



A General Framework for Classifying Spin-Offs

Rosa Caiazza

Parthenope University of Naples, Italy

David Audretsch

Indiana University, USA and WHU Otto Besheim School of Management, Germany

Abstract. Spin-offs without resources or a strong relational structure to support their activity and those that lack developmental support because they are created outside of high-tech clusters tend to remain small and do not become world leaders. The purpose of this article is to introduce and develop a general framework for classifying spin-offs according to three main dimensions: internal, relational and external. In order to develop this framework we utilize a methodology that draws on the various theoretical perspectives to explicitly distinguish those conditions conducive to growth from those that inhibit growth. The article contributes to the theoretical debate on the diffusion of innovative activity and entrepreneurship by offering a novel and unique framework to classify spin-offs. This new and novel framework should provide a useful tool to practitioners and policy-makers in their efforts to generate high growth and high impact spin-offs and ultimately spur innovation and growth, as has been the case in entrepreneurial clusters such as Route 128 and Silicon Valley.

1. Introduction

The factors that are conducive to spin-offs attaining higher rates of survival and growth have been the subject of several studies (Dierickx and Cool, 1989; Amit and Schoemaker, 1993; Collis and Montgomery, 1995). A first stream of research focuses on the internal resources of the firm as a predictor of spin-off growth (Barney et al., 2001; Brush et al., 2001). Other studies emphasize the relational dimension as an explanatory factor that affects a start-up's capability to obtain financial resources (Hellmann and Puri, 2000) and technological resources (Bower, 2003; Westhead and Storey, 1995; Shane and Stuart, 2002). The third stream of studies analyzes how the external environment may influence the spin-off process (Radosevich, 1995; Roberts and Malone, 1996; Carayannis et al., 1998; Steffensen et al., 2000; Meyer, 2003; Clarysse et al., 2005; Moray and Clarysse, 2005; Westhead and Storey, 1995; Lindelof and Lofsten, 2004). Each of the three streams of research—internal, relational, and external—is analyzed independently. However, spin-offs created outside of high-tech clusters tend to remain small because they lack resources, a strong relational structure, and developmental support. Unlike spin-offs that are established in more favorable contexts such as Route 128 and Silicon Valley, these do not become world

leaders. The purpose of this paper is to address this gap in the literature by linking previous research and developing a new and novel framework able to classify spin-offs. In order to develop such a novel framework, we first analyze in detail the various theoretical perspectives that identify favorable conditions for growth. This new framework should also serve as a guide for future research and provide policymakers and practitioners charged with a mandate for designing and implementing strategies to facilitate successful spin-offs.

2. Internal Dimension

Most research has followed the resource-based approach introduced by Penrose (1959) to identify internal factors that affect the growth of start-ups. In this approach, the enterprise is seen as the collection and link of productive resources, both tangible and intangible. Within this perspective, scholars have expanded Penrose's original ideas, giving rise to two schools of thought. Wernerfelt (1995) stresses the importance of the relationship between resources and diversification in business strategy, and Barney (1991) extends our understanding of the connection between resources and competitive advantage. Overall, the resource-based view (RBV) offers a significant contribution by identifying the resource combination as the decisive factor for the growth and development of any company (Prahalad and Hamel, 1990). The focus is therefore on the internal organization and resources, defined as tangible, human, organizational, and intangible assets, and the idiosyncrasies between resources play a crucial role. Companies with rare and irreplaceable resources can experience faster growth by implementing strategies that cannot be easily imitated by competitors (Barney and Clark, 2007).

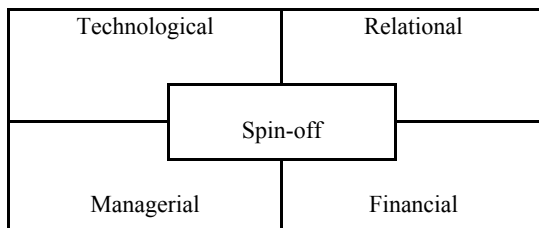
Although the resource-based view was developed to study the management of large organizations, the framework has been applied to the growth of start-ups from the entrepreneurial perspective. Several models have been developed to understand the relationship between resources and business growth. For example, Kazanjian (1988) identifies growth as a process characterized by linear regularity that can be segmented into discrete stages (Dodge and Robbins, 1992). Each growth phase is described as a time of crisis or breakdown that is addressed through the use of resources and followed by a period of stability. It is only if a start-up has sufficient resources that it will be able to overcome these crises and move forward to the next stage.

Scott and Bruce (1987) expanded upon the first models of resource-based growth by emphasizing the role of unique combinations of resources in explaining different rates of development of an enterprise. Using these assumptions, Garnsey (1998) and Reid and Garnsey (1998) proposed a resource-based view model in which the growth of start-ups is seen as a succession of multiple stages of development. In these stages, resources are acquired and used

to overcome difficulties in order to move on to the next step. The stages include resource access, resource mobilization, resource generation, growth reinforcement, and growth reversal. The fundamental assumption is that firm-specific needs and the ability to access critical resources lead to different growth paths and varying degrees of success. Failure to access critical resources can cease growth, leading to a period of stability or decline into a previous stage. Successful progression through all stages requires access to resources including know-how, capital equipment, and qualified human resources. In particular, research on spin-offs has shown that a paucity of technological resources as well as relational, financial, and general management are major hurdles to growth (Reid and Garnsey, 1998; Roberts, 1991; Stuart and Sorenson, 2003) (Figure 1).

Technological resources refer to the firm-specific products and technology (Borch et al., 1999) that affect the degree of innovativeness, scope of technology, quality or legitimacy of the firms' R&D, and position of the firm in the product-development cycle. Managerial resources refer to attributes of the founding team, the management team and the personnel of the company to manage the start-up. Relational resources of a company refer to its industry contacts (Brush et al., 2001; Elfring and Hulsink, 2003; Lee et al., 2001; Nohria, 1992). Finally the financial resources refer to the amount and type of financing of the firm.

Figure 1: Internal Dimension



Prahalad and Hamel (1990) argue that knowledge gained by highly qualified employees is one of the most important sources of competitive advantage in technology-based enterprises. Using such technological knowledge, businesses are able to continuously innovate. Stinchcombe (1965) showed that start-ups have a greater propensity to fail due to a lack of relationships with customers and suppliers. As a result, spin-offs that are able to attract potential customers and obtain a stable supplier have a greater chance to succeed in a new market. In addition to a lack of relations, a spin-off may also be lacking adequate financial capital (Stuart and Sorenson, 2003). In order to develop an innovative product, spin-offs require relatively large investments. As a means to generate this capital, a spin-off in the initial phase will sometimes try to generate income from other activities, such as consulting. This diversification, however, requires time and

attention that could otherwise be devoted to research and development of a new product as well as management practices required of the company. The last obstacle of the internal dimension of a spin-off is tied to a lack of managerial and entrepreneurial culture. Since spin-offs are intended to bring new technology and innovation to the market, the practical knowledge of market conditions and business dynamics are essential elements for success.

Despite the numerous obstacles related to the internal dimension of the spin-off, it is possible to identify factors that can overcome these problems. The first factor that can influence the growth of a spin-off is the risk profile of the spin-out strategy (Finney et al., 2008). A spin-off with strategies that support high risk-taking will invest in research and development and seek to be the first-mover in the market. In this way, the spin-off aims to obtain an advantage over current and potential competitors. However, this risk is high because the spin-off requires relatively large amounts of resources, and competitors can quickly imitate the product. This risk is greater for products rather than services, as products require organizing production processes, establishing relationships with suppliers, and creating production facilities. In the face of limited resources, these high-cost activities make the spin-off vulnerable early on and can have significant effects on growth. Conversely, spin-offs exposed to less risk, such as those that produce services, have more opportunity to grow by maintaining lower costs.

The second factor influencing the growth of a spin-off relates to the quantity and quality of its human capital (Schneider et al., 2007). The amount of human capital within the spin-off is dependent on its founders. Despite the potential for possible conflicts (Casson, 1982), a company founded by a team of researchers has better conditions for growth than those with a single founder. Several empirical studies have shown that having a team of founders enables businesses to benefit from extended networks and also facilitates the division of labor and specialization of knowledge (Lechler, 2001). The ability to access various resources is improved by highly extended networks developed by the spin-off. In addition, the quality of human capital varies in relation to the experience of the founders (Shane, 2000). Previous experience in starting a new venture allows researcher-entrepreneurs to have a greater ability to deal with various problems (Chandler and Hanks, 1994; Eisenhardt and Schoonhoven, 1990).

The ability of employers to prevent and overcome a lack of resources is the third factor influencing the growth of a spin-off (Heirman and Clarysse, 2004), one that has been discussed since the early studies of entrepreneurship (Schumpeter, 1934). Successful entrepreneurs have an exceptional capacity for recognizing opportunities and managing resources in the early years of the start-up. One of the most difficult tasks for researcher-entrepreneurs is to gain critical resources to build a solid customer base, experience, and reputation (McGrath, 1999). Spin-offs that are able to acquire resources early on are able to survive and grow.

The last factor is the ability of entrepreneurs to access resources in the initial phase through support from organizations that act as incubators. Formal support is geared towards the provision of tangible assets such as flexible working space, laboratory facilities, and financial support. Value-added support aims, instead, to link the start-up into networks, provide new business models, and create a culture of entrepreneurship (Hannon and Chaplin, 2003).

3. Relational Dimension

An analysis of relational dimension of spin-off's network provides an explanation for the impact of social capital on the growth process of a start-up (Cohen and Syme, 1985). Studies have shown that social networks are an essential component of social capital (Lin et al., 2001). According to Coleman (1990), social capital is the expression of an aspect of social structure that facilitates interactions among individuals. A definition proposed by Bourdieu (1985) identifies social capital as the sum of resources, real or virtual, resulting from mutual knowledge and recognition with other actors within a network. Social capital is the sum of the real and potential resources embedded within, available through, and derived from the network of relationships owned by an actor. In general, there is a broad consensus that social capital is an asset that derives its value from accessing resources through social relationships (Granovetter, 1983; Liao and Welsch, 2003).

The concept of social capital has been considered at multiple levels of analysis. At the level of the individual, social capital promotes the development of an individual's career path (Burt, 1992; Granovetter, 1974) and facilitates entrepreneurship (Chong and Gibbons, 1997; Anderson et al., 2007). At the corporate level, social capital enhances performance (Lee et al., 2001) and facilitates the creation and growth of new enterprises (Shane, 2004). In particular, Kogut and Zander (1996) argue that the origin of commercial advantages and growth potential come from a superior ability to create and transfer knowledge. In this approach, learning through social networks allows businesses to accumulate knowledge.

Despite the broad consensus on the importance of networks in the creation of social capital (Anderson et al., 2007), there is a pervasive debate on the type of network most beneficial for the development of a spin-off (Moran, 2005). In addition to the qualitative characteristics, the growth of a spin-off is also influenced by the structural characteristics of its network. Scholars have maintained two perspectives on the appropriate structural characteristics that support a spin-off—network-based closures and structural holes. The first perspective states that dense, closed networks offer greater support to enterprise growth (Coleman, 1988). In these networks, information is rapidly disseminated among actors and easily interpreted (Granovetter, 1974, 1995). The reputation

and trust implicit in a closed network reduces uncertainty and improves cooperation. These positive effects reduce the risk of opportunistic behavior (Granovetter, 1983). Actors who are part of these networks are more likely to comply with the norms of reciprocity as a failure to do so may involve penalties and reputational damage (Gulati, 1995). Tightly connected networks also facilitate tacit knowledge transfer (Hansen, 1998; 1999). However, these strongly connected networks have the disadvantage of limiting the autonomy of members strongly influenced by external pressures (Burt, 1992).

According to the structural holes perspective (Burt, 1992) a network with structural holes provides an opportunity to bridge the gap between disconnected segments (Lechner and Leyronas, 2007). If a spin-off is connected to two partners that are not connected to each other, the spin-off can fill this structural hole, bridging the gap between partners and enjoying the benefits of exclusivity. These benefits derive from the diversity of information and mediation opportunities created by the lack of direct links between other actors of the social network. Membership in this type of network has the advantage of allowing exclusive access to new information on market opportunities, investments, and business ideas. Ultimately, there are two diverging perspectives on the inherent structural characteristics of a network that are most beneficial to a spin-off. The network perspective stresses that close contacts between actors allows a spin-off to grow faster due to exchange of information, reputational factors, and access to external resources. The structural holes perspective argues that less dense networks enable a spin-off to bridge the gap between other actors and obtain exclusive information.

While the structural characteristics define the scope and range of resources that can be accessed by a spin-off, qualitative characteristics determine the mechanism by which these resources are acquired. In other words, they define the quality of networks (Moran, 2005). In the literature, these characteristics refer to the nature of the dyadic relationship between the spin-off and the partner that is commonly referred to as the strength of the bond. There are two types of links between spin-offs and partners, strong and weak. Strong ties require frequent contact, are long term, and are based on a high degree of trust and closeness (Granovetter, 1995; Marsden and Campbell, 1984). Some scholars argue that the importance of strong ties lies in their ability to facilitate the transfer of complex information (Hansen, 1999; Uzzi, 1996). Strong ties between the actors within an innovative environment encourage the development of ideas and give researcher-entrepreneurs more stimuli to transform an idea into a business through a spin-off (Nohria, 1992). Access to resources, information, and advice also facilitates the growth beginning in the early stages of development. A weak bond, however, is temporary and transient in nature and is usually based on smaller investments. Weak ties are able to provide information and resources that go beyond the narrow social circle (Granovetter, 1983) and can be sources of unique opportunities and access to new resources (Hansen, 1999).

Larson and Star (1992, 1993) showed that the formation of new firms follows a development processes based on three phases. In the first phase, entrepreneurs are tied exclusively to partners from whom they can draw critical resources. In the next phase, the bonds become more complex, involving many partners. In the last phase, the networks involve specialized actors who come from different backgrounds. These partners can facilitate the growth of a firm by increasing exposure to diversity. In fact, networks with diverse actors expose the spin-off to a variety of experiences (Rodan and Galunic, 2004; McPherson et al., 2001), perceptions, ideas, and strategies as well as allow access to a wide range of resources. According to Jacobs (1969), diversity promotes knowledge externalities, innovative activity, and economic growth.

Audretsch and Feldman (1996) demonstrate that innovation has a greater propensity to regionally cluster for industries in which knowledge externalities are important. Much attention has been given to the regional aspects that stimulate this innovative activity (Porter, 1998; Asheim and Isaksen, 1997; Cooke et al., 2005). In addition, empirical studies confirm that constant interactions with neighboring partners have a positive impact on learning. Proximity fosters trust and facilitates the exchange of tacit knowledge through direct interactions (Grossetti, 2008). Conversely, Bathelt et al. (2004) argue that if businesses act in local networks that are too closed and rigid, they may risk being exposed to fewer sources of diverse information, which can limit the growth of knowledge. The knowledge that circulates locally should be supplemented and combined with knowledge from outside sources. The spin-off, therefore, must simultaneously foster a relationship with its closest partners for idea development and build links with external actors in order to gain access to new information. The social network is extremely important in the early development of spin-offs.

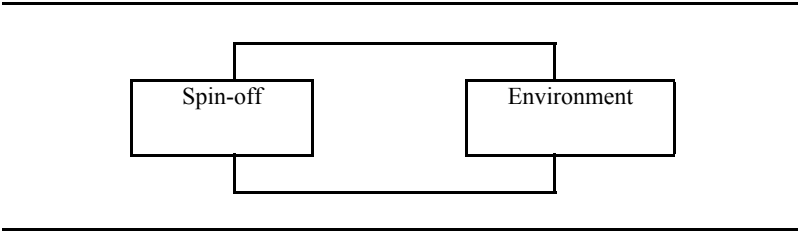
4. External Dimension

Institutional theory emphasizes that business growth depends on the environment in which the business was created (Caiazza, 2013; Oliver, 1991). Responding to external pressures and anticipating future trends are necessary for the survival of enterprises (Meyer and Rowan, 1977). According to institutional theory, institutionalized organizations adhere to the norms of their general environment, characterized by a specific configuration of rules, regulations, and culture (DiMaggio and Powell, 1991; Meyer and Rowan, 1977), as well as the specific environment in which the company was founded (DiMaggio and Powell, 1983). An organization that aligns to the standards, values, and rules of the environment in which it operates gains legitimacy, granting it access to resources that they do not possess internally. Therefore, the growth of a start-up is linked to compliance

with these rules and regulations. As a result, institutional theory predicts that start-ups will develop strategic behaviors in line with external pressures.

The entrepreneurial activity of the public research institutions (PRI) and the creation of a spin-off from PRI contribute to the level of innovation of an area. Therefore, while numerous cases of successful spin-offs from PRI encourage the development of areas such as Silicon Valley and Route 128, the high level of entrepreneurial capital that characterizes these places has, in turn, encouraged the emergence of new enterprises (Figure 2).

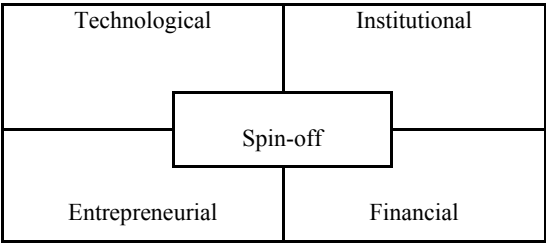
Figure 2: Circle



The environmental factors that promote the creation of a spin-off can also support the spin-off in its development (Roberts, 1991). In particular, it is possible to identify institutional, financial, technological, and entrepreneurial dimensions as those relevant to the growth of a spin-off (Figure 3).

The priority of these environmental dimensions differs based on the various support models, each providing a unique allocation of tangible and intangible resources to support the growth of the spin-off (Clarysse et al., 2001). However, in aware environments, the actors are aware of spin-offs, and the PRI are interested in the commercialization of research, though only a few have developed support facilities. The spin-offs do not have significant start-up capital, and there are not structures in place to support them in the incubation phase. However, there are external sources of funding, such as grants for R&D, that reduce the need to resort to secondary activities. In a weak innovative demand environment characterized by an undeveloped business community and a lack of key resources, the PRI are often called upon to play a more active role in the promotion of new business ventures.

Figure 3: External dimensions



In a supportive environment, PRI provides seed capital as well as legal and administrative support, which enable the company to focus on project development during the incubation phase. It is in these environments that spin-offs show a higher rate of growth, because the enterprise does not have to resort to secondary activities to finance themselves. Instead, the enterprise can successfully raise venture capital, shortening the incubation period. Supportive environments, such as Silicon Valley or Route 128, maintain a strong business community with the ability to select the most advantageous projects to allocate resources to. In these contexts, the process of creating a new spin-off is often driven by demand (demand-pull) and can benefit from external economies present at the local level, particularly in relation to innovative activities and R&D.

5. Spin-Off Framework

The integration of the theoretical perspectives that explain internal, relational and external dimensions provides a framework for the analysis of spin-offs. According to the resource-based perspective, in order to grow, start-ups need a series of resources that must be combined in a unique way. The external dependency on these resources leads start-ups to create relationships with other firms in order to access those resources that they do not possess internally. The internal development and external relationships of a start-up are influenced by the general environment in which they operate (Figure 4).

Silicon Valley companies are mutually dependent and highly specialized. Informal culture helped pioneer innovative firms to develop and grow in the area. The greater propensity for experimentation and risk-taking was considered a quality rather than a defect. The supportive context of Silicon Valley has led deeply integrated spin-offs with high levels of internal and relational resources to become global leaders (e.g., SUN, Netscape, America Online, Amazon.com and Google, Oracle, Cisco, Yahoo, 3Com, Silicon Graphics and Genentech).

In Oulu, Nokia and its subcontractors act as a major catalyst by attracting small startups. Despite the unaware environment of Oulu, Nokia has become an autonomous spin-off creator due to its resources, networks, and research center promoting technology transfer processes.

The Italian National Research Center (CNR) is a national public research institution that aims to carry out, promote, disseminate, and transfer research activities through spin-offs. One of the strengths of the spin-off of CNR is the scientific and technological cooperation between researchers, companies, and other scientific institutions in highly innovative sectors. However, despite its national dimension and mission, CNR has only created 58 spin-offs since 1996. Low external support and few internal and relational resources make Italian-CNR a clear example of forced spin-off.

Inducted spin-offs are those that are unable to develop specific strategies based on their own resources and relations and are established in contexts characterized by high levels of support. The University of Twente represents a systematic support structure in the creation of spin-offs. In the last twenty years, Twente has given rise to about 300 spin-off companies by offering physical spaces, loans, assistance from experienced academic-entrepreneurs, entrepreneurial training, research contracts for neo-entrepreneurs, and more. Most of the spin-offs of Twente, however, have been initiated by external support without finding their own dimension.

Figure 4: Spin-off framework

Internal and relational support:		
High	Integrated Spin-off Silicon Valley	Autonomous Spin-off Oulu
Low	Inducted Spin-off Twente	Forced Spin-off Italy
External support:		
	High	Low

Spin-offs can be classified into four distinct categories based on their possession of resources, the relationships with the actors that provide access to these resources, and the level of support received from the external environment. Integrated spin-offs are start-ups that originate from PRI, have a high level of resources and relationships, and have a high level of support from the external environment in terms of favorable legislation or local infrastructure. Autonomous spin-offs are start-ups from PRI with a high level of internal and relational

resources but low support within its environment. An inducted spin-off is one within a favorable environment but that lacks sufficient resources such that it is supported but unable to develop. Finally, a forced spin-off does not possess adequate resources for autonomous development or support from the external environment.

The growth of a spin-off is determined by the development strategies it adopts. These strategies are based on the resources either possessed by or easily accessed through its network and the support by and pressures of the external environment. Organizations that arise in environments supportive of entrepreneurship develop behaviors in line with external pressures in order to gain legitimacy, which then increases their access to the wealth of resources vital for their survival. These organizations strengthen their networks and assume central positions within them in order to exclusively access resources.

6. Conclusion

Three disparate strands of research have recently emerged providing a singular approach to facilitating entrepreneurial growth subsequent to spin-off. While each of these three literatures makes an important contribution, in fact, each approach has remained isolated and unconnected. By drawing on the essential elements of each of these three disparate literature on spin-off growth, this paper provides the first integrated coherent framework identifying those underlying forces and factors conducive to the growth of spin-offs. This new integrated framework enables us to integrate a combination of variables and dimension that together influence the success of spin-offs.

A particular contribution of this paper is to map the existing streams of literature onto the matrix, enabling an explicit identification of the gaps in the existing taxonomies as well as potential opportunities for future research. Specifically, previous studies that examine the factors affecting spin-off creation and development have focused their attention on internal, relational and external dimension independently. Our study therefore leads to the identification of relevant aspects that have not been addressed and provides opportunities for further research. First, the growth of a spin-off depends on the fit between the resource endowment of the firm and the resources necessary for its development that are present in the external environment. It would therefore be useful to shift the focus from the analysis of existing resources to the investigation of the resource gaps, the strategies adopted by firms to acquire the lacking resources, and the opportunities presented in the external context.

The original framework of spin-off growth introduced in this paper has significant implications for policymakers and practitioners. In particular, our analysis emphasizes the importance of understanding the heterogeneity of factors affecting spin-offs success. Thus, the development of strategies to aid spin-offs

should be tailored to the specific needs of the spin-off and the institutions from which they emerge.

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