

Concepts of synergy - Towards a clarification

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Abstract

This paper explores the concepts of synergy, economies of scope and complementary in an attempt to refine the concept of synergy. The paper develops a taxonomi consisting of four kinds of synergies: 1) The static and subadditive synergies consisting of economies of scope and asset amortization benefits, 2) the static and superadditive synergies known from the treatment by Ansoff (1965), 3) the dynamic and subadditive synergies which could be termed competence amortization benefits and 4) the dynamic and superadditive synergies consisting of complementarities between different activities or competences. These four kinds are then discussed and illustrated by examples from the Danish companies Danfoss and Bang & Olufsen.

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Introduction

Concepts such as “*dominant logic*” (Prahalad & Bettis, 1986), “*core competence*” (Prahalad & Hamel, 1990) and “*corporate coherence*” (Teece, Rumelt, Dosi and Winter, 1994) has become very influential in the management and strategy literature. The common feature of these concepts is that they all refer to the exploitation of some kind of *similarity* between businesses as the basis for achieving sustainable competitive advantage. Exploitation of similarities between different lines of business has for long been at the center of attention in the analysis of the managerial concept of *synergy* which has had an even greater impact among practitioners of management and strategy and in the press. The concept of synergy has not, so far, been connected to how competitive advantage can be achieved and sustained. Studies on diversification, mergers and acquisition are ambiguous on the impact of relatedness on financial performance (see Markides, 1995 for a review of studies on this issue). This ambiguity may be regarded as evidence of the difficulty in obtaining synergy (Campbell and Luchs, 1992). Studies on the direct impact of synergy on financial performance are scarce, but Mahajan and Wind (1988) finds that synergy is not always accompanied by improved profitability. This has set the stage for renewed research in how synergies are *created* and what the *limitations* to their exploitation are.

Progress in this research is in my view contingent on a *clarification* of the concept of synergy. Specifically I try to confront the managerial concept of synergy with the more well-defined concepts of *economies of scope* and *complementarity*, and thereby create a more refined view of the concept of synergy than the one used by Ansoff (1965) or the original conception by Ward (cf. Spender, 1994). In this way I attempt to bridge the work of management studies and economic research. I shall also try to illustrate these concepts by examples from my research in two medium sized Danish industrial corporations.

Concepts of synergy

The concept of synergy is at the core of resource-based thinking, dating back to Edith Penrose’s seminal contribution. More specifically Penrose (1959), without using the actual word though, was concerned with two forms of synergy: the possibility of sharing particularly managerial resources, which is brought about due to inevitable indivisibilities of resources, and transfer of excess (and limitedly tradeable) resources. According to Porter (1987) those are the only kinds of synergy available to firms, but this paper will hopefully make it clear that his conception is too narrow in scope.

Synergy and economies of scope

First I would like to return to the original conception of synergy in the field of management and economics and then discuss the differences between the concepts of synergy and economies of scope. Ansoff (1965, p. 80) describes four types of synergy:

Sales synergy which occurs when different products use common distribution channels, common sales administration, or common warehousing.

1. *Operating synergy* which includes higher utilization of facilities and personnel, spreading of overhead, advantages of common learning curves, and large-lot purchasing.
2. *Investment synergy* is the result of joint use of plant, common raw materials inventories, transfer of R&D from one product to another, common tooling and machinery.
3. *Managerial synergy* is possible when a new business venture faces strategic, organizational or operating problems which are similar to problems that the management has dealt with in the past.

Ansoff does not explain the reasons for these synergies, but Porter (1985 p. 328) provides the following explanation: “*sharing has the potential to reduce cost if the cost of a value activity is driven by economies of scale, learning or the pattern of capacity utilization*”.

A formal representation of synergy ($ROI(a, b) > ROI(a) + ROI(b)$) implies that there are more to synergy than just economies of scope ($C(a, b) < C(a) + C(b)$, cf. e.g. Teece, 1982 and Teece, Rumelt, Dosi and Winter, 1994). One obvious difference between the two terms is that synergy is concerned with more than the cost of production, even when production is defined in a broad sense. In other words, costs are only part of the equation ($ROI = (R - C)/I$). Where economies of scope deals with the reduced costs of joint production (i.e. resource sharing) vis á vis separate production, synergies are also about increasing revenue and reducing the need for investment.

Increased revenue may be the effect of economies of scope since (part of) the cost reduction can be used to reduce the prices. However this is contingent on the price elasticity of demand which has to be sufficiently high for the product in question to offset the lower price pr. product. Increased revenue through lower prices also requires that the economies of scope can be obtained without congestion since production has to be increased. Since economies of scope has been conceived from a production perspective, the literature on economies of scope does not consider the possibility of increasing revenue through positive externalities from supplying complementary products. These externalities can in part be explained by reduced transaction costs (e.g. reduced search and negotiation costs) and increased utility for the buyer.

Reducing the necessary level of investment in the introduction of new products can be obtained by sharing existing resources as long as congestion does not occur. Congestion is likely to happen when the shared resources are either tangible or financial, while intangible resources have expandable capacity (Itami and Roehl, 1987). Reducing the need for investment could also be the result of scale economies in upstream activities or learning economies where learning from past experiences makes it cheaper for the firm to engage in similar activities by avoiding mistakes and discovering new ways of doing things.

Markides and Williamson (1994) addresses this issue and describes four kinds of synergies available to the diversifying firm¹:

1. *Asset amortization*: the potential to reap economies of scope across business units that can share the same asset.
2. *Asset improvement*: the potential to use a core competence accumulated in the course of building or maintaining a strategic asset in one business unit to help improve an existing strategic asset in another business unit.
3. *Asset creation*: the potential to utilize a core competence developed through the experience of building strategic assets in existing businesses to create a new asset in a new business.
4. *Asset fission*: the potential for the process of related diversification to expand a corporation's existing pool of core competences because, as it builds strategic assets in a new business, it will learn new skills that in turn will allow it to improve the existing assets in existing businesses.

Markides and Williamson (1994) thus introduces a more dynamic view of synergy where, in the last three kinds of synergy, the company's competences are used to build new assets, and thereby establish a better fit between the company's pool of resources and the opportunities for growth. This calls for a distinction between a static view of synergy dealing with the sharing of stocks of existing assets between different businesses (asset amortization) which is implied in the usual definitions of synergy and economies of scope, and a more dynamic (process) view on synergy concerned with the sharing (amortization) of competences and accumulation of new assets.

4. Synergy and complementarity

The Markides and Williamson analysis does not capture another difference between the definitions of synergy and economies of scope. It is obvious from the definitions that synergy is a superadditive function while economies of scope are based on subadditivity. Neither

¹ Markides and Williamson distinguish between core competences, defined by Prahalad and Hamel as "the collective learning in the organization" (1990, p.164), and strategic assets consisting of bundles of resources (e.g. a dealer network).

Ansoff's definition nor the four kinds of synergies developed by Markides and Williamson does, however, address this difference.

The concept of *complementarity* explicitly focuses on superadditivity in performing complementary activities. In a sense all of a company's competences should be complementary in the technical sense of the term since all non-complementary resources and competences only create revenue when they are sold². In economic terms, activities are considered complementary (Edgeworth complements) "*if doing (more of) any one of them increases the returns to doing (more of) the others.*" (Milgrom & Roberts, 1995, p. 181).

Like the concept of synergy, Milgrom & Roberts' notion of complementarity is not concerned with just reducing the costs through joint production, although it could be reduced to a case of genuine joint production (i.e. economies of scope), where two or more products are produced simultaneously in the same process. But their notion of complementarity could also be connected to the Markides and Williamson (1994) analysis, which shows that learning from the process of asset accumulation may ease the maintenance or improvement of other assets.

Milgrom & Roberts' (1995) notion of complementarity however seems to narrow when they point out: "*Note that Complementarity is symmetric: If doing more of activity **a** raises the value of increases in activity **b**, then increasing **b** also raises the value of increasing **a**.*" (ibid., p.183). Depending on the definition of symmetry, this could be taken to mean that the increases in value have to be numerically similar, if certain activities were to be termed complementary. This seems to be a too narrow conception of the complementarity effect for practical purposes. It also eliminates the possible substitution of the synergy concept for the complementarity concept, since synergy is not conditioned on symmetry. Of the four kinds of synergy mentioned by Markides and Williamson only asset amortization can be said to imply symmetry, while the others - asset improvement, asset creation and asset fission does not, because utilizing the capabilities obtained from developing an asset in one business unit to build or improve an asset in another business unit does not enhance the value of the original asset. Thus increasing the stock of asset **b** does not increase the value of increasing the stock of asset **a**, although it may strengthen the asset-improving or asset-

² If one of the company's activities is not complementary to at least some of the others it does not contribute to generating revenue and is either unproductive (slack) or counterproductive. This is the sense of complementarity which Teece (1986) uses in his complementary assets framework where all the assets that contribute to appropriating the rents of an innovation are termed complementary.

building capability through learning and amortize the costs of developing that capability.

The concept of complementarity is however more dynamic than Ansoff's definition of synergy in that: "*investments at different points in time are mutually complementary, so higher early investments increase the pace of later investments.*" (ibid., p.187). The concept of complementarity can thereby enrich the concept of synergy, which treats investments as separate in the simple definition by Ansoff (1965).

4. Summing up

This discussion has shown that there is a need for a broader conception of synergy, which addresses the two crucial distinctions:

1. The distinction between static and dynamic synergies which is essentially a distinction between a static representation of the firm as a fixed collection of resources and a dynamic representation of the firm as an ever-evolving collection of competences in accumulating and deploying resources.
2. The distinction between subadditivity and superadditivity which basically concerns the difference between amortizing a fixed (indivisible) investment in acquiring a given resource (static view) or competence (dynamic view) and the complementarities between diverse resources (static view) and/or competences (dynamic view).

Together these distinctions form a two by two matrix describing four kinds of synergies (cf. table 1):

1. The static and subadditive synergies consisting of economies of scope and asset amortization benefits.
2. The static and superadditive synergies known from treatment by Ansoff (1965).
3. The dynamic and subadditive synergies which could be termed competence amortization benefits since they are formed by applying a competence to different lines of business and thereby amortizing the cost of developing that competence (i.e. asset improvement, asset creation and asset fission).
4. The dynamic and superadditive synergies consisting of complementarities between different activities or competences.

Table 1: Types of synergy

	Static	Dynamic
Subadditive	Economies of scope Asset amortization	Competence amortization
Superadditive	Ansoff's conception of synergy	Complementarity

4. Illustrations

4. *Static and subadditive synergies*

The *static* and *subadditive* kind of synergy has received the widest attention in economic literature usually in the form of shared physical resources like machines, tools, buildings and other fixed, indivisible investments. Other examples include a shared salesforce or sharing administrative functions like accounting and human resource management. Recent literature has introduced the concepts of core products (Prahalad and Hamel, 1990) and product platforms (Meyer and Utterback, 1992) which are physical and technological resources that can be shared between different end-products.

Although these examples are among the opportunities for synergy that are easiest to recognize, they also seem the hardest to sustain because they apparently reduce the firm's operating flexibility more than the sharing of competences (Mahajan and Wind, 1988, Prahalad and Doz, 1992).

The difficulty in sustaining economies of scope is illustrated by the experiences of the Danish companies Danfoss and Bang & Olufsen, who both have plants that manufacture and supply components to different product lines. In recent years both companies have decided to purchase more of their components from outside suppliers and concentrate on manufacturing the components that differentiate their products from the competitors. Danfoss has also decentralized the manufacture of components so that each of the ten product divisions produce more of their own components and fewer are procured from the centralized plants. Likewise Danfoss' central procurement department was decentralized in 1988 and the divisions assumed responsibility for their own purchases. In the beginning of 1997 all the manufacture of components will be transferred to the product divisions (Børsen 1996.12.03).

In 1988 Bang & Olufsen formed a subsidiary, Bang & Olufsen Technology, which were to develop and manufacture new products on behalf of other companies. The new company was expected to utilize the parent company's resources in manufacturing and R&D when they were in excess because of seasonal changes in the demand for the parent company's audiovisual products. This idea was soon abandoned because of coordination problems and the new company got its own staff and facilities.

4. *Dynamic and subadditive synergies*

The *dynamic* and *subadditive* kind of synergy is the focus of the attention in the literature on competence based competition (e.g. Hamel and Heene, 1994) which was set off by the

influential article by Prahalad and Hamel (1990). The focus has however been on asset improvement and asset creation and less on asset fission, perhaps because asset fission is contingent upon solving the tension between static and dynamic efficiency (Ghemawat and Costa, 1993). Some insights on solving this tension has been provided by the introduction of concepts like gap analysis (Grant, 1991) and industry specific factors (Amit and Schoemaker, 1993) and the analysis by Levinthal and March (1993). The question of which competences to develop and when to do it, however, remain largely unanswered.

Danfoss tries to solve this problem by developing what they call a technology pyramid which include competences, skills and technologies that are used corporate-wide. Each of these competences, skills and technologies are assigned a gatekeeper responsible for its development, for surveilling developments by other companies and research institutions, and for cooperating with other companies and research institutions in that technological field. The work of the gatekeeper is monitored by a committee.

In Bang & Olufsen the amortization of technological competences is accomplished by adopting a so-called network-organization in the R&D department where the technicians and engineers work on various projects based on their technical - rather than product - area of expertise. In this way an expert in the design of loudspeakers can work on developing both separate loudspeakers and speakers for use in televisions, telephones or portable equipment and thereby increase his or hers specialization to the benefit of different product lines that can share that persons skill. An example is the development of the Beosystem 2500 which was the first integrated integrated stereosystem that employed "active" loudspeakers³. This development of competence in active loudspeaker technology consequently led to the development of a whole range of active loudspeakers and the technology was also used in television sets.

4. Static and superadditive synergies

The *static* and *superadditive* synergies can be exemplified by a shared distribution network for complementary products where the convenience (e.g. reduced search and negotiation costs or increased utility) for the customer in bundling his purchases gives him an incentive to buy from a single supplier rather than using multiple suppliers. The keyword here is complementary products because shared distribution of unrelated products might have sub-

³ Active loudspeaker are loudspeaker with separate amplifiers for each of its drive units e.g. bass and treble.

additive effects due to economies of scope in handling the products or economies of scale in increased storage or display space. The superadditive effect consist in the buyers incentive to bundle his purchases because the products are interconnected in some way.

Danfoss achieves this kind of synergy by having complementary product lines like valves, thermostats and compressors which are all targeted at producers of refrigerators. Danfoss' sales subsidiaries also have the authority to buy complementary products from other companies and resell these products along with products manufactured by Danfoss. In fact part of Danfoss' strategy is to develop complementary products and acquire companies whose products are complementary to the existing product lines.

Bang & Olufsen also achieves this kind of synergy by developing products that forms integrated systems. For instance their remote controls can control both audio and video products so you only need one remote control to use the TV, VCR and stereosystem if they all are Bang & Olufsen-products. Likewise the fact that customers can buy a full system of Bang & Olufsen-products may increase the customers perceived value of the individual products because of the aesthetic and functional connectedness between the products.

4. Dynamic and superadditive synergies

The *dynamic* and *superadditive* kind of synergy is the result of the companys deployment of complementary competences. As discussed previously this does not mean deployment of competences that are complementary in a technical sense (e.g. competences in marketing, product development and manufacturing). Instead it means combining competences that contribute to the same activity, and where the collective benefit is greater than the sum of the individual contributions. In a recent article, Porter (1996) explores the difference between the search for operational effectiveness⁴ and strategy. While achieving operational effectiveness in individual activities (e.g. through the three previously discussed types of synergies) only leads to short term enhancements of performance because they are easy to imitate, achieving fit between complementary activities (or, in the context of this paper, competences) leads to sustainable competitive advantage, because "*rivals will get little benefit from imitation unless they successfully match the whole system.*" (Porter, 1996, p. 74). The possibility of competitors successful matching of whole system is reduced by the five isolating mechanisms indentified by Dierickx and Cool (1989), namely

⁴ "*Operational effectiveness (OE) means performing similar activities better than rivals perform them. Operational effectiveness includes but is not limited to efficiency*" (Ibid. p. 62).

1. *Time compression diseconomies*, which exists when a given level of expenditure over a particular period of time produces a larger increment in asset stock than the same level over a shorter period of time.
2. *Asset mass efficiencies*, which exists when adding to an existing asset stock is facilitated by possessing high levels of that stock.
3. *Asset stock erosion*, which occur in the absence of adequate expenditure in maintaining the asset stock.
4. *Asset stock interconnectedness*, which exists when adding to an existing asset stock depend not just on the level of that stock, but also on the level of other stocks.
5. *Causal ambiguity*, which exists when it is impossible to identify or control the variables leading to the accumulation of the assets.

Time compression diseconomies, asset mass efficiencies and asset stock interconnectedness can be seen as different types of synergies, which would not seem to be adequately described by the concept of economies of scope.

Bang & Olufsen have a reputation for creating audio-visual products with an appealing aesthetic design. This reputation is not just the result of a superior aesthetic design capability, in fact their products aesthetic design are made by independent designers. Bang & Olufsen themselves ascribes the succes of their products to the combination of six complementary competences:

1. A superior capability in developing the electronic circuitry to fit the designers ideas.
2. Competences in materials technology and mechanics (especially product surfaces).
3. A competence in developing systems with high quality in sound reproduction based on insights in psychoacoustics and a specially trained group of listeners (internal lead users).
4. A competence in developing systems with high quality in image reproduction based on research in quality attributes in image reproduction and a specially trained group of viewers (internal lead users).
5. A functional application competence in developing new ways of operating the products.
6. A competence in developing integrated systems that works in different rooms in the home (Link-systems).

The combination of these complementary competences is superadditive because it helps Bang & Olufsen to create products that are perceived as unique by most people which give the company a differentiation advantage. The combination of these complementary competences is also dynamic because it assures a continuing fit to the needs and wants of the segments of the market which Bang & Olufsen has chosen.

6. Conclusions

This paper has explored different concepts related to the concept of synergy. Comparing these concepts has revealed the two fundamental distinctions between static and dynamic synergies and between subadditive and superadditive synergies. These distinctions forms four categories of synergies consisting of the static and subadditive concept of economies of scope, the static and superadditive conception of synergies introduced by Ansoff, the dynamic and subadditive competence amortization benefits and finally the dynamic and superadditive concept of complementarity.

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