

AN ECONOMIC SYSTEM OF TECHNOLOGY-RELATED ACQUISITIONS
AND SPIN-OFFS

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Abstract

This paper argues that an economic system of large and small technology-based firms which interact through technology-related acquisitions and spin-offs can be highly conducive to overall innovativeness and growth. Based on Williamson's (1975) suggestion of a 'systems solution by classical specialisation', and the empirical research on Swedish technology-based firms reported by Lindholm (1994), an 'extended systems approach' is proposed and presented in this paper. This extended system includes the process by which firms spin off small technology-based firms (STBFs) for possible acquisition so that a market for technology-based firms is created as a supplement to other forms of technology markets.

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1. Introduction

Traditionally, innovation research, as well as policy debate, have focused on the question of whether large *or* small firms are the most frequent, effective and/or efficient innovators, rather than on the interaction between these firms. However, large and small firms interact in several ways, for example through different types of ownership changes. This paper concentrates on ownership changes in the forms of technology-related acquisitions and spin-offs.

The paper is based on the empirical research into technology-related ownership changes in Sweden reported by Lindholm (1994). This includes data from three different empirical studies of Swedish industry. The first of these analyses the acquisition and growth of small technology-based firms (STBFs). Data were collected from 75 large Swedish manufacturing firms, a cross-sectional study of 106 STBFs, and a case study of seven acquired and three non-acquired STBFs. In the second empirical study, 60 STBFs are analyzed, both independently established firms and firms spun off from other organizations (entrepreneurial spin-offs, or ESOs). This study sought to analyze the ESOs and their consequences for innovativeness and growth. The third empirical study consists of two case studies of large technology-based firms (LTBFs), both having acquired as well as spun off STBFs. Among other things, the results of this research indicate that technology-related acquisitions have become increasingly important for the sourcing of technology among Swedish LTBFs. In addition, the majority of these acquisitions are of businesses that have previously spun off from other organisations.

This research has to some extent a theoretical origin in Williamson's (1975, pp. 196-207) discussion of a 'systems approach' and proposition of a 'systems solution by classical specialisation'. Even though Williamson introduced what he called the 'systems solution' twenty years ago, the idea is still quite unexplored. Williamson's argument in brief is that small firms are frequently high performers when it comes to product innovation. Furthermore, small firms often have advantages in the early stages of the innovation process, as

as well as in less expensive and radical innovations, while large firms have an advantage in the later stages of scaling up innovations. In other words, large scale, or size, is often found to be a determinant of malfunctioning in the earlier and creative stages of the innovation process. Therefore, as Williamson (1975) proposed, the 'systems solution by classical specialisation' may be an efficient innovation process. He hypothesised that because of large firm innovative disabilities in the early stages, an efficient procedure by which to introduce new products would be to allow the initial stages of the innovation process to be carried out by independent innovators and small firms. The successful small companies would then be acquired for subsequent development by a large firm.

Of course, large firms also possess considerable potential as sources of technological innovation. This can be especially important in sectors with a high cost and long pay back period of research. Usually, an LTBF encompasses several technologies within its existing product areas, and this may give the large firm a potential advantage in achieving a relatively larger amount of technology development. These technologies may also have potential for innovation outside the firm's existing product areas. Usually, however, large firms do not encourage potential innovations outside their existing product areas. Large firms may often therefore possess neglected potential, as a source of radical new innovations. By spinning off this potential for external development, the large firm can act as an important source of innovation. Granstrand (1982) qualified Williamson's hypothesis, concluding that there are intermediate quasi-integrated forms of R&D organizations, and that these are the most conducive framework for technological innovation. Examples of quasi-integrated organizations include the acquisition of small innovative firms by large firms, and also small firms which are "spun off from larger ones as new business development units or exist as a permanent semi-autonomous innovation company for the purpose of acquisition and early stage development of internal and/or external ideas for transfer or divestment in some form at a later stage" (Granstrand 1982, p.198). If these ideas are further elaborated by including the mechanisms by which large firms spin off small, technology-based firms, an 'extended systems approach' can be proposed as an extension of Williamson's original idea (Lindholm 1994).

There are several reasons for believing that both the acquisition and spin-off of STBFs would be efficiency-inducing, and that these two processes may also complement each other. First, as hypothesised by Williamson, there are the small firm's early-stage advantages, the large firm's advantages in scaling up innovations, and the advantages of combining the small and large firms after acquisition. Second, there are advantages of spinning off STBFs from large firms. Such advantages may include the above mentioned development of potential new innovations which lie outside the scope of the large firm. Additionally, it can be argued that because of the early-stage innovation disadvantages of the large firm, there are potential benefits in developing such new innovations in newly created "firms" within the large firm. In this way, these new "firms" may be decreasingly integrated with the large firm, changing ownership and capital structure being possible to varying degrees. They may be jointly owned by the large firms and the inventors or spun off as fully independent new firms. They may also later be reintegrated by the large firm, or acquired by another large firm, in order to benefit from large firm advantages in scaling up the innovations. Both acquisitions and spin-offs can be made gradually, and with varying degrees of integration. Moreover, firms can be linked together by, and interact through, jointly owned small firms. The extended system envisaged in this paper will therefore consist of a population of large firms that acquire and spin off STBFs, and a population of small technology-based firms, independently established or spun off from large firms, which may subsequently be acquired by, and perhaps re-spun off from, large firms. Of course, small firms also often spin off additional small firms, and, less frequently, acquire other small firms. Thus, operating within the market for corporate control, the extended system could be considered as a collection of large firms with a cluster of small firms attached to them in a dynamically changing quasi-integrated manner. In this system a market for technology-based firms is created as a supplement to other forms of technology markets.

2. A Classification of Ownership Changes

Both acquisitions and spin-offs can be seen as cases of transactions of ownership rights within the market for corporate control. In this paper, acquisitions and spin-offs refer to the transfer of majority voting power

between existing legal bodies or, in the case of spin-offs, the transfer from existing legal bodies to a new body, that is, a start-up.

In many previous studies no clear distinction is made between **mergers and acquisitions**. Often, acquisition is included in the definition of a merger. However, here a separation of the two concepts is necessary: a 'merger' occurs when two companies are fused into a new firm, and none of the prior firms is the majority owner; an 'acquisition' occurs when a firm is taken over by another, usually larger, firm. In an acquisition, the acquiring firm (not an individual) must achieve a majority holding (at least 50 per cent) in the acquired firm. After the acquisition, the acquired firm is integrated into the organization of the acquiring firm, often as a subsidiary. Included in this concept is the case where an operating business unit or division is taken over from another firm, which can be viewed as a divestment from another company.

The literature on **spin-offs** is limited and the available definitions of the concept are heterogeneous. In this paper, spin-offs are defined as including both '**divestments**', '**entrepreneurial spin-offs**' and '**internal spin-offs**' (see Figure 1). Frequently, in earlier studies (see, for example, Duhaime and Grant 1984; Thomas 1986; Rizzi 1987; Woo et al. 1992), the concept of a '**divestment**' is defined as the sale by a company of one part of itself. Such divestments include: (1) 'sell-offs', (2) 'buy-outs', and (3) 'equity spin-offs'¹. A 'sell-off' is when one part of the company is acquired by another firm, thus becoming a part of that other firm (see, for example, Jain 1985; Coyne and Wright 1986; Woo et al. 1992). A 'buy-out' (Coyne 1986) is when a part or unit of the company is acquired either by the management of the unit (a 'management buy-out') or by some of its employees (an 'employee buy-out'). For financial reasons, other organizations or individuals often acquire a minority share of the firm, often defined as a 'leveraged buy-out'. In a buy-out, the divested part becomes an independent firm, but, unlike the two other categories, the parent company may retain a minority share of the new firm. An 'equity spin-off' is often defined as occurring when the company creates a new firm by distributing all of the stock to its own existing shareholders (Jain 1985; Kudla and McNish 1981, 1988; Coyne and Wright 1986; Seifert and Rubin 1989; Woo et al. 1989, 1992). The equity spin-off can then be regarded as a demerger, and as quasi-independent, since it has the same

shareholders but can decide its own management structure. Divestments may also include different forms of contracting out, or disposal of, parts of the operation which the company does not wish to exploit internally but in which it wishes to maintain an ownership interest.

A second type of spin-off, proposed by Lindholm (1994), may be termed '**entrepreneurial spin-offs**' (ESOs). Entrepreneurial spin-offs occur when an entrepreneur leaves his or her previous employment to start a firm of their own (see also Roberts 1968, 1991a, 1991b; Roberts and Weiner 1968; Cooper 1971, 1973, 1984; Smilor 1987; Dietrich and Gibson 1990; Granstrand and Alänge 1995). To be a spin-off, this must also include the transfer of certain rights, such as assets or knowledge, from the existing legal body to the new firm or body. Lindholm (1994) categorized firms as ESOs when the original product idea, which led to the establishment of the new firm, originated in the previous employment of the founder. The ESOs themselves can be categorized depending on from what legal body, or organization, they are spun off, and the source of the entrepreneur's background experience. Technology-based ESOs can therefore be subdivided into (1) university spin-offs (USOs), (2) corporate spin-offs, and (3) institutional spin-offs from organizations other than universities and corporations. An entrepreneur can also have several sources of background experience, reflecting the existence of an 'incubator system'; but here the ESO concept is subdivided with respect to the latest employer, that is, the 'main incubator' or 'spin-off parent'. An additional category of spin-offs proposed and included here is that of '**internal spin-offs**'. An internal spin-off occurs when one part or unit of a company is transferred to another part of the same company. This can take different forms, for example when a division divests one of its subsidiaries to another division, or when two or more subsidiaries are merged together to form a new division. To be an internal spin-off, this must include the transfer of rights from one legal body to another.

The concepts of technology-based firms and technology-related acquisitions or spin-offs can be confusing. The **technology-based firm** itself is often defined in various ways; for example, "a technologically based firm is defined as a company that emphasises research and development or that places major emphasis on exploiting new technical knowledge" (Cooper 1971, p.3). Closely related to this definition are the various definitions of 'new technology-based

firms'. As summarized by Bollinger et al. (1983), one can usually clearly identify a small nucleus of people as founders of the new technology-based firm. Further, the company is totally independent, and lastly, the primary motivation for founding such a firm should be to exploit a technically innovative idea. In this paper technology-based firms need not be newly established. Instead, a technology-based firm is here defined as a firm with an emphasis on the exploitation of new technical knowledge. This includes the development of new technical products and processes, as well as capabilities, competence, patent rights and other intangible technology assets. Often in the literature, **technology-related** acquisitions and/or spin-offs refer to external sourcing or exploitation of technology in general. In this paper, a technology-related ownership change occurs when the acquisition or spin-off of a firm includes the transfer of technology, in the sense that (1) technology-related *motives* are essential ingredients in the transaction or (2) the transaction had the *result* that the parent firm received and continued (acquisition) or else lost and discontinued (spin-off) a particular technology. Technology-related acquisition or spin-off includes the transfer of particular technological assets of a firm; and most often there is a technology-related motive in such a transaction of ownership rights. When there is both a technology-related motive and a transfer of technology, this is definitely a case of technology-related acquisition or spin-off. Furthermore, when there is a technology-related motive to acquire or spin off a firm, but the technology transfer fails, this is still a case of technology-related acquisition or spin-off. When there is no such motive, but a transfer of new technology nevertheless takes place, this is also regarded here as a technology-related acquisition or spin-off.

From earlier research it is clear that there is a need for a number of vital distinctions, especially between different kinds of ownership changes and different motives. Several earlier studies have shown that acquisitions are not as profitable as one would expect (see, for example Ravenscraft and Scherer 1987; Haspeslagh 1987; Schwartz 1984; Scherer 1988). These studies generally focus on the profitability of the acquiring firm. None of them analyzed technology-related acquisitions, but rather concluded that related acquisitions in general perform better than unrelated acquisitions. In general, technology-related acquisitions are seldom analyzed (some exceptions are: Chakrabarti and Burton 1983; Chakrabarti and Souder 1987; Chakrabarti

1990; Granstrand and Sjölander 1990; Lindholm 1990, 1994; Garnsey and Roberts 1992; Chakrabarti et al. 1994). Instead, many earlier studies on acquisitions (see, for example Salter and Weinhold 1979; Singh 1984; and Kusewitt 1985) used Rumelt's (1974) definition of relatedness between the businesses of a diversified company as the basis for distinguishing between different categories of acquisitions. Nevertheless, when it comes to spin-offs (which to some extent could be viewed as 'reverse acquisitions'), the issue of relatedness is seldom discussed. Here it is most usual to distinguish between spin-offs according to who is the spin-off parent and who is becoming the new owner. In consequence, there is a lack of comparability between acquisitions and spin-offs within earlier classifications.

2.1 Acquisitions

In Rumelt's definition, firms are considered as related if they (1) serve similar markets and use similar distribution systems, (2) employ similar production technologies, or (3) exploit similar science-based research. Related acquisitions are often found to have a better performance than unrelated acquisitions. However, when analyzing technology-related acquisitions, the categorisation of firms as either related or unrelated is not sufficient. Even though technology-related acquisitions generally do bring a related business to the acquirer, this is not always the case. For example, an acquired STBF might develop a technology which is quite different from that of the acquirer, who perhaps acquires the firm for that very reason. At the same time, this acquired firm might not yet have an already-developed product, and consequently might not have any production or serve any market. Thus, under Rumelt's definition, this firm would be classified as an unrelated acquisition. However, an unrelated acquisition of a technology-based firm is likely to have more in common with a related acquisition of a technology-based firm than it has with another (non-technology-based) unrelated acquisition. That is, it is more important to consider the technology aspects than to classify the acquisition as related or unrelated. Additionally, acquisitions made because of market-related motives, for example, to increase the market share or to internationalize the business of the parent, are almost exclusively to be considered as related acquisitions. The acquisition of an STBF and the acquisition of a large competitor are fundamentally very different, but most often they are both to be considered as related acquisitions. Thus, the concept

of related and unrelated acquisitions is both too wide and too narrow to be reliable when acquisitions of STBFs are analyzed. Even so, the classification can be used to distinguish on the one hand between various technology-related acquisitions, and on the other between various market-related acquisitions.

To include supplementary or complementary related acquisitions (and spin-offs) in the concept (see Salter and Weinhold 1979) does not help much in the analysis. Even though complementary related diversification involves the adding of key functional activities and skills, it does not include any substantial changes in the final product market. Instead, the purest form of a complementary related diversification is vertical integration, while in the supplementary related diversification it is horizontal integration (Salter and Weinhold 1979). Neither does this classification help in distinguishing between technology-related and market-related ownership changes. However, as in the argument above, to classify the related acquisitions and spin-offs as supplementary or complementary can prove to be useful as sub-classes of either technology-related or market-related ownership changes.

An additional classification of acquisitions was developed by Ansoff (1965), and used by Kitching (1973). Here acquisitions are divided into five categories: four related, and one unrelated or conglomerate acquisition. Related acquisitions include not only horizontal and vertical acquisitions, but also two partial diversifications: those involving concentric marketing and the use of concentric technology. The concentric marketing strategy includes the acquisition of a firm serving the same market, but with different production and/or R&D technology. However, as was argued above, the acquired technology-based firm may not necessarily serve the same market. Thus, according to this categorisation, such an acquisition would primarily be classified as a conglomerate or unrelated acquisition. However, this category of conglomerate or unrelated acquisitions could then also include the acquisition of a bank or a restaurant, which is obviously very different from acquiring a biotechnology firm. And once again, the acquisition of a technology-based firm within a conglomerate acquisition can be considered to have more similarities with other acquisitions of technology-based firms, for example in the concentric marketing category. It is therefore clear that

for analysis of acquisitions and spin-offs of technology-based firms, these earlier and common categories cannot be used in their original form without being further developed.

A further and perhaps useful categorisation of STBF acquisitions would be to separate them into (a) market-related (or horizontal) acquisitions, (b) product-related acquisitions, and (c) technology-related acquisitions. In terms of relatedness, this acquisition classification is telescopic, and can be defined as follows:

- a) Market-related acquisition: the acquisition brings market contribution, and **must** be product and technology-related,
- b) Product-related acquisition: the acquisition brings product contribution, and **must** be technology-related,
- c) Technology-related acquisition: the acquisition brings technology contribution.

In this classification, Rumelt's (1974) definition of relatedness has been used in the sense that each class includes a change in at least one of the three components of relatedness. An acquisition is classified by what primary contribution it brings (either intended or unintended) to the acquiring firm. A market-related (or horizontal) acquisition occurs when a firm which increases its marketing volume is purchased by the acquirer. A product-related acquisition occurs when a firm with a new product (or new service) is taken over by the acquirer. Lastly, a technology-related acquisition occurs when a firm with new technology is acquired. Additionally, with market-related acquisitions, both the technology, product-lines and product-markets are unchanged, while with product-related acquisitions the (research- or science-based) product technologies and production technologies are unchanged. In other words, both market-related and product-related acquisitions are related acquisitions, since they (at least) use the same technologies. However, as indicated earlier, technology-related acquisitions do not need to be related to the acquiring firm. They can involve both new products and new markets, as well as new production technologies and product technologies. It is also possible that a technology-related acquisition initially does not have either any products or any marketing, and that these will be developed after the acquisition. Also, technology-related acquisitions can turn out to be

technology-related if a sub-technology of the acquired firm is synergistic to a sub-technology of the acquiring firm in a way that allows these sub-technologies to be combined into the technology base of a new product. For these reasons, technology-related acquisitions can in due course turn out to be either related or unrelated.

2.2 Spin-offs

As with acquisitions, spin-offs can be discussed in terms of relatedness to their parent organizations. Here, too, theories of corporate diversification are essential for the spin-off classification, and research on acquisitions in the corporate portfolio development has contributed to the conceptual foundation of divestment research (see for example Woo et al. 1989 and 1992). However, to classify spin-offs as either related or unrelated has disadvantages similar to those for classifying acquisitions. First, by definition, it is not possible for a spin-off parent to divest a totally unrelated firm. Second, a technology-based spin-off firm is generally a related business that is spun off from the parent; the type of relatedness can be either market-related, product-related or technology-related. Moreover, a technology-related spin-off might be spun off when the spin-off parent's motive is to discontinue a certain business, and accordingly closes down the technology development, marketing activities and production. This kind of spin-off firm would therefore be classified as an unrelated spin-off. When a former employee establishes a new firm where the product idea has no origin in the business of the parent, this new firm is obviously not related to the parent's business, neither is it included in the definition of an ESO.

Once again, it seems reasonable to assume that related and unrelated technology-based spin-off firms have more in common than they have with market-based spin-off firms. Thus, when studying ownership changes in technology-based firms, the categorisation of firms as either related or unrelated businesses is not sufficient. Rather, as in the classification of acquisitions, the three components of relatedness used by Rumelt (1974) can be used to classify the spin-offs as either market-, product- or technology-related. To some extent, this spin-off classification is the reflected image of the acquisition classification. However, an acquisition results in two firms being integrated into one, while a spin-off results in one firm being split up

into two. Analogously to the acquisition classification, spin-offs are primarily classified as: (a) market-related spin-offs, where firms with similar markets and distribution systems are spun off; (b) product-related spin-offs, where the spin-off firms continue to develop their product line and product markets (including services) outside their previous owner; and (c) technology-related spin-offs, where the spun-off firms continue to develop new technology outside their previous owner. In the case of market-related spin-offs, both the technology and the product-lines and product-markets of the spin-off parent are unchanged, while in the case of product-related spin-offs, the product and production technologies of the spin-off parent are unchanged. In other words, market-related and product-related spin-offs can also be classified as related spin-offs, since they (at least) use the same technologies. Furthermore, technology-related spin-offs do not need to be related to the continued business of the spin-off parent. In terms of changes within the spin-off parent, this telescopic classification can be summarized as follows:

- a) Market-related spin-off: this **does not** involve any product- or technology-related change in the parent, but can involve a market-related change in the parent.
- b) Product-related spin-off: this **does not** involve any technology-related change in the parent, but can involve both a product- and a market-related change in the parent.
- c) Technology-related spin-off: this **can** involve both a technology-, a product- and a market-related change in the parent.

In this spin-off classification, a spin-off firm that continues further to develop technology gained from the spin-off parent is classified as a technology-related spin-off, no matter whether the spin-off parent keeps or discontinues the technology itself. Of course, when a technology-related spin-off continues to develop its technology after spin-off, it is possible that the spin-off parent will also continue to develop that same technology. Equally, even when a spin-off parent discontinues a certain technology following spin-off, the spin-off firm is still classified as a technology-related spin-off, no matter if it continues developing its technology.

2.3 A System of Ownership Changes

The above argument has attempted to develop an acquisition and spin-off classification for STBFs and parent companies. The technology-related spin-offs in this classification fall mainly into four different categories: (1) a direct divestment, (2) the creation of a new firm (ESO), subsequently acquired by another firm or (3) continuing as independent, and (4) the creation of a new firm that is later re-integrated into the spin-off parent organization. Internal spin-offs are included in the fourth category, since this category reduces to an internal spin-off when the time period as an independent firm is zero. In general, one of the main differences between the different spin-off categories is the length of time in which the firm is acting independently within the system.

For larger firms, building and maintaining the technology base can include internal development, as well as acquisition and spin-off of technology-based firms. In a system of firms interacting through ownership changes, the technology-related spin-off can be considered as a first mechanism, and acquisitions of technology-based firms as a second mechanism, within the system. Similarly, then, acquisitions can be made as (1) direct acquisition of other firms' divestments, (2) acquisition of other firms' ESOs, (3) acquisition of independent non-spin-off firms, and (4) acquisition of an earlier spin-off from the firm's own organization. Furthermore, as indicated above, all ownership changes can be made gradually, and as a result it is possible for a small firm to have several large firms as minority owners, for example both an earlier spin-off parent and a future owner. These different ownership changes are illustrated in the extended system shown in Figure 2 below.

In Figure 2, two main instruments of ownership *changes*, that is technology-related spin-offs and acquisitions, are illustrated. However, since an STBF can be involved in both a spin-off and an acquisition, there are four main categories of small technology-based *firms*. In accordance with these four categories of firms, the ownership changes are grouped into four types:

Type (1), Acquisition of a divestment: this is the acquisition of another firm's divestment.

Type (2), Acquisition of an ESO: this is the acquisition of an (entrepreneurial)

spin-off (including a spin-off of a previous spin-off) by another large firm. Type (3 acq), *Acquisition of an independent firm*; Type (3 spo), *Spin-off of a new firm*: these two sub-categories refer to the acquisition of an independently established firm (non-spin-off), or the establishment of a new (entrepreneurial spin-off) firm.

Type (4), *Acquisition of an own spin-off*: this is the acquisition of an earlier spin-off firm from the parent firm, including internal spin-offs.

Additionally, in the extended system, the four types of ownership changes can be further divided into sub-classes with respect to different constellations of incubator and acquiring organizations. Here consideration can be given to whether or not an STBF is spun off from, or acquired by, one or several organizations, that is, a single incubator/acquirer or an incubator/acquiring system. Also, consideration can be given to what kinds of organization (for example, large or small firms, a previous spin-off, university, or government agency) are acting as incubator and/or acquiring organizations. Thus, a large number of different sub-classes is possible within the extended system. Elaboration of these requires further research.

Among the four main processes identified above, type (1), (2) and (4) ownership changes all include the acquisition of a spin-off. The difference between them is that type (2) includes the small firm acting independently for a certain time period. Type (4) is simply the reintegration of an earlier (perhaps quasi-integrated) spin-off from the firm itself, and when the former does not act independently for any time period it is an internal spin-off. However, the distinguishing characteristic of the type (3) change is primarily that it deals with an independent STBF. In other words, except for this type (3) change, all types include *both* a spin-off and an acquisition. On empirical grounds, Lindholm (1994) concluded that - in Sweden - the majority of all acquisitions of STBFs are of firms which were at some earlier stage spin-offs. The frequencies of type (2) and type (3) acquisitions are approximately the same, and type (1) and type (4) acquisitions both involve spin-offs. In addition, Lindholm estimated that about half of all independent Swedish STBFs are ESOs (type 3 spo), and that more than half of all STBFs are later acquired (types 2 and 3 acq). That is, more than one-quarter of all Swedish STBFs experience both types of ownership changes (ESO and acquisition): they are established as spin-off firms (50 per cent of Swedish STBFs), and

after some years as independent firms, they are later acquired by another firm (63 per cent of Swedish ESOs). Thus, in a systems approach or systems solution by classical specialisation, the acquisition of earlier spin-offs must be viewed as an important complement to the acquisition of independently established STBFs. The procedure by which large firms spin-off STBFs must then be incorporated into an 'extended system', in which the population of STBFs available for acquisition is increased.

3. Characteristics of Technology-Related Acquisitions and Spin-offs

On the basis of Swedish empirical studies (see Lindholm 1990 and 1994) the key characteristics of the acquisition and spin-off processes involved in technology-related ownership changes can be summarised.

The technology-related acquisition: In a sample of 50 acquired Swedish STBFs, Lindholm (1994) found that the dominant motive reported by owner-directors for selling the firm was shortage of capital; for 68 per cent of the sellers, this was the primary or secondary motive. The second most common motive (the primary or secondary motive for 28 per cent of the sellers) was to be able to expand or internationalize the business. Interestingly, the motives of freeing capital for private consumption (the primary or secondary motive for 16 per cent of the sellers) or to sell because of age or health (the primary or secondary motive for 14 per cent of the sellers), were only the third and fourth most common motives for the owner-directors of Swedish STBFs. These results may be to some extent specific to Sweden; for example, it is possible that in countries where the availability of venture capital is greater, the motives of the sellers will be different.

The typical Swedish STBF acquisition target is a relatively young firm with limited annual sales. When technology development is complex (or has a high degree of diversity) it takes time before the firm has its first product fully developed. In turn, this limits the sales growth and development of the firm, which may also end up in a weak financial position. Firms with these characteristics often have several patents (but as yet no product) and a low pre-acquisition growth rate, and are forced to search for an acquirer in order to survive. Such a firm may be acquired because of the potential of its technology, rather than because of a high growth rate. It is also possible that

the firm is acquired because the price is low. From the point of view of continued innovativeness and growth, it is important for the target firm to find an acquirer with an offensive motive, and enough patience to wait several years (and perhaps invest a great deal) before the firm's performance is improved.

In a technology-related acquisition target with a less complex technology development path, the products are more likely to have been developed earlier, and thus the firm has a higher pre-acquisition growth rate. However, when compared to the average size of the potential acquirers, this growth is still very limited. Even in this case, the potential of the firm's technology and its products are more important reasons why an acquirer is likely to purchase the STBF. When a firm with already-developed products is acquired the price is likely to be higher, and the owner-directors of such a firm are likely to have other motives to sell. However, even in this case the primary motive for selling the firm is usually the need for capital, the difference being that the capital is needed for the establishment of marketing contacts and of an (international) distribution network.

As Figure 3 illustrates, the acquisition process can be subdivided into the pre-acquisition phase, the acquisition phase, and the post-acquisition phase. In the acquisition phase it is important that the transaction time is long enough both to allow a careful evaluation of the candidate, and to negotiate and agree about the strategy of integration and how to realize the potential synergy effects. For example, regardless of whether the price is low or high, a stepwise acquisition or down-payment formula is important for the continued development of the firm. This is related to, for example, the retention of key personnel and the continued motivation of the staff. In several cases the Swedish research noted above found that growth was very negatively affected when the acquiring firm itself later on became acquired. In this situation there was not much the STBF could do to affect the situation, and staff motivation - and also growth - decreased.

The post-acquisition phase includes an integration process. However, with a stepwise acquisition it can take a relatively long time before any integration is achieved. In most of the firms analyzed by Lindholm (1994) the degree of integration - except for managerial integration - was low. Additionally, the

results indicate that compared to the realized synergy effects, integration has only a limited effect on the performance of a technology-related acquisition. Technology-related acquisitions in fact usually fail to realize potential synergy effects. For example, Lindholm (1994) demonstrated that the need for capital, which often motivated the STBF to sell, was usually not felt to be important after the acquisition; rather the financial security of having a large owner was more important. Potential technology synergy effects can be especially difficult to realize. In some cases, the founders and key personnel of the target firm are most interested in technology and product development, and not in the management of the firm or the marketing of the products. If an acquirer can supply the target firm with managerial and marketing assistance this can be important for an improved post-acquisition performance. Such assistance can help stimulate growth by realizing marketing synergies, as well as indirectly by allowing key personnel to focus on product development and improving innovativeness. Additionally, managerial integration can work in a similar way *if* the key personnel are primarily interested in the development of technology. However, when the pre-acquisition key personnel are more interested in the management of the firm, post-acquisition managerial integration can have very negative effects, resulting in a loss of motivation and 'house-of-cards' effects, which in turn can decrease both growth and innovativeness. Finally, the Swedish research also found that earlier technology-related acquisitions with a poor performance, or integration problems and/or 'not-invented-here' effects, are likely to be divested.

The technology-related spin-off: Lindholm's work in Sweden reveals that the typical ESO incubator is a manufacturing firm. In addition, the most frequent previous employment for founders of ESOs is in an STBF, which are thus the primary source of direct incubators. Nonetheless, both universities and large industrial firms are important as indirect incubators, and are often included in an incubator system. Moreover, when divestments and internal spin-offs are included along with ESOs, the primary source of technology-related spin-offs is in fact LTBFs. In small firms internal spin-offs seem to be rare; a small firm does not often have different business units between which the internal spin-off may be transferred. Additionally, divestments are usually made from earlier acquired units, and small firms do not acquire other firms to the same extent as large firms. The Swedish empirical evidence thus indicates that the main source of technology-related spin-offs as a whole

are large technology-based firms (LTBFs), but that STBFs are especially important as a source of ESOs.

Regardless of whether the initial technology was developed in an externally acquired unit or an internal development project, technology-related spin-offs typically involve some technology development being carried out in a large industrial firm. For a small proportion of ESOs, however, no actual technology development is carried out - by the incubator - in the pre-spin-off phase. In this case an ESO is typically established when the incubator firm does not want to develop the founder's own idea. In a typical technology-related spin-off, the pre-spin-off period includes several years of technology development (either within a central R&D unit or in a separate product division). This technology development usually results in a developed product, rather than just a new product idea. However, in cases of complex technology (with several sub-technologies) the development often results in a wide range of potential product applications, where not all can be effectively utilized - or fully developed - within the parent company. In turn this opens up possibilities for the establishment of a new and smaller firm, where a particular product application, often with a relatively limited (in the eyes of the incubator) market-niche focus, may be further developed. In this case a long period of product development within a central R&D unit typically results in an ESO. When the incubator tries to prevent the founder from leaving the firm in order to establish an ESO, this may very well result in a **hostile ESO**, with few future possibilities of continued co-operation between the incubator and the ESO.

When technology development takes place within a product division, the development typically results in more fully developed products with clearer market focus. The development made in earlier technology-related acquisitions is mostly within separate product divisions rather than in central R&D units. The pre-spin-off phase of a technology-related spin-off from a separate product division is usually characterised by several reorganisations. These reorganisations may occur for several reasons (associated, for example, with technology development, or management or financial problems) and often earlier acquired units are connected with these reorganisations. However, it is not necessarily the earlier acquired unit that causes the problems; it may well be that the unit was acquired to help solve the problems. In the

representative technology-related spin-off case, the reorganisation - and its causes - results in internal conflicts and crisis. In turn this may encourage the parent to try to find an external acquirer for (parts of) the operations in the product division, and when it succeeds this is a representative case of a **technology-related divestment**.

Usually when the parent is not successful in finding a suitable acquirer - or when the price offered is considered to be too low - the operations in the product division continue for some time. The internal conflicts and problems rarely disappear, however, so (typically after approximately a year) the parent often tries to sell off the unit once again. At this stage it is also not uncommon for the parent firm to discuss a potential **buy-out**, primarily with the management of the unit. An **employee buy-out** is usually the result only in cases where the management is not interested in an MBO, and typically an employee buy-out does not require continued extensive development in the post-spin-off phase. In addition, all divestments (here sell-offs and buy-outs) are characterised by the spin-off unit being easily separable from other operations in the product division; it is mostly organised as a subsidiary. When this is not the case - or no one is interested in acquiring the unit - the parent usually decides to close down or discontinue the operations.

In addition to ESOs resulting from development in central R&D units (as mentioned above), the representative large firm **entrepreneurial spin-off** is established as a result of internal problems and reorganisations in the product division. Primarily these ESOs are established with defensive motives - the founder is "pushed" away from his previous employment - either as a result of a divestment (where the ESO founder did not want to continue his employment within the new acquiring firm) or when the operations are closed down. This pattern clearly demonstrates that divestments and ESOs are closely related to each other, as well as indicating a connection between technology-related acquisitions and spin-offs.

To *summarise* the discussion thus far, it can be argued that there are three main representative cases of technology related spin-offs: (1) ESOs resulting from the incubator not being interested in developing the ideas of the founder, (2) ESOs resulting from large and complex technology development, and (3) technology-related spin-offs - either divestments or ESOs - resulting from

internal problems in a product division. As Figure 4 illustrates, the spin-off process can, like the acquisition process, be subdivided into a pre-spin-off phase, a spin-off phase and a post-spin-off phase. The critical events in the development of a technology-related spin-off can also be related to these phases of the spin-off process.

Compared to the acquisition phase, the amount of negotiations and evaluations in the spin-off phase is typically more limited in the case of technology-related spin-offs. All kinds of divestments include negotiations in the spin-off phase, but since a divestment is always someone else's acquisition they can more typically be regarded as acquisition negotiations. Therefore, the characteristics of the spin-off phase depend upon the category of the spin-off. In ESOs, and especially in hostile ESOs, it is not unusual for there to be no negotiations or contracts at all. It is possible that the negotiations in sponsored spin-offs differ from other ESOs (and especially from hostile ones). Representative friendly (entrepreneurial) spin-offs in Lindholm's study were characterised by personnel reductions which led the incubator to encourage the founder to establish an ESO. In the spin-off phase, the negotiations between the incubator and the ESO founder were usually quite informal. Nevertheless, the negotiations often resulted in contracts involving a supplier/customer or a consultancy relationship for the post-spin-off phase. Usually, basic product rights were not transferred into the spin-off firm, the spin-off firm instead signing a royalty contract with the incubator.

In the post-spin-off phase, it is very unusual for there to be a continuing relationship between a divested unit and the spin-off parent. Hence, the post-spin-off phase in a divestment is more typically characterised by post-acquisition integration with the new owner. In contrast, a continued relation with the spin-off parent is important for the early development of most ESOs. However, these continued relations typically have a very informal nature. Besides the potential contract in the spin-off phase, it is very unusual for additional proprietary knowledge or assets to be transferred into the spin-off firm. Rather, the spin-off firm commonly continues to co-operate with the founder's earlier colleagues in the incubator firm. Sometimes these earlier colleagues themselves establish small consultancy firms in order to co-operate with the spin-off firm. There are usually several potential technology synergy effects between the spin-off firm and the incubator in the early post-spin-off

phase. When these are realized, this is typically through different kinds of R&D co-operation (for example, using laboratory equipment and the skills of R&D personnel). In turn, these technology synergies are initially important for the technology development and innovativeness of the spin-off firm. Additionally, co-operation with the incubator organization, and the realization of marketing synergies (for example, through the sharing of industry knowledge and - especially international - customer contacts), are also important for its early growth. The first years of the post-spin-off phase are indeed critical for its survival and development (i.e. growth and innovativeness)². However, it is usually the spin-off firm and not the incubator that is most aware of, and tries to realize, potential synergies with the incubator. Finally, the development of the firm in the post-spin-off phase has many similarities with the development of firms in a pre-acquisition phase, and the spin-off firm usually, and for various reasons such as the need of capital, becomes a technology-related acquisition target.

4. The Extended Systems Approach

In the introduction to this paper, an 'extended systems approach' was proposed. This was partly based on Williamson's (1975) systems approach and the 'systems solution by classical specialisation' of an efficient innovation process. In this extended systems approach, large and small firms interact through the acquisition and spin-off of STBFs. Further, these ownership changes can be made gradually, and thus the firms interact in a dynamically changing quasi-integrated (extended) system. By spinning off STBFs for subsequent acquisition, a market for technology-based firms is created as a supplement to other forms of technology markets, that is, on a market for corporate control where both acquisitions and spin-offs are made. When functioning, this market is (under certain conditions) conducive to innovation and technology-based business development.

This paper has argued that it is possible to identify four key types of ownership changes which can be involved in this extended system. These are, respectively, (1) *Acquisition of a divestment*, (2) *Acquisition of an ESO*, (3) *Acquisition of an independent firm, or Spin-off of a new firm*, and (4) *Acquisition of an own spin-off*. In general, it has been hypothesised that the population of technology-based firms available for acquisition by a

large firm mostly consists of spin-offs from other firms or organizations. Additionally, among the particular group of ESOs, Lindholm (1994) found that corporate spin-offs are more usual than university spin-offs, and that divestments are, naturally, also spin-offs from other corporations. These findings underline the importance of existing private firms, both small and large, as a source of new technology-based firms for later acquisitions. Further, Lindholm's empirical research found that, when compared to non-spin-offs, ESOs had a significantly higher growth rate after the age of ten years. It was also concluded that technology-related acquisitions increase the growth rate of STBFs, and are important for the growth of LTBFs. Hence, these empirical findings suggest that the most efficient type of extended system is one in which LTBFs and STBFs spin-off new firms which then develop and grow independently for about ten years, before being acquired by another large firm.

Since both acquisition frequency and the importance of making technology-related acquisitions appear to be increasing (Lindholm 1994), the demand for technology-based firms is growing. If the number of firms available for acquisition is not increased, there is an increased (in fact extreme, because each firm is also unique) risk of opportunism because of a small-numbers situation; thus, the transaction costs involved might increase. Indeed, a small-numbers situation (that is, few available acquisition candidates) can cause a risk of increased acquisition prices and shortened transaction times, and, together with opportunism, this will increase the risk of acquisition failures. Since over half of all technology-related acquisitions are made from the population of spin-off firms, an increased spin-off frequency is (apart from other spin-off benefits) very important for increasing the population of acquisition candidates, and thus indirectly for reducing the transaction costs of the extended system.

The findings of Cooper (1971), Dorfman (1983), and Bruno and Tyebjee (1984) suggest that the main source of technology-related spin-offs are other small technology-related spin-offs. Hence it was argued that past entrepreneurship makes future entrepreneurship more likely. Both Cooper and Dorfman have found it important for future entrepreneurs to know of other founders who had taken this step. Thus, a high spin-off frequency will cause even further spin-offs to take place. In line with this discussion,

successful technology-related acquisitions can also contribute to an increased (entrepreneurial) spin-off frequency. In a successful technology-related acquisition, the potential spin-off entrepreneur in the LTBF will come to know of the successful entrepreneur or founder of the acquired firm. It is also possible to assume that spin-off frequency from LTBFs may increase because of internal competition and 'not-invented-here' effects, caused by externally acquired technology and firms. Particularly when the externally acquired technology is favoured, this may lead potential spin-off entrepreneurs within LTBFs to leave the firm. On the other hand, Granstrand (1992) argues, an efficiently functioning extended system needs to include a suitable acquisition mechanism, which can compensate for a possibly too high or misdirected spin-off propensity and too great industrial fragmentation. In other words, when the extended system is functioning efficiently, it will be self-regulating in a way that will allow the supply and demand of STBFs to be in balance. Hereby, the system could be complemented with the important 'double sided' interaction between the acquisition mechanism and the spin-off mechanism.

An important feature of the extended system approach is the creation of a market where technology-based firms are acquired and sold, to the benefit of both spin-off parents, acquiring firms and the STBFs themselves. When such a market is functioning efficiently the spin-off procedure can be assumed to benefit the spin-off parents in a way that makes them (more) inclined not only to spin-off unwanted units, but more actively engage in sponsored spin-offs and different quasi-integrated ventures. Lindholm (1994) found that firms were more inclined actively to search for and acquire externally developed technology, than they were concerned about the potential benefits of quasi-integrated or sponsored spin-offs. In turn, this may indicate that the potential advantages and benefits of the extended systems approach are currently not being taken full advantage of, and that there is a bias in favouring externally developed technology. However, it is possible that the actual advantages of acquisition are greater - for the parent firm - than the advantages of spin-offs. This is an important issue for further research to investigate. Until such research has been carried out, and in the context of currently limited knowledge, serious mistakes may have to be made before policy-makers and managers learn to manage the spin-off process beneficially.

Notes

- 1 In many divestment studies the name 'spin-off' is used to refer to 'equity spin-offs'. In this paper the spin-off concept is much broader, and 'equity spin-offs' are only one category of the spin-offs included here.
- 2 In Lindholm's (1994) study the growth of spin-off firms was found to increase rapidly only after an initial ten-year period.

FIGURES

Figure 1: The spin-offs.

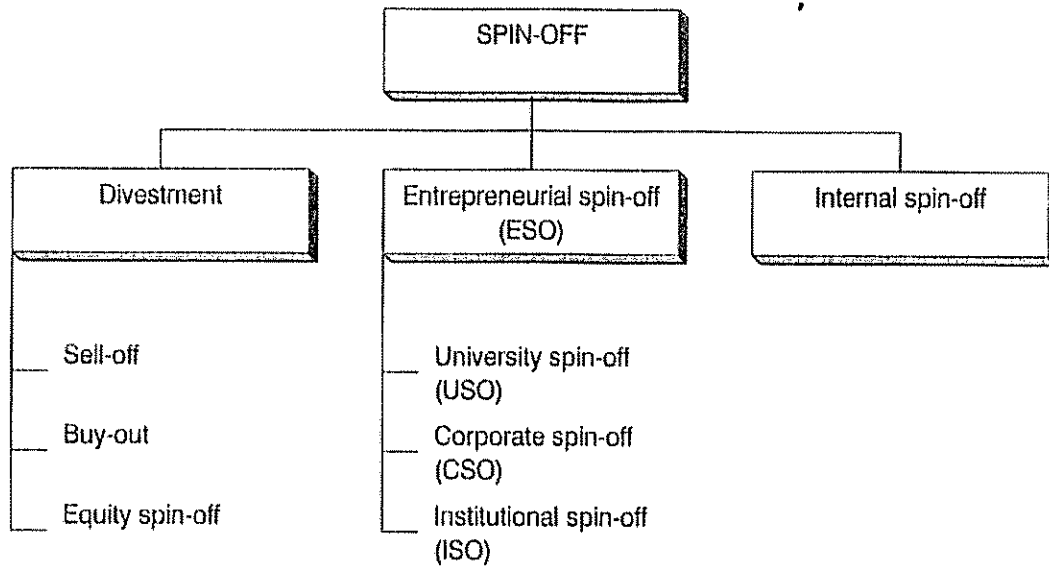


Figure 2: Spin-off and acquisition system of interaction between technology-based firms:
the 'extended system'.

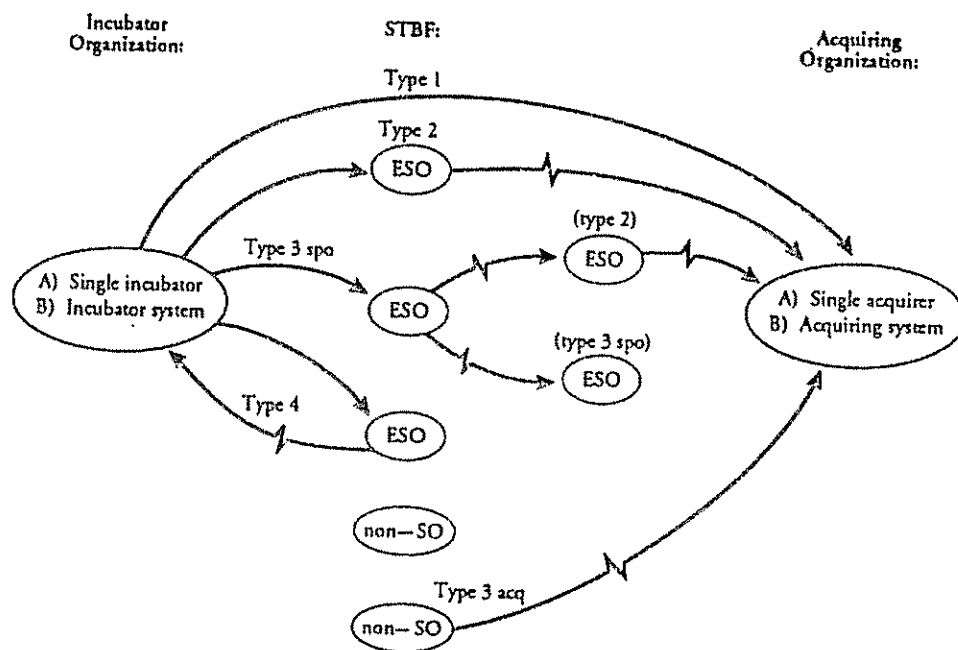


Figure 3: The pre-acquisition, the acquisition and the post-acquisition phases.

PRE ACQUISITION PHASE	ACQUISITION PHASE	POST-ACQUISITION PHASE
Including e.g.: - development and strategies - motives - technology and industry characteristics - financial strength	Including e.g.: - identification of candidate - negotiations - evaluation of target - contract and price	Including e.g.: - integration of operative systems - realization of potential synergy effects - integration of planning and control systems - management of interdependence

Figure 4: The pre-spin-off, the spin-off and the post-spin-off phases.

PRE-SPIN-OFF PHASE	SPIN-OFF PHASE	POST-SPIN-OFF PHASE
<p>Including e.g.:</p> <ul style="list-style-type: none"> - technology and product development: in central R&D unit, in product division, or of founder's own ideas - financial strength - industry characteristics - motives 	<p>Including e.g.:</p> <ul style="list-style-type: none"> - divestment/acquisition negotiations - informal ESO negotiations - contract and price 	<p>Including e.g.:</p> <ul style="list-style-type: none"> - disintegration - ongoing relation and co-operation - realization of potential synergy effects

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