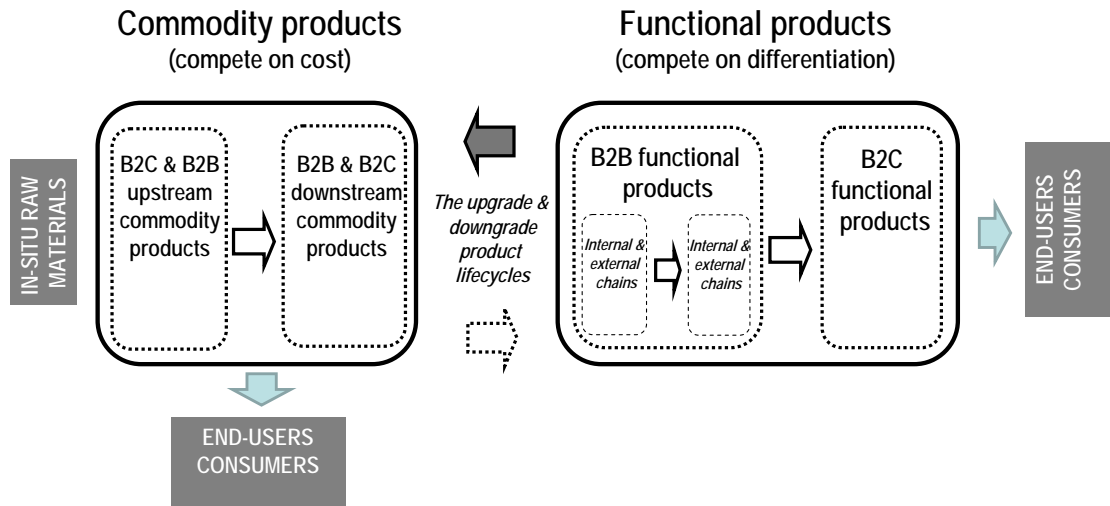


Figure 2. A model of the supply value chain in the Process Industries. A company may operate in one or more positions in such supply chains, and sometimes even cover the total chain from in-situ raw-materials to end-user.

The functional products have been separated into B2B (Business to Business) functional products and B2C (Business to Consumer) functional products. The differentiation has also been made because the competitive dimensions on the market are somewhat dissimilar. In the B2B competitive perspective, it is possible to establish a more long term collaborative relation with individual customers and even produce customised products that suit large customers' application needs. In the Chemical Industry, such products are often referred to as specialty products, and the period during which they are profitable is often substantially shorter than the lifespan of the products themselves (Cobbenhagen et al., 1990). For such products, customer services and collaborative development of the customer's use of the products is more in focus. In the B2C competitive perspective, apart from functionalites, the branding plays, so far, a much more prominent part in consumers' purchasing decisions.

## 2.2 Positioning products and product lines in the supply value chain

In Figure 3, a number of products and product lines from different sectors of the Process Industries are presented to illustrate the supply-chain positions of different kinds of products. The products are given only as examples, and represent a limited number of product categories from different industry sectors. Sometimes upstream commodity products, e.g. sawn wood products, are sold to consumers. Sometimes they are further processed into downstream commodity products retailed directly

to consumers (like petrol), or sold to industrial customers to be further processed into functional products. However, to guide the allocation of innovation and innovation-related resources it is not enough to locate the products in these different positions of the supply chain. A more detailed market competitive positioning is needed for each position in order to be able to establish a product & process roadmap for strategic innovation resource allocation.

## 3. A market competitive perspective on products in the supply value chain

A number of product competitive dimensions on the market will first of all be discussed with a view to developing a conceptual framework for an analysis of products in the different positions in the previously presented supply value chain model. Afterwards the selected dimensions will be further used in the design of four two-dimensional product matrices, each representing a position in the supply value chain.

### 3.1 Competing on the market with commodities

Using the classical cost leadership strategy recommended by Porter (1980) as one generic strategy, it is recognised that to be able to follow a price compression/product innovation strategy, innovative manufacturing technologies are vital for companies in the so-called traditional industries. In a study of micro-segmentation of customers for reinforcement steel products it was noticed that mature industries operate within supply chains that comprise multiple layers of buyers and sellers.

Process Industries \ Product category	B2C & B2B upstream commodity products	B2C & B2B downstream commodity products	B2B functional products	B2C functional products
<i>Oil &amp; Gas</i>	<i>Crude oil B2B</i>	<i>Petrol B2C</i>	<i>Greases B2B &amp; B2C</i>	
<i>Beverage</i>	<i>Oranges B2C &amp; B2B Grapes</i>	<i>Orange juice B2B &amp; B2C</i>		<i>Champagne; CocaCola</i>
<i>Forest</i>	<i>Timber B2B Solid wood products B2C</i>	<i>Pulp B2B A4 printing paper B2C</i>	<i>Newsprint B2B Paperboard B2B</i>	<i>Hygien products B2C</i>
<i>Utilities</i>	<i>Tap water B2B &amp; B2C Electricity B2B &amp; B2C</i>			
<i>Steel</i>	<i>Pig Iron Steel Billets</i>	<i>Construction steel B2B</i>	<i>High strength steel B2B</i>	
<i>Mining &amp; Metal</i>	<i>Bauxite B2B, Phosphate B2B Lumpy iron ore B2B</i>	<i>Base Fe Powders; Metals like Copper, Nickel, Zinc B2B</i>	<i>Fe Powder Mixes Iron ore pellets B2B</i>	
<i>Mineral &amp; Material</i>	<i>Steam Coal B2B</i>	<i>Plate Glass B2B B2C Metallurgical Coke B2B Standard cement B2B B2C</i>	<i>Minerals for paper coating Turbo cement; Advanced ceramics Carbon fibres</i>	<i>Insulation B2B &amp; B2C</i>
<i>Food</i>	<i>Grain B2B, Soya beans B2B Coffee, Milk powder B2B</i>	<i>Flower B2C, Milk B2C Butter B2C</i>		<i>Branded food B2C Functional food B2C</i>
<i>Chemical</i>	<i>Rubber B2B Sulphuric acid B2B</i>	<i>Ethylene B2B, Polypropylene Sulphuric acid B2B</i>	<i>Nylon B2B</i>	<i>Detergents B2C</i>
<i>Pharmaceutical &amp; biotechnology</i>				<i>Patented drugs B2C Generics drugs B2C</i>

Figure 3. A tentative positioning of some products and product lines from different sectors of the Process Industries in the supply value chain model. The figure is developed only to illustrate different kinds of products in different positions of the model.

Since commodity product attributes are generally mandated by industry norms, this leads to a stable set of product offerings and an inability to differentiate across sellers (Albert, 2003). Commodity bundling as an alternative to forward integration has so far however mainly been discussed in the context of consumer products (McCormick et al., 2006). The complex interplay between raw materials, process technology and product qualities for different kinds of commodities is well illustrated with the following old, but certainly still valid statement:

*Ore is an aggregation of metallic minerals ... the value of the metal extracted must be greater than the costs incurred in the extraction. ... The income side is affected by the metal content of the ore and the metal price, the expenditure side by the metal losses and the cost of isolating the pure metal. ... A non-exploitable prospect can for example become ore through price increases or through better process technology or operations management (Fahlström, 1960)*

There are basically three different product/price competitive mechanisms for commodity products:

- Products that are traded on raw material exchanges, where world market prices are

set and fluctuate according to the current supply and demand situation. Price is certainly not a competitive dimension, especially for upstream commodities, and since the products are traded on raw material exchanges, market share is not an issue of importance. In this category we have for example crude oil and food products like soya beans and grain.

- Products that are not traded on raw material exchanges but for which “de facto” raw material prices are negotiated and set on the world market, or by spot pricing mechanisms. Price is not a competitive dimension for these often downstream commodity products, but there is a need to create strong customer relations in order to secure market share.
- Products that are traded and retailed on the world market where the market price of the product is the main competitive dimension. In the process industries such products are often downstream commodity B2C products like A4 copy paper or orange juice, and in other manufacturing industries items like household products, personal computers and small flat-screen television sets.

For commodity products in the above categories, the company's fundamental and most important competitive dimension is thus not the price, but the production cost. Since price and profit margins naturally are strongly related to production costs for commodities, the cost dimension has been selected as one important product competitive dimension instead of the market related price dimension.

#### *The production cost dimension*

Commodity prices have a strong tendency to fluctuate in trade cycles, and because of that the production cost is the one dimension that will determine the producer's long-term competitiveness. Depending on the kind of product, production cost may best be considered and compared as cost per unit of raw material or cost per unit of finished product. The production cost is often related to the "processability" of such raw materials. Lacking a better scale, a rather tentative differentiation of production cost into three categories is presented as follows:

*Low:* Production cost is among the lower 1/3 in a world-wide competitive perspective.

*Medium:* Production cost is among the middle 1/3 in a world-wide competitive perspective.

*High:* Production cost is among the top 1/3 in world-wide competitive perspective.

#### *The upstream raw material quality dimension*

For upstream commodity producers, the quality of the raw material supply (captive or non-captive) is of an importance second to none. The quality of the raw material thus often determines the overall product profitability and is then the most competitive dimension. The quality of the raw material supply is influenced for example by:

- The size and grade of the raw material supply base (e.g. the size of an oil field, the metal grades of a mineral deposit, the area of a forest).
- Raw materials are more or less difficult to extract or process (e.g. mineralogical complexity of a mineral deposit, the processability of tar sands or shales, the depth of off-shore oil resources or mineral resources).
- The extraction or recovery (yield) of the material from an in-situ raw material deposit (e.g. the extractable percentage of a crude oil deposit, the minable part of a mineral deposit or the percentage recoverable as finished product).

- The quality characteristic of the recovered raw material (e.g. the fibre quality from the forest resources, the quality of the grapes from a vineyard or the sulphur content of steam coal)

*Low raw material supply quality:* Difficult to exploit with current process technology.

*Medium raw material supply quality:* A workable raw material supply base.

*High raw material supply quality:* A superior raw material supply base.

#### *The downstream product quality dimension*

The quality of a downstream commodity product is determined as a relation to set standard specifications. Sometimes these are well articulated (for products traded on raw material bourses), sometimes they are more of a "de facto" standard set by leading players on a market. Studying the two cases of thermoplastics forming and moulding and application of industrial gases, the results indicate that suppliers of commodities will tend to innovate in a downstream process when they are relatively concentrated, the prospective innovations promise to expand the market for the material greatly, and the process users are relatively concentrated (Van der Werf, 1992).

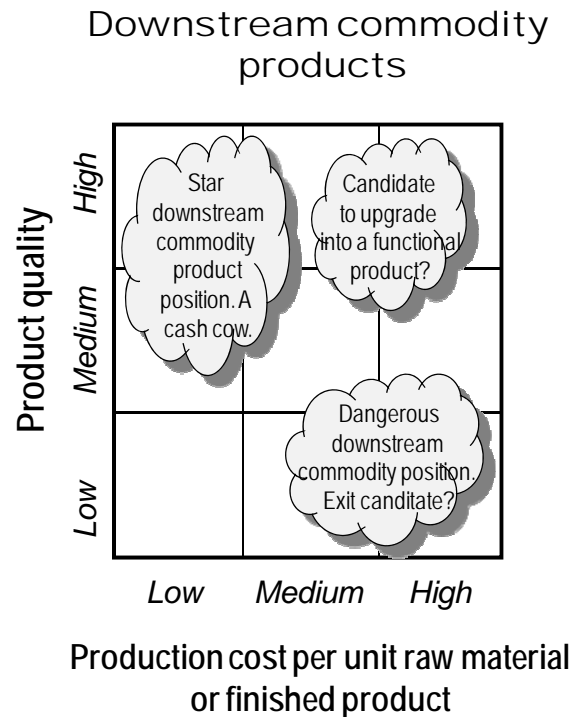
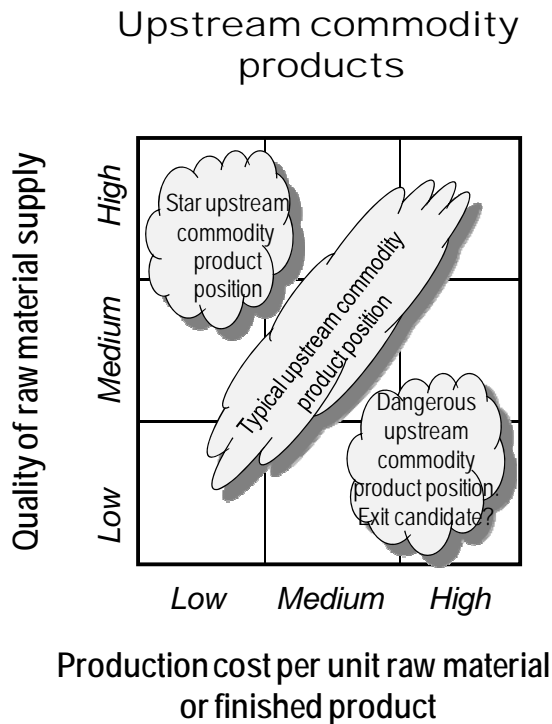
*Low quality:* The product quality is sometimes below set specifications. The uniformity of the product is low and the span for variations is high; frequent customer complaints.

*Medium quality:* The product quality is according to set specifications and rather quite similar between competing products on the market; few customer complaints.

*High quality:* The product quality is above standard specifications, sometimes creating a possibility for a premium price or bonus. Product specifications may to some extent be adapted to selected customer demands.

#### *Combining the different dimensions into two product competitive matrices*

For both matrices, the production cost dimension has been selected as of similar importance in both positions. For upstream commodity products the complementary selected dimension was the quality of raw material supply, while for the downstream commodity products the outgoing product quality was selected. The matrices are intended to be used to position companies' products or product lines and competitive products on the market.



Figures 4a and 4b Product competitive matrices for upstream and downstream commodities. Different positions in the matrices are tentatively illustrated and denominated.

Lacking, so far, empirical information and input from different industry sectors and companies, different positions have only been tentatively illustrated for each matrix. For high-cost producers during market “bust periods”, the competitive position for upstream commodities with a low quality raw material supply will be dangerous. In a similar vein, low-quality downstream commodity producers may find it difficult to even sell their products to their customers. Downstream commodity producers in the upper right corner must however consider whether they should try to become producers of more functional products (move to another matrix) or move downwards into a more profitable commodity position in this matrix.

### 3.2 Competing on the market with functional products

For functional products competing on the market, the product functionality is naturally one of the most important competitive dimensions. In this case the two alternative generic strategies, differentiation or market specialisation, may be appropriate (Porter, 1980).

#### *The product functionality dimension*

Using application development as one competitive dimension is fairly common in the Process

Industries. Application development here aims at improved use of the company’s products in the customer’s processes.

*Weak functionality:* Similar functionality to competitive products on the market. Customer buying decisions are to some extent influenced by product functional properties.

*Medium functionality:* The competitiveness of the product on the market is largely determined by its functional properties as they affect customer/consumer applications.

*Strong functionality:* A product that is possible to protect by patents or design. Alternatively product functionalities can only be created using secret proprietary production technology or patented production processes.

#### *Customer services and other added value*

R&D policies need to look beyond the development of physical technologies and should also encompass organisational issues and the need to take account of, and deal with, knowledge of the service operations required to support the products (Gann and Salter, 2000). In a study of product-service packages, it was found that the greater the degree to which companies customise their products, the more they tend to link products and services into packages. This enables producers to tailor products

to meet the requirements of particular clients. It was concluded that customisation enables companies to learn much more about clients' long-term needs (Marceau and Martinez, 2002). The study also showed that many companies in all positions in the supply chains were in fact producing packages of goods and services, not products alone.

#### *Services*

Services with a direct relation to industrial products are thus gaining importance. In their efforts to evolve from producers of goods to problem-solvers for their customers, industrial companies are systematically expanding product-related services (Lay, 2002). The conclusion from a benchmarking study of manufacturing industry (not process industry) is that the service business is the overlooked jewel of many corporate portfolios, rarely receiving the attention it deserves (Koudal, 2006).

*“Escalating customer expectations for rapid, flawless service support have increased the opportunity for companies to profit from appropriately priced differentiated service products targeted to meet the needs of particular market segments. Exploitation of the willingness to pay for service across these segments opens up the opportunity to increase profit through optimised pricing and service product strategies. ... this has opened up new opportunities for collaboration and revenue generation with upstream suppliers and downstream customers (Cohen et al., 2004).”*

Under the banner of beating the “Commodity Magnet”, Rangan & Bowman emphasise the service dimension as one complement to price in designing a strategy to survive in a commoditisation marketplace (1992).

*“For example, data show that some manufacturers of industrial chemicals such as Arco, Dow, and Ethyl Corporation reported a return on sales comparable to that of some of the better-performing specialty chemical companies such as Betz and Great Lakes. Similarly, in the steel industry, diversified steel producers such as Wheeling, Armco, and Bethlehem have from time to time performed as well as focused specialty steel producers Allegheny and Carpenter.”*

Customers increasingly demand integrated solutions that fit their individual needs instead of buying standardised physical goods. One way for providers to satisfy this demand is to offer

integrated value bundles consisting of services and physical goods as value propositions to their customers. Value bundles can be seen as an intermediate between pure physical products and pure intangible services (Becker et al., 2010).

#### *Industrial branding*

Van Riel & al noticed an increasingly important role of industrial branding in the commoditisation of many industrial products. They point out for example that DuPont, as an industrial company, brands almost all the products and ingredients it manufactures and that they have had considerable success with brands such as Teflon, Kevlar, and Lycra (van Riel et al., 2005). In an exploratory review of branding in industrial markets, McDowell-Mudambi & al (1997) conclude that intangible factors matter, even in rational and systematic decision-making. They recognise the importance of naming strategies, the possibility to relate the presence and degree of branding to financial performance, and the importance of considering alternative ways to add value to the product. In studying brand equity (overall brand image created by the totality of brand associations perceived by customers) in the business-to-business market, Bendixen & al questioned whether industrial buyers, who are rational trained professionals and who normally operate within buying centres, can be influenced by brand images that are based on non-functional and subjective attributes (2004). Their overall conclusion was, however, that the leading industrial brand name could command a price premium of 6.8% over the average industrial brand and 14% over a new, unknown brand. Further on, the main brand-equity-generating variable was found to be product quality.

#### *Customer services and other added value dimension*

*Weak:* Low level of services provided with the product. No industrial branding. No application development with customers.

*Medium:* Services are provided with the product but no branding and no application development.

*Strong:* Extensive services are provided with the product. Products are branded. Application development together with customers is common.

#### *The consumer brand strength dimension*

Branding commodities and functional consumer products is common nowadays, and in a survey of commodity-like wood products it was noted that 68% of the manufacturers believed that brand naming gave them more protection, although few believed that branding gave them an ability to command a higher price (Sinclair and Seward, 2002). In a study of brand management of paper



products, Rosenbröijer concludes that it is a phenomenon that has numerous effects on many levels of analysis. The brand resource can be controlled by the producer (producer brand) or the distributor (private label brand). A further conclusion was that corporate structural features hindered changes in branding strategy, making branding a complex strategic issue (Rosenbroijer, 2001). The following somewhat simplified scale has been tentatively used:

*Low:* No branding at all or private label branding

*Medium:* Branded product

*High:* World-class brand

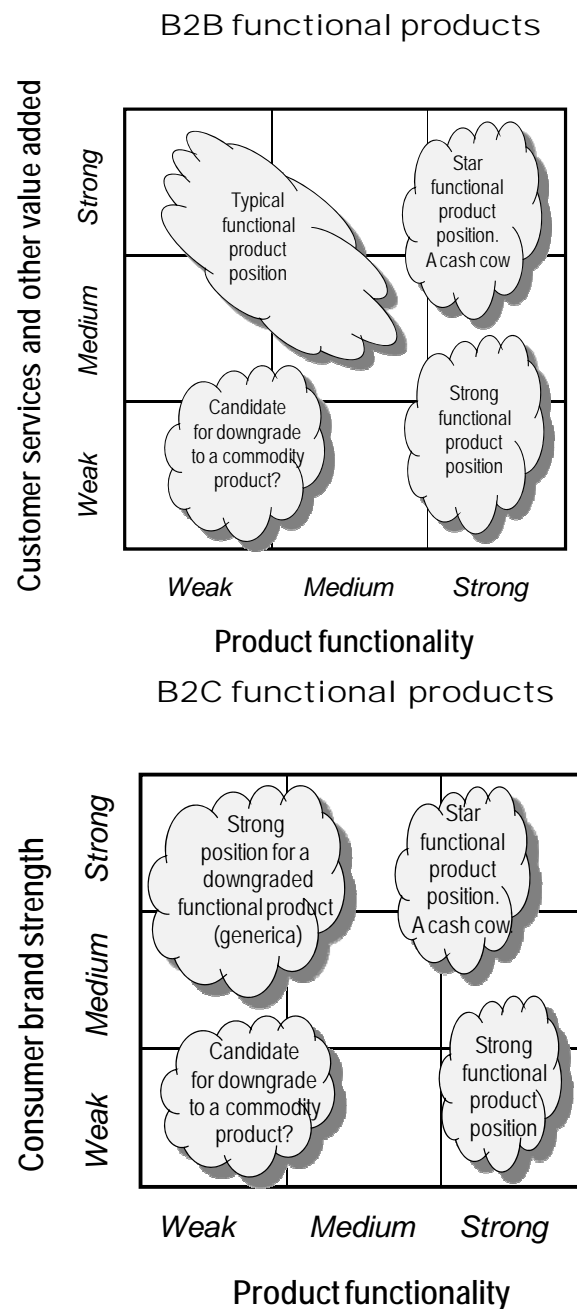
*Combining the dimensions into two competitive matrices*

For both matrices the product functionality dimension has been selected as of similar importance in both positions. For B2B functional products the complementary selected dimension was customer services and other value added, while for the B2C functional products the consumer brand strength was selected. The matrices are intended to be used to position company products or product lines and competitive products on the market.

Lacking, so far, empirical information and input from different industry sectors and companies, different positions have only been tentatively illustrated for each matrix. A weak product functionality with no value added is a risky position for a B2B product, making degradation to a commodity a not unlikely scenario. A B2B product with medium functionality and some value added services is probably a most common position. On the other hand, the development of B2C products with strong functionality (patent protection) combined with a strong brand has the potential to become a real “cash cow” (van Riel et al., 2005). Pharmaceutical products are however starting in the bottom right position and, if the branding process has been successful, end up in the top left position as successful generics.

#### 4. Selecting future corporate product/market battlegrounds and innovation strategies

Facing a Commodity Battle and trying to avoid being a commodity producer is not a situation unique to companies in the Process Industries. Under the banner “Avoiding Commodity Hell”, John Deere, a manufacturer of agricultural equipment, deploys a well-communicated innovation strategy aiming at sustained profitability



Figures 5a and 5b. Product competitive matrices for B2B and B2C functional products. Different positions in the matrices are tentatively illustrated.

(Lane, 2008). Another example is the IMI engineering group, who declare: “We have sold all of our businesses in markets where price was the basis of competition”, (Marsh, 2007 ). Companies’ business models (well articulated or not) can be looked upon as their selected product/market battlegrounds. Positioning company products or product lines in the supply value chain model and further on in the associated product matrices can be a point of departure in reconsidering the company’s future product competitive positions and battlegrounds.

#### 4.1 Working the functional ladder

In a dynamic review of such competitive positions, there are options to move both between the different positions in the supply value chain, and within each domain of the associated matrix.

##### *Commoditise or functionalise – moving within the supply value chain model*

Movement between different positions in the supply value chain model probably most often takes the form of movement between weak functional products and strong downstream commodities, as has been illustrated before in Figure 2. In the pharmaceutical industry, Merck & Company acquired a mail-order pharmacy and prescription-benefits-management company back in 1993. The most compelling logic for this acquisition was to give opportunities to increase market share as prices decrease across the industry. The LKAB group, a supplier of iron ore products to customers in the European steel industry, has for example for a long period of time gradually striven to move upwards on the functional ladder. From initially being positioned as an upstream or downstream commodity supplier, their extensive technical services and application development with their customers have repositioned their products as more in the nature of functional B2B products (LKAB, 2009). Depending on the competitive forces and the profitability in different positions in companies' internal supply chains, repositioning can however also be considered in the opposite direction as a movement backwards in the value chain.

Experience from an ongoing research project shows that such repositioning may create new business opportunities for a company as a knowledgeable supplier instead of being an end-product manufacturer (Sköld, 2009). Thus Statoil, the Norwegian energy group, is planning to spin off its international chain of 2300 filling stations, reflecting a broader tendency by oil and gas producers to move away from roadside retail operations and to move backwards in the supply value chain model (Ward and Hoyos, 2010). Statoil is thus following an industry trend of integrated oil companies like BP, Chevron, ConocoPhillips and Shell to shed the retail sites representing the lowest profit margins of the business. Another "voluntary descent" on the functional ladder is demonstrated by Dow Corning. From being only a producer of products with strong or medium product functionality, it was decided also to operate as retailer of their more commodity-like products. The pre-studies however revealed that the existing business model for their traditional products was not likely to support such a different operation. It was thus necessary to develop a new, better-adapted business model (and a new organisational

subsidiary) that fostered a rather different organisational culture, focusing on activities like cost-efficient supply chains and less customer support (Johnson et al., 2008).

##### *Selecting future product competitive position - moving within the matrices*

The overall conclusion from the previous discussion is thus that the solution for competitiveness and profitability may not be a total avoidance of producing commodities or commodity-like products! For both commodities and functional products, the overall objective must be to secure competitive and profitable positions in the marketplace. A company's decision to stay in the present domain of a product matrix could be described as a product strategy of "holding the fort". Staying in a position does not however imply that further product or process innovation can be neglected. Market competitive forces will in that case very likely and gradually outperform such a product. The outcome may then be an involuntary descent on the functional ladder and a possible commoditisation of such a functional product. Because of that, being a successful producer and retailer of commodity products may however not only require improved or even changed business models, but may also involve changes in strategic innovation resource allocations. The shift to being a producer of a voluntarily or involuntarily downgraded functional product, and thus competing mainly on cost, may require a much stronger focus on process innovation. On the other hand, reallocation of innovation resources to product innovation or other external customer innovation-related activities may be required to upgrade a downstream commodity product to a functional product. Using the matrices to position a company's products and competitor's products, necessary strategic actions can be considered within each business model and the desired repositioning of products can serve as a roadmap for the development of necessary strategic research agendas.

#### 4.2 Corporate strategic resource allocation to innovation and innovation-related activities

Each strategic choice may strongly influence not only the necessary total resource allocation to innovation but also the further distribution of innovation and innovation-related resources. As a consequence of positioning of products or product lines in the previously presented matrices, it is necessary to consider or reconsider not only allocation of resources to development of product functionalities and competitive process technology,

but also resource allocation to the development of raw materials, product quality, technical services and other value added. In the light of the previously developed model and matrices, the following underlying research question that prompted the development of this framework can now be more easily comprehended:

Depending on a product's position in the supply value chain model and its competitive position in its associated matrix, what is the proper allocation of innovation resources to support a sustainable and profitable product position? Alternatively, if a change in position is desired, in a more dynamic point of view, what are the necessary consequences for innovation resource allocation?

#### *How much innovation is enough?*

Starting with this seemingly trivial question, resource allocation models for innovation are rare, if indeed they exist at all. Surprisingly little research has been done on the topic of a company's resource allocation (Bower, 1970, Bower and Gilbert, 2005, Cooper and Kleinschmidt, 1988, Hamilton, 2006). In the overall corporate resource allocation process, the distribution of corporate total resources to different functional areas like sales & marketing, production and R&D is often based on traditional percentages and yesterday's needs (Christensen and Raynor, 2003). The lack of usable and robust model for resource allocation is unfortunately particularly acute with regard to the distribution of corporate resources to innovation. The authors' anecdotal industrial experience also suggests that corporate excellence in this area seems to be high on a project level, but gradually diminishes as one approaches R&D or company level. How then should resources for R&D be allocated in a short-term, medium-term and long-term perspective?

Traditional industrial pseudo-models may be:

- R&D will get as much as we can afford this year.
- R&D will get as much as they usually get each year.
- R&D will get an average for our industry sector.

"The boom sows the seeds of the next bust, and the bust sows the seeds of the next boom." (Morrison, 2005 ) During industry periods of "boom" or "bust", and in the face of the recent crises, what is the proper level for R&D intensity, and what guidelines for overall investments in R&D can be developed?

#### *How to spend it?*

Resource allocation models for the distribution of innovation resources to different areas of innovation or innovation-related activities are totally lacking. The different dimensions in the previously presented matrices illustrate well that product innovation and process innovation in the Process Industries are only two activities out of a spectrum of more innovation and innovation-related activities to consider, which in this context will be called the company's "distributed innovation intensities" (Lager, 2010 Forthcoming). Depending on each product's position in the supply value chain model and further on in individual competitive matrices, the distributed innovation intensities have been outlined as a matrix in Figure 8. Apart from current distribution, future allocation of innovation resources can also be decided upon using this matrix.

#### *An exploratory empirical study*

Three respondents from different sectors of the Process Industries were contacted to supplement this theoretical development with some exploratory empirical information. They were first of all asked to give comments and suggest improvements on the full paper, models and framework. Afterwards they were asked to rate the estimated present and future importance of different areas of innovation and innovation-related activities for different positions in the supply value chain. Figure 8 shows an average estimate given by the industry respondents, presented as: **Very important = black; Important = dark grey; Not so important = light gray; Irrelevant = white**. It must also be observed that in a specific industrial setting, the position of all a company's products or product lines in the different domains of each matrix can give figures on the distributed innovation intensities that can be further aggregated into company overall allocation of resources to innovation and innovation-related activities.

### *4.3 Empirical findings*

The respondents generally experienced the framework and models as interesting and usable in in-house strategic discussions of innovation resource allocations. This more "top down" view of resource allocation was considered to be of interest by one respondent since the more common resource allocation model based on an aggregation of project resources tends to represent individual wishes rather than a company's coherent strategic vision. As such the framework was considered by one respondent as an "eye-opener" for further discussions of innovation strategies in different parts of the value chain.

<div> <div>Product position in the supply chain</div> <div>Firm Innovation and innovation-related activities</div> </div>		B2C & B2B upstream commodities Resource allocation	B2C & B2B downstream commodities Resource allocation	B2B functional products Resource allocation	B2C functional products Resource allocation
Development of captive raw material supply					
Development with raw material suppliers					
Innovation with the internal customer	Process development			+	+
	Industrialisation				
	Internal technical support				
Innovation with the external customer	Product development				
	Application development				
	External customer support			+	
Applied research					
Basic research					

Figure 8. Corporate innovation and innovation-related activities (Lager, 2010 Forthcoming) against product supply value chain positions. The matrix represents the average of the results from only three respondents. The crosses mark areas where there was a general consensus that the importance of that area was expected to grow in the future.

The denominations and more distinct differentiation of commodities and functional products were also considered to be important. One respondent remarked that position changes within or between the matrices are often well recognised within the company, but necessary changes in the resource allocation are not always articulated. One can, not unsurprisingly, see a difference in resource allocations between commodities and functional products and even more so between upstream commodities and B2B functional products. Comparing the total areas of innovation with the external customer, the differences between commodities and functional products are very clear. The strong importance of process development was quite surprising, as was the expected increase of this importance for functional products.

## 5. Discussions and managerial implications

### 5.1 Methodological reflections

Using the definition of management innovation as: “the generation and implementation of a management practice, process, structure, or technique that is new to the state of the art and is

intended to further organisational goals (Birkinshaw et al., 2008)”, this theoretical development can be looked upon as such an activity. In his paper “Theory Construction as Disciplined Imagination” Weick gives an interesting quotation (1989):

*“Theorists often write trivial theories because their process of theory construction is hemmed in by methodological strictures that favour validation rather than usefulness (Lindblom, 1987). These strictures weaken theorising because they de-emphasise the contribution that imagination, representation, and selection make to the process, and they diminish the importance of alternative theorising activities such as mapping, conceptual development, and speculative thought. Theory cannot be improved until we improve the theorising process, and we cannot improve the theorising process until we describe it more self-consciously, and decouple it from validation more deliberately.”*

The methodological approach in this project is very much in line with those thoughts. The research design is partly built on the concept of “action research” introduced by Kurt Lewin (1946) and further promoted by Chris Argyris (2002), as the approach of active involvement combined with expected insights developed through research. Not only would the authors like to profess themselves adherents of grounded theory where the pragmatic criterion of truth is its usability (Glaser and Strauss, 1967), but also the post-modernistic views that the value of knowledge is considered as a function of its usability (Lyotard, 1984).

It is rather difficult to study “intellectual” and possibly “collective” work processes in a company or decision patterns which are not formally administered but may even be arrived at intuitively or even instinctively. Resource allocation to innovation, as presented in the previous section, is an area which has scarcely been researched at all in academia and where a company’s behaviour is often based on historical practice. The data presented in the previous sections have been used to demonstrate the conceptual framework, and also to illustrate the importance of resource allocation to different areas of innovation and innovation-related activities. The comments from the three respondents on the overall framework and models cannot validate or dismiss the findings but should be looked upon as snapshots from industrial reality which will guide further research in this area. In that respect the respondents collaboration makes them more like informants (Miles and Huberman, 1994), than respondents in their in their research participation.

## 5.2 Discussion and implications

First of all it must be recognised that the results in Figure 8 represent only the very tentative considerations from three respondents. The results are thus primarily presented only to illustrate the use of the matrix. Filling in the matrix also gave the respondents hands-on experience of using it. The average results given in Figure 8 do not however show some of the differences between the individual companies. For example one company recognised the very strong importance of captive raw material development and development with raw material suppliers for the future. Some uncertainties about industrialisation resulted in a “white space” in the matrix. Revisiting the research question, one cannot say that it has been given its proper answer yet through this study. However, there is a good indication that the positions of products or product groups in the proposed supply value chain model should influence the innovation resource allocation work process. So far, the individual matrices have not been explored in such

an analysis which will be done in further research. The product/market perspective is one but not the only perspective to consider when improved models for innovation resource allocation are sought. In the Process Industries, reliance on raw material supplies and production process technology are important factors that may also in different degrees influence the company’s innovation resource allocation process for different positions in the previously presented overall supply and value chain (Storm et al., 2010).

The useful feedback from the respondents on a company’s usability of the proposed conceptual framework will encourage the authors to further develop it into an even more adapted tool for company use in the Process Industries. However, companies would be well advised to start testing and using the concepts and models in their internal strategic innovation resource allocation processes. In such an endeavour they are first of all advised to position their various product groups (see the examples in Figure 1) in the proposed supply value chain model. Afterwards they can take those product groups, or selected product groups requiring special attention, and position them in the appropriate matrix. Competitors’ product groups may be added, and the initial discussion should focus on whether the position is sustainable or if there is a need for a change. Following such possible strategic changes or repositionings, necessary innovation resource allocations should be reconsidered.

## 6. Conclusions and outlook

The topic of corporate resource allocation is surprisingly little researched, and the lack of usable and robust models for resource allocation is unfortunately particular acute in the distribution of corporate resources to innovation. The different dimensions in the previously presented matrices illustrate well that product innovation and process innovation in the Process Industries are only two activities out of a spectrum of more innovation and innovation-related activities to consider. In the development of this conceptual framework it was recognised that resource allocation to development of product functionalities and competitive process technology must be individually discussed and considered; but not only that: other aspect such as resource allocation to the development of raw materials, internal and external technical services, branding of industrial products and other value-added activities must also be carefully considered. The respondents generally felt the framework and models to be interesting and usable in company internal strategic discussions on innovation resource allocations. This “top down” view of

resource allocation was considered to be of interest since the more common resource allocation model based on the aggregation of project resources tends to represent individual wishes rather than a company's coherent strategic vision. The empirical findings indicate that depending on product/product-group positions in the supply value chain, resource allocation to innovation ought to be different. Further empirical research by the authors from a larger sample of companies in the Process Industries may not only supplement and further develop the research findings, but also refine and possibly validate the framework or part of the framework.

In such a development an interactive approach is desired; this can probably be facilitated in small workshops rather than using traditional research methodologies such as case studies or a survey. In the further development the application of this framework to different sectors of the Process Industries will be sought in order to test its usability in different industrial contexts.

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